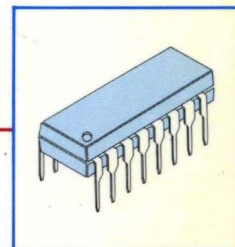


Linear IC

VOL. 1, 1989



- Audio
- Video
- TOY Radio
Control Actuators

Copyright 1989 by Samsung

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photo copying, recording, or otherwise, without the prior written permission of Samsung.

The information contained herein is subject to change without notice. Samsung assumes no responsibility for the use of any circuitry other than circuitry embodied in a Samsung product.

No other circuit patent licenses are implied.

SAMSUNG

DATA BOOK LIST

- I. Semiconductor Product Guide
- II. Transistor Data Book
 - Vol. 1: Small Signal TR
 - Vol. 2: Bipolar Power TR
 - Vol. 3: TR Pellet
- III. Linear IC Data Book
 - Vol. 1: Audio/Video
 - Vol. 2: Telecom/Industrial
 - Vol. 3: Data Converter IC
- IV. CMOS Consumer IC Data Book
- V. High Speed CMOS Logic Data Book
- VI. MOS Memory Data Book
- VII. SFET Data Book
- VIII. MPR Data Book
- IX. CPL Data Book
- X. Dot Matrix Data Book

LINEAR IC DATA BOOK

VOLUME 1.

AUDIO ICs
VIDEO ICs

VOLUME 2.

TELECOM ICs
VOLTAGE REGULATORS
VOLTAGE REFERENCES
OPERATIONAL AMPLIFIERS
COMPARATORS
TIMERS
TOY RADIO CONTROL ACTUATOR

VOLUME 3.

DATA CONVERTER ICs

TABLE OF CONTENTS (VOLUME 1)

I. QUALITY AND RELIABILITY	21
II. PRODUCT GUIDE	59
1. Function Guide	61
2. Cross Reference Guide	70
3. Ordering Information	78
III. AUDIO ICs	77
IV. VIDEO ICs	441
V. TOY RADIO CONTROL ACTUATORS	807
VI. PACKAGE DIMENSIONS	877
VII. SALES OFFICES and MANUFACTURER'S REPRESENTATIVES	889

(VOLUME 2)

I. QUALITY AND RELIABILITY

II. PRODUCT GUIDE

1. Function Guide
2. Cross Reference Guide
3. Ordering Information

III. TELECOMMUNICATION ICs

IV. INDUSTRIAL ICs

1. Voltage Regulators
2. Voltage References
3. Operational Amplifiers
4. Comparators
5. Timers

V. MISCELLANEOUS ICs

VI. PACKAGE DIMENSIONS

VII. SALES OFFICES and MANUFACTURER'S REPRESENTATIVES

ALPHANUMERIC INDEX

Device	Function	Package	Page
KA33V	Silicon Monolithic Bipolar Integrated Circuit Voltage Stabilizer for Electronic Tuner	TO-92	Vol. 2
KA201A	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
KA219	Dual High Speed Voltage Comparator	14 DIP/14 SOP	Vol. 2
KA301A	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
KA319	Dual High Speed Voltage Comparator	14 DIP/14 SOP	Vol. 2
KA331	Voltage to Frequency Converter	8 DIP/8 SOP	Vol. 2
KA336-5.0/2.5	Voltage Reference Diode	TO-92	Vol. 2
KA337	1A Negative Adjustable Voltage Regulator	TO-220	Vol. 2
KA340	1A Positive Voltage Regulator	TO-220	Vol. 2
KA350	3 A Adjustable Positive Voltage Regulator	TO-3P	Vol. 2
KA431	Programmable Precision Reference	TO-92/8 DIP/8 SOP	Vol. 2
KA710C/I	High Speed Voltage Comparator	14 DIP/14 SOP	Vol. 2
KA711C/I	Dual High Speed Differential Comparator	14 DIP/14 SOP	Vol. 2
KA733C	Differential Video Amplifier	14 DIP/14 SOP	Vol. 2
KA1222	Dual Low Noise Equalizer Amplifier	8 DIP	79
KA2101	TV Sound IF Amplifier	14 DIP	443
KA2102A	TV Sound System	14 DIP H/S	448
KA2103L	Sound Mute System for TV	8 SIP	452
KA2104	Auto Power Off and Sound Mute System for TV	9 SIP	455
KA2105	Limiter Amplifier and Detector for a TV SIF	9 SIP	459
KA2106	Dual Sound Multiplex for a TV SIF	16 DIP	463
KA2107	DC Volume Tone Control Circuit	12 SIP	467
KA2130A	TV Vertical Deflection System	10 SIP H/S	471
KA2131	TV Vertical Output Circuit	10 SIP H/S	474
KA2133	1 Chip Deflection System	16 DIP H/S	478
KA2134	Color TV Deflection Signal Processing IC	18 DIP	482
KA2135	Horizontal Signal Processing IC	12 SIP	487
KA2136	Low Noise TV Vertical Deflection System	12 ZDIP/F	491
KA2137	TV Horizontal Processor	16 DIP	498
KA2138	Deflection Processor for CRT Display	20 DIP	509
KA2153	Video Chroma Deflection System for a Color TV (NTSC)	42 DIP	513
KA2154	Video Chroma Deflection System for a Color TV (PAL/NTSC)	42 DIP	524
KA2155/56	Video Chroma Deflection System for a Color TV (NTSC)	30 SDIP	545
KA2181	Remote Control Pre-Amplifier	8 SIP	551
KA2182/83	Remote Control Pre-Amplifier	8 SIP	554
KA2184	Remote Control Pre-Amplifier	8 SIP	557
KA2186	Video Switching Circuit for TV	8 DIP	561
KA2201	1.2W Audio Power Amplifier	8 DIP	83
KA2201B	0.5W Audio Power Amplifier	8 DIP	87
KA2206	2.3W Dual Audio Power Amplifier	12 DIP/F	90
KA22062	4.5W Dual Power Amplifier	12 SIP H/S	98
KA22063	4.5W Dual Power Amplifier	12 SIP H/S	105
KA2209	Dual Low Voltage Power Amplifier	8 DIP	111
KA2210	5.5W Dual Power Amplifier	12 SIP H/S	114
KA22101	23W Power Amplifier	12 SIP H/S	119
KA2211	5.8W Dual Power Amplifier	12 SIP H/S	126
KA2212	0.5W Audio Power Amplifier	9 SIP	131
KA2213	One Chip Tape Recorder System	14 DIP H/S	136
KA22131	Dual Pre-Power Amplifier for Auto Reverse	24 SOP	143

ALPHANUMERIC INDEX (Continued)

Device	Function	Package	Page
KA22134	Dual Pre-Power Amplifier with DC Volume Control	16 DIP	150
KA22135	Dual Pre-Power Amplifier and DC Motor Speed Controller	22 SDIP	155
KA2214	1W Dual Power Amplifier	14 DIP H/S	160
KA2220	Equalizer Amplifier with ALC	9 SIP	165
KA2221	Dual Low Noise Equalizer Amplifier	8 SIP	170
KA22211	Dual Low Noise Equalizer Amplifier	8 SIP	174
KA2223	5 Band Graphic Equalizer Amplifier	16 DIP	178
KA22231	5 Band Dual Graphic Equalizer Amplifier	28 SOP	184
KA22232	3 Band Dual Graphic Equalizer Amplifier	20 SOP	188
KA22233	3 Band Dual Graphic Equalizer Amplifier	22 DIP	192
KA22234	5 Band Dual Graphic Equalizer Amplifier	24 SZIP	196
KA22235	5 Band Graphic Equalizer Amplifier	18 ZIP	200
KA2224	Dual Equalizer Amplifier with ALC	14 DIP	205
KA22241	Dual Equalizer Amplifier with ALC	9 SIP	212
KA22242	Dual Equalizer Pre-Amplifier with ALC	10 SIP	217
KA2225	Dual Pre-Amplifier for 3V Using	16 DIP/16 SOP	225
KA22261	Dual Equalizer Amplifier with REC Amplifier	16 DIP	230
KA2228	Dual Equalizer Amplifier System	21 SZIP	236
KA2229A	Quad Equalizer Amplifier for Double Cassette	24 SDIP	246
KA2230	9-Program Music Selector	22 DIP	251
KA2231	Audio Level Sensor	9 SIP	258
KA22421	AM 1 Chip Radio	16 DIP/16 SOP	263
KA22427	AM/FM 1 Chip Radio	16 DIP	273
KA22429	FM 1 Chip Radio	16 SOP	282
KA2243	AM/FM IF System	16 DIP	287
KA2244	FM IF System for Car Radio	9 SIP	293
KA22441	FM IF System for Car Stereo	16 ZIP	297
KA2245	FM IF System for Car Radio	7 SIP	305
KA22461	Electronic Tuning AM Radio Receiver for Car Stereo	19 ZIP	309
KA2247	FM IF/AM Tuner System	16 DIP	314
KA22471	FM IF/AM Tuner System	16 DIP	319
KA2248	3V FM IF/AM Tuner System	16 DIP/20 SOP	324
KA2249	FM Front End Portable Radio	7 SIP	329
KA22495	FM Front End	9 SIP/14 SOP	333
KA22496	FM Front End	9 SIP	341
KA2261	FM Stereo Multiplex Decoder	16 DIP	346
KA2262	FM Stereo Multiplex Decoder for Car Stereo	16 ZIP	351
KA2263	FM Stereo Multiplex Decoder	9 SIP	361
KA2264	FM Stereo Multiplex Decoder	9 SIP/16 SOP	365
KA2265	VCO Non-Adjusting FM Stereo Multiplex Decoder	16 DIP	370
KA2266	MPX for Car Stereo	16 ZIP	376
KA2268N	One Chip TV Sound MPX (Korea Two Carrier System)	28 DIP	563
KA22682	One Chip TV MPX Demodulator (Korea Two Carrier System)	28 DIP	571
KA2269	TV Sound MPX for USA	42 SDIP	579
KA2270	Noise Reduction System for TV Sound	16 DIP	592
KA2272	FM Noise Canceller	16 ZIP/16 SOP	380
KA2281	5 DOT Dual LED Level Meter Driver	16 DIP	386
KA2283	5 DOT Dual LED Level Meter Driver	16 DIP	389
KA2284/85	5 DOT LED Level Meter Driver	9 SIP	393
KA2286/87	5 DOT LED Linear Level Meter Driver	9 SIP	396
KA2288	7 DOT LED Level Meter Driver	16 DIP	399

ALPHANUMERIC INDEX (Continued)

Device	Function	Package	Page
KA2303	Toy Radio Control Actuator	9 SIP	809
KA2304	Toy Radio Control Actuator	9 SIP	812
KA2305A	Toy Radio Control Actuator (Rx)	12 SIP-SH	814
KA2306A	Toy Radio Control Actuator (Rx)	14 DIP	818
KA2309	Toy Radio Control Actuator (Rx)	16 DIP	822
KA2310	Toy Radio Control Actuator (Tx)	9 SIP	829
KA2311	Toy Radio Control Actuator (Rx)	16 DIP	832
KA2312	Toy Radio Control Actuator (Tx)	9 SIP	837
KA2401	DC Motor Speed Controller	8 DIP	402
KA2402	Low Voltage DC Motor Speed Controller	8 DIP	408
KA2404	DC Motor Speed Controller	TO-92L	415
KA2407	DC Motor Speed Controller	TO-126	421
KA2410	Tone Ringer	8 DIP	Vol. 2
KA2411	Tone Ringer	8 DIP	Vol. 2
KA2412A	Telephone Speech Circuits	14 DIP	Vol. 2
KA2413	Dual Tone Multi Frequency Generator	16 DIP	Vol. 2
KA2418	Tone Ringer with Bridge Diode	8 DIP	Vol. 2
KA2425A/B	Telephone Speech Network with Dialer Interface	18 DIP	Vol. 2
KA2580A	8-Channel Source Drivers	18 DIP	Vol. 2
KA2588A	8-Channel Source Drivers	20 DIP	Vol. 2
KA2605	Sync Separator I	9 SIP	596
KA2606	Sync Separator II	9 SIP	600
KA2615/16/17/18	LED and Lamp Driver	9 SIP	607
KA2651	Fluorescent Display Drivers	18 DIP	Vol. 2
KA2654	Line Transceiver	8 DIP	Vol. 2
KA2655/6/7/8/9	High Voltage, High Current Darlington Arrays	16 DIP/16 SOP	Vol. 2
KA2803	Low Power Consumption Earth Leakage Detector	8 DIP	Vol. 2
KA2804	Zero Voltage Switch	8 DIP	Vol. 2
KA2807	Earth Leakage Detector	8 DIP	Vol. 2
KA2911/16	Video IF System for Color TV	16 DIP	611
KA2912	Video IF Processor for B/W TV	14 DIP H/S	616
KA2913A/17	Video and Sound IF Amplifier for Monochrome TV Receivers	16 DIP	620
KA2914A/18	Video IF + SIF System	24 DIP	629
KA2915	TV VIF & SIF & Deflection System (IC for TV Large Integration)	28 DIP	644
KA2919	VIF + SIF System for Color TV	30 SDIP	650
KA2922/23	Video & Sound IF Amplifier for TV Sets VTR's	20 DIP	655
KA2944	Write & Read Amplifier	28 DIP	660
KA2945	Video Amplifier	28 DIP	667
KA2981	VHF Band RF Modulator	16 DIP	673
KA2983	Switchless Recording/Play Back Amplifier	18 DIP	680
KA2988	Chroma Signal Processor	28 DIP	683
KA3524	Regulator Pulse Width Modulator	16 DIP	Vol. 2
KA6101/02	Analog Interface Circuit for Teletex System	18 DIP	688
KA6201	Flexible Disk Read Amplifier	18 DIP	694
KA6202	Two Phase Stepping Motor Driver	16 DIP	705
KA7226	Dual Equalizer Amplifier with ALC	14 DIP	425
KA7500	Switchmode PWM Control Circuits	16 DIP	Vol. 2
KA78S40	Switching Regulator	16 DIP	Vol. 2
KA78TXX	3A Positive Voltage Regulator	TO-220	Vol. 2

ALPHANUMERIC INDEX (Continued)

Device	Function	Package	Page
KA8101	Detail Enhancer	9 SIP	709
KA8102	Write & Read Amplifier	22 SDIP	712
KA8103	Luminance Processor	48 SDIP	717
KA8104	Chrominance Processor	30 SDIP	725
KA8301	Meter Driver for VTR	10 SIP H/S	734
KA8302/12	Servo Control Amplifier	12 SIPS	740
KA8303	VTR Digital Servo Controller	42 SDIP	744
KA8304	2-Phase DD Motor Driver	12 SIP H/S	753
KA8306	Dual Bridge Driver	10 SIP H/S	761
KA8308	1-Chip Digital Servo Controller for VTR	30 SDIP	768
KA8401	Switchless Recording/Play Back Amplifier	24 ZIP	775
KA8402	2-Input Switch	7 SIP	781
KA8403	3-Input Switch	9 SIP	786
KA9256	Dual Power Operational Amplifier	10 SIP H/S	431
KA9257	Dual Power Operational Amplifier	12 SIP H/S	433
KAD0808	8 Bit μ p-Compatible A/D Converter with 8-Channel Multiplexer	28 DIP	Vol. 3
KAD0809	8 Bit μ p-Compatible A/D Converter with 8-Channel Multiplexer	28 DIP	Vol. 3
KAD0820A/B	8 Bit High Speed μ p-Compatible A/D Converter with Track/Hold Function	20 DIP	Vol. 3
KDA0800	8 Bit D/A Converter	16 DIP	Vol. 3
KDA0801	8 Bit D/A Converter	16 DIP	Vol. 3
KDA0802	8 Bit D/A Converter	16 DIP	Vol. 3
KF347	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
KF351	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
KF442	Dual Operational Amplifier	8 DIP/8 SOP	Vol. 2
KS272	Dual Operational Amplifier	8 DIP/9 SIP	Vol. 2
KS274	Quad Operational Amplifier	14 DIP	Vol. 2
KS555	CMOS Timer	8 DIP/8 SOP	Vol. 2
KS555H	CMOS Timer	8 DIP/8 SOP	Vol. 2
KS556	CMOS Timer	14 DIP/14 SOP	Vol. 2
KS5410	Remote Control Transmitter	20 SOP	789
KS5706	3 Line Drivers and 3 Line Receivers	16 DIP/16 SOP	Vol. 2
KS5788	Quad CMOS Line Driver	14 DIP/14 SOP	Vol. 2
KS5789A	Quad CMOS Line Receiver	14 DIP/14 SOP	Vol. 2
KS5803A/B	Remote Control Transmitter	16 DIP/20 SOP	799
KS5805A/B	Telephone Pulse Dialer with Redial	18 DIP	Vol. 2
KS58C/D05	Telephone Pulse Dialer with Redial	18 DIP	Vol. 2
KS58E05	Telephone Pulse Dialer with Redial	16 DIP	Vol. 2
KS5808	Dual Tone Multi Frequency Dialer	16 DIP	Vol. 2
KS5809	DTMF Dialer	16 DIP	Vol. 2
KS5810	DTMF Dialer with Redial	16 DIP	Vol. 2
KS5811	DTMF Dialer with Redial	16 DIP	Vol. 2
KS5812	Quad Universal Asynchronous Receiver and Transmitter	40 DIP	Vol. 2
KS58A/B/C/D19	Tone/Pulse Dialer with Redial	22 DIP/SDIP	Vol. 2
KS58A/B/C/D20	Tone/Pulse Dialer with Redial	18 DIP	Vol. 2
KS5822	10 Memory Tone/Pulse Repertory Dialer	22 DIP	Vol. 2
KS58A/B/C/D23	10 Memory Tone/Pulse Repertory Dialer	18 DIP	Vol. 2
KS5824	Universal Asynchronous Receiver and Transmitter	24 DIP	Vol. 2
KS7126	3 1/2 Digit A/D Converter	40 DIP	Vol. 3
KS25C02	8 Bit CMOS Successive Approximation Register	16 DIP/24 SDIP	Vol. 3
KS25C03	8 Bit CMOS Successive Approximation Register	16 DIP/24 SDIP	Vol. 3
KS25C04	12 Bit CMOS Successive Approximation Register	24 DIP/24 SDIP	Vol. 3

ALPHANUMERIC INDEX (Continued)

Device	Function	Package	Page
KSV3100A	High-Speed A/D-DA Converter	40 DIP	Vol. 3
KSV3110	High-Speed A/D-DA Converter	40 DIP	Vol. 3
KSV3208	High-Speed A/D Converter	28 DIP	Vol. 3
KT3040/A	PCM Monolithic Filter	16 CERDIP	Vol. 2
KT3170	DTMF Receiver	18 DIP	Vol. 2
KT5116	μ -Law Companding CODEC	16 CERDIP	Vol. 2
KT8520	μ -Law Companding CODEC	24 CERDIP	Vol. 2
KT8521	A-Law Companding CODEC	22 CERDIP	Vol. 2
KT8554	μ -Law COMBO CODEC	16 CERDIP	Vol. 2
KT8555	Time Slot Assignment Circuit	20 CERDIP	Vol. 2
KT8557	A-Law COMBO CODEC	16 CERDIP	Vol. 2
KT8564	μ -Law COMBO CODEC	20 CERDIP	Vol. 2
KT8567	A-Law COMBO CODEC	20 CERDIP	Vol. 2
LM224/A	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM239/A	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
LM248	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM258/A	Dual Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
LM293/A	Dual Differential Comparator	8 DIP/8 SOP	Vol. 2
LM311	Voltage Comparator	8 DIP/8 SOP	Vol. 2
LM317	3-Terminal Positive Adjustable Regulator	TO-220	Vol. 2
LM323	3-Terminal Positive Adjustable Regulator	TO-3P	Vol. 2
LM324/A	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM339/A	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
LM348	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM358/A	Quad Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
LM386/S/D	Low Voltage Audio Power Amplifier	8 DIP/8 SOP/9 SIP	437
LM393/A	Dual Differential Comparator	8 DIP/8 SOP	Vol. 2
LM567C	Tone Decoder	8 DIP/8 SOP	Vol. 2
LM567L	Micropower Tone Decoder	8 DIP/8 SOP	Vol. 2
LM723	Precision Voltage Regulator	14 DIP/14 SOP	Vol. 2
LM741C/E/I	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
LM2901	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
LM2902	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM2903	Dual Differential Comparator	8 DIP/8 SOP	Vol. 2
LM2904	Dual Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
LM3302	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
MC1458/C/I	Dual Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
MC1488	Quad Line Driver	14 DIP/14 SOP	Vol. 2
MC1489/A	Quad Line Receiver	14 DIP/14 SOP	Vol. 2
MC3303	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
MC3361	Low Power Narrow Band FM IF	16 DIP/16 SOP	Vol. 2
MC3403	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
MC4558/C/A/I	Dual Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
MC78XX	3-Terminal 1A Positive Voltage Regulator	TO-220	Vol. 2
MC78LXX	3-Terminal 0.1A Positive Voltage Regulator	TO-92	Vol. 2
MC78MXX	3-Terminal 0.5A Positive Voltage Regulator	TO-220	Vol. 2
MC79XX	3-Terminal 1A Negative Voltage Regulator	TO-220	Vol. 2
MC79LXX	3-Terminal 0.1A Negative Voltage Regulator	TO-92	Vol. 2
MC79MXX	3-Terminal 0.5A Negative Voltage Regulator	TO-220	Vol. 2
NE555	Single Timer	8 DIP/8 SOP	Vol. 2
NE556	Dual Timer	14 DIP/14 SOP	Vol. 2
NE558	Quad Timer	16 DIP/16 SOP	Vol. 2

PRODUCT INDEX

1. Audio Application

Device	Function	Package	Page
KA1222	Dual Low Noise Equalizer Amplifier	8 DIP	79
KA2201	1.2W Audio Power Amplifier	8 DIP	83
KA2201B	0.5W Audio Power Amplifier	8 DIP	87
KA2206	2.3W Dual Audio Power Amplifier	12 DIP/F	90
KA22062	4.5W Dual Power Amplifier	12 SIP H/S	98
KA22063	4.5W Dual Power Amplifier	12 SIP H/S	105
KA2209	Dual Low Voltage Power Amplifier	8 DIP	111
KA2210	5.5W Dual Power Amplifier	12 SIP H/S	114
KA22101	23W Power Amplifier	12 SIP H/S	119
KA2211	5.8W Dual Power Amplifier	12 SIP H/S	126
KA2212	0.5W Audio Power Amplifier	9 SIP	131
KA2213	One Chip Tape Recorder System	14 DIP H/S	136
KA22131	Dual Pre-Power Amplifier for Auto Reverse	24 SOP	143
KA22134	Dual Pre-Power Amplifier with DC Volume Control	16 DIP	150
KA22135	Dual Pre-Power Amplifier and DC Motor Speed Controller	22 SDIP	155
KA2214	1W Dual Power Amplifier	14 DIP H/S	160
KA2220	Equalizer Amplifier with ALC	9 SIP	165
KA2221	Dual Low Noise Equalizer Amplifier	8 SIP	170
KA22211	Dual Low Noise Equalizer Amplifier	8 SIP	174
KA2223	5 Band Graphic Equalizer Amplifier	16 DIP	178
KA22231	5 Band Dual Graphic Equalizer Amplifier	28 SOP	184
KA22232	3 Band Dual Graphic Equalizer Amplifier	20 SOP	188
KA22233	3 Band Dual Graphic Equalizer Amplifier	22 DIP	192
KA22234	5 Band Dual Graphic Equalizer Amplifier	24 SZIP	196
KA22235	5 Band Graphic Equalizer Amplifier	18 ZIP	200
KA2224	Dual Equalizer Amplifier with ALC	14 DIP	205
KA22241	Dual Equalizer Amplifier with ALC	9 SIP	212
KA22242	Dual Equalizer Pre-Amplifier with ALC	10 SIP	217
KA2225	Dual Pre-Amplifier for 3V Using	16 DIP/16 SOP	225
KA22261	Dual Equalizer Amplifier with Ree AMP	16 DIP	230
KA2228	Dual Equalizer Amplifier System	21 SZIP	236
KA2229A	Quad Equalizer Amplifier for Double Cassette	24 SDIP	246
KA2230	9-Program Music Selector	22 DIP	251
KA2231	Audio Level Sensor	9 SIP	258
KA22421	AM 1 Chip Radio	16 DIP/16 SOP	263
KA22427	AM/FM 1 Chip Radio	16 DIP	273
KA22429	FM One Chip Radio	16 SOP	282
KA2243	AM/FM IF System	16 DIP	287
KA2244	FM IF System for Car Radio	9 SIP	293
KA22441	FM IF System for Car Stereo	16 ZIP	297
KA2245	FM IF System for Car Radio	7 SIP	305
KA22461	Electronic Tuning AM Radio Receiver for Car Stereo	19 ZIP	309
KA2247	FM IF/AM Tuner System	16 DIP	314
KA22471	FM IF/AM Tuner System	16 DIP	319
KA2248	3V FM IF/AM Tuner System	16 DIP/20 SOP	324
KA2249	FM Front End Portable Radio	7 SIP	329
KA22495	FM Front End	9 SIP/14 SOP	333
KA22496	FM Front End	9 SIP	341
KA2261	FM Stereo Multiplex Decoder	16 DIP	346
KA2262	FM Stereo Multiplex Decoder for Car Stereo	16 ZIP	351
KA2263	FM Stereo Multiplex Decoder	9 SIP	361
KA2264	FM Stereo Multiplex Decoder	9 SIP/16 SOP	365
KA2265	Vco Non-Adjusting FM Stereo Multiplex Decoder	16 DIP	370
KA2266	MPX for Car Stereo	16 ZIP	376
KA2272	FM Noise Canceller	16 ZIP/16 SOP	380
KA2281	5 Dot Dual Led Level Meter Driver	16 DIP	386
KA2283	5 Dot Dual Led Level Meter Driver	16 DIP	389
KA2284/85	5 Dot Led Level Meter Driver	9 SIP	393
KA2286/87	5 Dot Led Linear Level Meter Driver	9 SIP	396
KA2288	7 Dot Led Level Meter Driver	16 DIP	399
KA2401	DC Motor Speed Controller	8 DIP	402
KA2402	Low Voltage DC Motor Speed Controller	8 DIP	408
KA2404	DC Motor Speed Controller	TO-92L	415
KA2407	DC Motor Speed Controller	TO-126	421
KA7226	Dual Equalizer Amplifier with ALC	14 DIP	425
KA9256	Dual Power Operational Amplifier	10 SIP H/S	431
KA9257	Dual Power Operational Amplifier	12 SIP H/S	433
LM386	Low Voltage Audio Power Amplifier	8 DIP/8 SOP/9 SIP	437

PRODUCT INDEX (Continued)

2. Video Application

Device	Function	Package	Page
KA2101	TV Sound IF Amplifier	14 DIP	443
KA2102A	TV Sound System	14 DIP H/S	448
KA2103L	Sound Mute System TV	8 SIP	452
KA2104	Auto Power Off and Sound Mute System for TV	9 SIP	455
KA2105	Limiter Amplifier and Detector for A TV SIF	9 SIP	459
KA2106	Dual Sound Multiplex for A TV SIF	16 DIP	463
KA2107	DC Volume Tone Control Circuit	12 SIP	467
KA2130A	TV Vertical Deflection System	10 SIP H/S	471
KA2131	TV Vertical Output Circuit	9 SIP H/S	474
KA2133	1 Chip Deflection System	16 DIP H/S	478
KA2134	Color TV Deflection Signal Processing IC	18 DIP	482
KA2135	Horizontal Signal Processing	12 SIP	487
KA2136	Low-Noise TV Vertical Deflection System	12 ZDIP/F	491
KA2137	TV Horizontal Processor	16 DIP	498
KA2138	Deflection Processor for CRT Display	20 DIP	509
KA2153	Video-Chroma Deflection System for A Color TV (NTSC)	42 DIP	513
KA2154	Video-Chroma-Deflection System for Color Television (PAL/NTSC)	42 DIP	524
KA2155/56	Video Chroma Deflection System for A Color TV (NTSC)	30 SDIP	545
KA2181	Remote Control Preamplifier	8 SIP	551
KA2182/83	Remote Control Preamplifier	8 SIP	554
KA2184	Remote Control Preamplifier	8 SIP	557
KA2186	Video Switching Circuit for TV	8 DIP	561
KA2268N	One Chip TV Sound MPX (Korea Two Carrier System)	28 DIP	563
KA22682	One Chip TV MPX Demodulator (Korea Two Carrier System)	28 DIP	571
KA2269	TV Sound MPX for USA	42 SDIP	579
KA2270	Noise Reduction System for TV Sound	16 DIP	592
KA2605	Sync Separator I	9 SIP	596
KA2606	Sync Separator II	9 SIP	600
KA2615/16	LED and Lamp Driver	9 SIP	607
KA2617/18	LED and Lamp Driver	9 SIP	607
KA2911/16	Video IF System for Color TV	16 DIP	611
KA2912	Video IF Processor for B/W TV	14 DIP H/S	616
KA2913A/17	Video and Sound IF Amplifier for Monochrome TV Receivers	16 DIP	620
KA2914A/18	Video IF + SIF System	24 DIP	629
KA2915	TV VIF & SIF & Deflection System (IC for TV Large Integration)	28 DIP	644
KA2919	(VIF + SIF) System for Color TV	30 SDIP	650
KA2922/23	Video & Sound IF Amplifier for TV Sets VTR's	20 DIP	655
KA2944	Write & Read Amplifier	28 DIP	660
KA2945	Video Amplifier	28 DIP	667
KA2981	VHF Band RF Modulator	16 DIP	673
KA2983	Switchless Recording/Playback Amplifier	18 DIP	680
KA2988	Chroma Signal Processor	28 DIP	683
KA6101/02	Analog Interface Circuit for Teletext System	18 DIP	688
KA6201	Flexible Disk Read Amplifier	18 DIP	694
KA6202	Two Phase Stepping Motor Driver	16 DIP	705
KA8101	Detail Enhancer	9 SIP	709
KA8102	Write & Read Amplifier	22 SDIP	712
KA8103	Luminance Processor	48 SDIP	717
KA8104	Chrominance Processor	30 SDIP	725
KA8301	Motor Driver for VTR	10 SIP H/S	734
KA8302/12	Servo Control AMP	12 SIP	740
KA8303	VTR Digital Servo Controller	42 SDIP	744
KA8304	2-Phase DD Motor Driver	12 SIP H/S	753
KA8306	Dual Bridge Driver	10 SIP H/S	761
KA8308	1-Chip Digital Servo Controller for VTR	30 SDIP	768
KA8401	Switchless Recording/Play Back Amplifier	24 ZIP	775
KA8402	2-Input Switch	7 SIP	781
KA8403	3-Input Switch	9 SIP	786
KS5410	Remote Control Transmitter	20 SOP	789
KS5803/B	Remote Control Transmitter	16 DIP/20 SOP	799

PRODUCT INDEX (Continued)

3. Telecommunication Application

Device	Function	Package	Page
KA2410	Tone Ringer	8 DIP	Vol. 2
KA2411	Tone Ringer	8 DIP	Vol. 2
KA2412A	Telephone Speech Circuits	14 DIP	Vol. 2
KA2413	Dual Tone Multi Frequency Generator	16 DIP	Vol. 2
KA2418	Tone Ringer with Bridge Diode	8 DIP	Vol. 2
KA2425A/B	Telephone Speech Network with Dialer Interface	18 DIP	Vol. 2
KA2654	Line Transceiver	8 DIP	Vol. 2
KS5706	3 Line Drivers and 3 Line Receivers	16 DIP/SOP	Vol. 2
KS5788	Quad CMOS Line Driver	14 DIP/SOP	Vol. 2
KS5789A	Quad CMOS Line Receiver	14 DIP/SOP	Vol. 2
KS5805A/B	Telephone Pulse Dialer with Redial	18 DIP	Vol. 2
KS58C/D05	Telephone Pulse Dialer with Redial	18 DIP	Vol. 2
KS58E05	Telephone Pulse Dialer with Redial	16 DIP	Vol. 2
KS5808	Dual Tone Multi Frequency Dialer	16 DIP	Vol. 2
KS5809	DTMF Dialer	16 DIP	Vol. 2
KS5810	DTMF Dialer with Redial	16 DIP	Vol. 2
KS5811	DTMF Dialer with Redial	16 DIP	Vol. 2
KS5812	Quad Universal Asynchronous Receiver and Transmitter	40 DIP	Vol. 2
KS58A/B/C/D19	Tone/Pulse Dialer with Redial	22 DIP	Vol. 2
KS58A/B/C/D20	Tone/Pulse Dialer with Redial	18 DIP	Vol. 2
KS5822	10 Memory Tone/Pulse Repertory Dialer	22 DIP	Vol. 2
KS58A/B/C/D23	10 Memory Tone/Pulse Repertory Dialer	18 DIP	Vol. 2
KS5824	Universal Asynchronous Receiver and Transmitter	24 DIP	Vol. 2
KT3040/A	PCM Monolithic Filter	16 Cerdip	Vol. 2
KT3170	DTMF Receiver	18 DIP	Vol. 2
KT5116	μ -Law Companding CODEC	16 Cerdip	Vol. 2
KT8520	μ -Law Companding CODEC	24 Cerdip	Vol. 2
KT8521	A-Law Companding CODEC	22 Cerdip	Vol. 2
KT8554	μ -Law COMBO CODEC	16 Cerdip	Vol. 2
KT8555	Time Slot Assignment Circuit	20 Cerdip	Vol. 2
KT8557	A-Law COMBO CODEC	16 Cerdip	Vol. 2
KT8564	μ -Law COMBO CODEC	20 Cerdip	Vol. 2
KT8567	A-Law COMBO CODEC	20 Cerdip	Vol. 2
LM567C	Tone Decoder	8 DIP/SOP	Vol. 2
LM567L	Micropower Tone Decoder	8 DIP/SOP	Vol. 2
MC1488	Quad Line Driver	14 DIP/SOP	Vol. 2
MC1489/A	Quad Line Receiver	14 DIP/SOP	Vol. 2
MC3361	Low Power Narrow Band FM IF	16 DIP/SOP	Vol. 2
KA2580A	8-Channel Source Drivers	18 DIP	Vol. 2
KA2588A	8-Channel Source Drivers	20 DIP	Vol. 2
KA2651	Fluorescent Display Drivers	18 DIP	Vol. 2
KA2655/6/7/8/9	High Voltage, High Current Darlington Arrays	16 DIP/SOP	Vol. 2

PRODUCT INDEX (Continued)

4. Industrial Application

Device	Function	Package	Page
KA33V	Silicon Monolithic Bipolar Integrated Circuit Voltage Stabilizer for Electronic Tuner	TO-92	Vol. 2
KA201A	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
KA219	Dual High Speed Voltage Comparator	14 DIP/14 SOP	Vol. 2
KA301A	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
KA319	Dual High Speed Voltage Comparator	14 DIP/14 SOP	Vol. 2
KA331	Voltage to Frequency Converter	8 DIP/8 SOP	Vol. 2
KA336-5.0/2.5	Voltage Reference Diode	TO-92	Vol. 2
KA337	Negative Adjustable-Voltage Regulator	TO-220	Vol. 2
KA340	1A Positive Voltage Regulator	TO-220	Vol. 2
KA350	3A Adjustable Positive Voltage Regulator	TO-3P/TO-220	Vol. 2
KA431	Programmable Precision Reference	TO-92/8 DIP/8 SOP	Vol. 2
KA710C/I	High Speed Voltage Comparator	14 DIP/14 SOP	Vol. 2
KA711C/I	Dual High-Speed Differential Comparator	14 DIP/14 SOP	Vol. 2
KA733C	Differential Video Amplifier	14 DIP/14 SOP	Vol. 2
KA2807	Earth Leakage Detector	8 DIP	Vol. 2
KA3524	PWM Control Circuits	16 DIP	Vol. 2
KA7500	Switchmode PWM Control Circuits	16 DIP	Vol. 2
KA78S40	Switching Regulator	16 DIP	Vol. 2
KA78TXX	3A Positive Voltage Regulator	TO-220	Vol. 2
KA9256	Dual Power Operational Amplifier	10 SIP	Vol. 2
KF351	Single Operating Amplifier	8 DIP/8 SOP	Vol. 2
KF347	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
KF442	Dual Operational Amplifier	8 DIP/8 SOP	Vol. 2
KS272	Dual Operational Amplifier	8 DIP	Vol. 2
KS274	Quad Operational Amplifier	14 DIP/9 SIP	Vol. 2
KS555	CMOS Timer	8 DIP/8 SOP	Vol. 2
KS555H	CMOS Timer	8 DIP/8 SOP	Vol. 2
KS556	CMOS Timer	14 DIP/14 SOP	Vol. 2
LM224/A	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM239/A	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
LM248	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM258/A	Quad Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
LM293/A	Dual Differential Comparator	8 DIP/8 SOP	Vol. 2
LM311	Voltage Comparator	8 DIP/8 SOP	Vol. 2
LM317	3-Terminal Positive Voltage Regulator	TO-220	Vol. 2
LM323	3-Terminal Positive Voltage Regulator	TO-3P	Vol. 2
LM324/A	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM339/A	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
LM348	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM358/A	Quad Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
LM393/A	Dual Differential Comparator	8 DIP/8 SOP	Vol. 2
LM723	Precision Voltage Regulator	14 DIP/14 SOP	Vol. 2
LM741C/E/I	Single Operational Amplifier	8 DIP/8 SOP	Vol. 2
LM2901	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2

PRODUCT INDEX (Continued)

4. Industrial Application (Continued)

Device	Function	Package	Page
LM2902	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
LM2903	Dual Differential Comparator	8 DIP/8 SOP	Vol. 2
LM2904	Quad Operational Amplifier	8 DIP/8 SOP/8 SIP	Vol. 2
LM3302	Quad Differential Comparator	14 DIP/14 SOP	Vol. 2
MC1458/C/I	Dual Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
MC3303	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
MC3403	Quad Operational Amplifier	14 DIP/14 SOP	Vol. 2
MC4558/C/A/I	Dual Operational Amplifier	8 DIP/8 SOP/9 SIP	Vol. 2
MC78XX	3-Terminal 1A Positive Voltage Regulator	TO-220	Vol. 2
MC78LXX	3-Terminal Positive Voltage Regulator	TO-92	Vol. 2
MC78MXX	3-Terminal 0.5A Positive Voltage Regulator	TO-220	Vol. 2
MC79XX	3-Terminal Negative Voltage Regulator	TO-220	Vol. 2
MC79LXX	0.1A Negative Voltage Regulator	TO-92	Vol. 2
MC79MXX	3-Terminal 0.5A Negative Voltage Regulator	TO-220	Vol. 2
NE555	Timer	8 DIP/8 SOP	Vol. 2
NE556	Dual Timer	14 DIP/14 SOP	Vol. 2
NE558	Quad Timer	16 DIP/16 SOP	Vol. 2

5. Data Converter Application

Device	Function	Package	Page
KSV3100A	8 Bit A/D Converter + 10 Bit D/A Converter	40 DIP	Vol. 3
*KSV3110	8 Bit A/D Converter + 10 Bit D/A Converter	40 DIP	Vol. 3
*KSV3208	8 Bit A/D Converter	28 DIP	Vol. 3
**KAD0206	6 Bit A/D Converter (20 MSPS)	32SOIC/30 SDIP	Vol. 3
KAD0808/09	8 Bit up-Compatible A/D Converter (8 CH)	28 DIP	Vol. 3
*KAD0817	8 Bit up-Compatible A/D Converter (16 CH)	40 DIP	Vol. 3
KAD0820	8 Bit up-Compatible A/D Converter	20 DIP	Vol. 3
KS7126	3 1/2 Digit A/D Converter	40 DIP	Vol. 3
*KDA0406	Tripple 6 Bit D/A Converter (20 MSPS)	28SOIC/28 SDIP	Vol. 3
*KDA3310	10 Bit D/A Converter	28 CERDIP	Vol. 3
KDA0800/08	8 Bit D/A Converter	16 DIP	Vol. 3
KS25C02	8 Bit CMOS Successive Approximation Register	16 DIP	Vol. 3
KS25C03	8 Bit CMOS Successive Approximation Register	16 DIP	Vol. 3
KS25C04	12 Bit CMOS Successive Approximation Register	16 DIP	Vol. 3

6. Toy Application

Device	Function	Package	Page
KA2303	Toy Radio Control Actuator	9 SIP	809
KA2304	Toy Radio Control Actuator	9 SIP	812
KA2305A	Toy Radio Control Actuator (Rx)	12 SIP-SH	814
KA2306A	Toy Radio Control Actuator (Rx)	14 DIP	818
KA2309	Toy Radio Control Actuator (Rx)	16 DIP	822
KA2310	Toy Radio Control Actuator (Tx)	9 SIP	829
KA2311	Toy Radio Control Actuator (Rx)	16 DIP	832
KA2312	Toy Radio Control Actuator (Tx)	9 SIP	837
KA2303	Application Note		840
KA2309	Application Note		847
KA2311	Application Note		857
KA2312	Application Note		868

*: New Product

** : Under Development

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

1

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

2

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

3

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

4

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

Industrial Control Actuators

5

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

Industrial Control Systems

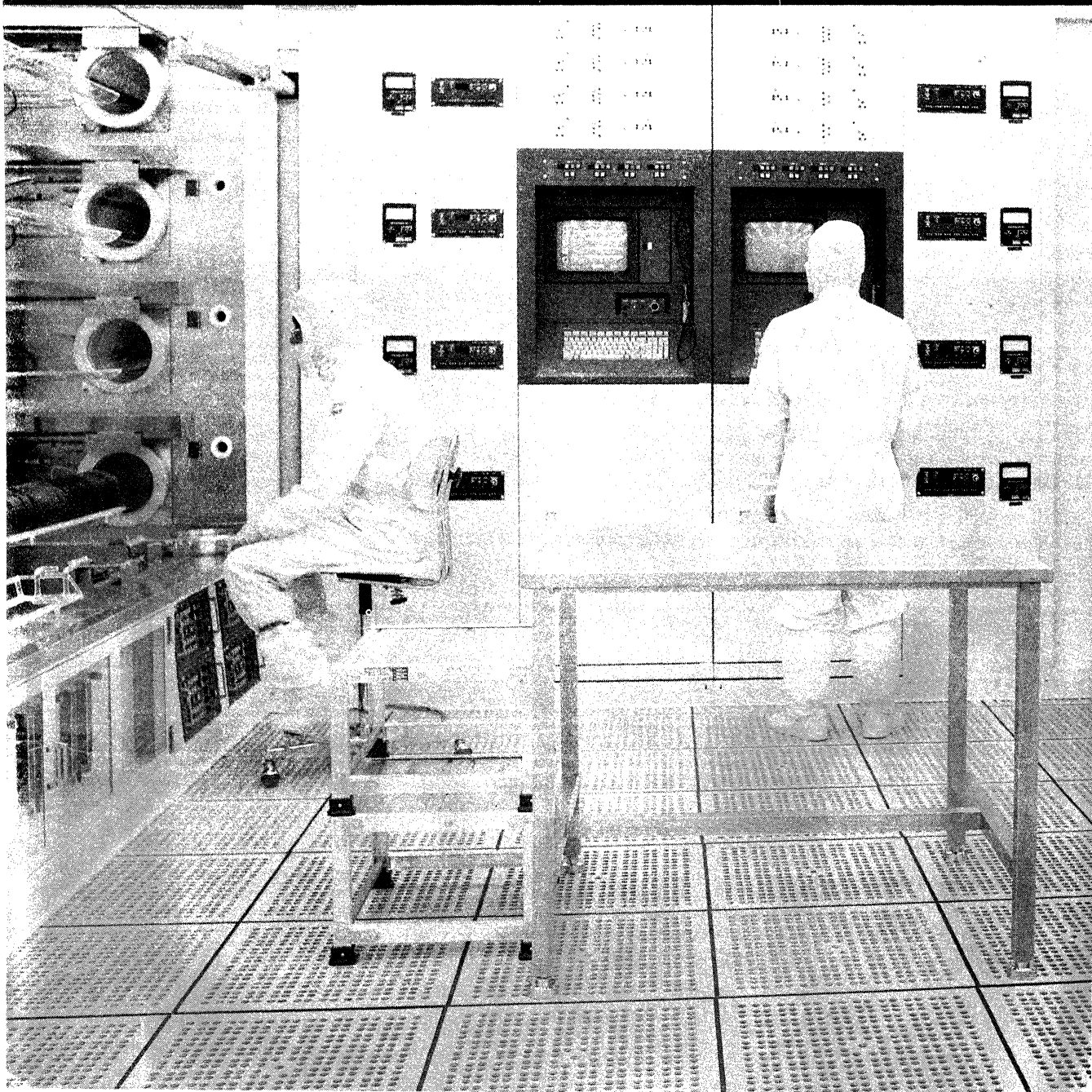
6

...the most common type of actuator used in industrial applications. It is a device that converts electrical energy into mechanical energy, and is used to move or position a load. The most common type of actuator is the electric motor, which is used to drive a variety of machinery. Other types of actuators include pneumatic actuators, which use compressed air to move a load, and hydraulic actuators, which use hydraulic fluid to move a load. Actuators are used in a wide variety of applications, from simple on/off control to complex motion control.

Industrial Control Manufacturers

7

QUALITY & RELIABILITY 1



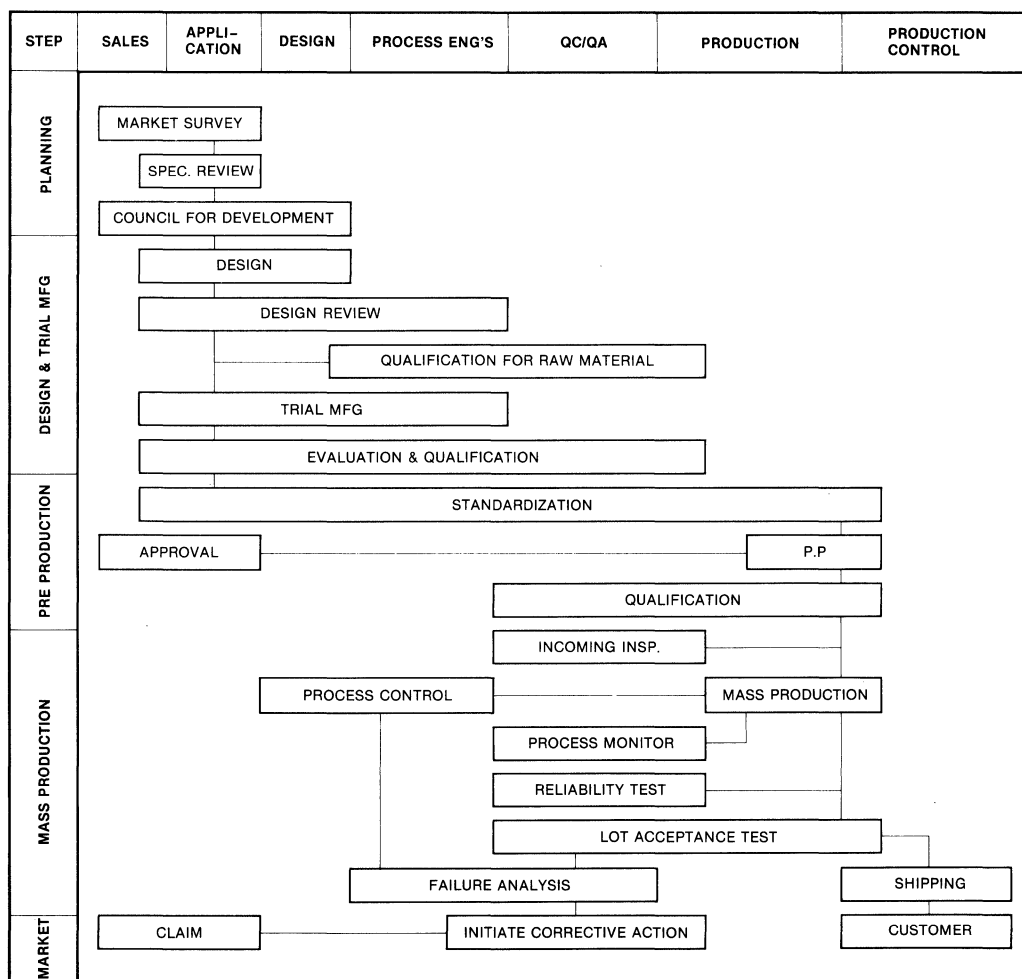
QUALITY and RELIABILITY

INTRODUCTION

Samsung's linear IC products are among the most reliable in the industry. Samsung has always made a commitment to achieve the highest possible quality, reliability, and customer satisfaction with its products. Extensive qualification, monitor and outgoing programs are used to scrutinize product quality and reliability. Stringent controls are applied to every wafer fabrication and assembly lot to achieve reproducibility, and therefore maintain product reliability.

In this chapter, the quality and reliability programs established at Samsung will be discussed. In addition, a description of reliability theory, reliability tests and various support efforts provides a broad framework from which to comprehend Samsung quality and reliability.

To better understand the Quality Department's role in product development and manufacturing, a detailed diagram is listed below. As can be noted, Quality Engineering is involved in all phases, save that of initial product planning.

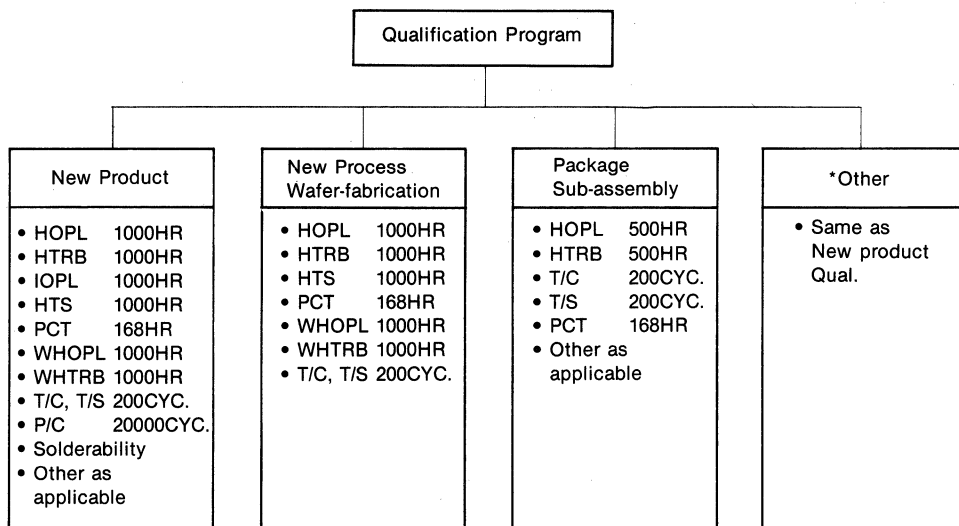


Quality Assurance During Development

QUALITY and RELIABILITY

QUALIFICATION

Procedures to qualify devices are listed below. There are both general and product-specific requirements. Procedures are detailed for new products, die-only qualifications, and package-only qualifications. The latter two are for products and/or packages already qualified, but where there is room for further product optimization.



* Design, Equipment, Material(s), etc....

Qualification Programs.

QUALITY and RELIABILITY

A) New Product Qualification Test Items

No.	Test Item	Test Condition	Part		Sample Size	LTPD	ACC. No	Reference Method	Note
			L-IC	Discrete					
1	High Temperature Reverse Bias (HTRB)	Ta = T _i (max) V _{CB} = 0.8 × V _{CBO} 1000HRS	—	YES	45	10	1		48HR for PRT
2	High Temperature Operating Life (HOPL)	Ta = T _{opr} (max) V _{CC} = V _{CC} (max) Static, Dynamic 1000HRS	YES	—	45	10	1	MIL-STD-883 1005	48HR for PRT
3	High Temperature Storage (HTS)	Ta = T _i (max) 1000HRS	YES	YES	45	10	1		
4	Operating Life (OPL)	Ta = 25°C Pc = Pc(max) 1000HRS	—	YES	45	10	1	MIL-STD-750 1026.3	for Small-Signal Device
5	Intermittent OPL (IOPL)	Ta = 25°C Pc = Pc(max) 2min/2min On/Off 1000HRS	—	YES	45	10	1	MIL-STD-750 1036.3	
6	Power Cycle (P/C)	ΔT _j = 125°C 45Sec/90Sec On/Off 20000CYC.	YES	YES	45	10	1		For PWR TR, PWR IC
7	Pressure Cooker Test (PCT)	Ta = 121°C ± 2°C RH = 100% 15PSIG 168HRS	YES	YES	45	10	1		48HR for PRT
8	Wet High Temperature Reverse Bias (WHTRB)	Ta = 85°C, RH = 85% V _{CB} = 0.8 × V _{CBO} 1000HRS	—	YES	45	10	1		
9	Wet High Temperature Operating Life (WHOPL)	Ta = 85°C, RH = 85% V _{CC} = V _{CC} (opr), P _{dmin} 1000HRS	YES	—	45	10	1		
10	Thermal Shock (T/S)	– 65°C → 150°C (Liquid) 5min < 10Sec, 5min 200 Cycles	YES	YES	45	10	1	MIL-STD-883 1011	
11	Temperature Cycle (T/C)	– 65°C → 25°C → 150°C 10min, 5min, 10min 200 Cycles	YES	YES	45	10	1	MIL-STD-883 1011	

QUALITY and RELIABILITY

A) New Products Qualification Test Item (Continued)

No.	Test Item	Test Condition	Part		Sample Size	LTPD	ACC. No.	Reference Method	Note
			L-IC	Discrete					
12	Solder Heat Resistance (S/H)	Ta = 260°C ± 5°C t = 10 ± 0.5sec	YES	YES	10	N/A	0	MIL-STD-750 2031	
13	Solderability	Ta = 245°C ± 5°C t = 10 ± 1Sec	YES	YES	10	N/A	0	MIL-STD-883 2003	
14	Salt Atmosphere	Ta = 35°C, 5% NaCl 24HRS	YES	YES	10	N/A	0	MIL-STD-883 1009A	
15	Mechanical Shock	1500G, 0.5ms 3.Times each direction of X, Y and Z Axis	YES	YES	10	N/A	0	MIL-STD-750 2016	For Hermetic
16	Vibration	20G, 3Axis f = 20 to 2000 cps for 4min, 4 cycles	YES	YES	10	N/A	0	MIL-STD-883 2007	For Hermetic
17	Constant Acceleration	2000G X, Y, Z Axis 1min for each Axis	YES	YES	10	N/A	0	MIL-STD-883 2001	For Hermetic
18	ESD (Human Body (Model))	R = 1.5KΩ C = 100pF 5 Discharge V ≥ ± 1000V	YES	YES	5	N/A	0	MIL-STD-883 3015	
19	Latch-up Test		YES	—	5	N/A	0	—	For CMOS
20	Fine Leak Gross Leak	Helium Fluoro carbon	YES	YES	45	10	1	MIL-STD-883 1014	For Hermetic

Note) • N/A: Not available
 • SOT-23, TO-92S PKG: PCT 48HR
 • PRT: Process Reliability Test (all outgoing Lots)

QUALITY and RELIABILITY

B) New Process, Wafer Fabrication Qualification

No	Test Item	Test Condition	Package		Sample Size	LTPD	ACC No
			L-IC	Discrete			
1	High Temperature Operating Life (HOPL)	$T_a = T_{opr(max)}$ $V_{CC} = V_{CC(max)}$ STATIC, DYNAMIC 1000HRS	YES	—	45	10	1
2	High Temperature Reverse Bias (HTRB)	$T_a = T_j(max)$ $V_{CB} = 0.8 \times V_{CBO}$ 1000HRS	—	YES	45	10	1
3	High Temperature Storage (HTS)	$T_a = T_j(max)$ 1000HRS	YES	YES	45	10	1
4	Pressure Cooker Test (PCT)	$T_a = 121^\circ\text{C} \pm 2^\circ\text{C}$ RH = 100% 15 PSIG 168HRS	YES	YES	45	10	1
5	Wet High Temperature Operating Life (WHOPL)	$T_a = 85^\circ\text{C}$, RH = 85% $V_{CC} = V_{CC(opr)}$ 1000HRS	YES	—	45	10	1
6	Wet High Temperature Reverse Bias (WHTRB)	$T_a = 85^\circ\text{C}$, RH = 85% $V_{CB} = 0.8 \times V_{CBO}$ 1000HRS	—	YES	45	10	1
7	Thermal Shock (T/S)	$-65^\circ\text{C} \rightarrow 150^\circ\text{C}$ (Liquid) 5min < 10sec, 5min 200 Cycles	YES	YES	45	10	1
8	Temperature Cycle (T/C)	$-65^\circ\text{C} \rightarrow 25^\circ\text{C} \rightarrow 150^\circ\text{C}$ 10min, 5min, 10min 200 Cycles	YES	YES	45	10	1

QUALITY and RELIABILITY

C) Package Sub-Assembly Qualification

No	Test Item	Test Condition	Package		Sample Size	LTPD	ACC No	Notes
			Plastic	Hermetic				
1	High Temperature Reverse Bias (HTRB)	$T_a = T_j(\max)$ $V_{CB} = V_{CBO} \times 0.8$ 500HRS	YES	YES	45	10	1	For Discrete
2	High Temperature Operating Life (HOPL)	$T_a = T_{opr}(\max)$ $V_{CC} = V_{CC}(\max)$ Static, Dynamic 500HRS	YES	YES	45	10	1	For L-IC
3	Temperature Cycle (T/C)	$-65^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \rightarrow 150^{\circ}\text{C}$ 10min, 5min, 10min 200 Cycles	YES	YES	45	10	1	
4	Pressure Cooker Test (PCT)	$T_a = 121^{\circ}\text{C} \pm 2^{\circ}\text{C}$ RH = 100%, 15PSIG 168HRS	YES	—	45	10	1	
5	Thermal Shock (T/S)	$-65^{\circ}\text{C} \rightarrow 150^{\circ}\text{C}$ (Liquid) 5min < 10sec, 5min 200 Cycles	YES	YES	45	10	1	
6	Solder Heat Resistance (S/H)	$260^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 10 ± 1 sec	YES	YES	10	N/A	0	
7	Vibration (Variable-Frequency)	100 – 200 – 100Hz 20G, 5min, 5Times, X, Y, Z	—	YES	10	N/A	0	For Discrete, others as applicable
8	Mechanical Shock (M/S)	1500G, 0.5ms 3 Times, X, Y, Z	—	YES	10	N/A	0	same as above
9	Constant Acceleration	20000G X, Y, Z Axis 1 min for each Axis	—	YES	10	N/A	0	same as above

Note) • N/A: not available

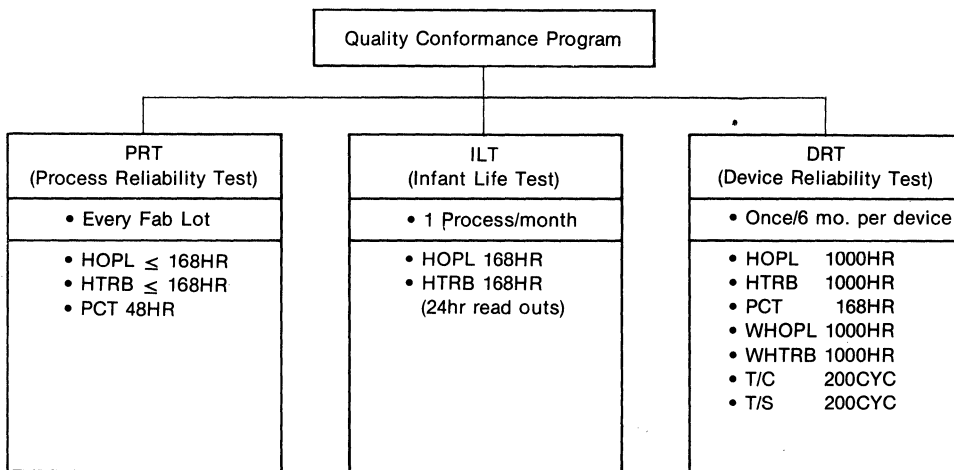
QUALITY and RELIABILITY

Product Reliability (Quality Conformance) Monitors

Samsung implements periodic testing to monitor the ongoing reliability of its products. A subset of stresses used for qualification are run; they are seen as most critical for basic device reliability. Formally this is known as the Device Reliability Test System, or simply as DRT.

Lot-by-lot infant mortality reliability testing is also accomplished at Samsung. The purpose of this is to verify process integrity in a full QA step. Formally this is known as Process Reliability Testing, or more simply as PRT. Normally a short term accelerated lifetest and package reliability test are done, although exceptions are made in the case of special devices.

Although Samsung scrupulously utilizes statistical controls throughout it's production process, DRT and PRT serve as confirmation that indeed the customer does receive only high-grade units. The tables on the following give details of DRT and PRT processing.



Note: Test descriptions given on following pages.

Quality Conformance Program

QUALITY and RELIABILITY

DESCRIPTION

Samsung has established a comprehensive reliability program to monitor and ensure the ongoing reliability of the linear IC family. This program involves not only reliability data collection and analysis on existing parts, but also rigorous in-line quality controls for all products.

Listed below are details of tests performed to ensure that manufactured product continues to meet Samsung's stringent quality standards. In line quality controls are reviewed extensively in later sections.

The tests run by the quality department are accelerated tests, serving to model "real world" applications through boosted temperature, voltage, and/or humidities. Accelerated conditions are used to derive device knowledge through means quicker than that of typical application situations. These accelerated conditions are then used to assess differing failure rate mechanisms that correlate directly with ambient conditions. Following are summaries of various stresses (and their conditions) run by Samsung on linear IC products.

HIGH TEMPERATURE OPERATING LIFE TEST (HOPL)

($T_j = 125^{\circ}\text{C}$, $V_{cc} = V_{cc} \text{ max}$, static)

High temperature operating life test is performed to measure actual field reliability. Life tests of 1000HR to 2000HR durations are used to accelerate failure mechanisms by operating the device at an elevated ambient temperature (125°C). Data obtained from this test are used to predict product infant mortality, early life, and random failure rates. Data are translated to standard operating temperatures via failure analysis to determine the activation energy of each of the observed failures, using the Arrhenius relationship as previously discussed.

WET HIGH TEMPERATURE OPERATING LIFE TEST (WHOPL)

($T_a = 85^{\circ}\text{C}$, R.H. = 81%, $V_{cc} = V_{cc} \text{ opt}$, static)

Wet high temperature operating life test is performed to evaluate the moisture resistance characteristics of plastic encapsulated components. Long time testing is performed under static bias conditions at $85^{\circ}\text{C}/81$ percent relative humidity with nominal voltages. To maximize metal corrosion, the biasing configuration utilizes low power levels.

INTERMITTENT OPERATING LIFE (IOPL)

(P_{max} , 25°C , 2min on/2 min off)

This test is normally applied to scrutinize die bond thermal fatigue. A stressed device undergoes an "ON" cycle, where there is thermal heating due to power dissipation, and an "OFF" cycle, where there is thermal cooling due to lack of inputted power. Die attach (between die and package) and bond attach (between wire and die) are the critical areas of concern.

HIGH TEMPERATURE STORAGE TEST (HTS)

($T_a = 125^{\circ}\text{C}$, UNBIASED)

High temperature storage is a test in which devices are subjected to elevated temperatures with no applied bias. The test is used to detect mechanical instabilities such as bond integrity, and process wearout mechanisms.

PRESSURE COOKER TEST (PCT)

(121°C , 15PSIG, 100% R.H., UNBIASED)

The pressure cooker test checks for resistance to moisture penetration. A highly pressurized vessel is used to force water (thereby promoting corrosion) into packaged devices located within the vessel.

TEMPERATURE CYCLING (T/C)

(-65°C to $+150^{\circ}\text{C}$, AIR, UNBIASED)

This stress uses a chamber with alternating temperatures of -65°C and $+150^{\circ}\text{C}$ (air ambient) to thermally cycle devices within it. No bias is applied. The cycling checks for mechanical integrity of the packaged device, in particular bond wires and die attach, along with metal/polysilicon microcracks.

THERMAL SHOCK (T/S)

(-65°C to $+150^{\circ}\text{C}$, LIQUID, UNBIASED)

This stress uses a chamber with alternating temperatures of -65°C to $+150^{\circ}\text{C}$ (liquid ambient) to thermally cycle devices within it. No bias is applied. The cycling is very rapid, and primarily checks for die/package compatibility.

QUALITY and RELIABILITY

RESISTANCE TO SOLDER HEAT

(Unbiased, 260°C, 10 sec)

Solder Heat Resistance is performed to establish that devices can withstand the thermal effects of solder dip, soldering iron, or solder wave operations.

MECHANICAL SHOCK

(Unbiased, 1500g, Pulse = 0.5msec)

This test determines the suitability of a device to be used in equipment where mechanical "shocks" may occur. Such shocks result from sudden or abrupt changes produced by rough (non-standard) handling, transportation, or field operations.

VARIABLE FREQUENCY VIBRATION

(Unbiased, Range = 100 to 2000Hz)

Variable Frequency Vibration is done to model the effects of differential vibration in the specified range. Die attach and bonding integrity are particularly stressed, testing the mechanical soundness of device packaging.

CONSTANT ACCELERATION

(Unbiased, 10kg to 20kg)

This is an accelerated test designed to indicate types or modes of structural and mechanical weaknesses not necessarily detectable in Mechanical Shock and Variable Frequency Vibration stressing.

RELATIVE STRESS COMPARISONS

Many stresses are run at Samsung on many different devices. Through both theoretical and actual results, it was clearly determined which stresses were most effective. Also established were the stresses which weren't fully effective.

Comparisons have been made on the basis of defects able to be determined, efficiency in detection, and cost. For the reader's benefit, Samsung provides the results of its conclusions on the following pages.

QUALITY and RELIABILITY

COMPARISON OF RELIABILITY TEST METHODS

Test Method	Defect	Effectiveness	Cost	Remarks
Internal Visual Inspection	Lead Structure Metalization Oxide Film Foreign Particles Die Bond Wire Bond Contamination Corroded Substrate	Good	Slightly Inexpensive to Moderate	This method of screening must be performed for high reliability devices. Cost is affected by the degree of visual inspection
Infrared ray	Design (thermal)	Very Good	Expensive	For use in design evaluation only
Radiography	Die Bond Lead Structure (Gold) Foreign Particles Manufacturing (Gross Error) Seal Package Contamination	Extremely Good Good Good Good Good Good Good	Moderate	Advantage to using this screening method lies in the ability to test die frame/header bonding, and to be able to perform inspection after sealing. However, some materials being transparent to X-rays (for example, Al and Si) are not able to be analyzed. The use of the complex test system results in cost six times that of visual inspection.
High Temperature Storage	Electrical stability Metalization Bulk Silicon Corrosion	Good	Very Inexpensive	This is a highly desirable screening method
Temperature Cycling	Package Seal Die Bond Wire Bond Cracked Substrate Thermal Mismatching	Good	Very Inexpensive	This screening method is one of the most effective for use
Thermal Shock	Package Seal Die Bond Wire Bond Cracked Substrate Thermal Mismatching	Good	Inexpensive	While this screening method is similar to temperature cycling, it enables high stress levels as well. It is probably equal to the temperature cycling method.
Constant Acceleration	Lead Structure Die Bond Wire Bond Cracked Substrate	Good	Moderate	Doubt exists as to the effectiveness of screening aluminum wires with stress levels in the range of 0 – 20,000 G

QUALITY and RELIABILITY

COMPARISON OF RELIABILITY TEST METHODS (Continued)

Test Method	Defect	Effectiveness	Cost	Remarks
Shock (Without Monitoring)	Lead Structure	Fairly Poor	Moderate	Drop shock testing is thought to be inferior to constant acceleration methods. However, the pneupactor shock test is more effective. Shock test is a destructive test method.
Shock (With Monitoring)	Particles Intermittent Short Intermittent Open	Fairly Poor Fairly Good Fairly Good	Expensive	Visual inspection or radiography is more desirable for detection of particles
Vibration Fatigue	Lead Structure Package Die Bond Wire Bond Cracked Substrage	Fairly Poor	Expensive	This test is destructive and without merit.
Variable Frequency Vibration (Without Monitoring)	Package Die Bond Wire Bond Substrate	Fairly Poor	Expensive	
Variable Frequency Vibration (Without Monitoring)	Foreign Particles Lead Structure Intermittent Open	Fairly Good Good Good	Very Expensive	The effectiveness of the method for detecting particles depends on the type of particle
Random Vibration (Without Monitoring)	Package Die Bond Wire Bond Substrate	Good	Expensive	This screening method is more effective than variable frequency vibration (without monitoring), when used with equipment intended for space vehicle operation, although it is more expensive
Random Vibration (Without Monitoring)	Foreign Particle Lead Structure Intermittent Open	Fairly Good Good Good	Very Expensive	This is one of the most expensive screening methods
Vibrational Noise	Foreign Particles	Good	Expensive	
Radioisotope Leak Test	Package Seal	Good	Moderate	This screening method is effective for detecting leakage in the range 10E6 – 10E12 atm. ml/sec

QUALITY and RELIABILITY

COMPARISON OF RELIABILITY TEST METHODS (Continued)

Test Method	Defect	Effectiveness	Cost	Remarks
Helium Leak Test	Package Seal	Good	Moderate	This screening method is effective for detecting leak in the range $10E6 - 10E12$ atm. ml/sec
Gross Leak Test	Package Seal	Good	Inexpensive	Effectiveness is dependent upon volume. Testing is possible for detecting leaks above $10E-3$ atm. ml/sec.
High Voltage Test	Oxide Film	Good	Inexpensive	Effectiveness Depends on Structure
Insulation Resistance	Lead Structure Metallization Contamination	Fairly Good	Inexpensive	
Intermittent Operation	Metallization Bulk Silicon Oxide Film Inversion/Channeling Design Parmeter Drift Contamination	Good	Expensive	Probably about the same as AC operating life
AC Operation	Metallization Bulk Silicon Oxide Film Inversion/Channeling Design Parmeter Drift Contamination	Very Good	Expensive	
DC Operation	Basically the Same as Intermittent Operation	Good	Expensive	The AC operation life method is more effective for any failure mechanism
High Temperature AC Operation	Same as AC Operation Life Test	Extremely Good	Very Expensive	Failures are accelerated by temperature. This is probably the most expensive and one of the most effective screening methods.
High Temperature Reverse Bias	Inversion /Channeling	Fairly Poor	Expensive	

QUALITY and RELIABILITY

RELIABILITY TEST RESULTS

This section is divided into two parts-actual and predicted test results. Actual test results are those derived via accelerated stressing done by the QA department. Predicted results are calculated by taking actual test results and derating them using statistical and mathematical models to determine device performance in "real-time" user conditions.

1

ACTUAL TEST RESULTS

Stress	Conditions	Number of Devices	Number of Hours/Cycles	Number of Device Hours/Cycles	Number of Failures	% Failures per 1000HRS (Cycles) (60% UCL)
HOPL	$T_j = 125^{\circ}\text{C}$ $V_{CC} = V_{CC \text{ max}}$	180	1,000	180,000	0	0.51%/1K HR
WHOPL	$85^{\circ}\text{C}/81\% \text{ R.H.}$ $V_{CC} = V_{CC \text{ opt}}$	180	1,000	180,000	0	0.51%/1K HR
IOPL	$T_a = 25^{\circ}\text{C}$ $V_{CC} = V_{CC \text{ max}}$	180	1,000	180,000	0	0.51%/1K HR
HTS	$T_a = 125^{\circ}\text{C}$ Unbiased	135	1,000	135,000	0	0.67%/1K HR
PCT	121°C 15 PSIG	225	168	37,800	1	0.89%/168 HR
T/C	-65°C to 150°C Air to Air	180	200	36,000	0	0.51%/200 CL
T/S	-65°C to 150°C Liquid to Liquid	135	200	27,000	0	0.67%/200 CL

PREDICTED TEST RESULTS

The Arrhenius equation, which is reviewed in another section of this chapter, can be applied to derive typical "user-condition" device failure rates.

STESS: HOPL

180,000 Device Hours at 125°C

Average Activation Energy: 1.0 eV.

De-Rating to User Conditions Yields:

70°C Operation

Equivalent Device Hours	% Failures Per 1000 Hours (60% UCL)	*FITs	**MTTF (Years)
1.93×10^7	0.0047	47	2435

55°C Operation

Equivalent Device Hours	% Failures Per 1000 Hours (60% UCL)	*FITs	**MTTF (Years)
9.07×10^7	0.0010	10	11447

* FIT : Failure in time or failure unit. Represents the number of failures expected for 10^9 (one billion) device hours.

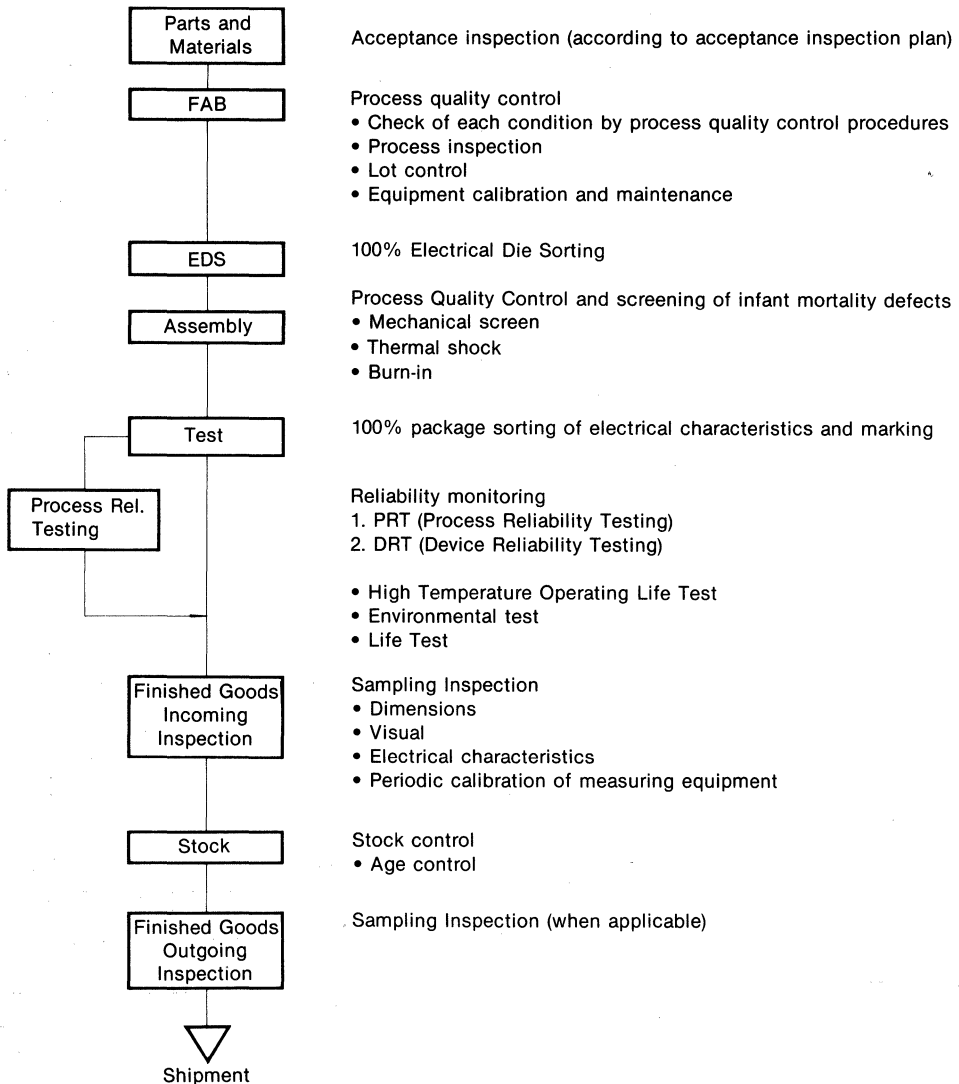
** MTTF: Mean time to failures.

QUALITY and RELIABILITY

PROCESS CONTROL

GENERAL PROCESS CONTROL

The general process flow in Samsung is shown in Figure 8. This illustration contains the standard process flow from incoming parts and materials to customer shipment.



General Process Flow Chart

QUALITY and RELIABILITY

WAFER FABRICATION

Process Controls

The Quality Control program utilizes the following methods of control to achieve its previously stated objectives: process audits, environmental monitors, process monitors, lot acceptance inspections, and process integrity audits.

Definitions

The essential method of the Quality Control Program is defined as follows:

1. Process Audit-Performed on all operations critical to product quality and reliability.
2. Environmental Monitor-Monitors concerning the process environment, *i.e.*, water purity, temperature, humidity, particle counts.
3. Process Monitor-Periodic inspection at designated process steps for verification of manufacturing inspection and maintenance of process average. These inspections provide both attribute and variable data.
4. Lot Acceptance-Lot-by-lot sampling. This sampling method is reserved for those operations deemed as critical, and require special attention.

Environmental Monitor

Process	Control Item	Spec. Limit	Insp. Frequency
Clean Room	• Temperature • Humidity • Particle • Air Velocity	• Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec.	24 Hrs. 24 Hrs. 24 Hrs. 24 Hrs.
D.I. Water	• Particle • Bacteria • Resistivity	• 5 ea/50ml (0.8μ) • 50 colonies/100ml (0.45μ) • Main (Line): More than 16 Mohm-cm • Using point: More than 14 Mohm-cm	24 Hrs. Weekly 24 Hrs. 24 Hrs.

* Instruments

- FMS (Facility Monitoring System) HIAC/ROYCO
- CPM (Central Particle Monitoring System-Dan Scientific)
- Liquid Dust Counter Etch Rate
- Filtration System for Bacterial check
- Air Particle counter
- Air Velocity meter

Process Monitor

Process	Control Item	Spec. Limit	Insp. Frequency
Photo	• Aligner N₂ Flow Rate • Aligner Vacuum • Aligner Air • Aligner Pressure • Aligner Intensity • Coater Soft Bake Temperature • Vacuum	• Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec.	Once/Shift Once/Shift Once/Shift Once/Shift Once/Shift Once/Shift Once/Shift
Etch	• Etchant Temp. • Etch Rate • Spin Dryer N₂ Flow RPM • Hard Bake Temp. • N₂ Flow	• Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec. • Individual Spec.	Once/Shift Once/Shift Once/Shift Once/Shift Once/Shift Once/Shift

QUALITY and RELIABILITY

Process Monitor (Continued)

Process	Control Item	Spec. Limit	Insp. Frequency
Thin Film	- Cooling Water Temp. - Thickness	$26 \pm 3^{\circ}\text{C}$ - Individual Spec.	Once/Shift Once/Shift
CVD	- Pin Hole - Thickness	- Individual Spec. - Individual Spec.	Once/Shift Once/Shift
Diffusion	- Tube Temp. - C-V Plot Run Tube - Sheet Resistance - Thickness	- Individual Spec. - Individual Spec. - Individual Spec. - Individual Spec. - Individual Spec.	Once/Shift Once/Shift Once/10days Once/Shift Once/Shift

Raw Material Incoming Inspection

1. Mask Inspection

Defect Detection	- Pinhole & Clear-extension - Opaque Projections & Spots - Scratch/Particle/Stain - Substrate Crack/Glass-chip - Others	All Masks	- Defect Size $\leq 1.5\mu\text{m}$ - Defect Density $\leq 0.124\text{EA}/\text{cm}^2$
Registration	- Run-out (X-Y Coordinate) - Orthogonality - Drop-in Accuracy - Die Fit/Rotation	20% All New Masks	$\pm 0.75\mu\text{m}$ $\pm 0.75\mu\text{m}$ $\pm 0.50\mu\text{m}$ $\pm 0.50\mu\text{m}$
Critical Dimension	Critical Dimension	All Masks	Purchasing Spec.

* Instrument

- Auto mask inspection system for defect-detection (NJS 5MD-44)
- Comparator for registration (MVG 7X7)
- Automatic linewidth measuring system for CD (MPV-CD)

2. Wafer Inspection

Purpose	Insp. Items	Sample	Remarks
Structural	Crystallographic Defect	All Lots	Sirtl Etch
Electrical	- Resistivity - Conductivity	All Lots	Monitor Water
Dimensional	- Thickness - Diameter - Orientation - Flatness	All Lots	TTV, NTV, Epi-thickness TIR (FPD) Local Slope
Visual	- Surface Quality - Cleanliness	All Lots	Purchasing Spec.

* Instrument

- 4 point probe for resistivity (Kokusai VR-40A, Tencor sonogage, ASM AFPP)
- Flatness measuring system (Siltec)
- Epi. layer thickness gauge (Digilab FTG-12, Qualimatic S-100)
- Automatic Surface Insp. System (Aeronca Wis-150)
- Non-contact thickness gauge (ADE6034)

QUALITY and RELIABILITY

In-Process Quality Inspection (FAB)

1. Manufacturing Section

Process Step	Process Control Insp.	Frequency
Oxidation	Oxide Thickness	All Lots
Diffusion	Oxide Thickness Sheet Resistance Visual	All Lots All Lots All Lots
Photo	Critical Dimension Visual Mask Clean Inspection	All Lots (MOS) All Lots All Masks with Spot Light (MOS) or Microscope (BIP)
Etch	Critical Dimension Visual	All Lots All Wafers
Thin Film	Metal Thickness Visual	All Lots All Lots
Ion Implant	Sheet Resistance	All Lots (Test Wafer)
Low Temp. Oxide	Thickness	All Lots
	Visual	All Lots
E-Test	Electrical Characteristics	All Lots
Fab. Out	Visual	All Wafers

2. FAB, QC Monitor/Gate

Process Step	FAB, QC Insp.	Frequency
Oxidation	Oxide Thickness C-V Test on Tubes Visual	Once/Shift Once/10 Days and After CLN Once/Shift
Diffusion	Oxide Thickness C-V Test on Tubes Visual	Once/Shift Once/10 Days and After CLN Once/Shift
Photo	Critical Dimension Visual Mask CLN Inspection	All Lots (MOS) Once/Shift All Masks After 10 Times Use
Etch	Critical Dimension Visual	All Lots (MOS) All Lots
Thin Film	C-V Test on Tubes on Lots Reflectivity	Once/10 Days and After CLN Once/Shift Once/Shift
Low Temp. Oxide	Refractive Index, Wt% of Phosphorus Visual	1 Test Wafer/Lot 1 Test Wafer/Lot 1 Test Wafer/Lot
E-Test	Measuring Data	All Lots
Calibration	Instrument for Thickness and C.D. Measuring	Once/week

QUALITY and RELIABILITY

3. Photo/Etch process quality control

Process Flow	Process Step	MFG. Control Item	QC Monitor/Gate
	Prebake	Oven PM, Temperature Time	Oven Particle Temp. N ₂ Flow Rate
	Photo Resist (PR) —spin	Thickness Machine PM	
	Soft Bake	Oven PM, Temperature Time	Temp. N ₂ Flow Rate
	Align/Expose	Light Uniformity Alignment, Focus Test Mask Clean Inspection Mask Clean Exposure Light Intensity	Light Intensity Mask Clean Insp.
	Develop	Equipment PM Solution Control	Vacuum
	Develop Check	PR/C.D.'S Alignment Particles Mask and Resist Defects	
	QC Inspection		Critical Dimension (CD)
	Hard Bake	Oven PM, Temperature Time	Temp. N ₂ Flow Rate
	Etch	Etch rate, Equipment PM & Settings, Etch Time to Clear	Etchant Temp. Etch Rate
	Inspection	Over/Under	
	PR Strip	Machine-PM	
	Final Check	C.D.'S Over and under Etch, Particles, PR Residue, Defects, Scratches	
	QC Inspection		Same as Final Check, However, More Intense on limited Sample Basis. (AQL 6.5%)

Note: PM represents Preventive Maintenance

4. Reliability-related Interlayer Dielectric, Metallization, and Passivation Process Quality Control Monitor

Item	Frequency
Wt% Phosphorus Content of the Dielectric Glass	1/Shift
Metallization Interconnect	1/Month
Al Step Coverage	1/Month
Metallization Reflectivity	1/Shift
Passivation Thickness and Composition	1/Shift
Thin Film Defect Density	1/Shift

QUALITY and RELIABILITY

Figure 9. General Wafer Fabrication Flow

Process Flow	Process Step	Major Control Item
	Wafer and Mask Input	
	Starting Material Incoming Inspection	Mask: (See mask Inspection) Wafer: (See wafer Inspection)
	Wafer Sorting and Labelling	Resistivity
	Initial Oxidation	Oxide Thickness
	Photo	• (See manufacturing section) • (See FAB, QC Monitor/gate)
	Inspection	• Critical Dimension • Visual/Mech — Major: AQL 1.0% — Minor: AQL 6.5%
	QC Gate	• Critical Dimension
	Etch	• (See manufacturing section) • (See FAB, QC Monitor/gate)
	Inspection	• Critical Dimension • Visual/Mech — Major: AQL 1.0% — Minor: AQL 6.5%
	QC Gate	• Critical Dimension • Visual/Mech
	Diffusion Metalization	• (See in-process Quality Inspection)
	E-test	• Electrical Characteristics

QUALITY and RELIABILITY

Figure 9. General Wafer Fabrication Flow (Continued)

Process Flow	Process Step	Major Control Item
Die Attach	QC Gate	• Electrical Characteristics
	Back-Lap	• Thickness
	Back Side Evaporation	• Thickness, Time Evaporation Rate
	Final Inspection	• All Wafers Screened (Visual/Mech)
	QC Fab. Final Gate	• Visual/Mech. — Major: AQL 1.0% — Minor: AQL 6.5%
	EDS (Electrical Die Sorting)	
	QC Gate	• Function Monitor
	Sawing	
	Inspection	• Chip Screen
	QC Final Inspection	• AQL 1.0% • Fab. Defect • Test Defect • Sawing Defect

QUALITY and RELIABILITY

ASSEMBLY

The process control and inspection points of the assembly operation are explained and listed below:

1. Die Inspection:

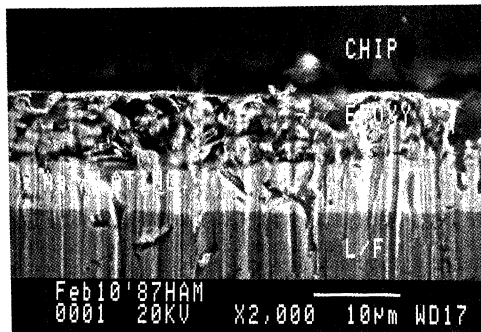
Following 100% inspection by manufacturing, in-process Quality Control samples each lot according to internal or customer specifications and standards.

2. Die Attach Inspection:

Visual inspection of samples is done periodically on a machine/operator basis. Die Attach techniques are monitored and temperatures are verified.

3. Die Shear Strength:

Following Die Attach, Die Shear Strength testing is performed periodically on a machine/operator basis. Either manual or automatic die attach is used.



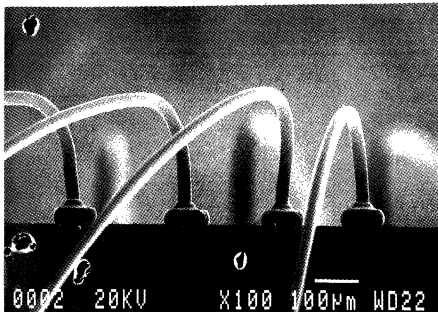
DIE ADHESIVE THICKNESS MONITOR RESULTS.(JEOL SEM, JSM IC845)

4. Wire Bond Inspection:

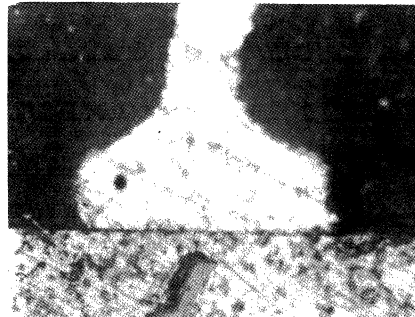
Visual inspection of samples is complemented by a wire pull test done periodically during each shift. These checks are also done on a machine/operator basis and XR data is maintained.

5. Pre-Seal/Pre-Encapsulation Inspection:

Following 100% inspection of each lot, samples are taken on a lot acceptance basis and are inspected according to internal or customer criteria.



WIRE LOOP MONITOR RESULTS.



CROSS SECTION INSPECTION FOR BALL BOND.

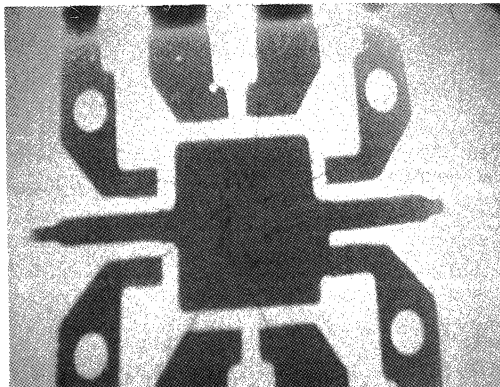
QUALITY and RELIABILITY

6. Seal Inspection:

Periodic monitoring of the sealing operation checks the critical temperature profile of the sealing oven for both glass and metal seals.

7. Post-Seal Inspection:

Subsequent to a 100% visual inspection, In-Process Quality Control samples each for conformance to visual criteria.



X-RAY MONITOR RESULT (PHILIPS MG161)

8. General Assembly Flow is shown in Figure 11.

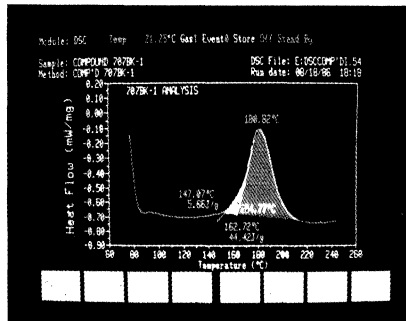
Sampling Plans

1. Sampling plans are based on an AQL (Acceptable Quality Level) concept and are determined by internal or by customer specifications.

2. Raw Material Incoming Inspection. (continued)

Material	Inspection Item	Acceptable Quality Level
Lead Frame	1) Visual Inspection 2) Dimension Inspection 3) Function Test 4) Work Test	LTPD 10%, C = 2 LTPD 20%, C = 0 LTPD 20%, C = 0 LTPD 20%, C = 0
Wafer	1) Visual Inspection	AQL 0.65%
Au/Al Wire	1) Visual Inspection 2) Bond Pull Strength Test 3) Bondability Test 4) Chemical Composition Analysis	n:5, C = 0 n: 13, C = 0 Critical Defect: 0.65% Major Defect: 1.0% Minor Defect: 1.5% n: 5, C = 0
Molding Compound	1) Visual Inspection 2) Moldability Test 3) Chemical Composition Analysis	n: 5, C = 0 Critical Defect: 0.15% Major Defect: 1.0% Minor Defect: 1.5% n: 5, C = 0

QUALITY and RELIABILITY



MOLDING COMPOUND INCOMING INSPECTION
(THERMAL ANALYSER, DUPONT 9900)

(Continued)

Material	Inspection Item	Acceptable Quality Level
Packing Tube & Pin	1) Visual Inspection 2) Dimension Inspection 3) Electro-Static Inspection 4) Hardness Test	LTPD 15%, C = 2 LTPD 15% C = 2 n: 5, C = 0 n: 5, C = 0
Solder	1) Visual Inspection 2) Weight Inspection 3) Chemical Composition Analysis	LTPD 20% C = 0 LTPD 20% C = 0 LTPD 20% C = 0
Flux	1) Acidity Test 2) Specific Gravity Test 3) Chemical Composition Analysis	LTPD 20% C = 0 LTPD 20% C = 0 LTPD 20% C = 0
Solder Preform	1) Visual Inspection 2) Work Test 3) Chemical Composition Analysis	AQL 1.0% AQL 1.0% AQL 1.0%
Coating Resin	1) Visual Inspection 2) Work Test 3) Chemical Composition Analysis	AQL 1.0% AQL 1.0% AQL 1.0%
Marking Ink	1) Work Test 2) Mark Permanency Test	Critical Defect: 0.15% Major Defect: 1.0% Minor Defect: 1.5% n: 5, C = 0
Chip Carrier	1) Visual Inspection 2) Dimension Inspection 3) Electro-Static Inspection 4) Hardness Test	LTPD 15% C = 2 LTPD 15% C = 0 n: 5, C = 0 n: 5, C = 0
Vinyl Pack	1) Visual Inspection 2) Work Test 3) Electro-Static Inspection	LTPD 20% C = 0 LTPD 20% C = 0 LTPD 15% C = 0
Ag Epoxy	1) Work Test 2) Chemical Composition Analysis	n:8, C = 0 n:8, C = 0
Letter Marking	1) Visual Inspection 2) Work Test	
Spare Parts & Others	1) Dimension Inspection 2) Visual Inspection	n:5, C = 0 n:5, C = 0

QUALITY and RELIABILITY

3. In-Process Quality Inspection

A. Assembly Lot Acceptance Inspection

(1) Acceptance quality level for wire bond gate inspection

Defect Class	Inspection Level	Type of Defect	
Critical Defect	AQL 0.65%	— Missing Metal — Chip Crack — No Probe — Epoxy on Die — Mixed Device — Wrong Bond — Missing Bond	— Diffusion Defect — Ink Die — Exposed Contact — Bond Short — Die Lift — Broken Wire
Major Defect	AQL 1.0%	— Metal Missing — Metal Adhesion — Pad Metal Discolored — Tilted Die — Die Orientation — Partial Bond	— Oxide Defect — Probe Damage — Metal Corrosion — Incomplete Wetting — Weakened Wire
Minor Defect	AQL 1.5%	— Adjacent Die — Passivation Glass — Die Attach Defect — Wire Loop Height — Extra Wire	— Contamination — Ball Size — Wire Clearance — Bond Deformation

(2) Acceptance quality level for Mold/Trim gate inspection

Defect Class	Inspection Level	Kind of Defect	
Critical Defect	AQL 0.15%	— Incomplete Mold — Void, Broken Package — Misalignment	— Deformation — No Plating — Broken Lead
Major Defect	AQL 0.4%	— Ejector Pin Defect — Package Burr — Flash on Lead	— Crack, Lead Burr — Rough Surface — Squashed Lead
Minor Defect	AQL 0.65%	— Lead Contamination — Poor Plating — Package Contamination	— Bent Lead

B. In-process monitor inspection

Inspection Item	Frequency	Reference
• Die Shear Test • Bond Strength Test • Solderability Test • Mark Permanency Test • Lead Integrity Test • In-Process Monitor Inspection for Product • X-Ray Monitor Inspection for Molding • Monitor Inspection for Production Equipment	- Each Lot - Each Lot - Weekly - Weekly - Weekly 4 Times/Shift/Each Process 2 Times/Shift/Mold Press 2 Times/Shift/Each Unit of Equipment	- MIL-STD-883C, 2019-2 - MIL-STD-883C, 2011-4 - MIL-STD-883C, 2003-3 - MIL-STD-883C, 2015-4 - MIL-STD-883C, 2004-4 - Identify for Each Control Limit - Identify for Each Control Limit - Identify for Each Control Limit

QUALITY and RELIABILITY

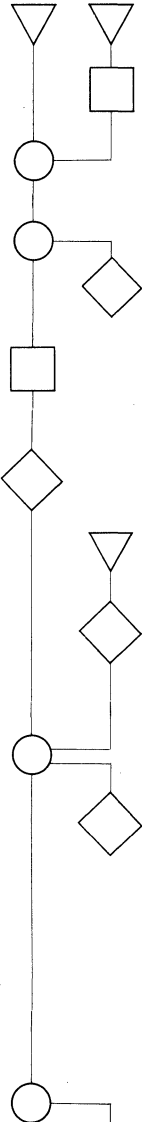
4. Outgoing quality inspection plan (LTPD)

Defect Class	Discrete	LSI	Kind of Defect
Critical Defect electrical visual	1%	2%	Open, short Wrong configuration, no marking
Major Defect electrical visual	1.5%	3%	Items which affect reliability most strongly
Minor Defect electrical visual	2%	5%	Items which minimally or do not affect reliability at all (cosmetic, appearance, etc.)

1

QUALITY and RELIABILITY

Figure 10. General Assembly Flow

Process Flow	Process Step	Major Control Item								
	Wafer									
	Wafer Incoming Inspection	Q.C. Wafer Incoming Inspection AQL 4.0%								
	Tape Mount									
	Sawing Q.C. Monitor	Q.C. Monitoring: — Chip-out — Scratch — Crack — Sawing Discoloration — Sawing-speed — Cut Count — D.I. Purity — CO ₂ Bubble Purity								
	Visual Inspection	100% Screen: — FAB Defect — EDS Test Defect — Sawing & Scratch Defect								
	Q.C. Gate	1st AQL 1.0% Reinspection AQL: 0.65%								
	Lead Frame (L/F)									
	Lead Frame Incoming	*Q.C.L/F Incoming Inspection 1. Acceptance Quality Level — Dimension LTPD 20%, C=0 — Visual & Mechanical: LTPD 10%, C=2 — Functional Work Test: LTPD 10%, C=2								
	Die Attach (D/A)									
	Q.C. Monitor	*Q.C.D/A Monitor Inspection 1. Bond force 2. Frequency: 4 Times/Station/Shift 3. Sample: 24 ea Time 4. Acceptance Criteria <table border="1" data-bbox="720 1265 1107 1367"><thead><tr><th>Defect</th><th>Acceptance</th><th>Reject</th></tr></thead><tbody><tr><td>Critical</td><td>0</td><td>1</td></tr><tr><td>Major</td><td>1</td><td>2</td></tr></tbody></table>	Defect	Acceptance	Reject	Critical	0	1	Major	1
Defect	Acceptance	Reject								
Critical	0	1								
Major	1	2								
Cure										

QUALITY and RELIABILITY

Figure 10. General Assembly Flow (Continued)

Process Flow	Process Step	Major Control Item
	Q.C. Monitor	*Q.C. Cure Monitor Inspection 1. Control Item — Temperature — In/out Time 2. Frequency — 1 Time/Shift
	Au Wire	
	Bonding Wire Incoming Inspection	*Q.C Au Wire Incoming Inspection 1. Visual Inspection: N = 5, C = 0 2. Bond Pull Test Strength Test: N = 13, C = 0 3. Bondability Test — Critical Defect: AQL 0.65% — Major Defect: AQL 1.0% — Minor Defect: AQL 1.5%
	Wire Bonding (W/B)	
	100% Visual Inspection	
	Q.C. Monitor	*Q.C. W/B Monitor Inspection 1. Frequency: 6 Times/Mach/Shift
	Q.C. Gate	1. Q.C. Acceptance Quality Level — Critical Defect: AQL 0.65% — Major Defect: AQL 1.0% — Minor Defect: AQL 1.5%
	Mold Compound	
	Incoming Inspection Mold	*Moldability Test — Critical Defect: AQL 0.15% — Major Defect: AQL 1.0% — Minor Defect: AQL 1.5%
	Mold	
	Q.C. Monitor	*Q.C. Mold Monitor Inspection 1. In-Process Monitor Inspection — Frequency: 4 Times/Station/Shift — Sample: 200 Units/Time 2. Acceptance Quality Level — Critical Defect: AQL 0.25% — Major Defect: AQL 0.4%

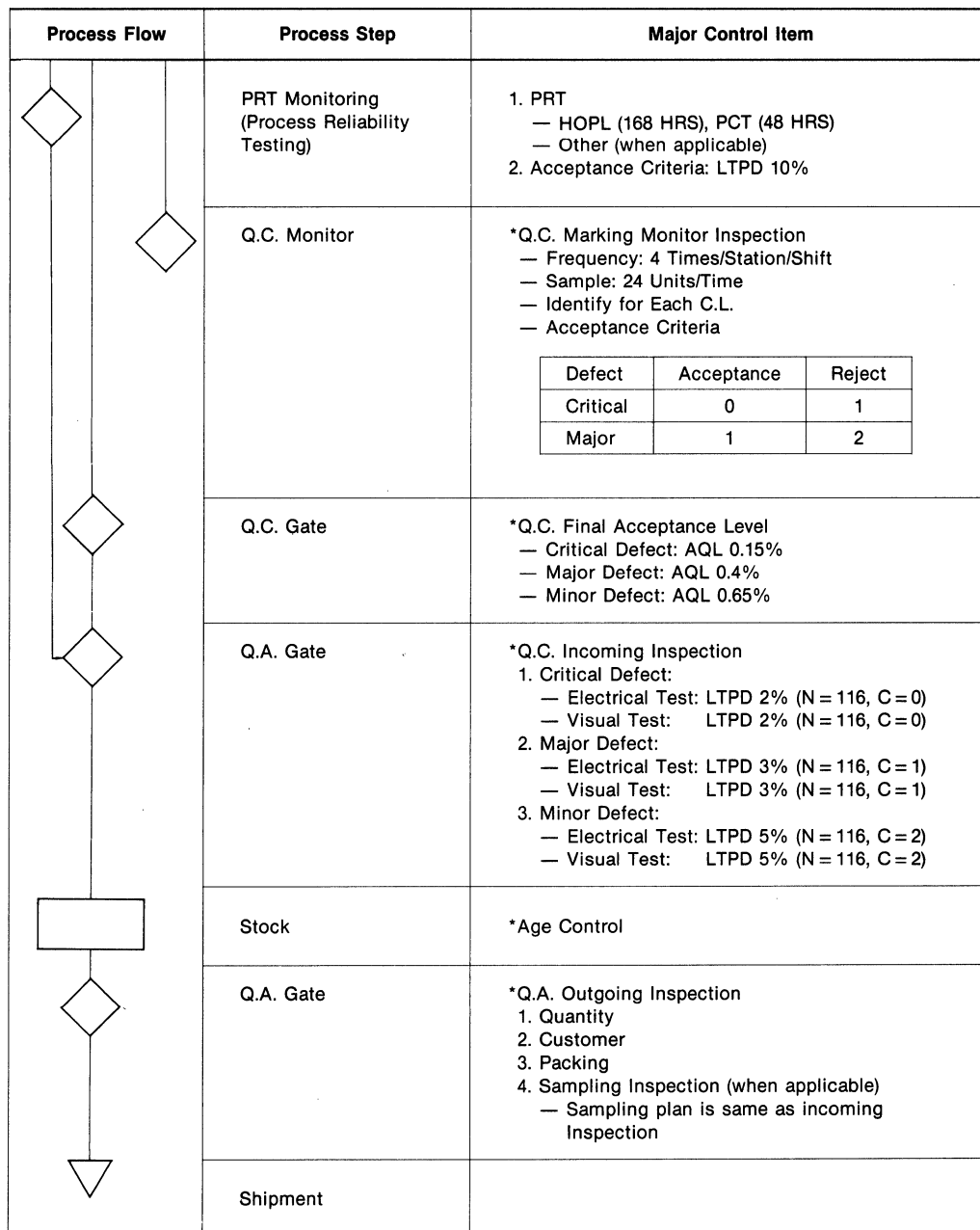
QUALITY and RELIABILITY

Figure 10. General Assembly Flow (Continued)

Process Flow	Process Step	Major Control Item
	Cure	
	Q.C. Monitor	*Q.C. Cure Monitor Inspection 1. Control Item — Temperature — In/out Time 2. Frequency — 1 Time/shift
	Deflash	
	Q.C. Monitor	*Q.C. Deflash Monitor Inspection 1. Control Item — Pressure — Belt Speed — Visual/Mechanical Inspection 2. Frequency: 4 Times/Mach/Shift 3. Identify each Defect Control Limit
	TRIM/BEND	
	Q.C. Monitor	*Q.C. Trim/Bend Monitor Inspection 1. Visual Inspection 2. Frequency: 4 Times/Station/Shift
	Solder	100% Visual Inspection
	Q.C. Monitor	*Q.C. Solder Monitor Inspection 1. Frequency: 4 Times/Mach/Shift 2. Criteria — Critical Defect: AQL 0.65% — Major Defect: AQL 1.0%
	Q.C. Gate	*Q.C. Mold Gate — Acceptance Criteria Critical Defect: AQL 0.15% Major Defect: AQL 0.4% Minor Defect: AQL 0.65%
	Test	100% Electrical Test
	Q.C. Monitor	Correlation Sample Reading for Initial Device Test
	Mark	100% Visual Inspection

QUALITY and RELIABILITY

Figure 10. General Assembly Flow (Continued)



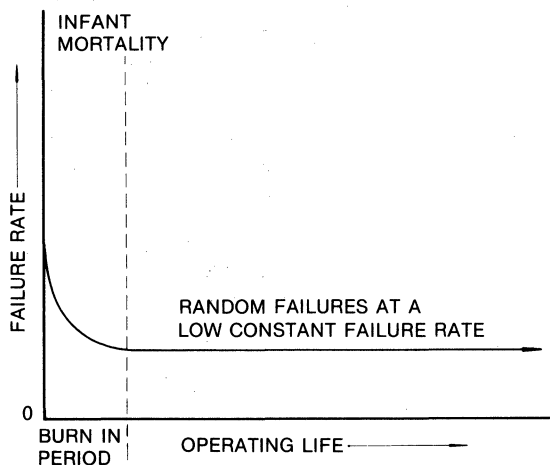
QUALITY and RELIABILITY

SAMSUNG's BEST PROGRAM

The SAMSUNG Best Program has been designed to offer the customer an alternative to standard off-the-shelf plastic encapsulated LINEAR circuits. The Best Program will significantly reduce incoming inspection requirements as well as early device failures (infant mortality). These results are achieved by a tightened AQL inspection plan and a burn-in of each unit for 160 + 8, - 0 hours at 125°C or equivalent conditions established from a time/temperature regression curve.

The AQL Plan. Acceptable Quality Levels (AQL) are a measure of the quality of outgoing LINEAR circuits. These levels are established by the manufacturer to show the process percent defective being produced and to ensure that the customer is receiving material that meets his requirements. The SST Best Program has tightened these AQL levels to a point at which incoming inspection by the customer is no longer a necessity. Best product quality is monitored significantly more closely than standard product; those lots which fall the AQL level are 100% reworked before resubmission to the AQL gate.

The Reliability Plan. Reliability is the statistical probability that a product will give satisfactory performance for a specified period of time when used under specified conditions. A typical rate curve is shown below:

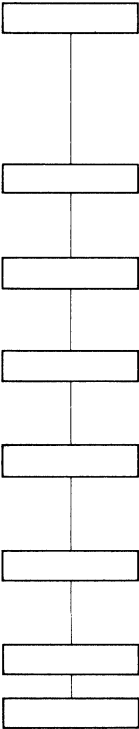


Reliability theory assumes that devices fail according to the above curve. When a group of devices is manufactured a small portion of the units will be inherently weaker than the average. These weak units will probably fail during the first few hours of operation—hence the term “infant mortality.” If the units are burned-in however, thereby allowing the weak units to fail, there is a much lower probability that those finally put into system use will fail.

The SAMSUNG Best Flow. In order to achieve an extremely high quality unit and reduce infant mortality failures the following flow has been established:

QUALITY and RELIABILITY

Process Flow

FLOW CHART	DESCRIPTION
	WAFER FABRICATION LINEAR PROCESS CV PLOTS OXIDE THICKNESS MEASUREMENTS OPTICAL INSPECTIONS SEM ANALYSIS
	ENCAPSULATION MOLDING COMPOUND ULTRA PURE FOR LINEAR APPLICATIONS
	POST MOLD BAKE 6 HOURS AT 175 DEG. C. CURES PLASTIC STRESSES ALL WIRE BONDS AND DIE
	O/S FUNCTIONAL ELECTRICAL 100% TESTING OPENS/SHORTS AND INTERMITTENTS REMOVE
	HIGH TEMPERATURE BURN-IN 160 HOURS AT 125 DEG. C. OR EQUIVALENT CONDITIONS ESTABLISHED FROM A TIME/ TEMPERATURE REGRESSION CURVE. 0.96 eV
	FULL FUNCTIONAL AND PARAMETRIC ELECTRICAL TESTING 100% ELECTRICAL TESTING AC, DC 88 DEG. C.
	TIGHT AQL SAMPLING PLAN ELECTRICAL – 0.05% AQL AT 88 DEG. C. MECHANICAL – 0.01% AQL CRITICAL & MAJOR
	SHIP UNITS

1

QUALITY and RELIABILITY

RELIABILITY AND PREDICTION THEORY

RELIABILITY

Reliability can be loosely characterized as long term product quality.

There are two types of reliability tests: those performed during design and development, and those carried out in production. The first type is usually performed on a limited sample, but for long periods or under very accelerated conditions to investigate wearout mechanisms and determine tolerances and limits in the design process. The second type of tests is performed periodically during production to check, maintain, and improve the assured quality and reliability levels. All reliability tests performed by Samsung are under conditions more severe than those encountered in the field, and although accelerated, are chosen to simulate stresses that devices will be subjected to in actual operation. Care is taken to ensure that the failure modes and mechanisms are unchanged.

FUNDAMENTALS

A semiconductor device is very dependent on its conditions of use (*e.g.*, junction temperature, ambient temperature, voltage, current, *etc.*). Therefore, to predict failure rates, accelerated reliability testing is generally used. In accelerated testing, special stress conditions are considered as parametrically related to actual failure modes. Actual operating life time is predicted using this method. Through accelerated stresses, component failure rates are ascertained in terms of how many devices (in percent) are expected to fail for every 1000 hours of operation. A typical failure rate versus time of activity graph is shown below (the so-called "bath tub curve")

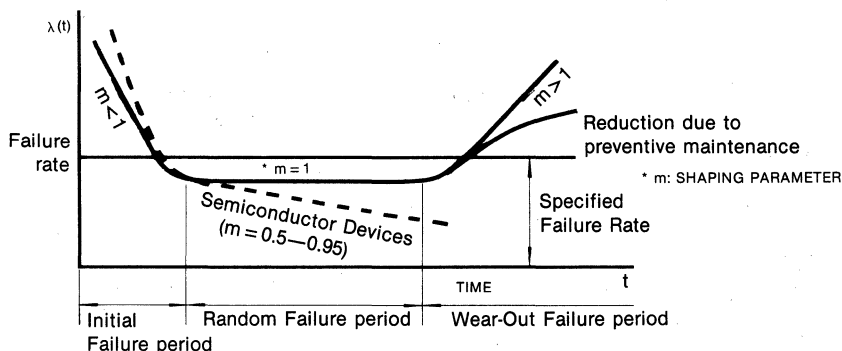


Figure 3. Failure Rate Curve ("Bath Tub Curve")

During their initial time period, products are affected by "infant mortality," intrinsic to all semiconductor technologies. End users are very sensitive to this parameter, which causes early assembly/operation failures in their own system. Periodically, Samsung reviews and publishes life time results. The goal is a steady shift of the limits as shown below.

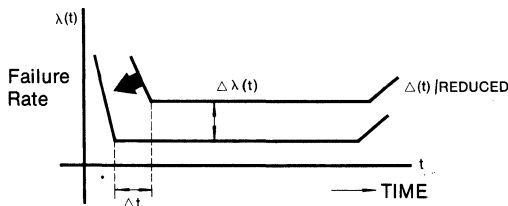


Figure 4. Failure Rate

QUALITY and RELIABILITY

ACCELERATED HUMIDITY TESTS

To evaluate the reliability of products assembled in plastic packages, Samsung performs accelerated humidity stressing, such as the Pressure Cooker Test (PCT) and Wet High Temperature Operating Life Test (WHOPL).

Figure 5 shows some results obtained with these tests, which illustrate the improvements in recent years. These improvements result mainly from the introduction of purer molding resins, new process methods, and improved cleanliness.

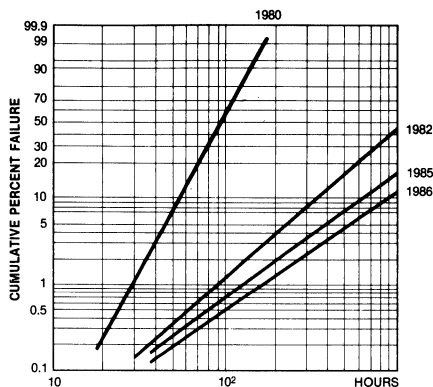


Figure 5. Improvement in Humidity Reliability

ACCELERATED TEMPERATURE TESTS

Accelerated temperature tests are carried out at temperatures ranging from 75°C to 200°C for up to 2000 hours. These tests allow Samsung to evaluate reliability rapidly and economically, as failure rates are strongly dependent on temperature.

The validity of these tests is demonstrated by the good correlation between data collected in the field and laboratory results obtained using the Arrhenius model. Figure 6 shows the relationship between failure rates and temperatures obtained with this model.

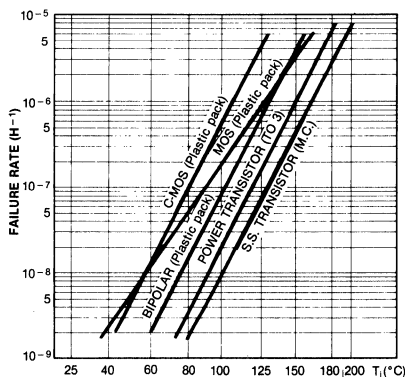


Figure 6. Failure Rate Versus Temperature

QUALITY and RELIABILITY

FUNDAMENTAL THEORY FOR ACCELERATED TESTING

Accelerated life testing is powerful because of its strong relation to failure physics. The Arrhenius model, which is generally used for failure modelling, is explained below.

1. Arrhenius model

This model can be applied to accelerated Operating Life Tests and uses absolute (Kelvin) temperatures.

$$L = A + E_a/K \cdot T_j$$

L : Lifetime

A : Constant

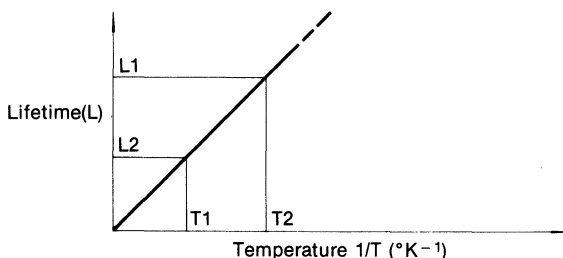
E_a : Activation Energy

K : Boltzman's constant

T_j : Absolute Junction temperature

If Lifetimes L_1 and L_2 correspond to Temperatures T_1 and T_2 :

$$L_1 = L_2 \exp \left(\frac{E_a}{K} \left(\frac{1}{T_1} - \frac{1}{T_2} \right) \right)$$



Actual junction temperature should always be used, and can be computed using the following relationship.

$$T_j = T_a + (P \times \theta_{ja})$$

Where T_j = Junction temperature

T_a = Ambient temperature

P = Actual power consumption

θ_{ja} = Junction to Ambient thermal resistance (typically 100 degrees celsius/watt for a 16-Pin PDIP).

2. Activation Energy Estimate

Clearly the choice of an appropriate activation energy, E_a , is of paramount importance. The different mechanisms which could lead to circuit failure are characterized by specific activation energies whose values are published in the literature. The Arrhenius equation describes the rate of many processes responsible for the degradation and failure of electronic components. It follows that the transition of an item from an initially stable condition to a defined degraded state occurs by a thermally activated mechanism. The time for this transition is given by an equation of the form:

$$MTBF = B \exp(E_a/KT)$$

MTBF = Mean time between failures

B = Temperature-independent constant

MTBF can be defined as the time to suffer a device degradation. The dramatic effect of the choice of the E_a value can be seen by plotting the MTBF equation. The acceleration effect for a 125°C device junction stress with respect to 70°C actual device junction operation is equal to 1000 for $E_a = 1\text{eV}$ and 7 for $E_a = 0.3\text{eV}$.

QUALITY and RELIABILITY

Some words of caution are needed about published values of E_a :

- A. They are often related to high-temp tests where a single E_a (with high value) mechanism has become dominant.
- B. They are specifically related to the devices produced by that supplier (and to its technology) for a given period of time
- C. They could be modified by the mutual action of other stresses (voltage, mechanical, etc.)
- D. Field device-application condition(s) should be considered.

(Activation energy for each failure mode)

Failure Mechanism	E_a
Contamination	1 ~ 1.4 eV
Polarization	1 eV
Aluminum Migration	0.5 ~ 1 eV
Trapping	1 eV
Oxide Breakdown	0.3 eV
Silicon Defects	0.3 ~ 0.5 eV

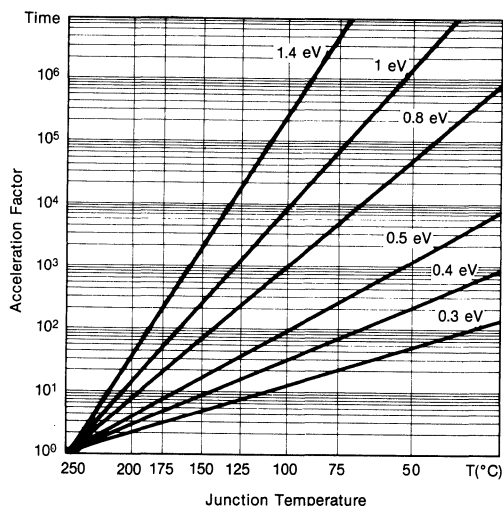
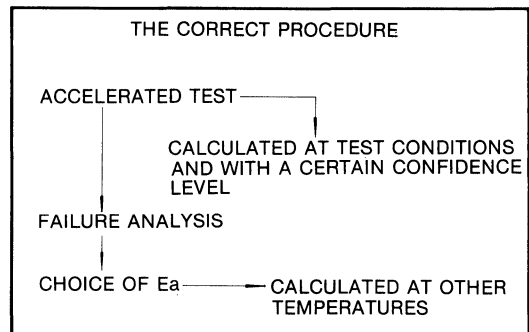


Figure 7. Acceleration Factor Versus Temperature

QUALITY and RELIABILITY

Failure Rate Prediction

Accelerated testing defines the failure rate of products. By derating the data at different conditions, the life expectancy at actual operating conditions can be predicted. In its simplest form the failure rate (at a given temperature) is:

$$FR = \frac{N}{DH}$$

Where FR = Failure Rate

N = Number of failures

D = Number of components

H = Number of testing hours

If we intend to determine the FR at different temperatures, an acceleration factor must be considered. Some failure modes are accelerated via temperature stressing based upon the accelerations of the Arrhenius Law.

For two different temperatures:

$$FR(T_1) = FR(T_2) \exp \left(\frac{E_a}{K} \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \right)$$

FR (T1) is a point estimate, but to evaluate this data for an interval estimate, we generally use a X² (chi square) distribution. An example follows:

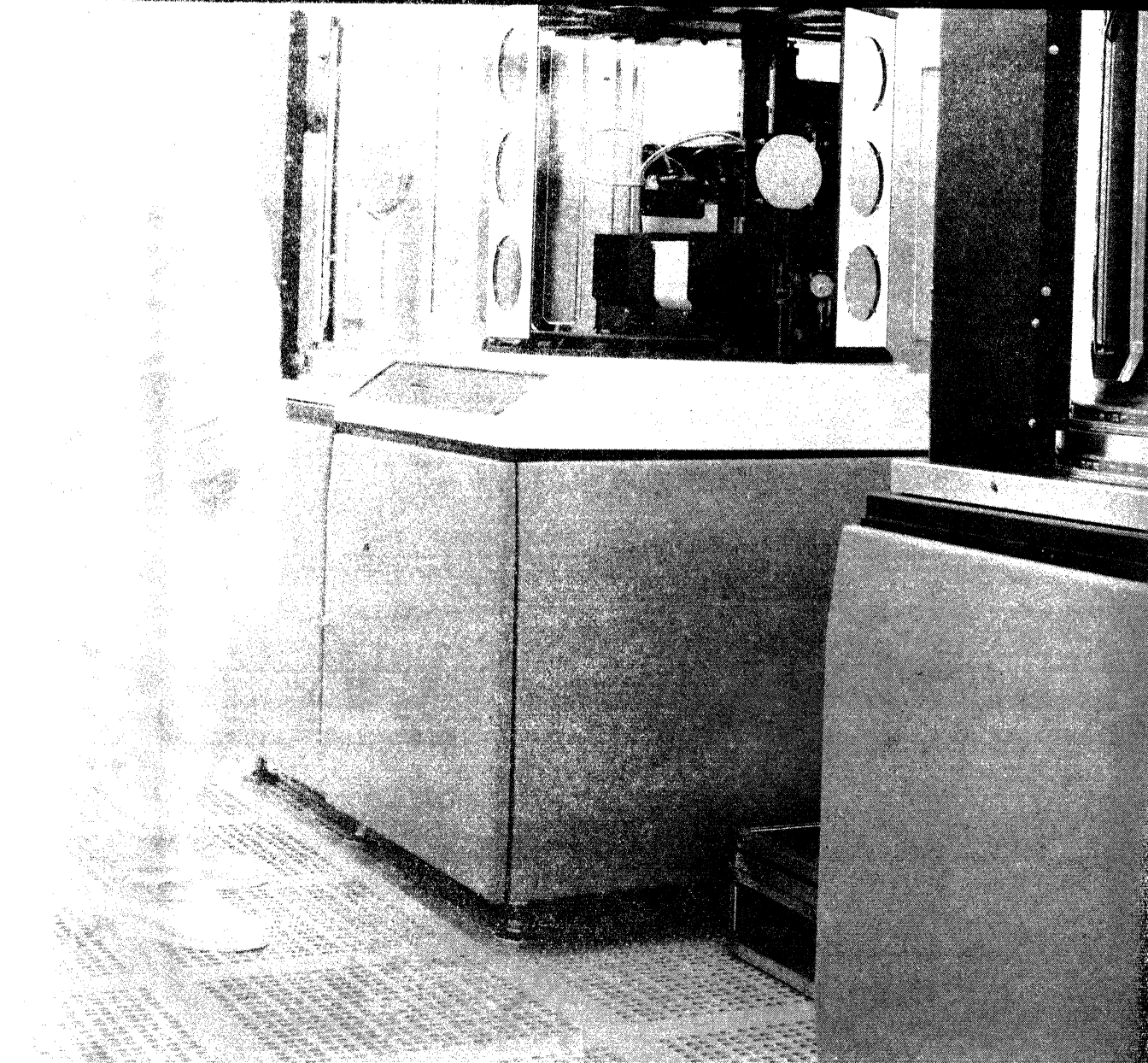
Failure Rate Elaluation

Unit: %/1000HR

Dev. x Hours at 125°C	Fail	Failure Rate at 60% Confidence Level			
		Point Estimate	85°C	70°C	55°C
1.7 × 10 ⁶	2	0.18	0.0068	0.0018	0.00036

The activation energy, from analysis, was chosen as 1.0 eV based upon test results. The failure rate at the lower operating temperature can be extrapolated by an Arrhenius plot.

PRODUCT GUIDE 2



1. AUDIO APPLICATION

A. FM Front End

Type	Package	Function			Use			Remark
		RF	OSC	MIXER	R/C	Car	Hi-Fi	
KA2249	7 SIP	*	*	*	*			$V_{CC} = 2 \sim 7V$
KA22495	9 SIP/14 SOP	*	*	*	*		*	$V_{CC} = 1.6 \sim 6V$
KA22496	9 SIP	*	*	*	*		*	$V_{CC} = 1.6 \sim 6V$

B. FM/AM RF, IF and Detector System, AM Tuner System

Type	Package	Function						Use			Remark
		AM RF CONV	AM IF AMP	AM DET	FM IF AMP	FM DET	S/M	R/C	Car	Hi-Fi	
KA22461	19 ZIP	*	*	*					*		$V_{CC} = 8 \sim 15V$
KA2243	16 DIP		*	*	*	*	*	*		*	$V_{CC} = 3 \sim 14V$
KA2244	9 SIP				*	*	*		*		$V_{CC} = 8 \sim 16V$
KA22441	16 ZIP				*	*	*		*		$V_{CC} = 6 \sim 14V$
KA2245	7 SIP				*	*			*		$V_{CC} = 8 \sim 15V$
KA2247	16 DIP	*	*	*	*	*	*	*			$V_{CC} = 3 \sim 8V$
KA22471	16 DIP	*	*	*	*	*	*	*			$V_{CC} = 3 \sim 8V$
KA2248A/D	16 DIP/20 SOP	*	*	*	*	*	*	*			$V_{CC} = 1.8 \sim 6V$

C. FM Stereo Multiplex Decoder

Type	Package	PLL	Lamp Driver	VCO Stop	Sep. Cont.	Use			Remark
						R/C	Car	Hi-Fi	
KA2261	16 DIP	*	*	*	*	*	*		Sep = 45dB
KA2262	16 ZIP	*	*	*	*		*		SNC/HCC
KA2263	9 SIP	*	*	*		*	*		Sep = 45dB
KA2264/D	9 SIP/16 SOP	*	*	*		*			$V_{CC} = 1.8 \sim 5V$
KA2265	16 DIP	*	*	*	*			*	VCO Non-Adjusting MPX
KA2266	16 ZIP	*	*	*	*		*		Pilot Cancellor SNC/HCC

† New Product
 †† Under Development

D. Audio Power Amplifier

Type	Package	V _{CC} (V)	Output Power		Use			Remark
			R _L = 4 ohm	R _L = 8 ohm	R/C	Car	Hi-Fi	
KA2201/N/B	8 DIP	6		0.5W	*			V _{CC} = 3 ~ 14V
		9		1.2W				
KA2206	12 DIP/F	9	2.3W × 2		*			V _{CC} = 4.5 ~ 11V
KA22062	12 SIP H/S	12	4.6W × 2		*			V _{CC} = 6 ~ 15V
†KA22063S	12 SIP H/S	12	4.6W × 2		*			V _{CC} = 6 ~ 15V
KA2214	14 DIP H/S	9		1.2W × 2	*			V _{CC} = 3 ~ 16V
KA2209	8 DIP	3	110mW × 2		*			V _{CC} = 1.8 ~ 9V
KA2210	12 SIP H/S	13.2	5.5W × 2			*		V _{CC} = 10 ~ 16V
†KA22101	12 ZIP H/S	13.2	23W			*		V _{CC} = 9 ~ 18V
††KA22102	17 ZIP H/S	13.2	15W × 2			*		V _{CC} = 9 ~ 18V
††KA22103	17 ZIP H/S	13.2	19W × 2			*		V _{CC} = 9 ~ 18V
KA2211	12 SIP H/S	13.2	5.8W × 2			*		V _{CC} = 9 ~ 18V
KA2212	9 SIP	6		0.5W	*			V _{CC} = 3.5 ~ 14V
LM386/S/D	8 DIP/9 SIP/8 SOP	6		0.325W	*			V _{CC} = 4 ~ 12V
KA22131	24 SOP	3	69mW × 2 (R _L = 16Ω)		*			V _{CC} = 1.8 ~ 3.6V Included Auto Reverse Pre-AMP
KA2213	14 DIP H/S	6	1W		*			Included Pre-Amp with ALC
††KA22132	16 DIP	3	30mW × 2 (R _L = 32Ω)		*			V _{CC} = 1.8 ~ 7.5V Dual PRE + POWER AMP with Volume Control
††KA22134	16 DIP	3	30mW × 2 (R _L = 32Ω)		*			
KA22135	22 DIP-S	3	28mW × 2 (R _L = 32Ω)		*			V _{CC} = 2 ~ 7.5V Dual PRE-POWER AMP and DC Motor Speed Controller
††KA22136	28 SOP	3	28mW × 2 (R _L = 32Ω)		*			V _{CC} = 2 ~ 7.5V Dual PRE-POWER AMP with Volume Control and DC Motor Speed Controller

† New Product

†† Under Development

E. Pre-Amplifier

Type	Package	Function	Use			Remark
			R/C	Car	Hi-Fi	
KA1222	8 SIP	Dual Pre-amplifier	*			V _{CC} = 2.5 ~ 6V
KA2220	9 SIP	Pre-amplifier with ALC	*		*	V _{CC} = 3.5 ~ 14V
KA2221	8 SIP	Dual Pre-amplifier	*	*	*	Included Voltage Regulator
KA22211	8 SIP	Dual Pre-amplifier	*	*	*	V _{CC} = 5 ~ 14V
KA2223	16 DIP	5 Band Mono Graphic EQ AMP	*	*	*	V _{CC} = 5 ~ 13V
†KA22232D	20 SOP	3 Band Dual Graphic EQ AMP	*			V _{CC} = 1.6 ~ 6V
KA22233	22 DIP	3 Band Dual Graphic EQ AMP	*	*	*	V _{CC} = 5 ~ 15V
†KA22234	24 ZIP-S	5 Band Dual Graphic EQ AMP	*	*	*	V _{CC} = 3.5 ~ 14V
KA22235	18 ZIP	5 Band Mono Graphic EQ AMP	*	*	*	V _{CC} = 3.5 ~ 16V
KA2224	14 DIP	Dual Pre-amplifier with ALC	*		*	V _{CC} = 4 ~ 13V
KA22241	9 SIP	Dual Pre-amplifier with ALC	*			V _{CC} = 4.5 ~ 14V
†KA22242	10 SIP	Dual Pre-amplifier with ALC	*			V _{CC} = 4 ~ 12V
KA2225/D	16 DIP/16 SOP	Dual Pre-amplifier with Mute	*			V _{CC} = 1.6 ~ 5V
KA22261	16 DIP	Dual Pre-amplifier with ALC	*		*	Included REC AMP
†KA2228	21 ZIP-S	Dual Pre-amplifier system	*		*	V _{CC} = 3.5 ~ 7V
††KA2229A	24 DIP-S	Quad Pre-amplifier system	*		*	V _{CC} = 3.5 ~ 7V
KA7226	14 DIP	Dual Pre-amplifier with ALC	*		*	V _{CC} = 3 ~ 16V

F. LED Level Meter Driver

Type	Package	Function	Remark
KA2281	16 DIP	5 Dot dual red/yellow/green LED driver	VU scale, input amplifier Reference voltage included
KA2283	16 DIP	5 Dot dual red/yellow/green LED driver	VU scale, input amplifier Reference voltage included
KA2284	9 SIP	5 Dot mono green LED driver	VU scale Reference voltage included
KA2285	9 SIP	5 Dot mono red LED driver	VU scale Reference voltage included
KA2286	9 SIP	5 Dot mono red LED driver	Linear scale Reference voltage included
KA2287	9 SIP	5 Dot mono green LED driver	Linear scale Reference voltage included
KA2288	16 DIP	7 Dot mono LED driver	VU scale Reference voltage included

† New Product

†† Under Development

G. Music Selector

Type	Package	Function	Remark
KA2230	22 DIP	9-Program Random Selector	$V_{CC} = 5 \sim 14V$
KA2231	9 SIP	Audio Level Sensor	$V_{CC} = 3.5 \sim 14V$

H. 1 Chip Radio

Type	Package	Function	Remark
KA22421/D	16 DIP/16 SOP	AM 1 Chip Radio	$V_{CC} = 2 \sim 5V$
††KA22426	28 SOP	AM/FM 1 Chip Radio	$V_{CC} = 1.6 \sim 6V$
KA22427	16 DIP	AM/FM 1 Chip Radio	$V_{CC} = 3 \sim 13V$
†KA22429	16 SOP	FM 1 Chip Radio	$V_{CC} = 1.6 \sim 6V$
††KA2291	24 SOP	FM F/E + AM/FM IF	$V_{CC} = 2 \sim 9V$
††KA2292	24 DIP	AM/FM TUNER + MPX	$V_{CC} = 2 \sim 9V$

I. Noise Reduction

Type	Package	Function	Remark
†KA2270	16 DIP	dBX Type	$V_{CC} = 5 \sim 15V$
†KA2271	16 DIP	Dolby B Type	$V_{CC} = 8.5 \sim 16V$
†KA22711	16 DIP	Dolby B Type	$V_{CC} = 5.0 \sim 16V$
KA22712	16 DIP	Dolby B Type	$V_{CC} = 6.5 \sim 16V$
KA2272	16 ZIP	FM Noise Canceller	$V_{CC} = 8 \sim 15V$
†KA2273	14 DIP	DNR for CAR Stereo	$V_{CC} = 8 \sim 15V$

J. CD Player

Type	Package	Function	Remark
KA9256	10 SIP H/S	Dual Amp for CDP Motor Driver	$V_{CC} = 5V$, $V_{EE} = -5V$
KA9257	12 SIP H/S	Dual Amp for CDP Motor Driver	$V_{CC} = 5V$
††KS5990	80 FQP	16K SRAM + Digital Signal Processor	$V_{CC} = 5V$
††KA8309	48 FQP	Servo Signal Processor	$V_{CC} = 5V$
††KDA0313	20 SOP	13 bits D/A Converter	$V_{CC} = 5V$
††KA9201	30 SOP	RF Amp for CDP	$V_{CC} = 5V$
††KA9255	22 SOP	PWM Motor Driver for CDP	$V_{CC} = 5V$

2. VIDEO APPLICATION

TV Use

Application	Type	Package	Circuit Function
SIF System	KA2101	14 DIP	IF amp, IF limiter, IF detector
SIF Subsystem for MPX	KA2105	9 SIP	IF amp, IF limiter, IF detector
	KA2106	16 DIP	(KA2105) × 2
Sound System	KA2102A	14 DIP H/S	KA2101 + 2.4W audio power amp.
Sound MPX (Two Carrier System in Korea)	KA2268N	28 DIP	SIF amp, IF limiter, IF detector, LED driver, Mode SW, Matrix, VCO
	KA22682		
Sound Muting	KA2103L	9 SIP	Hori sync detector, Integrator, Comparator, Voltage controller
Auto Power Off + Sound Muting	KA2104	9 SIP	KA2103 + auto power off control
VIF System	KA2911	16 DIP	VIF amp, Limiter, Video detector, Video amp, Noise invert, AGC detector, IF AGC, AFT, Reverse RF AGC
	KA2916	16 DIP	Forward RF AGC version of KA2911
	KA2912	14 DIP H/S	VIF amp, Limiter, Video detector, Video amp, IF AGC, Forward RF AGC, Noise canceller
VIF + SIF System	KA2913A	16 DIP	VIF amp, Limiter, Video detector, IF AGC, Forward RF AGC, SIF limiter, Sound detector
	KA2917	16 DIP	Reverse RF AGC version of KA2913A
	KA2914A	24 DIP	VIF amp, Limiter, Video detector, Video AFT, IF AGC, Reverse RF AGC, SIF amp, SIF limiter, Sound detector
	KA2918	24 DIP	Forward RF AGC version of KA2914A
	KA2919	30 SDIP	VIF amp, Video detector, AFT, IF AGC, Reverse RF AGC, Noise canceller, Video amp, SIF detector, Limiter amp, Mute, Attenuator, AF amp
	KA2922	20 DIP	VIF amp, Video Det, AFT, Noise Canceller, IF AGC, Forward RF AGC, amp, FM Det, Mute
	KA2923	20 DIP	VIF amp, Video Det, AFT, Noise canceller, IF AGC, Reverse RF AGC, Limit amp, FM Det, Mute.
VIF + SIF + Deflection	KA2915	28 DIP	VIF amp, Limiter, Video Detector, Video AFT, IF AGC, Forward RF AGC, SIF amp, SIF limiter, SIF detector, Sync separator, Hori OSC/driver/AFC, OSC/pre-driver
PAL Chroma System	KA2151	24 DIP	Chroma amp, DC chroma gain control, ACC peak detector, Burst amp, Killer detector, APC phase detector, DC uni-color control, ACC amp, Burst gate, PAL switch, flip-flop, Matrix, VCO
NTSC Chroma + Deflection + Video System	KA2153	42 DIP	ACC amp./detector, Killer detector, Phase detector, CW OSC, Demodulator, Sawtooth gen, APC, X-ray protection, Hori OSC/drive, Vert OSC/amp, Reverse amp
	KA2155	30 SDIP	Video tone/contrast, Pedestal amp, Bright control, Color demodulator, APC, Tint control, VCO, ACC, Color killer, Hori OSC/AFC, Predriver, Sync separator, Burst gate, Vert blank/driver, Ramp generator, X-ray protection
	KA2156		

TV Use (Continued)

Application	Type	Package	Circuit Function
PAL Chroma + Deflection + Video System	KA2154	42 DIP	ACC amp/detector, Killer detector, Phase detector, CW OSC, Demodulator, Sawtooth-Gen, APC, X-ray protection, Hori OSC/drive, Vert OSC/amp, Reverse amp
NTSC C/TV 1 Chip	†KA2159	42 SDIP	VIF, SIF, Video, Chroma Deflection Circuit
Vertical System	KA2130A	10 DIP H/S	Vert OSC/driver/output, Sawtooth generator
	KA2136	12 DIP/F	Synchronization circuit, OSC, Ramp generator, High power gain amplifier, Flyback Generator, Voltage regulator
Vertical Output	KA2131	10 SIP H/S	Driver, Output, Flyback generator, Pulse shaper
Horizontal System	KA2135	12 SIP	Polarity SW, AFC, Hori OSC/preamp, Pulse width adj, X-ray protector
	KA2137	16 DIP	Noise gated sync separator, Vert sync separator, Hori OSC with frequency limiter, Protection circuit phase comparator, Sync and OSC pulse, flyback and OSC pulse, Loop gain and time constant switching, Composite blanking, Key pulse generator, Output stage with high current capability
Deflection System	KA2133	16 DIP H/S	Vert OSC/driver/output, Sawtooth generator, Hori OSC/pre-driver, AFC
	KA2134	18 DIP	Sync separator, Noise detector, Hori/OSC/buffer, AFC, Vert OSC/driver/amp, Ramp generator, X-ray protector
	†KA2138	20 DIP	Vert OSC, Ramp generator, Sampling type, DC voltage control, Horiz OSC, AFC X-ray protector, Horiz phase shifter, Horiz pulse duty setting
	KA2921	16 DIP	Sync separator, Noise blanking, Voltage regulator, Vert OSC/pre-driver/amp, Hori OSC/driver, AFC, X-ray protector
Remocon Transmitter	KS5803A	16 DIP	Key In/output, Driver, Output control, OSC, Data register, Controller
	KS5803B	20 SOP	
	KS5410	20 SOP	
Infrared Preamp	KA2181	8 SIP	ALC, Input separation stage, Output gain control
	KA2182	8 SIP	ALC, Input separation stage, Output gain control, Low voltage use amp
	KA2183		
	†KA2184	8 SIP	ALC, Limite amp, BPF, Detector, Hysteresis Comparator
DC Volume & Tone Control	KA2107	12 SIP	Tone control, Balance control, Volume control, Output amp
Digital Volume Control	KA2611	8 DIP	Up/down counter, D/A convertor, RC OSC, Initial control, Clear circuit, Logic SW, Voltage regulator
Sync Separator	KA2605	9 SIP	Phase Inverter, Hori sync separator, Vert sync separator, Composite sync separator, Vertical filter, Horizontal filter
	KA2606	9 SIP	Phase Inverter, Hori sync separator, Hori sync compensation, Composite sync separator, Vertical filter, Horizontal filter
R.G.B. Interface	KA6101	18 DIP	R.G.B. clamp, R.G.B. amp, Contrast control, Brightness control, Clamp pulse generator, R/Y, G/Y, B/Y switch, Switching pulse generator
	KA6102	18 DIP	R.G.B. clamp R.G.B. amp, Contrast control, Brightness control, Clamp pulse generator, R/Y, G/Y, B/Y switch, Switching pulse generator
Audio & Video Switch	†KA2186	8 DIP	Switching Circuit Reference (Low Impedance)

† New Product

†† Under Development

B. VTR Use

Application	Type	Package	Circuit Function
Write & Read	KA2944	28 DIP	Sync tip clamp, Dynamic emphasis, Main pre-emphasis, White/dark clip, Frequency modulator, REC buffer amp, FM AGC, DOC, Pre-amp, SW amp
	†KA8102	22 SDIP	EQ amp, Current amp, Pre amp, Chrominance amp, Peaking amp, RF AGC amp
	†KA8115	22 SDIP	EQ amp, Current amp, Pre amp, Chrominance amp, Peaking amp.
Luminance Processor	KA2945	28 DIP	Video AGC, EE Monitor squelch, FM limiter, FM demodulation, Dynamic de-emphasis, Noise cancel, Y/C mix. squelch, Sync separation, Video output amp
	†KA8103	48 SDIP	Comb filter, Detail Enhancer, White clip, Picture control, Line Noise canceller, Sync LPF, Main de-emphasis, LPF, Clamp, Edit control, DOC
	††KA8113	30 SDIP	AGC, SYNC sep. Detail enhancer, Non linear emphasis, Main emphasis, 75Ω driver, FMAGC, DOC, Line noise canceller, Noise canceller, Picture control
Chrominance Processor	KA2988	28 DIP	Auto color, Burst pre-emphasis, Converter, AFC, APC, VCO (160fH), Sub-converter, 4-Phase 40fH Signal generator, ID input, VCO (3.579545MHz)
	†KA8104	30 SDIP	320fH(NTSC)/321fH(PAL) VCO, REC LPF, Edit control, PB input signal level compensator, fsc Multiplier (2fsc), Field Start inhibit, High speed APC circuit, APC Reference control
Audio Processor	KA2983	18 DIP	REC/PB Pre-amplifier, Line amp, ALC, Analog SW, REC/PB/Muting control, REC amplifier
	KA8401	24 SZIP	EP/SP SW, REC/PB SW, PB/EE SW, REC/EE SW, Line muting SW, ALC, Line amp, REC amp, PB EQ amp
Digital Servo Controller	†KA8303	42 SDIP	Speed/Phase servo for VTR drum and capstan. Many built-in functions including special playback and extended recording.
	†KA8308	30 SDIP	Speed/Phase servo for VCR DRUM and capstan serial mode input, Viss, STILL, SLOW, etc.
	†KA8313	30 SDIP	Speed/Phase servo for VCR DRUM and capstan motor, still, slow
	††KA8316	56 SDIP	Speed/Phase servo for VCR DRUM and capstan motor
Servo Control Amplifier	KA8302	12 SDIP	CTL amp, FG amp, Doubler, Schmitt trigger
	†KA8312	12 SDIP	CTL AMP, FG AMP, Doubler, Schmitt trigger, 1/2 block
RF Modulator	KA2981	16 DIP	Video clamp, White clip AM modulator, Sound FM modulator, Carrier OSC with SAW channel select SW

†: New Product

††: Under Development

*: Direct Replacement

VTR Use (Continued)

Application		Type	Package	Circuit Function
A/V Switch		KA8402	7 SIP	2-input switch
		†KA8403	9 SIP	3-input switch
Detail Enhancer		KA8101	9 SIP	Limiter, Enhancer
Motor Driver		KA8301	10 SIP H/S	Pre amp, Driver, Logic circuit
		KA8304	12 SIP H/S	Control amp, CW/CCW, Hall amp, 2-phase DRUM motor driver
		KA8306	10 SIP H/S	Control circuit, Protect circuit, Dual motor driver
		†KA8310	20 ZIP	2 phase DC brushless hall motor driver IC DRUM motor, CTL amp, Hall amp, CW/CCW, Driver, TSD
		††KA8311	30 DIP H/S	3 phase capstan DD motor driver
Demodulator		KA2914A	24 DIP	VIF amp, Limiter, Video detector, Video AFT, IF AGC, Reverse RF AGC, SIF amp, SIF limiter, Sound detector
		KA2917	16 DIP	VIF amp, Limiter, Video detector, IF AGC, Reverse RF AGC, SIF limiter, Sound detector
		KA2919	30 SDIP	VIF amp, Video detector, AFT, IF AGC, Reverse RF AGC, Noise canceller, Video amp, SIF detector, Limiter amp, Mute, Attenuator, AF amp
		KA2923	20 DIP	VIF amp, Video Det, AFT, Noise canceller, IF AGC, Reverse RF AGC, Limit amp, FM Det, Mute
S-VHS Sub Emphasis		†KA8106	18 DIP	NL processor, VHS & S-VHS SW SP/EP Mode & PB/REC SW
Sound MPX		KA22682	28 DIP	SIF amp, IF limiter, IF detector, LED driver, Mode SW, Matrix, VCO (Two Carrier System in Korea)
		†KA2269	42 SDIP	Decoder (Sound MPX in USA)
		††KA2270	16 DIP/SOP	dbx NR (Sound MPX in USA)
Character Generator		††KS5580	32 SOP	Sync separator & OSC, Character memory & ROM, Data/Address SW, Video output
LED & Lamp Driver		KA2618	9 SIP	4-NPN TR array
CCD 1H Delay Line		††KS7100	8 DIP	Clamp, CCD, Bias, S&H, Buffer, Clock driver
Remocon	Tx	KS5803A	16 DIP	Key In/output, Driver, Output control, OSC, Data register, Controller
		KS5803B	20 SOP	
		†KS5410	20 SOP	
	Pre Amp	KA2181	8 SIP	ALC, Input separation stage, Output gain control
		†KA2184	8 SIP	ALC, Limite amp, BPF, Detector, Hysteresis Comparator

† New Product

†† Under Development

3. TOY APPLICATION

Device	Function					Package	V _{cc} (V)	A _v (dB)	Operating Mode	Application
	F/W	B/W	Stop	L/R Turn	Turbo					
KA2303	○	○	○			9 SIP	2.5-10	65	RF	3 Function RC TOY CAR (RX)
KA2304	○	○				9 SIP	2.5-10	65	RF	2 Function RC TOY CAR (RX)
KA2305A	○	○	○			12 SIP	3-18	58	RF + PWM	3 Function RC TOY CAR (RX)
KA2306A	○	○	○		○	14 DIP	3-18	58	RF + FM	3 Function + Turbo (RX)
KA2309	○	○	○	○	○	16 DIP	3-18	58	RF + FM + PWM	7 Function RC TOY CAR (RX)
KA2310	○	○	○	○	○	9 SIP	6-12		RF + FM + PWM	KA2309 Transmitter
KA2311	○	○	○	○	○	16 DIP	3-18	65	RF + FM + PWM	Full Function RC TOY CAR (RX) (L/R Turn on stop state)
KA2312	○	○	○	○	○	9 SIP	6-12		RF + FM + PWM	KA2311 Transmitter

4. FDD APPLICATION

Device	Package	Function	Features	Application
KA6201	18 DIP	FDD Read Amp	Gain selector, Peak detector Wave shape	FDD (5.25", 3")
KA6202	16 DIP	2-phase stepping motor driver	330mA output current capability, Dual bridge included, Single input direction control, Low supply current	FDD HDD

1. AUDIO LINEAR ICs

Application	SAMSUNG	SANYO	TOSHIBA	MATSUSHITA	ROHM	Others
Power Amplifier	KA2201/N	LA4145		AN7116	BA527	*TBA820M
	KA2201B	LA4145		AN7116	BA527	*TBA820M
	KA2212	*LA4140	*TA7313AP	*AN7112	BA526	
	†KA22101		*TA7250BP			
	††KA22102		*TA8205AM			
	LM386		TA7336P		BA546	*LM386/*NJM386
Dual Power Amplifier	KA2206	*LA4182/3	TA7769P	AN7143	BA534	TEA2025
	KA22062		*TA7283AP		BA5406	
	†KA22063		*TA7282			
	KA2209	LA4530	TA7376P	AN7118		*TDA2822M
	KA2210	*LA4445	TA7227P	AN7147	BA532	
	KA2211	LA4440	*TA7240AP	AN7178	BA532	
EQ AMP + Power	KA2214					*μPC1263C
	KA2213	*LA4160	TA7628P			μPC1165C
Dual EQ AMP + Power	†KA22131	LA4560M			*BA3502F	
	††KA22132	LA4520		*AN7108		*CXA1034P
	††KA22134		*TA8119P			
	†KA22135					*LAG637D
	††KA22136					*LAG665
EQ AMP + ALC	KA2220	*LA3210	*TA7137P	AN7320	*BA333	μPC1158H
Dual EQ AMP	KA1222	*LA3160	TA7312P			*M51521L
	KA2221	*LA3161	*TA7375P	AN7310	*BA328	*M5152L
	KA22211	*LA3160	TA7312P			*M51521L
Graphic EQ AMP	KA2223	*LA3600	TA7796P			*M5226P
	KA22231	LA3610M				TK10586M
	KA22232					TK10580M
	KA22233			AN7330K	BA3822L	
	†KA22234				*BA3822L	
	KA22235				*BA3812L	
Dual EQ AMP + ALC	KA2224	*LA3220		AN7312	BA343	
	KA22241	LA3225/6N			*BA3308	M51544L
	†KA22242	LA3225/6N			*BA3312N	M51544L
	KA22261		*TA7668BP			
	KA7226		*TA7658P	AN7312	BA343	
	†KA2228		*TA7417P		BA3416BL	
Quad EQ AMP	††KA2229A					M51166P
Dual EQ AMP + Mute	KA2225	LA3230	*TA7709P/F	AN7315	BA3304	
Music Selector	KA2230	LC7517	TC9167P			*IR3R24
	KA2231	*LA2010	TA7341P	AN6262N/3N	BA335	
AM 1 Chip Radio	KA22421		*TA7641BP			*CIC7641
	††KA22426					*CXA1019
AM/FM 1 Chip Radio	KA22427		*TA7613AT			*TDA1083/*ULN2204
FM 1 CH 1P Radio	††KA22429					*TDA7021T

† New Product †† Under Development * Direct Replacement

AUDIO LINEAR ICs (Continued)

Application	SAMSUNG	SANYO	TOSHIBA	MATSUSHITA	ROHM	Others
AM/FM IF + DET	KA2243				*BA4220	*HA12413
FM IF + DET	KA2244		*TA7303P	AN278	*BA404	
	KA22441	*LA1140		AN7277	*BA4110	
	KA2245	*LA1150	*TA7130P		*BA403	*μPC1028H
AM Tuner System	KA22461	LA1135	TA7402P	AN7250S		*μPC1215V
AM Tuner + AM/FM IF + DET	KA2247	*LA1260		AN7223	*BA4260	
	KA22471		*TA7640AP	AN7223		
	KA2248A	LA1270	*TA7687AP		BA4228L	
FM Front End	KA2249	LA1180	TA7335P	*AN7213	BA4402	
	KA22495	*LA1185	*TA7358AP	*AN7205		
	KA22496		*TA7358P			
FM Stereo Multiplex Decoder	KA2261	*LA3361	*TA7604P	*AN7410	*BA1330	*HA11227/*μPC1197C
	KA2262	*LA3370	TA7401AP	AN7417	BA1356	
	KA2263		*TA7343AP	*AN7420		
	KA2264	LA3330	*TA342P	*AN7421	BA1360	
	KA2265	*LA3410	TA7413AP	AN7470		
	†KA2266	*LA3375	TA7401AP			
Noise Reduction	†KA2271		TA7719P			*CXA1101P
	†KA22711					*CXA1102
	†KA22712					*CXA1163
	†KA2272	*LA2110				
	KA2273					*LM1894M
LED Level Meter Driver	KA2281		*TA7666P			IR2E27
	KA2283		*TA7667P			
	KA2284	*LB1403	TA7366P	*AN6884	*BA6124	
	KA2285	*LB1423	TA7366P		*BA6137	
	KA2286	*LB1433			BA656	
	KA2287	*LB1413			*BA6125	
	KA2288					*IR2E02
AM/FM 1 Chip Tuner	††KA2291					*CX20111
AM Tuner + MPX	††KA2292		*TA8127			
CDP	††KS5990					*CXD1130
	††KA8309					*CXA1082Q
	††KDA0313					*CXD1140
	††KA9255				*BA6280	
	††KA9201					*CXA1081Q

† New Product †† Under Development * Direct Replacement

2. VIDEO LINEAR ICs

A. TV Use

Application	SAMSUNG	SANYO	MATSUSHITA	TOSHIBA	HITACHI	NEC	Others
SIF System	KA2101	*LA1365	*AN240	*TA7176	*HA1125	μ PC1382	*ULN2165N
SIF Subsystem For MPX	KA2105		AN5215	*TA7337			
	KA2106						
SIF + Audio Output	KA2102A		AN5250		HA1364	* μ PC1353C	
Sound MPX (Two Carrier System in Korea)	KA2268N						
	KA22682						
Sound MPX (USA)	Decoder †KA2269						CX20112
	dbx NR †KA2270						CXA1011
Sound Muting	KA2103L						
Sound Muting + Auto Power Off	KA2104						
VIF System	KA2911	LA1357	AN5111	*TA7607	HA11225	μ PC1356	*TDA2544
	KA2916			*TA7611			
	KA2912	LA7507				* μ PC1366	
VIF + SIF System	KA2913A			*TA7678		* μ PC1414	
	KA2914A			*TA7680		μ PC1411C	
	KA2917						
	KA2918						
	KA2919	*LA7520					
	KA2922	*LA7535					
	KA2923	*LA7530N					
VIF + SIF + Def	KA2915		*AN5151N				
PAL Chroma System	KA2151		AN5620	*TA7193		μ PC1365	
NTSC Chroma/ Deflection	KA2153			*TA7644BP		μ PC1401C	*IROPO4
	†KA2155	*LA7625					
	†KA2156	*LA7626					
PAL Chroma/ Deflection	KA2154			*TA7698			
C/TV 1 Chip (NTSC)	†KA2159	*LA7655					
Vertical System	KA2130A	*LA1385		*TA7242		* μ PC1031H2	
	KA2132						*TDA1044U
	KA2136						*TDA1170N
Vertical Output	KA2131	LA7830	*AN5512			μ PC1378H	
Horizontal System	KA2135		*AN5790N				
	KA2137						*TDA1180P

† New Product

†† Under Development

* Direct Replacement

TV Use (Continued)

Application	SAMSUNG	SANYO	MATSUSHITA	TOSHIBA	HITACHI	NEC	Others
Def. System	KA2133					*μPC1379	
	KA2134		*AN5436				
	KA2921			*TA7609			
	†KA2138	*LA7851					
Remocon Transmitter	KS5803A					*μPD1913C	
	KS5803B					*μPD1943G	
	†KS5410			*TC9012F			
Infrared Preamp	KA2181					*μPC1373H	
	KA2182/3					*μPC1374H	
	KA2184						*CX20106A
DC Volume & Tone Control	KA2107		*AN5836	TA7630P			
Digital Volume Control	KA2611						
Sync Separator	KA2605						
	KA2606						
R.G.B. Interface	KA6101		*AN5355				
	KA6102		*AN5356				
Audio & Video Switch	KA2186						*TEA2014
PLL + Prescaler	†KA2185			*TD6359P			

† New Product †† Under Development * Direct Replacement

B. VTR Use

Application	SAMSUNG	HITACHI	NEC	TOSHIBA	SANYO	ROHM	Others
Write & Read Amplifier	KA2944	*HA11744	* μ PC1534C				
	†KA8102		* μ PC2313CA				
	†KA8115						Original
Luminance Process	KA2945	*HA11745	* μ PC1536C				
	†KA8103		* μ PC2317CA				
	†KA8113				*LA7323		
Chrominance Processor	KA2988	*HA11741	* μ PC1536C				
	†KA8104		* μ PC2315CA				
Audio Processor	KA2983					*BA5102	
	KA8401					*BA7751LS	
Digital Servo Controller	†KA8303			*TD6362N			
	†KA8308					*BU2758S	
	†KA8313		* μ PD6163				
	††KA8316	*HD49748					
Servo Control Amplifier	KA8302			*TA8617S			
	††KA8312			*TA8618S			
RF Modulator	KA2981		* μ PC1507C	*TA7673P			
Motor Driver	KA8301					*BA6209	
	KA8304					*BA6411	
	†KA8306			*TA7288P			
	†KA8310						*M51721ATL
	††KA8311						*M52440ASP
A/V Switch	KA8402			*TA7347P			
	†KA8403			*TA7348P			
Demodulator	KA2914A		* μ PC1411C	*TA7680P			
	KA2917			*TA7625			
	KA2919				*LA7520		
	KA2923				*LA7530N		
Detail Enhancer	KA8101				*LA7308		
S-VHS Sub-Emphasis	†KA8106						*VC2031
Character Generator	††KS5580						*M50554

† New Product

†† Under Development

* Direct Replacement

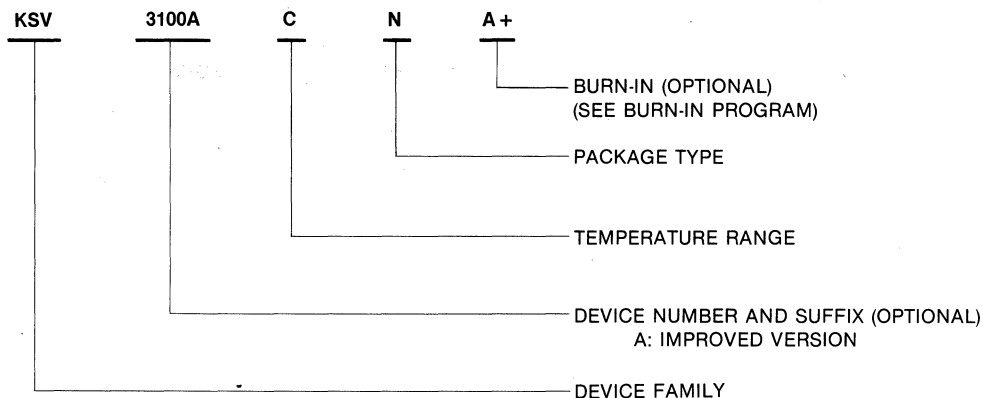
VTR Use (Continued)

Application		SAMSUNG	HITACHI	NEC	TOSHIBA	SANYO	ROHM	Others
Sound MPX		KA22682						Original
		†KA2269						*CX20112
		††KA2270						*CXA1011
LED & Lamp Driver		KA2618			*TD62555S			
CCD 1H Delay Line		††KS7100						*MSM6964RS
Remocon	Tx	KS5803A		*μPD1319C				
		KS5803B		*μPD1319G				
		†KS5410			*TC9012F			
	Pre Amp	KA2181		*μPC1373H				
		†KA2184						*CX20106A
System Controller (μ-Com)		†KS56C400	PB only, ROM 4K, RAM 256 words					
		KS56C460	ROM 4K, RAM 320 words					
		††KS56C1610	ROM 16K, RAM 512 words, 45V drive					
		†KS56C1660	ROM 16K, RAM 512 words					

† New Product †† Under Development * Direct Replacement

LINEAR ICs

ORDERING INFORMATION



TEMPERATURE RANGE

BLANK	SEE INDIVIDUAL SPEC
C	COMMERCIAL 0 ~ + 70°C
I	INDUSTRIAL - 25 ~ + 85°C - 40 ~ + 85°C
M	MILITARY - 55 ~ + 125°C

PACKAGE TYPE

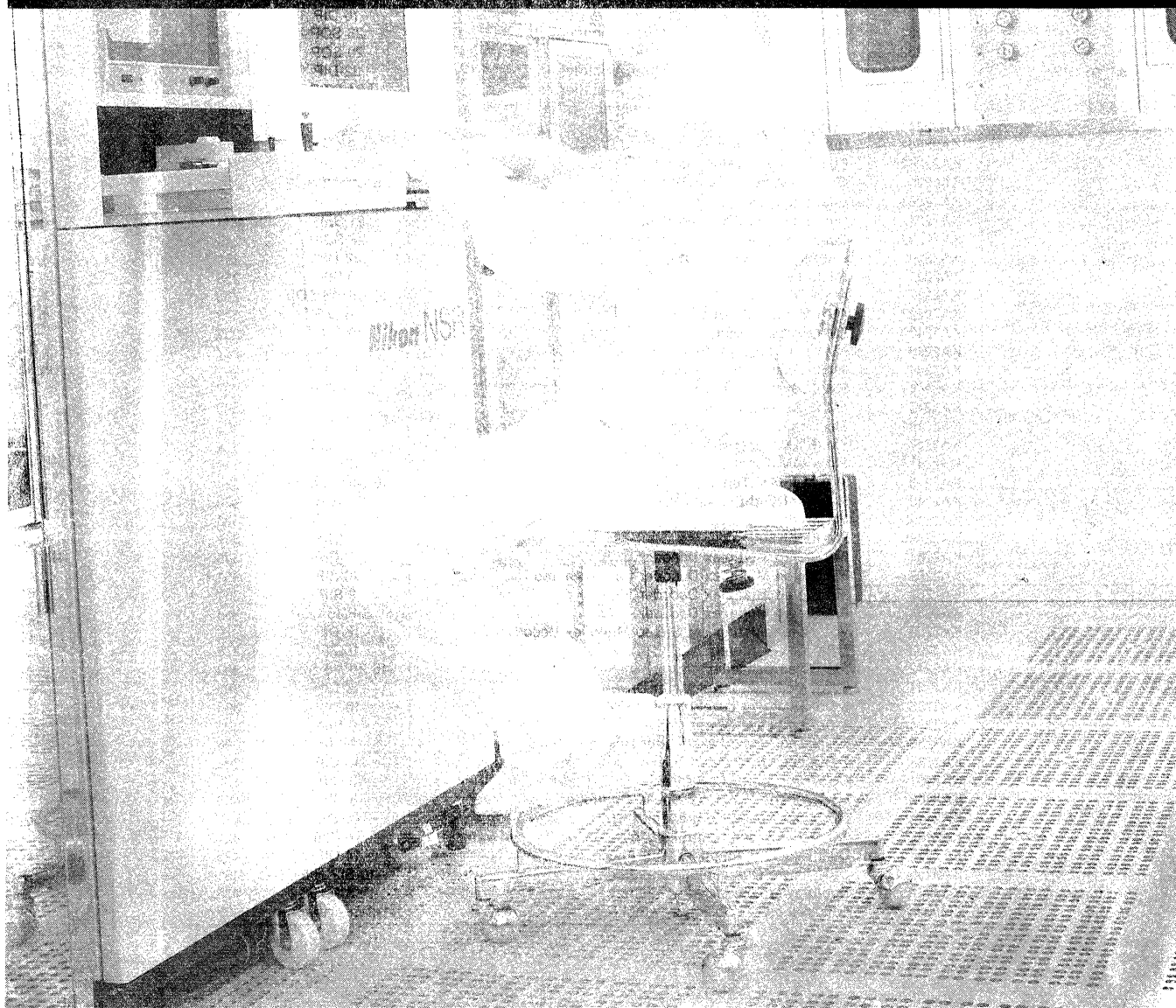
CODE	PKG. TYPE
D	SOIC
J	CERAMIC DIP
N	PLASTIC DIP (300/600 mil)
S	SIP
Q	FQP
E	SD (400 mil)
B	SSD (Skinny Shrink DIP) (400 mil. Small Pitch)
P	SHD (Shrink DIP) (300 mil. Small Pitch)
W	ZIP
U	PGA
L	LCC
PL	PLCC
M	TO-3
H	TO-3P
Z	TO-92
V	TO-92L
A	TO-126
T	TO-220
X	TO-247
G	BARE CHIP

INTEGRATED CIRCUIT

KA	LINEAR IC
KS	CMOS IC
KT	TELECOM IC
LM	NATIONAL
MC	MOTOROLA
NE	SIGNETICS
KSV	A/D-D/A CONVERTER
KAD	A/D CONVERTER
KDA	D/A CONVERTER



AUDIO ICs 3



Audio Application

Device	Function	Package	Page
KA1222	Dual Low Noise Equalizer Amplifier	8 DIP	79
KA2201	1.2W Audio Power Amplifier	8 DIP	83
KA2201B	0.5W Audio Power Amplifier	8 DIP	87
KA2206	2.3W Dual Audio Power Amplifier	12 DIP/F	90
KA22062	4.5W Dual Power Amplifier	12 SIP H/S	98
KA22063	4.5W Dual Power Amplifier	12 SIP H/S	105
KA2209	Dual Low Voltage Power Amplifier	8 DIP	111
KA2210	5.5W Dual Power Amplifier	12 SIP H/S	114
KA22101	23W Power Amplifier	12 SIP H/S	119
KA2211	5.8W Dual Power Amplifier	12 SIP H/S	126
KA2212	0.5W Audio Power Amplifier	9 SIP	131
KA2213	One Chip Tape Recorder System	14 DIP H/S	136
KA22131	Dual Pre-Power Amplifier for Auto Reverse	24 SOP	143
KA22134	Dual Pre-Power Amplifier with DC Volume Control	16 DIP	150
KA22135	Dual Pre-Power Amplifier and DC Motor Speed Controller	22 SDIP	155
KA2214	1W Dual Power Amplifier	14 DIP H/S	160
KA2220	Equalizer Amplifier with ALC	9 SIP	165
KA2221	Dual Low Noise Equalizer Amplifier	8 SIP	170
KA22211	Dual Low Noise Equalizer Amplifier	8 SIP	174
KA2223	5 Band Graphic Equalizer Amplifier	16 DIP	178
KA22231	5 Band Dual Graphic Equalizer Amplifier	28 SOP	184
KA22232	3 Band Dual Graphic Equalizer Amplifier	20 SOP	188
KA22233	3 Band Dual Graphic Equalizer Amplifier	22 DIP	192
KA22234	5 Band Dual Graphic Equalizer Amplifier	24 SZIP	196
KA22235	5 Band Graphic Equalizer Amplifier	18 ZIP	200
KA2224	Dual Equalizer Amplifier with ALC	14 DIP	205
KA22241	Dual Equalizer Amplifier with ALC	9 SIP	212
KA22242	Dual Equalizer Pre-Amplifier with ALC	10 SIP	217
KA2225	Dual Pre-Amplifier for 3V Using	16 DIP/16 SOP	225
KA22261	Dual Equalizer Amplifier with Ree AMP	16 DIP	230
KA2228	Dual Equalizer Amplifier System	21 SZIP	236
KA2229A	Quad Equalizer Amplifier for Double Cassette	24 SDIP	246
KA2230	9-Program Music Selector	22 DIP	251
KA2231	Audio Level Sensor	9 SIP	258
KA22421	AM 1 Chip Radio	16 DIP/16 SOP	263
KA22427	AM/FM 1 Chip Radio	16 DIP	273
KA22429	FM One Chip Radio	16 SOP	282
KA2243	AM/FM IF System	16 DIP	287
KA2244	FM IF System for Car Radio	9 SIP	293
KA22441	FM IF System for Car Stereo	16 ZIP	297
KA2245	FM IF System for Car Radio	7 SIP	305
KA22461	Electronic Tuning AM Radio Receiver for Car Stereo	19 ZIP	309
KA2247	FM IF/AM Tuner System	16 DIP	314
KA22471	FM IF/AM Tuner System	16 DIP	319
KA2248	3V FM IF/AM Tuner System	16 DIP/20 SOP	324
KA2249	FM Front End Portable Radio	7 SIP	329
KA22495	FM Front End	9 SIP/14 SOP	333
KA22496	FM Front End	9 SIP	341
KA2261	FM Stereo Multiplex Decoder	16 DIP	346
KA2262	FM Stereo Multiplex Decoder for Car Stereo	16 ZIP	351
KA2263	FM Stereo Multiplex Decoder	9 SIP	361
KA2264	FM Stereo Multiplex Decoder	9 SIP/16 SOP	365
KA2265	Vco Non-Adjusting FM Stereo Multiplex Decoder	16 DIP	370
KA2266	MPX for Car Stereo	16 ZIP	376
KA2272	FM Noise Canceller	16 ZIP/16 SOP	380
KA2281	5 Dot Dual Led Level Meter Driver	16 DIP	386
KA2283	5 Dot Dual Led Level Meter Driver	16 DIP	389
KA2284/85	5 Dot Led Level Meter Driver	9 SIP	393
KA2286/87	5 Dot Led Linear Level Meter Driver	9 SIP	396
KA2288	7 Dot Led Level Meter Driver	16 DIP	399
KA2401	DC Motor Speed Controller	8 DIP	402
KA2402	Low Voltage DC Motor Speed Controller	8 DIP	408
KA2404	DC Motor Speed Controller	TO-92L	415
KA2407	DC Motor Speed Controller	TO-126	421
KA7226	Dual Equalizer Amplifier with ALC	14 DIP	425
KA9256	Dual Power Operational Amplifier	10 SIP H/S	431
KA9257	Dual Power Operational Amplifier	12 SIP H/S	433
LM386	Low Voltage Audio Power Amplifier	8 DIP/8 SOP/9 SIP	437

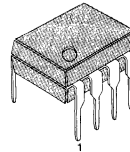
DUAL LOW NOISE EQUALIZER AMPLIFIER

The KA1222 is a monolithic integrated circuit consisting of 2 channel pre-amplifier in 8 pin plastic single in line package. Minimum operating voltage is 2.5 Volt, thus it is suitable for low voltage application.

FEATURES

- Wide operating supply voltage range (2.5V ~ 6V).
- Low noise ($V_{NI}=1.0\mu\text{V}$: Typ).
- High channel separation.
- Good ripple rejection ratio.
- Minimum number of external parts required.

8 DIP

**SCHEMATIC DIAGRAM****ORDERING INFORMATION**

Device	Package	Operating Temperature
KA1222	8 DIP	-20 ~ +70°C

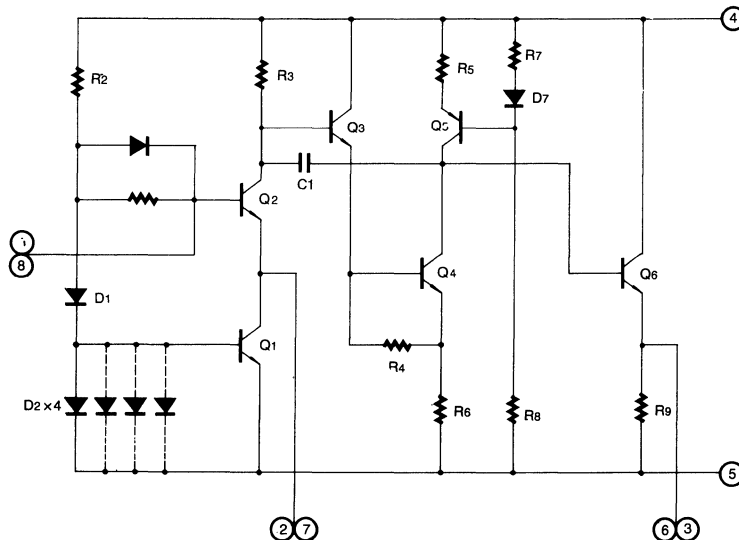


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	7.5	V
Power Dissipation	P_d	200	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 4\text{V}$, $R_L = 10\text{K}\Omega$, $R_g = 600\Omega$, $f = 1\text{KHz}$, NAB, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		2.0	6.0	mA
Voltage Gain (Open Loop)	A_{VO}		65	80		dB
Voltage Gain (Closed Loop)	A_V	$V_O = 0.2\text{V}$	33	35	37	dB
Output Voltage	V_O	THD = 1%	0.4	0.7		V
Total Harmonic Distortion	THD	$V_O = 0.2\text{V}$		0.1	0.3	%
Input Resistance	R_i			150		$\text{K}\Omega$
Equivalent Input Noise Voltage	V_{NI}	$R_g = 2.2\text{K}\Omega$ BW (-3dB) = 15Hz ~ 30KHz		1.0	2.0	μV
Cross Talk	CT	$R_g = 2.2\text{K}\Omega$	50	65		dB

TEST CIRCUIT

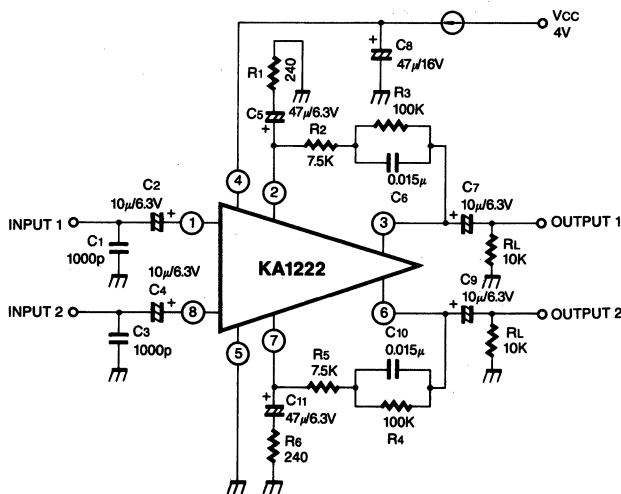
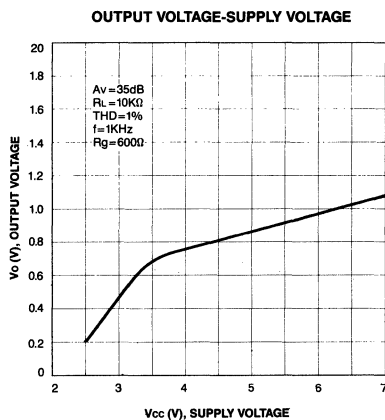
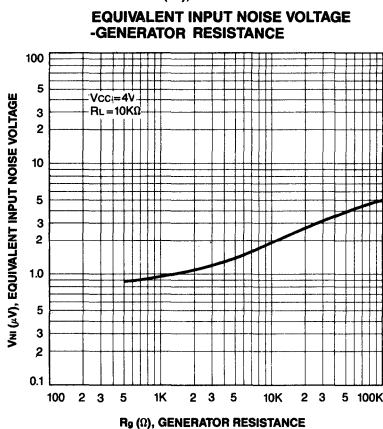
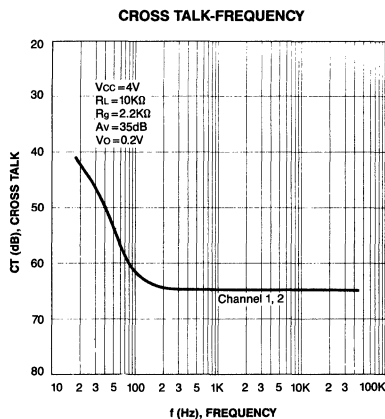
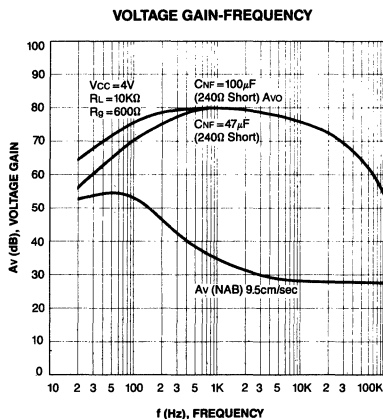
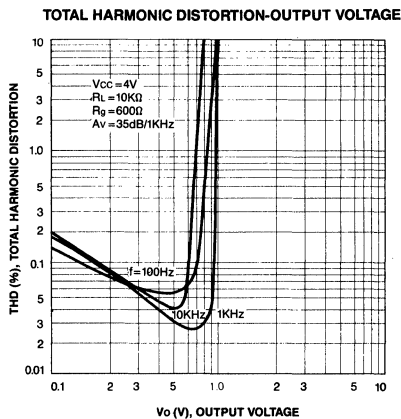
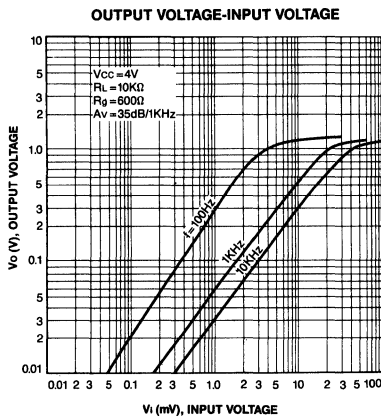
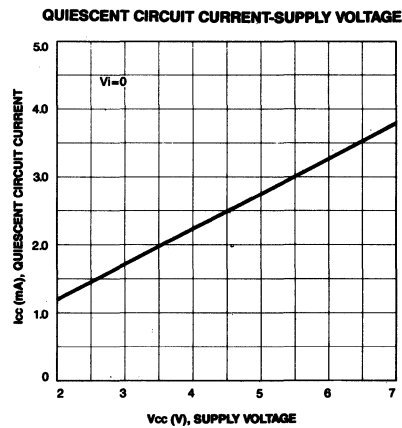
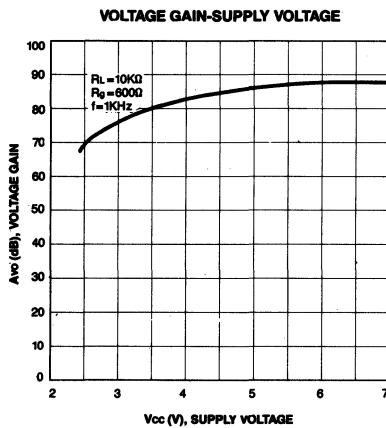


Fig. 2





TYPICAL APPLICATION CIRCUIT

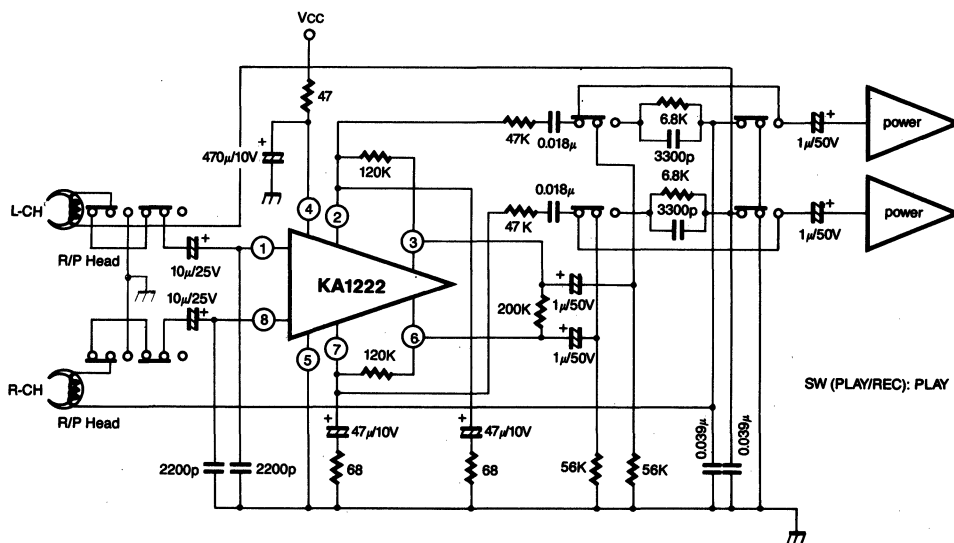


Fig. 3

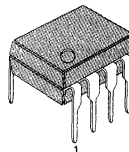
1.2W AUDIO POWER AMPLIFIER

The KA2201 is a monolithic integrated audio amplifier in 8 pin plastic dual in line package designed for audio frequency class B amplifier.

FEATURES

- Wide operating supply voltage (3V ~ 14V)
- Medium output power.
 $P_O = 1.2W$ at $V_{CC} = 9V$, $R_L = 8\Omega$, $THD = 10\%$.
- Low quiescent circuit current ($I_{CC} = 4mA$: Typ).
- Good ripple rejection.
- Minimum number of external parts required.

8 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2201	8 DIP	- 20 ~ + 70°C
KA2201N		
KA2201G	PELLET	

SCHEMATIC DIAGRAM

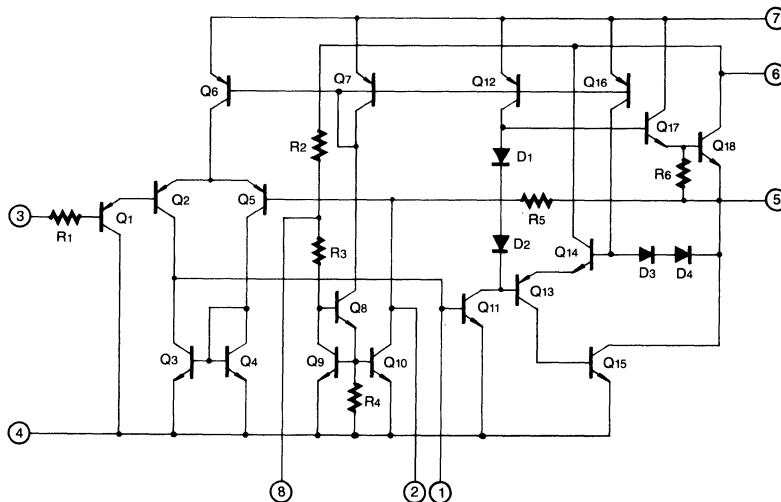


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Output Peak Current	I_o	1.5	A
Power Dissipation	P_d	1.25	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $f = 1\text{KHz}$, $R_g = 600\Omega$, $R_i = 120\Omega$, $R_L = 8\Omega$ unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		4	12	mA
Output Power	P_o	$V_{CC} = 9\text{V}$, $R_L = 4\Omega$, THD = 10%		1.6		W
		$V_{CC} = 9\text{V}$, $R_L = 8\Omega$, THD = 10%	0.9	1.2		
		$V_{CC} = 6\text{V}$, $R_L = 4\Omega$, THD = 10%		0.75		
		$V_{CC} = 6\text{V}$, $R_L = 8\Omega$, THD = 10%	0.4	0.5		
		$V_{CC} = 12\text{V}$, $R_L = 8\Omega$, THD = 10%		2		
Total Harmonic Distortion	THD	$P_o = 500\text{mW}$		0.3	1.0	%
Voltage Gain (Open Loop)	A_{VO}	$R_i = 0$		75		dB
Voltage Gain (Closed Loop)	A_V	$R_i = 120\Omega$	33	36	39	dB
Input Resistance	R_i			5		$\text{M}\Omega$
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$ $\text{BW} (-3\text{dB}) = 50\text{Hz} \sim 20\text{KHz}$		0.3	1.0	mV

TEST CIRCUIT

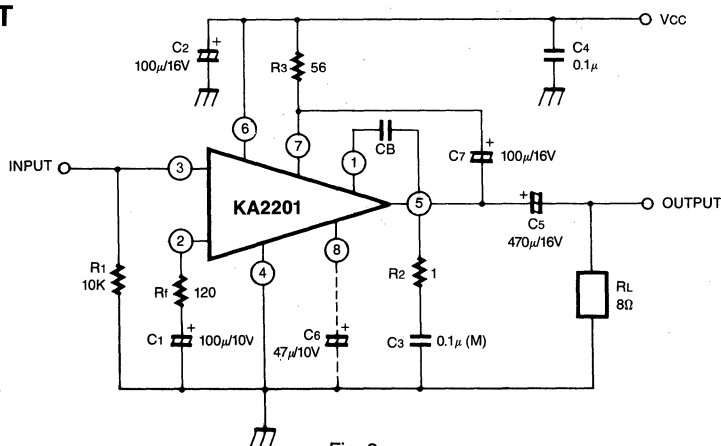
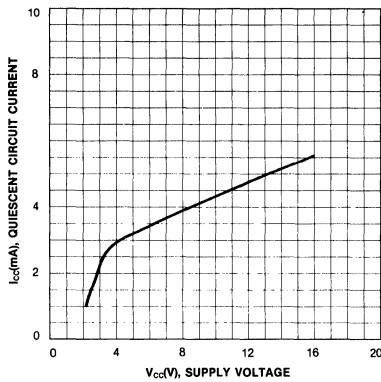
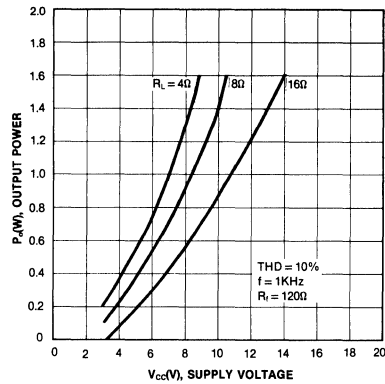


Fig. 2

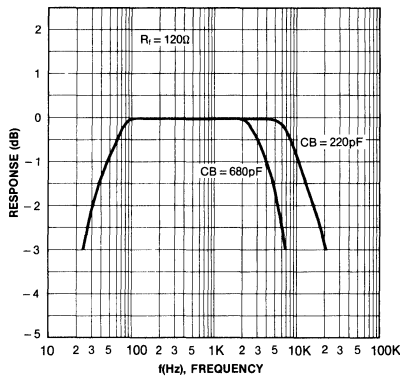
QUIESCENT CIRCUIT CURRENT—SUPPLY VOLTAGE



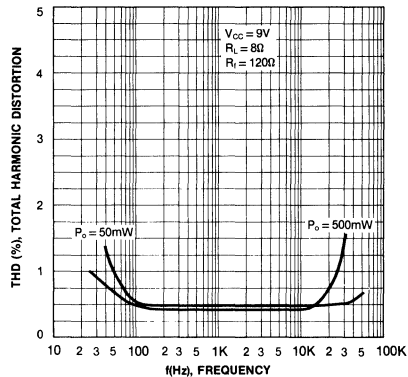
OUTPUT POWER—SUPPLY VOLTAGE



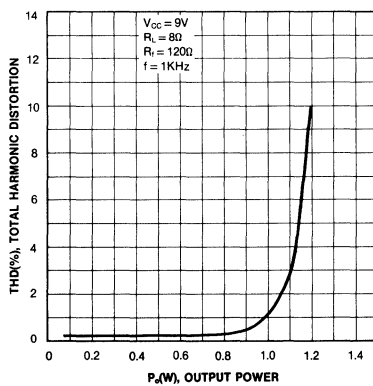
FREQUENCY RESPONSE



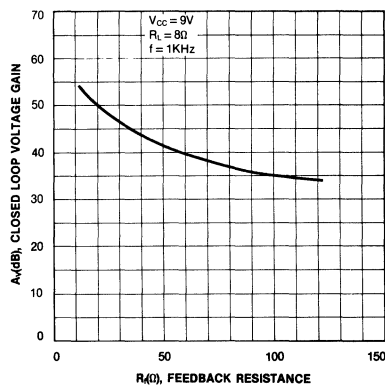
TOTAL HARMONIC DISTORTION—FREQUENCY

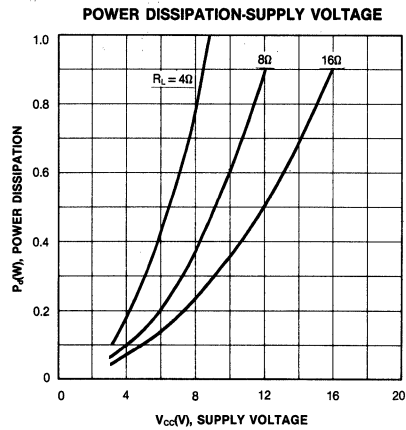
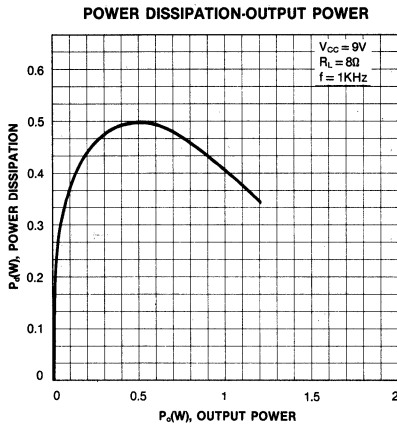


TOTAL HARMONIC DISTORTION—OUTPUT POWER



VOLTAGE GAIN—FEEDBACK RESISTANCE





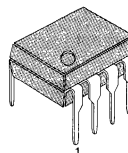
0.5W AUDIO POWER AMPLIFIER

The KA2201B is a monolithic integrated audio amplifier in 8 pin plastic dual in line package, designed for audio frequency class B amplifier.

FEATURES

- Wide operating supply voltage (3V ~ 12V).
- Medium output power.
 $P_O = 0.5W$ at $V_{CC} = 6V$, $R_L = 8\Omega$, THD=10%.
- Low quiescent circuit current ($I_{CC} = 3.5mA$: Typ).
- Good ripple rejection.
- Minimum number of external parts required.
- Built-in bootstrap resistor R_7 (External resistor R_3 (56 Ω) of the KA2201)

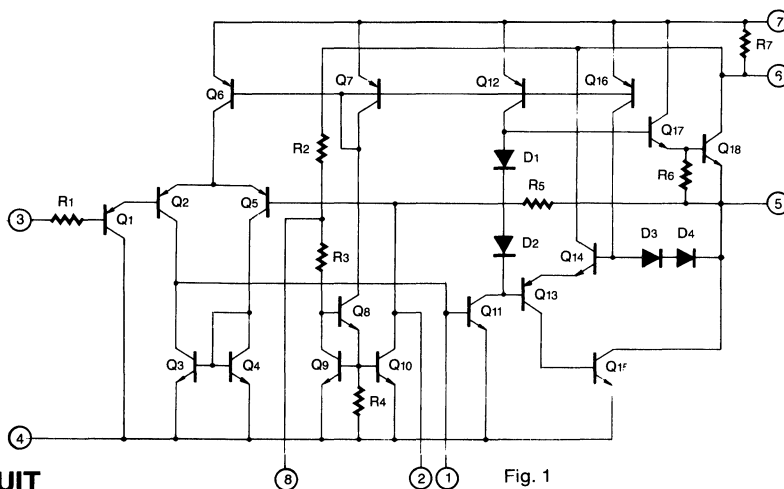
8 DIP



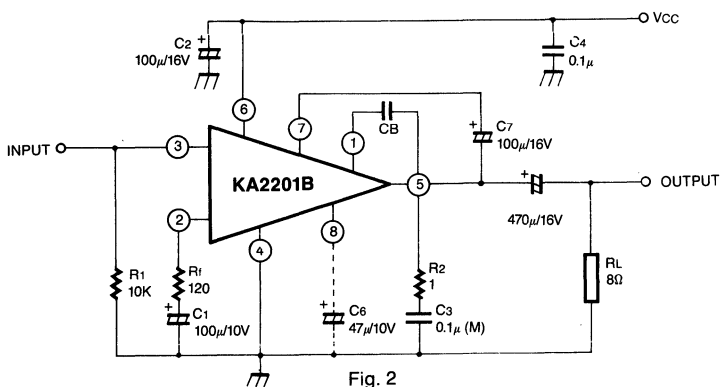
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2201B	8 DIP	- 20 ~ + 70°C

SCHEMATIC DIAGRAM



TEST CIRCUIT



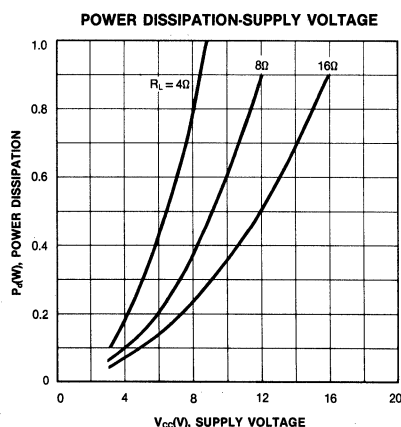
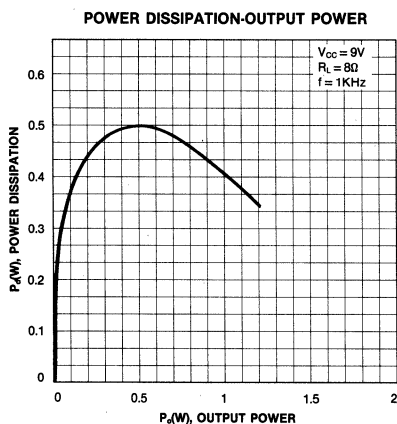
ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Output Peak Current	I_o	1.5	A
Power Dissipation	P_d	1.25	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

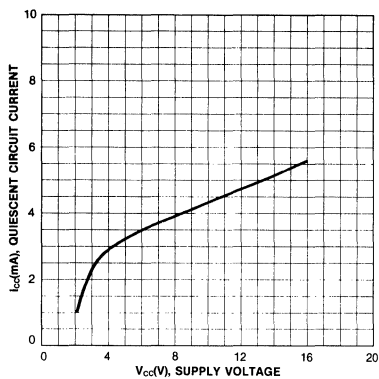
ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$, $f = 1\text{KHz}$, $R_g = 600\Omega$, $R_L = 8\Omega$ unless otherwise specified)

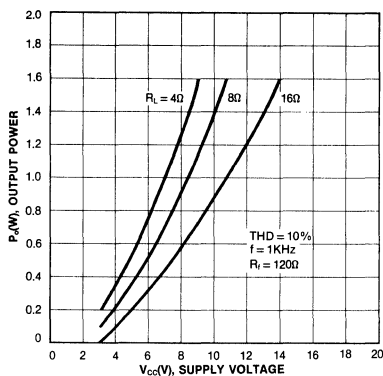
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		3.5	7.0	mA
Output Power	P_o	$V_{CC} = 6\text{V}$, $R_L = 8\Omega$, THD = 10% $V_{CC} = 6\text{V}$, $R_L = 4\Omega$, THD = 10% $V_{CC} = 9\text{V}$, $R_L = 8\Omega$, THD = 10% $V_{CC} = 9\text{V}$, $R_L = 4\Omega$, THD = 10% $V_{CC} = 12\text{V}$, $R_L = 8\Omega$, THD = 10%	0.4 0.9	0.5 0.75 1.2 1.6 2		W
Total Harmonic Distortion	THD	$P_o = 100\text{mW}$		0.3	1.0	%
Voltage Gain (Open Loop)	A_{VO}	$R_i = 0$		75		dB
Voltage Gain (Closed Loop)	A_V	$R_i = 120\Omega$	33	36	39	dB
Input Resistance	R_i			5		$\text{M}\Omega$
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$ $\text{BW} (-3\text{dB}) = 50\text{Hz} \sim 20\text{KHz}$		0.3	1.0	mV



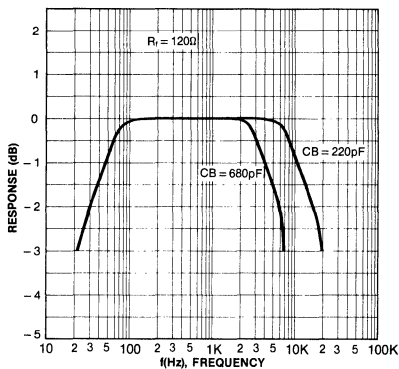
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



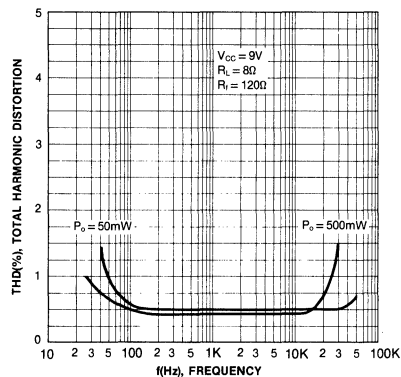
OUTPUT POWER-SUPPLY VOLTAGE



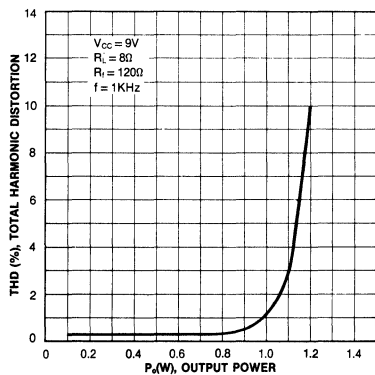
FREQUENCY RESPONSE



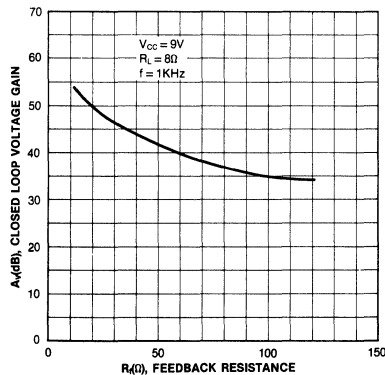
TOTAL HARMONIC DISTORTION-FREQUENCY



TOTAL HARMONIC DISTORTION-OUTPUT POWER



VOLTAGE GAIN-FEEDBACK RESISTANCE



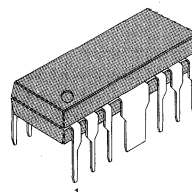
2.3W DUAL AUDIO POWER AMPLIFIER

The KA2206 is a monolithic integrated circuit consisting of 2 channel power amplifier. It is suitable for stereo and bridge amplifier application of radio cassette tape recorder.

FEATURES

- High output power
Stereo: $P_o = 2.3W$ (Typ) at $V_{cc} = 9V$, $R_L = 4\Omega$.
Bridge: $P_o = 4.7W$ (Typ) at $V_{cc} = 9V$, $R_L = 8\Omega$.
- Low switching distortion at high frequency.
- Small shock noise at the time of power on/off due to built-in muting circuit.
- Good ripple rejection due to built-in ripple filter.
- Good channel separation.
- Soft tone at the time of output saturation.
- Closed loop voltage gain fixed 45dB (Bridge: 51dB) but availability with external resistor added.
- Minimum number of external parts required.
- Easy to design radiator fin.

12 DIP/F



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2206	12 DIP/F	$-20 \sim +70^\circ\text{C}$

BLOCK DIAGRAM

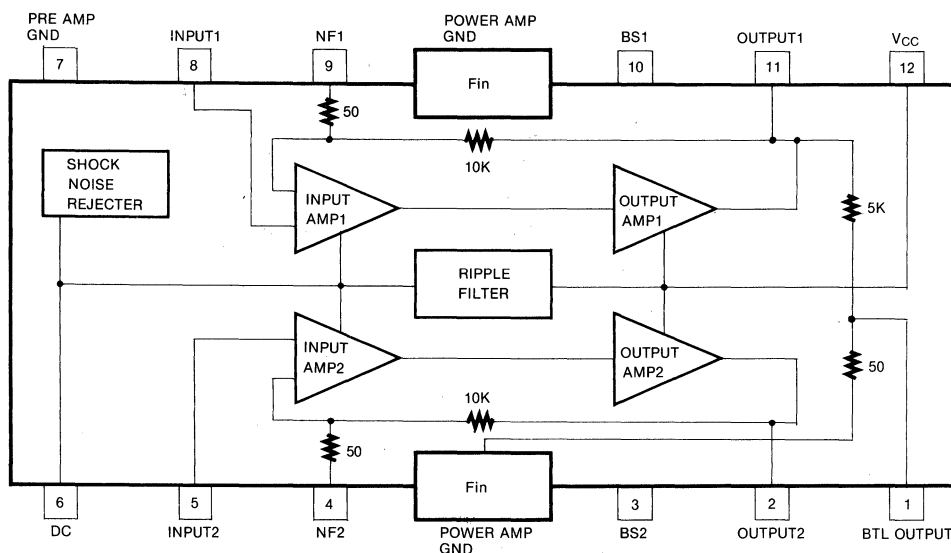


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_d	4*	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

* Fin is soldering on PCB

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $f = 1\text{KHz}$, $R_g = 600\Omega$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Supply Voltage	V_{CC}			9	11	V
Quiescent Circuit Current	I_{CC}	$V_i = 0$, Stereo		40	55	mA
Closed Loop Voltage Gain	A_v	Stereo	43	45	47	dB
		Bridge	49	51	53	dB
Channel Balance	CB	Stereo	-1	0	+1	dB
Output Power	P_o	Stereo	$R_L = 4\Omega$, THD=10%,	1.7	2.3	W
			$R_L = 8\Omega$, THD=10%	1.3		W
		Bridge	$R_L = 8\Omega$, THD=10%	4.7		W
Total Harmonic Distortion	THD	Stereo	$P_o = 250\text{mW}$, $R_L = 4\Omega$	0.3	1.5	%
		Bridge		0.5		%
Input Resistance	R_i		21	30		$\text{K}\Omega$
Ripple Rejection	RR	Stereo, $R_g = 0\Omega$, $V_r = 150\text{mV}$ $f = 100\text{Hz}$	40	46		dB
Output Noise Voltage	V_{NO}	Stereo, $R_g = 0\Omega$		0.3	1.0	mV
		Stereo, $R_g = 10\text{K}\Omega$		0.5	2.0	mV
Cross Talk	CT	Stereo, $R_g = 10\text{K}\Omega$, $V_o = 0\text{dBm}$	40	55		dB

TYPICAL APPLICATION CIRCUIT: Stereo Amplifier

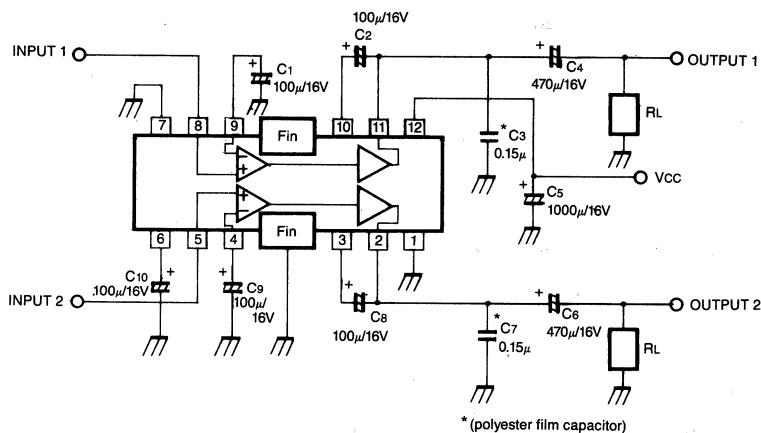


Fig. 2

TYPICAL APPLICATION CIRCUIT: Bridge Amplifier

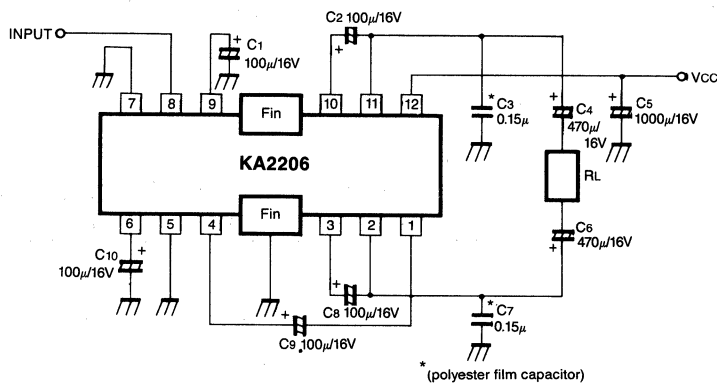
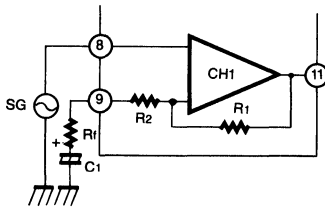


Fig. 3

VOLTAGE GAIN ADJUSTMENT

1. Stereo application



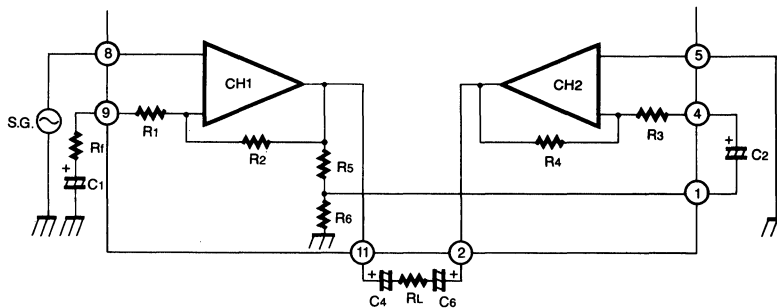
- i) Fixed voltage gain
(Pin 9 connected to GND directly)

$$A_v = 20 \log \frac{R_1}{R_2} \text{ (dB)}$$

- ii) Variable voltage gain
(R_f and C_1 connected with pin 9)

$$A_v = 20 \log \frac{R_1}{R_2 + R_f} \text{ (dB)}$$

2. Bridge application



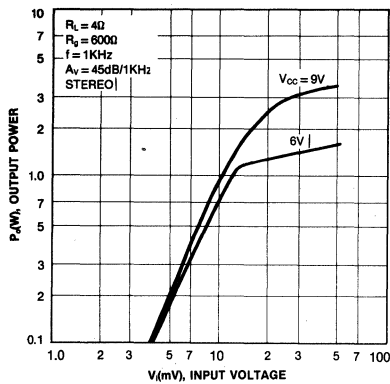
- i) Fixed voltage gain (Pin 9 connected to GND directly)

$$A_v = 20 \log \frac{R_2}{R_1} + 6 \text{ (dB)}$$

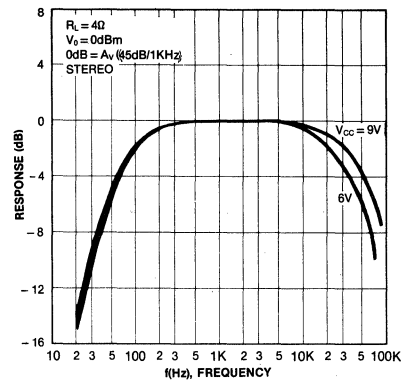
- ii) Variable voltage gain (R_f and C_1 connected with pin 9)

$$A_v = 20 \log \frac{R_2}{R_1 + R_f} + 6 \text{ (dB)}$$

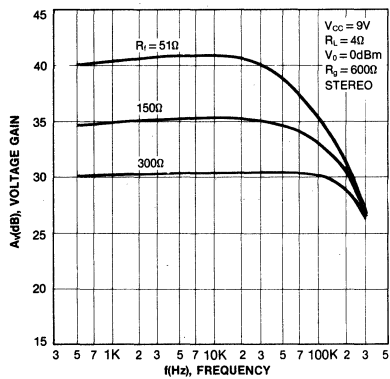
OUTPUT POWER-INPUT VOLTAGE



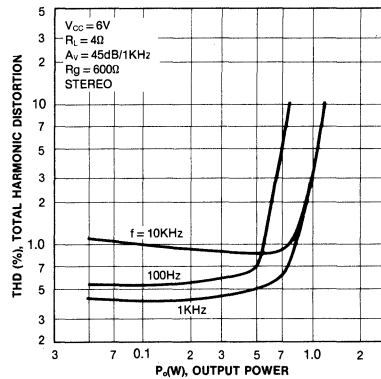
FREQUENCY RESPONSE



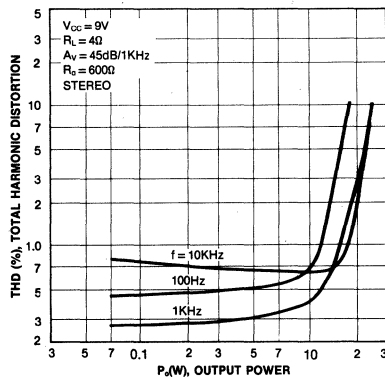
VOLTAGE GAIN-FREQUENCY



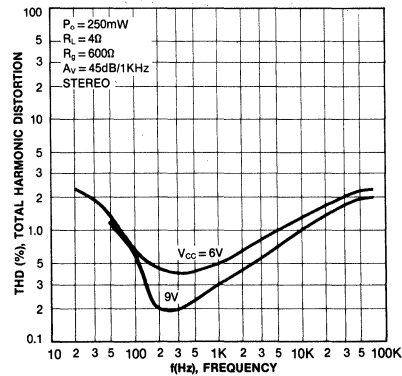
TOTAL HARMONIC DISTORTION-OUTPUT POWER

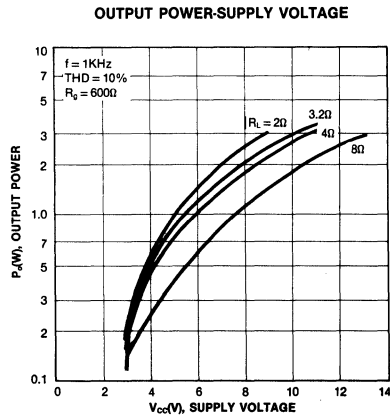
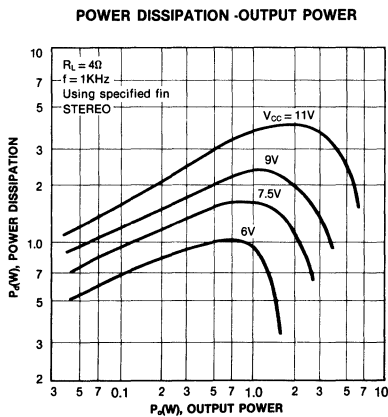
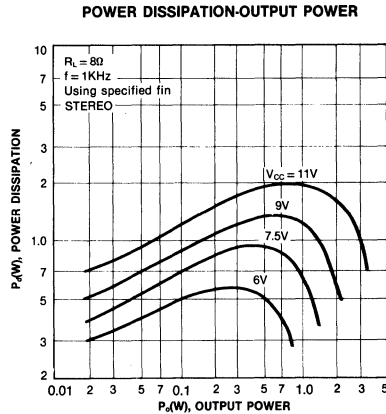
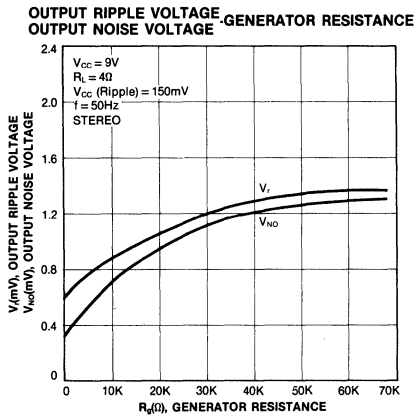
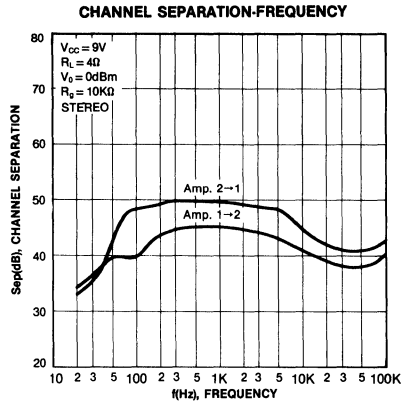
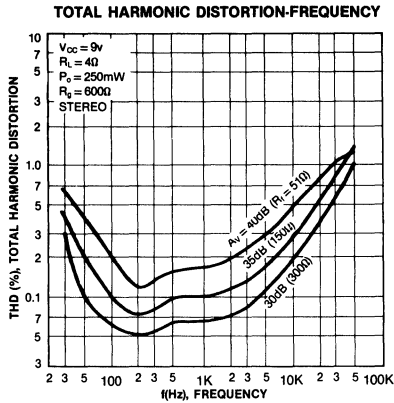


TOTAL HARMONIC DISTORTION-OUTPUT POWER

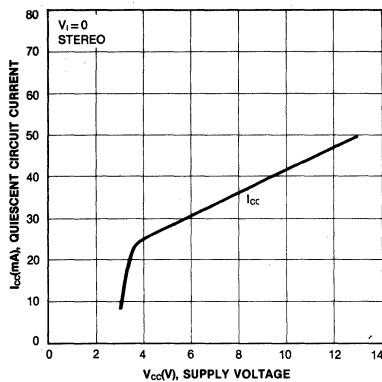


TOTAL HARMONIC DISTORTION-FREQUENCY

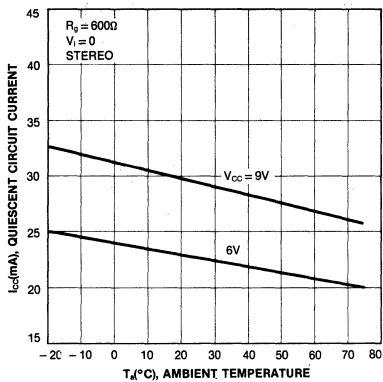




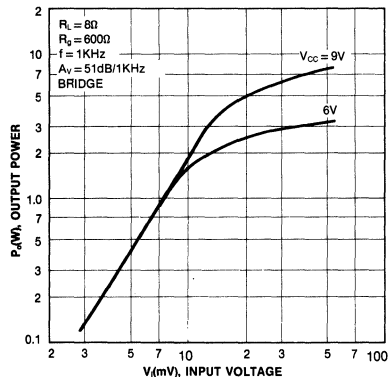
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



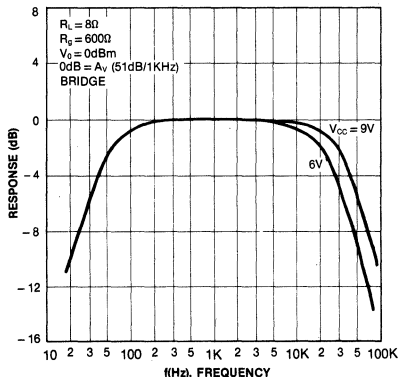
QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE



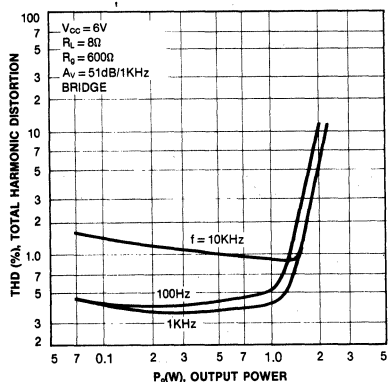
OUTPUT POWER-INPUT VOLTAGE



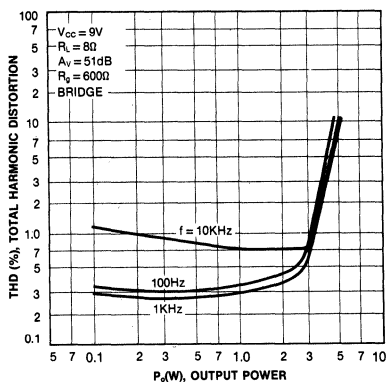
FREQUENCY RESPONSE

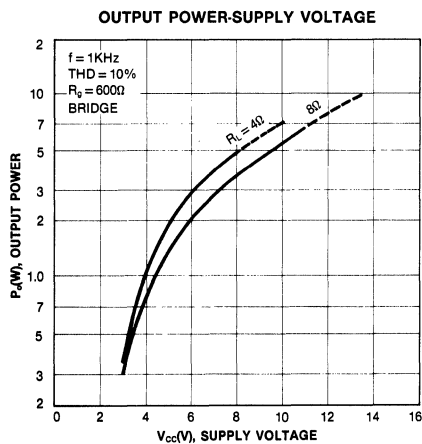
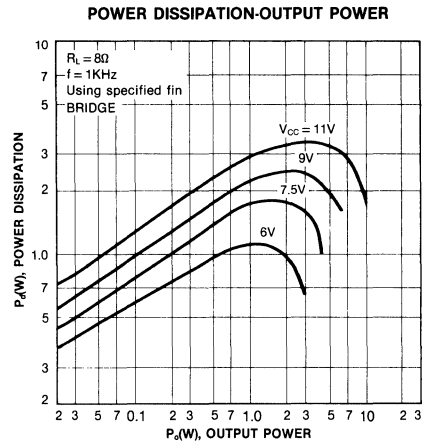
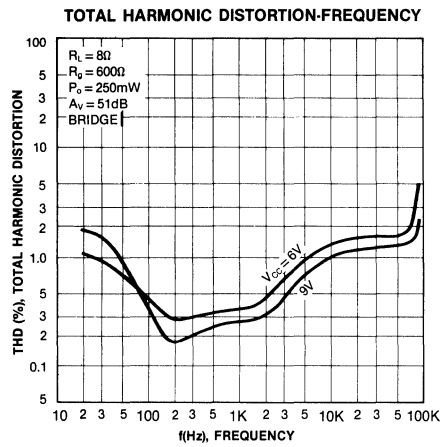


TOTAL HARMONIC DISTORTION-OUTPUT POWER



TOTAL HARMONIC DISTORTION-OUTPUT POWER





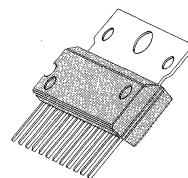
4.5W DUAL POWER AMPLIFIER

The KA22062 is a monolithic integrated circuit consisting of dual power amplifier. It is suitable for portable radio cassette recorder.

FEATURES

- Dual power amplifier: $4.5W \times 2$ (Typ)
- Low quiescent circuit current; $I_{CC} = 19mA$ (Typ)
- High output
- Small pop noise at the power on
- Minimum external parts required
- Supply voltage range: $V_{CC} = 6V \sim 15V$
- Including the thermal protection circuit

12 SIP H/S



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22062S	12 SIP H/S	- 20 ~ + 70°C
KA22062G	PELLET	

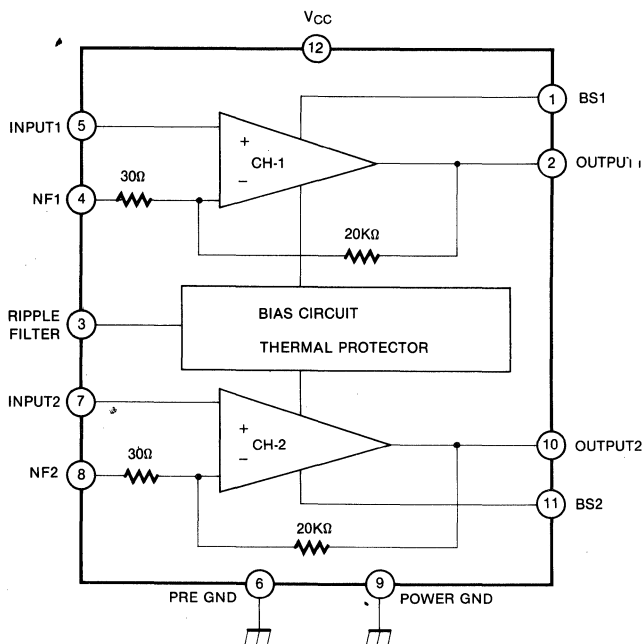


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Output Current (1CH)	I_o (peak)	2.5	A
Power Dissipation	P_d	12.5	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $R_L = 4\Omega$, $f = 1\text{KHz}$, $R_g = 600\Omega$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		19	45	mA
Output Power	P_o	THD = 10%	2.0	2.5		W
		THD = 10%, $V_{CC} = 12\text{V}$		4.5		W
Total Harmonic Distortion	THD	$P_o = 1\text{W}$		0.2	1.0	%
Voltage Gain (Closed Loop)	A_v	$R_i = 82\Omega$, $V_o = 0.775\text{V}$	43	45	47	dB
		$R_i = 0\Omega$, $V_o = 0.775\text{V}$		56		dB
Input Resistance	R_i			30		$\text{K}\Omega$
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$, $\text{BW}(-3\text{dB}) = 20\text{Hz} \sim 20\text{KHz}$		0.3	1.0	mV
Ripple Rejection Ratio	RR	$R_g = 600\Omega$, $f = 120\text{Hz}$, $V_r = 300\text{mV}$		54		dB
Cross Talk	CT	$R_g = 10\text{K}\Omega$, $V_o = 0\text{dBm}$		60		dB
Input Offset Voltage	V_5, V_7			20	60	mV

TEST CIRCUIT

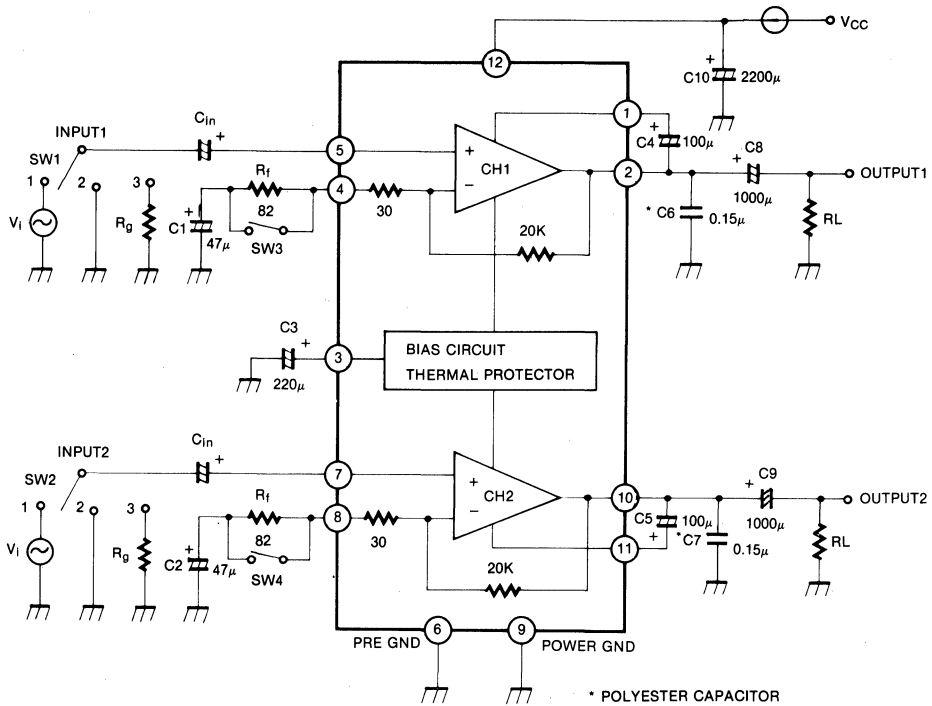
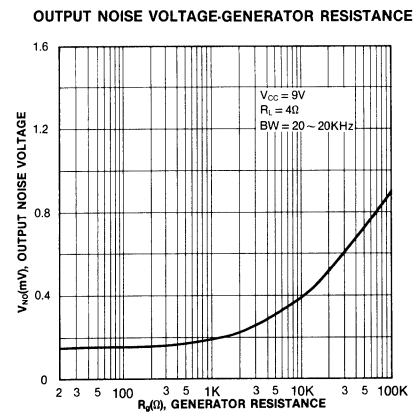
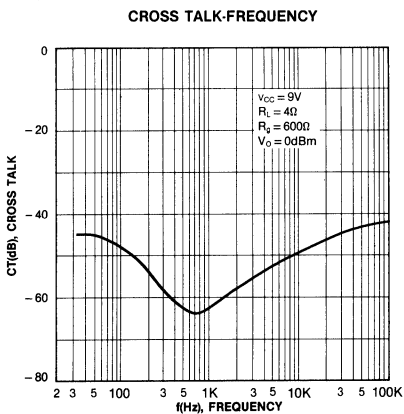
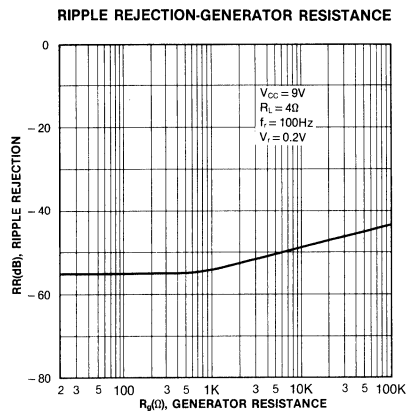
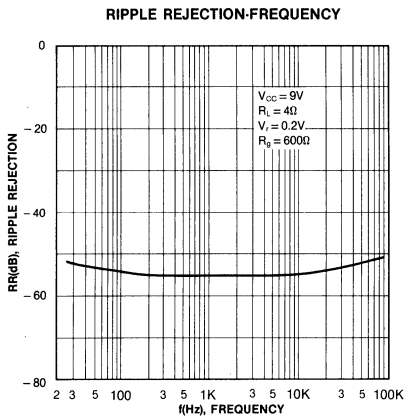
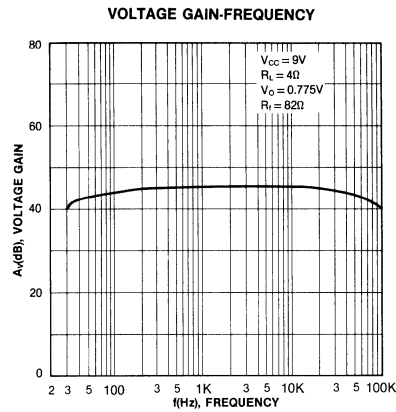
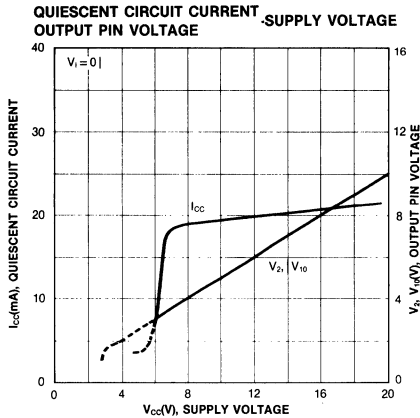
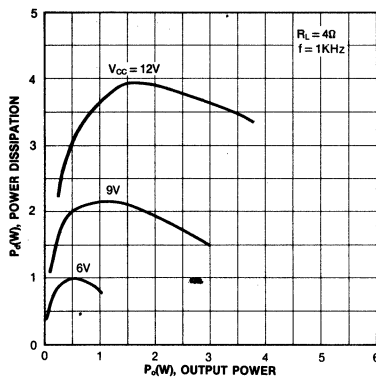


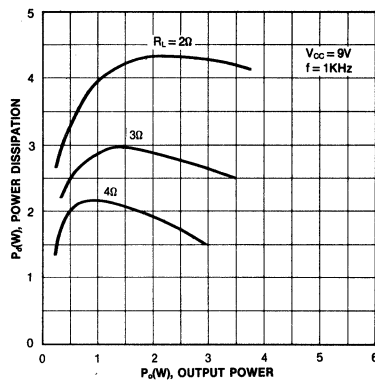
Fig. 2



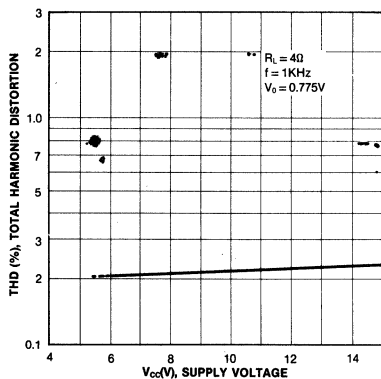
POWER DISSIPATION-OUTPUT POWER



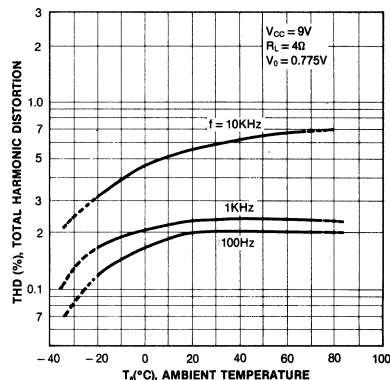
POWER DISSIPATION-OUTPUT POWER



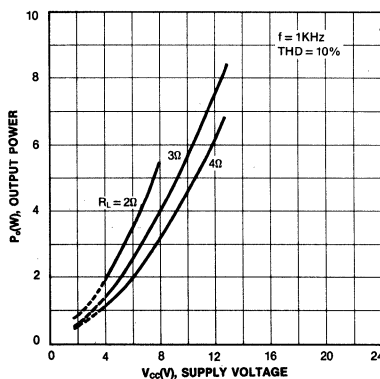
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE



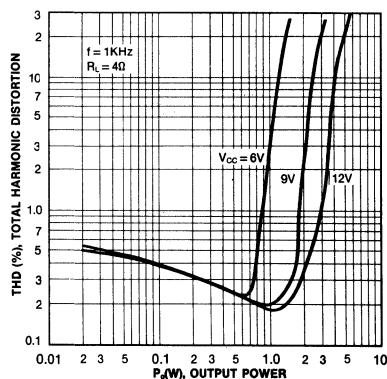
TOTAL HARMONIC DISTORTION-AMBIENT TEMPERATURE



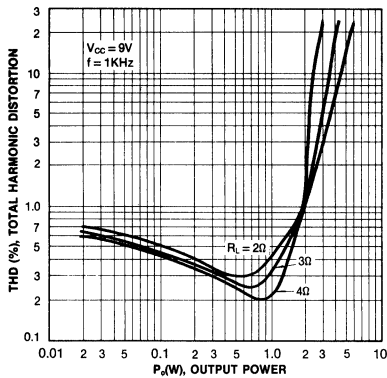
OUTPUT POWER-SUPPLY VOLTAGE



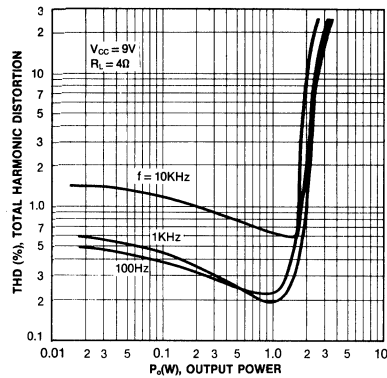
TOTAL HARMONIC DISTORTION-OUTPUT POWER



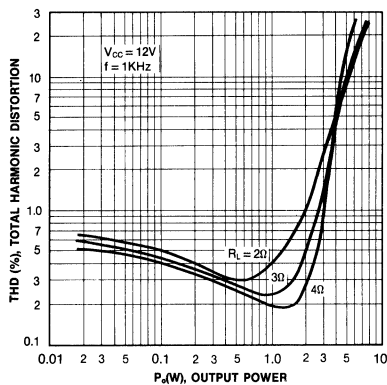
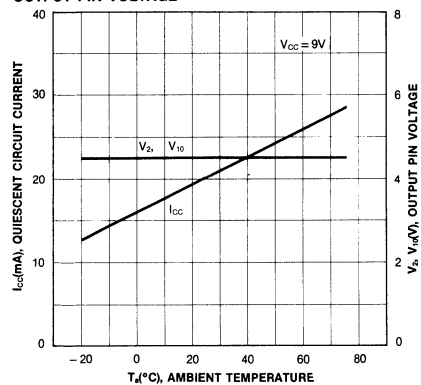
TOTAL HARMONIC DISTORTION-OUTPUT POWER



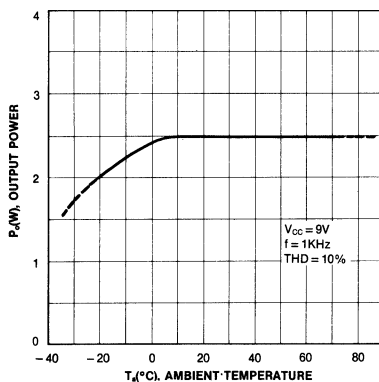
TOTAL HARMONIC DISTORTION-OUTPUT POWER



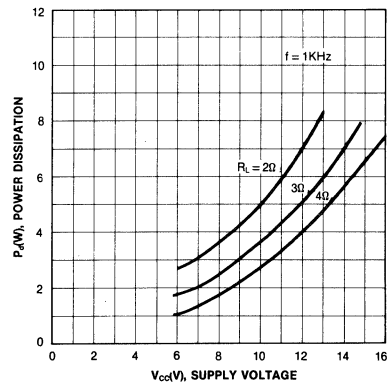
TOTAL HARMONIC DISTORTION-OUTPUT POWER

QUIESCENT CIRCUIT CURRENT - AMBIENT TEMPERATURE
OUTPUT PIN VOLTAGE

OUTPUT POWER-AMBIENT TEMPERATURE



POWER DISSIPATION-SUPPLY VOLTAGE



APPLICATION CIRCUIT

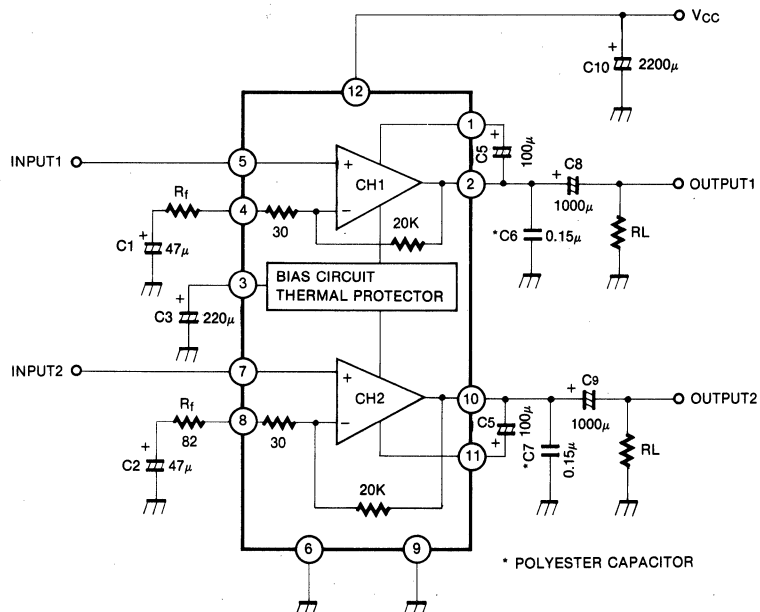


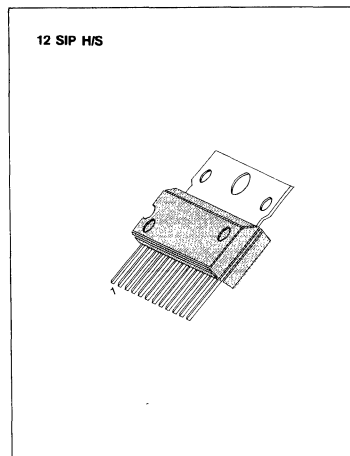
Fig. 3

4.5W DUAL POWER AMP

The KA22063 is a monolithic integrated circuit consisting of 2 channel power amplifier with power on/off (stand-by switch) function. It is suitable for the portable radio cassette recorder.

FEATURES

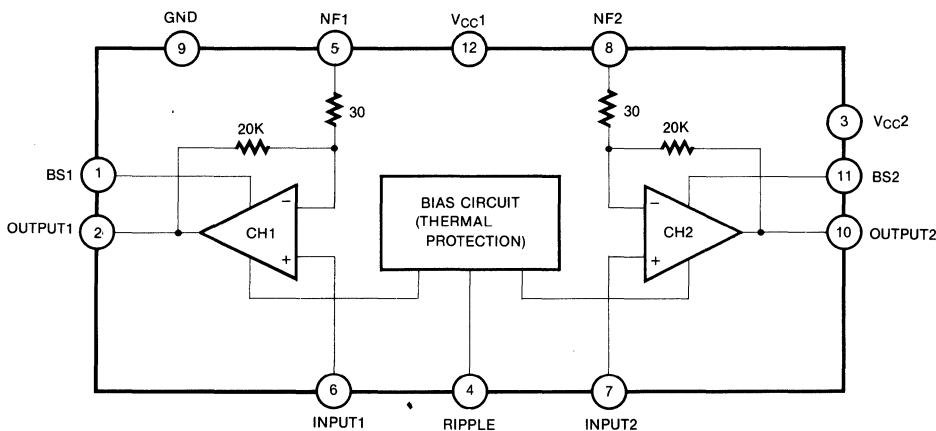
- **2 channel amplifier: 4.5W × 2 (typ.)**
- **Low quiescent circuit current: $I_{CC} = 16\text{mA}$ (typ.)**
- **High output**
- **Small pop noise at the power on**
- **Minimum external parts required**
- **Supply voltage: 6V to 15V**
- **Including the thermal protection circuit**



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22063S	12 SIP H/S	- 20 ~ + 70°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

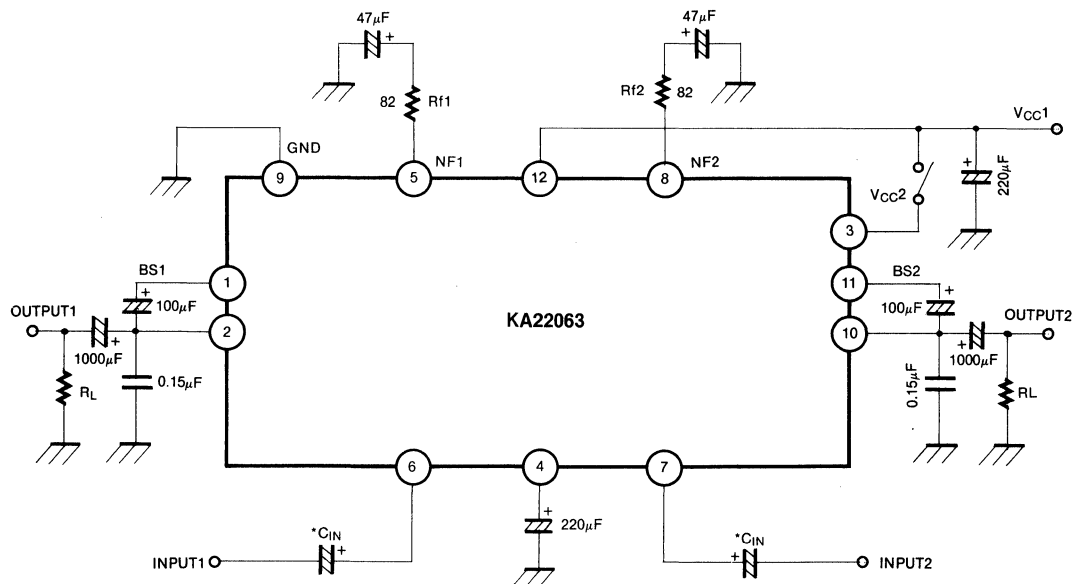
Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Output Current (Channel)	I_o (peak)	2.5	A
Power Dissipation	P_d	12.5	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTIC

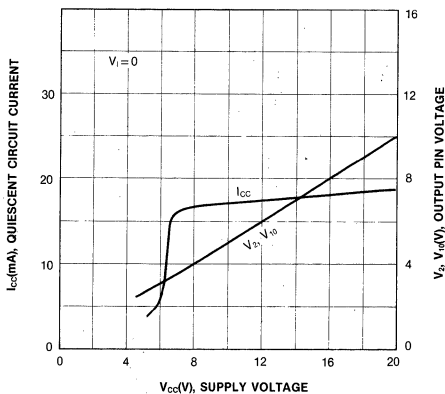
($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $R_L = 4\Omega$, $f = 1\text{KHz}$, $R_g = 600\Omega$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		16	28	mA
Output Power	P_{O1}	THD = 10%	2.0	2.5		W
	P_{O2}	THD = 10%, $V_{CC} = 12\text{V}$		4.5		W
Total Harmonic Distortion	THD	$P_o = 1\text{W/CH}$		0.2	1.0	%
Voltage Gain (Closed Loop)	AV_1	$R_f = 82\Omega$, $V_o = 0.775\text{V}$	43	45	47	dB
	AV_2	$R_f = 0\Omega$, $V_o = 0.775\text{V}$		56		dB
Input Resistance	R_i			30		$\text{K}\Omega$
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$, BW = 20Hz – 20KHz		0.3	1.0	mV
Ripple Rejection Ratio	R.R.R.	$R_g = 600\Omega$, $f = 120\text{Hz}$		54		dB
Cross Talk	C.T	$R_g = 10\text{K}\Omega$, $V_o = 0\text{dBm}$, $f = 1\text{KHz}$		45		dB
Input Offset Voltage	V_5, V_7			20	60	mV

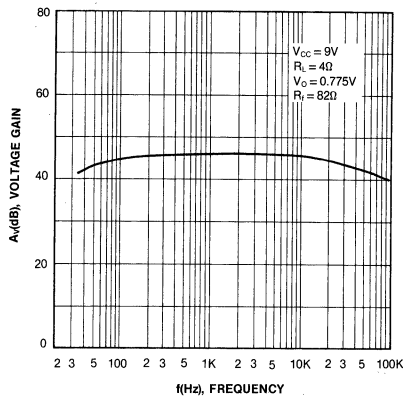
APPLICATION CIRCUIT



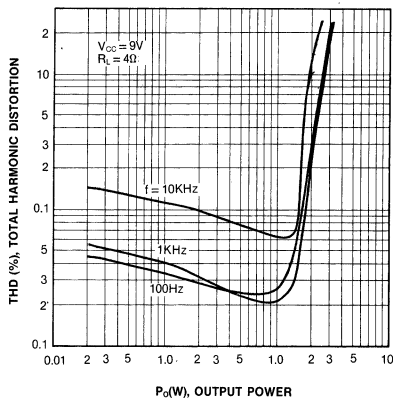
QUIESCENT CIRCUIT CURRENT
OUTPUT PIN VOLTAGE-SUPPLY VOLTAGE



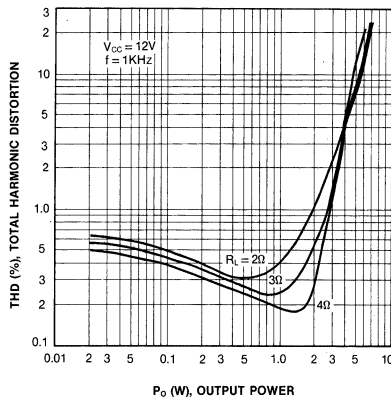
VOLTAGE GAIN-FREQUENCY



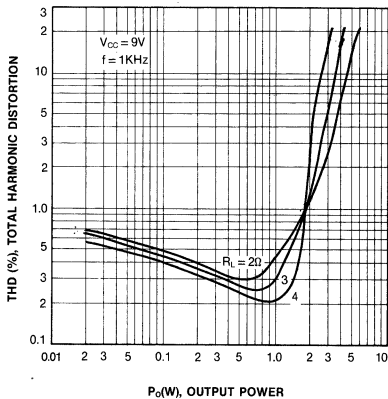
TOTAL HARMONIC DISTORTION-OUTPUT POWER



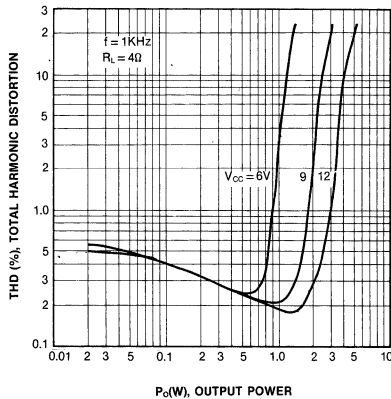
TOTAL HARMONIC DISTORTION-OUTPUT POWER



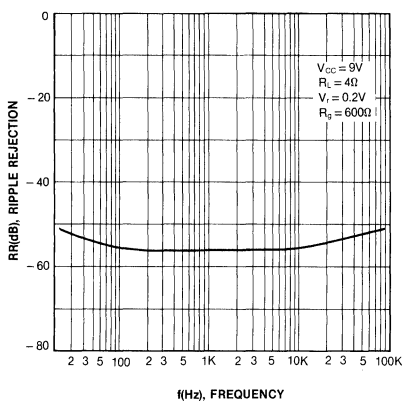
TOTAL HARMONIC DISTORTION-OUTPUT POWER



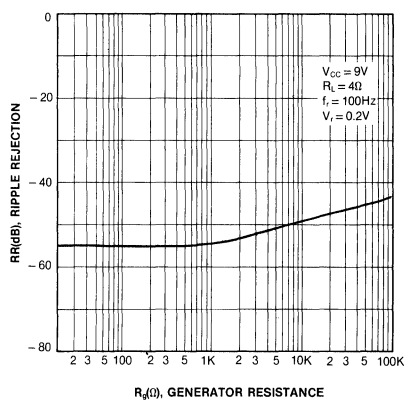
TOTAL HARMONIC DISTORTION-OUTPUT POWER



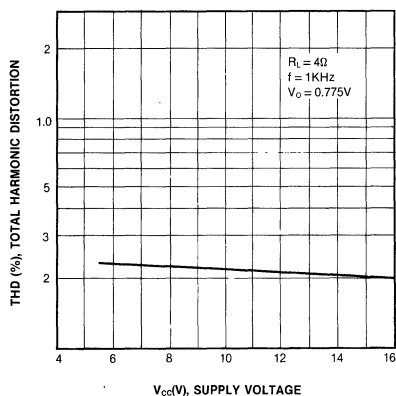
RIPPLE REJECTION-FREQUENCY



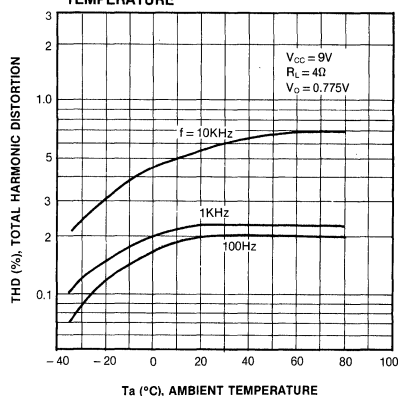
RIPPLE REJECTION-GENERATOR RESISTANCE



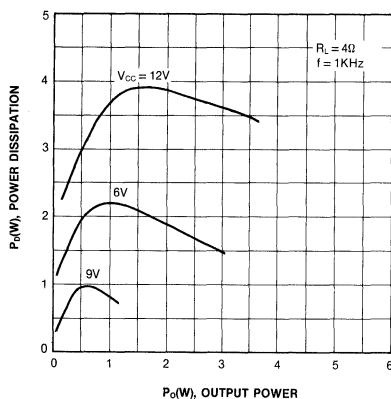
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE



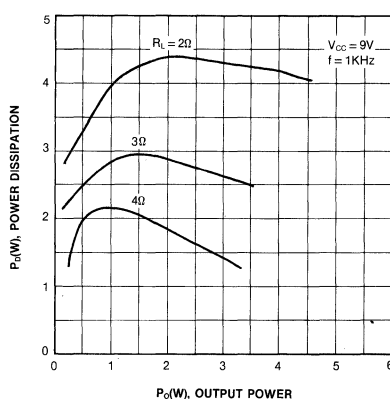
TOTAL HARMONIC DISTORTION-AMBIENT TEMPERATURE



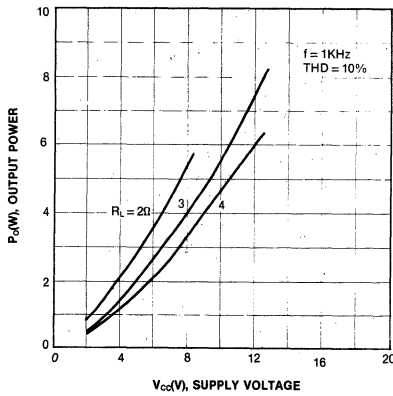
POWER DISSIPATION-OUTPUT POWER



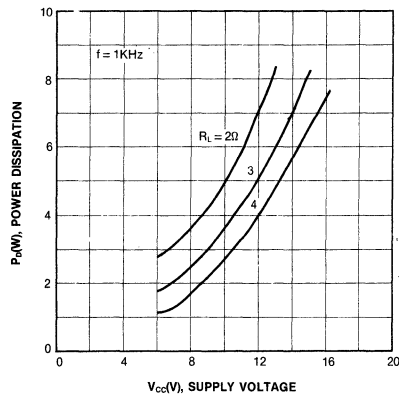
POWER DISSIPATION-OUTPUT POWER



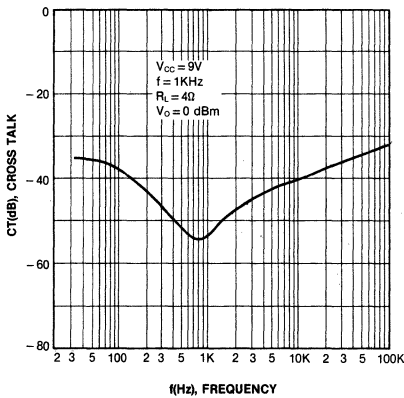
OUTPUT POWER-SUPPLY VOLTAGE



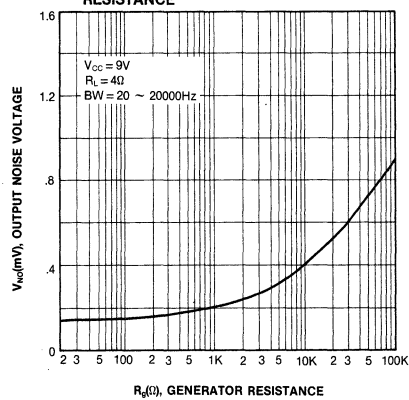
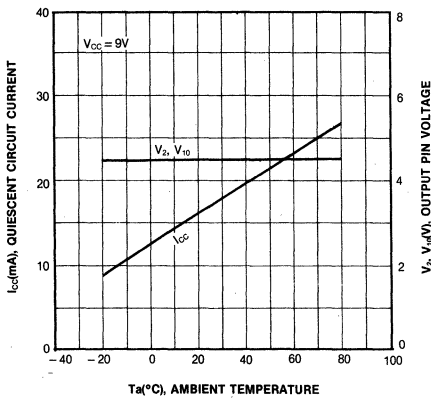
POWER DISSIPATION-SUPPLY VOLTAGE



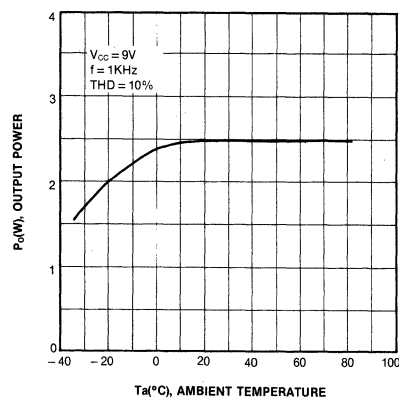
CROSS TALK-FREQUENCY



OUTPUT NOISE VOLTAGE-GENERATOR RESISTANCE

QUIESCENT CIRCUIT CURRENT
OUTPUT PIN VOLTAGE-AMBIENT TEMPERATURE

OUTPUT POWER-AMBIENT TEMPERATURE



DUAL LOW VOLTAGE POWER AMPLIFIER

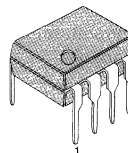
The KA2209 is a monolithic integrated audio amplifier in 8 pin plastic dual in line package. It is designed for portable cassette players and radios. radios.

FEATURES

- Wide operating supply voltage: $V_{CC}=1.8V \sim 9V$
- Low crossover distortion
- Low quiescent circuit current
- Bridge/stereo configuration

BLOCK DIAGRAM

8 DIP

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA2209	8 DIP	$-20 \sim +70^{\circ}\text{C}$

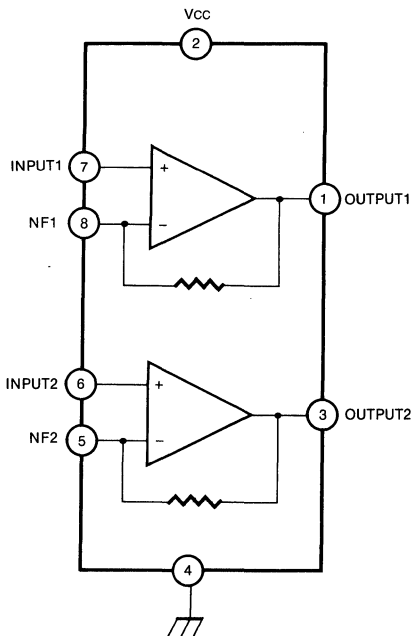


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Output Peak Current	$I_{O(\text{peak})}$	1	A
Power Dissipation	P_d	1	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(T_a = 25°C, V_{CC} = 6V, f = 1KHz, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Supply Voltage	V_{CC}		1.8		9	V
Quiescent Circuit Current	I_{CC}	$V_i = 0$		9		mA
Closed Loop Voltage Gain	A_v	Stereo		40		dB
		Bridge		40		dB
Channel Balance	CB	Stereo	-1	0	1	dB
Output Power	P_o	Stereo	$V_{CC} = 6V, R_L = 4\Omega, THD = 10\%$	0.4	0.65	W
			$V_{CC} = 3V, R_L = 4\Omega, THD = 10\%$	0.11		W
		Bridge	$V_{CC} = 6V, R_L = 8\Omega, THD = 10\%$	0.9	1.35	W
			$V_{CC} = 3V, R_L = 4\Omega, THD = 10\%$	0.35		W
Total Harmonic Distortion	THD	Stereo, $R_L = 8\Omega, P_o = 0.2W$		0.5		%
		Bridge, $R_L = 8\Omega, P_o = 0.5W$		0.5		%
Ripple Rejection	RR	Stereo, $f = 100\text{Hz}, C_3 = 100\mu\text{F}$	24	30		dB
Output Noise Voltage	V_{NO}	Stereo, $BW(-3\text{dB}) = 20\text{Hz} \sim 20\text{KHz}$		0.5	2.0	mV
Cross Talk	CT	Stereo, $f = 1\text{KHz}$		50		dB
Input Resistance	R_i		100			K Ω

TEST CIRCUIT 1: STEREO

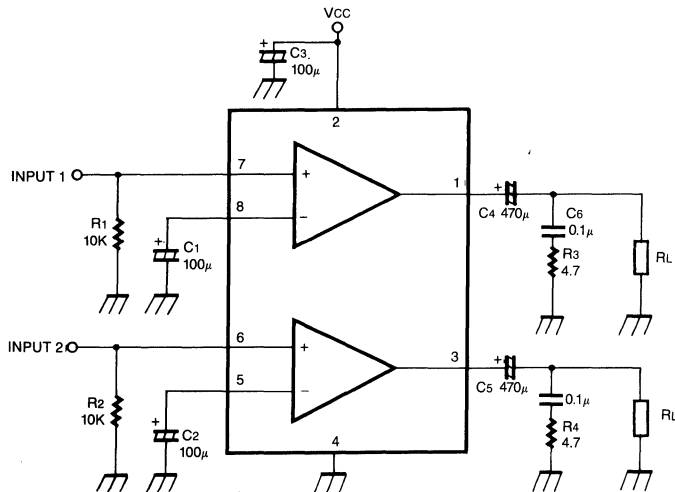


Fig. 2

TEST CIRCUIT 2: BRIDGE

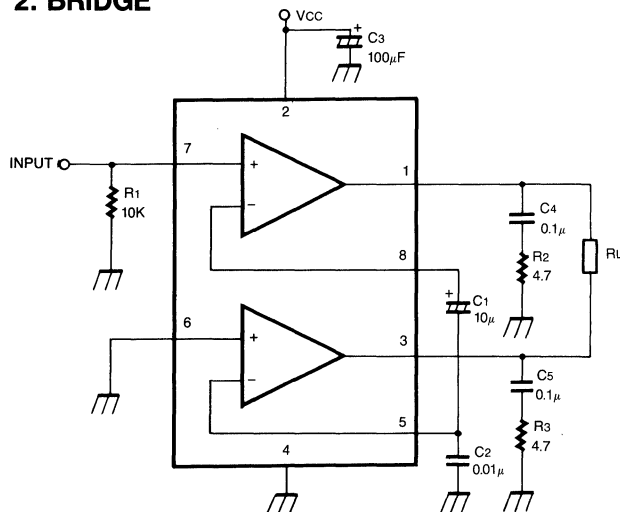


Fig. 3

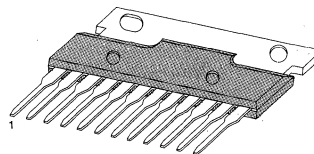
5.5W DUAL POWER AMPLIFIER

The KA2210 is a monolithic integrated circuit consisting of 2 channel power amplifier. It is suitable for stereo and bridge amplifier application of car stereo.

FEATURES

- 2 channel amplifier: 5.5W×2 (Typ).
- Minimum number of external parts required.
- Small shock noise at the time of power on/off and good starting balance.
- High ripple rejection ratio: 46dB (Typ).
- Good channel separation.
- Small residual noise. ($R_g=0$)
- Included various kind of protectors;
Thermal protector.
Surge and over-voltage protector.
 V_{CC} and output short protector.

12 SIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2210	12 SIP H/S	- 20 ~ + 70°C
KA2210G	PELLET	

BLOCK DIAGRAM

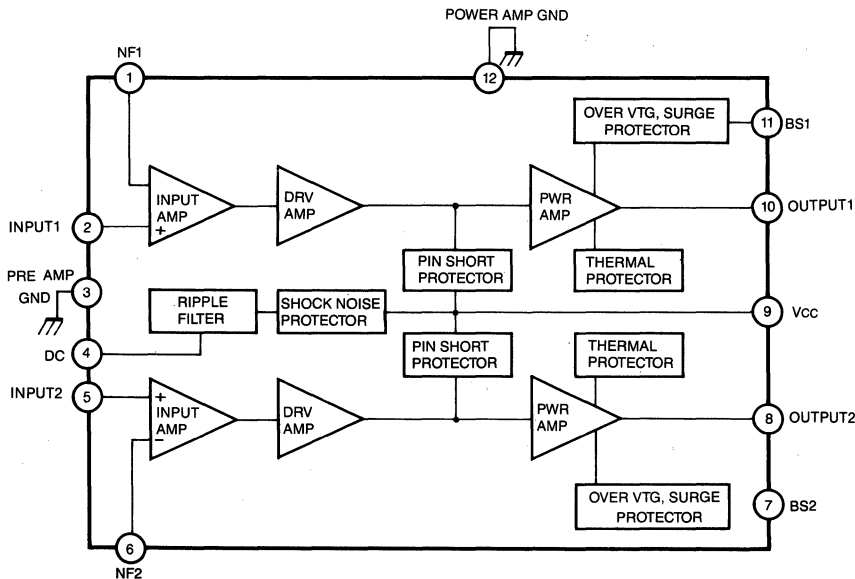


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

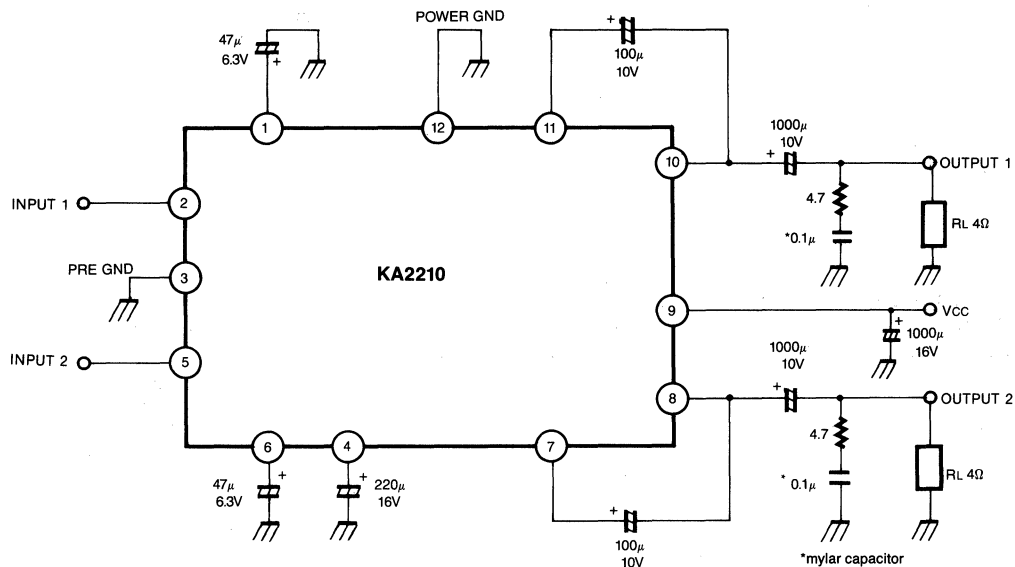
Characteristic	Symbol	Value	Unit
Maximum Supply Voltage (Quiescent)	V_{CC} (max 1)	25	V
Maximum Supply Voltage (with Signal)	V_{CC} (max 2)	18	V
Surge Voltage ($t \leq 0.2$ sec)	V_{CC} (Surge)	50	V
Maximum Output Current (1 Channel)	I_o (peak)	3.5	A
Power Dissipation	P_d (max)	15	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

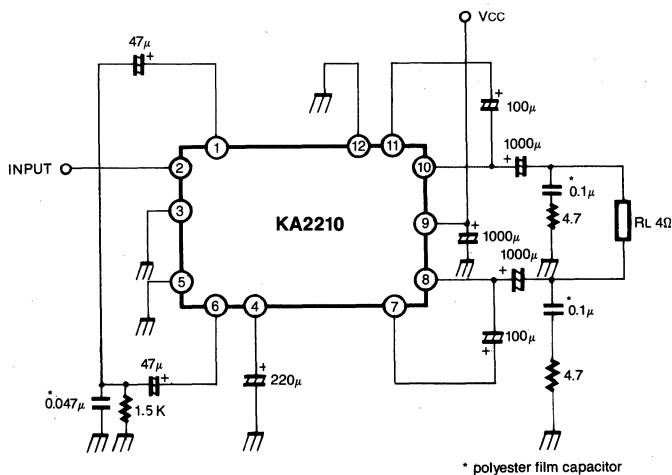
($T_a = 25^\circ\text{C}$, $V_{CC} = 13.2\text{V}$, $R_L = 4\Omega$, $f = 1\text{KHz}$, $R_g = 600\Omega$, $100 \times 100 \times 1.5\text{mm}^3$ AI H/S, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Supply Voltage	V_{CC}		10	13.2	16	V
Quiescent Circuit Current	I_{CC}	$V_i = 0$		75	150	mA
Output Power	P_o	THD = 10%, Stereo	5.0	5.5		W
Voltage Gain	A_v	$P_o = 1\text{W}$	49.5	51.5	53.5	dB
Total Harmonic Distortion	THD	$P_o = 1\text{W}$		0.15	1.0	%
Input Resistance	R_i			30		$\text{K}\Omega$
Output Noise Voltage	V_{No}	$R_g = 0$, BW(- 3dB) = 20Hz ~ 20KHz		0.6	1.0	mV
		$R_g = 10\text{K}\Omega$, BW(- 3dB) = 20Hz ~ 20KHz		1.0	2.0	mV
Ripple Rejection Ratio	RR	$R_g = 0$, $V_r = 200\text{mV}$, $f = 100\text{Hz}$		46		dB
Channel Separation	Sep	$R_g = 10\text{K}\Omega$, $V_o = 0\text{dBm}$	45	55		dB

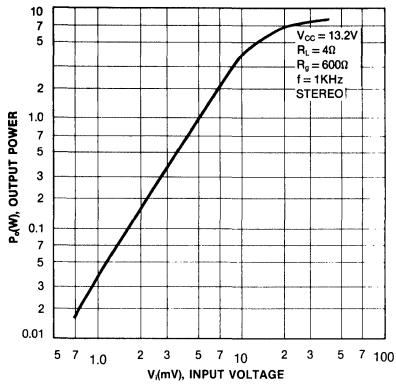
TYPICAL APPLICATION CIRCUIT: STEREO



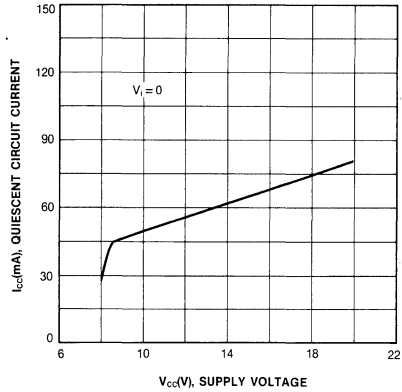
APPLICATION CIRCUIT: BRIDGE



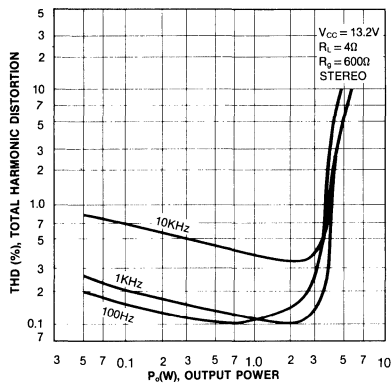
OUTPUT POWER-INPUT VOLTAGE



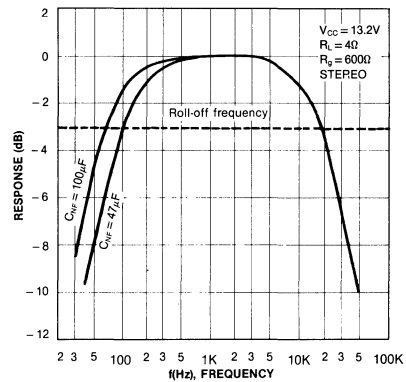
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



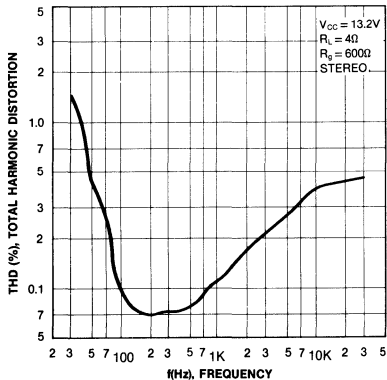
TOTAL HARMONIC DISTORTION-OUTPUT POWER



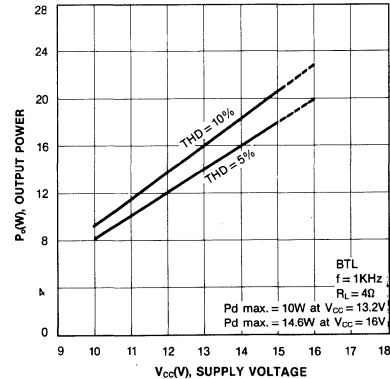
FREQUENCY RESPONSE



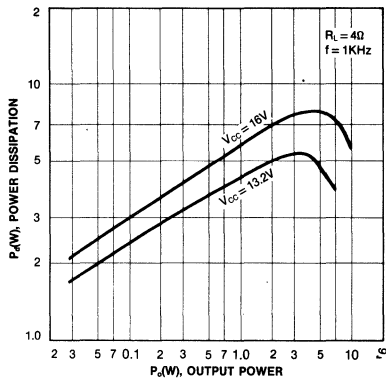
TOTAL HARMONIC DISTORTION-FREQUENCY



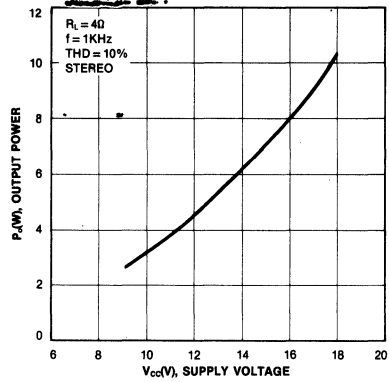
OUTPUT POWER-SUPPLY VOLTAGE



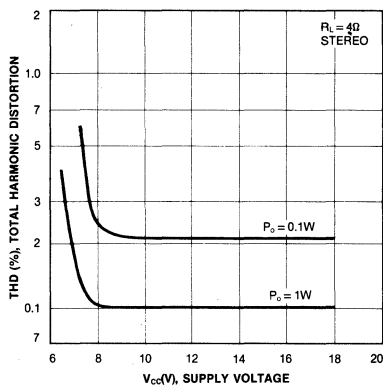
POWER DISSIPATION-OUTPUT POWER



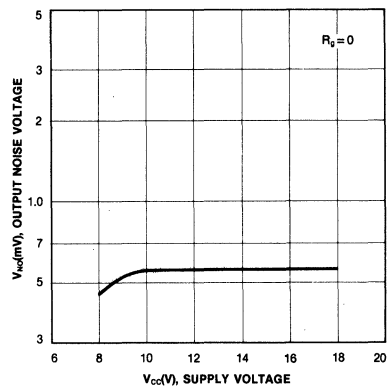
OUTPUT POWER-SUPPLY VOLTAGE



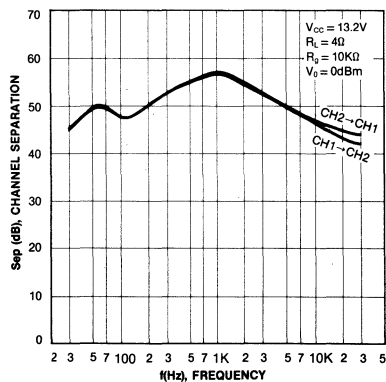
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE



OUTPUT NOISE VOLTAGE-SUPPLY VOLTAGE



CHANNEL SEPARATION-FREQUENCY



23W POWER AMPLIFIER

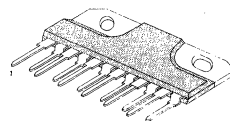
The KA22101 is a 23W power amplifier suitable for car audio and it can be used in bridge applications. It is designed for high power, low distortion and low noise, according to a tendency to Hi-Fi mode of car Audio.

And this device includes various kinds of protection circuit for car.

FEATURES

- **High Power**
 $P_{O1} = 23W$ (Typ) at $V_{CC} = 13.2V$, $R_L = 4\Omega$, THD = 10%, $f = 1KHz$
 $P_{O2} = 26W$ (Typ) at $V_{CC} = 13.2V$, $R_L = 3.2\Omega$, THD = 10%, $f = 1KHz$
- **Wide Output Range**
 $P_{O3} = 18W$ (Typ) at $V_{CC} = 13.2V$, $R_L = 4\Omega$, THD = 1%, $f = 50Hz \sim 20KHz$
- **Low Distortion**
 THD = 0.015% (Typ) at $V_{CC} = 13.2V$, $f = 1KHz$, $P_O = 4W$, $R_L = 4\Omega$
- **Include various kinds of protection circuit**
 : Temperature, Overvoltage, Output pin to V_{CC} short, Output pin to GND short, Load short protection.
- **Wide Operating Voltage:** $V_{CC} = 9V \sim 18V$

12 ZIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22101	12 ZIP H/S	-20 ~ +70°C

BLOCK DIAGRAM

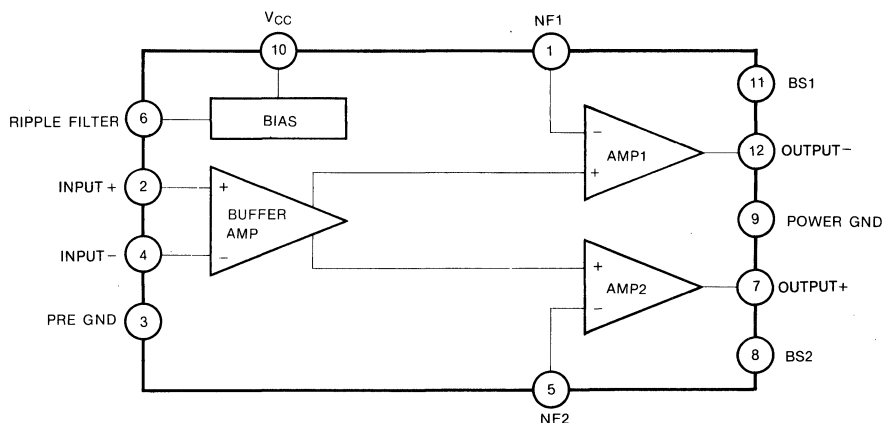


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Condition	Value	Unit
Surge Voltage	V_{CC} (surge)	$t = 0.2 \text{ sec}$	50	V
Maximum Supply Voltage	V_{CC} (max. 1)	$V_i = 0$	25	V
Maximum Supply Voltage	V_{CC} (max. 2)	with signal	18	V
Maximum Output Current	I_o (peak)		9	A
Power Dissipation	P_d		25	W
Operating Temperature	T_{opr}		$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}		$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 13.2\text{V}$, $R_L = 4\Omega$, $R_g = 600\Omega$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		120	200	mA
Output Power	P_{O1}	THD = 10%	20	23		W
	P_{O2}	THD = 10%, $R_L = 3.2\Omega$	22	26		W
	P_{O3}	THD = 1%, $f = 50\text{Hz} \sim 20\text{KHz}$	15	18		W
Total Harmonic Distortion	THD	$P_o = 4\text{W}$		0.015	0.1	%
Voltage Gain	A_v	$V_i = -50\text{dBm}$	39.5	41	42.5	dB
Output Noise Voltage	V_{NO1}	$R_g = 0$, DIN45405 (Noise Filter)		0.25		mV
	V_{NO2}	$R_g = 10\text{K}\Omega$, BW = 20Hz $\sim$ 20KHz		0.35	0.9	mV
Ripple Rejection Ratio	RR	$f = 100\text{Hz}$, $V_r = 0\text{dBm}$	40	47		dB

TEST AND APPLICATION CIRCUIT

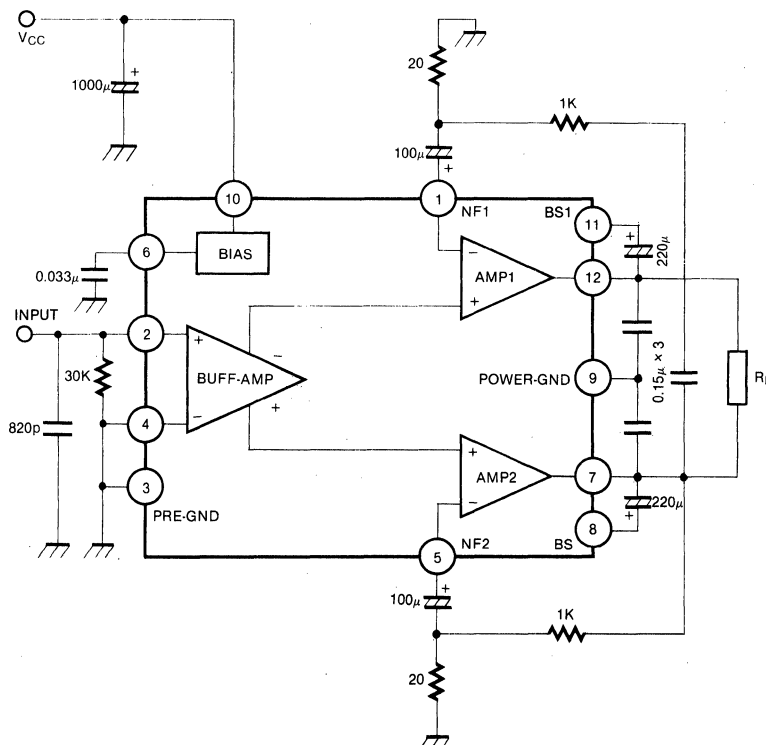


Fig. 2

PIN DC VOLTAGE

(Typical value in the test circuit, $V_{CC} = 13.2V$, $T_a = 25^\circ C$)

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
DC Voltage (V)	1.95	0.01	GND	0	1.95	6.6	6.6	12.5	GND	V_{CC}	12.5	6.6

PRECAUTIONS AND APPLICATION METHODS

1. VOLTAGE GAIN CONTROL

When feedback resistor R_{f1} couples with the external parts, as the temperature characteristic is better than being in the internal of I.C. and KA22101 obtains stabilized gain.

If $R_o \gg R_{f1} > R_{f2}$, voltage gain (A_v) is

$$A_v = 20 \log \frac{R_{f1}}{R_{f2}} + 6 \text{ (dB)} \quad (R_o \cong 20K\Omega)$$

Because the pin 12 is a center voltage level of output and the current I is supplied with R_{f1} and R_{f2} , it is recommend that R_{f1} and R_{f2} are not to use too small value.

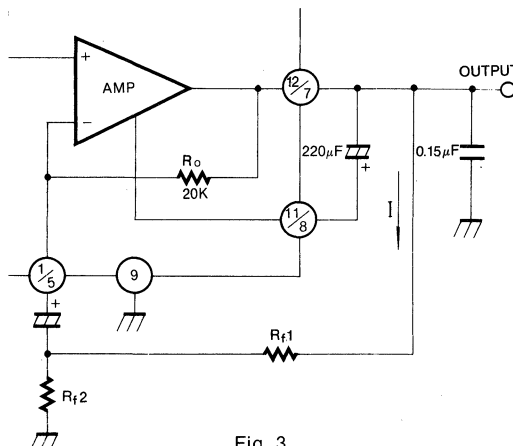


Fig. 3

2. OSCILLATION SUPPRESS

For using a capacitor for getting rid of oscillation between output and GND or another output, in order to reduce the temperature influence (especially when uses the ceramic capacitor), polyester film capacitor is recommended. Also, the value of this capacitor must not exceed the recommended value and oscillation margin range (temperature assurance range) should be confirmed through a temperature test.

Especially when IC is used with the Low Voltage Gain and with the amount of feed back increased, so the phase inverses at high frequency range and the oscillation is liable to be produced, the value, type and mounting position of capacitor must be considered before using it within above $A_v = 40\text{dB}$.

3. ASO CIRCUIT

The IC contains protection circuits of output- V_{CC} fault, output-GND fault and output-output fault.

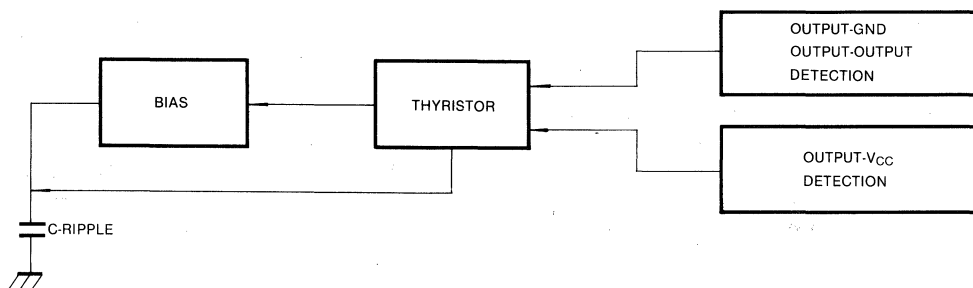


Fig. 4

4. RIPPLE REJECTION

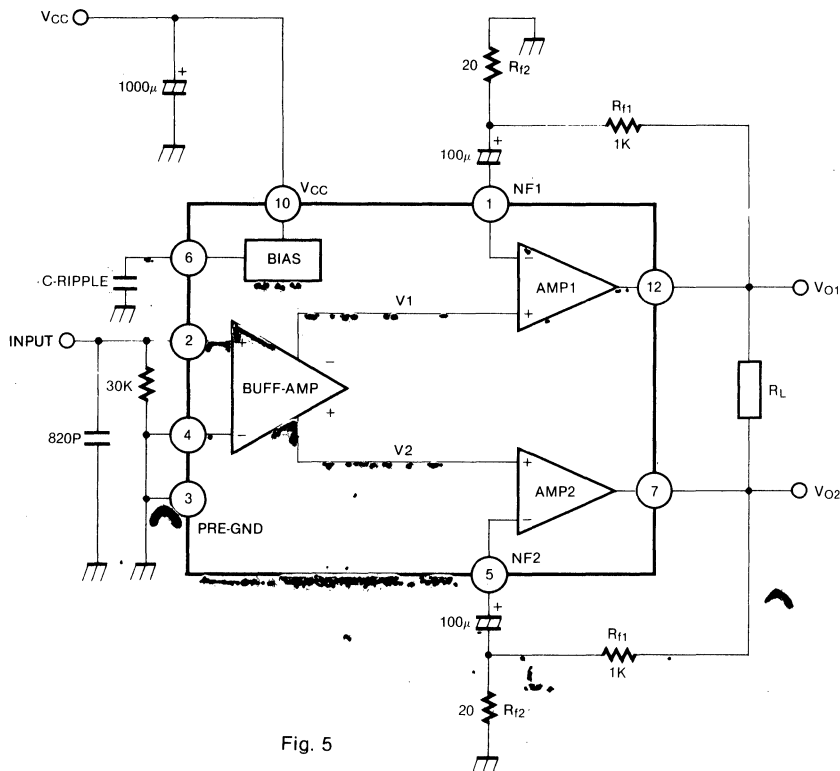


Fig. 5

When the value of ripple capacitor is small, following influence are expected.

- (1) If Cripple is small (recommended value = $0.033\mu F$), such ripple figure is produced as the output of gain 1 through the phase inversion Amp of the primary stage.

This becomes input signal V_1 & V_2 at power Amp stage.

- (2) V_1 and V_2 are amplified to V_1 and V_2 at power stage and $|V_{O1} - V_{O2}|$ appears as output ripple voltage when BTL is operated.

The characteristics of ripple rejection is determined by

1. gain dispersion of power stage CH1 and CH2

2. the dispersion between the external feedback resistance (R_{f1} , R_{f2} , R_{f1} , R_{f2}) and the internal resistance.

So, as the pair characteristics (CH1, CH2) of external feedback resistance control the ripple characteristics, it must be used highly precise resistance which has the pair characteristics.

5. CAPACITY OF RIPPLE FILTER

The protector ON/OFF time constant of KA22101 is determined by the capacity of pin 6 (ripple filter).

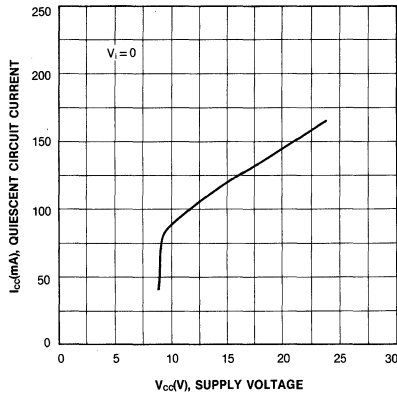
If the capacity of ripple capacitor increases, ripple rejection improves but it appears the risk of the two problems.

1. Sound interruption at over-input.

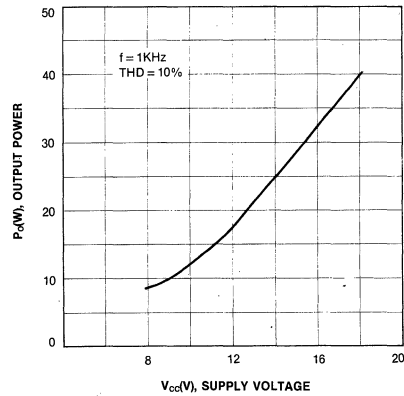
2. Reduction in the protector strength for the short of output- V_{CC} , output-GND, output-output.

So ripple capacity of $0.033\mu F$ is recommended.

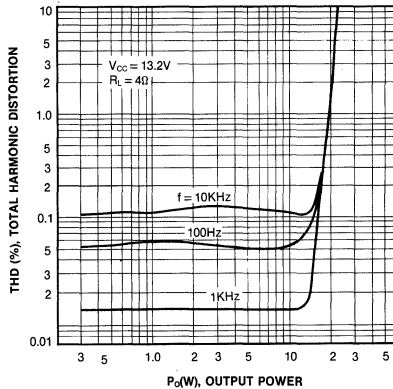
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



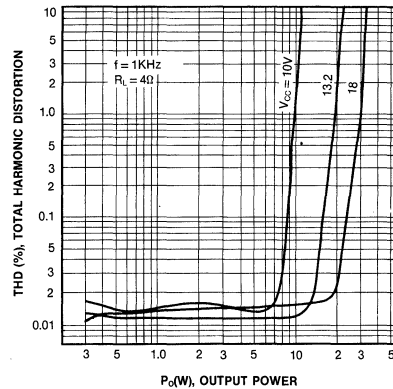
OUTPUT POWER-SUPPLY VOLTAGE



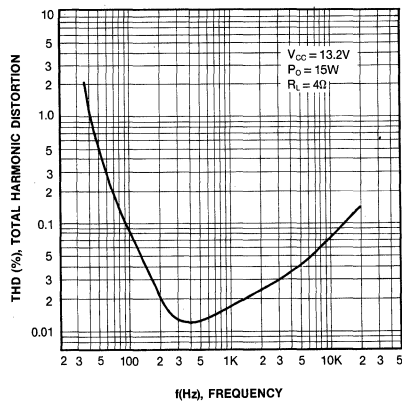
TOTAL HARMONIC DISTORTION-OUTPUT POWER



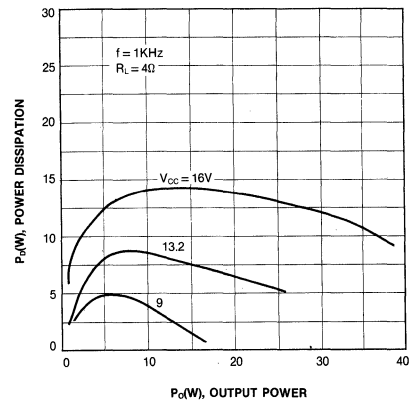
TOTAL HARMONIC DISTORTION-OUTPUT POWER



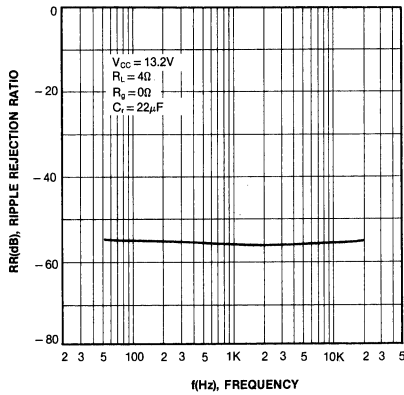
TOTAL HARMONIC DISTORTION-FREQUENCY



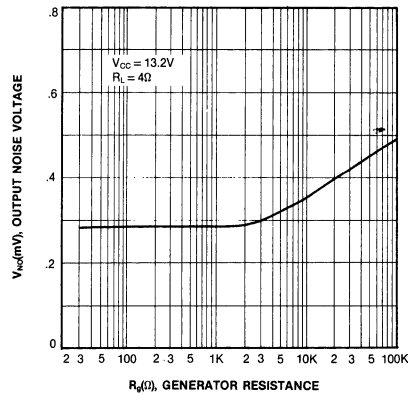
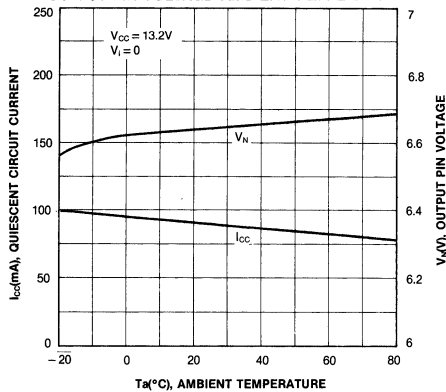
POWER DISSIPATION-OUTPUT POWER



RIPPLE REJECTION RATIO-FREQUENCY



OUTPUT NOISE VOLTAGE-GENERATOR RESISTANCE

QUIESCENT CIRCUIT CURRENT
OUTPUT PIN VOLTAGE-AMBIENT TEMPERATURE

5.8W DUAL POWER AMPLIFIER

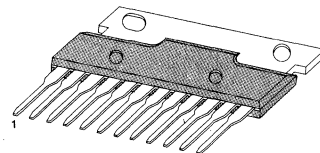
The KA2211 is a dual audio power amplifier for consumer application. It is designed for high power, low dissipation and low noise.

It also contains various kind of protectors. It is suitable for car-audio power amplifier with high performance.

FEATURES

- Operating supply voltage range: $V_{CC}=10V \sim 18V$
- High power (Dual)
 $P_o = 5.8W$ (Typ) at $V_{CC} = 13.2V$, $R_L = 4\Omega$, $THD = 10\%$
- Low distortion (Dual)
 $THD = 0.06\%$ (Typ) at $V_{CC} = 13.2V$, $R_L = 4\Omega$, $P_o = 1W$, $A_v = 52dB$
- Low noise (Dual)
 $V_{NO} = 0.7mV$ (Typ) at $V_{CC} = 13.2V$, $R_L = 4\Omega$, $R_o = 10K\Omega$,
 $A_v = 52dB$, $BW(-3dB) = 20Hz \sim 20KHz$
- Protector; Thermal shut down
 Over voltage protection
 DC short protection

12 SIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2211	12 SIP H/S	$-20 \sim +70^{\circ}C$

BLOCK DIAGRAM

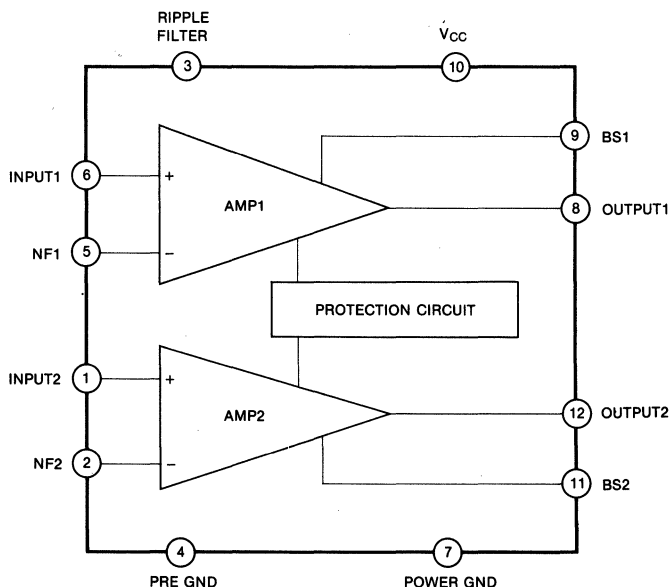


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Condition	Value	Unit
Surge Voltage	V_{CC} (surge)	$t = 0.2 \text{ sec}$	45	V
Maximum Supply Voltage	V_{CC} (max 1)	$V_i = 0$	25	V
Maximum Supply Voltage	V_{CC} (max 2)	with signal	18	V
Maximum Output Current	I_o (peak)		3.5	A
Power Dissipation	P_d		15	W
Operating Temperature	T_{opr}		$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}		$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 13.2\text{V}$, $R_L = 4\Omega$, $R_g = 600\Omega$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		80	145	mA
Output Power	P_o	THD = 10%	5	5.8		W
Total Harmonic Distortion	THD	$P_o = 1\text{W}$		0.06	0.3	%
Voltage Gain	A_v	$V_o = 0\text{dBm}$	50	52	54	dB
Channel Balance	CB	$V_o = 0\text{dBm}$	-1	0	1	dB
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$, BW(-3dB) = 20Hz ~ 20KHz		0.7	1.5	mV
Ripple Rejection Ratio	RR	$f = 120\text{Hz}$, $V_r = 0\text{dBm}$	40	52		dB
Cross Talk	CT	$V_o = 0\text{dBm}$		57		dB
Input Resistance	R_i	$f = 1\text{KHz}$		33		K Ω

TEST AND APPLICATION CIRCUIT

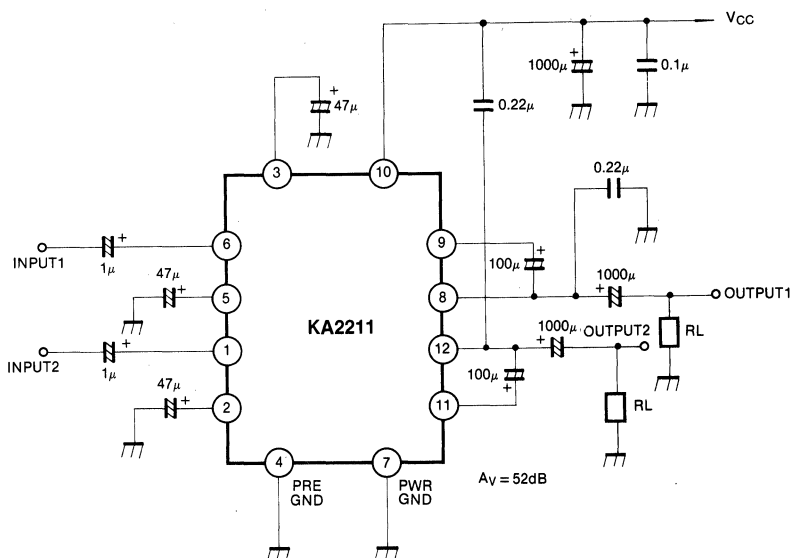
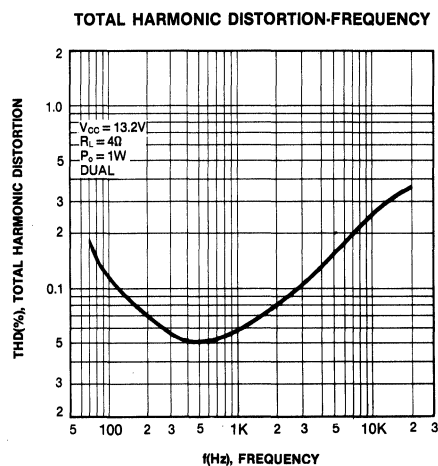
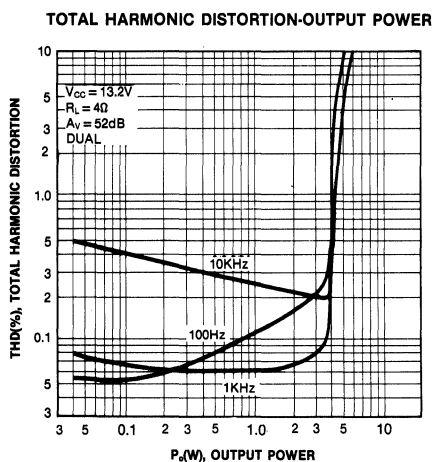
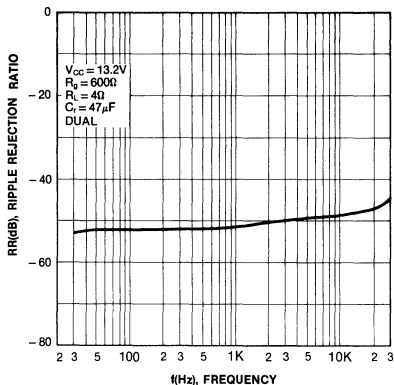


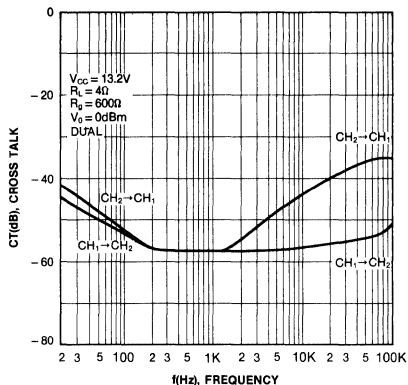
Fig. 2



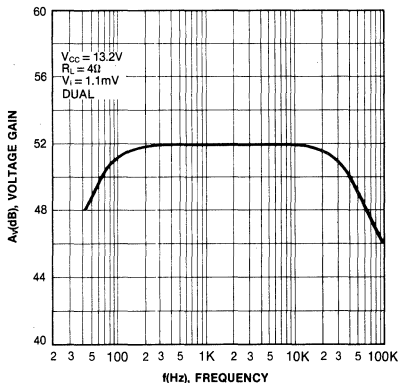
RIPPLE REJECTION RATIO-FREQUENCY



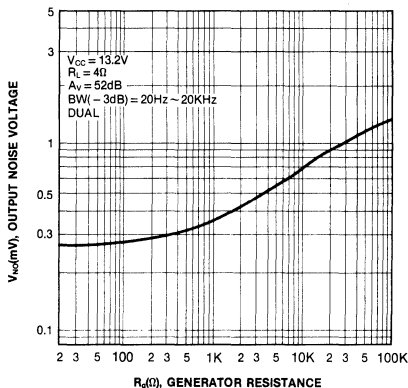
CROSS TALK-FREQUENCY



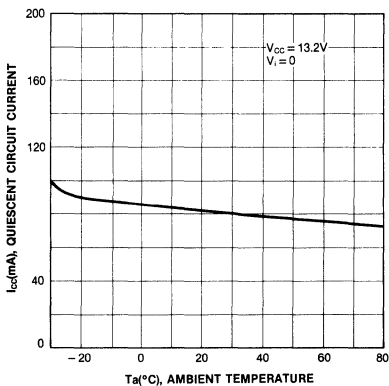
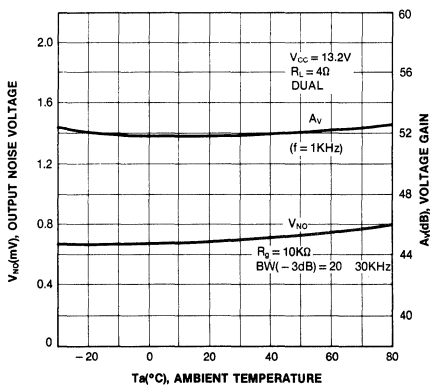
VOLTAGE GAIN-FREQUENCY



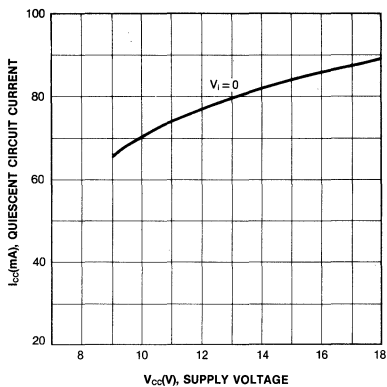
OUTPUT NOISE VOLTAGE-GENERATOR RESISTANCE



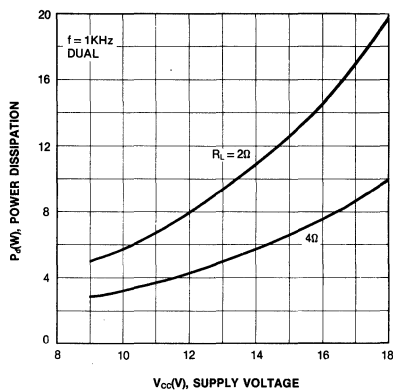
QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE

OUTPUT NOISE VOLTAGE-AMBIENT TEMPERATURE
VOLTAGE GAIN

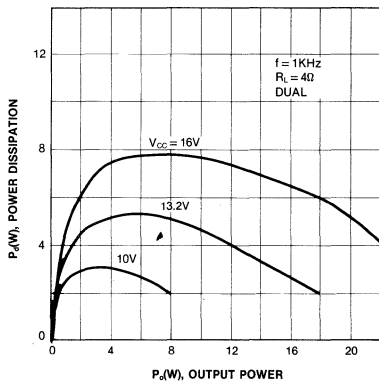
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



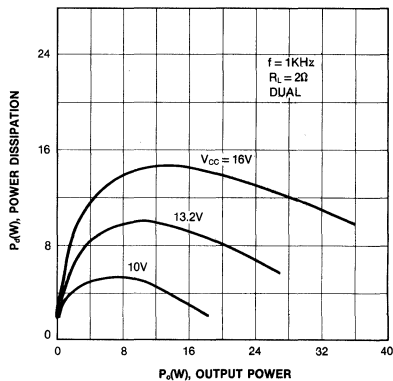
POWER DISSIPATION-SUPPLY VOLTAGE



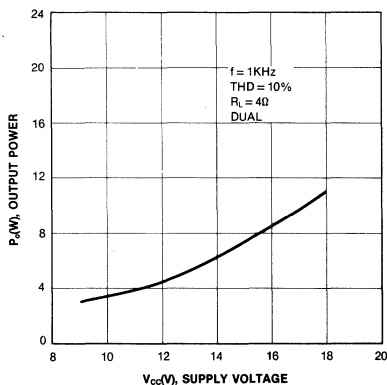
POWER DISSIPATION-OUTPUT POWER



POWER DISSIPATION-OUTPUT POWER



OUTPUT POWER-SUPPLY VOLTAGE



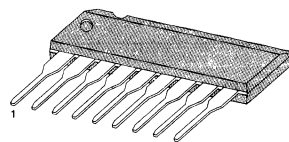
0.5W AUDIO POWER AMPLIFIER

The KA2212 is a monolithic integrated audio power amplifier in 9 pin plastic single in line package, designed for audio frequency class B amplifier.

FEATURES

- Suitable for portable radio, cassette tape recorder.
- Medium output power.
 $P_O = 0.5W$ (Typ) at $V_{CC} = 6V$, $R_L = 8\Omega$, $THD = 10\%$.
- Wide operating supply voltage range (3.5V ~ 12V).
- Low quiescent circuit current.
- Excellent thermal stability.

9 SIP



SCHEMATIC DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2212	9 SIP	- 20 ~ + 70°C

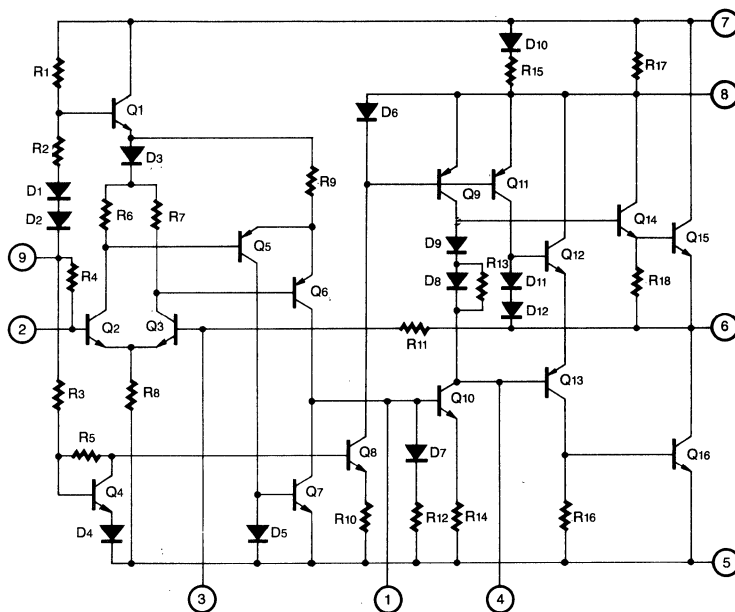


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	14	V
Power Dissipation	P_d	750	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$, $R_L = 8\Omega$, $R_g = 600\Omega$, $R_f = 68\Omega$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		14		mA
Voltage Gain (Open Loop)	A_{VO}	$R_f = 0\Omega$	60	75		dB
Voltage Gain (Closed Loop)	A_V	$R_f = 68\Omega$	47	50	52	dB
Output Power	P_O	THD = 10%	0.45	0.5		W
Total Harmonic Distortion	THD	$P_O = 100\text{mW}$		0.3	1.0	%
Input Resistance	R_i			15		$\text{K}\Omega$
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$ BW (-3dB) = 50Hz ~ 20KHz		0.4	1.0	mV

TEST CIRCUIT

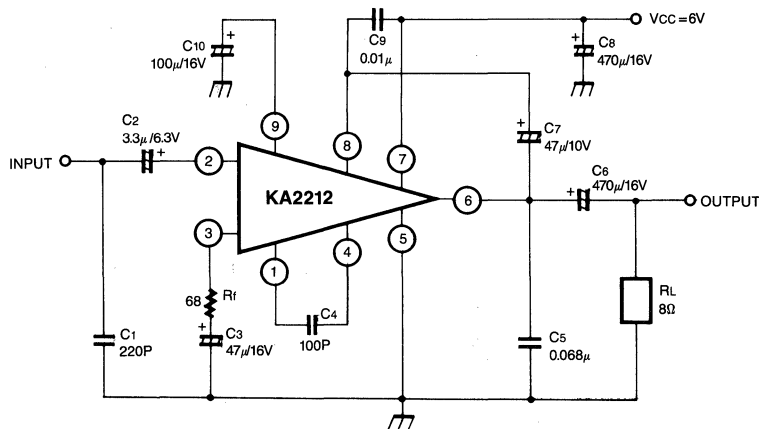
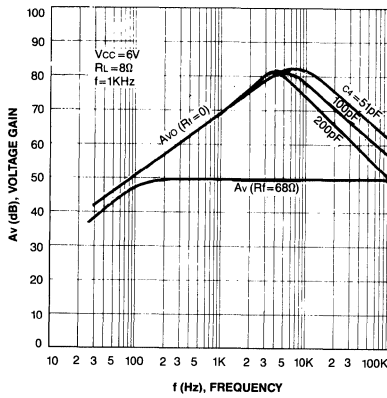
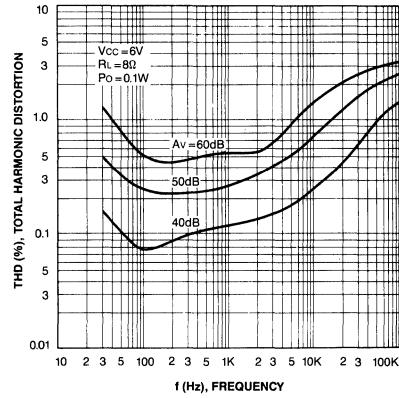


Fig. 2

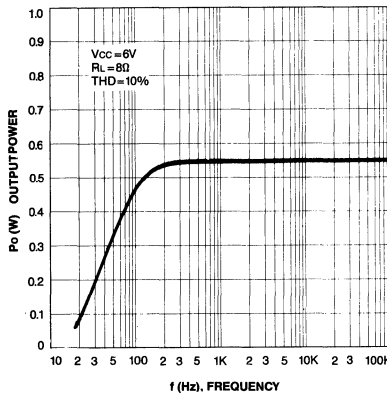
VOLTAGE GAIN-FREQUENCY



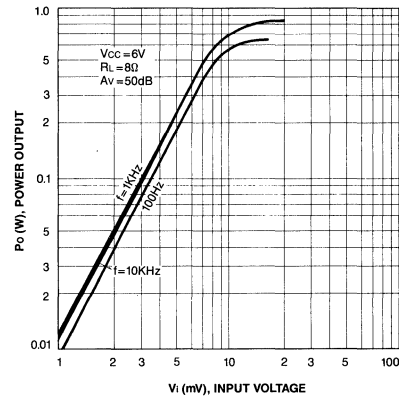
TOTAL HARMONIC DISTORTION-FREQUENCY



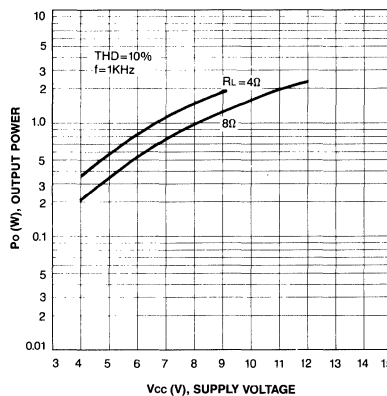
OUTPUT POWER-FREQUENCY



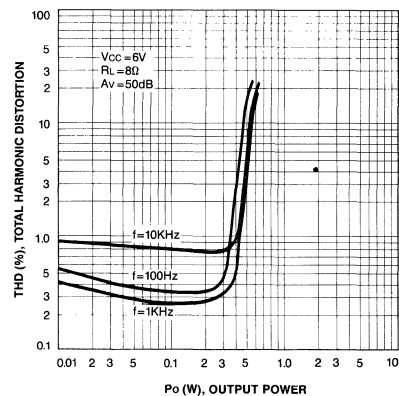
OUTPUT POWER-INPUT VOLTAGE



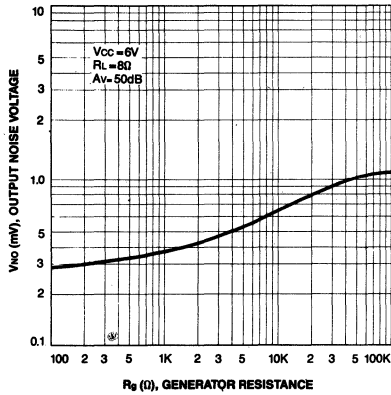
OUTPUT POWER-SUPPLY VOLTAGE



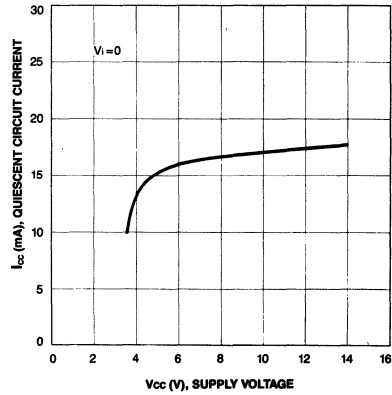
TOTAL HARMONIC DISTORTION-OUTPUT POWER



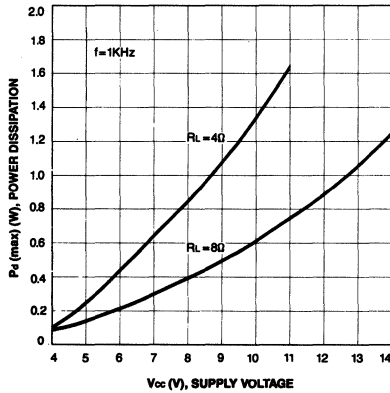
OUTPUT NOISE VOLTAGE-GENERATOR RESISTANCE



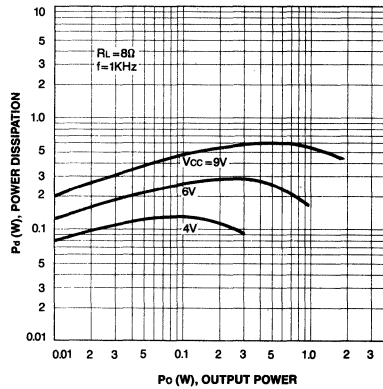
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



POWER DISSIPATION-SUPPLY VOLTAGE



POWER DISSIPATION-OUTPUT POWER



External Components (Refer to test circuit)

C₁: Noise filter

C₂: Input coupling capacitor

The recommended value for this capacitor is 3.3μF.

If made too small, low frequency characteristic is a change for the worse. Too large a capacitance value will increase rise time when power is applied and may generate noise due to the charging current when the volume control is adjusted.

R_f, C₃: Feedback components

The variation of closed loop gain is depending on this component which are determined as follows.

$$C_3 = \frac{1}{2\pi f_L \cdot R_f} \quad A_v = 20 \log \frac{20000}{R_f} \text{ (dB)}$$

Where f_L: low cut-off frequency

A_v: closed loop gain

C₄: Compensation capacitor

The high cut-off frequency is determined by C₄, which contributes to suppress the oscillation at the higher frequency range.

C₅, C₉: Oscillation suppression capacitors

The mylar capacitor is be used for C₅ to get a better characteristic for temperature and the frequency.

C₆: Output coupling capacitor

It decides output power level of low frequency.

C₇: Bootstrap capacitor

In case of low value reduced rated output power and increased distortion at low frequency.

C₈: Ripple filter for power supply

The large value is required to get an excellent ripple characteristic under the line operation but the small one can be used with the battery.

C₁₀: Filter capacitor

Rejects power line hum.

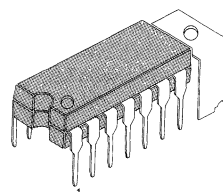
ONE CHIP TAPE RECORDER SYSTEM

The KA2213 is a monolithic integrated circuit consisting of preamplifier, ALC circuit, power amplifier in 14 pin plastic dual in line package with heat sink.

FEATURES

- Suitable for play and recording mono cassette tape recorder.
- Wide operating supply voltage range (4V ~ 12V).
- High gain preamplifier and power amplifier.
- Output power of power amplifier state
 $P_O = 1W$ at $V_{CC} = 6V$, $R_L = 4\Omega$, THD = 10%.
- Soft tone quality at the time of output saturation.
- Wide ALC range and small variation in output voltage.
- Small shock noise at the time of power on/off due to built-in prevention circuit.
- Variable monitor capability due to recording amplifier consisting of preamplifier alone.
- Minimum number of external parts required.

14 DIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2213	14 DIP H/S	- 20 ~ + 70°C
KA2213G	PELLET	

BLOCK DIAGRAM

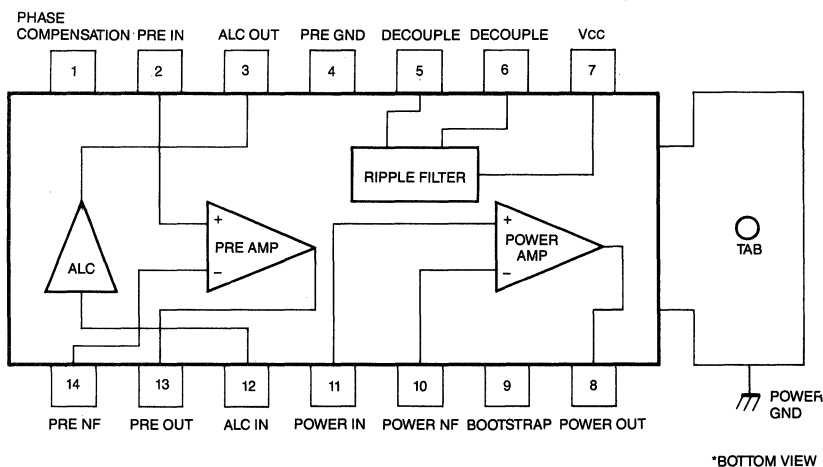


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	13	V
Power Dissipation	P_d	1.2 2.25*	W W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

* Mounted and soldered on a 50mm × 50mm copper foil of PCB

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I _{CC}	V _{CC} = 6V, V _i = 0		18	30	mA
		V _{CC} = 9V, V _i = 0		23	40	mA
Pre-amplifier						
Voltage Gain (Open Loop)	A _{VO}	Open loop		85		dB
Voltage Gain (Closed Loop)	A _V	Closed loop, Play		40		dB
Output Voltage	V _O	THD=1%, Play	0.9	1.2		V
Input Resistance	R _i		21	30		KΩ
Equivalent Input Noise Voltage	V _{NI}	Play		1.0	2.0	μV
ALC Input Level	ALC	THD=1%, Play	− 20	− 12		dBm
Power Amplifier						
Voltage Gain (Closed Loop)	A _V	R _f = 51Ω	43	45	47	dB
Output Power	P _O	V _{CC} = 6V, R _L = 4Ω, THD = 10%	0.7	1.0		W
		V _{CC} = 7.5V, R _L = 4Ω, THD = 10%	1.0	1.5		W
		V _{CC} = 9V, R _L = 4Ω, THD = 10%	1.7	2.2		W
Total Harmonic Distortion	THD	P _O = 250mW		0.3	1.5	%
Input Resistance	R _i			30		KΩ
Output Noise Voltage	V _{NO}	R _g = 10KΩ		0.6	1.8	mV
Ripple Rejection	RR	R _g = 0Ω, V _r = 150mV, f = 100Hz	40	45		dB

TEST CIRCUIT

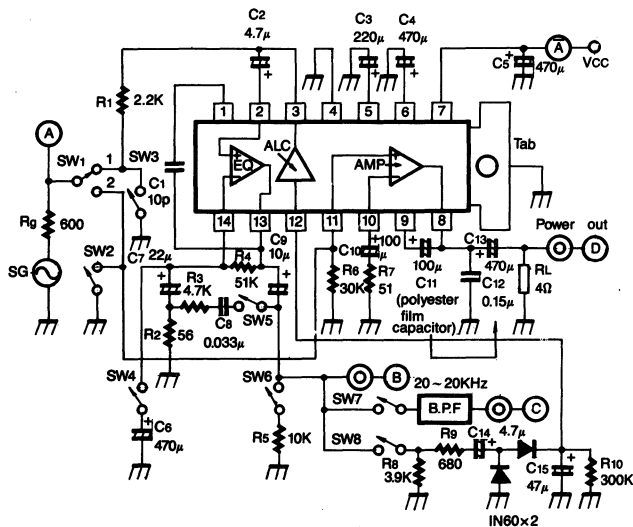


Fig. 2

TEST CONDITION

Characteristic		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	Test Point	Test Method
Power Amplifier	I _{CC}		on	on	off	on	on	off	off		Test circuit current
	A _V	2	off	off	off	on	on	off	off	A.D	A _V =20 log V _O /V _i (dB)
	P _O	2	off	off	off	on	on	off	off	D	Test output voltage at THD = 10%
	THD	2	off	off	off	on	on	off	off	D	Test THD at output voltage V _O = 1V
	V _{NO}		on	off	off	on	on	off	off	D	Test output noise voltage
	RR		on	off	off	on	on	off	off	D	RR = 20 log V _r /150 (dB) Test output ripple voltage (V _r)
Pre-amplifier	A _{VO}	1	off	off	on	off	on	off	off	A.B	A _{VO} =20 log V _O /V _i (dB)
	V _O	1	off	off	off	on	on	off	off	B	Test output voltage at THD = 1%
	V _{NI}		off	on	off	on	on	on	off	C	Convert output noise voltage at R ₀ =2.2KΩ, V _{NI} =V _{NO} /A _V
	ALC Input level	1	off	off	off	off	off	off	on	A.B	Test input voltage at THD = 1%

TYPICAL APPLICATION CIRCUITS

1. Mono cassette tape recorder

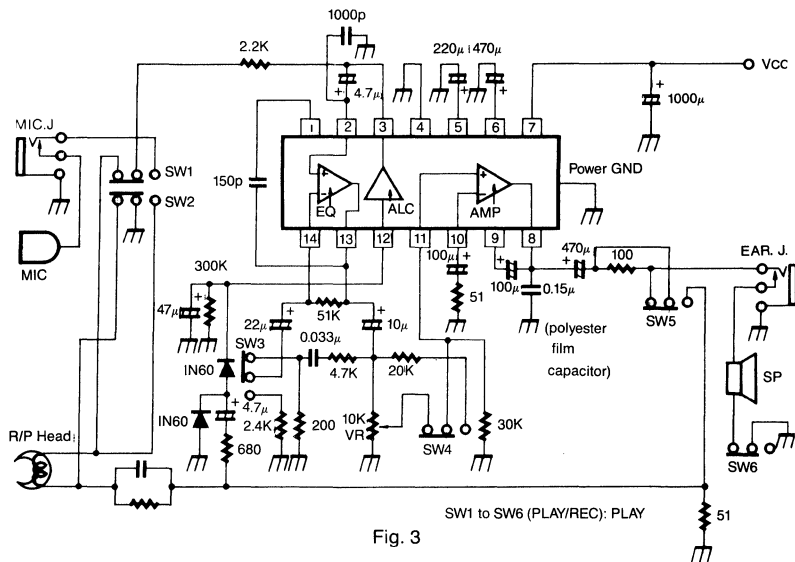


Fig. 3

2. Radio cassette tape recorder

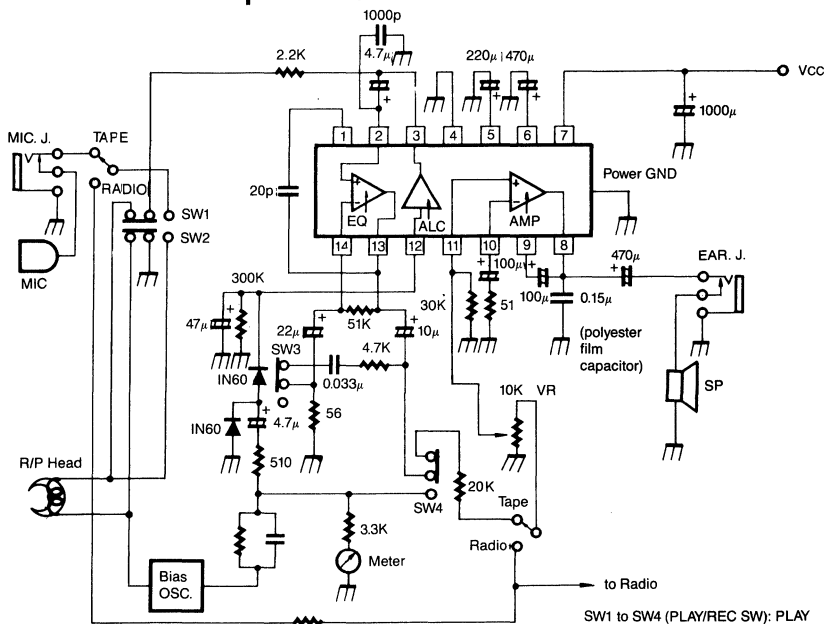
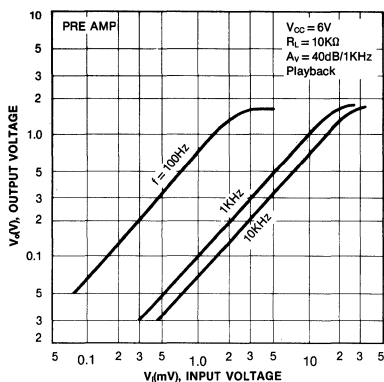
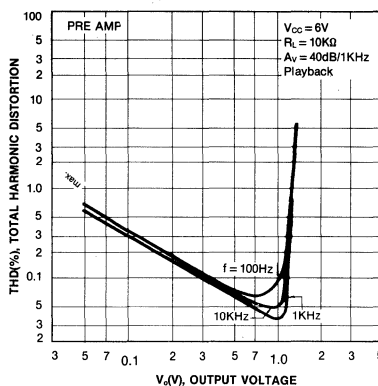


Fig. 4

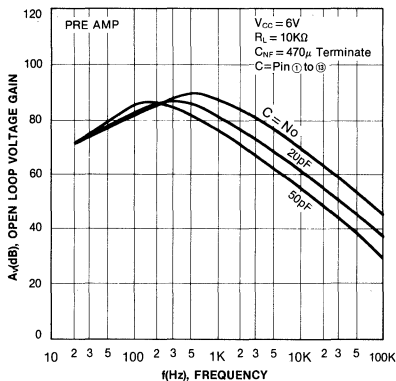
OUTPUT VOLTAGE-INPUT VOLTAGE



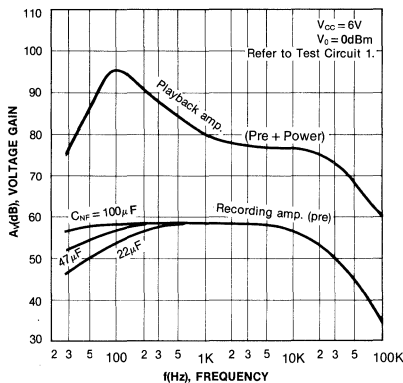
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



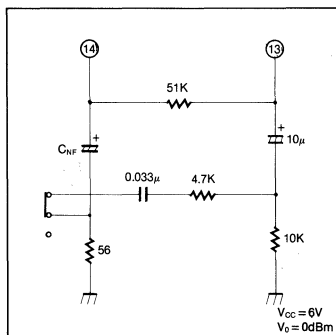
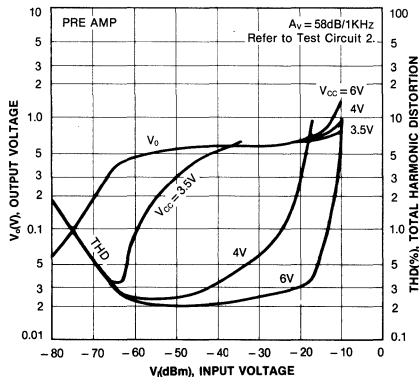
OPEN LOOP VOLTAGE GAIN-FREQUENCY



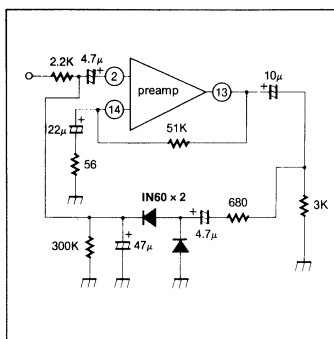
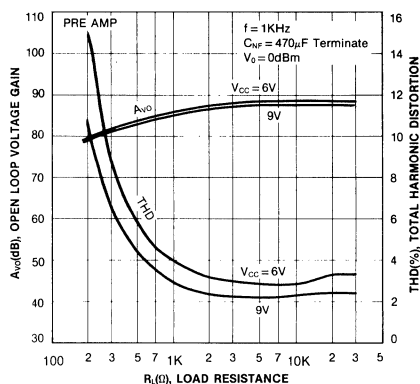
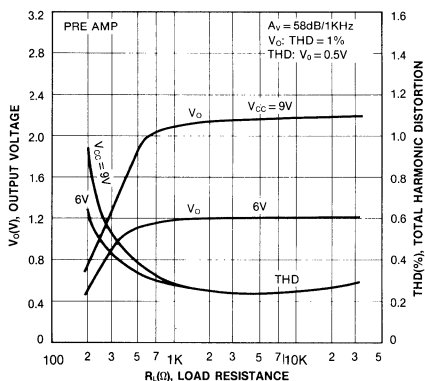
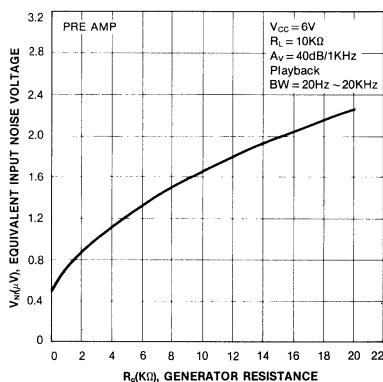
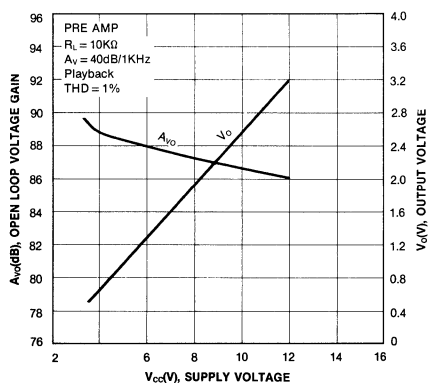
VOLTAGE GAIN-FREQUENCY



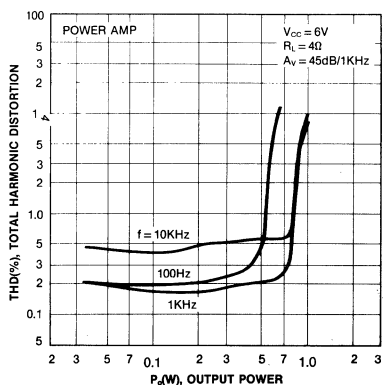
TEST CIRCUIT 1

OUTPUT VOLTAGE
TOTAL HARMONIC DISTORTION

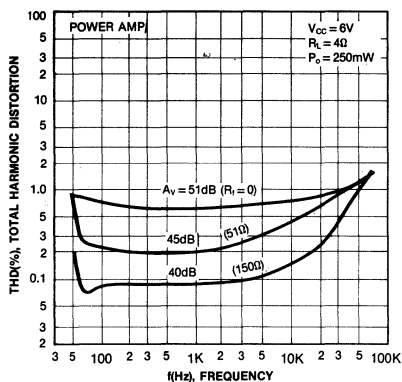
TEST CIRCUIT 2

VOLTAGE GAIN
TOTAL HARMONIC DISTORTION-LOAD RESISTANCEOUTPUT VOLTAGE
TOTAL HARMONIC DISTORTION-LOAD RESISTANCEEQUIVALENT INPUT
NOISE VOLTAGE-GENERATOR RESISTANCEOPEN LOOP VOLTAGE GAIN
OUTPUT VOLTAGE-SUPPLY VOLTAGE

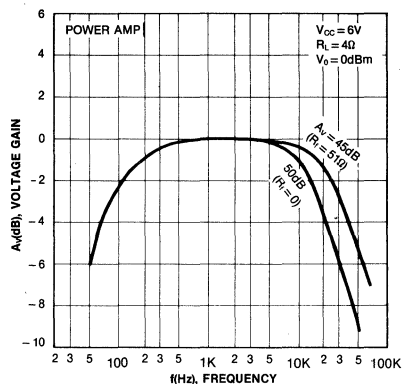
TOTAL HARMONIC DISTORTION-OUTPUT POWER



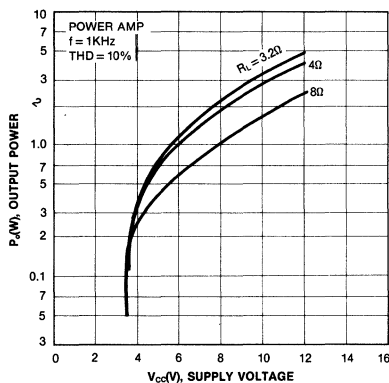
TOTAL HARMONIC DISTORTION-FREQUENCY



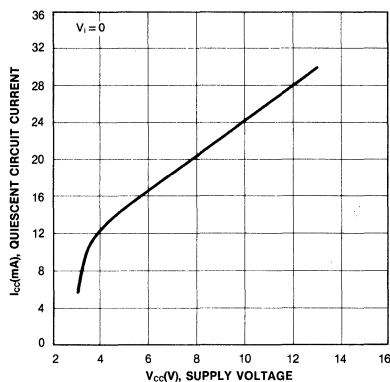
VOLTAGE GAIN-FREQUENCY



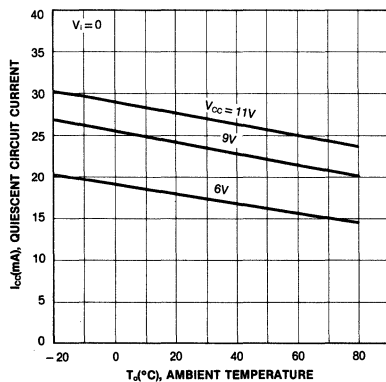
OUTPUT POWER-SUPPLY VOLTAGE



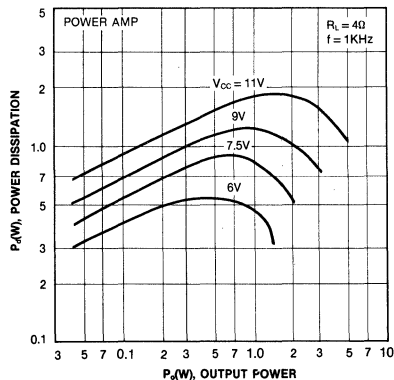
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE



POWER DISSIPATION-OUTPUT POWER



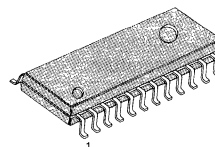
DUAL PRE-POWER AMPLIFIER FOR AUTO REVERSE

The KA22131 is a monolithic integrated circuit consisting of auto-reverse dual pre and power amplifier. It is suitable for 3V portable radio cassette with auto-reverse.

FEATURES

- Dual pre-power amplifier on 1 chip
- Auto-reverse switch included
- Muting circuit included for Metal/Normal gain control
- LED drive circuit included for tape direction indication
- Power ON muting circuit included for suppression of shock-noise at the power ON time.
- Operating supply voltage range: $V_{CC} = 1.8V \sim 3.6V$

24 SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22131D	24 SOP	-20 ~ +70°C

BLOCK DIAGRAM

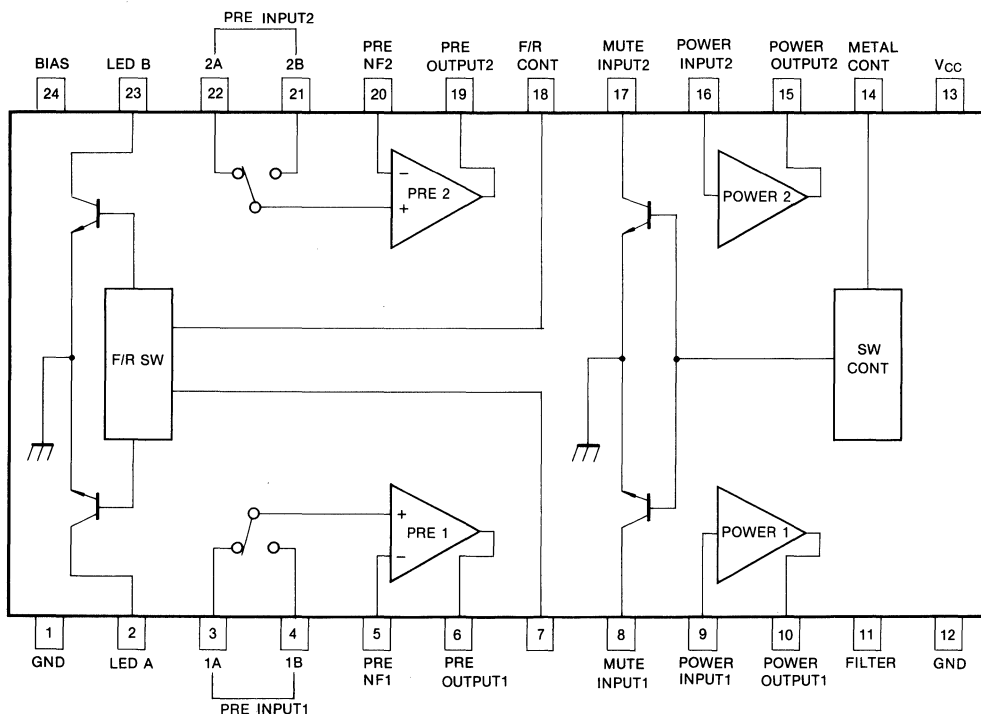


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	4.5	V
Power Dissipation	P _d	600	mW
Operating Temperature	T _{opr}	-20 ~ +70	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 3V, f = 1KHz, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I _{CC}	V _i = 0V, Pin 14, 18: Open	4	9	15	mA
PRE-AMP (R_L = 10KΩ)						
Open Loop Voltage Gain	A _{VO}	V _o = -10dBm	72	83		dB
Output Voltage	V _o	THD = 1%	300	450		mV
Total Harmonic Distortion	THD	V _o = 0.2V, NAB = 33dB		0.03	0.08	%
Equivalent Input Noise Voltage	V _{NI}	R _g = 2.2KΩ BW(-3dB) = 20Hz ~ 20KHz		0.9	1.2	μV
Ripple Rejection Ratio	RR	V _i = -20dBm, f = 100Hz NAB = 33dB	43	53		dB
FWD-REV Cross Talk	CT _{F-R}	V _o = -10dBm, R _g = 2.2KΩ BW = 20Hz ~ 20KHz	65	75.5		dB
Input Bias Current	I _B	V _i = 0V		130	500	nA
POWER-AMP (R_L = 16Ω)						
Output Power	P _o	THD = 10%	50	69		mW
Closed Loop Voltage Gain	A _V	V _i = -40dBm	24.6	26.6	28.6	dB
Total Harmonic Distortion	THD	P _o = 1mW		0.27	0.5	%
Output Noise Voltage	V _{NO}	R _g = 0Ω, BW(-3dB) = 20Hz ~ 20KHz		27	39	μV
Ripple Rejection Ratio	RR	V _i = -20dBm, f = 100Hz, R _g = 0Ω	45	61		dB
Input Resistance	R _i		21.4	30	38.6	KΩ
Input Bias Current	I _B	V _i = 0V, R _g = 100KΩ		10	90	nA
Channel Balance	CB	V _o = -10dBm		0.1	0.7	dB
LED Maximum Current	I _{LED}	V _{CE(sat)} = 0.3V	5			mA
PRE + POWER AMP						
L-R Cross Talk	CT _{L-R}	VR: Max, PRE: R _g = 2.2KΩ BW = 20Hz ~ 20KHz, Power: V _o = -5dBm	40	48		dB
Signal Leakage	SL	PRE: V _o = -12dBm VR: Min		-66	-60	dBm

TEST CIRCUIT

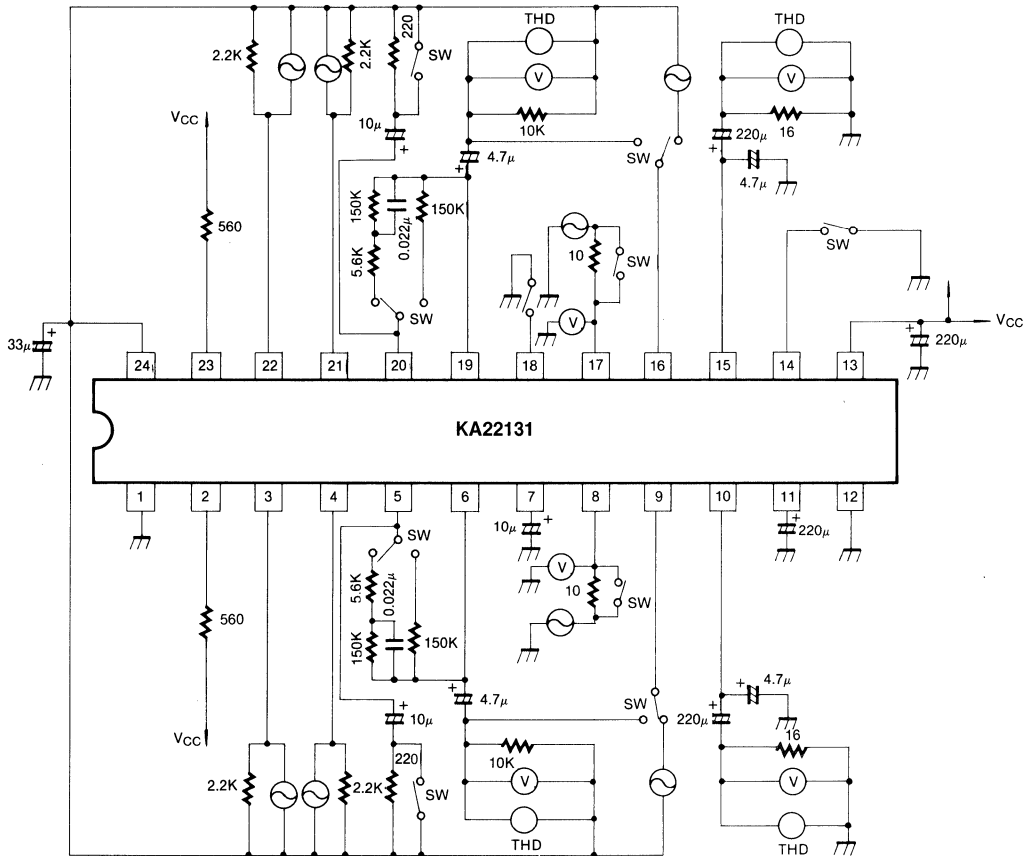


Fig. 2

APPLICATION CIRCUIT

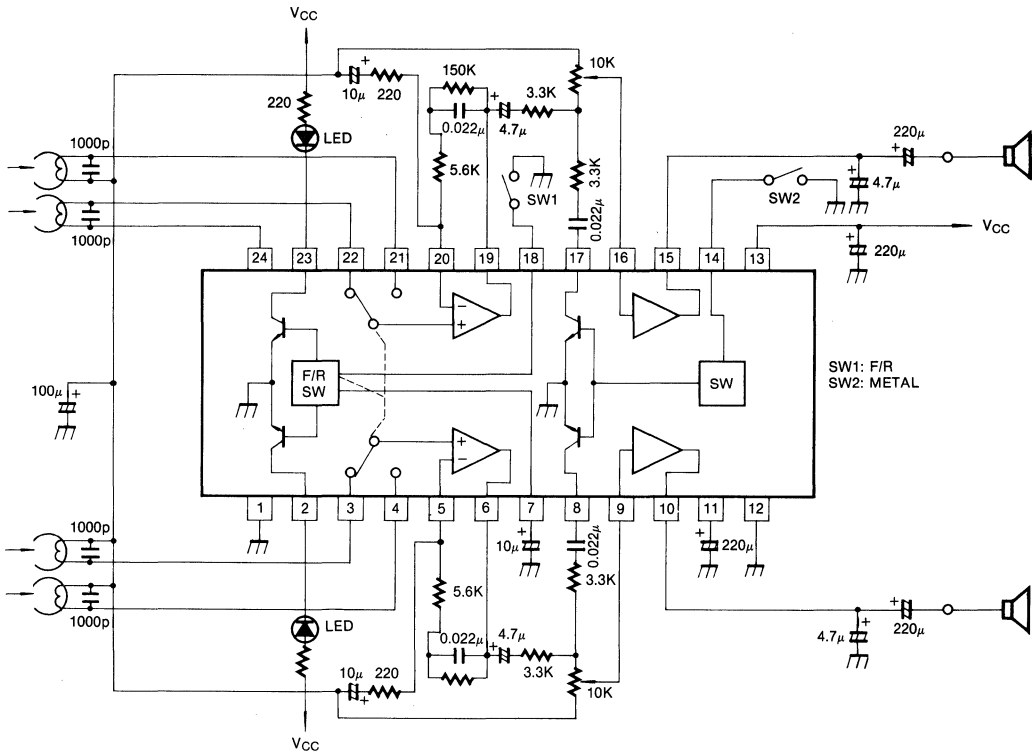
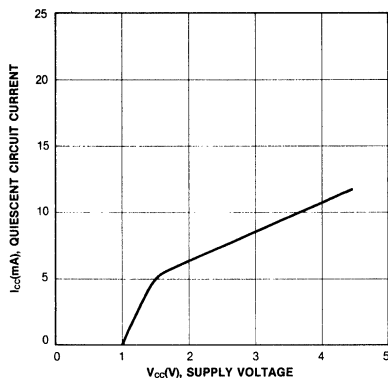
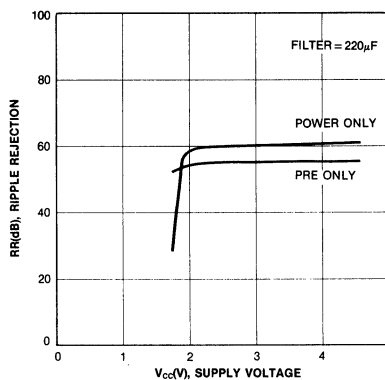


Fig. 3

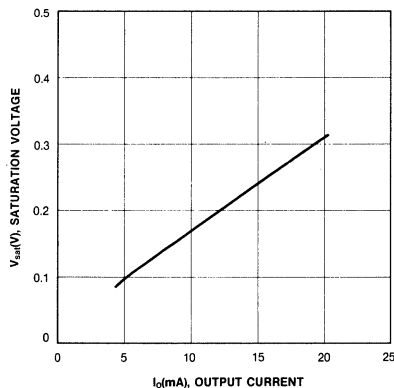
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



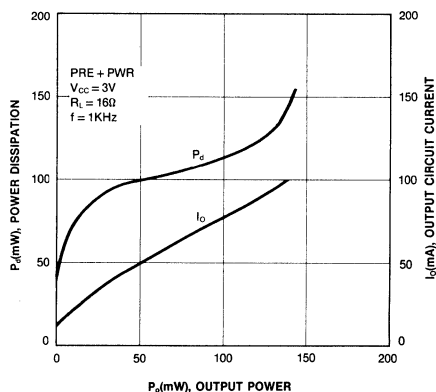
RIPPLE REJECTION-SUPPLY VOLTAGE



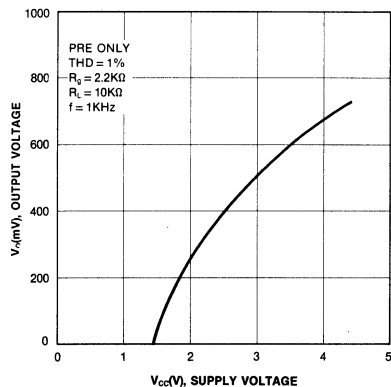
SATURATION VOLTAGE-OUTPUT CURRENT



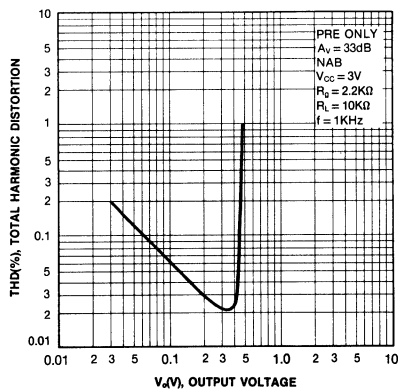
POWER DISSIPATION -OUTPUT POWER



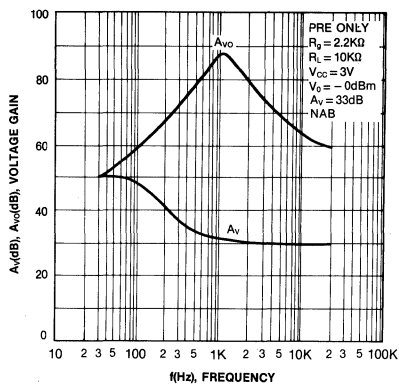
OUTPUT VOLTAGE-SUPPLY VOLTAGE



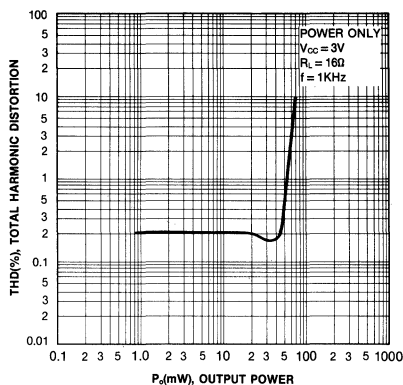
TOTAL HARMONIC DISTORTION OUTPUT VOLTAGE



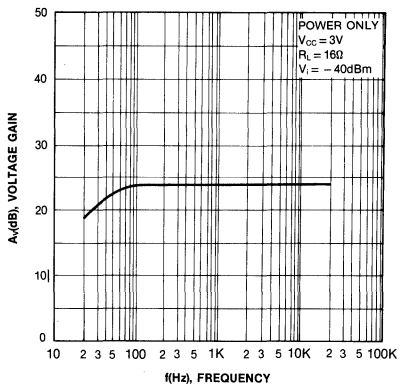
VOLTAGE GAIN-FREQUENCY



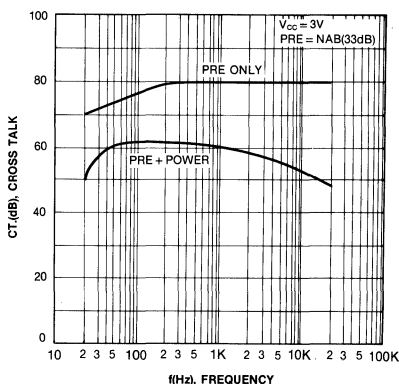
TOTAL HARMONIC DISTORTION-OUTPUT POWER



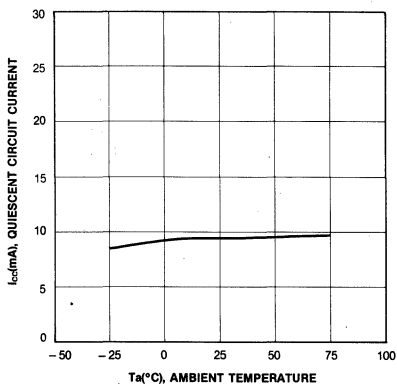
VOLTAGE GAIN-FREQUENCY



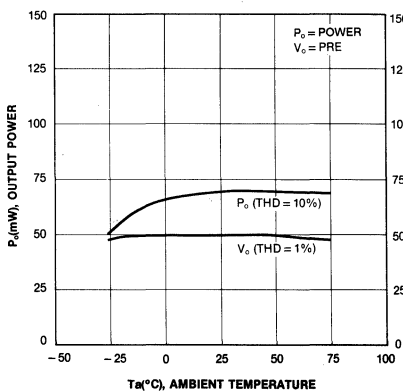
CROSS TALK-FREQUENCY

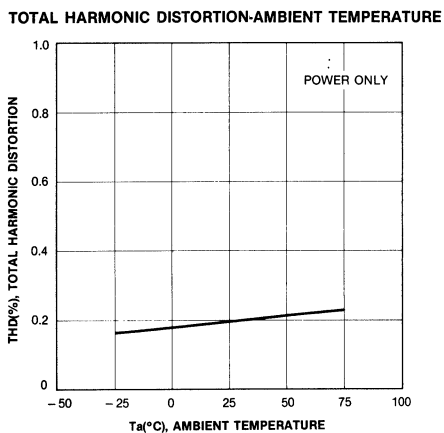
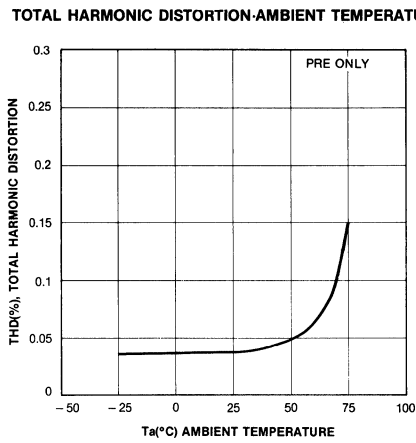
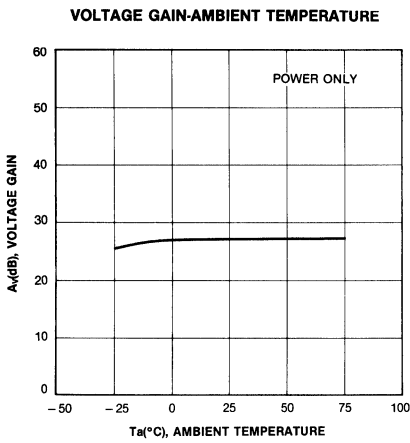


QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE



OUTPUT POWER-AMBIENT TEMPERATURE





DUAL PRE-POWER AMPLIFIER WITH DC VOLUME CONTROL

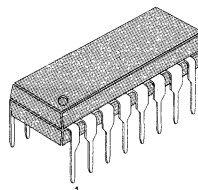
The KA22134 is a monolithic integrated circuit designed for use in low voltage and low power applications. It has all functions including dual audio pre-power amplifier, DC volume control and headphone drive circuits.

It is suitable for portable tape recorder or headphone cassette recorder.

FEATURES

- Built-in DC volume control circuit.
- Wide operation supply voltage: $V_{CC} = 1.8 \sim 6V$
- Only a few components to compose headphone cassette tape recorder.
- Built-in ripple filter.

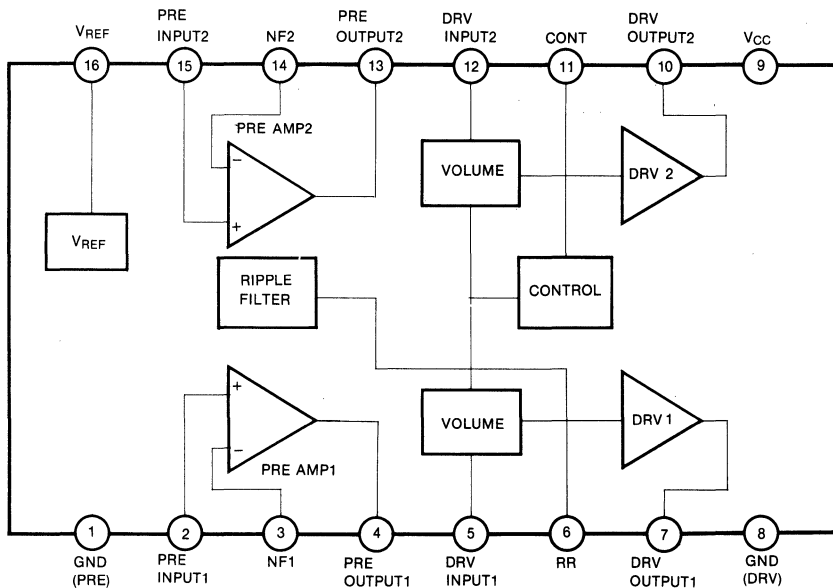
16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22134	16 DIP	$-20 \sim +75^{\circ}\text{C}$

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	7	V
Power Dissipation	P _d	750	mW
Operating Temperature	T _{opr}	- 20 ~ + 75	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(V_{CC} = 3V, Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I _{CC1}	V _i = 0, V _{OL} = min		9	13	mA
	I _{CC2}	V _i = 0, V _{OL} = max		11.0		mA
Cross Talk	CT	R _g = 2.2KΩ, V _o = - 10dBm	34	40		dB

PRE-AMPLIFIER SECTION

(V_{CC} = 3V, Ta = 25°C, fo = 1KHz, RL1 = 10KΩ, unless otherwise specified)

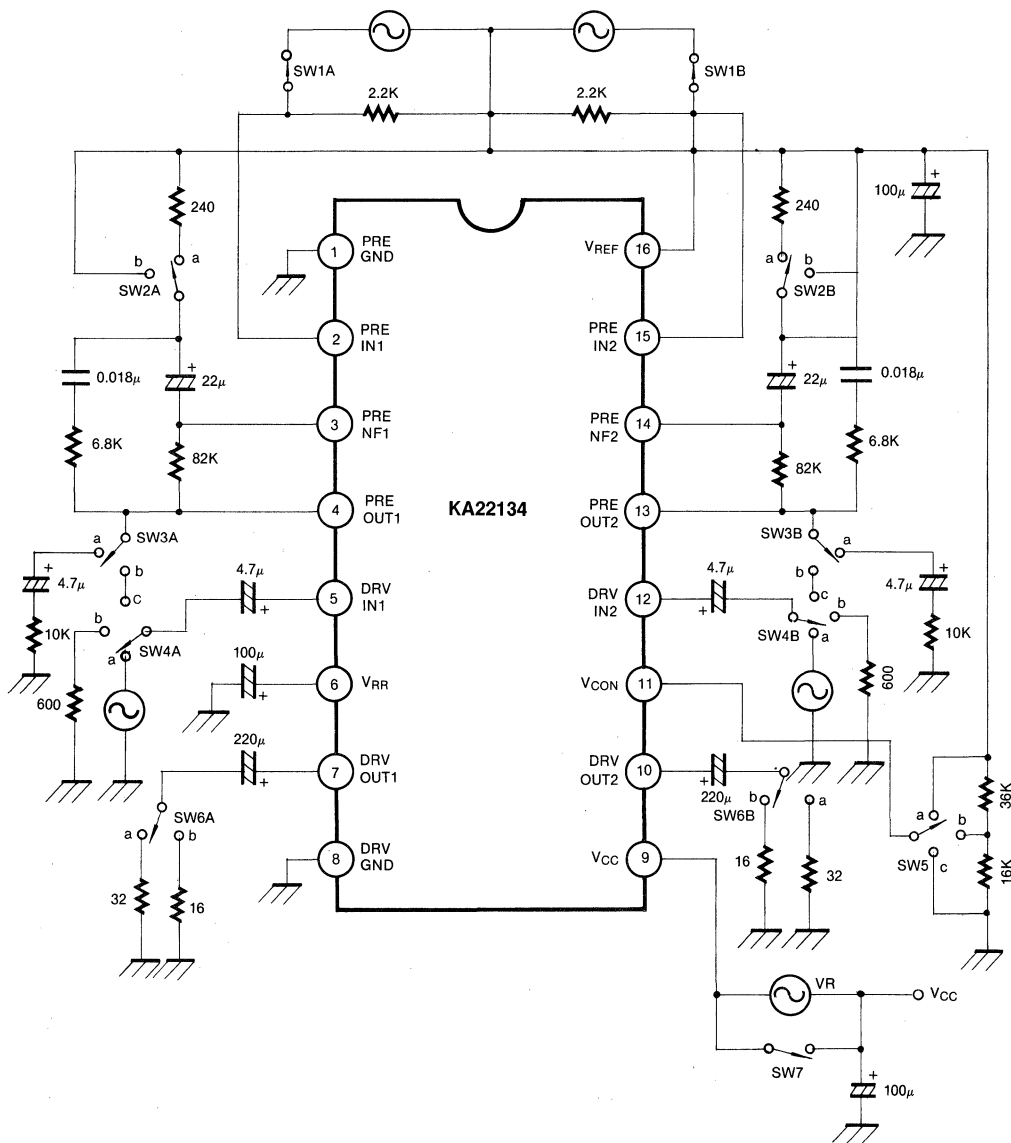
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Open Loop Voltage Gain	A _{VO}	V _i = 0.2mV	55	62		dB
Closed Loop Voltage Gain	A _{V1}	V _o = - 10dBm, NAB 1KHz		33		dB
Output Voltage	V _{om}	THD = 1%	600	720		mV
Total Harmonic Distortion	THD ₁	V _o = - 10dBm		0.04	0.1	%
Ripple Rejection Ratio	RR ₁	R _g = 2.2KΩ VR = - 20dBm, f _r = 100Hz		46		dB
Equivalent Input Noise Voltage	V _{NI}	R _g = 2.2KΩ, BW = 30 ~ 20KHz Gain for NAB 1KHz		1.2	2.0	μV

POWER AMPLIFIER SECTION

(V_{CC} = 3V, Ta = 25°C, fo = 1KHz, RL2 = 32Ω, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Power	P _{O1}	THD ₂ = 10%	20	27		mW
	P _{O2}	THD ₂ = 10%, R _L = 16Ω		39		mW
Total Harmonic Distortion	THD ₂	P _o = 10mW, Volume: 100%		0.5	1.2	%
	THD ₃	P _o = 10mW, Volume: 50%		0.3		%
Closed Loop Voltage Gain	A _{V2}	V _o = - 10dBm, Volume: 100%	28	30	32	dB
	A _{V3}	V _o = - 10dBm		15		dB
Channel Balance	CB	V _o = - 10dBm	- 1.5	0	- 1.5	dB
Volume Rejection Ratio	V _{min}	V _o = - 10dBm, Volume: 100% to 0%	66	72		dB
Output Noise Voltage	V _{NO}	BW = 30 ~ 20KHz, R _g = 600Ω		250	320	μV
Ripple Rejection Ratio	RR ₂	R _g = 600Ω, f _r = 100Hz VR = - 20dBm		46		dB

TEST CIRCUIT

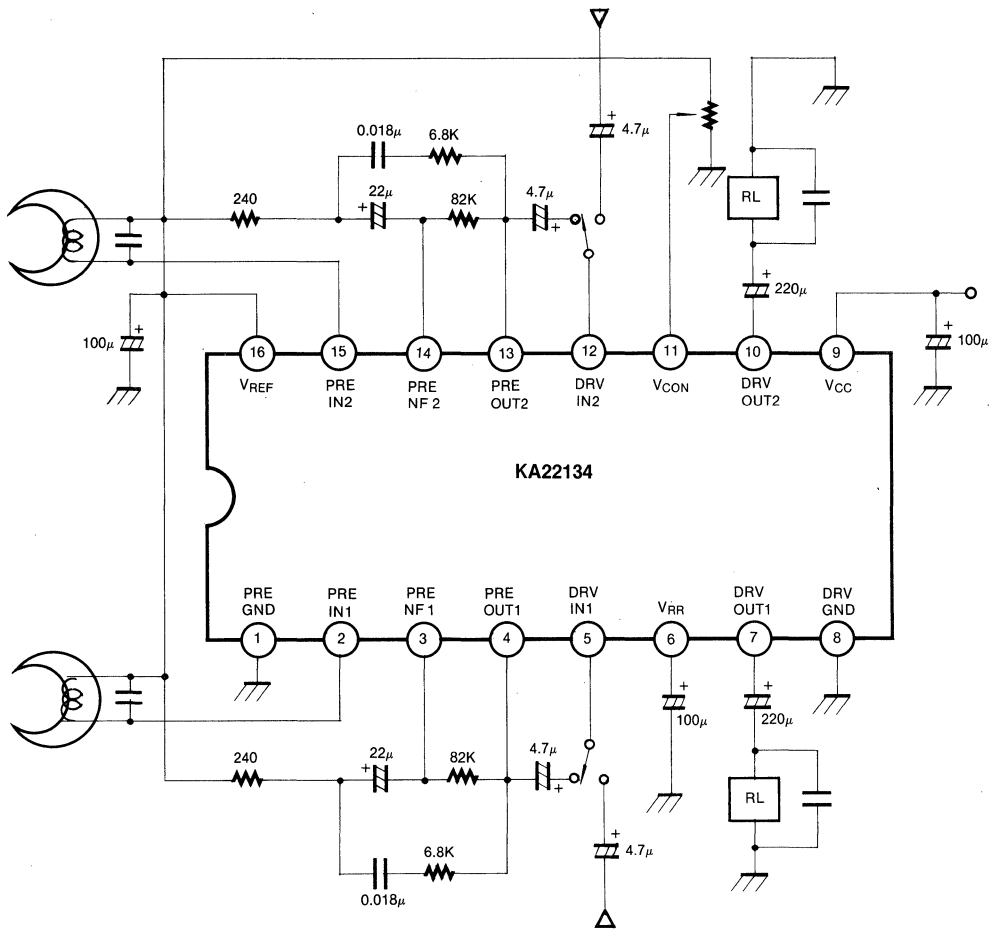


TEST CONDITIONS

Item	SW1A	SW1B	SW2A/B	SW3A/B	SW4A/B	SW5	SW6A/B	SW7
I _{CC1}	x	x	a	a	b	c	a	0
I _{CC2}	x	x	a	a	b	a	a	0
A _{V0}	0	0	b	a	b	c	a	0
A _{V1}	0	0	a	a	b	c	a	0
V _{om}	0	0	a	a	b	c	a	0
THD ₁	0	0	a	a	b	c	a	0
V _{N1}	x	x	a	a	b	c	a	0
RR ₁	x	x	a	a	b	c	a	x
P _{O1}	x	x	a	a	a	a	a	0
P _{O2}	x	x	a	a	a	a	b	0
A _{V2}	x	x	a	a	a	a	a	0
A _{V3}	x	x	a	a	a	b	a	0
CB	x	x	a	a	a	a	a	0
THD ₂	x	x	a	a	a	a	a	0
THD ₃	x	x	a	a	a	b	a	0
V _{no}	x	x	a	a	b	a	a	0
V _{min}	x	x	a	a	a	a→c	a	0
RR ₂	x	x	a	a	b	c	a	x
CT	x/0	0/x	a	b	c	a	a	0

Note: 0 = close, x = open

APPLICATION CIRCUIT



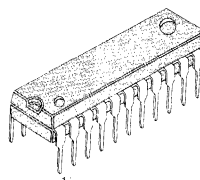
DUAL PRE-POWER AMPLIFIER AND DC MOTOR SPEED CONTROLLER

The KA22135 is a monolithic integrated circuit designed for use in low voltage and low power applications. It has all functions including dual audio pre-power amplifier and motor speed controller in a single chip. It is suitable for portable tape recorder, head phone cassette tape recorder or radio by battery use.

FEATURES

- Low current consumption in a operating voltage range.
- Wide operating supply voltage range; $V_{CC} = 2V \sim 7.5V$.
- Only a few components to compose headphone cassette tape recorder.
- Dual audio pre-power amplifier and motor speed controller in a single chip.
- Reduced input and output coupling capacitors because of 1/2 V_{CC} AMP adaption on chip as AC GND.

22 SDIP



3

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22135	22 SDIP	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM

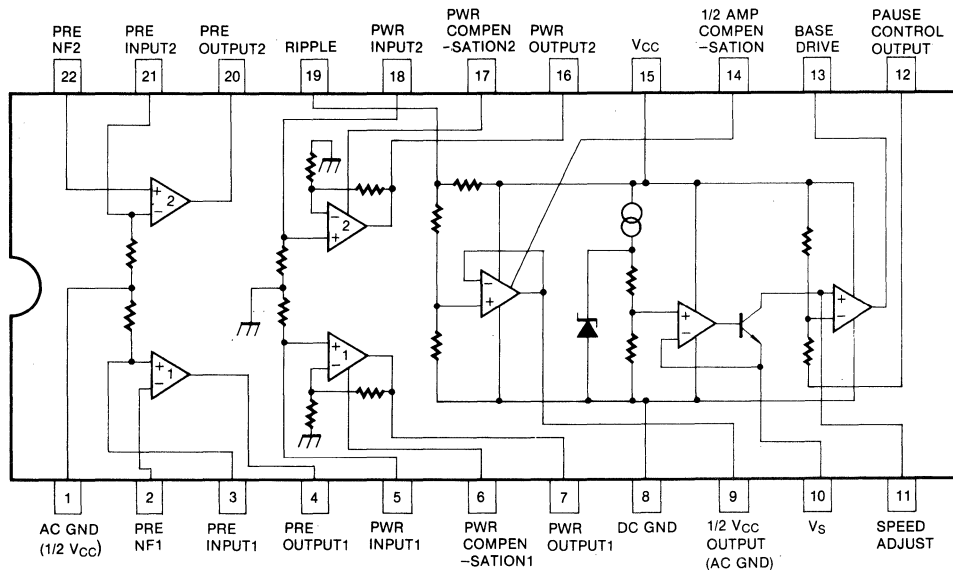


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	10	V
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	-20 ~ +70	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_{CC} = 3V, V_i = 0, I_m = 0mA$		15	25	mA

PRE AMPLIFIER SECTION(Ta = 25°C, $V_{CC} = 3V$, $f = 1KHz$, $R_{L1} = 10K\Omega$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Open Loop Voltage Gain	A_{VO}	$V_o = -10dBm, R_L = \infty$		72		dB
Closed Loop Voltage Gain	A_V	$V_o = -10dBm$	40	42	44	dB
Output Voltage	V_o	THD = 1%	0.35	0.6		V
Total Harmonic Distortion	THD	$V_o = 400mV$		0.05	0.5	%
Output Noise Voltage	V_{NO}	$V_i = 0, R_g = 2.2K\Omega$ $BW(-3dB) = 30Hz \sim 20KHz$		70	300	μV
Input Resistance	R_i	$V_o = -10dBm$	18	22		$K\Omega$
Cross Talk	CT	$R_g = 2.2K\Omega, V_o = -10dBm$	45	62		dB

POWER AMPLIFIER SECTION(Ta = 25°C, $V_{CC} = 3V$, $f = 1KHz$, $R_{L2} = 32\Omega$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Closed Loop Voltage Gain	A_V	$P_o = 5mW$	26	28	30	dB
Output Power	P_o	THD = 10%	20	28		mW
Total Harmonic Distortion	THD	$P_o = 5mW$		0.2	2.0	%
Output Noise Voltage	V_{NO}	$R_g = 10K\Omega, BW(-3dB) = 30Hz \sim 20KHz$		0.25	1.0	mV
Input Resistance	R_i	$P_o = 5mW$	10	20		$K\Omega$
Cross Talk	CT	$P_o = 5mW, R_g = 10K\Omega$	35	50		dB

MOTOR SPEED CONTROLLER SECTION

($T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, $I_m = 100\text{mA}$, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Base Driving Current	I_B		10	18		mA
Reference Voltage	V_{ref}		0.22	0.26	0.30	V
Reference Voltage Regulation 1	ΔV_{ref1}	$V_{CC} = 2.0 \sim 6.5V$		0.05		%/V
Reference Voltage Regulation 2	ΔV_{ref2}	$I_m = 25 \sim 200mA$		0.1		%/mA
Reference Voltage Regulation 3	ΔV_{ref3}	$T_a = -10 \sim +60^\circ C$		0.01		%/°C
Current Coefficient	K	$K = \frac{V_L - V_{R2}}{V_{R1} + V_{R2}}$	3.7	4	4.3	
Current Coefficient Regulation 1	ΔK_1	$V_{CC} = 2.0 \sim 6.5V$		0.05		%/V
Current Coefficient Regulation 2	ΔK_2	$I_m = 25 \sim 200mA$		0.1		%/mA
Current Coefficient Regulation 3	ΔK_3	$T_a = -10 \sim +60^\circ C$		0.1		%/°C

TEST CIRCUIT

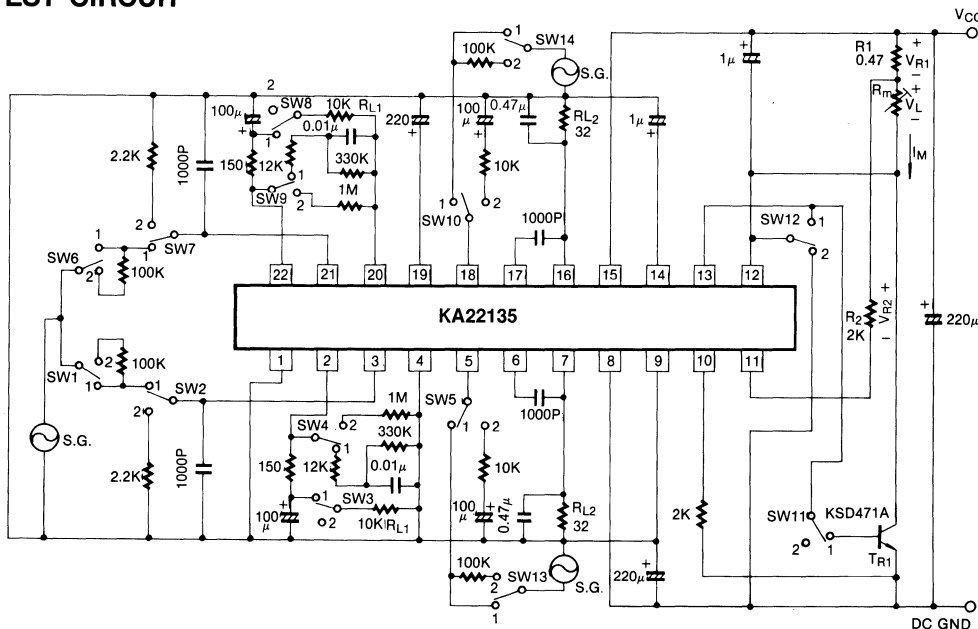


Fig. 2

Note: PIN8 is DC GND
PIN9 is AC GND

TEST METHOD

SWITCH TEST ITEM		1	2	3	4	5	6	7	8	9	10	11	12	13	14
I_{CC}		1	2	1	1	2	1	2	1	1	2	1	2	1	1
PRE AMP	CH1 A_{VO}	"	1	2	2	"	"	"	"	"	"	"	"	"	"
	CH1 A_V	"	"	1	1	"	"	"	"	"	"	"	"	"	"
	CH1 V_O	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH1 THD	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH1 V_{no}	"	2	"	"	"	"	"	"	"	"	"	"	"	"
	CH1 R_i	2	1	"	"	"	"	"	"	"	"	"	"	"	"
	CH2 A_{VO}	1	2	"	"	"	"	1	2	2	"	"	"	"	"
	CH2 A_V	"	"	"	"	"	"	"	1	1	"	"	"	"	"
	CH2 V_O	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH2 THD	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH2 V_{no}	"	"	"	"	"	"	2	"	"	"	"	"	"	"
	CH2 R_i	"	"	"	"	"	2	1	"	"	"	"	"	"	"
	C.T1 (2→1)	"	"	"	"	"	1	1	"	"	"	"	"	"	"
	C.T2 (1→2)	"	1	"	"	"	"	2	"	"	"	"	"	"	"
POWER AMP	CH1 A_V	"	2	"	"	1	"	"	"	"	"	"	"	"	"
	CH1 P_O	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH1 THD	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH1 V_{no}	"	"	"	"	2	"	"	"	"	"	"	"	"	"
	CH1 R_i	"	"	"	"	1	"	"	"	"	"	"	"	2	"
	CH2 A_V	"	"	"	"	2	"	"	"	"	1	"	"	1	"
	CH2 P_O	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH2 THD	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	CH2 V_{no}	"	"	"	"	"	"	"	"	"	2	"	"	"	"
	CH2 R_i	"	"	"	"	"	"	"	"	"	1	"	"	"	2
	C.T1 (2→1)	"	"	"	"	"	"	"	"	"	"	"	"	"	1
	C.T2 (1→2)	"	"	"	"	1	"	"	"	"	2	"	"	"	"
M.S.C.	I_b	"	"	"	"	2	"	"	"	"	"	2	1	"	"
	V_{ref}	"	"	"	"	"	"	"	"	"	"	1	"	"	"
	ΔV_{ref}	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	ΔK	"	"	"	"	"	"	"	"	"	"	"	"	"	"

APPLICATION CIRCUIT

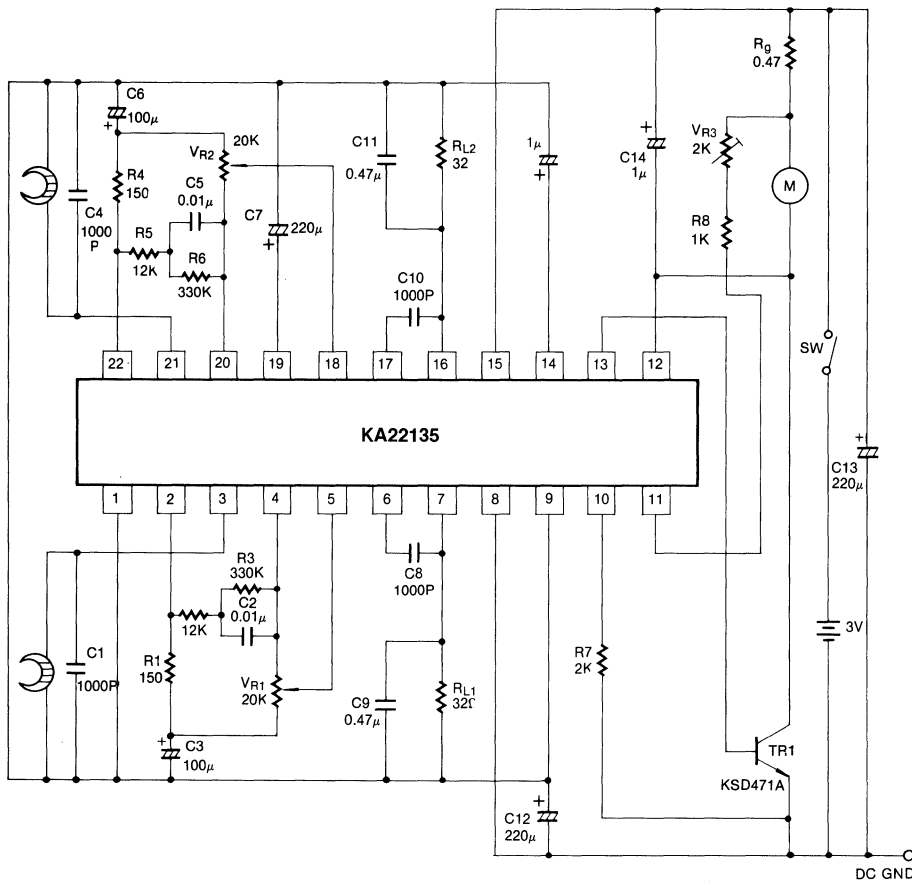


Fig. 3

- Note:**
1. In case of C12, use a capacitor of Low $\tan \delta$
 2. In case of C9 and C11, use solid state capacitors with better characteristics at low temperature
 3. Please locate R7 just around the EMITTER of TR1, KSD471A.

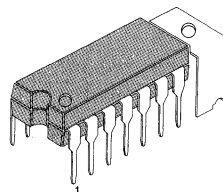
1W DUAL POWER AMPLIFIER

The KA2214 is a dual audio power amplifier in a 14 pin dual in line package. It is designed for portable audio sets.

FEATURES

- Wide operating voltage; $V_{CC} = 3V \sim 13V$
- High output power; $P_o = 2W$ at $12V/8\Omega/THD = 10\%$
 $P_o = 1.6W$ at $9V/4\Omega/THD = 10\%$
 $P_o = 1.2W$ at $9V/8\Omega/THD = 10\%$
 $P_o = 0.7W$ at $6V/4\Omega/THD = 10\%$
 $P_o = 0.5W$ at $6V/8\Omega/THD = 10\%$
 $P_o = 50mW$ at $4.5V/32\Omega/THD = 10\%$
- High ripple rejection ratio; 50dB (Typ)
- Low quiescent current; 10mA ($V_{CC} = 9V$)
- Easy assembly so that two power amplifiers are built in a package.

14 DIP H/S



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2214	14 DIP H/S	$-20 \sim +70^{\circ}C$

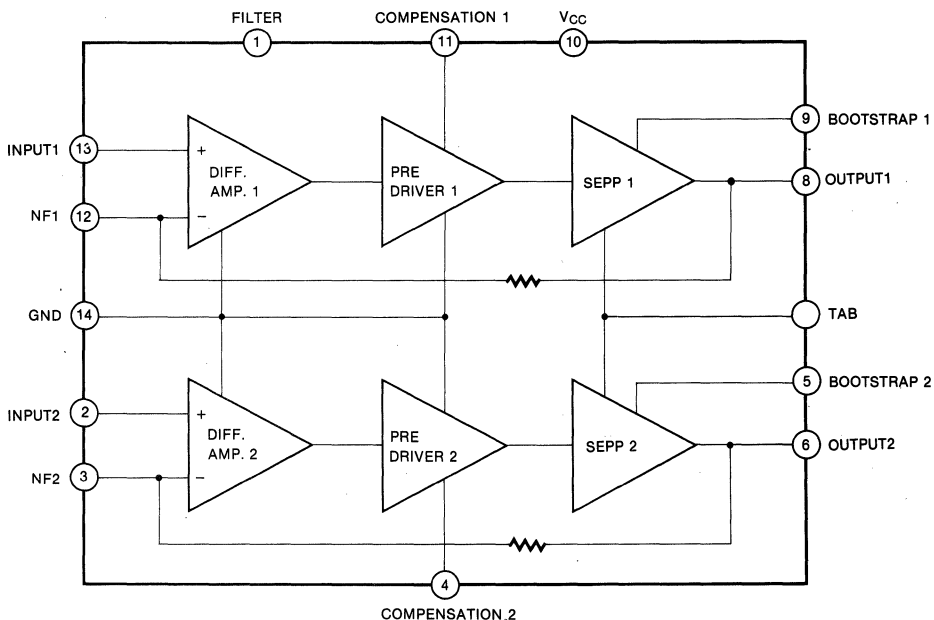


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage (No Signal)	V_{CC}	18	V
Supply Voltage (Operating)	V_{CC}	16	V
Power Dissipation	P_d	2.4	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $R_f = 33\Omega$, $f = 1\text{KHz}$, $R_L = 8\Omega$, $R_g = 600\Omega$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		10		mA
Voltage Gain	A_{V1}	$P_o = 0.25\text{W}$, $R_f = 33\Omega$		44		dB
	A_{V2}	$P_o = 0.25\text{W}$, $R_f = 120\Omega$		34		dB
Output Power	P_{o1}	$V_{CC} = 12\text{V}$, $R_L = 8\Omega$, THD = 10%		2		W
	P_{o2}	$V_{CC} = 9\text{V}$, $R_L = 4\Omega$, THD = 10%		1.6		W
	P_{o3}	$V_{CC} = 9\text{V}$, $R_L = 8\Omega$, THD = 10%	0.9	1.2		W
	P_{o4}	$V_{CC} = 6\text{V}$, $R_L = 4\Omega$, THD = 10%		0.7		W
	P_{o5}	$V_{CC} = 6\text{V}$, $R_L = 8\Omega$, THD = 10%		0.5		W
	P_{o6}	$V_{CC} = 4.5\text{V}$, $R_L = 32\Omega$, THD = 10%		50		mW
Total Harmonic Distortion	THD ₁	$P_o = 0.5\text{W}$, $R_f = 33\Omega$		0.8		%
	THD ₂	$P_o = 0.5\text{W}$, $R_f = 120\Omega$		0.4		%
Output Noise Voltage	V_{NO}	$R_g = 10\text{K}\Omega$, BW(- 3dB) = 20Hz ~ 20KHz		0.6		mV
Ripple Rejection Ratio	RR	$R_g = 0$, $f = 120\text{Hz}$, $V_i = 0.3\text{V}$		50		dB
Cross Talk	CT	$R_g = 0$, $P_o = 0.25\text{W}$		55		dB
Channel Balance	CB	$P_o = 0.25\text{W}$	-2	0	2	dB
Input Resistance	R_i			5		M Ω

APPLICATION CIRCUIT

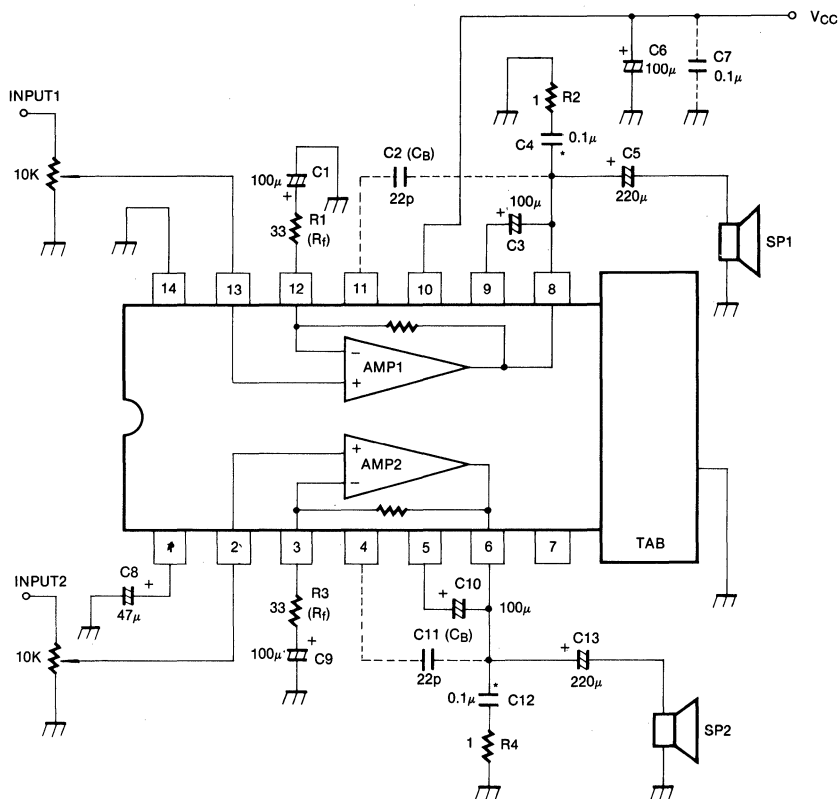


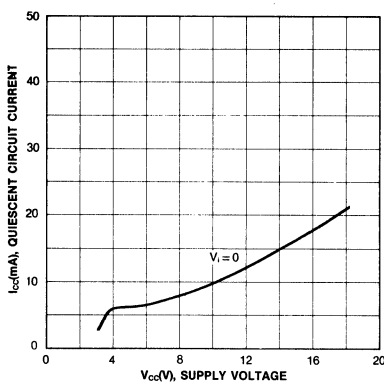
Fig. 2

* Mylar Capacitor

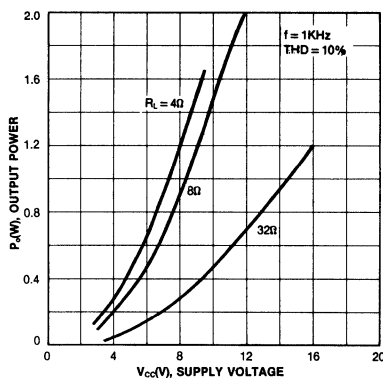
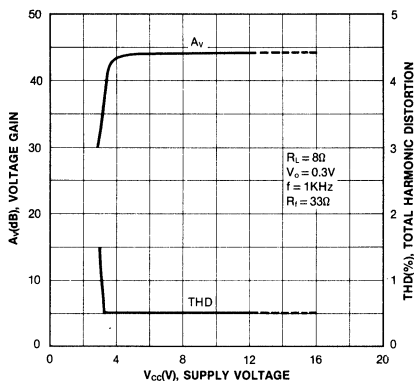
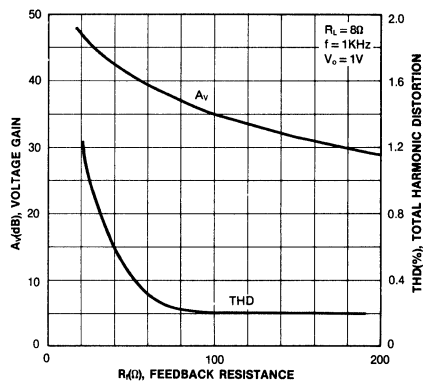
APPLICATION NOTES

- (1) Mylar capacitor is recommended as C4, C12.
- (2) Add C2, C11, in the case of reducing voltage gain at high frequency.
- (3) Add C7 or increase capacitance of C4, C12, when a oscillation may occur due to the pattern on PCB.
- (4) Voltage gain can be changed by value of R1, R3.

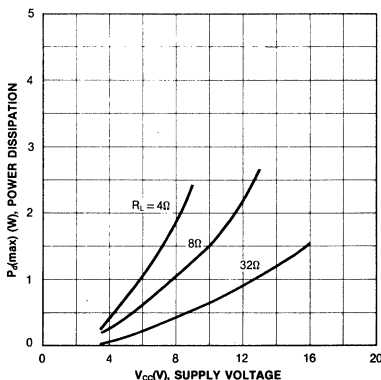
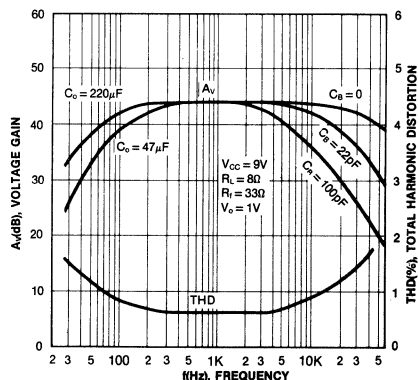
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



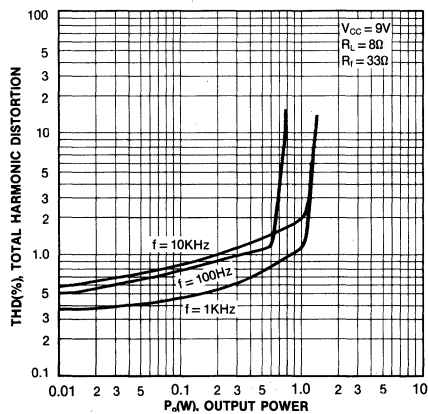
OUTPUT POWER-SUPPLY VOLTAGE

VOLTAGE GAIN
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGEVOLTAGE GAIN
TOTAL HARMONIC DISTORTION-FEEDBACK RESISTANCE

POWER DISSIPATION-SUPPLY VOLTAGE

VOLTAGE GAIN
TOTAL HARMONIC DISTORTION-FREQUENCY

TOTAL HARMONIC DISTORTION-OUTPUT POWER



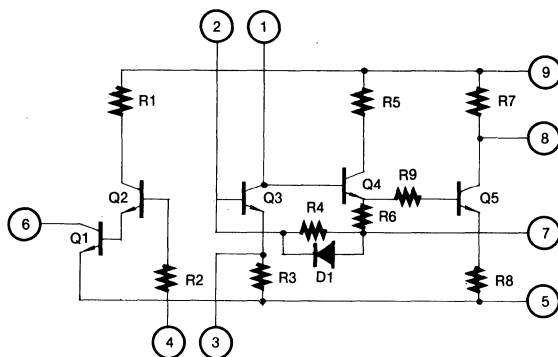
EQUALIZER AMPLIFIER WITH ALC

The KA2220 is a monolithic integrated circuit consisting of a preamplifier and ALC circuit for cassette tape recorder.

FEATURES

- Low noise amplifier.
- Wide operating supply voltage range: $V_{CC} = 3.5V \sim 14V$
- High output voltage.
- Low distortion.
- Wide ALC range.
- KA2220 ST: Good ALC pair characteristic for stereo tape recorder.

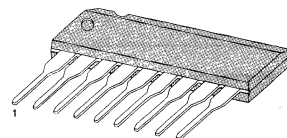
SCHEMATIC DIAGRAM



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2220	9 SIP	$-20 \sim +70^{\circ}C$

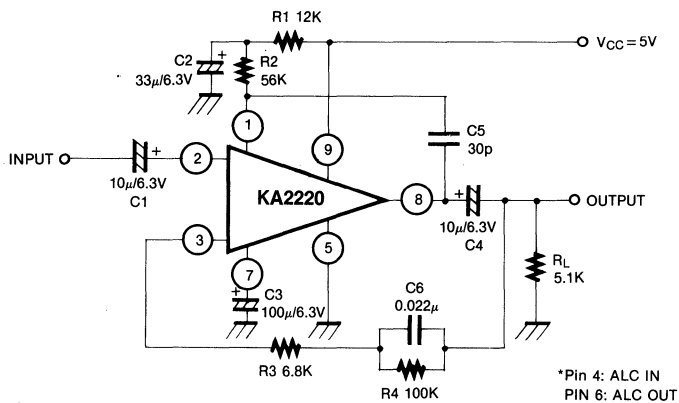
9 SIP



3

Fig. 1

TEST CIRCUIT



*Pin 4: ALC IN
PIN 6: ALC OUT

Fig. 2

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_d	200	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $R_L = 5.1\text{K}\Omega$, $R_g = 600\Omega$, $f = 1\text{KHz}$, NAB, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$, ALC OFF		1.4	2.0	mA
Voltage Gain (Open Loop)	A_{VO}		66	69		dB
Voltage Gain (Closed Loop)	A_V	$V_O = 0.7\text{V}$	33	35	37	dB
Output Voltage	V_O	THD=1%	0.7	1.0		V
Total Harmonic Distortion	THD	$V_O = 0.2\text{V}$		0.1		%
Input Resistance	R_i		60	100		$\text{K}\Omega$
Equivalent Input Noise Voltage	V_{NI}	$R_g = 2.2\text{K}\Omega$, NAB BW (-3dB) = $15\text{Hz} \sim 30\text{KHz}$		1.0		μV
ALC Transistor Saturation Voltage	V_{SAT}			75	100	mV

ALC GRADE BINNING TEST CIRCUIT

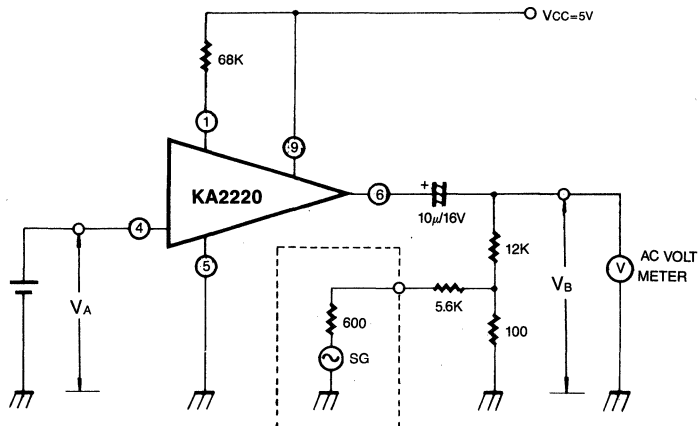


Fig. 3

Test condition: S.G output level should be adjusted to be 13.8mV of the AC voltmeter reading (V_B) when the D.U.T is not connected from the test circuit ($V_{CC} = 5\text{V}$, $V_A = 1.16\text{V}$, $T_a = 25^\circ\text{C}$)

ALC RANK is defined as $\text{ALC-G.R} = 20 \log V_{B2}/V_{B1}$

where

V_{B1} : AC voltmeter reading when the D.U.T is not connected

V_{B2} : AC voltmeter reading when the D.U.T is connected

ALC-G.R BINNING TABLE

Symbol	A _v (dB)		ALC Grade (dB)	
	Min	Max	Min	Max
KA2220 H	34	36	- 16.0	- 20.0
KA2220 J			- 18.5	- 22.5
KA2220 K			- 21.0	- 25.0
KA2220 L			- 24.0	- 28.0
KA2220 M			- 27.0	- 31.0
KA2220 N			- 30.0	- 34.0

External Components (Refer to test circuit)

C₁: Input coupling capacitor

The recommended value is 10μF. If made too small, low frequency characteristic should be changed for the worse, too large a capacitance value will increase rising time when power is applied.

C₂: Ripple filter for power supply

The large value required to get an excellent ripple characteristic under the line operation, but sometime make smaller for starting time short.

C₃: Bypass capacitor

Short emitter resistor on AC and prevents AC signal from feedback to input.

C₄: Output coupling capacitor

C₄ is determined as follows.

$$C_4 = \frac{1}{2\pi \cdot f_L \cdot R_L}$$

f_L: low cut-off frequency

R_L: load resistance

C₅: Phase compensation capacitor.

Prevents from high frequency oscillation by phase error when feedback deeply.

C₆, R₃, R₄: Equalizer network

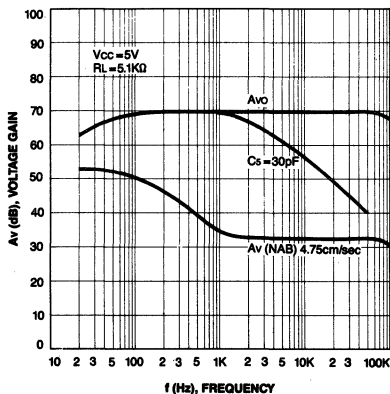
Closed loop voltage gain determined by these components in relation to the internal resistance at pin 3.

R₁: Filter resistance.

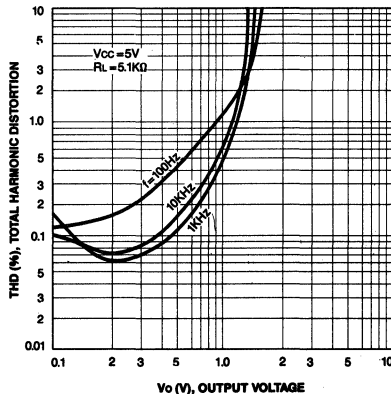
R₂: Collector resistor of first stage transistor of IC

Low voltage characteristic can be improved by adjusted this resistance.

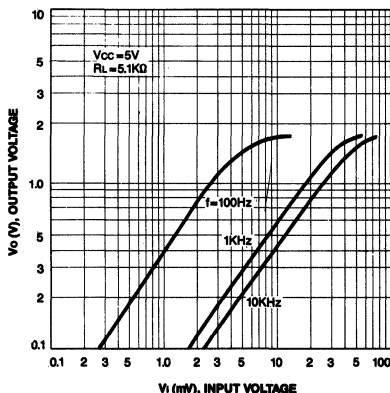
VOLTAGE GAIN-FREQUENCY



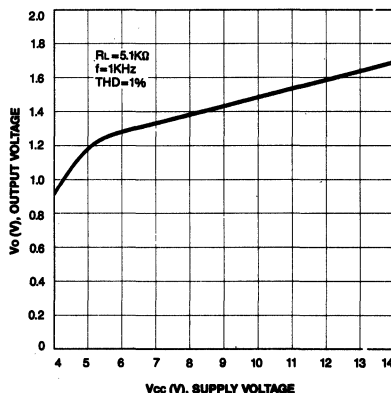
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



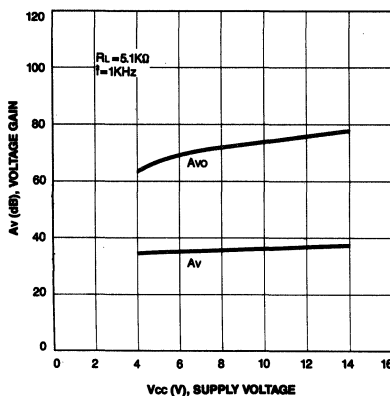
OUTPUT VOLTAGE-INPUT VOLTAGE



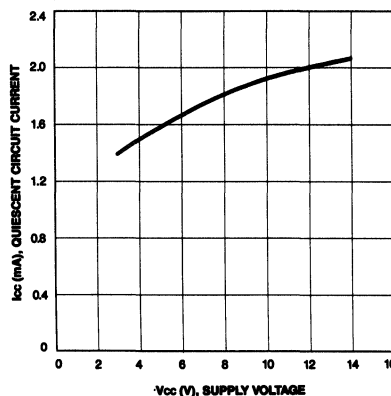
OUTPUT VOLTAGE-SUPPLY VOLTAGE

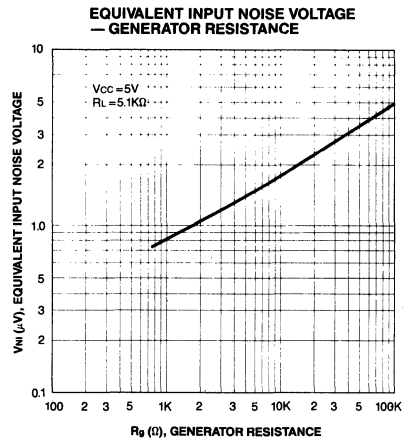
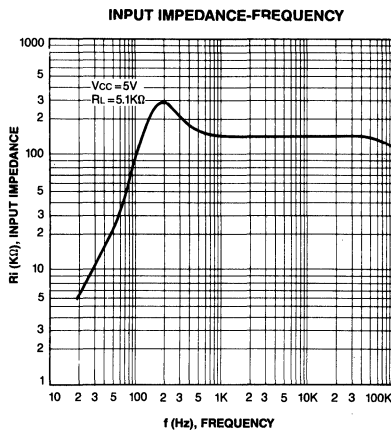


VOLTAGE GAIN-SUPPLY VOLTAGE



QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE





TYPICAL APPLICATION CIRCUIT

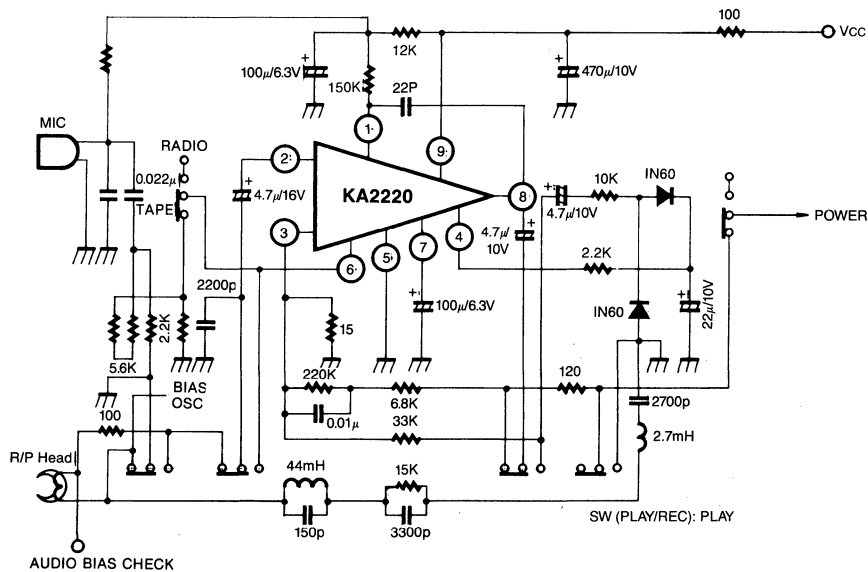


Fig. 4

DUAL LOW NOISE EQUALIZER AMPLIFIER

The KA2221 is a monolithic integrated circuit consisting of 2 channel low noise amplifiers and regulated power supply for car stereo.

FEATURES

- Suitable for car stereo.
- Low noise amplifier.
- Voltage regulator included.
- Good ripple rejection.
- High channel separation (65dB Typ).
- Minimum number of external parts required.

8 SIP

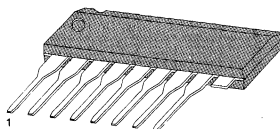
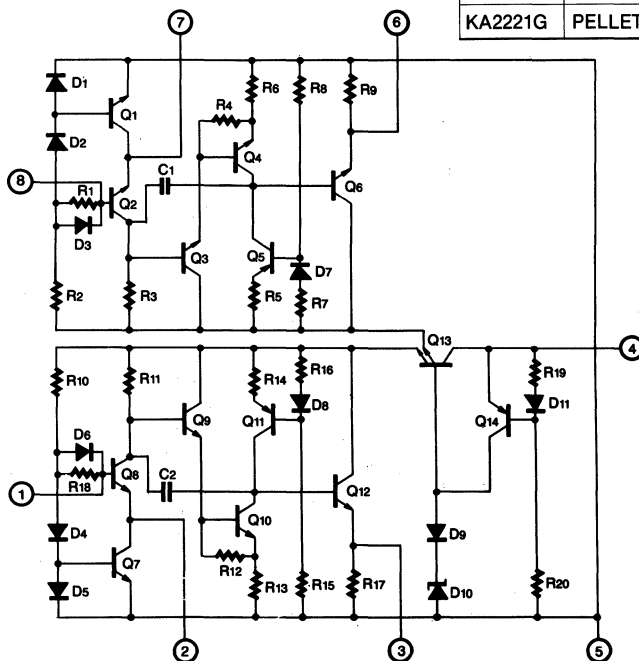
**SCHEMATIC DIAGRAM**

Fig. 1

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2221	8 SIP	- 20 ~ + 70°C
KA2221G	PELLET	

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Power Dissipation	P_d	200	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $R_L = 10\text{K}\Omega$, $f = 1\text{KHz}$, NAB, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		6.0	9.0	mA
Voltage Gain (Open Loop)	A_{VO}		65	80		dB
Voltage Gain (Closed Loop)	A_V	$V_O = 0.5\text{V}$	33	35	37	dB
Output Voltage	V_O	THD=1%	0.6	1.0		V
Total Harmonic Distortion	THD	$V_O = 0.5\text{V}$		0.1	0.3	%
Input Resistance	R_i			150		$\text{K}\Omega$
Equivalent Input Noise Voltage	V_{NI}	$R_g = 2.2\text{K}\Omega$ $\text{BW} (-3\text{dB}) = 15\text{Hz} \sim 30\text{KHz}$		1.0	2.0	μV
Cross Talk	CT	$R_g = 2.2\text{K}\Omega$	50	65		dB

TEST CIRCUIT

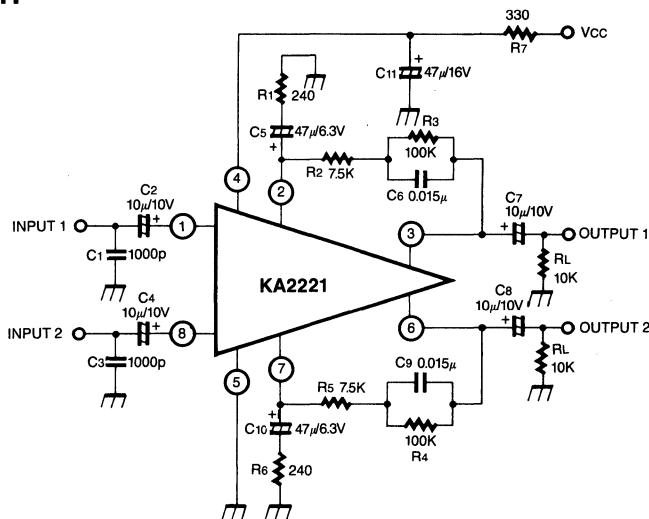
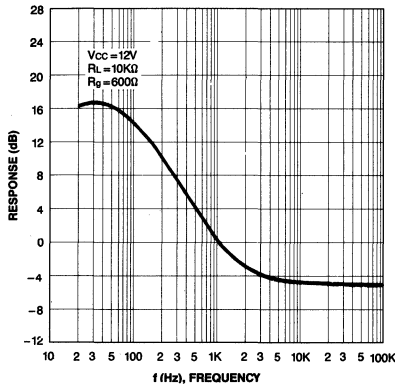
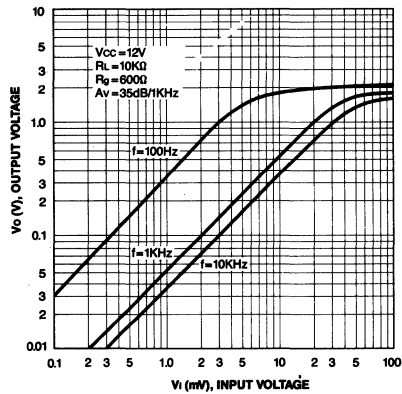


Fig. 2

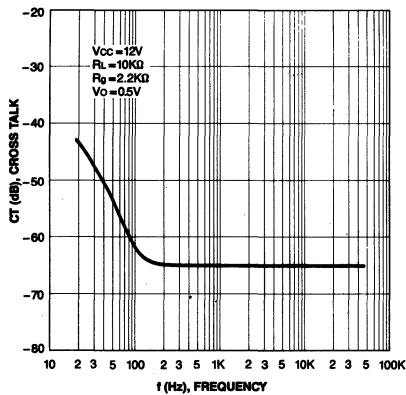
FREQUENCY RESPONSE



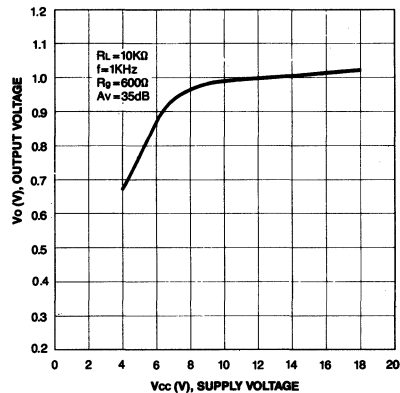
OUTPUT VOLTAGE-INPUT VOLTAGE



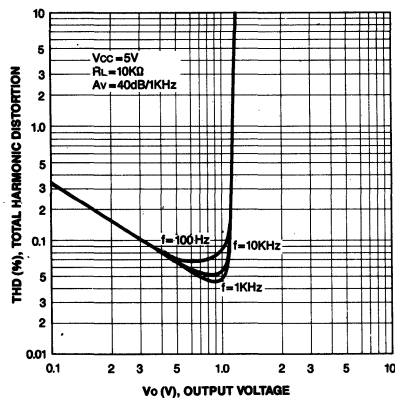
CROSS TALK-FREQUENCY



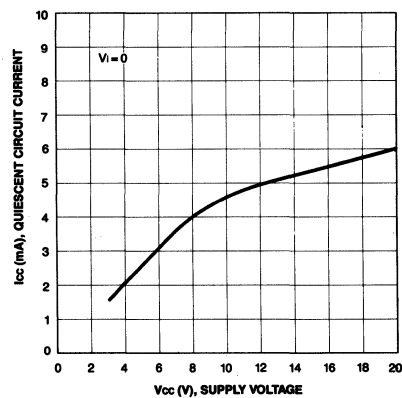
OUTPUT VOLTAGE-SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



External components (Refer to test circuit)

C₁ (C₃): Noise filter

These capacitors prevent from radio interference in the strong electric field. The recommended value is 1000pF.

C₂ (C₄): Input coupling capacitor

The recommended value is 10μF. If made too small, low frequency characteristic should be changed for the worse, too large value will increase rising time when power is applied.

C₅ (C₁₀): Negative feedback capacitor

The lower cut-off frequency depends on the value of these capacitors, and determined as follows.

$$C_5 (C_{10}) = \frac{1}{2\pi f_L \cdot R_1 (R_6)}$$

f_L: Low cut-off frequency

If the value of these capacitors are made larger, the starting time of amplifier is more delayed.

C₇ (C₈): Output coupling capacitor

The recommended value is 10μF.

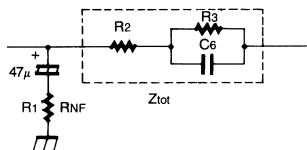
R₂, R₃, C₆ (R₄, R₅, C₉): Equalizer network

The time constants of standard NAB characteristic are follow.

Tape speed	9.5cm/sec	4.75cm/sec
C ₆ (R ₂ + R ₃)	3180μsec	1590μsec
R ₂ , C ₆	90μsec	120μsec

R₁ (R₆): Feedback component

The closed loop gain is determined approximately by the following relationship.



$$A_v = 20 \log \frac{Z_{tot}}{R_{NF}} (\text{dB})$$

$$Z_{tot} = R_2 + R_3 // C_6$$

* Choose R₂, R₃, (DC resistance of NAB element) as 100KΩ approximately.

DUAL LOW NOISE EQUALIZER AMPLIFIER

The KA22211 is a monolithic integrated circuit consisting of 2 channel pre-amplifier in 8 pin plastic single in-line package.

FEATURES

- Recommended operating supply voltage range (5V~14V)
- Low noise ($V_{NI} = 1.0\mu\text{V}$: Typ)
- High channel separation
- Minimum number of external parts required

SCHEMATIC DIAGRAM

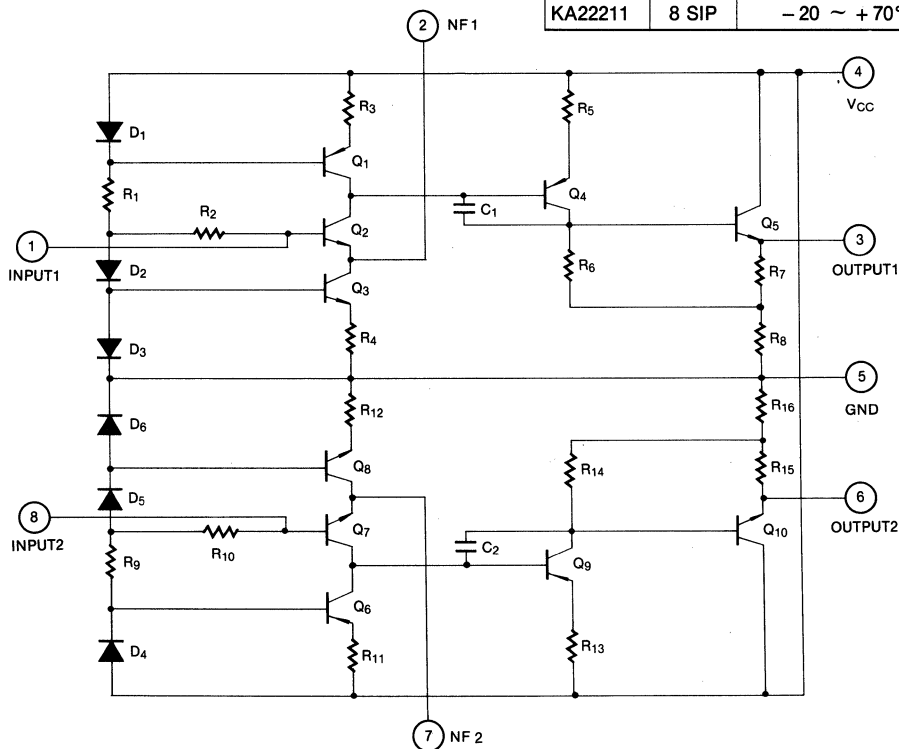
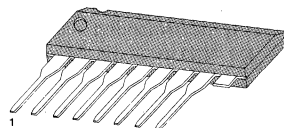


Fig. 1

8 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22211	8 SIP	-20 ~ +70°C

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	18	V
Power Dissipation	P _d	200	mW
Operating Temperature	T _{opr}	- 20 ~ + 70	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 9V, R_L = 10KΩ, R_g = 600Ω, f = 1KHz, NAB, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I _{CC}	V _i = 0		4.0	6.0	mA
Voltage Gain (Open Loop)	A _{VO}		65	80		dB
Voltage Gain (Closed Loop)	A _V	V _o = 0.5V	33	35	37	dB
Output Voltage	V _o	THD = 1%	1.1	1.3		V
Total Harmonic Distortion	THD	V _o = 0.5V		0.1	0.3	%
Input Resistance	R _i		70	100		KΩ
Equivalent Input Noise Voltage	V _{NI}	R _g = 2.2KΩ BW (- 3dB) = 15Hz ~ 30KHz		1.0	2.0	μV
Cross Talk	CT	R _g = 2.2KΩ	50	65		dB

TEST CIRCUIT

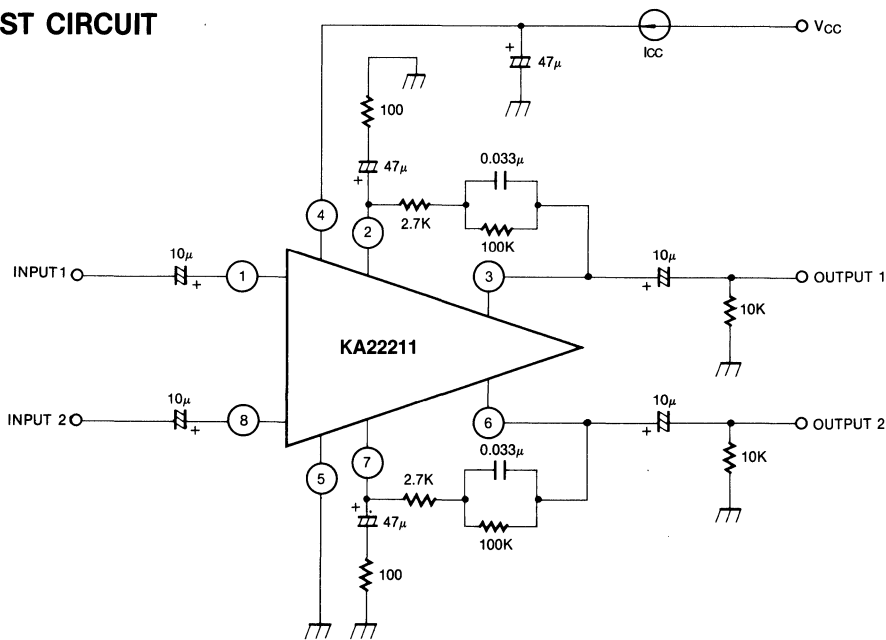


Fig. 2

APPLICATION CIRCUIT

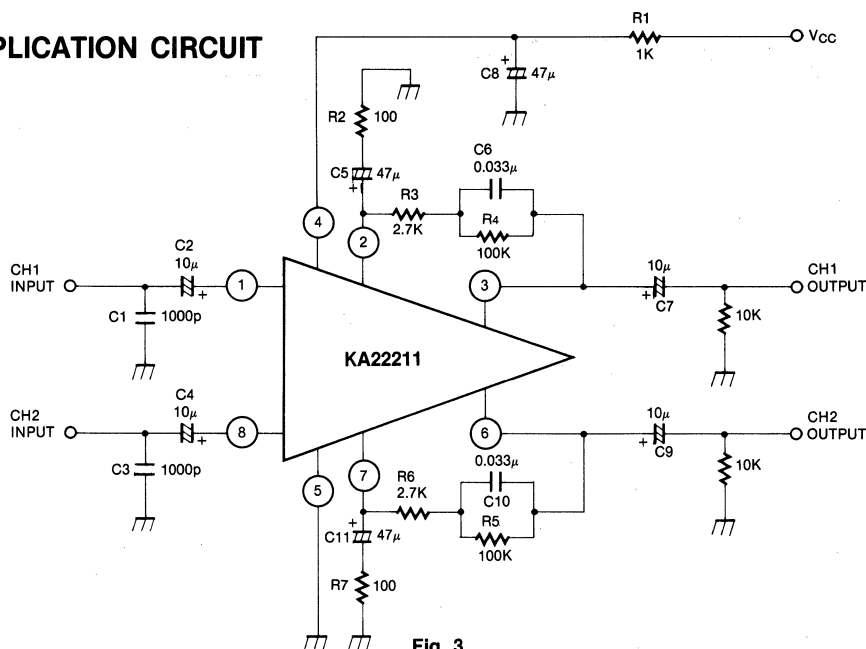


Fig. 3

External Components

C_2 (C_4): Input coupling capacitor

This components are concerned with output noise and operation starting time, and its capacitance is adequate for $10\mu\text{F}$.

As C_2 (C_4) below $4.7\mu\text{F}$ extends operation starting time, capacitance over $4.7\mu\text{F}$ is recommended.

C_5 (C_{11}): Negative feedback capacitor

This components decide low cut-off frequency, which determined as follows.

$$C_5 (C_{11}) = \frac{1}{2\pi f_L \cdot R_2 (R_7)} \quad \text{where, } f_L: \text{low cut-off frequency.}$$

Large C_5 (C_{11}) makes operation starting time of an amplifier late. It's capacitance is adequate for $47\mu\text{F}$.

C_6 , R_4 , R_3 (C_{10} , R_5 , R_6): Equalizer network

This components decide frequency response of an equalizer amplifier. The time constant of standard NAB characteristic is as follows.

Tape Speed	9.5cm/sec	4.75cm/sec
Time Constant		
$C_6 (R_3 + R_4)$	$3,180\mu\text{sec}$	$1,590\mu\text{sec}$
C_6, R_3	$90\mu\text{sec}$	$120\mu\text{sec}$

C_8 : Filter capacitor of power line

This is located as next to supply voltage pin (pin 4) as possible. The recommended value is $47\mu\text{F}$.

C_1 (C_3): Protection capacitor

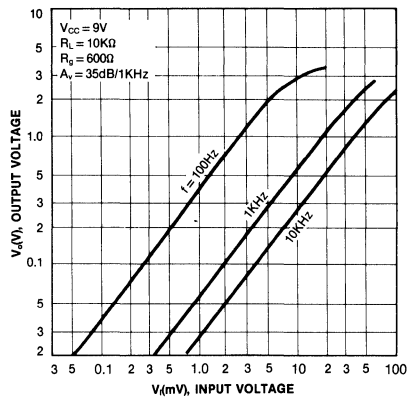
This components are the protector from an electric wave damage under strong electric field, engine noise damage and blocking oscillation at high amplifying operation.

The recommended value is 1000pF .

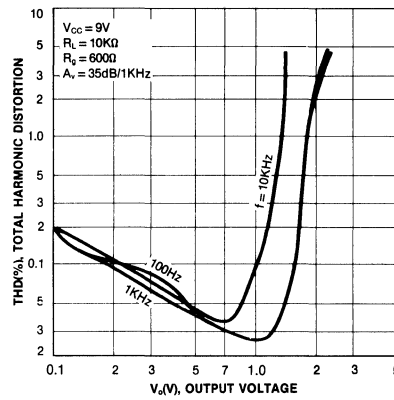
C_7 (C_9): Output coupling capacitor

The recommended value is $10\mu\text{F}$.

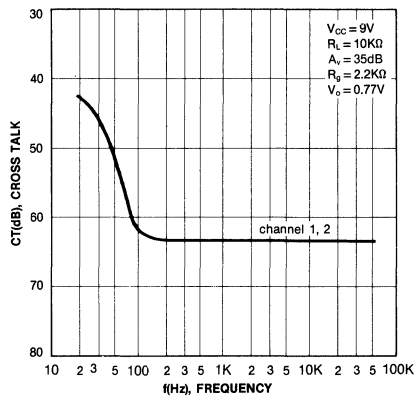
OUTPUT VOLTAGE-INPUT VOLTAGE



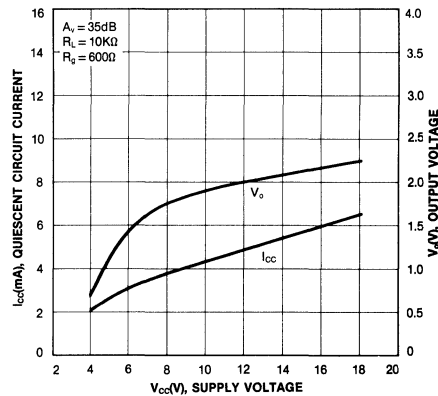
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



CROSS TALK-FREQUENCY



QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



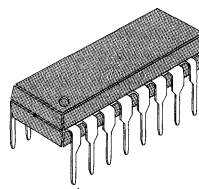
5 BAND GRAPHIC EQUALIZER AMPLIFIER

The KA2223 is a monolithic integrated circuit consisting of operational amplifier five resonant circuit with active filter, and it is suitable for radio-cassette tape recorder, car stereo or music center audio system.

FEATURES

- Tone control with independent adjustment of each band through external capacitor.
- Gain control through external variable resistor.
- Increasing the bands by adding resonant circuit or using two KA2223 in series.
- Low noise ($V_{No}=7\mu V$: Typ. Flat).
- Low distortion (THD=0.02% Typ. $f=1\text{KHz}$ Flat).
- Large allowable input ($V_i=2.3V$: Typ, $V_{cc}=9V$, $f=1\text{KHz}$ Flat).
- Operating supply voltage (5V ~ 13V)

16 DIP



SCHEMATIC DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2223	16 DIP	- 20 ~ + 70°C
KA2223G	PELLET	

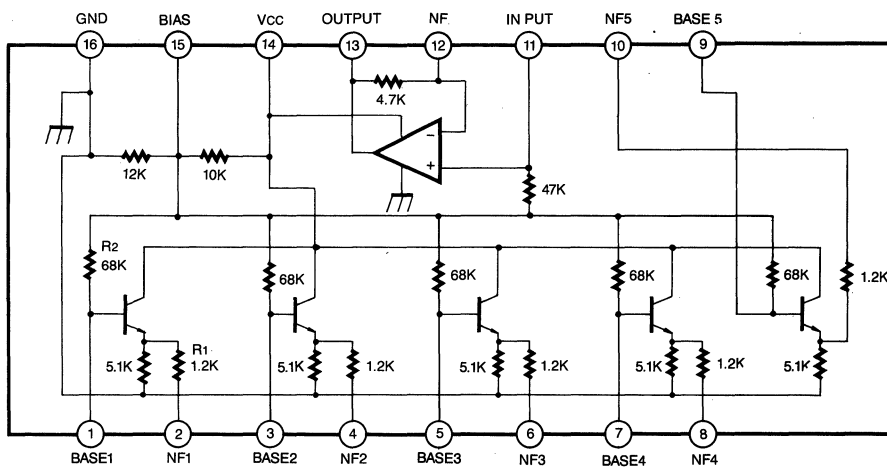


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Power Dissipation	P_d	700	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$ unless otherwise specified)

Characteristic		Symbol	Test		Min	Typ	Max	Unit
			f(Hz)	Conditions				
Quiescent Circuit Current		I _{CC}		V _i = 0	3.0	5.2	8.0	mA
Voltage Gain	Flat	A _V (Flat)	1K	V _i = − 10dBm	− 3.8	− 0.8	2.2	dB
	Boost	A _V (Boost)	108	V _i = − 10dBm	7.2	9.7	11.2	dB
			343					dB
			1.08K					dB
			3.43K					dB
			10.8K					dB
	Cut	A _V (Cut)	108	V _i = − 10dBm	− 12.8	− 11.3	− 8.8	dB
			343					dB
			1.08K					dB
			3.43K					dB
			10.8K					dB
Total Harmonic Distortion		THD	1K	V _i = 1V		0.02	0.1	%
Output Noise Voltage		V _{NO}	Flat, Input Short BW(− 3dB) = 10Hz ~ 30KHz			7.0	30	μV

TYPICAL APPLICATION CIRCUIT

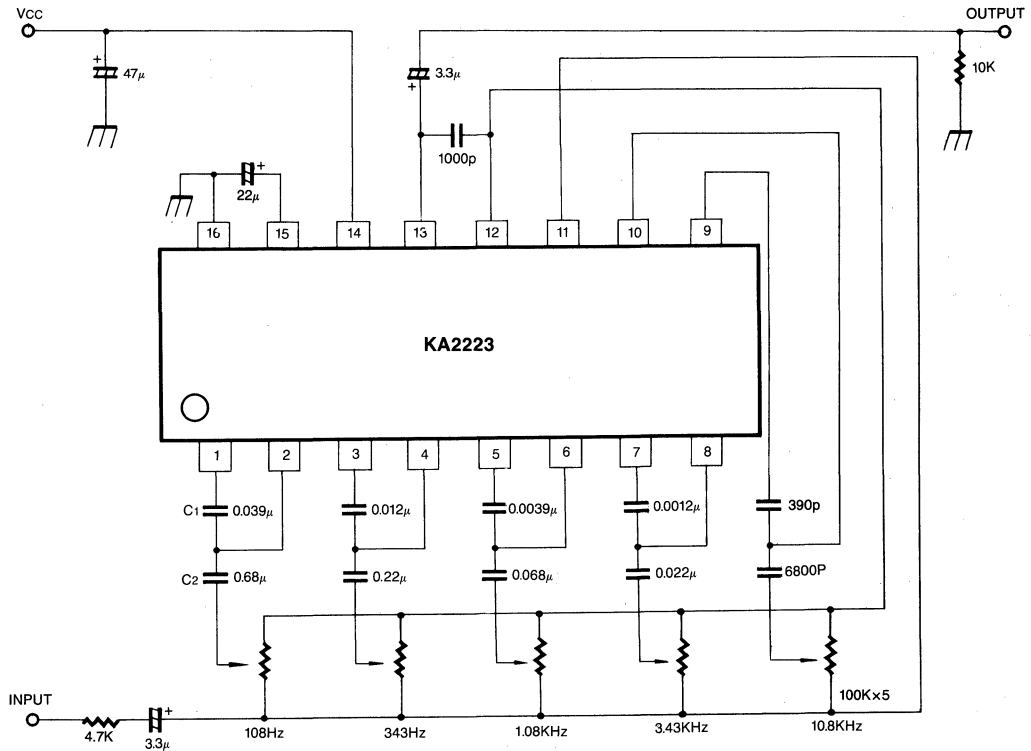


Fig. 4

$$\text{Resonant frequency } f_0 = \frac{1}{2\pi\sqrt{R_1 R_2 C_1 C_2}}$$

($R_1 = 1.2K$, $R_2 = 68K$ on-chip resistor)

APPLICATION CIRCUIT 1 (7 Band)

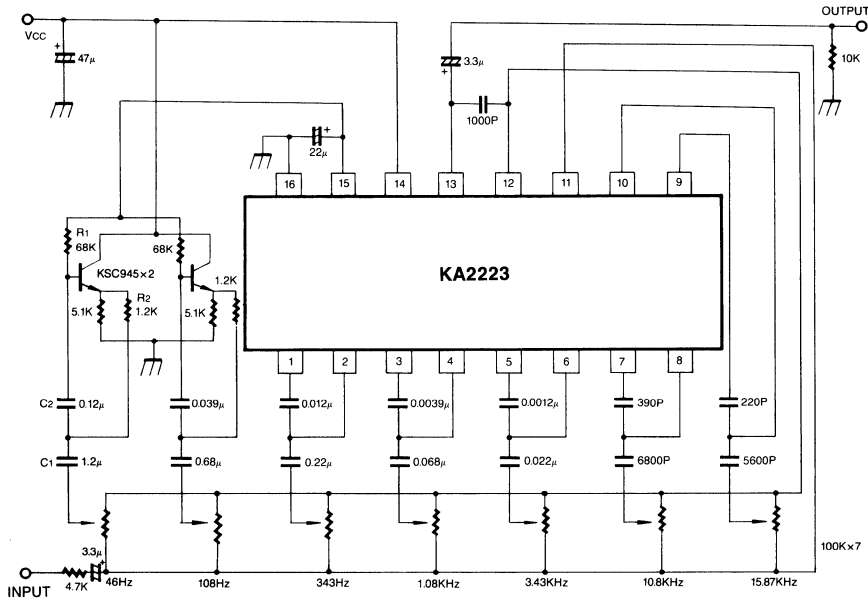


Fig. 2

APPLICATION CIRCUIT 2 (10 Band)

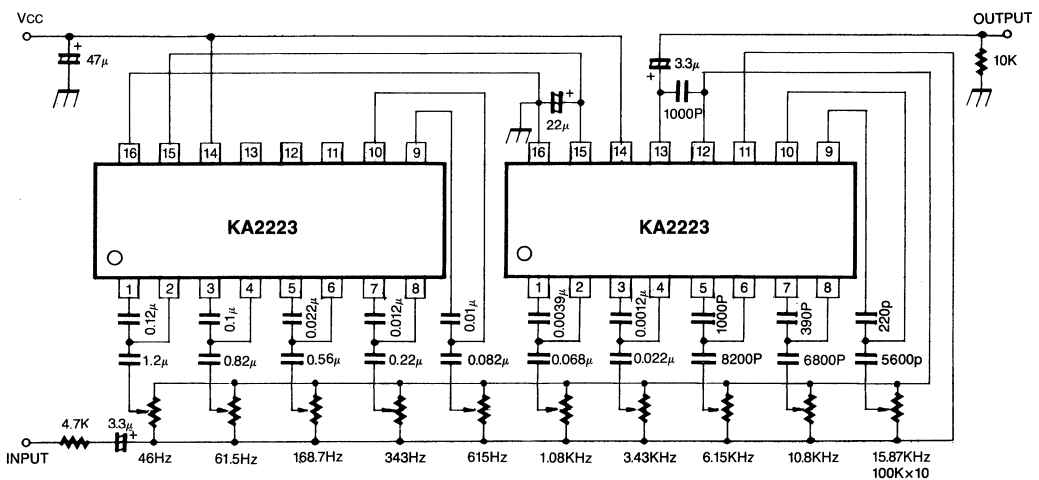
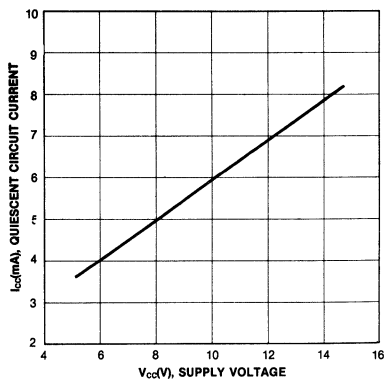
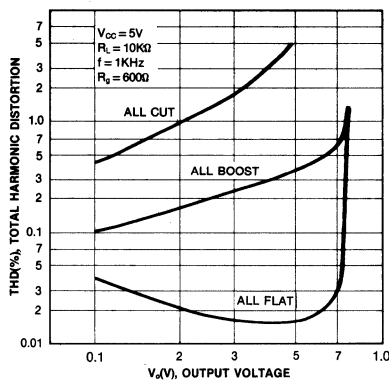


Fig. 3

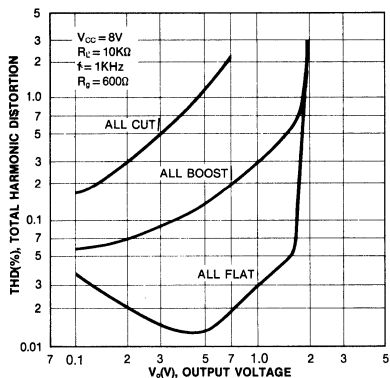
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



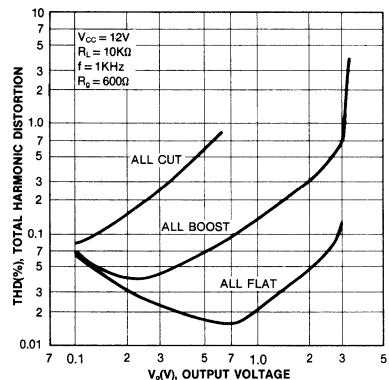
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



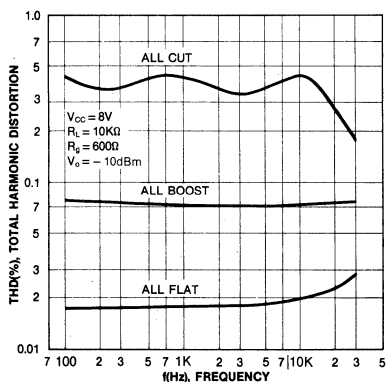
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



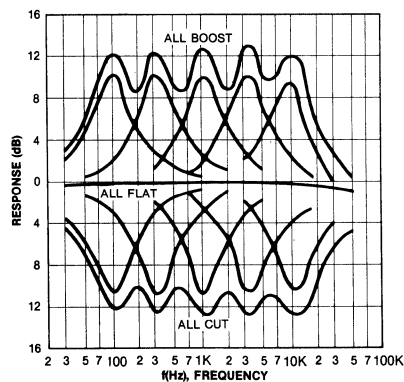
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



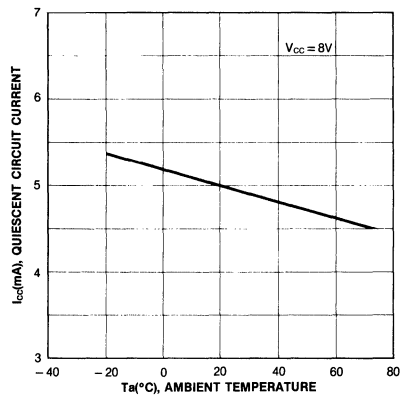
TOTAL HARMONIC DISTORTION-FREQUENCY



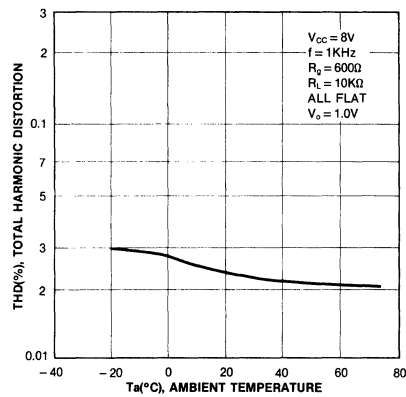
FREQUENCY RESPONSE



QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE



TOTAL HARMONIC DISTORTION - AMBIENT TEMPERATURE



5 BAND DUAL GRAPHIC EQUALIZER AMPLIFIER

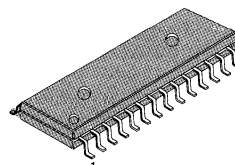
The KA22231 is a monolithic integrated circuit consisting of operational amplifier and 5 resonant circuit with active filter.

It is suitable for 3V headphone stereo and mini radio cassette tape recorder.

FEATURES

- Tone control with independent adjustment of each band through external capacitor
- Gain control through external variable resistor (Gain = ± 9 dB)
- Low noise ($V_{NO} = 4\mu V$, Typ at $f = 1\text{KHz}$, Flat)
- Low distortion (THD = 0.04% Typ. at $f = 1\text{KHz}$, Flat)
- Low current dissipation ($I_{CC} = 4\text{mA}$ Typ at $V_i = 0$)
- Operating supply voltage range: $V_{CC} = 1.6\text{V} \sim 6\text{V}$

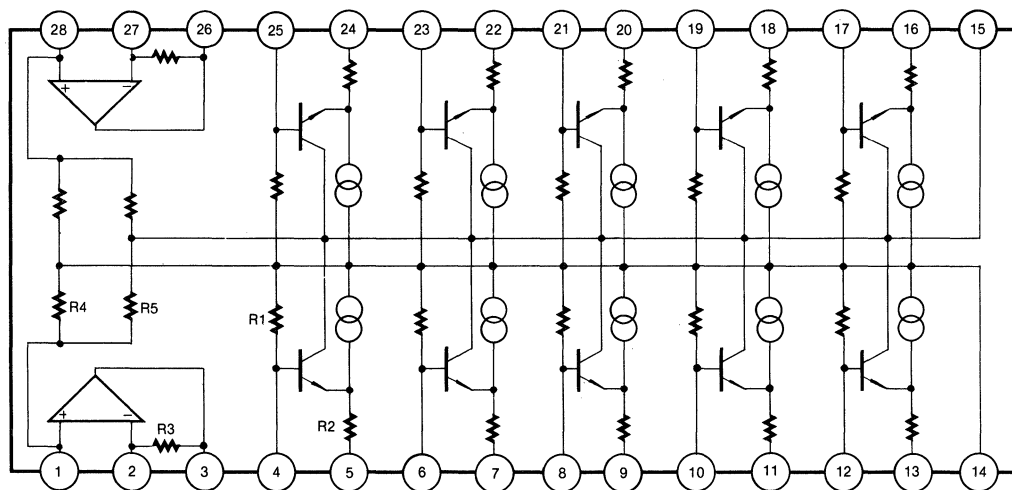
28 SOP.



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22231D	28 SOP	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM



Note: $R_1 = 68\text{K}$ $R_2 = 1.2\text{K}$ $R_3 = 4.7\text{K}$ $R_4 = 13.5\text{K}$ $R_5 = 13\text{K}$

Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

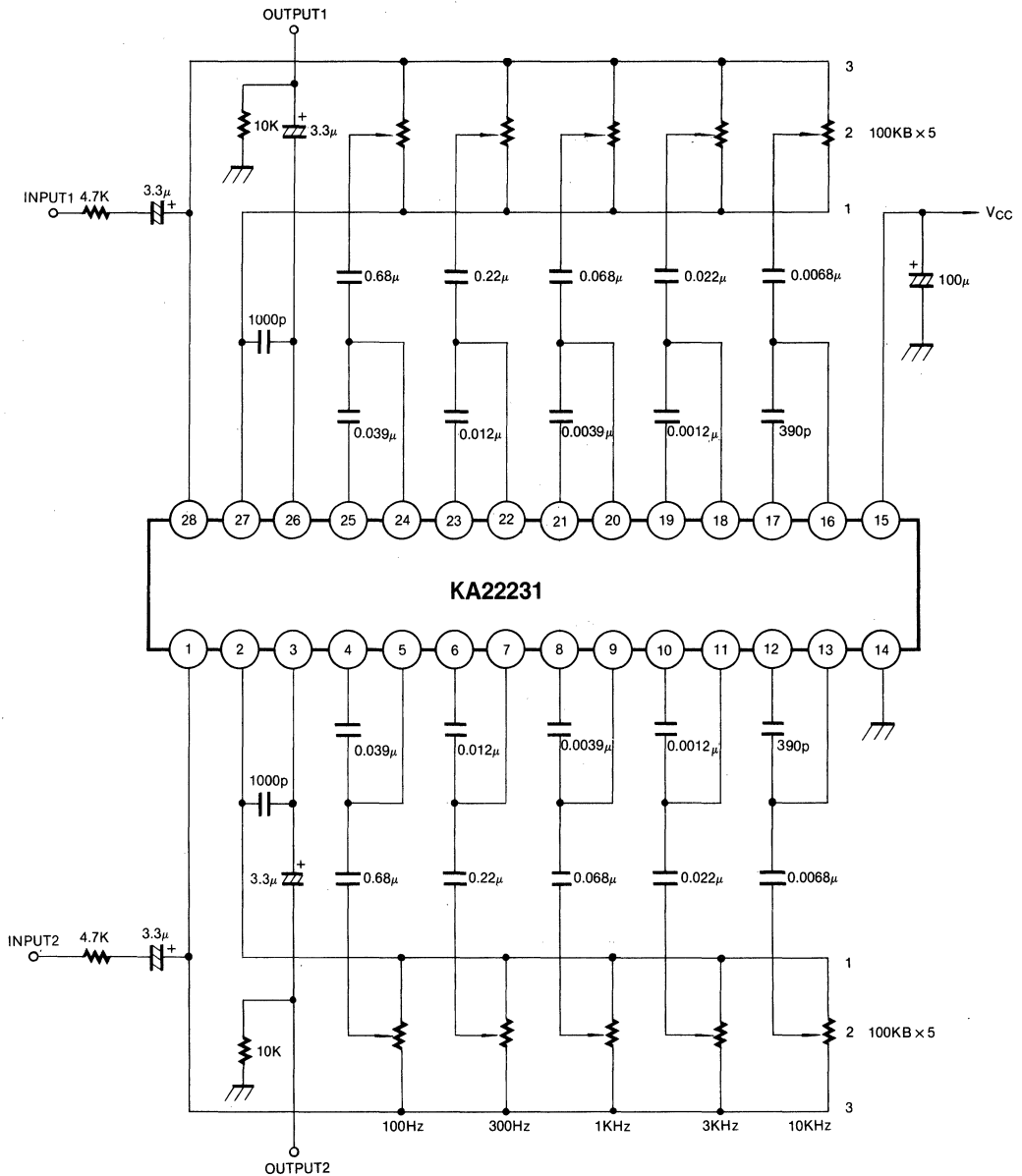
Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	8	V
Power Dissipation	P_d	300	mW
Operating Temperature	T_{opr}	- 20 ~ + 70	°C
Storage Temperature	T_{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 3V, R_L = 10K Ω , unless otherwise specified)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
			f(Hz)	Condition				
Quiescent Circuit Current		I_{CC}		$V_i = 0$	2.0	4.0	8.0	mA
Output Voltage		V_o	1K	THD = 1%	500	800		mV
Total Harmonic Distortion		THD	1K	$V_o = 300mV$		0.04	0.1	%
Channel Balance		CB	1K		- 1.0	0	1.0	dB
Cross Talk		CT	1K	$R_g = 0$	40	50		dB
Output Noise Voltage		V_{NO}	Flat, Input Short BW(- 3dB) = 10Hz ~ 30KHz			4.0	20	μV
Voltage Gain	Flat	$A_v(Flat)$	1K	$V_i = 100mV$	- 4.0	- 1.0	2.0	dB
	Boost	$A_v(Boost)$	100	$V_i = 100mV$	8.0	10.0	12.0	dB
			340					
			1K					
			3.4K					
	Cut	$A_v(Cut)$	10K	$V_i = 100mV$	- 12.0	- 10.0	- 8.0	dB
			100					
			340					
			1K					
			3.4K					
			10K					

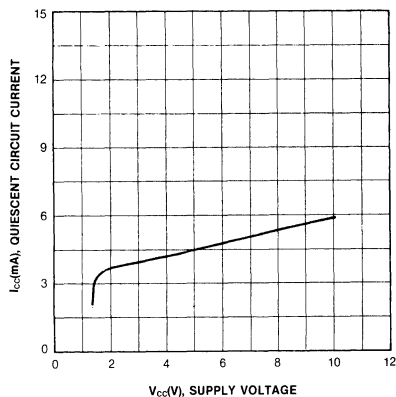
TYPICAL APPLICATION CIRCUIT



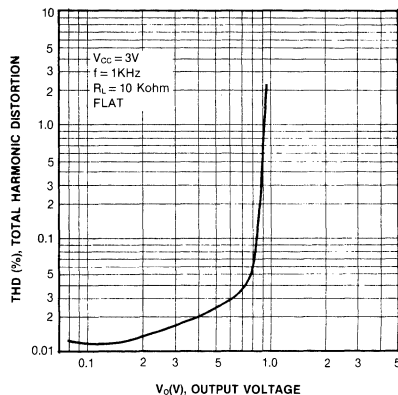
Note. Point 1: Boost, Point 2: Flat, Point 3: Cut

Fig. 2

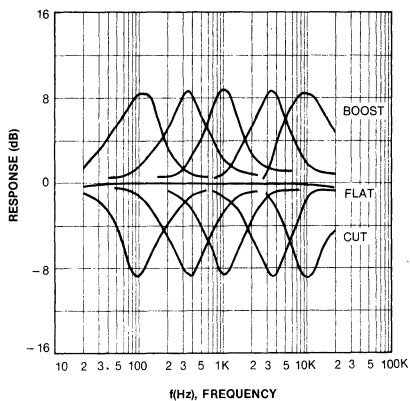
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



FREQUENCY RESPONSE



3 BAND DUAL GRAPHIC EQUALIZER AMPLIFIER

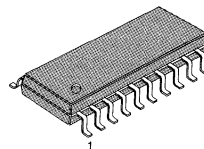
The KA22232 is a monolithic integrated circuit consisting of operational amplifier and three resonant circuit with active filter.

It is suitable for 3V headphone stereo and mini radio cassette tape recorder.

FEATURES

- Tone control with independent adjustment of each band through external capacitor
- Gain control through external variable resistor (Gain = $\pm 9\text{dB}$)
- Low noise ($V_{NO} = 4\mu\text{V}$, Typ at Flat)
- Low distortion (THD = 0.04% Typ. at $f = 1\text{KHz}$, Flat)
- Low current dissipation ($I_{CC} = 4\text{mA}$ Typ at $V_i = 0$)
- Operating supply voltage range: $V_{CC} = 1.6\text{V} \sim 6\text{V}$

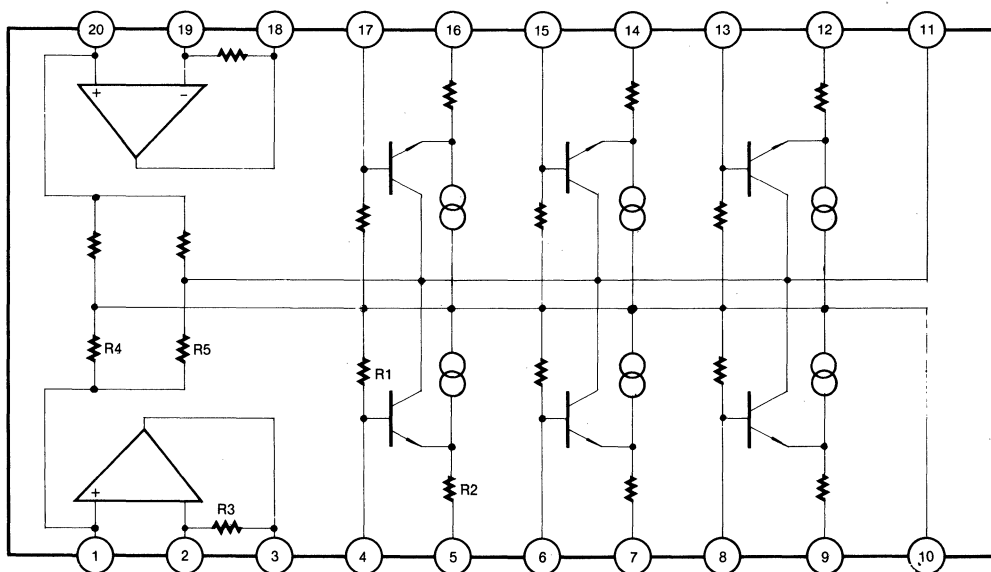
20 SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22232D	20 SOP	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM



Note: R1 = 68K R2 = 1.2K R3 = 4.7K R4 = 13.5K R5 = 13K

Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

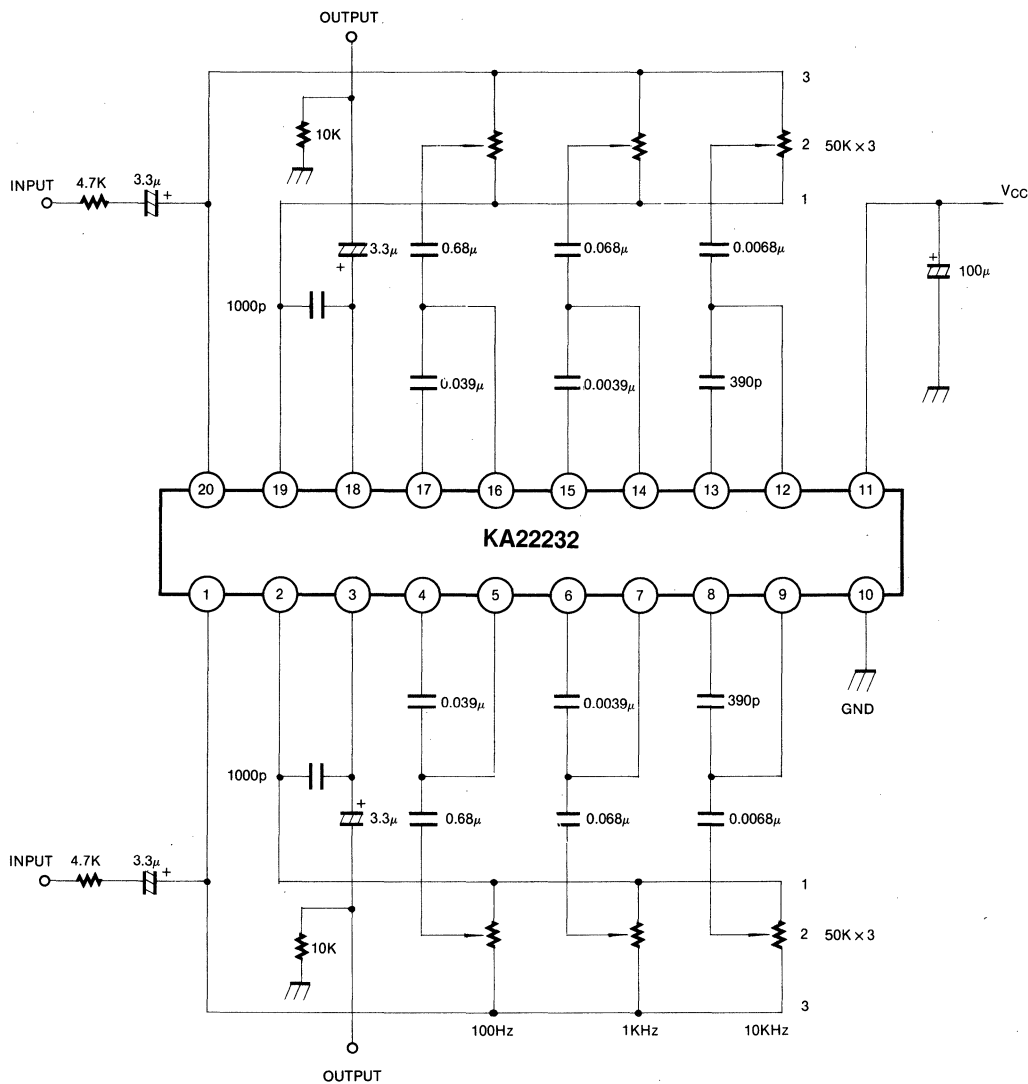
Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	8	V
Power Dissipation	P_d	300	mW
Operating Temperature	T_{opr}	- 20 ~ + 70	°C
Storage Temperature	T_{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 3V, f = 1KHz, V_i = 100mV, R_L = 10KΩ, VR = Flat, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	2	4	8	mA
Maximum Input Voltage	V_i (max)	THD = 1%	500	800		mV
Total Harmonic Distortion	THD			0.04	0.1	%
Voltage Gain	A_v		- 4	- 1	2	dB
Control Range	CR		± 7	± 9	± 11	dB
Cross Talk	CT	$R_o = 0$	40	50		dB
Channel Balance	CB		- 1	0	1	dB
Output Noise Voltage	V_{NO}	BW (- 3dB) = 20Hz ~ 20KHz		4	20	μV

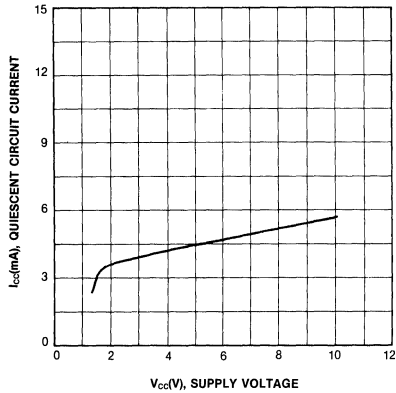
TYPICAL APPLICATION CIRCUIT



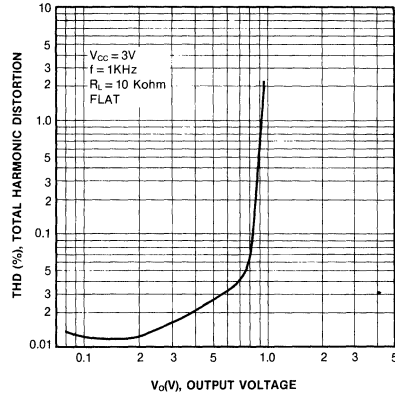
Note. Point 1: Boost,
Point 2: Flat,
Point 3: Cut

Fig. 2

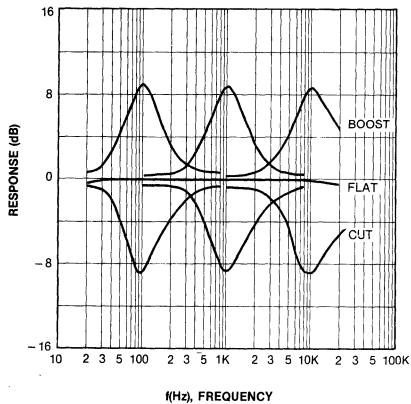
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



FREQUENCY RESPONSE



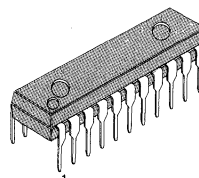
3 BAND DUAL GRAPHIC EQUALIZER AMPLIFIER

The KA22233 is a monolithic integrated circuit consisting of operational amplifier, three resonant circuit with active filter, and it is suitable for radio cassette recorder, car stereo or music center and audio system.

FEATURES

- Tone control with independent adjustment of each band through external capacitor.
- Gain control through external variable resistor.
- Increasing the bands by adding resonant circuit or using two KA22233 in series.
- Low noise ($V_{NO}=7\mu V$ Typ, at Flat).
- Low distortion (THD=0.02% Typ, at $f=1\text{KHz}$, Flat).
- Large allowable input ($V_i=2.3V$ Typ, at $V_{CC}=9V$, $f=1\text{KHz}$, Flat).
- Wide operating supply voltage range: $V_{CC}=5V \sim 15V$

22 DIP



SCHEMATIC DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22233	22 DIP	- 20 ~ + 70°C

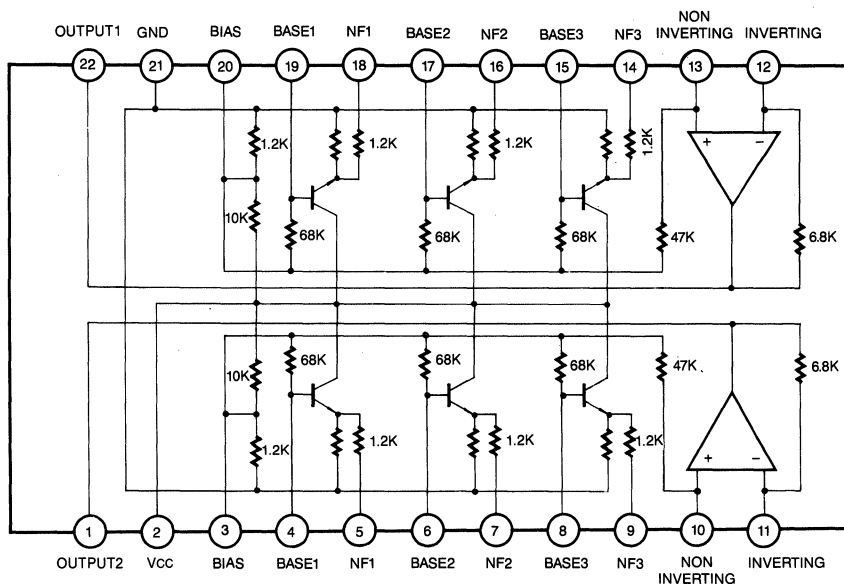


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Power Dissipation	P_d	700	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $R_g = 600\Omega$, $R_L = 10\text{K}\Omega$, unless otherwise specified)

Characteristic		Symbol	Test		Min	Typ	Max	Unit	
			f (Hz)	Conditions					
Quiescent Circuit Current		I _{CC}		V _i = 0	5.0	7.2	10.0	mA	
Voltage Gain	Flat	A _V (Flat)	1K	V _i = − 10dBm	− 2.5	− 0.5	+ 1.5	dB	
	Boost	A _V (Boost)	108	V _i = − 10dBm	10.5	12.5	14.5	dB	
			1.08K						
			10.8K						
	Cut	A _V (Cut)	108	V _i = − 10dBm	− 14.5	− 12.5	− 10.5	dB	
			1.08K						
10.8K									
Total Harmonic Distortion		THD	1K	V _i = 1V		0.02	0.1	%	
Output Noise Voltage		V _{NO}	Flat, Input Short BW(− 3dB) = 10Hz ~30KHz				7.0	30	μV
Channel Balance		CB	1K	V _i = 1V	− 2.0	0	+ 2.0	dB	
Cross Talk		CT	1K	V _i = 1V		70		dB	

APPLICATION CIRCUIT

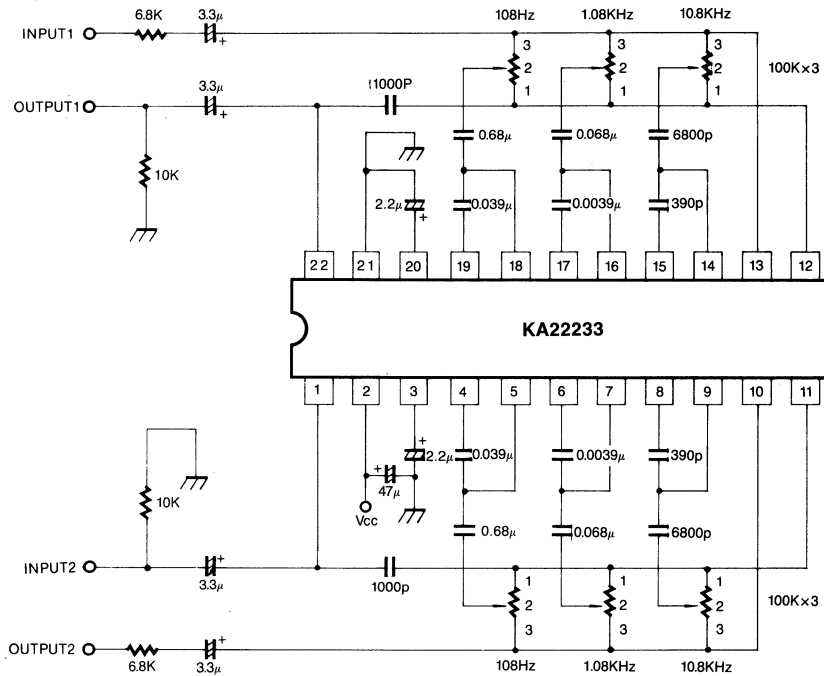
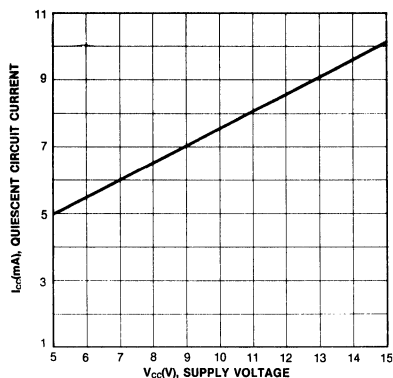


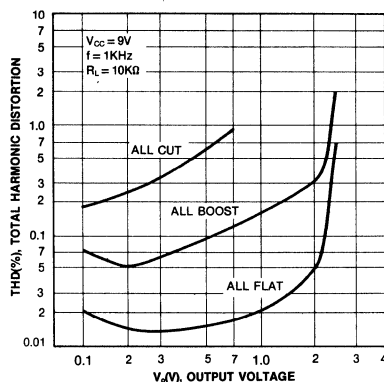
Fig. 2

Note: Volume Function
 Position 1: Boost
 Position 2: Flat
 Position 3: Cut

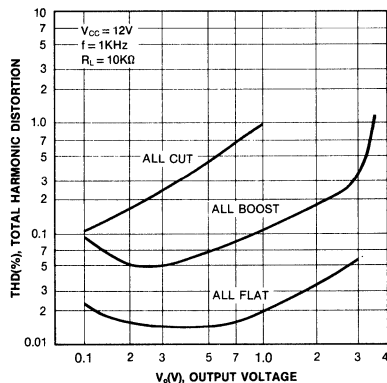
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



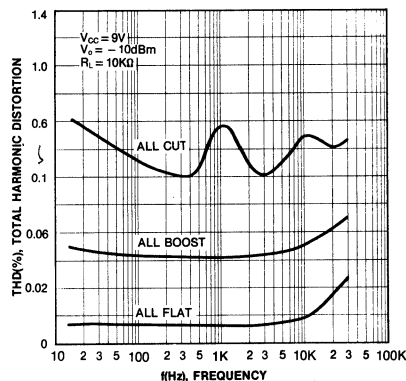
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



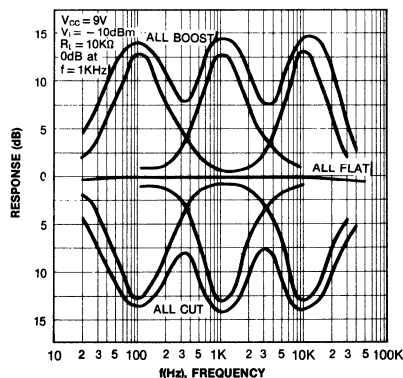
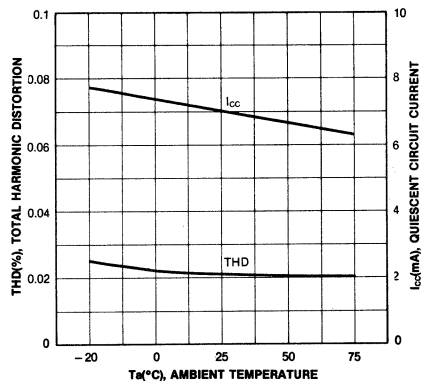
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



TOTAL HARMONIC DISTORTION-FREQUENCY



FREQUENCY RESPONSE

TOTAL HARMONIC DISTORTION-AMBIENT TEMPERATURE
QUIESCENT CIRCUIT CURRENT

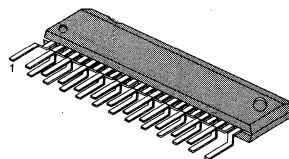
5 BAND DUAL GRAPHIC EQUALIZER AMPLIFIER

The KA22234 is a monolithic integrated circuit developed for the stereo 5 band graphic equalizer amplifier. It is consisting of operational amplifier, four resonant circuit with active filter, and it is suitable for radio cassette, car stereo or music center etc.

FEATURES

- Tone control with independent adjustment of each band through external capacitor
- Gain control through external variable resistor (Gain = $\pm 11\text{dB}$)
- Excellent cross talk characteristic (CT = 70dB Typ, at $R_g = 0$)
- Wide operating supply voltage range: $V_{CC} = 3.5\text{V} \sim 14\text{V}$

24 SZIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22234	24 SZIP	$-20 \sim +70^\circ\text{C}$

BLOCK DIAGRAM

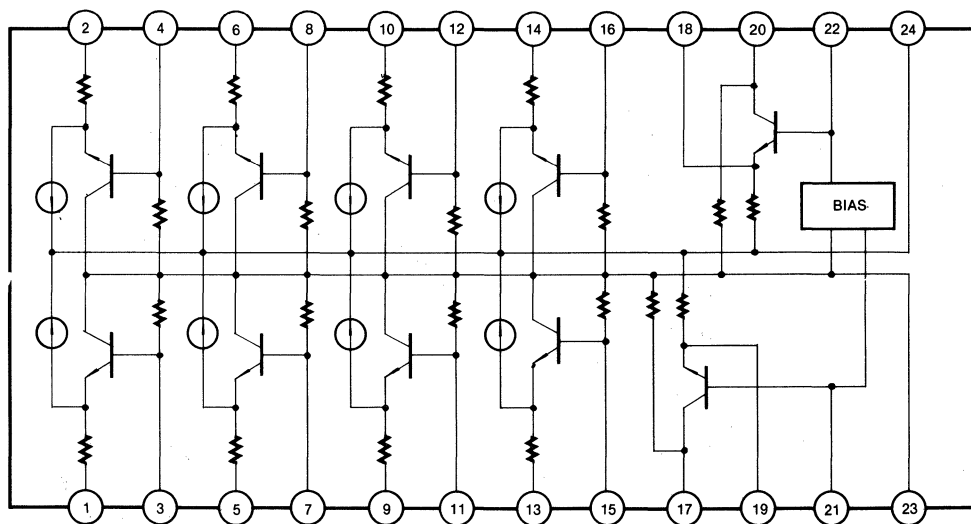


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_d	500	mW
Operating Temperature	T_{opr}	-20 ~ +70	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS(Ta = 25°C, V_{CC} = 8V, R_L = 20KΩ, Flat Mode, unless otherwise specified)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
			f(Hz)	Condition				
Quiescent Circuit Current		I_{CC}		$V_i = 0$	4.0	7.0	10.0	mA
Output Voltage		V_o	1K	THD = 1%	500	600		mV
Total Harmonic Distortion		THD	1K			0.1	0.3	%
Channel Balance		CB	1K		-1.0	0	1.0	dB
Cross Talk		CT	1K		50	70		dB
Output Noise Voltage		V_{No}	Flat, $R_g = 2.2K\Omega$ BW(-3dB) = 10Hz ~ 30KHz			10	20	μV
Voltage Gain	Flat	$A_v(Flat)$	1K	$V_i = 100mV$	-2.0	-1.5	1.0	dB
	Boost	$A_v(Boost)$	100	$V_i = 100mV$	9.0	11.0	14.0	dB
			300					
			1K					
			3K					
			10K					
	Cut	$A_v(Cut)$	100	$V_i = 100mV$	-14.0	-11.0	-9.0	dB
			300					
			1K					
			3K					
			10K					

TYPICAL APPLICATION CIRCUIT

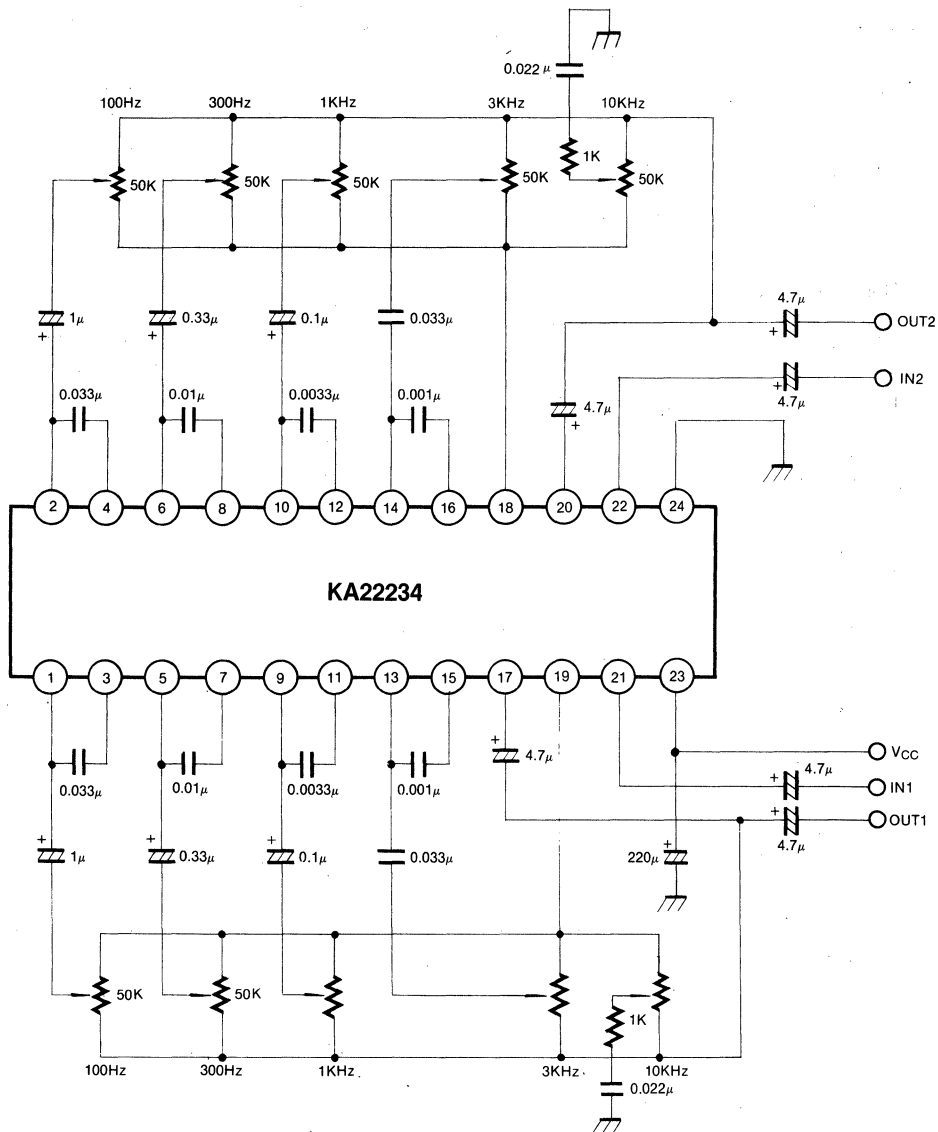
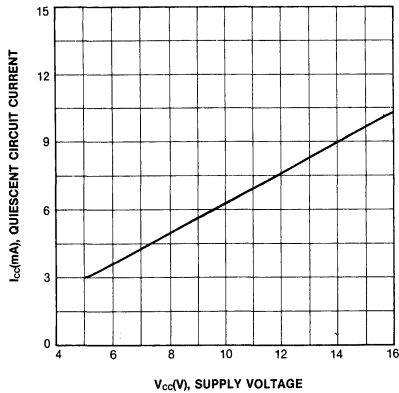
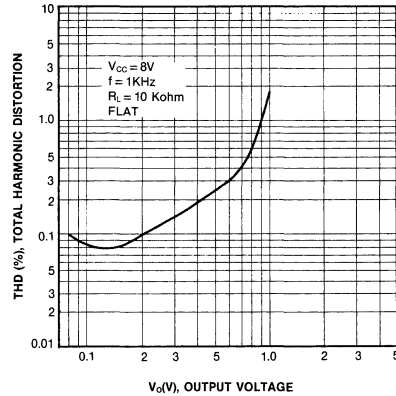


Fig. 2

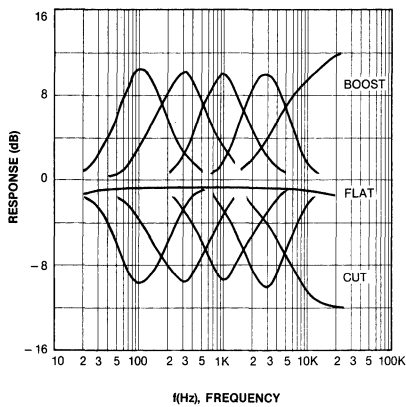
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



FREQUENCY RESPONSE



5 BAND GRAPHIC EQUALIZER AMPLIFIER

The KA22235 is a monolithic integrated circuit consisting of operational amplifier five resonant circuit with active filter, and it is suitable for radio cassette tape recorder, car stereo or music-center audio system.

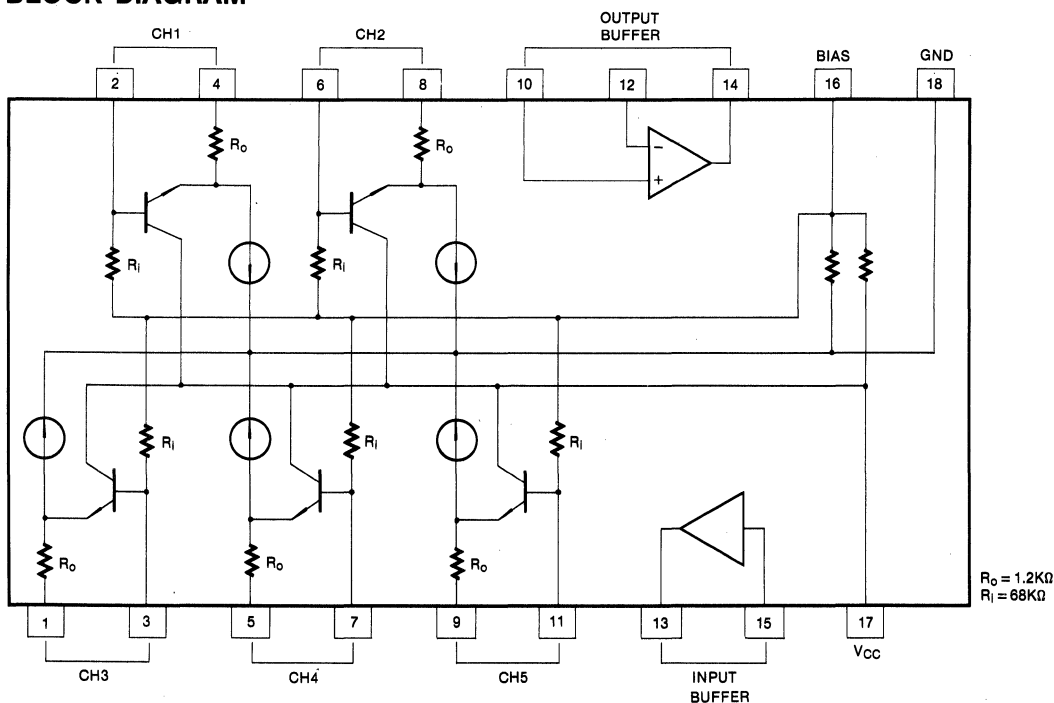
FEATURES

- Low peripheral parts.
- Low distortion (THD = 0.01% Typ. $f = 1\text{KHz}$ Flat).
- Low noise ($V_{NO} = 7\mu\text{V}$ Typ. Flat).
- Wide operating voltage range: $V_{CC} = 3.5\text{V} \sim 16\text{V}$.
- Recommended supply voltage: $V_{CC} = 5\text{V} \sim 14\text{V}$.
- Low current: $I_{CC} = 5\text{mA}$ (Typ).
- Large allowable input ($V_i = 2.1\text{V}$ Typ. $V_{CC} = 8\text{V}$, $f = 1\text{KHz}$ Flat).
- Increasing the bands by adding resonant circuit or using two KA22235 in series.
- Built in input buffer, output buffer.

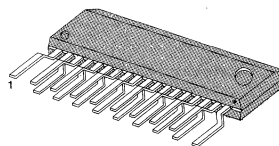
APPLICATIONS

- Radio Cassette
- Home Stereo
- Car Stereo

BLOCK DIAGRAM



18 ZIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22235	18 ZIP	$-20 \sim +70^{\circ}\text{C}$

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

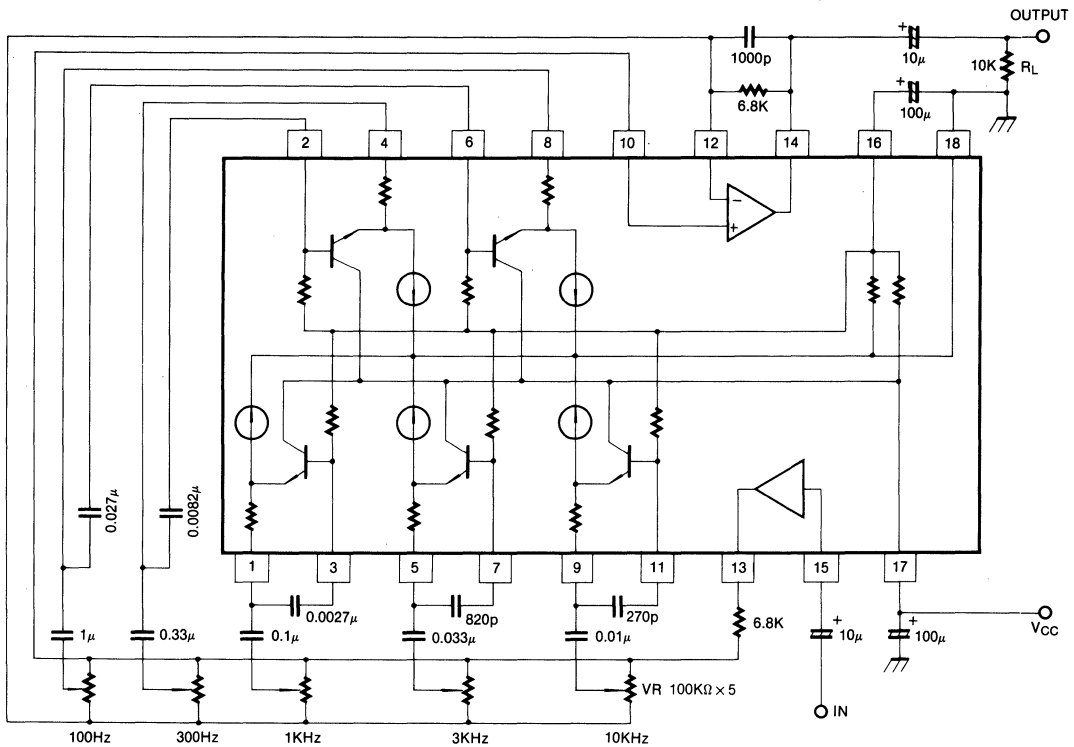
Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	16	V
Power Dissipation	P _d	550	mW
Operating Temperature	T _{opr}	- 20 ~ + 70	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 8V, unless otherwise specified)

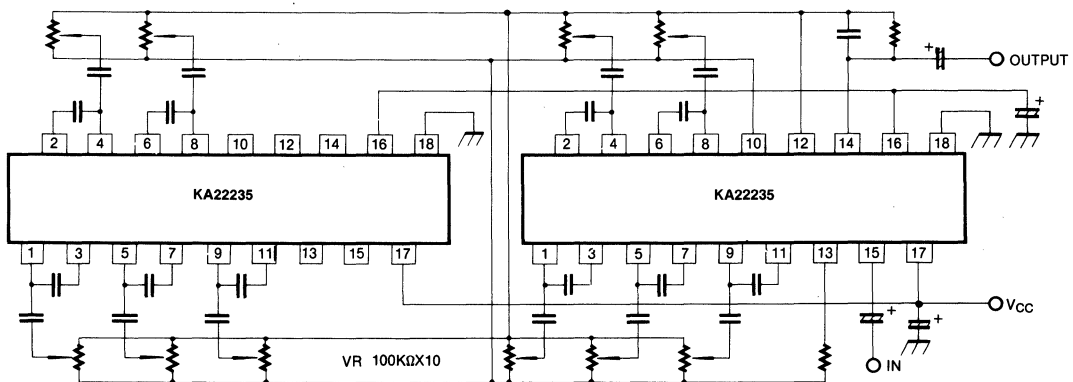
Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
			f(Hz)	Condition				
Circuit Current		I _{CC}		V _i = 0	3.0	5.0	8.0	mA
Output Voltage		V _o	1K	THD = 1%	1.5	2.1		V
Total Harmonic Distortion		THD	1K	V _o = 120mV		0.01	0.1	%
Output Noise Voltage		V _{NO}		R _g = 0, Flat BW(-3dB) = 10Hz ~ 30KHz		7.0	30	μV
Voltage Gain	Flat	A _v (Flat)	1K	V _i = 200mV	- 2.5	0.5	1.5	dB
	Boost	A _v (Boost)	100	V _i = 200mV	10.5	12.5	14.5	dB
			300					
			1K					
			3K					
			10K					
	Cut	A _v (Cut)	100	V _i = 200mV	- 14.5	- 12.5	- 10.5	dB
			300					
			1K					
			3K					
			10K					

TEST CIRCUIT



APPLICATION CIRCUIT

(1) 10 Band Graphic Equalizer



(2) 7 Band Dual Graphic Equalizer

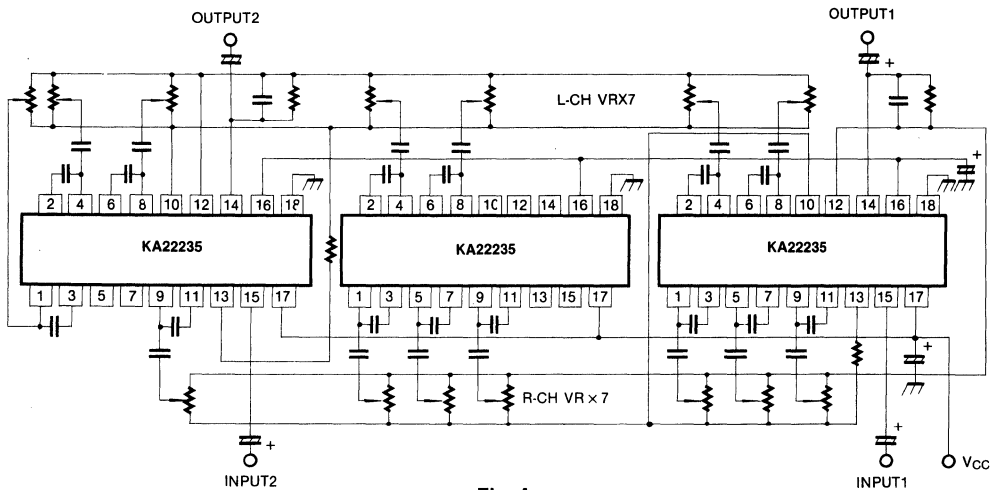


Fig. 4

SIMULATED INDUCTOR

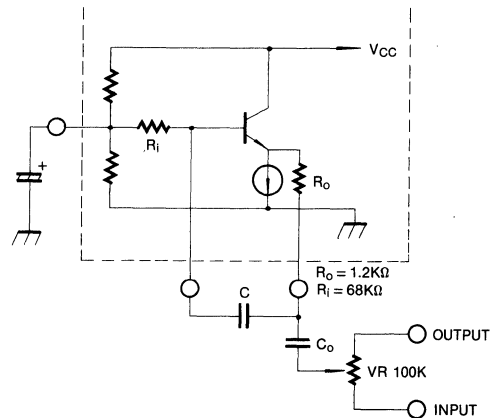


Fig. 5

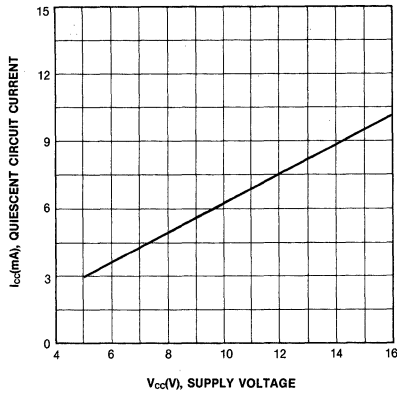
As shown in Fig. 5 resonant frequency f_o , selectivity Q are determined with external capacitor, C , C_o , built-in resistor, R , R_o , as follows.

$$f_o(\text{Hz}) = \frac{1}{2\pi\sqrt{R_o R_1 C C_o}}$$

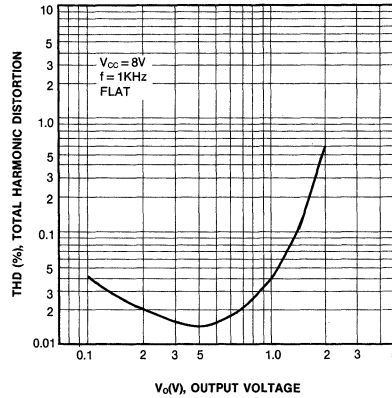
$$Q = \sqrt{\frac{C R_o}{C_o R_1}}$$

where $R_1 = 68\text{K}\Omega$, $R_o = 1.2\text{K}\Omega$

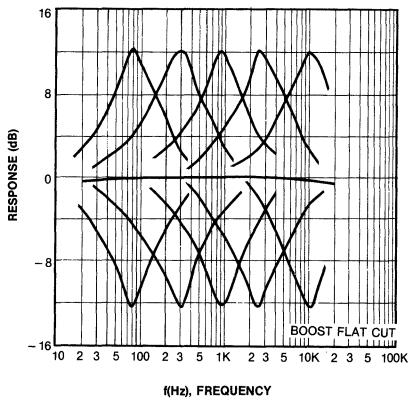
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



FREQUENCY RESPONSE



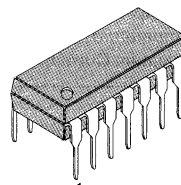
DUAL EQUALIZER AMPLIFIER WITH ALC

The KA2224 is a monolithic integrated circuit consisting of dual equalizer amplifier with ALC, and it is suitable for stereo radio cassette.

FEATURES

- Dual equalizer amplifier with built-in ALC circuit.
- Recording amp available because of high gain characteristic (Variable monitor possible).
- Good channel separation (Sep=50dB Typ).
- Quick stabilization after power on.
- Capable of direct meter driving and ALC transistor.
- Good ALC response balance between channels.
- Wide operating supply voltage range (4V ~ 13V).

14 DIP

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA2224	14 DIP	- 20 ~ + 70°C
KA2224G	PELLET	

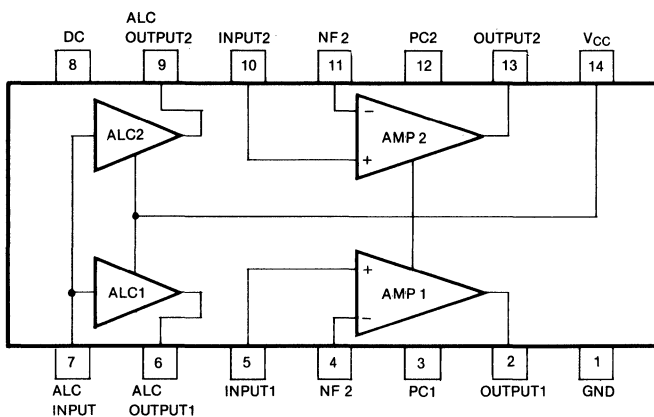
BLOCK DIAGRAM

Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

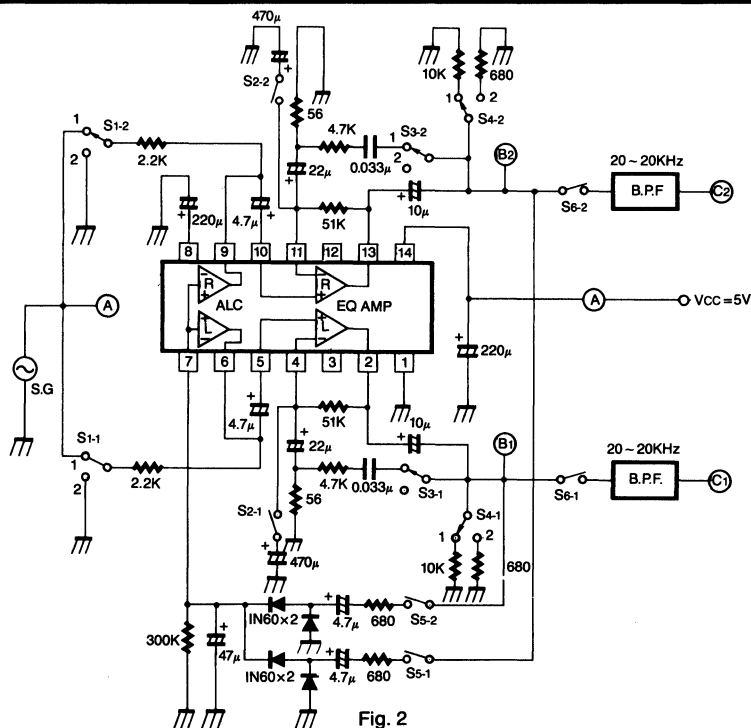
Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	14	V
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$
ALC TR Maximum Current		3.5	mA

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $R_L = 10\text{K}\Omega$, $f = 1\text{KHz}$: play, $R_L = 680\Omega$: Recording)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		4.5	10	mA
Voltage Gain (Open Loop)	A_{VO}			85		dB
Voltage Gain (Closed Loop)	A_{V1}	Play		40		dB
	A_{V2}	Record		58		dB
Output Voltage	V_O	THD=1%, Play	0.9	1.2		V
Total Harmonic Distortion	THD	$V_O = 0.5\text{V}$, Play		0.1	1.0	%
Input Resistance	R_i		21	30		$\text{K}\Omega$
Equivalent Input Noise Voltage	V_{Ni}	BW (-3dB) $= 20\text{Hz} \sim 20\text{KHz}$		1.0	2.0	μV
Cross Talk	CT	$R_g = 2.2\text{K}\Omega$	40	50		dB
ALC Range	ALC (R)	$V_i = -60\text{dBm}$, Record	35	45		dB
ALC Balance	ALC (B)	$V_i = -20\text{dBm}$, Record		0	2.0	dB
ALC Distortion	ALC (THD)	$V_i = -20\text{dBm}$, Record		0.5	2.0	%

TEST CIRCUIT



TEST METHOD

Characteristic	S1	S2	S3	S4	S5	S6	Test Point	Test Method	
I _{CC}	2	off	off	1	off	off			
A _{VO}	1	on	off	1	off	off	A, B	A _{VO} = 20 log V _O /V _i (dB) with Input voltage V _i , output voltage at V _O	
A _V	1	off	on	1	off	off	A, B	A _V = 20 log V _O /V _i (dB)	
V _O	1	off	on	1	off	off	B	Measure output voltage V _O at THD=1%	
THD	1	off	on	1	off	off	B	Measure distortion factor at V _O = 0.5V	
CT	S1-1 1 2	S1-2 2 1	off	on	1	off	off	B	Measure crosstalk of amp 1,2 at output voltage V _O = 0 dBm
V _{NI}	2	off	on	1	off	on	C	Convert output noise voltage at 1KHz gain when R _g = 2.2KΩ	
ALC Range	1	off	off	2	on	off	B	Input voltage range from when input voltage V _i = -60dBm until output voltage V _O goes up 3 dB.	
ALC Balance	1	off	off	2	on	off	B	Output voltage V _O level difference of amp 1, 2 when input voltage V _i = -20dBm is applied.	
ALC Distortion	1	off	off	2	on	off	B	Measure distortion factor when input voltage V _i = -20dBm is applied.	

TYPICAL APPLICATION CIRCUIT

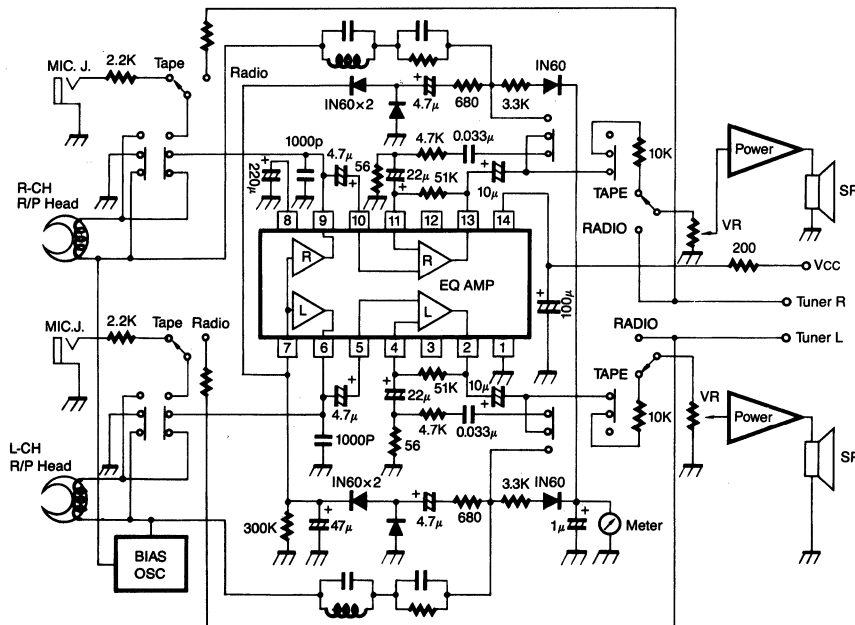


Fig.3

GENERAL OPERATING CONSIDERATIONS

1. Closed loop voltage gain

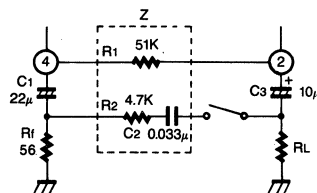


Fig. 4

SW on: play
off: record

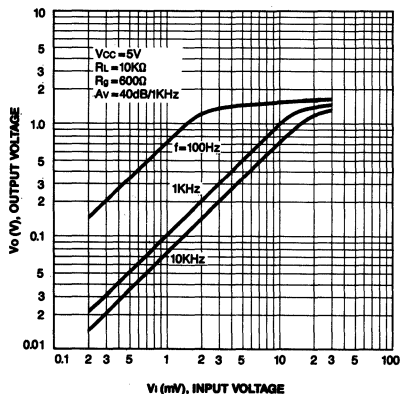
A. Playback amplifier

$$A_v = 20 \log \frac{Z}{R_f} \text{ (dB) at } f=1\text{KHz, } A_v=42\text{dB (Typ)} \quad Z = R_1 // (R_2 + \frac{1}{2\pi f C_2})$$

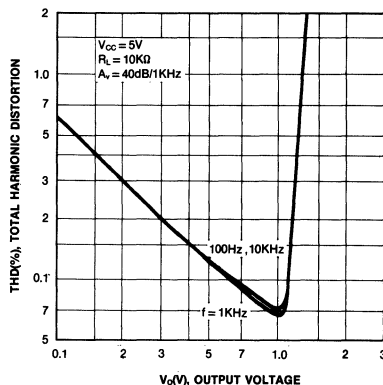
B. Recording amplifier

$$A_v = 20 \log \frac{R_1}{R_f} \text{ (dB) at } f=1\text{KHz, } A_v=58\text{dB (Typ)}$$

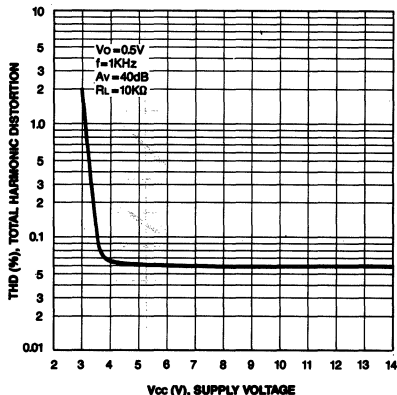
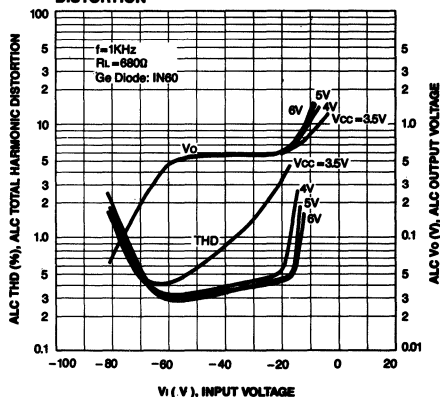
OUTPUT VOLTAGE-INPUT VOLTAGE



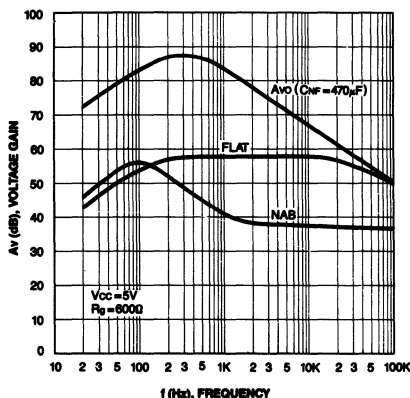
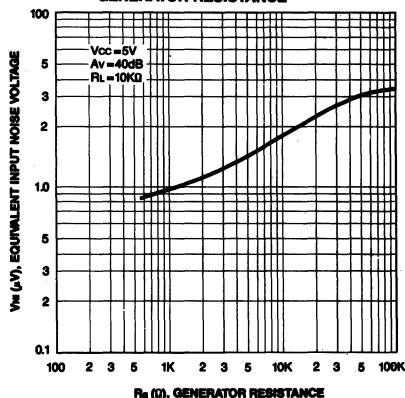
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



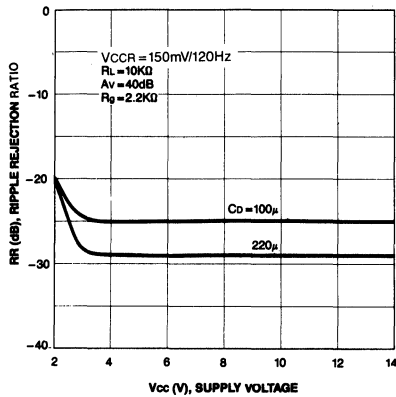
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE

ALC OUTPUT VOLTAGE
ALC TOTAL HARMONIC DISTORTION

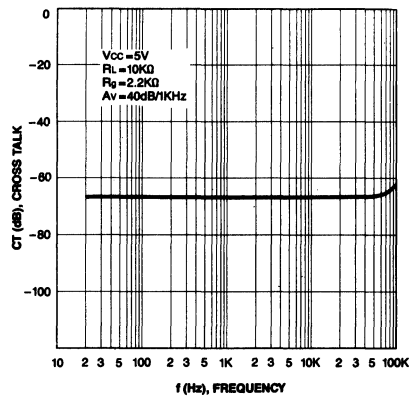
VOLTAGE GAIN-FREQUENCY

EQUIVALENT INPUT NOISE VOLTAGE
-GENERATOR RESISTANCE

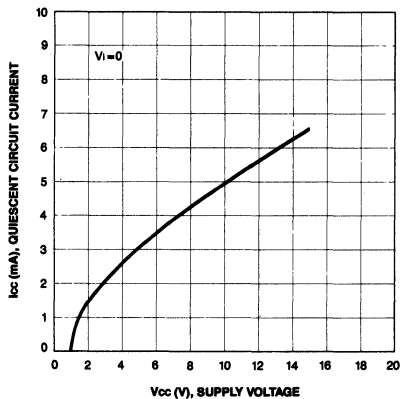
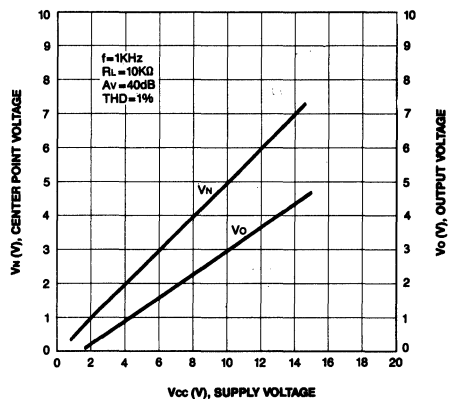
RIPPLE REJECTION RATIO-SUPPLY VOLTAGE



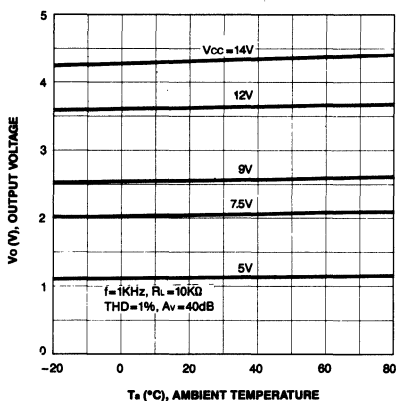
CROSS TALK-FREQUENCY



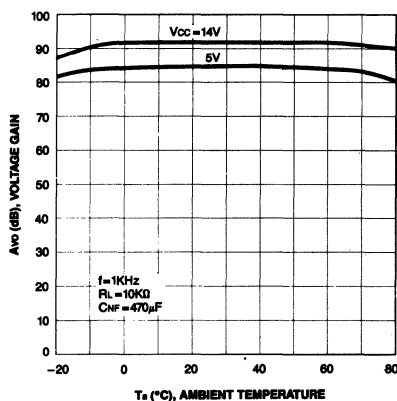
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE

CENTER POINT VOLTAGE, -SUPPLY VOLTAGE
OUTPUT VOLTAGE

OUTPUT VOLTAGE-AMBIENT TEMPERATURE



VOLTAGE GAIN-AMBIENT TEMPERATURE



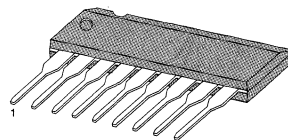
DUAL EQUALIZER AMPLIFIER WITH ALC

The KA22241 is a monolithic integrated circuit consisting of dual equalizer amplifier with ALC, and it is suitable for stereo radio cassette tape recorder.

FEATURES

- Dual equalizer amplifier with built in ALC circuit
- Low noise; $V_{NI} = 1.0\mu V$ (Typ)
- High open loop voltage gain; 80 dB (Typ)
- Wide operating supply voltage range; $V_{CC} = 4.5V \sim 14V$
- Good ALC response balance between channels
- Non necessary the input coupling capacitor
- Non necessary diode or transistor for ALC
- Built in power supply muting circuit
- Minimum number of external parts required

9 SIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22241	9 SIP	$-20 \sim +75^{\circ}C$

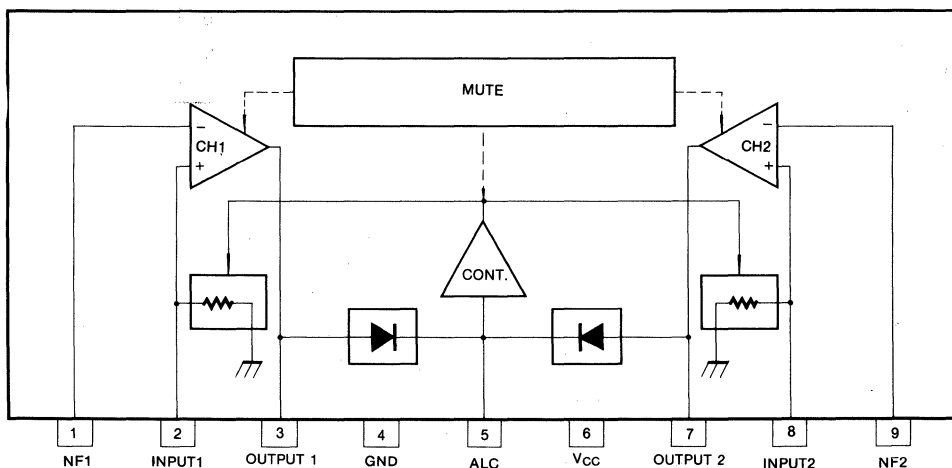


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Power Dissipation	P_d	*550	mW
Operating Temperature	T_{opr}	- 20 ~ + 75	°C
Storage Temperature	T_{stg}	- 40 ~ + 125	°C

* : Derated above Ta = 25°C in the proportion of 5.5mW/°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 7V, f = 1KHz, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	1.5	3.5	4.5	mA
Open Loop Voltage Gain	A_{VO}	$V_o = 0.3V$	70	80		dB
Closed Loop Voltage Gain	A_V	$V_o = 0.3V$	45	48	50	dB
Output Voltage	V_o	THD = 1%	0.6	1.2		V
Total Harmonic Distortion	THD	$V_o = 0.3V$		0.1	0.3	%
Equivalent Input Noise Voltage	V_{NI}	$R_g = 2.2K\Omega$, BW(- 3dB) = 20Hz ~ 20KHz		1.0	2.0	μV
Input Resistance	R_i		15	25	45	K Ω
ALC Range	ALC(R)	$R_g = 3.9K$, THD = 10%	40	45		dB
ALC Balance	ALC(B)	$V_i = 1mV$		0	2.5	dB

TEST CIRCUIT

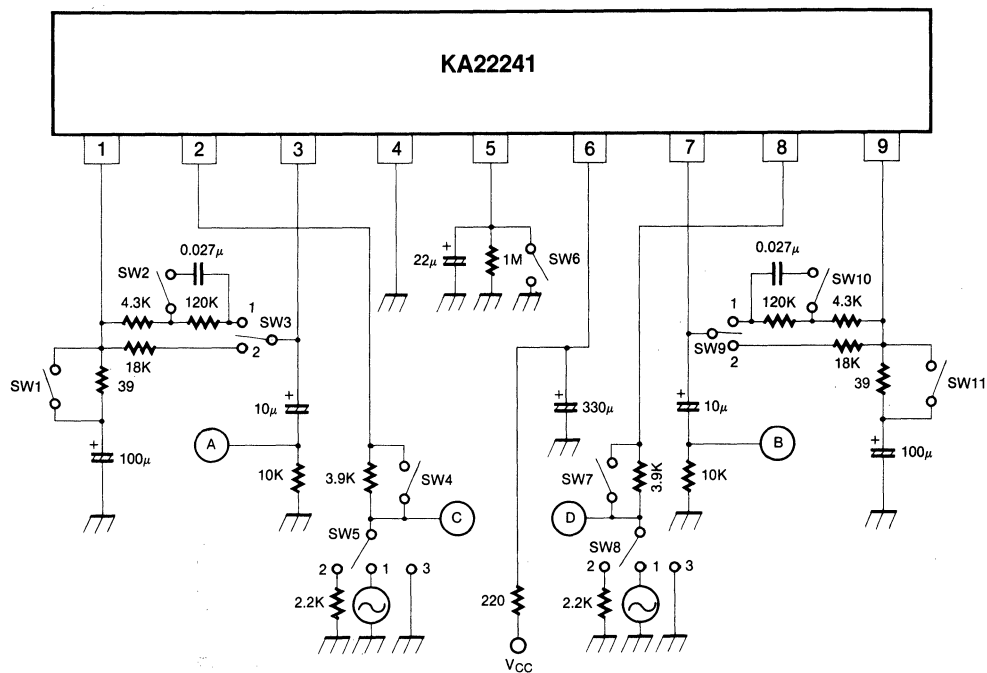


Fig. 2

TEST METHOD

Symbol		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
I_{CC}		ON	OFF	1	ON	3	ON	ON	3	1	OFF	ON
A_{vo}		ON	OFF	1	ON	1	ON	ON	3	1	OFF	ON
A_v	CH-1	OFF	ON	1	ON	1	ON	ON	3	1	OFF	ON
THD	CH-1	OFF	ON	1	ON	1	ON	ON	3	1	OFF	ON
V_o	CH-1	OFF	ON	1	ON	1	ON	ON	3	1	OFF	ON
V_{NI}	CH-1	OFF	ON	1	ON	2	ON	ON	3	1	OFF	ON
	CH-2	ON	OFF	1	ON	3	ON	ON	2	1	ON	OFF
ALC(R)	CH-1	OFF	OFF	2	OFF	1	OFF	ON	3	1	OFF	ON
ALC(B)		OFF	OFF	2	OFF	1	OFF	OFF	1	2	OFF	OFF

APPLICATION CIRCUIT 1

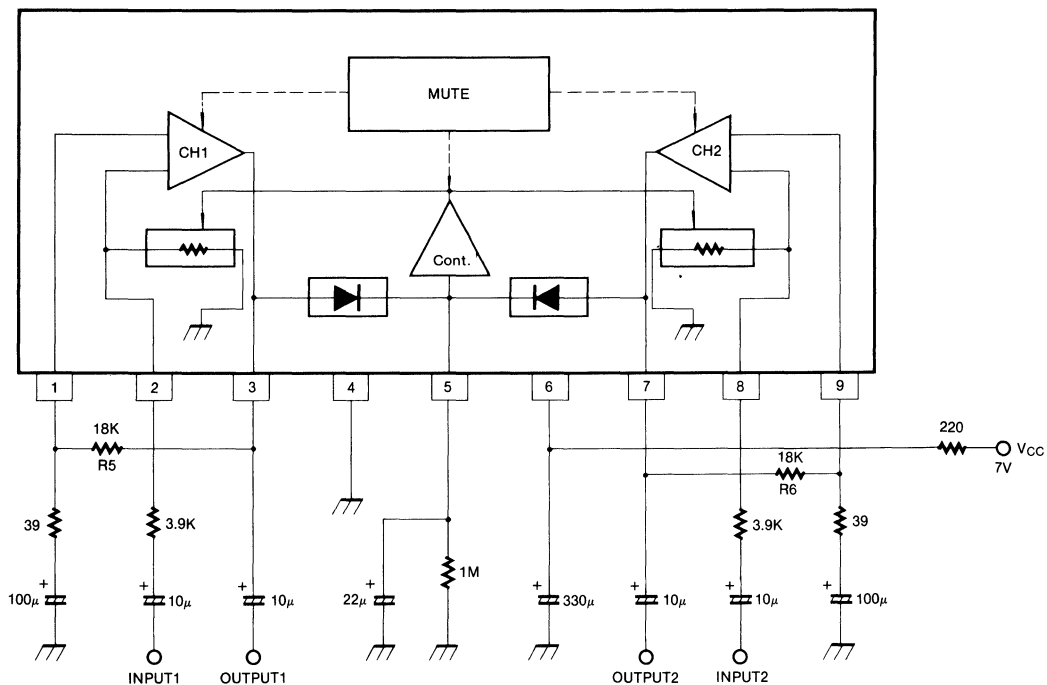
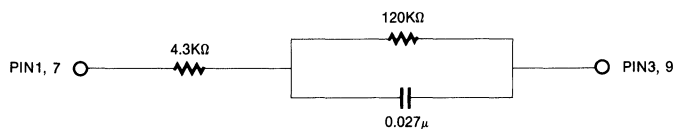


Fig. 3

NOTE

ON recording, connect the time constant circuit as shown below, instead of R5, R6 of pin 1-3, 7-9, which is used in NAB.



APPLICATION CIRCUIT 2

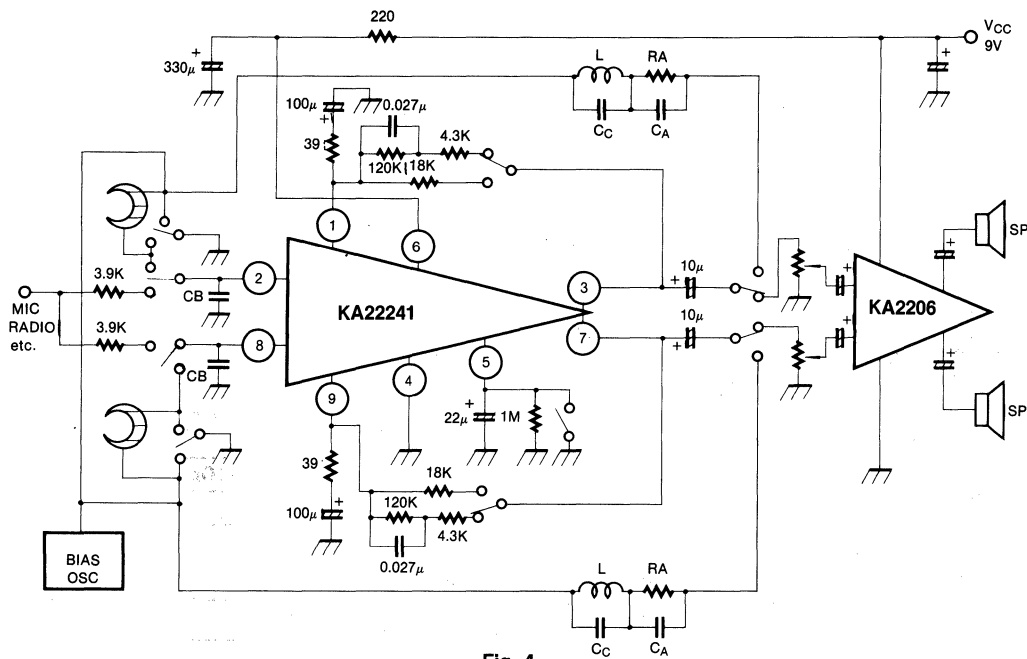


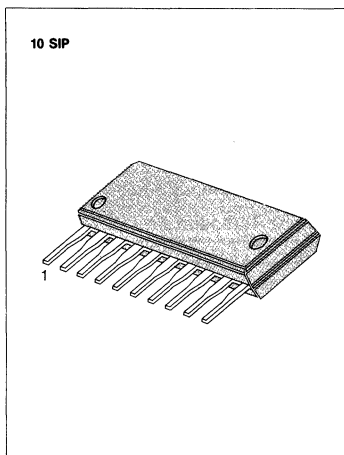
Fig. 4

DUAL EQUALIZER PRE-AMPLIFIER WITH ALC

The KA22242 is a monolithic integrated circuit consisting of dual equalizer amplifier with ALC and Mute function, and it is suitable for stereo radio cassette tape recorder.

FEATURES

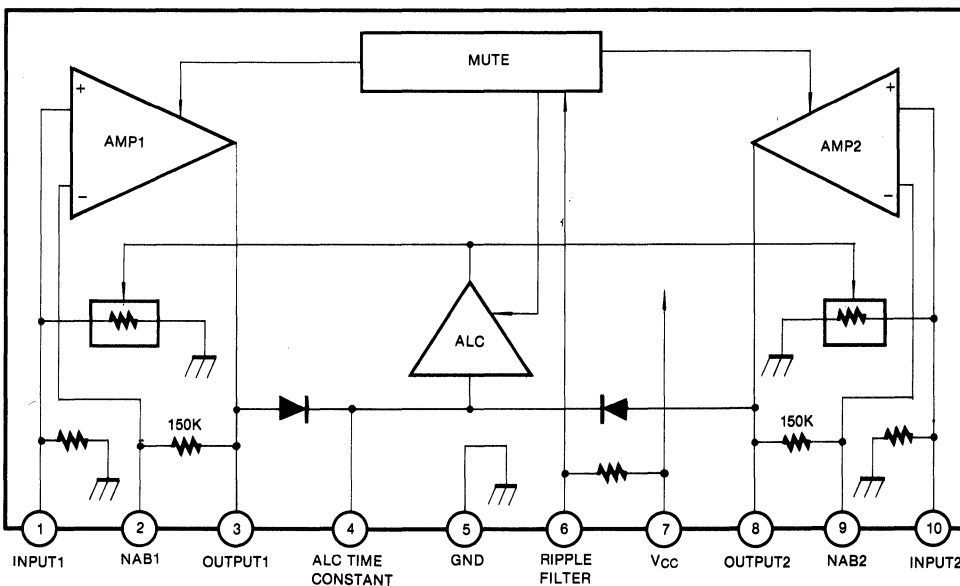
- Dual equalizer amplifier with ALC circuit
- Direct coupling system of input circuit
- High open loop voltage gain ($A_{VO} = 85\text{dB}$ at $f = 1\text{KHz}$)
- Wide operating supply voltage range ($V_{CC} = 4 \sim 12\text{V}$)
- Low noise ($V_{NI} = 1.0\mu\text{V}$ at $R_g = 2.2\text{K}\Omega$)
- Ripple rejection filter
- High input impedance ($Z_{IN} = 62\text{K}\Omega$)



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22242	10 SIP	$-20 \sim +75^\circ\text{C}$

BLOCK DIAGRAM



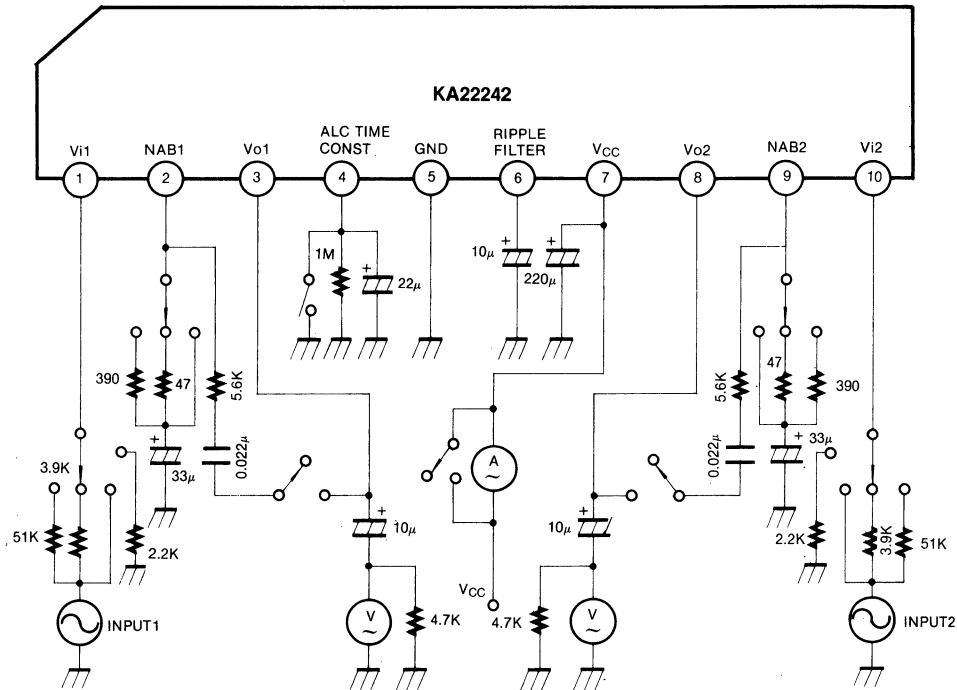
ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	14	V
Power Dissipation	P_d	550	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

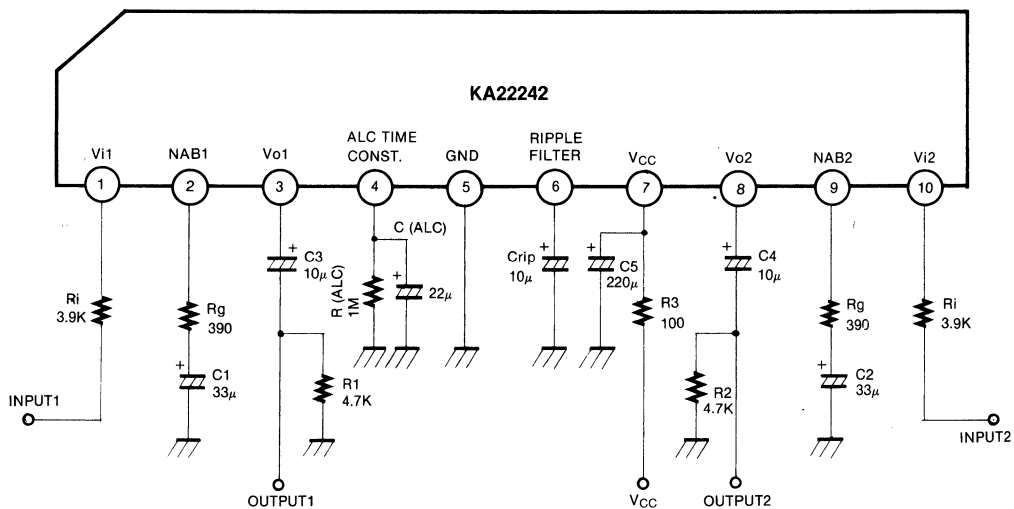
ELECTRICAL CHARACTERISTIC($T_a = 25^\circ\text{C}$, $V_{CC} = 8\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Current	I_{CC}		2.5	3.3	4.0	mA
Open-loop Voltage Gain	G_{VO}	$V_O = 1\text{V}$	75	85		dB
Total Harmonic Distortion	THD	$V_O = 0.3\text{V}$		0.5	1.0	%
Max Output Voltage	V_{OM}	THD = 1%	1.9	2.2		V
Equivalent Input Noise Voltage	V_{NI}	$R_g = 2.2\text{K}\Omega$		1.0	2.5	$\text{K}\Omega$
Input Impedance	Z_{IN}			62		$\text{K}\Omega$
Channel Cross Talk	CT	$R_g = 2.2\text{K}\Omega$, $V_O = 1\text{V}$	45	55		dB
ALC Range	ALC(R)	$V_i = -52\text{dBm}$, 3dB up	40	45		dB
ALC Balance	ALC(B)	$V_i = -45\text{dB}$		0.0	2.0	dB
ALC Distortion	THD(ALC)	$V_i = -45\text{dB}$		0.2	0.6	%
ALC Output Voltage	$V_O(\text{ALC})$	$V_i = -45\text{dB}$	0.6	0.7	0.85	V

TEST CIRCUIT



APPLICATION CIRCUIT



DESCRIPTION OF KA22242

The KA22242 is a simple package, 10-pin and built-in ALC detector, mute circuit and ripple rejection filter developed for cassette tape recorders. To provide stereo function, it is developed into 2-channel pre-amplifier for recording and playback. Also to provide high speed dubbing and recording gain, its gain is high ($f = 1\text{KHz}$, $G_{VO} = 85\text{dB}$) and total harmonic distortion is low ($f = 1\text{KHz}$, $\text{THD} = 0.5\%$). Input circuit is used a direct coupling system to eliminate the input coupling capacitor and prevent tape head magnetization and pop noise. It is built-in ripple circuit (ripple rejection transistor) to improve the ripple rejection ratio. And ALC circuit can achieve a wide dynamic range by attaching simply a time-constant circuit.

APPLICATION DESCRIPTION

1. Playback Amplifier

To use the playback mode, KA22242 can be application for an NAB equalizer amplifier. The NAB characteristic is obtained by installing a NAB circuit in the Negative Feedback section (between pin 2 and 3). In this case, pin 4 is connected with GND to eliminate the ALC effect.

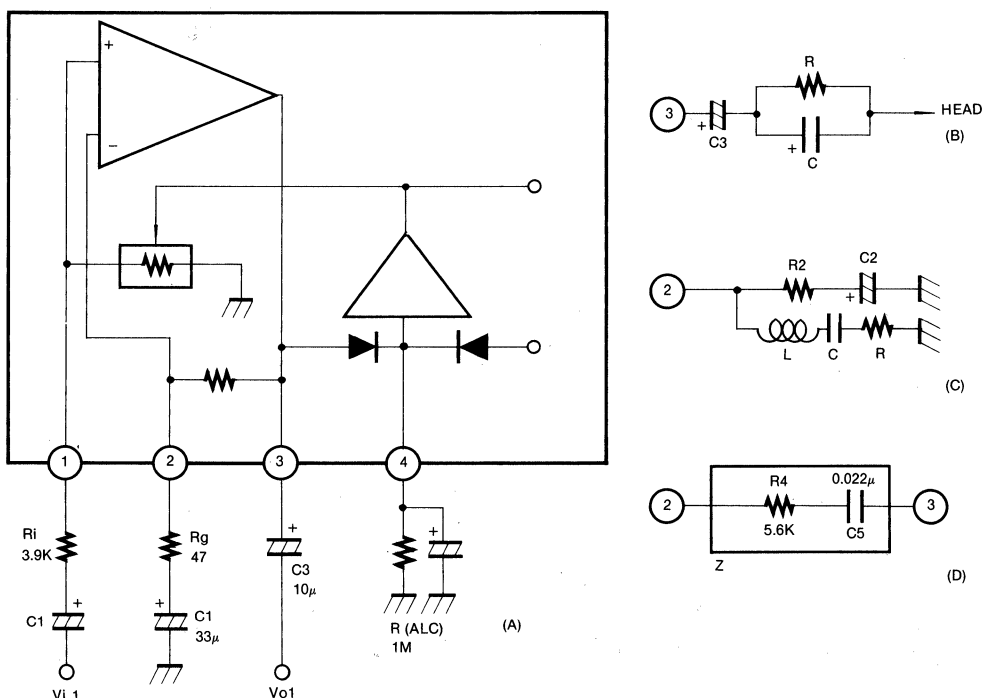


Fig. 1

2. Recording Amplifier (Figure 1 (A))

The recording amplifier's voltage gain is determined by the ratio of the internal $150\text{K}\Omega$ to R_2

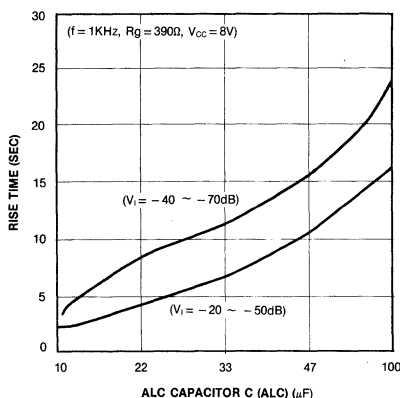
$$G_V = 150\text{K}\Omega / R_2$$

The recording amplifier requires a compensation circuit to correct loss at high frequencies. The compensation circuit may be either CR or LC resonance. Frequency response of resonance circuit is fixed at $1 \sim 4\text{KHz}$. An example using CR is shown in Figure 1(B), and one using LC resonance in Figure 1(C).

2. ALC Circuit

For the dynamic range, the ALC circuit uses the simple time-constant circuit. ALC operation of KA22242 is accomplished with signal rectifier and electronic volume control. The signal rectifier uses the comparator circuit and the comparator circuit compares the DC voltage of output signal with the reference voltage. If the output voltage is higher than the reference voltage, the comparator turns on to charge smoothing capacitor C_4 .

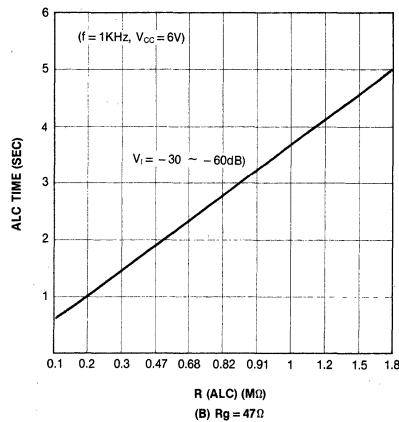
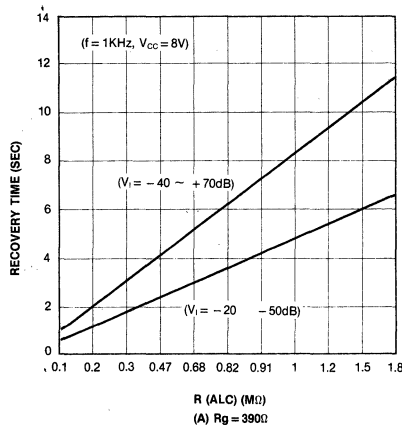
For the dynamic range, a turn-off level ($0.7V_{\text{rms}}$) + 6dB is ensured at $V_{\text{CC}} = 6\text{V}$. When the peak voltage of output signal is $0.7V_{\text{rms}}$, the comparator comes on and the electronic volume control is connected between the input line and GND. The input signal is attenuated by the ratio of the external resistance R_1 to the electronic volume control resistance and ALC circuit is operated. The ALC range can be varied by changing R_1 . If R_1 is too large, the S/N ratio may degrade, so several Kohm is proper. The ALC attack time and recovery time are set at pin 4 by C_4 and R_3 . Note that the greater the time constant (C_4, R_3), the longer the recovery time, and the greater C_4 , the shorter the attack time.



Especially, Figure 2 is a ALC Time graph of KA22242 at $R_2 = 390\Omega$.

At $R_2 = 390\Omega$, $V_i = -40\text{dB}$,

ALC Recovery time is about 8 sec and when the ALC capacitor is increased, it is increased also. And it can be adjusted to fix the design point. But as the recovery time varies by input level, it must be considered the value of this capacitor when designs the set.



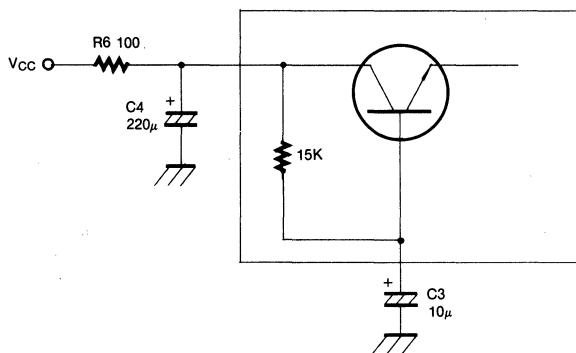
As the Figure 3, because R_g range is 47 ~ 100 ohm normally at the set application, there is considered the matching between R_3 and C_4 .

4. Mute Function

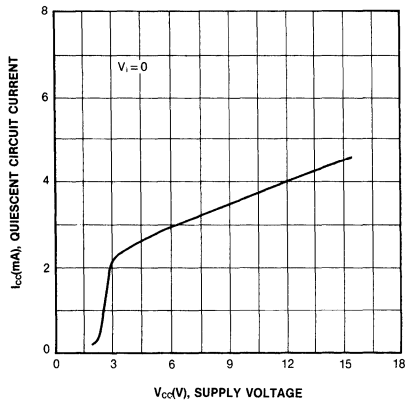
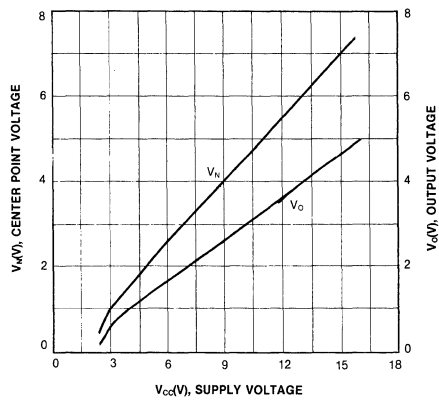
KA22242 has a mute function to mute at the power switch on/off. To prevent the malfunction of ALC circuit, KA22242 is muted at this time. If ALC is not muted, the supply voltage charges the ALC capacitor and there is generated error-operations. The muting time is varied by the time-constant of the ripple filter.

$C_3 \cdot R$ internal (15K)

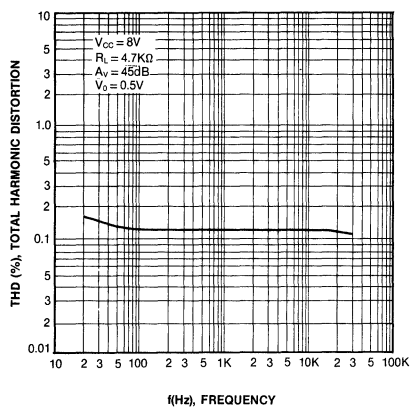
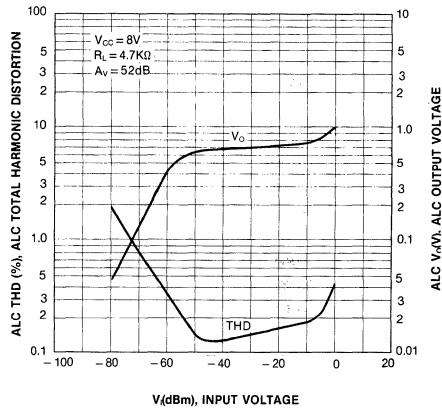
If C_3 is too large, the rise time becomes too slowly and pop noise occurs when other IC begins to operate faster than KA22242 in some application circuit. In this case, if the combination with resistance is about 1Kohm, the DC voltage (V_{ODC}) at the output terminal is nearly constant.



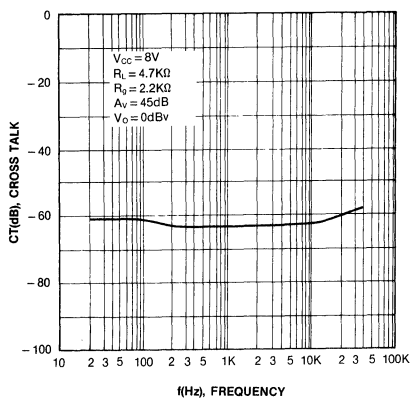
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE

CENTER POINT VOLTAGE
OUTPUT VOLTAGE-SUPPLY VOLTAGE

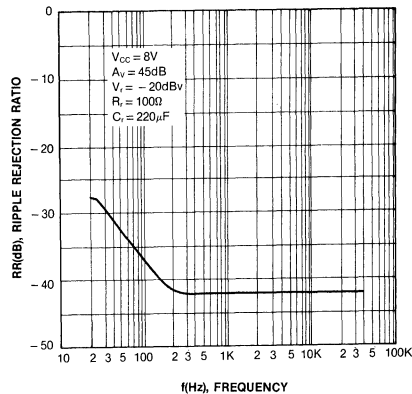
TOTAL HARMONIC DISTORTION-FREQUENCY

ALC OUTPUT VOLTAGE ALC TOTAL
HARMONIC DISTORTION-INPUT VOLTAGE

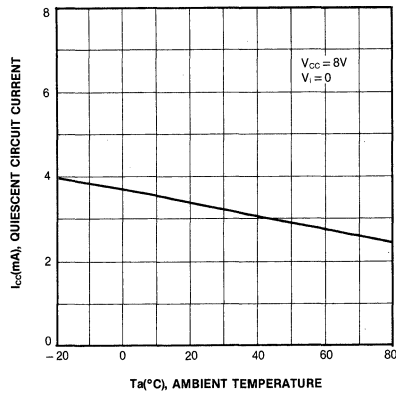
CROSS TALK-FREQUENCY



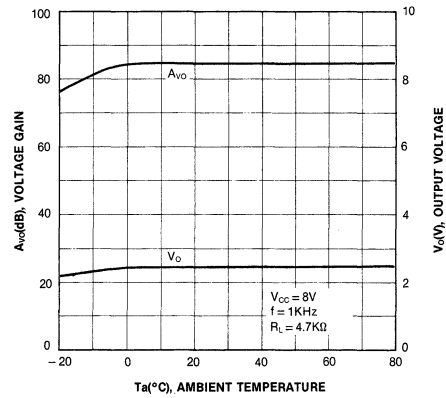
RIPPLE REJECTION RATIO-FREQUENCY



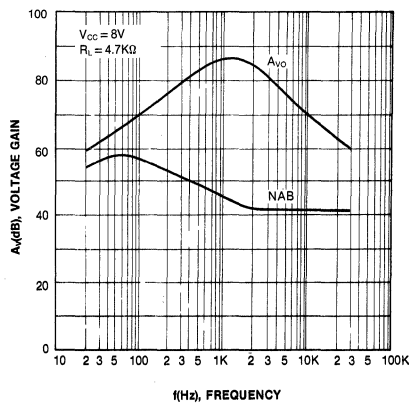
QUIESCENT CIRCUIT
CURRENT-AMBIENT TEMPERATURE



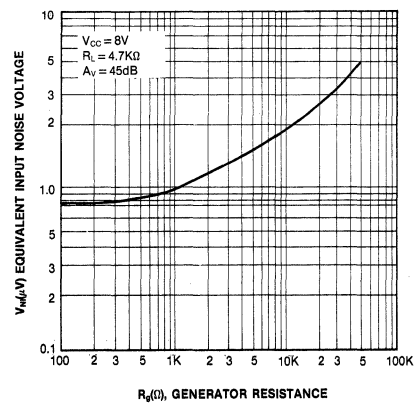
VOLTAGE GAIN OUTPUT
VOLTAGE-AMBIENT TEMPERATURE



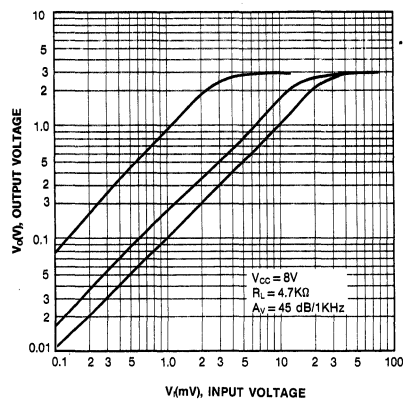
VOLTAGE GAIN-FREQUENCY



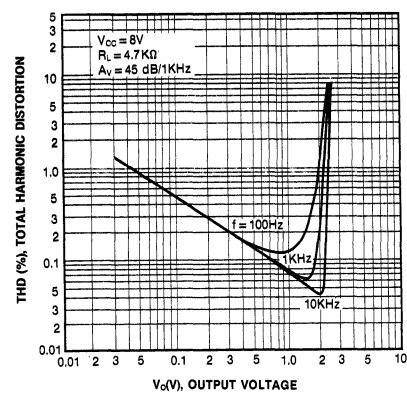
EQUIVALENT INPUT NOISE
VOLTAGE-GENERATOR RESISTANCE



OUTPUT VOLTAGE-INPUT VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE

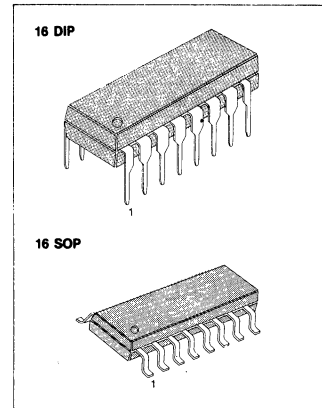


DUAL PREAMPLIFIER FOR 3V USING

The KA2225 is a monolithic integrated circuit consisting of dual equalizer amplifier, and it is suitable for 3V stereo radio cassette.

FEATURES

- High open loop gain: 85dB (Typ) ($V_{CC}=3V$, $f=1kHz$).
- Non-necessary the input coupling capacitors.
- Operating supply voltage range: $V_{CC}=1.6V \sim 5V$.
- Good channel separation: 60dB (Typ).



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2225	16 DIP	- 20 ~ + 70°C
KA2225D	16 SOP	

BLOCK DIAGRAM

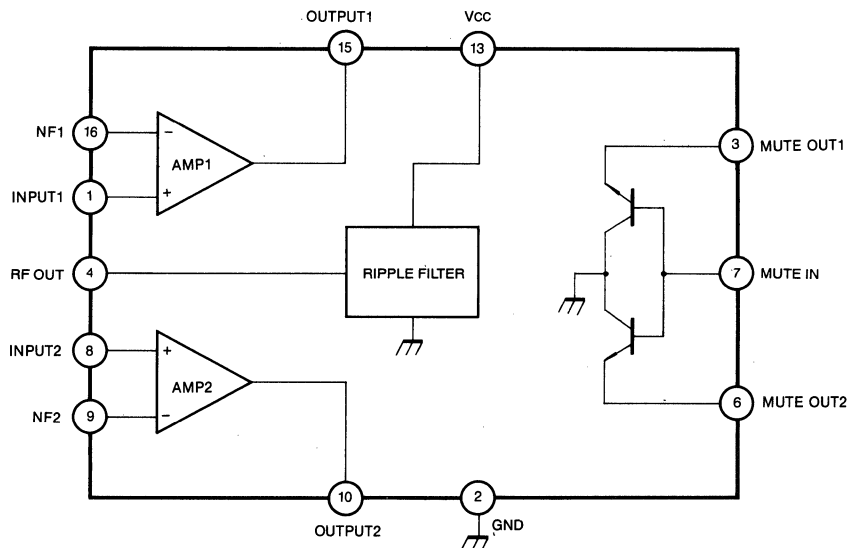


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

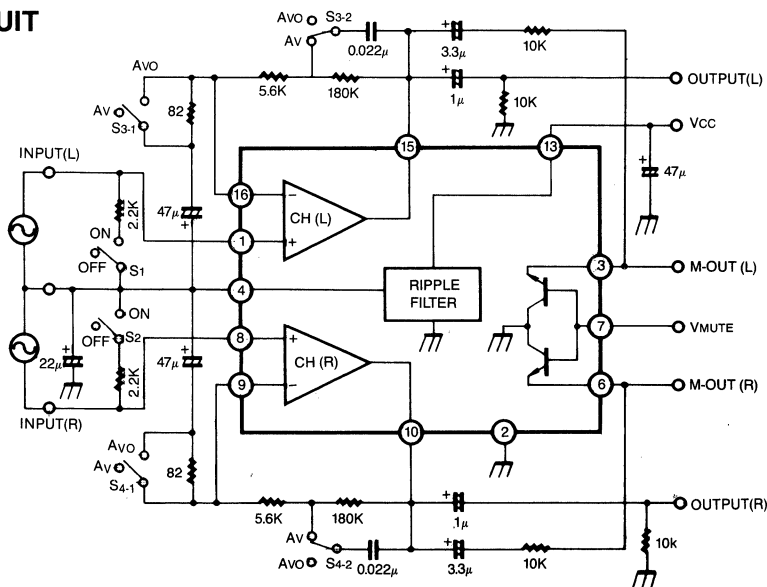
Characteristic		Symbol	Value	Unit
Supply Voltage		V_{CC}	7	V
Power Dissipation	KA2225	P_d	750	mW
	KA2225D		350	
Operating Temperature		T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature		T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

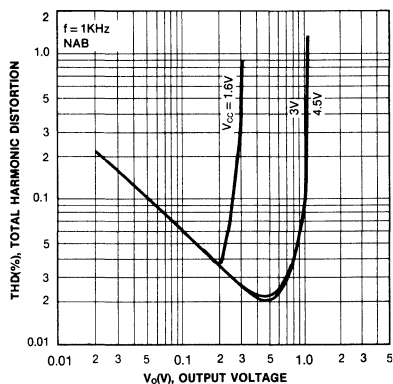
($T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current	I_{CC}	$V_i = 0$		2	3.4	mA
Voltage Gain	Open Loop A_{VO}		70	85		dB
	Closed Loop A_V			40		dB
Output Voltage	V_O	THD=1%	0.5	0.8		V
Total Harmonic Distortion	THD	$V_O = 0.1\text{V}$		0.07	0.5	%
Output Noise Voltage	V_{NO}	$R_g = 2.2\text{K}\Omega$, $A_V = 40\text{dB}$ $BW(-3\text{dB}) = 50\text{Hz} \sim 20\text{KHz}$		0.14	0.22	mV
Cross Talk	CT	$R_g = 600\Omega$, $V_O = -10\text{dBv}$		60		dB
Muting Attenuation	M (att)	$V_{MUTE} = 1\text{V}$		43		dB
Input Resistance	R_i		20	30		$\text{K}\Omega$

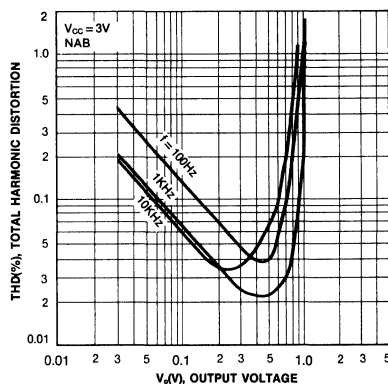
TEST CIRCUIT



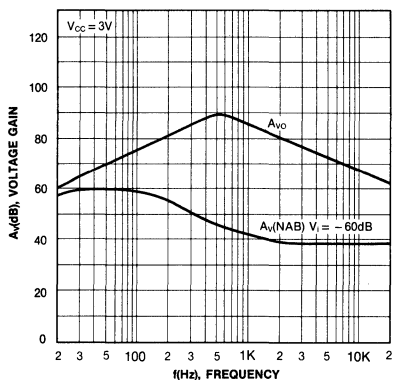
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



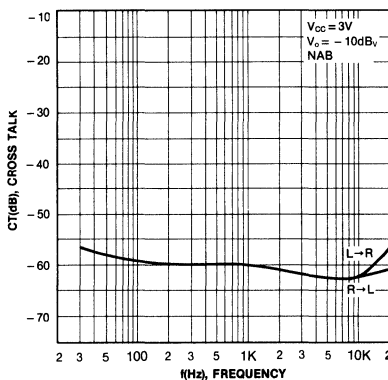
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



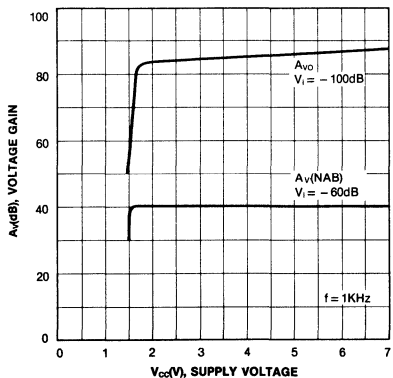
VOLTAGE GAIN-FREQUENCY



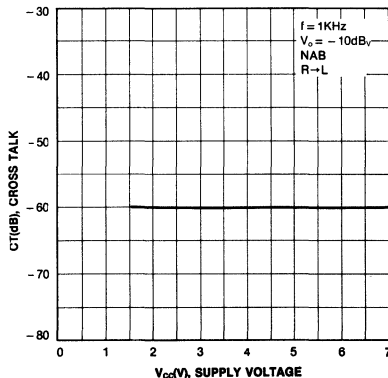
CROSS TALK-FREQUENCY

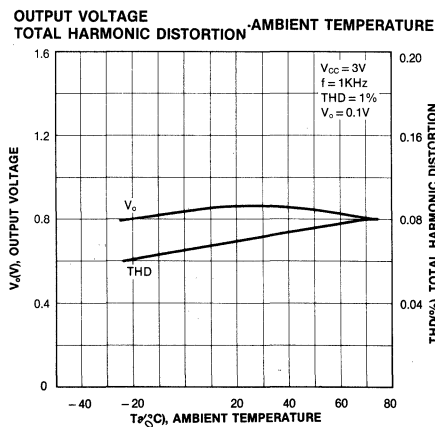
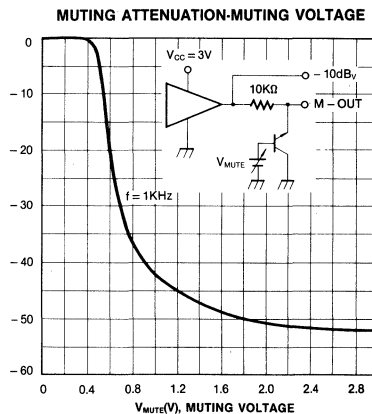
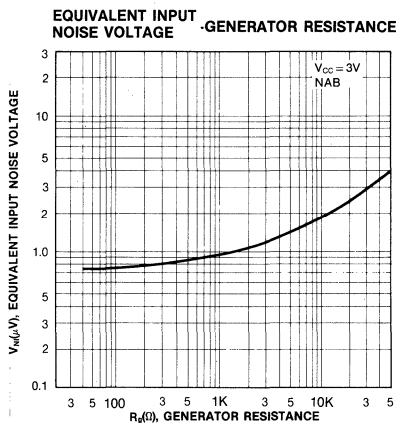
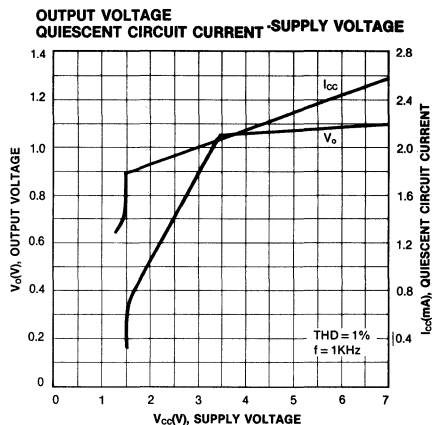
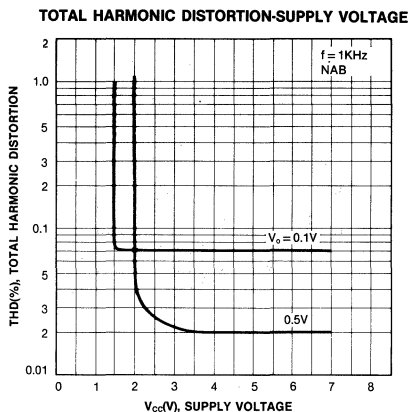


VOLTAGE GAIN-SUPPLY VOLTAGE



CROSS TALK-SUPPLY VOLTAGE





APPLICATION CIRCUIT

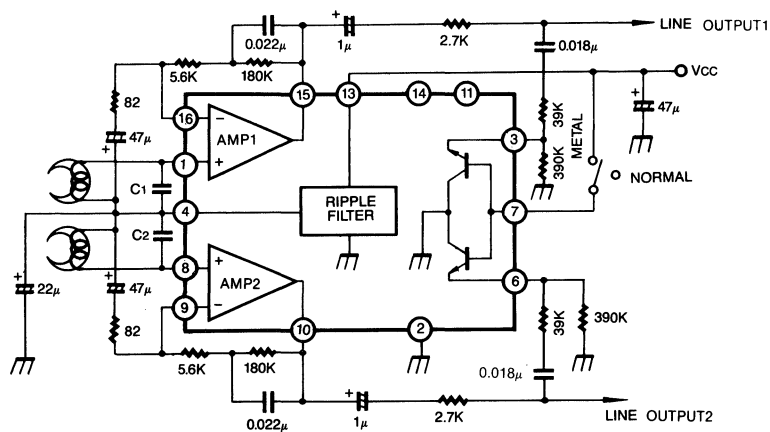


Fig. 3

- Capacitor C_1 and C_2 may be required for preventing a instability caused by the pattern layout or interference of external high frequency signal.

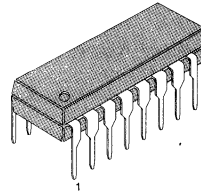
DUAL EQUALIZER AMPLIFIER WITH REC AMP

The KA22261 is a monolithic integrated circuit consisting of dual equalizer amplifier with REC AMP, and it is suitable for stereo radio cassette.

FEATURES

- Dual equalizer amplifier with ALC circuit.
- High open loop voltage gain: 78dB (Typ).
- Recording amplifier available because of high open loop voltage gain.
- Non-necessary any diode or transistor for ALC.
- Good channel separation: 60dB (Typ).
- Good ALC response balance between channels.
- Wide operating supply voltage range: $V_{cc} = 6V \sim 15V$.

16 DIP

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA22261	16 DIP	-20 ~ +70°C

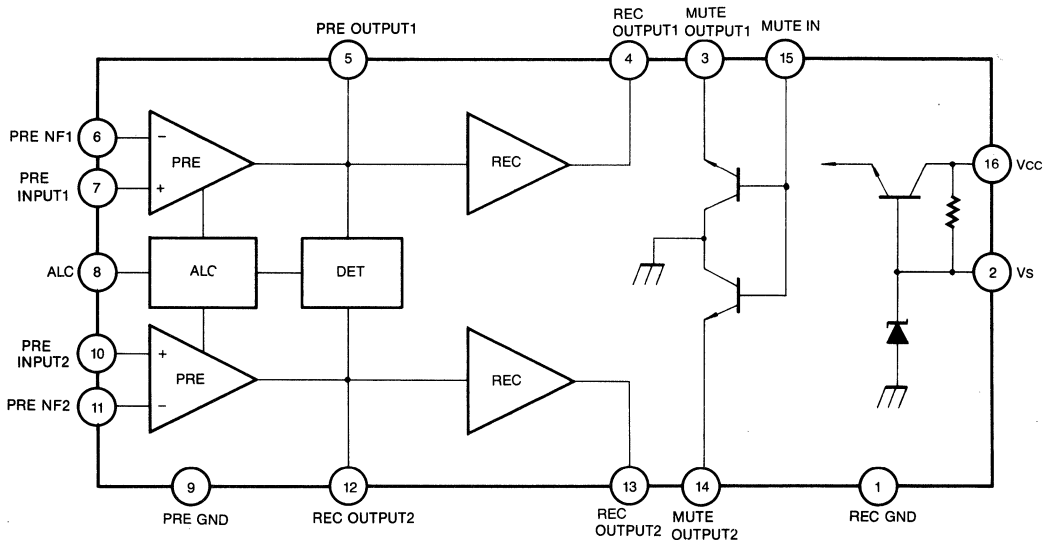


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a=25^{\circ}\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Power Dissipation	P_d	750	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a=25^{\circ}\text{C}$, $V_{CC}=9\text{V}$, $f=1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current	I_{CC}	$V_i=0$		8.5	10.5	mA
PRE AMP	Open Loop Gain	A_{VO} $V_i=-80\text{dBm}$	65	78		dB
	Output Voltage	VO_1 $\text{THD}=1\%$	0.5	0.8		V
	Total Harmonic Distortion	THD (1) $V_O=0.2\text{V}$		0.15	0.5	%
	Output Noise Voltage	V_{NO} $R_g=2.2\text{K}\Omega$. NAB $\text{BW}(-3\text{dB})=30\text{Hz} \sim 20\text{KHz}$		0.26	0.6	mV
	Cross Talk	CT $R_g=2.2\text{K}\Omega$	47	60		dB
REC AMP	Closed Loop Gain	A_V $R_L=10\text{K}\Omega$	12.7	14.7	16.7	dB
	Output Voltage	VO_2 $\text{THD}=1\%$	2.0	2.5		V
	Total Harmonic Distortion	THD (2) $V_O=1.5\text{V}$		0.3	1.0	%
	ALC Range (Note 1)	ALC (R) $V_i=-60\text{dB}$, $R_g=2.2\text{K}\Omega$		45		dB
	ALC Distortion	ALC THD $V_i=-20\text{dBm}$, $R_g=2.2\text{K}\Omega$		0.3	1.0	%
	ALC Voltage	$\text{ALC } V_O$ $V_i=-20\text{dBm}$, $R_g=2.2\text{K}\Omega$	0.9	1.1	1.42	V
Muting Attenuation	$M(\text{att})$		45	55		dB
ALC Balance	ALC (B)	$V_i=-20\text{dBm}$		0	2	dB

Note 1: Input voltage range from $V_i=-60\text{dB}$ to output voltage $V_O=3\text{dB}$ up.

TEST CIRCUIT

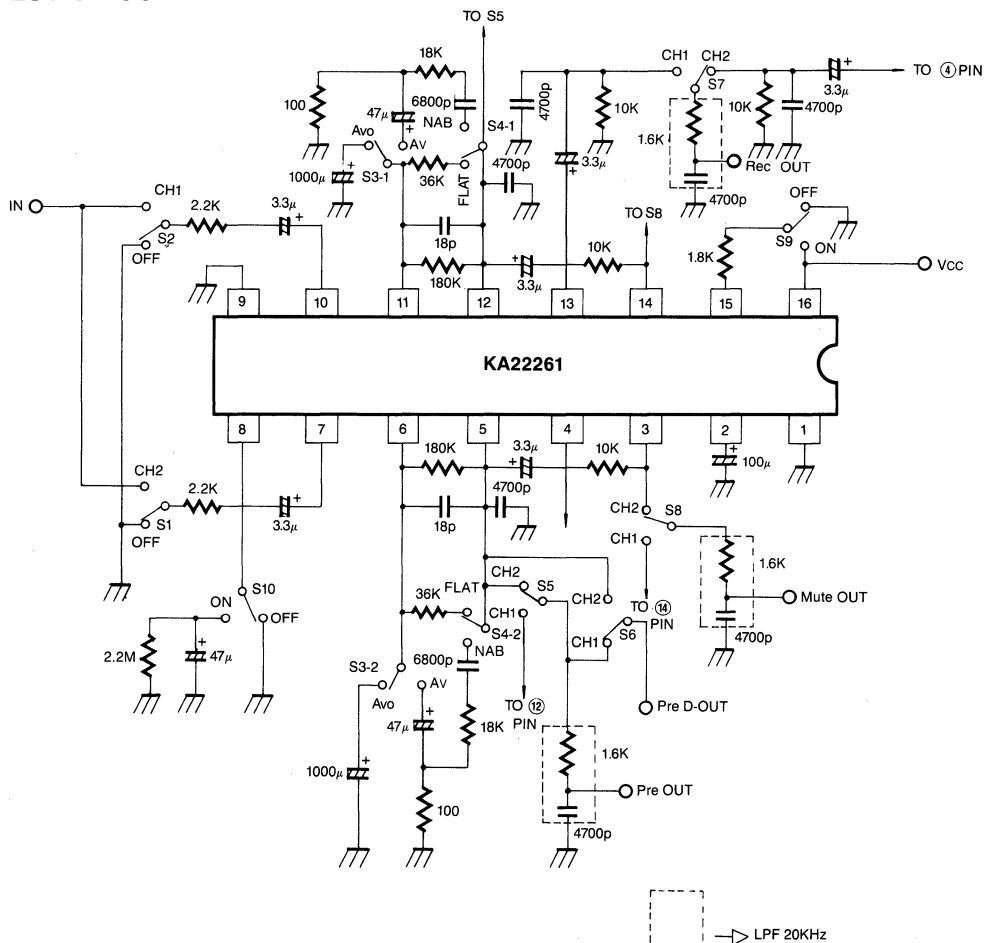


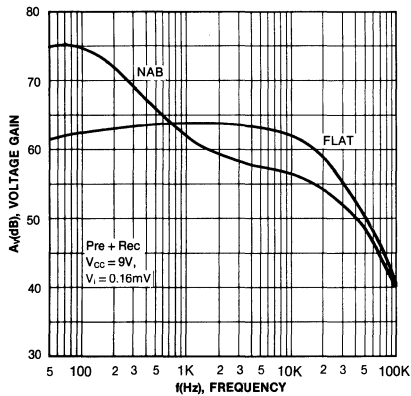
Fig. 2

TEST METHOD

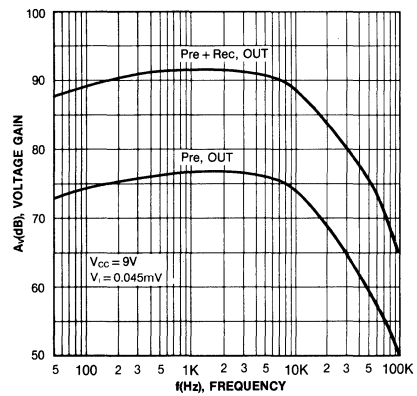
*: NO specified.

SW Symbol	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Measure Terminal
I_{CC}	*	*	*	*	*	*	*	*	OFF	*	V_{CC}
A_{VO}	OFF	CH1	A_{VO}	FLAT	CH1	*	*	*	OFF	OFF	Pre OUT
$V_O(1)$	OFF	CH1	A_V	NAB	CH1	*	*	*	OFF	OFF	Pre OUT
THD (1)	OFF	CH1	A_V	NAB	CH1	*	*	*	OFF	OFF	Pre OUT
V_{NO}	OFF	OFF	A_V	NAB	CH2	CH1	*	*	OFF	OFF	Pre D-OUT
C.T.	OFF	CH1	A_V	FLAT	CH1→CH2	*	*	*	OFF	OFF	Pre OUT
A_V	OFF	CH1	A_V	FLAT	CH1	*	CH1	CH2	OFF	OFF	Pre OUT→Rec OUT
$V_O(2)$	OFF	CH1	A_V	FLAT	CH2	*	CH1	CH2	OFF	OFF	Rec OUT
THD (2)	OFF	CH1	A_V	FLAT	CH2	*	CH1	CH2	OFF	OFF	Rec OUT
ALC (R)	OFF	CH1	A_V	FLAT	CH2	*	CH1	CH2	OFF	ON	Rec OUT
ALC (THD)	OFF	CH1	A_V	FLAT	CH2	*	CH1	CH2	OFF	ON	Rec OUT
ALC (V_O)	OFF	CH1	A_V	FLAT	CH2	*	CH1	CH2	OFF	ON	Rec OUT
ATT	OFF	CH1	A_V	FLAT	CH1	*	*	CH1	OFF→ON	OFF	Mute OUT
ALC (B)	CH2	CH1→CH2	A_V	FLAT	*	*	CH1→CH2	*	OFF	ON	Rec OUT

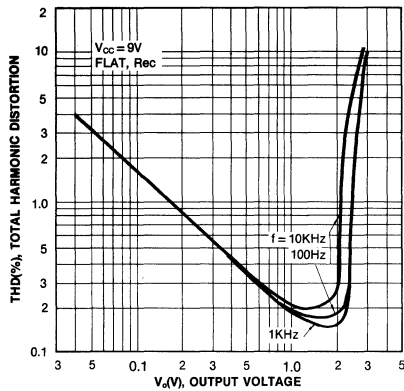
VOLTAGE GAIN-FREQUENCY



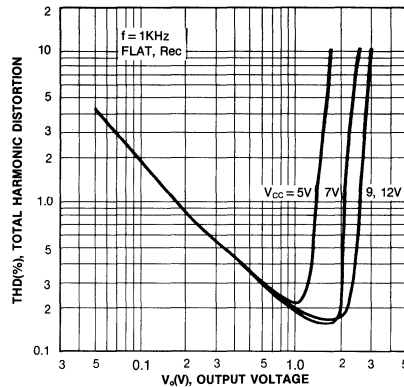
VOLTAGE GAIN-FREQUENCY



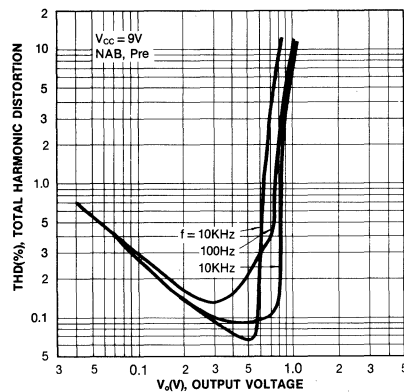
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



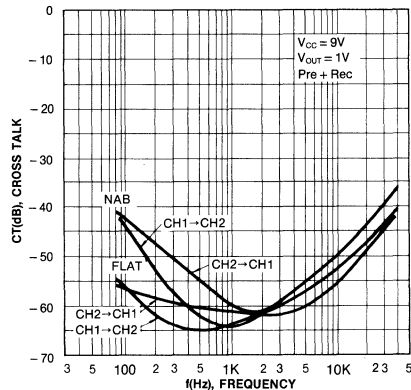
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



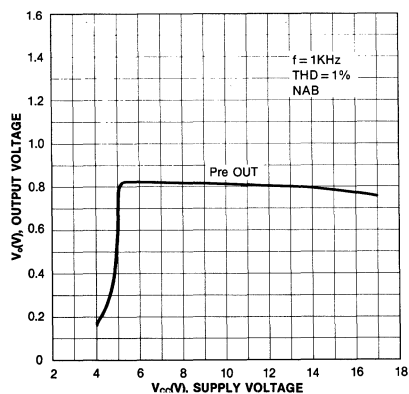
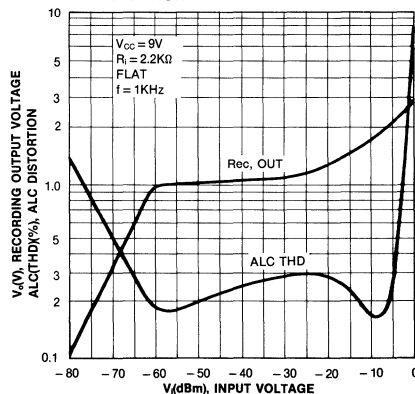
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



CROSS TALK-FREQUENCY



OUTPUT VOLTAGE-SUPPLY VOLTAGE

RECORDING OUTPUT VOLTAGE - INPUT VOLTAGE
ALC DISTORTION

APPLICATION CIRCUIT

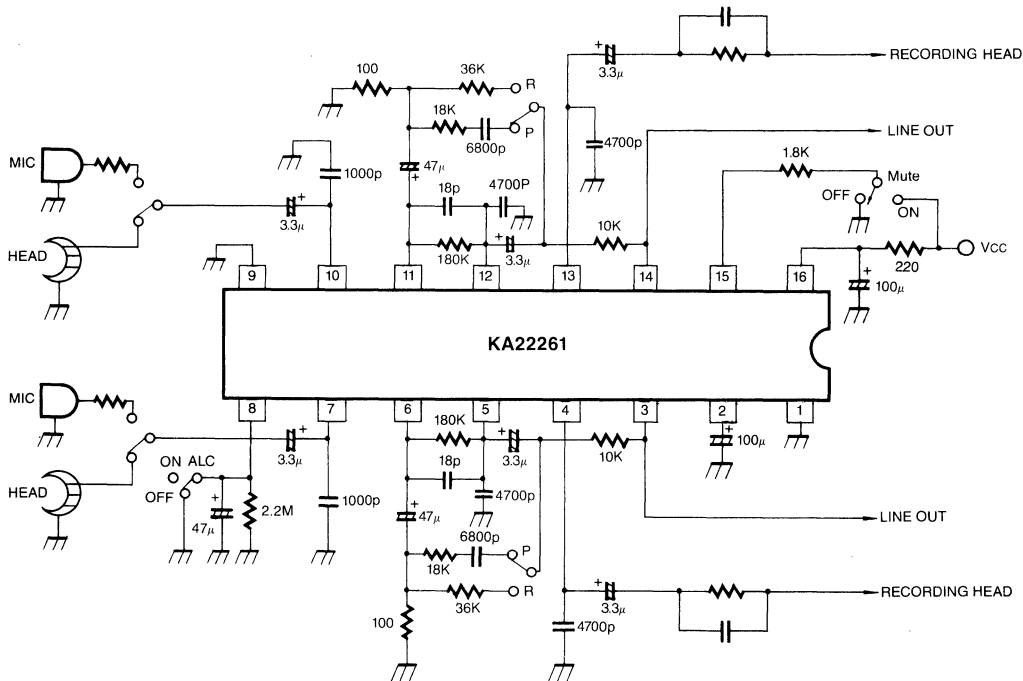
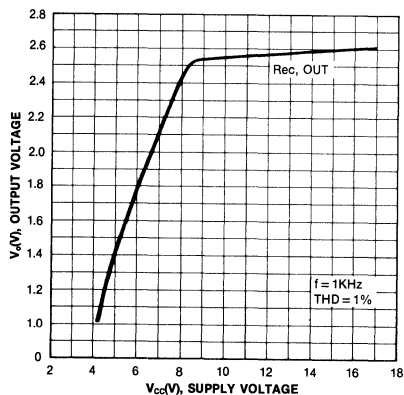
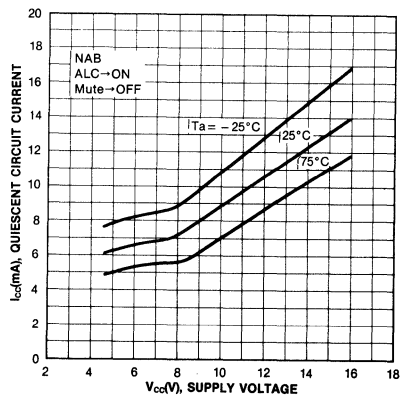


Fig. 3

OUTPUT VOLTAGE-SUPPLY VOLTAGE



QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



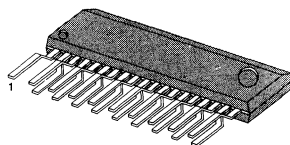
DUAL EQUALIZER AMPLIFIER SYSTEM

The KA2228 is a monolithic integrated circuit consisting of play back AMP, REC AMP with ALC, mic AMP with ALC and monitor AMP etc. It is dual EQ AMP system built-in switch for selecting REC/PLAY mode, tape or radio (Aux) modes. It is used for radio cassette player and can be applied easily because of getting rid of conventional mechanism REC/PLAY switch.

FEATURES

- Following 4 modes can be operated by external switches combination: radio (Aux), radio (Aux) recording, mic recording and tape play back
- Built-in switch for selecting REC/PLAY mode.
- Built-in switch for selecting radio (Aux) or tape input.
- Few external parts.
- Small package: 21 shrink ZIP type.
- Operation supply voltage range: 3.5 ~ 7.0V

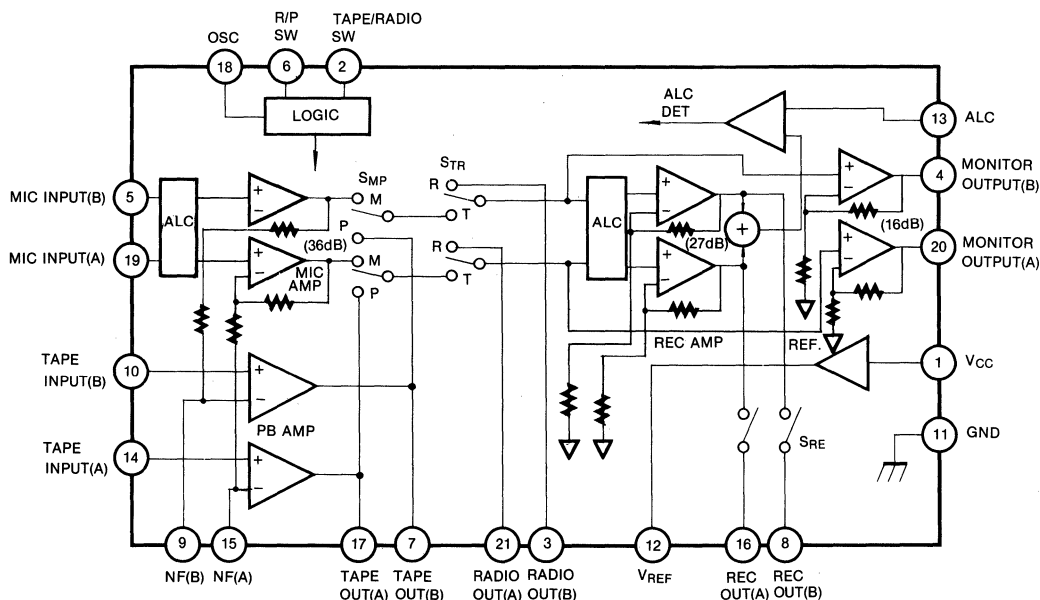
21 SZIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2228	21 SZIP	- 25 ~ + 75 °C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	8	V
Power Dissipation	P_d	750	mW
Operating Temperature	T_{opr}	$-25 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +155$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS($T_a = 25^\circ\text{C}$, $V_{CC} = 8\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC1}	Radio, $V_i = 0$	7	10	14	mA
	I_{CC2}	Radio REC, $V_i = 0$	10	13	16	mA
	I_{CC3}	Tape PB, $V_i = 0$	7	10	14	mA
	I_{CC4}	Mic REC, $V_i = 0$	6	9	12	mA
Reference Voltage	V_{ref}		1.8	2.0	2.3	V
MONITOR AMP						
Voltage Gain	A_{V1}	$V_i = -50\text{dB}$	15	16	18	dB
Maximum Output Voltage	V_{OM1}	THD = 1%	1.0	1.3		V
Total Harmonic Distortion	THD ₁	$V_o = -10\text{dBv}$		0.06	0.2	%
Output Noise Voltage	V_{NO1}	Audio Band		14	30	μV
Cross Talk	CT ₁	$V_o = 0\text{dB}$, Audio Band	45	60		dB
Ripple Rejection Ratio	RR ₁	$V_r = -20\text{dBv}$ $f = 120\text{Hz}$	40	50		dB
PLAY BACK AMP						
Closed Loop Voltage Gain	A_{V2}	$V_i = -50\text{dBv}$	36	38		dB
Open Loop Voltage Gain	A_{VO2}	$V_i = -90\text{dBv}$	70	78		dB
Maximum Output Voltage	V_{OM2}	THD = 1%	1.0	1.3		V
Total Harmonic Distortion	THD ₂	$V_o = -10\text{dBv}$		0.02	0.05	%
Output Noise Voltage	V_{NO2}	Audio Band		80	150	μV
Cross Talk	CT ₂	$V_o = -10\text{dBv}$, Audio Band	65	75		dB
Ripple Rejection Ratio	RR ₂	$V_R = -20\text{dBv}$ $f = 120\text{Hz}$	34	42		dB

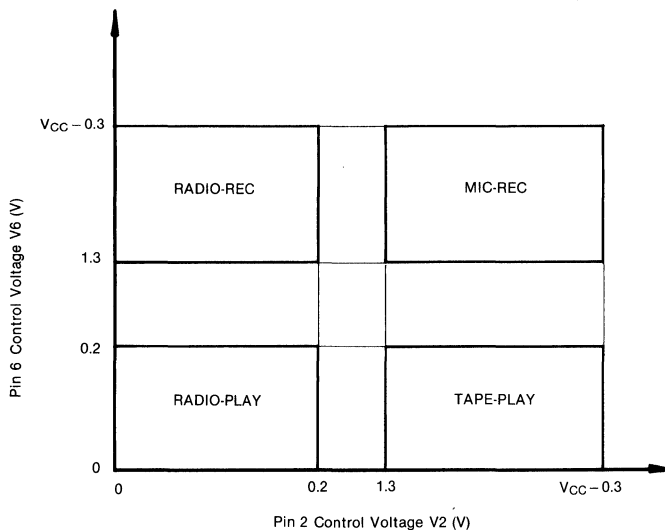
ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
RECORDING AMP						
Voltage Gain	A_{V3}	$V_i = -50\text{dBv}$	25	27	30	dB
Total Harmonic Distortion	THD_3	$V_o = -10\text{dBv}$		0.04	0.1	%
Output Noise Voltage	V_{N03}	Audio Band		120	250	μV
Cross Talk	CT_3	$V_o = -10\text{dBv}$, Audio Band	55	65		dB
Ripple Rejection Ratio	RR_3	$V_i = -20\text{dBv}$, $f = 120\text{Hz}$	34	42		dB
ALC Voltage	ALC_{31}	$V_i = -20\text{dBv}$	-4.4	-2.7	0	dBv
ALC Voltage	ALC_{32}	$V_i = -15\text{dBv}$	-4.2	0.04	0.2	dBv
ALC Voltage	ALC_{33}	$V_i = -5\text{dBv}$	-4.0	120	0.5	dBv
MIC + REC AMP						
Voltage Gain	A_{V4}	$V_i = -80\text{dBv}$	60	65	66	dB
Total Harmonic Distortion	THD_4	$V_o = -10\text{dBv}$, Audio Band		42	2.0	%
Output Noise Voltage	V_{N04}	Audio Band		-2.7	7.0	mv
Cross Talk	CT_4	$V_o = -10\text{dBv}$, Audio Band	30	-2.5		dB
Ripple Rejection Ratio	RR_4	$V_R = -20\text{dBv}$, $f = 120\text{Hz}$	13	-2.2		dB
ALC Voltage	ALC_{41}	$V_i = -60\text{dBv}$	-4.0	63	0.5	dBv
ALC Voltage	ALC_{42}	$V_i = -40\text{dBv}$	-4.0		0.5	dBv
ALC Voltage	ALC_{43}	$V_i = -20\text{dBv}$	-4.0		0.5	dBv

OPERATION MODE BY EXTERNAL SWITCHES (S1, S2) COMBINATION

CIRCUIT BLOCK	S2 S1	S2 = REC		S2 = PLAY	
		S1 = RADIO	S1 = TAPE	S1 = RADIO	S1 = TAPE
MIC AMP		ON	ON	OFF	OFF
PB AMP		OFF	OFF	ON	ON
REC AMP		ON	ON	OFF	OFF
MONITOR AMP		ON	OFF	ON	ON
SMP		M	M	P	P
STR		R	T	R	T
SRE		ON	ON	OFF	OFF
OPERATION MODE		RADIO REC	MIC REC	RADIO PLAY	TAPE PLAY BACK

CONTROL SWITCH TERMINAL (2, 6 PIN) THRESHOLD VOLTAGE

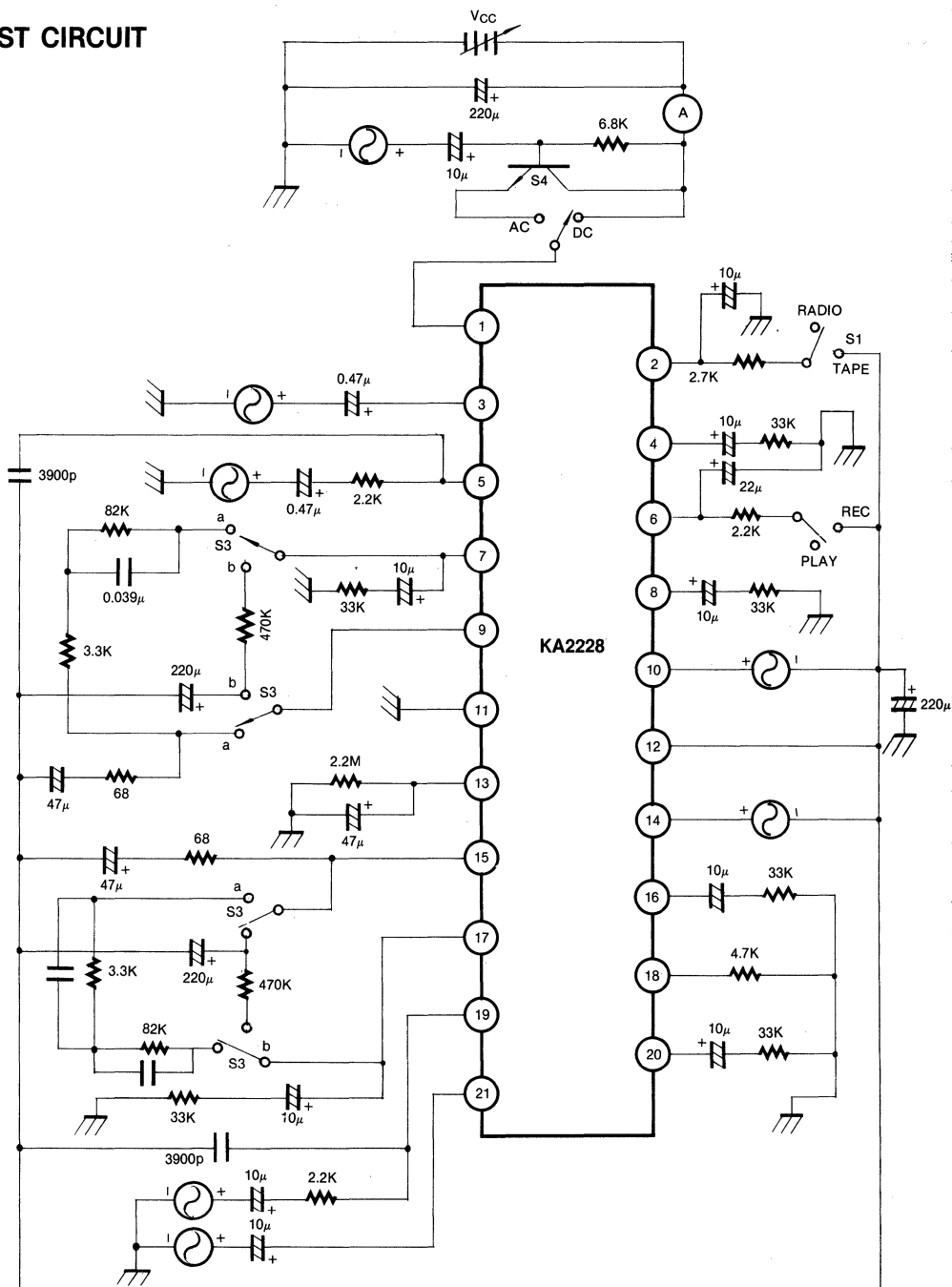


TEST METHOD (See Test Circuit)

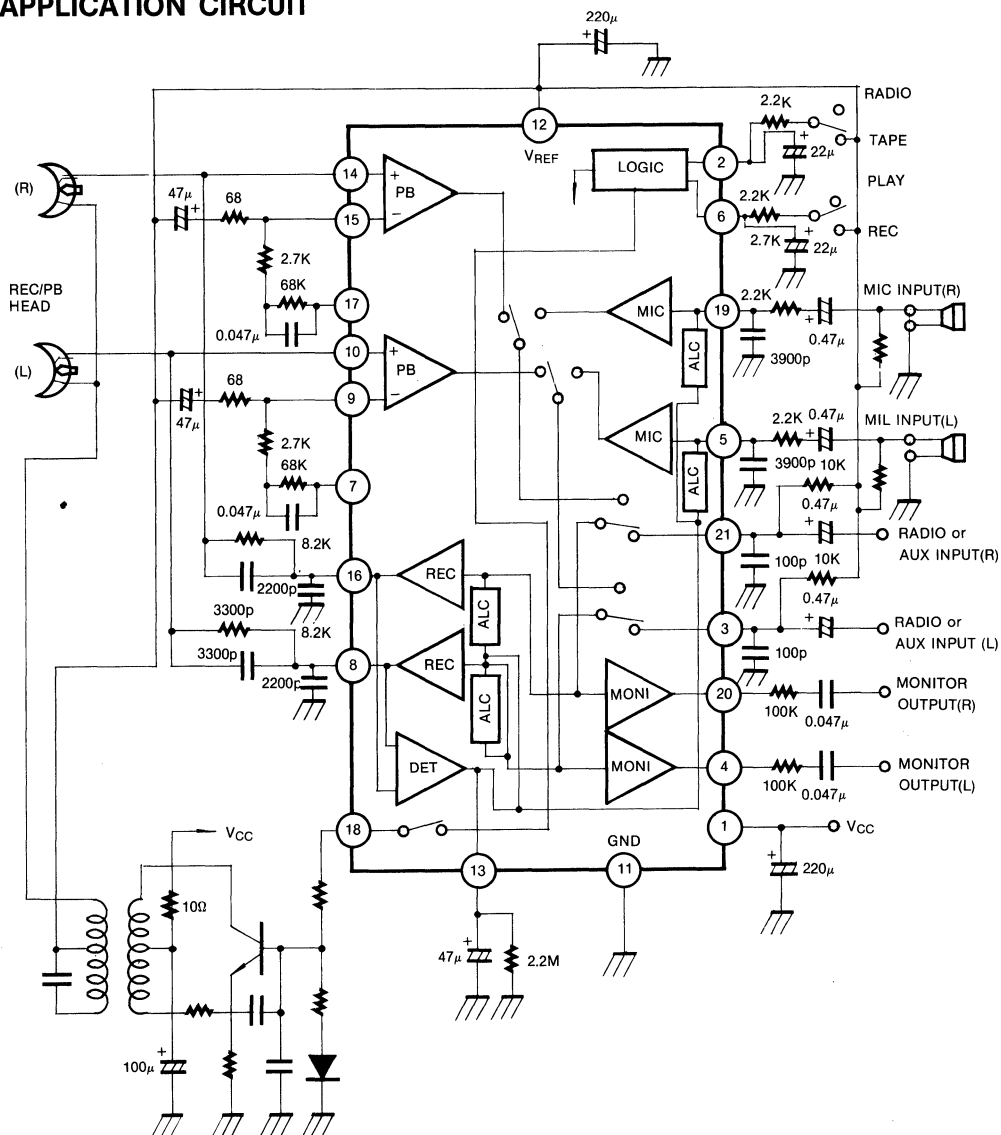
Symbol	S1	S2	S3	S4
I_{CC1}	RADIO	PLAY	a	DC
I_{CC2}	RADIO	REC	"	"
I_{CC3}	TAPE	PLAY	"	"
I_{CC4}	TAPE	REC	"	"
V_{REF}	—	—	"	"
A_{V1}	RADIO	REC	a	DC
$V_O m1$	"	"	"	"
V_{NO1}	"	"	"	"
THD_1	"	"	"	"
CT_1	"	"	"	"
RR_1	RADIO	REC	a	AC
A_{VO2}	TAPE	PLAY	b	DC
A_{V2}	TAPE	PLAY	a	DC
V_{OM2}	"	"	"	"
V_{NO2}	"	"	"	"
THD_2	"	"	"	"
CT_2	"	"	"	"
RR_2	TAPE	PLAY	a	AC

Symbol	S1	S2	S3	S4
A_{V3}	RADIO	REC	a	DC
V_{NO3}	"	"	"	"
THD_3	"	"	"	"
CT_3	"	"	"	"
RR_3	RADIO	REC	a	AC
ALC_{31}	RADIO	REC	a	DC
ALC_{32}	"	"	"	"
ALC_{33}	"	"	"	"
A_{V4}	TAPE	REC	a	DC
V_{NO4}	"	"	"	"
THD_4	"	"	"	"
CT_4	"	"	"	"
RR_4	TAPE	REC	a	AC
ALC_{41}	TAPE	REC	a	DC
ALC_{42}	"	"	"	"
ALC_{43}	"	"	"	"

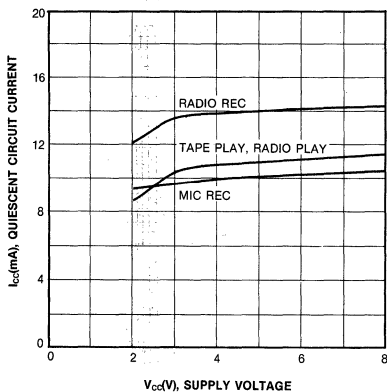
TEST CIRCUIT



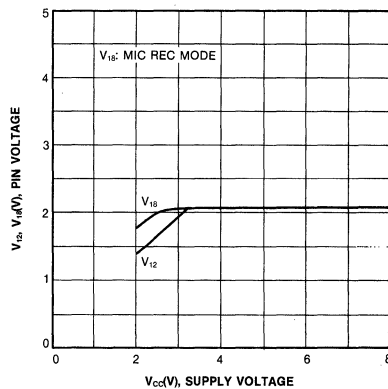
APPLICATION CIRCUIT



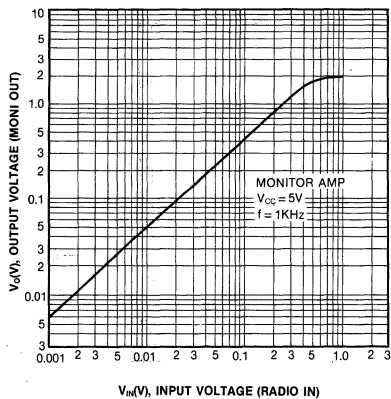
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



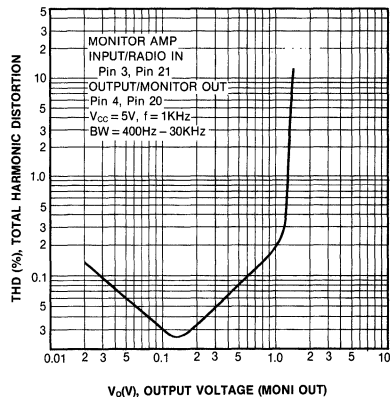
PIN VOLTAGE-SUPPLY VOLTAGE



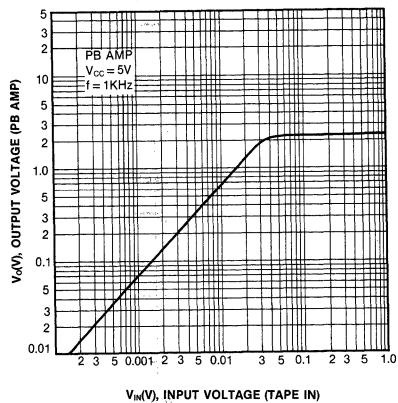
OUTPUT VOLTAGE-INPUT VOLTAGE



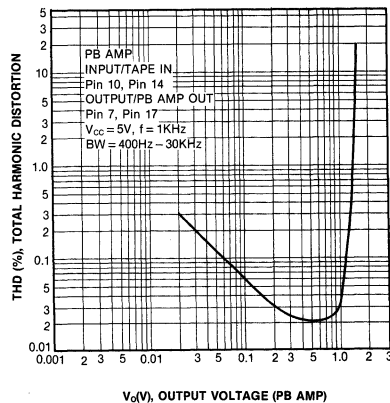
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



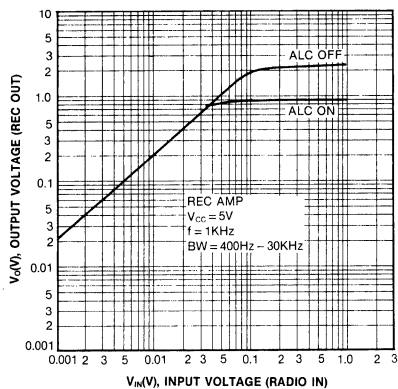
OUTPUT VOLTAGE-INPUT VOLTAGE



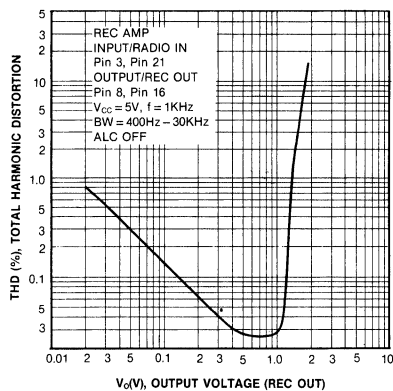
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



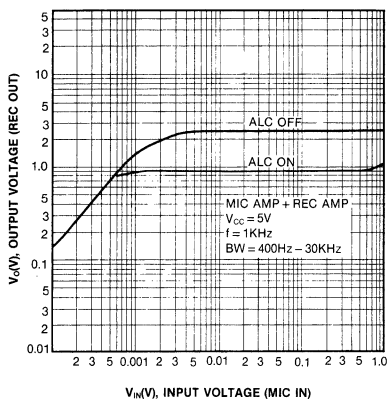
OUTPUT VOLTAGE-INPUT VOLTAGE



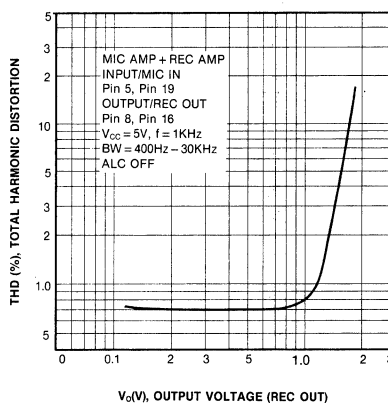
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



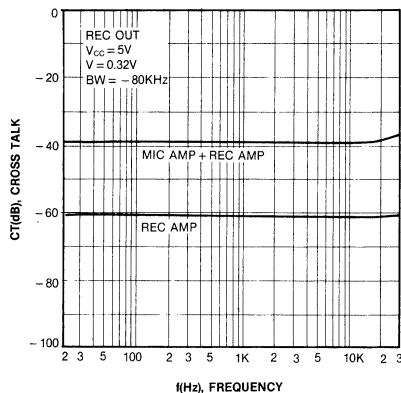
OUTPUT VOLTAGE-INPUT VOLTAGE



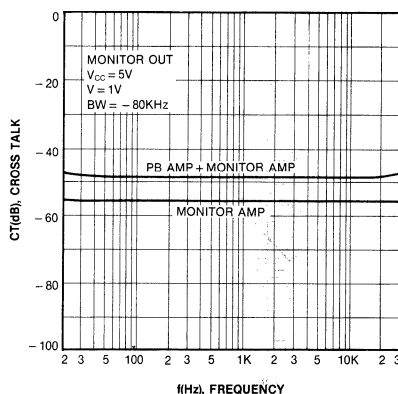
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



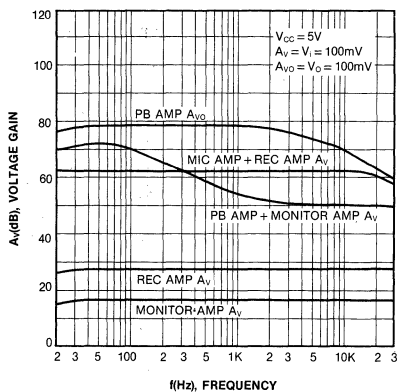
CROSS TALK-FREQUENCY



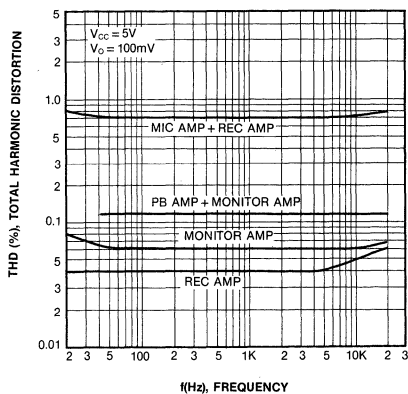
CROSS TALK-FREQUENCY



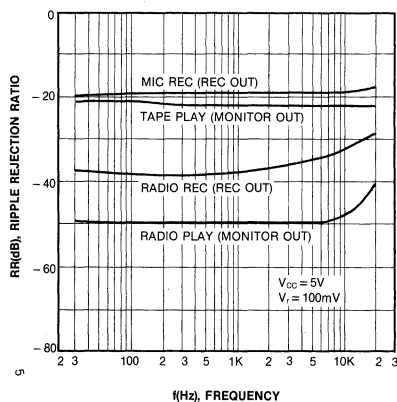
VOLTAGE GAIN-FREQUENCY



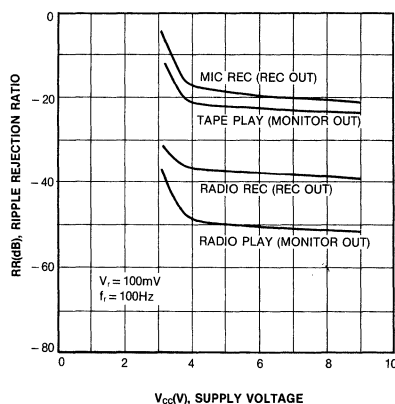
TOTAL HARMONIC DISTORTION-FREQUENCY



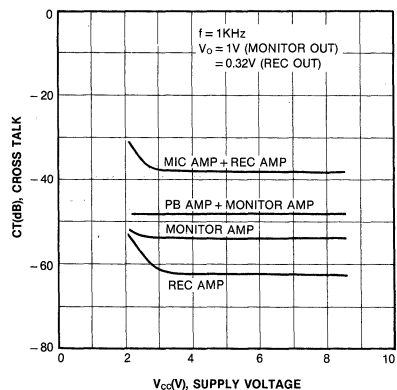
RIPPLE REJECTION RATIO-SUPPLY VOLTAGE



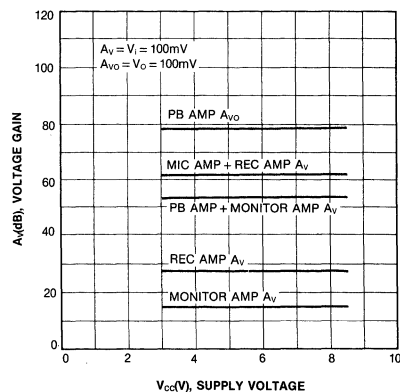
RIPPLE REJECTION RATIO-SUPPLY VOLTAGE



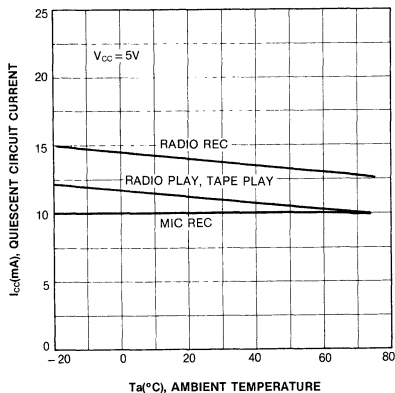
CROSS TALK-SUPPLY VOLTAGE



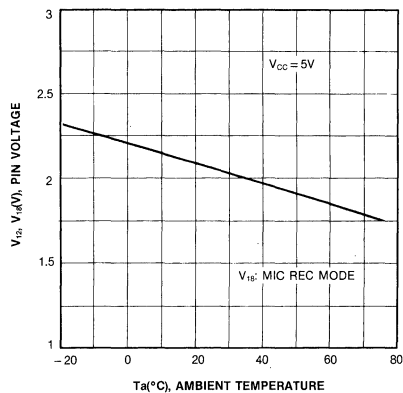
VOLTAGE GAIN-AMBIENT TEMPERATURE



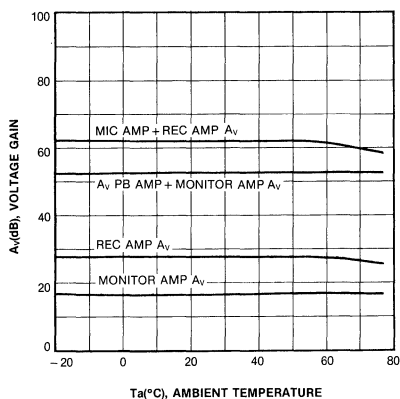
QUIESCENT CIRCUIT CURRENT
-AMBIENT TEMPERATURE



PIN VOLTAGE-AMBIENT TEMPERATURE



VOLTAGE GAIN-SUPPLY VOLTAGE



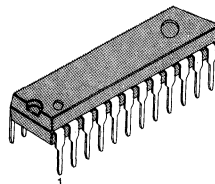
QUAD EQUALIZER AMPLIFIER FOR DOUBLE CASSETTE

The KA2229 is a monolithic integrated circuit consisting of quad equalizer amplifier, R/P SW, ALC circuit and Muting circuit, and it is suitable for radio double cassette.

FEATURES

- 2-Input double deck player back amplifier
- Record amplifier
- Internal Electronic Control Switch
- Built-in ALC circuit
- Built-in mute circuit
- Low noise
- Operating supply voltage range: $V_{CC} = 5 \sim 14V$

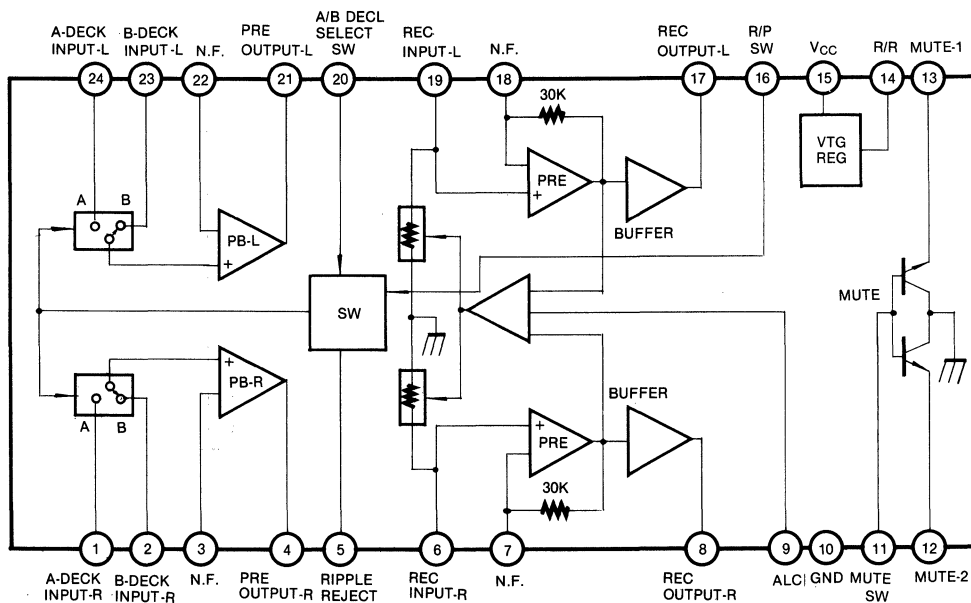
24 SDIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2229A	24 SDIP	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM



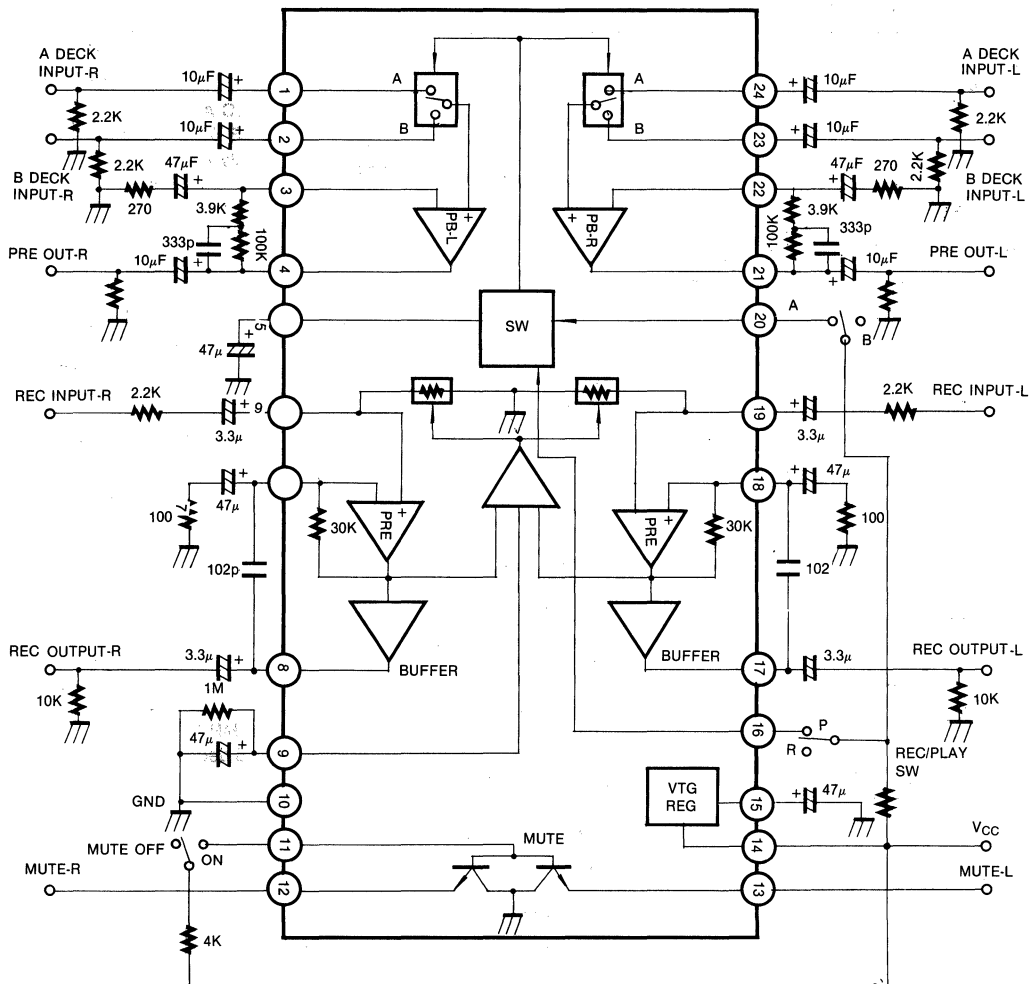
ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Power Dissipation	P_d	1	W
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTIC

(Ta = 25°C, V_{CC} = 9V, f = 1KHz, unless otherwise specified)

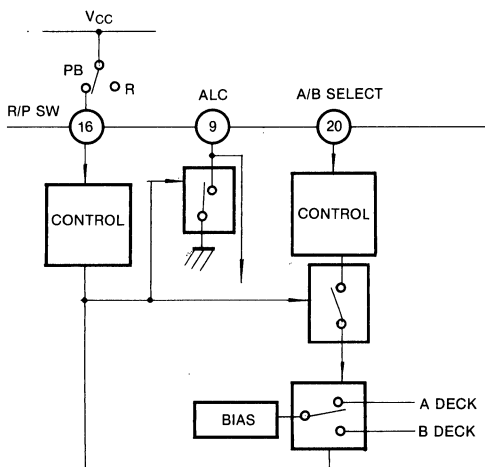
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Circuit Current		I_{CCQ}	Rec Mode, $V_i = 0V$		13	18	mA
Play Back	Open-loop Gain	A_{VO}	$V_{OUT} = 0.5V$	65	90		dB
	Close-loop Gain	A_V	$V_{OUT} = 0.5V$	34	35	36	dB
	Max Output Voltage	$V_{O(1)}$	THD = 1%	0.8	1.1		V
	Total Harmonic Distortion	THD ₍₁₎	$V_{OUT} = 0.6V$		0.05	0.6	%
	Cross Tack	CT ₁	$R_g = 2.2K$	45	60		dB
	Equivalent Input Noise	V_{NI1}	$R_g = 2.2K$, BW = D _{IN} - Audio		1.2	2	μV
Record Back	Close-loop Gain	A_{VC}	$R_L = 10K$	58	62	64	dB
	Max Output Voltage	$V_{O(2)}$	$R_L = 10K$, THD = 1%	1.1	1.6		V
	Total Harmonic Distortion	THD ₍₂₎	$R_L = 10K$, $V_{OUT} = 1V$		0.3	1	%
	ALC Range	ALC(R)	$R_L = 10K$, $R_i = 2.2K$, $V_i = -56dBm + 3dB$	36	42		dB
	ALC Distortion	ALC(THD)	$R_L = 10K$, $R_i = 2.2K$, $V_i = -20dBm$		0.3	1	%
	ALC Voltage	ALC(VO)	$R_L = 10K$, $R_i = 2.2K$, $V_i = -30dBm$	0.8	0.95	1.1	dB
	ALC Balance	ALC(B)			0	2	dB
Cross Tack		CT ₂	$V_O = 0dBm$, ALC = off	40	50		dB
Muting Attenuation		$M_{(att)}$	$V_O = 0dBm$	45	60		dB



*Information of switch function

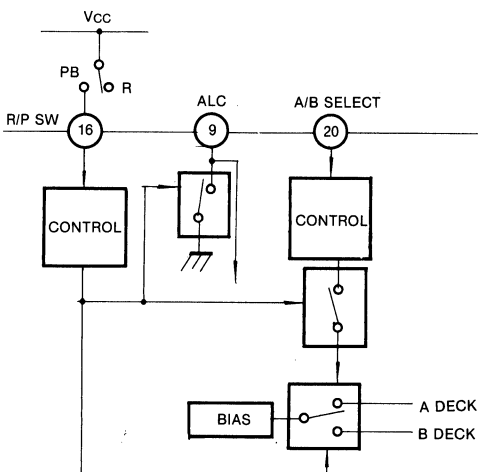
1. Record/Play Select Switch

A. Record Mode (R/P SW = Open)



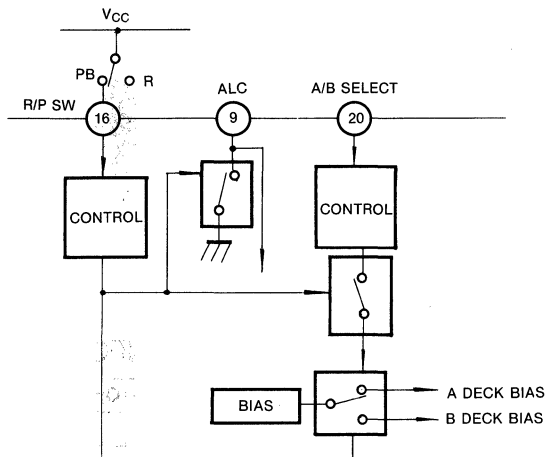
- (1) REC AMP ON with ALC
- (2) A/B Switch invalid
- (3) Only A-deck Available

B. PLAY Mode (R/P SW = V_{CC})



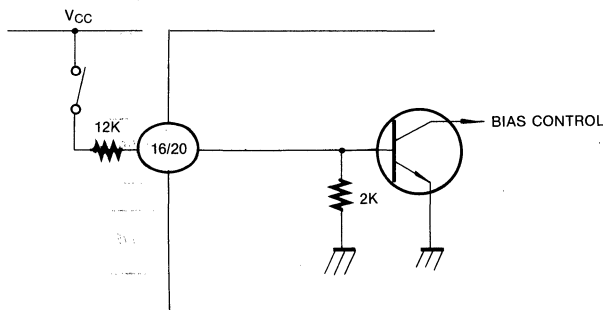
- (1) REC AMP ON without ALC
- (2) PB A/B-deck Select Available

C. PB A/B Deck Select (switch control)



- (1) A-DECK MODE (Pin 20 = V_{CC})
- (2) B-DECK MODE (Pin 20 = Open)

D. Control Switching Voltage



$$I = \frac{2K}{12K + 2K} \cdot V_C \quad V_C > V_{BE} (0.7V)$$

$$V_C \geq 5.2V$$

Notice: in case of $V_{BE} = 1V$, notice of Pop Noise.

9-PROGRAM MUSIC SELECTOR

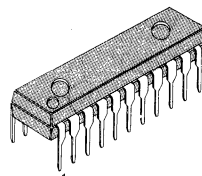
The KA2230 is an automatic music selector IC which can scan and detect the start point of up to 9-program. Selection of program number can be taken by pressing the select button number times in succession. After the setting of program count, the display changes one program at a time until the preselected program is reached.

At which point the control output is set on. The display is a 7-segment numerical display. It is suitable for radio cassette, cassette deck and car stereo.

FEATURES

- Maximum 9-program random search
- On-chip amplifier, detector, comparator
- On-chip automatic reset circuit
- 7-segment of numerical display
- Operating supply voltage: $V_{CC} = 5 \sim 14V$

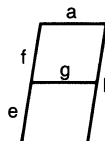
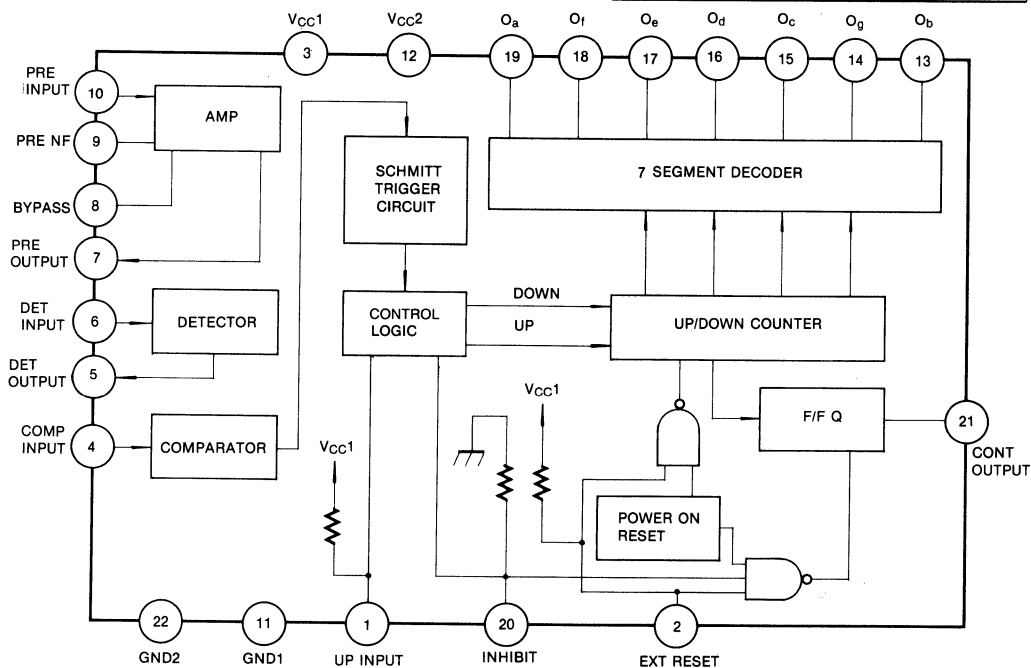
22 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2230	22 DIP	-20 ~ +70°C

BLOCK DIAGRAM



The segment output pins $O_a \sim O_g$ accord to the numerical display segment a ~ g.

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Condition	Value	Unit
Supply Voltage	V _{CC1}		16	V
Supply Voltage	V _{CC2}		20	V
Input Voltage	V _i	Except for the pre-amp or the detector input	0 ~ V _{CC1}	V
7-Segment Display Current	I _d		20	mA
Control Output Voltage	V _o		20	V
Control Output Current	I _o		50	mA
Power Dissipation	P _d	Ta = 25°C	850	mW
Derating		Ta ≤ 25°C	12.5	mW/°C
Operating Temperature	T _{opr}		-20 ~ +70	°C
Storage Temperature	T _{stg}		-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 9V, f = 10KHz, R_g = 600Ω, 0dB = 1V, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	T/F
Operating Supply Voltage	V _{CC}	− 20 ~ + 60°C	5	9	14	V	
Quiescent Circuit Current	I _{CC1}	V _i = 0		8	12	mA	1
	I _{CC2}	I _d = 20mA, at the reset		125	130		
Input Level							
Input Threshold Level	V _{ith}	A _v = 53dB	− 60	− 58	− 55	dBv	2.3
Frequency Characteristics	F _{vih}	V _{ih} , V _{il} = V _{ith} + 3dB	40	56		KHz	
	F _{vil}			600	800	Hz	
Input Threshold Level Variation by a Supply Voltage	V _{id}	The difference of V _{ith} between V _{CC} = 9V and 5V		1	2	dB	
Maximum Input Voltage	V _i (max)		350			mV	
Release Time	T _{dl}	V _i = − 37dB ~ − 97dB		250		ms	2.3
Release Time Variation by a Supply Voltage	T _{dld}	Difference of T _{dl} , V _{CC} = 9V and 5V		10		ms	
Attact Time	T _{dh}	V (pin6) = 0V − 3V		5		ms	4
Attact Time Variation by a Supply Voltage	T _{dhd}	Difference of T _{dh} , V _{CC} = 9V and 5V		0.1		ms	
Pre-Amp							
Input Resistance	R _i	A _v = 53dB	37	47	57	KΩ	5
Output Noise Voltage	V _{no}	A _v = 53dB, R _g = 100KΩ			20	mV	6
Open Loop Voltage Gain	A _{vo}	V _i = − 90dB	65	68	72	dB	7

I_{CC} = 5mA + XId, X: The number of 7-segment display Bit-on at the reset.

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	T/F
Control-Output							
Saturation VTG (turn on)	V_o (sat)	$I_o = 50\text{mA}$			0.5	V	
Leakage Current (turn off)	I_o (leak)				10	μA	
7 Segment Display Output							
Output Voltage (turn on)	V_{dh}	$I_o = 20\text{mA}$	7			V	
Leakage Current (turn off)	I_o (leak)				1	μA	
Up Input, Reset Input							
Input Voltage (H)	V_{ih}		2			V	
Input Voltage (L)	V_{il}				1	V	
Input Current	I_{ih}			250	500	μA	
Inhibit							
Input Voltage (H)	V_{ih}		1.8			V	
Input Voltage (L)	V_{il}				1	V	
Input Current	I_{ih}			350	700	μA	
Hysteresis Width				100		mV	

PIN CONNECTIONS

Pin No.	Pin Name	Pin No.	Pin Name
1	Up Input	12	V_{cc2}
2	Reset	13	7-Segment Display Output (b)
3	V_{cc1}	14	7-Segment Display Output (g)
4	Comparator Input	15	7-Segment Display Output (c)
5	Detector Output	16	7-Segment Display Output (d)
6	Detector Input	17	7-Segment Display Output (e)
7	Pre-Amp Output	18	7-Segment Display Output (f)
8	Bypass	19	7-Segment Display Output (a)
9	Pre-Amp Negative Feedback	20	Inhibit
10	Pre-Amp Input	21	Control Output
11	GND 1	22	GND 2

TEST CIRCUIT

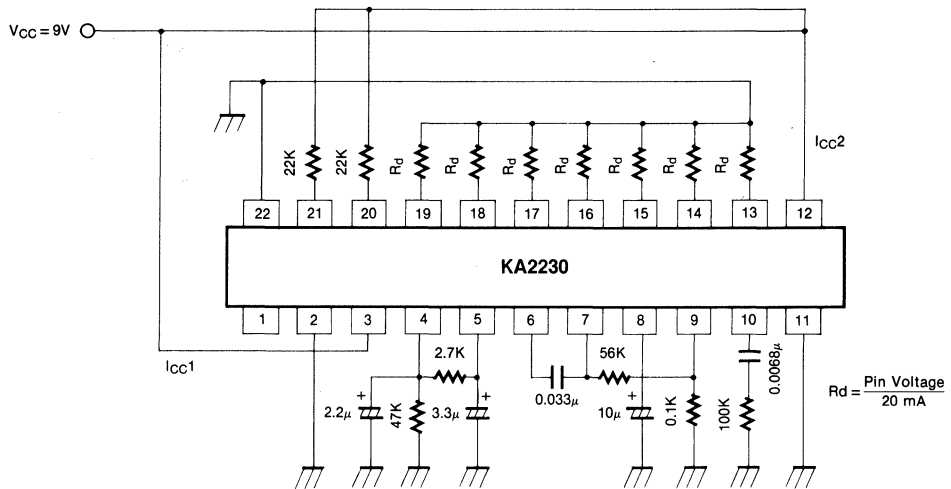


Fig. 1

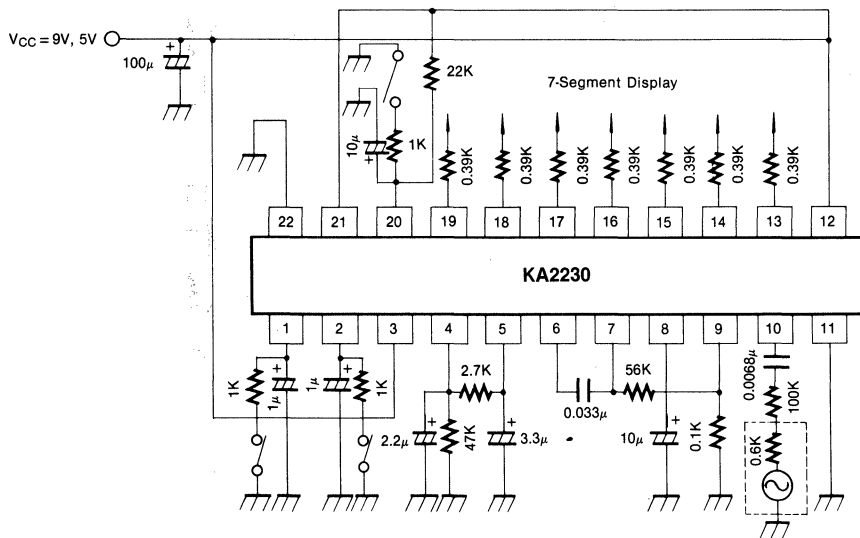


Fig. 2

TEST CIRCUIT (Continued)

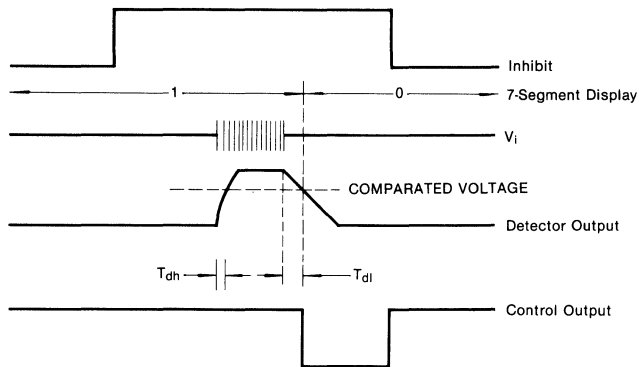


Fig. 3

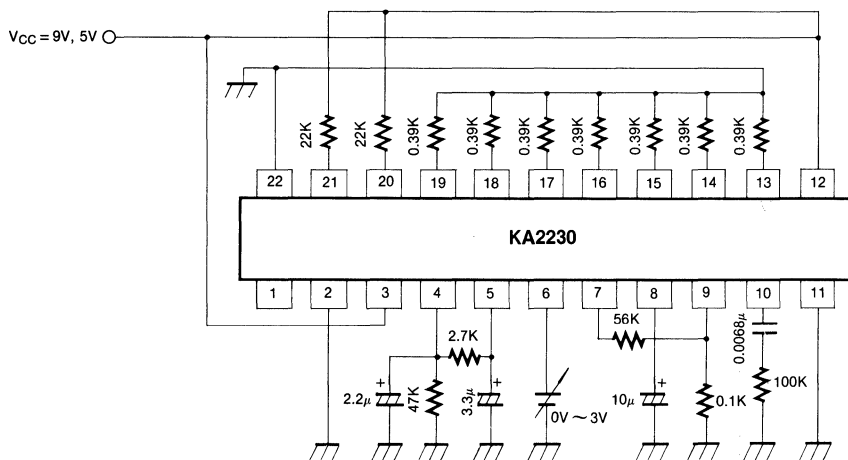


Fig. 4

TEST CIRCUIT (Continued)

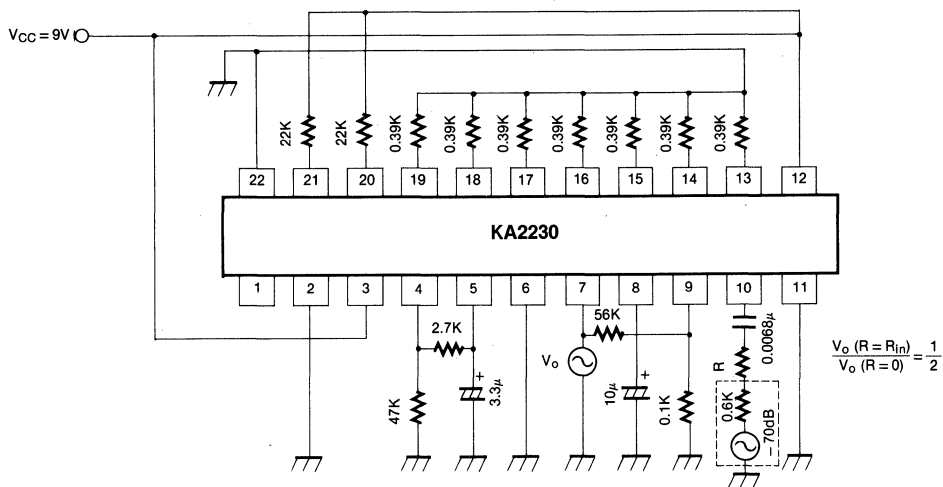


Fig. 5

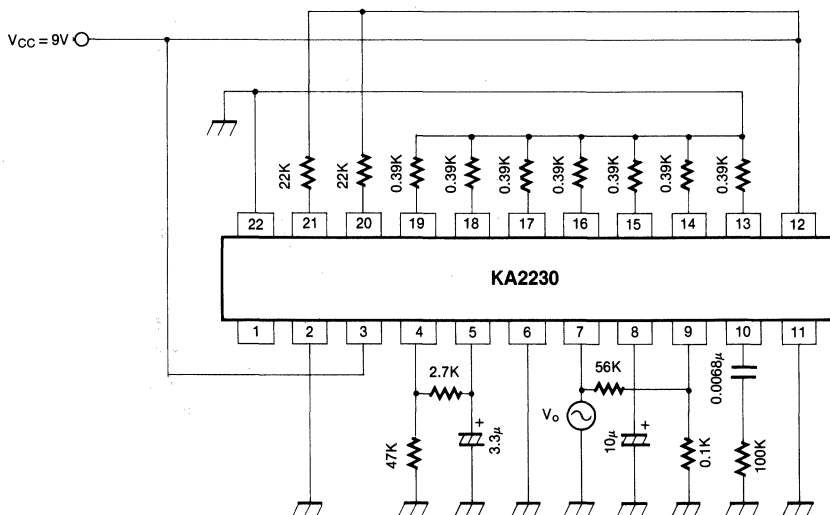


Fig. 6

TEST CIRCUIT (Continued)

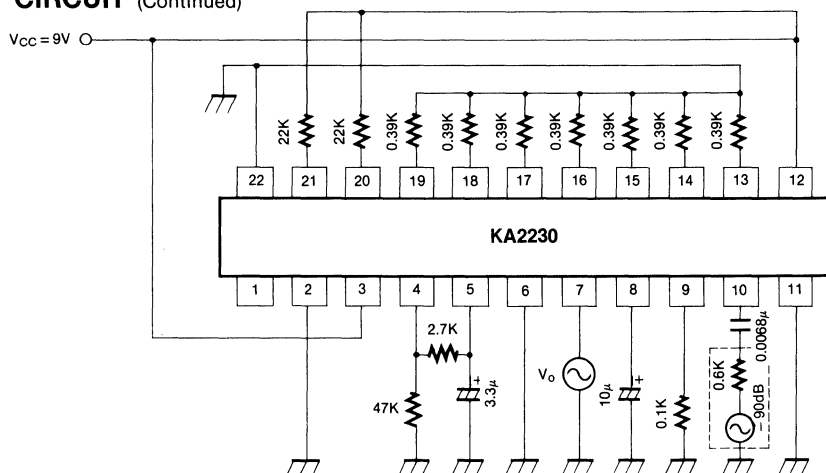


Fig. 7

FUNCTION DESCRIPTION

(1) Auto Reset

The Power-on reset circuit is reset between $V_{CC} = 1.7 \sim 4V$ on the rise of supply voltage while the control output turns off with the segment output initialized to 0 PROGRAM.

(2) Up

The UP-input pin going from "High" to "Low" level counts up on its rise.

(The segment output goes PROGRAM 0 → PROGRAM 2 → PROGRAM 3 → PROGRAM 4 → PROGRAM 5 → PROGRAM 6 → PROGRAM 7 → PROGRAM 8 → PROGRAM 9 → PROGRAM 1 → PROGRAM 2)

(3) Down

The signal input, amplified and detected, is supplied as DC voltage to the comparator circuit. Down-count takes place when the comparator circuit input falls from "High" to "Low" level.

(The segment output goes PROGRAM 9 → PROGRAM 8 → PROGRAM 7 → PROGRAM 6 → PROGRAM 5 → PROGRAM 4 → PROGRAM 3 → PROGRAM 2 → PROGRAM 1 → PROGRAM 0 → PROGRAM 0)

For down-count to proceed, INHIBIT should be at "High" level.

(4) Inhibit

Inhibits down-count at "Low" level and resets the control output.

"High" level enables down-count.

(5) Reset

Resets the segment output and control output to 0 program and OFF respectively.

(6) Control Output

The control output turns ON on the next down-count when the segment output is 1 program 0 programs. It can be reset again to OFF using the INHIBIT or RESET pin.

(7) Power Supply

Only the power supply for the segment output circuit is V_{CC2} while all the others are V_{CC1} .

(8) GND

Only the GND of control output circuit is GND2 while all the others are GND1.

GND1 and GND2 should be at the same voltage.

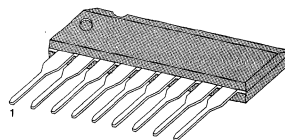
AUDIO LEVEL SENSOR

The KA2231 is an interprogram spaces detection IC with the function of music selection and can be used for radio cassette, cassette deck, car stereo etc.

FEATURES

- Built-in plunger driver TR (Max: 600mA).
- Built-in protection diode to prevent induced reverse voltage.
- Built-in protection circuit to prevent the error operation of plunger, when power switching on.
- Built-in detector for detecting recorded area.
- Capable of desired timing setting by using external C.R.
- Detects unrecorded areas of tape and drives plunger.
- Wide operating supply voltage range: $V_{CC} = 3.5V \sim 14V$.
- Recommended operating supply voltage: $V_{CC} = 9V$.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2231	9 SIP	-20 ~ +70°C

BLOCK DIAGRAM

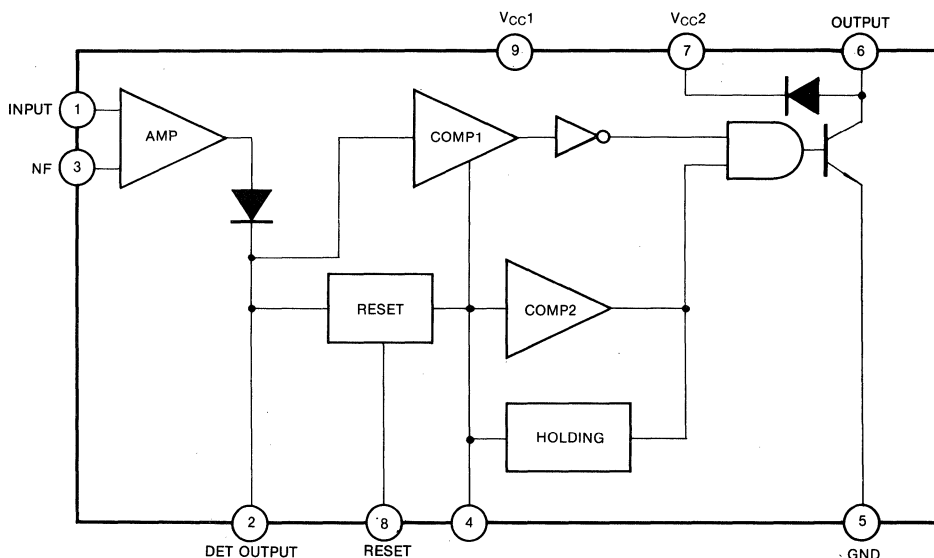


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	15	V
Flow-in Current	I ₆	600	mA
Power Dissipation	P _D	540	mW
Operating Temperature	T _{opr}	-20 ~ +70	°C
Storage Temperature	T _{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 9V, f = 1KHz, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current		I _{CC}	V _I = -30dBv		11	22	mA
Output TR Saturation VTG		V _{CE} (sat)	I ₆ = 600mA		1.1	1.6	V
Output Diode Forward VTG		V _F	I _F = 600mA		1.5	2.0	V
Input Sensitivity		V _I (sen)	Pin6: L→H	-47	-50	-53	dBv
Comparator Level (1)	ON	V _{th} 1-H	Pin6 Inverted	3.0	3.5	4.0	V
	OFF	V _{th} 1-L	Pin6 Inverted	1.8	2.2	2.6	V
Comparator Level (2)	ON	V _{th} 2-H	Pin6 Inverted	4.7	5.5	6.3	V
	OFF	V _{th} 2-L	Pin6 Inverted	3.6	4.0	4.6	V
Pin4 Reset Level		V4	V _I = -30dBv, Pin8 = 1.0V		0.02	0.1	V
Pin8 Reset Voltage	1	V8R-1	Pin1 Inverted, R _g = 0	0.6	0.7	0.8	V
	2	V8R-2	V _I = -30dBv, Pin4 Inverted	1.1	1.3	1.5	V

TEST CIRCUIT

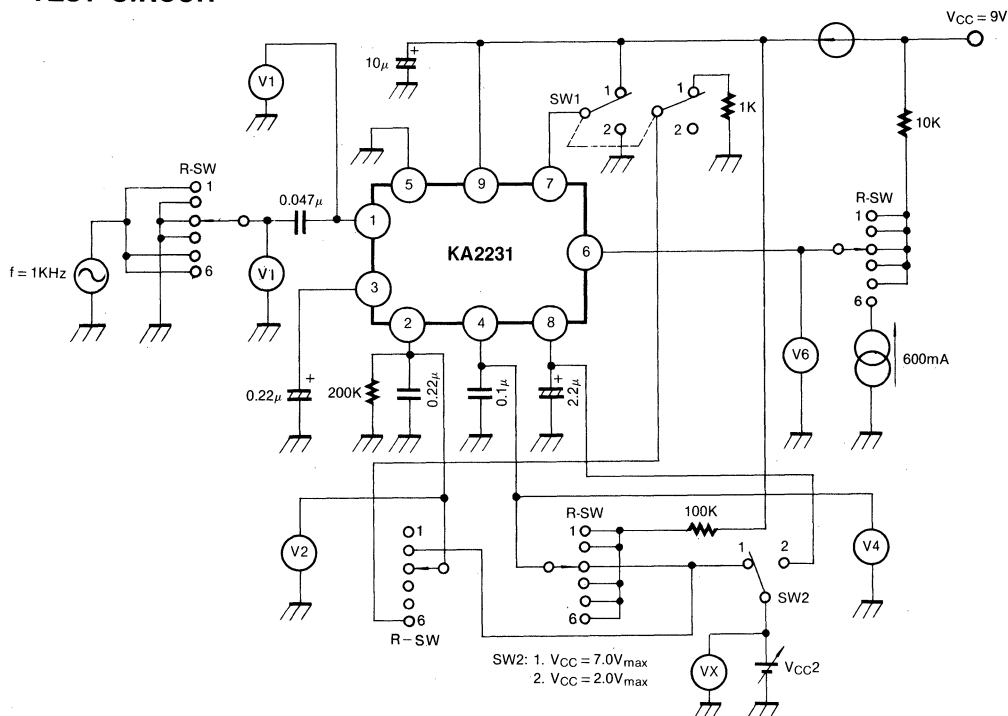


Fig. 2

TEST METHOD

Characteristic	R-SW	SW-1	SW-2	Test Method
Input Sensitivity	1	1	1	Measure AC input level V_i at pin6 L→H inversion mode
Circuit Current	5	1	1	Measure supply current
Output TR Saturation VTG	6	1	1	Measure pin6 voltage V_6 at 600mA
Output diode forward VTG	6	2	1	Measure pin6 voltage V_6 at 600mA
Comparator (1) ON Level	2	1	1	Measure pin2 V_2 at pin6 L→H inversion mode
Comparator (1) OFF Level	2	1	1	Measure pin2 V_2 at pin6 H→L inversion mode
Comparator (2) ON Level	3	1	1	Measure pin4 V_4 at pin6 H→L inversion mode
Comparator (2) OFF Level	3	1	1	Measure pin4 V_4 at pin6 L→H inversion mode
Pin4 Reset Voltage	5	1	2	Measure pin4 voltage V_4 at $V_X = 1V$
Pin8 Reset Voltage 1	4	1	2	Measure V_X voltage at pin1 inversion mode
Pin8 Reset Voltage 2	5	1	2	Measure V_X voltage at pin4 inversion mode

APPLICATION CIRCUIT

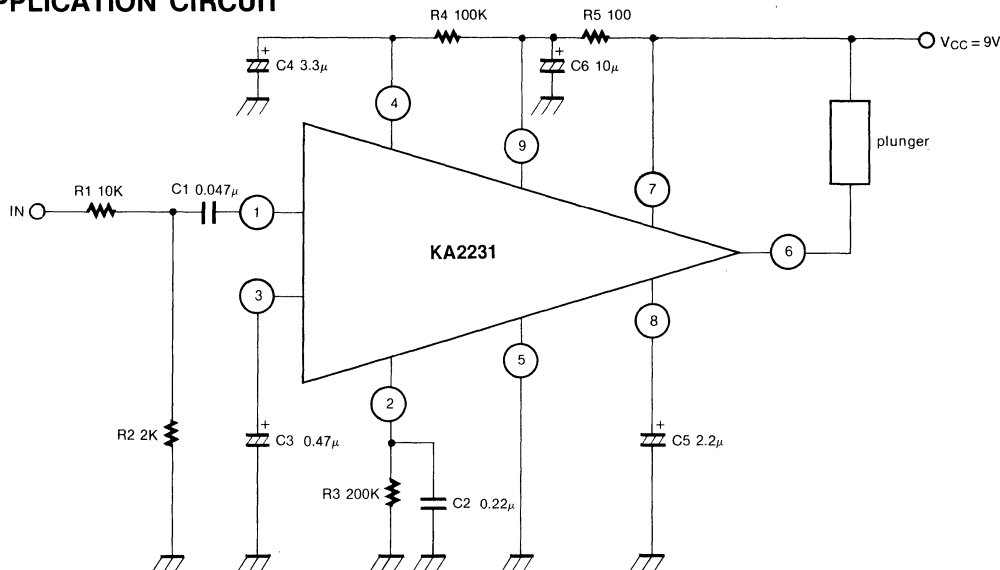
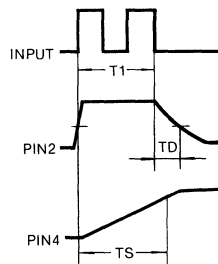


Fig. 4

EXTERNAL COMPONENTS

- C1** : Input coupling capacitor
The recommended value is 0.047μF.
- R1, R2** : Input level control resistor
Pin1 is high in input impedance; in order to be free from external effect, R2 must not exceed 10KΩ and must be GND.
- C2, R3** : Interprogram space detect time (TD)—setting capacitor and resistor
 $TD = 1.34 \cdot C2 \cdot R3$ (sec)
 It is recommended to use R3 of 150KΩ to 500KΩ.
 It is recommended to use C2 of 0.22μF (Mylar Capacitor).
- C3** : Negative feedback capacitor
The lower cut-off frequency depends on the value of this capacitor, and determined as follows.

$$C3 = \frac{1}{0.942 \cdot f_L} \text{ (}\mu\text{F)}$$
 The recommended value is 0.47μF.
- C4, R4** : Recorded area detect time (TS)—setting capacitor and resistor
The recorded area detect time is set by:
 $TS = C4 \cdot R4$ (msec)
 It is recommended to use R4 of 100KΩ.
 (The resistance value of R4 must be 50KΩ to 200KΩ)
 It is recommended to use C4 of 1μF to 3.3μF.
 (The capacitance value of C4 must not exceed 4.7μF)
 For recorded area $TS < T1 + TD$
 For unrecorded area $TS > T1 + TD$
 Therefore, if the recorded area detect time (TS) is longer than the input signal time (T1) + the unrecorded area detect time (TD), no program is present.
- C5** : For setting reset time.
Capacitor used to set the time for initializing the circuit at the time of application of power.
The reset pulse is generated for a certain period of time $TR = 14.4 \cdot C5$ (msec), that is set each time power is applied.
- C6, R5** : For power ripple filter.



TIMING CHART

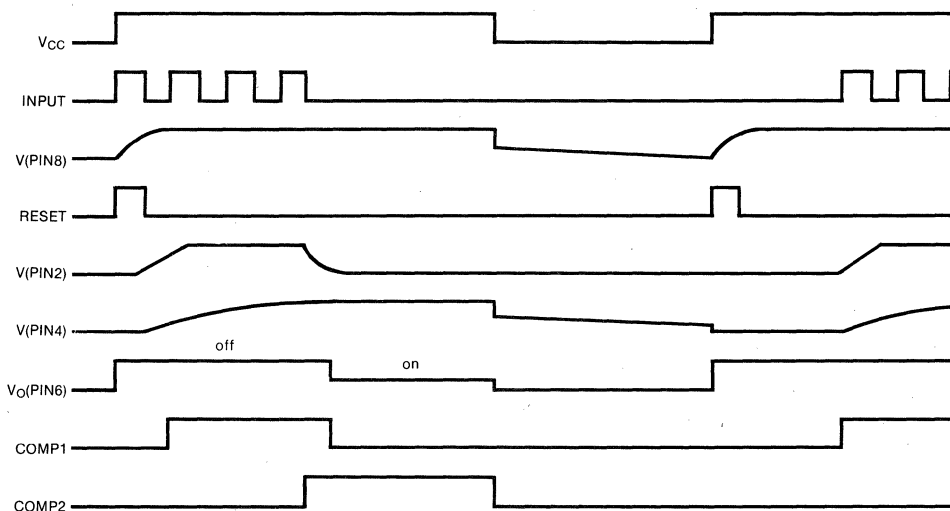


Fig. 5

DESCRIPTION OF OPERATION (See timing chart)

When power supply is applied, the reset circuit operates to initialize the inner circuit. The reset time is determined by the capacitance value of C5 on pin8, and input signal is not accepted while the reset circuit is operating.

When the reset mode is released and the input signal exceeds the input check level, C2 and R3 on pin2 are charged and the potential on pin2 rises, therefore the comparator (1) is inverted.

When the comparator (1) is inverted, C4 on pin4 charged and the potential on pin4 begins rising.

When this potential exceeds the threshold voltage, the comparator (2) is inverted and program presence mode is memorized; thus the potential on pin4 is held at high level. During this period of time, the output terminal (pin6) is held at high level.

When the input signal disappears and the comparator (1) is inverted, output terminal (pin6) turns to low level, therefore causing the plunger to be driven.

The reset pulse is generated for a certain period of time whenever power supply is applied, therefore causing the inner circuit to be initialized.

PROPER CARES IN USING IC

- Maximum Ratings

If the maximum ratings are exceeded, breakdown or deterioration may result.

Use the IC in the range where the maximum ratings are not exceeded.

- Pin to Pin Short and Inverted Insertion

These may cause breakdown or deterioration to occur.

Be extremely careful when mounting the IC on the board.

- The voltage on pin1 must not exceed that on pin9.

- The current flowing into pin2 and pin4 must not exceed $\pm 0.5\text{mA}$ continuously.

- The voltage on pin8 is 2.5V max. and must not exceed that on pin7.

- Electrolytic capacitors are used to set the recorded area detect time and reset time. The actual time constants are 15 to 20% larger than the calculated values obtained by using the catalog values of such capacitors.

For polyester film capacitor and tantalum electrolytic capacitor, the calculated values hold to a fairly good approximation.

AM 1 CHIP RADIO

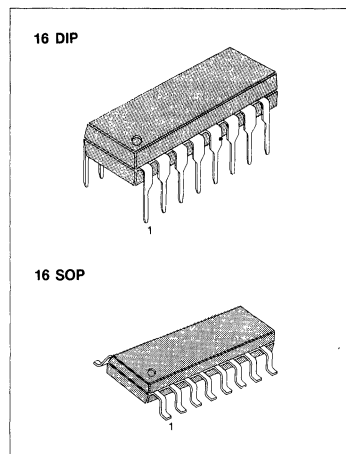
The KA22421 is a monolithic integrated circuit designed for the portable AM Radio.

FUNCTIONS

- Converter
- IF Amp
- AM DET
- Power Amp

FEATURES

- Portable AM 1 chip radio.
- Low quiescent current: $I_{CC} = 1.6\text{mA}$ (Typ) at $V_{CC} = 3\text{V}$.
- Operating supply voltage range: $V_{CC} = 2\text{V} \sim 5\text{V}$.
- High power efficiency
- Power output: $P_O = 100\text{mW}$ (Typ) at $THD = 10\%$.



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22421	16 DIP	- 20 ~ + 70°C
KA22421D	16 SOP	

BLOCK DIAGRAM

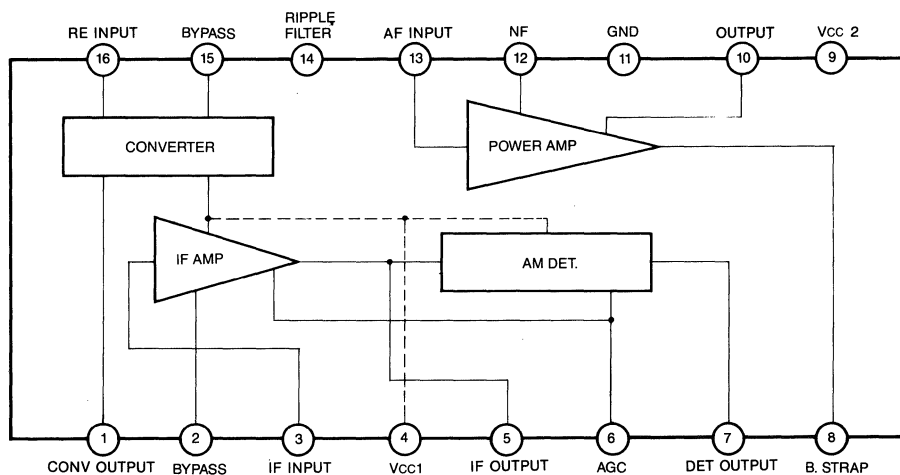


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic		Symbol	Value	Unit
Supply Voltage		V_{CC}	6	V
Power Dissipation	KA22421	P_d	750	mW
	KA22421D		350	
Output Current		I_o (Peak)	0.2	A
Operating Temperature		T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature		T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

Note: Derated above $T_a = 25^\circ\text{C}$ in the proportion of $6\text{mW}/^\circ\text{C}$ (KA22421D: $2.8\text{mW}/^\circ\text{C}$)

ELECTRICAL CHARACTERISTICS

($V_{CC} = 3\text{V}$, $f = 1\text{MHz}$, $f_m = 1\text{KHz}$, 30% Mod, $R_g = 50\Omega$, $R_L = 8\Omega$, $T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Circuit	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	1	$V_i = 0$	0.7	1.6	3.0	mA
Maximum Sensitivity	Max (Sen)	1	$V_i = 20\text{dB}\mu$, $VR = \text{Max}$	200			mV
Output Power	P_o	1	$V_i = 42\text{dB}\mu$, $VR = \text{Max}$	80	100		mW
Total Harmonic Distortion	THD	1	$V_i = 42\text{dB}\mu$		2	6	%
Signal to Noise Ratio	S/N	1	$V_o = 200\text{mV}$		44		dB
Output Noise Voltage	V_{NO}	1	$V_i = 0$, $VR = \text{Max}$		3.5		mV
16 Pin Parallel Input Impedance	$R_{IP} (16)$	2	$f = 1\text{MHz}$		500		$\text{K}\Omega$
	$C_{IP} (16)$				2.5		pF
1 Pin Parallel Output Impedance	$R_{OP} (1)$	3	$f = 1\text{MHz}$		500		$\text{K}\Omega$
	$C_{OP} (1)$				3.9		pF
3 Pin Parallel Input Impedance	$R_{IP} (3)$	4	$f = 500\text{KHz}$		60		$\text{K}\Omega$
	$C_{IP} (3)$				2.2		pF
5 Pin Parallel Output Impedance	$R_{OP} (5)$	5	$f = 500\text{KHz}$		100		$\text{K}\Omega$
	$C_{OP} (5)$				3.0		pF

TEST CIRCUIT 1

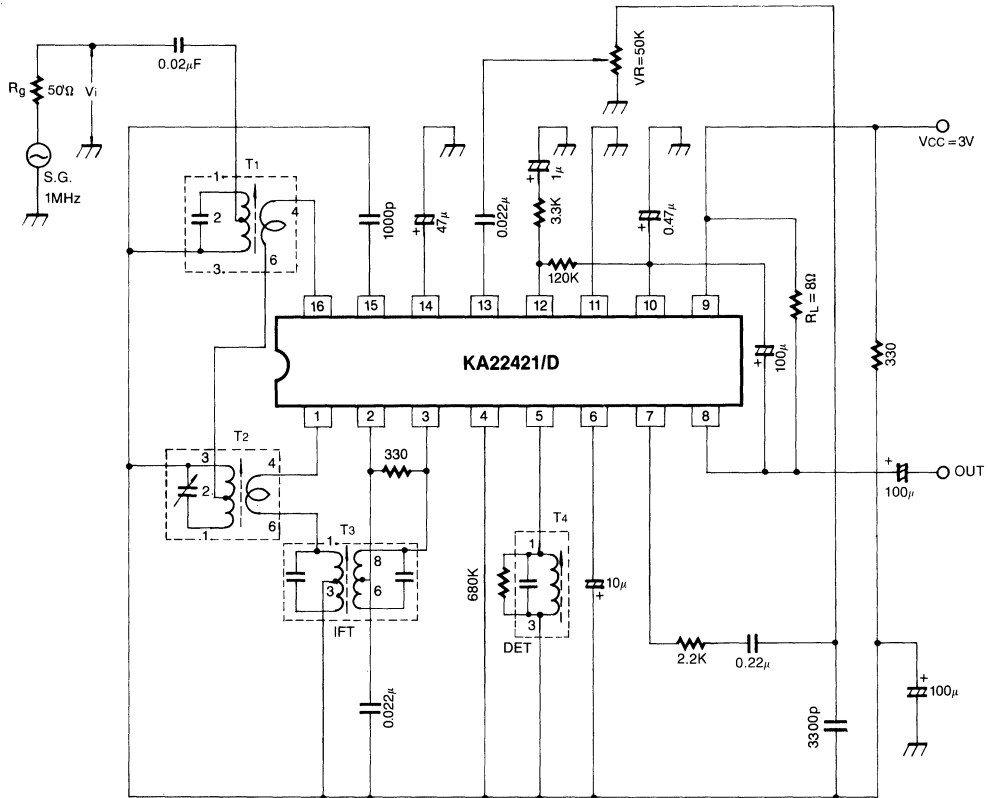


Fig. 2

TEST CIRCUIT 2

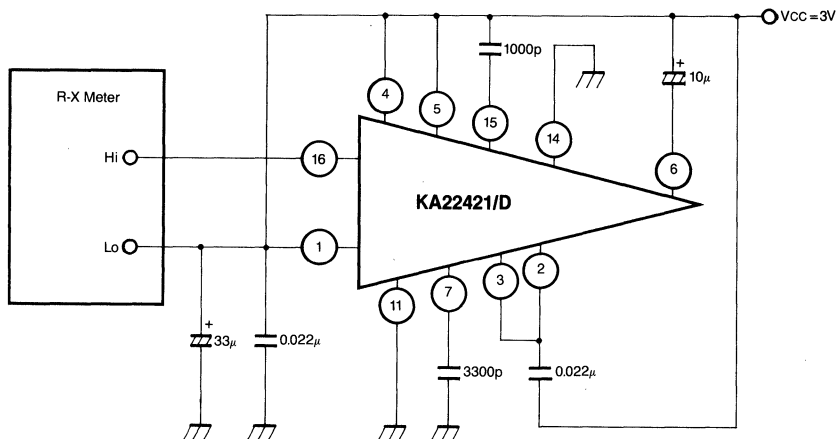


Fig. 3

TEST CIRCUIT 3

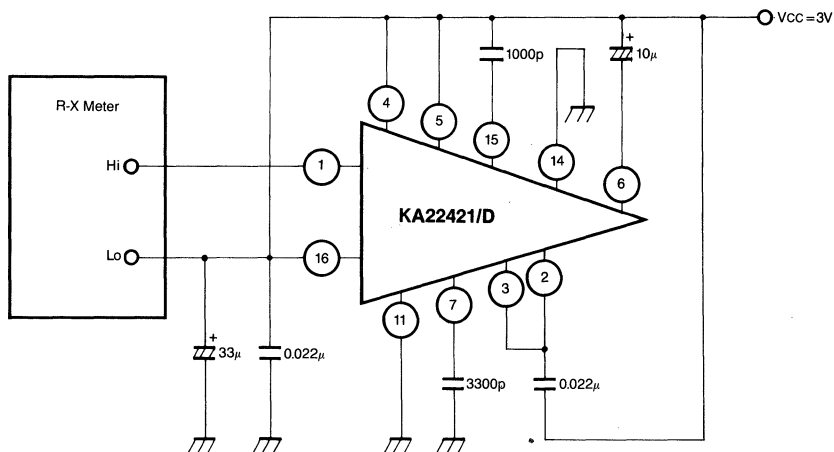


Fig. 4

TEST CIRCUIT 4

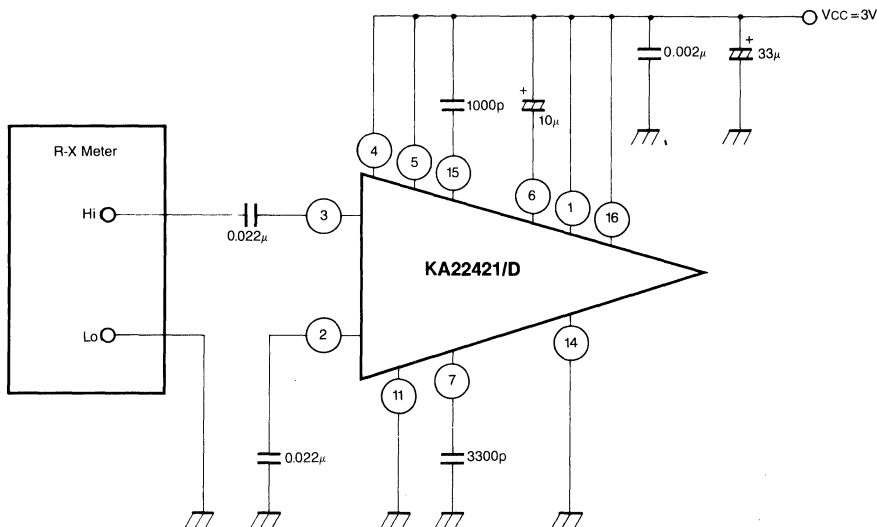


Fig. 5

TEST CIRCUIT 5

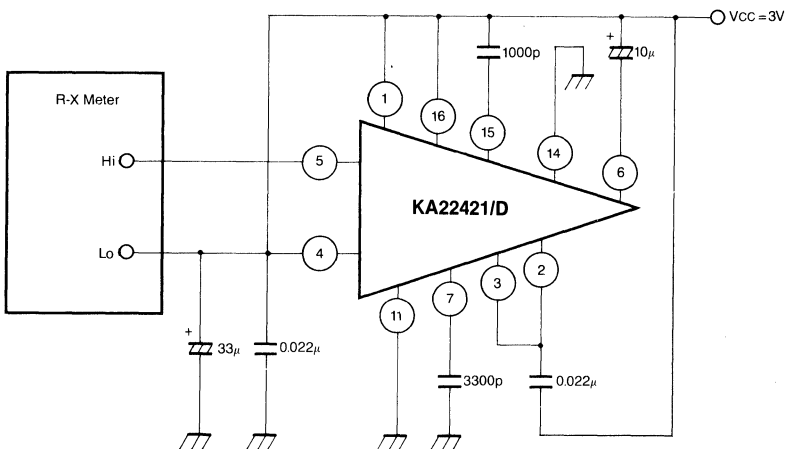


Fig. 6

APPLICATION CIRCUIT

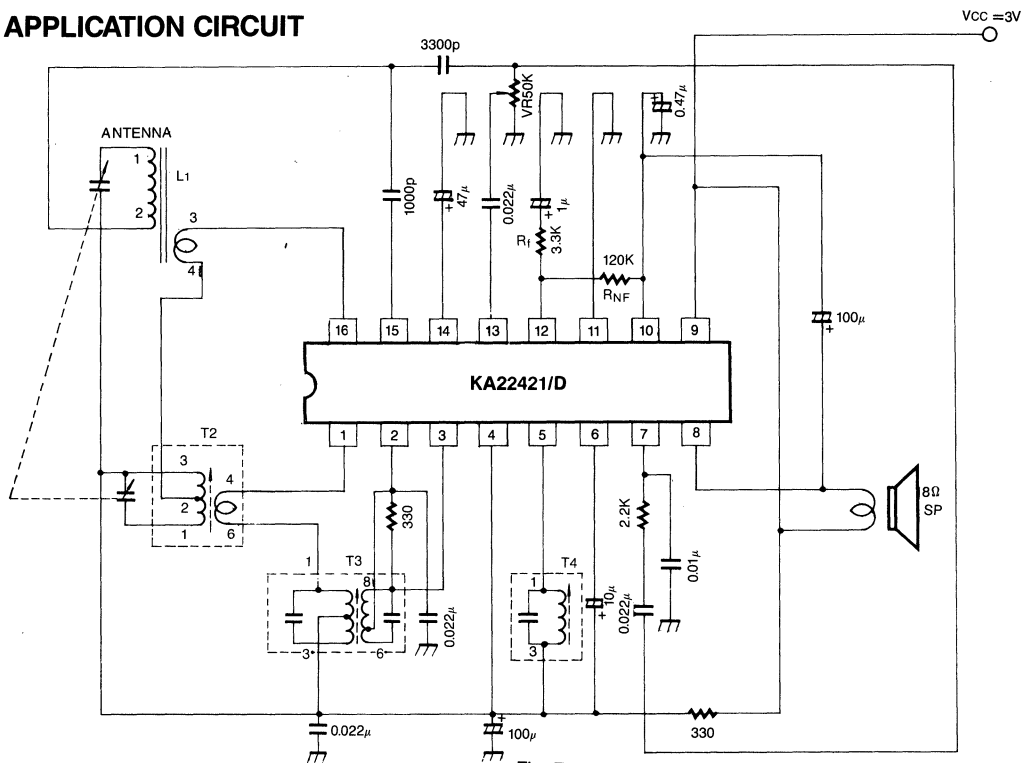


Fig. 7

ELECTRICAL CHARACTERISTICS (at application circuit)

(Unless otherwise specified $T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, $f = 1\text{MHz}$, 30% Mod., $R_L = 8\Omega$, $f_m = 1\text{KHz}$, $R_g = 50\Omega$)

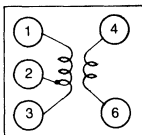
Characteristic	Symbol	Test Conditions	Typ. Value	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	1.6	mA
Maximum Sensitivity	Max (Sen)	$P_O = 5\text{mW}$	41	dB/m
Usable Sensitivity	Use (Sen)	$S/N = 20\text{dB}$	49	dB/m
Signal to Noise Ratio	S/N	$V_i = 74\text{dB/m}$	44	dB
AGC Ratio (Note 1)	AGC	-10dB Output Reduction (from 100dB/m)	50	dB
Recovered Output Voltage	V_{OD}	$V_i = 74\text{dB/m}$ Measure Pin 7	131	mV
Power Amplifier Voltage Gain (Note 2)	A_v	$R_{NF} = 120\text{K}\Omega$, $R_f = 3.3\text{K}\Omega$	26	dB
Output Power	P_O	THD=10%	100	mW
Total Harmonic Distortion	THD	$V_i = 74\text{dB/m}$	2	%

Note 1. The AGC Ratio is defined as the input electric intensity ratio between the output voltage at 100dB/m and -10dB output voltage.

2. The open loop voltage gain of the power amplifier is typical 33dB.

COIL SPECIFICATION

T1 Antenna Coil

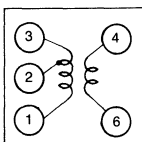


(Bottom View)

f (kHz)	L (μ H)	Q _o	TURNS		
			1-2	2-3	4-6
300	600	115	2	130	8

Wire: 0.07mm ϕ UEW

T2 OSC Coil

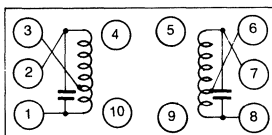


(Bottom View)

f (kHz)	L (μ H)	Q _o	TURNS		
			1-2	2-3	4-6
796	360	125	92 $\frac{1}{2}$	8	10 $\frac{1}{2}$

Wire: 0.08mm ϕ UEW

T3 AM IFT

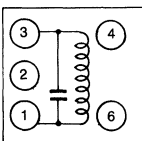


(Bottom View)

C _o (pF)		f (kHz)	Q _o	TURNS			
1-2	7-8			1-2	1-3	2-3	6-7
150	150	455	65	80	148	196	32

Wire: 0.08mm ϕ UEW

T4 Detector Coil

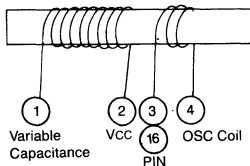


(Bottom View)

C _o (pF)	f (kHz)	Q _o	TURNS
1-3	1-3	1-3	1-3
180	455	65	142

Wire: 0.08mm ϕ UEW

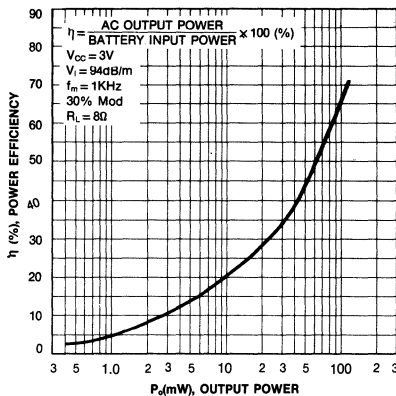
L1 Bar Antenna Coil



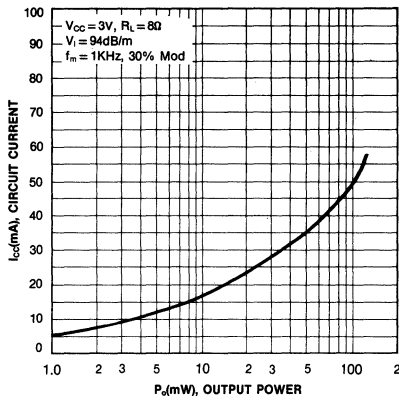
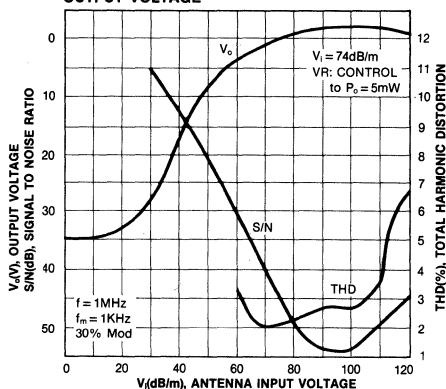
f (kHz)	L (μ F)	Q _o	TURNS	
			1-2	3-4
796	625	200 Min	105	20

Core: 12mm ϕ $\times$ 52mm ϕ Wire: USTC-0.1mm ϕ

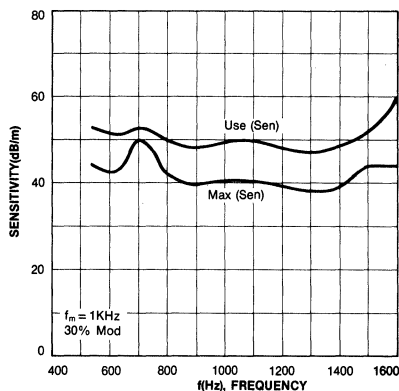
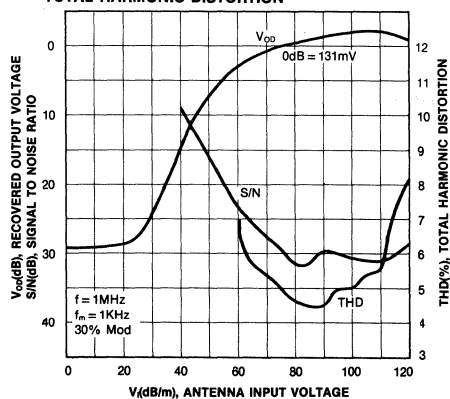
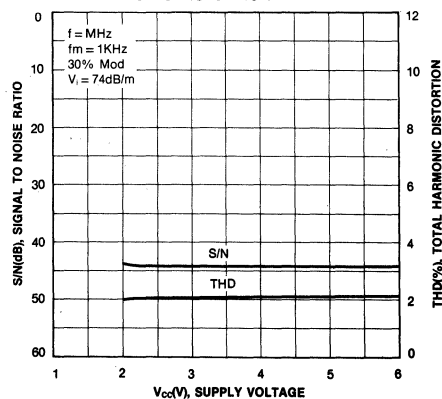
POWER EFFICIENCY-OUTPUT POWER

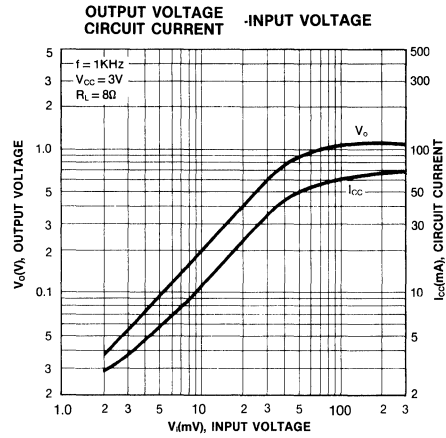
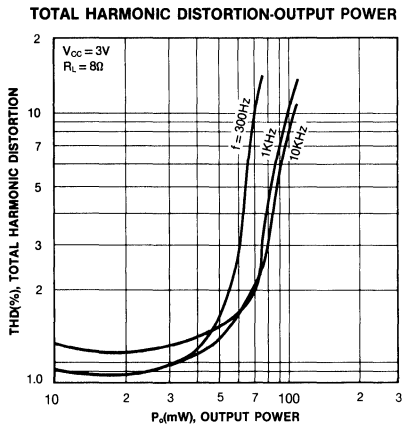
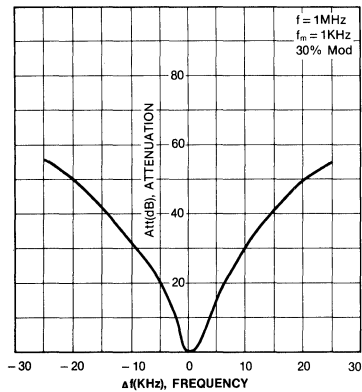
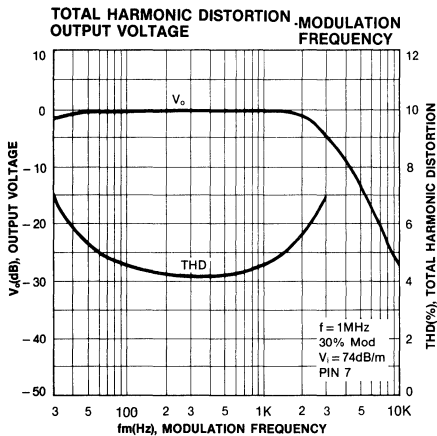
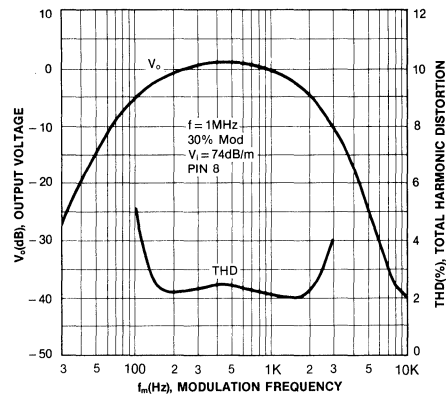
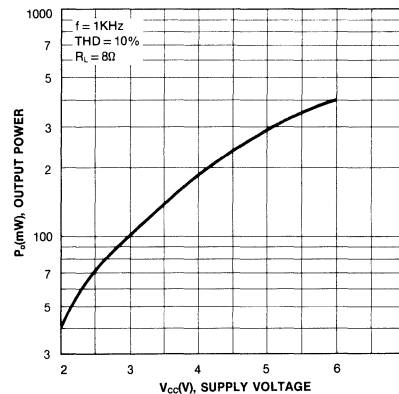


CIRCUIT CURRENT-OUTPUT POWER

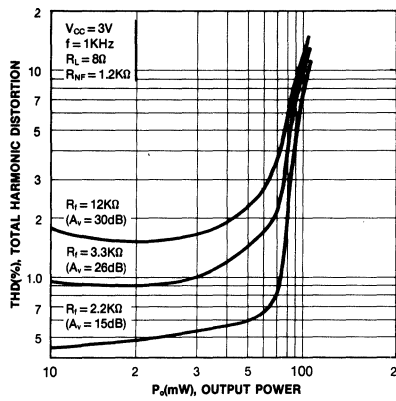
TOTAL HARMONIC DISTORTION
SIGNAL TO NOISE RATIO
OUTPUT VOLTAGE

SENSITIVITY-FREQUENCY

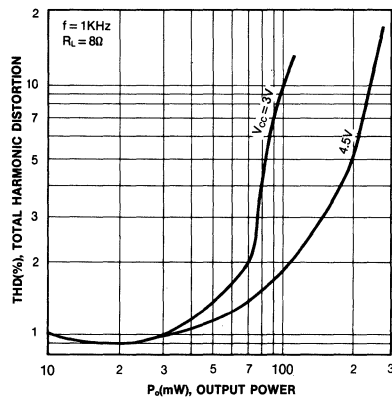
RECOVERED OUTPUT VOLTAGE
SIGNAL TO NOISE RATIO
TOTAL HARMONIC DISTORTIONSIGNAL TO NOISE RATIO
TOTAL HARMONIC DISTORTION

**ATTENUATION-FREQUENCY****TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE
MODULATION FREQUENCY****OUTPUT POWER-SUPPLY VOLTAGE**

TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



AM/FM 1 CHIP RADIO

KA22427 is a monolithic integrated circuit designed for the portable AM/FM radio or AM/FM clock radios.

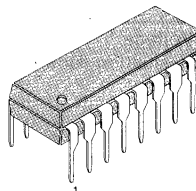
FUNCTIONS

- AM RF & MIX
- AM AGC
- AM/FM DET
- Regulator
- AM Local OSC
- AM/FM IF AMP
- Audio Power AMP
- FM AFC Control

FEATURE

- Portable AM/FM 1 chip radio
- Wide operating supply voltage range; $V_{CC} = 3 \sim 12V$ (Approximately)
(Depending on the internal regulator tolerance)
- Recommended operating supply voltage; $V_{CC} = 4.5 \sim 9V$

16 DIP

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA22427	16 DIP	-20 ~ +70°C

V_{CC} R_L	4.5V	6.0V	7.5V	9.0V	Line Operated
8Ω	○	○	○	X	X
16Ω	○	○	○	○	X
45Ω	○	○	○	○	○

- On using AC line as internal shunt regulator mode, it is possible to use low cost application without transformer (approximately 42mA)
- IF AMP gain is determined by DC voltage appeared at IC pin 16.
- Power output: $P_o = 0.28W$ (Min.) at THD = 10% ($V_{CC} = 5.5V/8\Omega$).

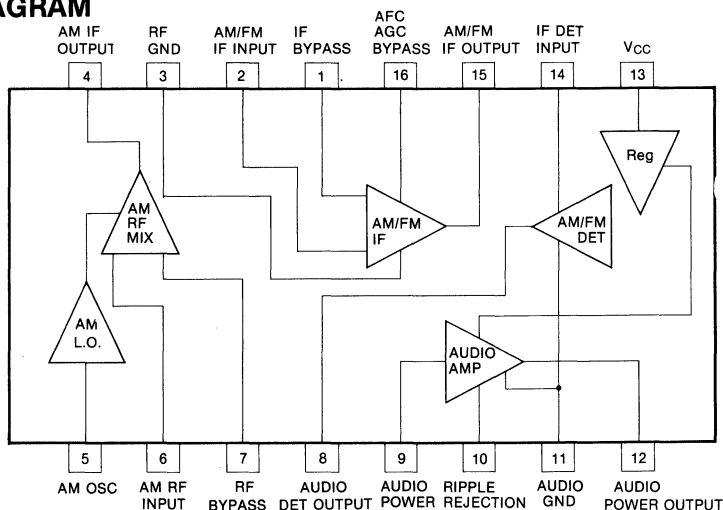
BLOCK DIAGRAM

Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	13	V
Power Dissipation (Note) Ta ≤ 65°C	P _d	600	mW
Supply Current	I _{CC}	44	mA
Thermal Resistance	R _{thA}	100	°C/W
Operating Temperature	T _{opr}	-20 ~ +70	°C
Storage Temperature	T _{stg}	-55 ~ +150	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 5.5V, f_m = 1KHz, AM: f = 1MHz, 30% Mod, FM: f = 10.7MHz
 $\Delta f = 22.5\text{KHz}$, Unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
FM	Quiescent Circuit Current	I _{CC}	SW: FM, V _{CC} = 3V	10	15	20	mA
			SW: FM, V _{CC} = 9V	13	20	26	
	Pin 16 Terminal Voltage	V ₁₆ (FM)	SW: FM, V _{CC} = 9V, V _i = 0	2.0	2.4	3.1	V
	Input Limiting Sensitivity	V _i (lim)	SW: FM, -3dB V ₁₆ = 2.4V, V _R Min		57		dB μ
AM	Internal Regulated Vtg.	V _{CC}	SW: AM, I _{CC} = 42mA	12	13.2	14.0	V
	Pin 16 Voltage	V ₁₆ (AM)	SW: AM, V _{CC} = 9V, V _i = 0	1.4		1.9	V
	Maximum Sensitivity	Max (Sen)	SW: AM, V _{CC} = 12V V _i = 37dB μ , R _L = 45 Ω	1.5	3.0		V
	Signal to Noise Ratio	S/N	V _i = 37.5dB μ , R _L = 8 Ω P _o = 50mW	15	20		dB
PWR AMP	Output Power	P _o	f = 1KHz, THD = 10% V _R Min, R _L = 8 Ω	0.28			W
	Total Harmonic Distortion	THD	I _{CC} = 42mA, R _L = 45 Ω f = 1KHz, V _o = 2V V _R Min		0.5	4.0	%
	Voltage gain	A _v	f = 1KHz, R _L = 8 Ω P _o = 50mW		41		dB

TEST CIRCUIT

1. CIRCUIT

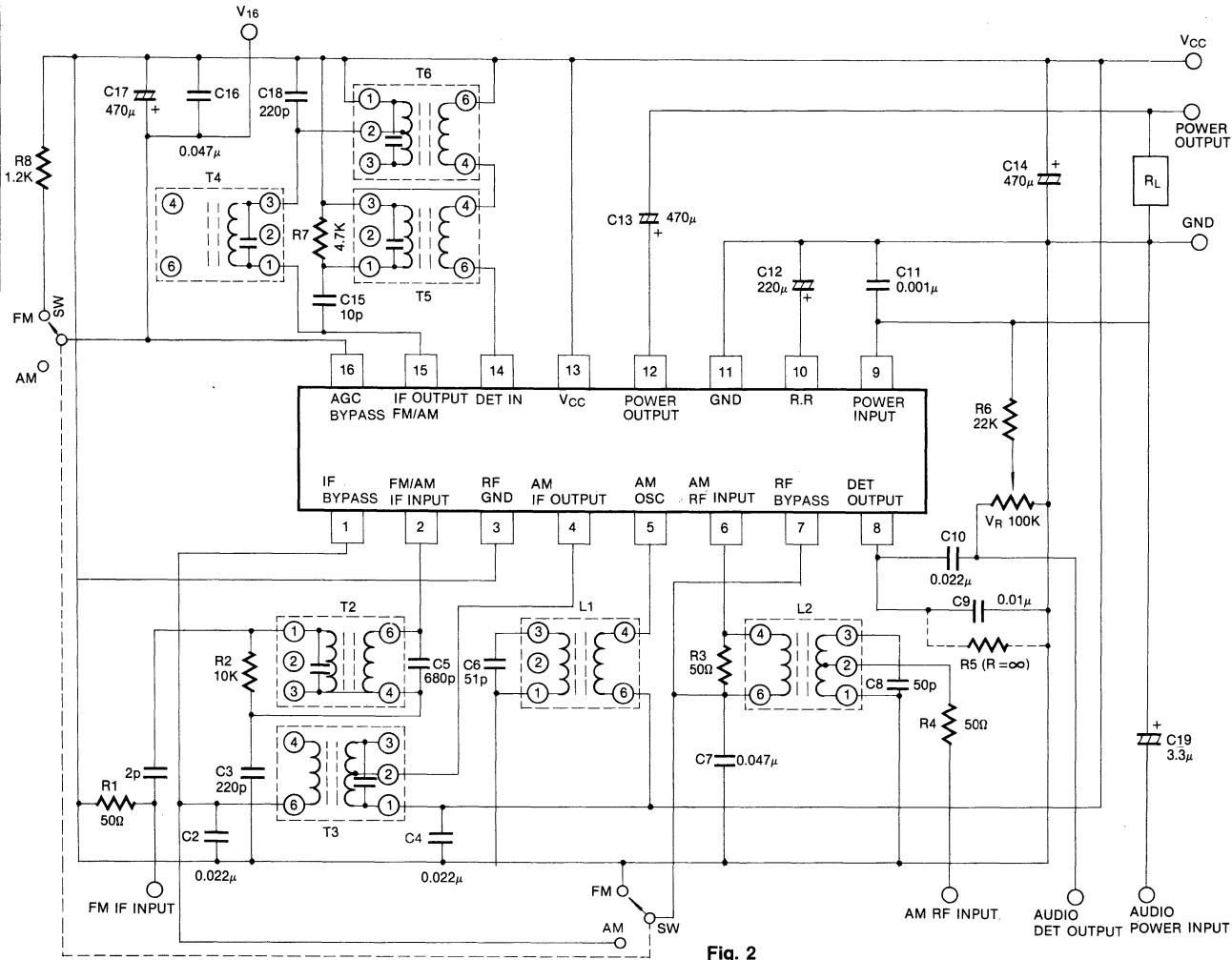


Fig. 2

EXTERNAL PARTS TABLE

Parts Number	Purpose	Typical	Influence	
			Smaller Than Typ	Greater Than Typ
R5	AM Gain Control	47K Ω (33K ~ ∞)	Low AM Gain	AGC Distortion Increase, High Gain
R7	FM Detector Dampener	4.7K Ω	Low Detector Output, Stable IF Gain, Low FM Gain	Sharp IF AMP Curve
R8	FM Gain Adjust	470	Low FM Gain	High Gain, but Noise Increase
C2	IF Bypass	0.022 μ F	Should Not Less Than 0.005 μ F	High IF Gain, S/N Ratio Degrade
C4	IF Filter	0.022 μ F	Remove May Cause IF Oscillation	No Influence
C7	AM Bypass	0.047 μ F	Low Gain	Using over 1 μ F Will Cause FM Distortion at Small Signal
C9	Detector Filter	0.01 μ F	Unstable IF AMP Oscillation	Poor FM Frequency Response
C10	Audio Coupling	0.022 μ F	Lower Sensitivity, Poor Low Frequency Response	Bass Boost Affecting De-emphasis Curve
C11	Audio Input High-Cut	0.001 μ F	Audio Oscillation	Poor Response
C12	Ripple Filter	220 μ F	Poor Frequency Response & Low Gain	Improve AC Hum
C13	Audio Output Coupling	470 μ F	Poor Low Frequency Response	Can Achieve Optimum Output Power
C14	Power Line Filter	470 μ F	Poor AC Hum	Improve AC Hum
C15	FM Detector Phase-Shift	10pF	Narrow IF Bandwidth	Wide IF Bandwidth
C16	High Freq. (IF) Bypass	0.047 μ F	Remove Will Cause FM Oscillation	No Influence
C17	AM AGC Time Constant and High Frequency (IF) Bypass	0.047 μ F	Not Recommend to Charge	

APPLICATION NOTE (Pin 16 DC Voltage)

1. IF Gain Grouping Table

(1) Test Condition: $V_{CC} = 9V$ (Pin 13).Pin 8 resistance (AM) = $47K\Omega$.Pin 16 resistance (FM) = $1.2K\Omega$.

(2) Grouping Table

V16 (AM)	1.4 – 1.7V	1.7 – 1.9V
V16 (FM)	C1	C2
2.6 – 3.0V		

2. IF gain is determined by DC voltage appeared at IC pin 16.

The DC voltage at pin 16 to following values.

AM = 1.4 – 1.65V (DC)

FM = 1.9 – 2.10V (DC)

AM gain can be adjusted by loading resistor value of pin 8 (AM) from $33K\Omega$ to infinity.FM gain can be adjusted by loading resistor value of pin 16 (FM) from 390Ω to 680Ω .

Recommended resistance (Pin 8, Pin 16).

Pin 8 (AM) = $47K\Omega$ Pin 16 (FM) = 470Ω

APPLICATION CIRCUIT 1

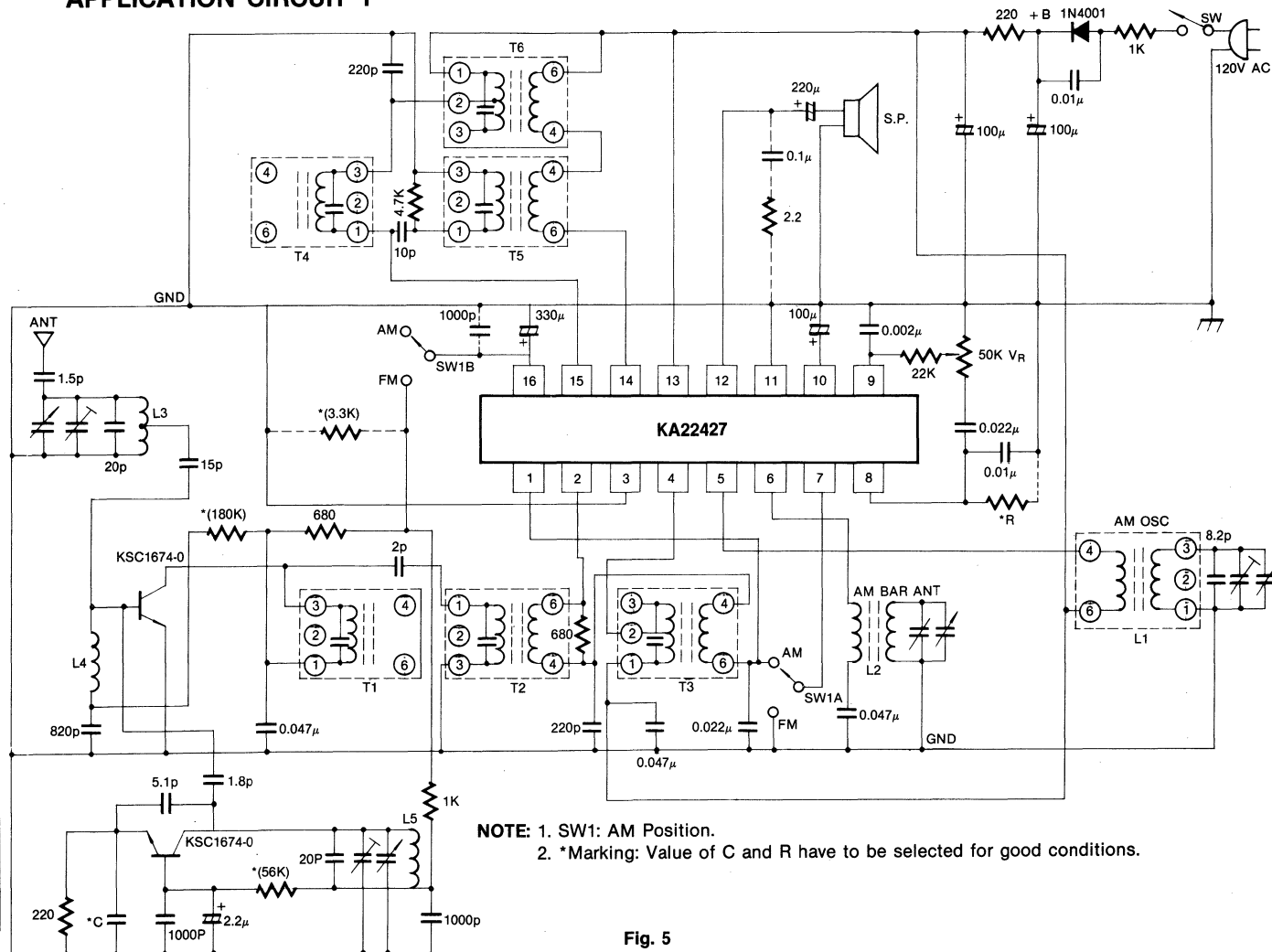


Fig. 5

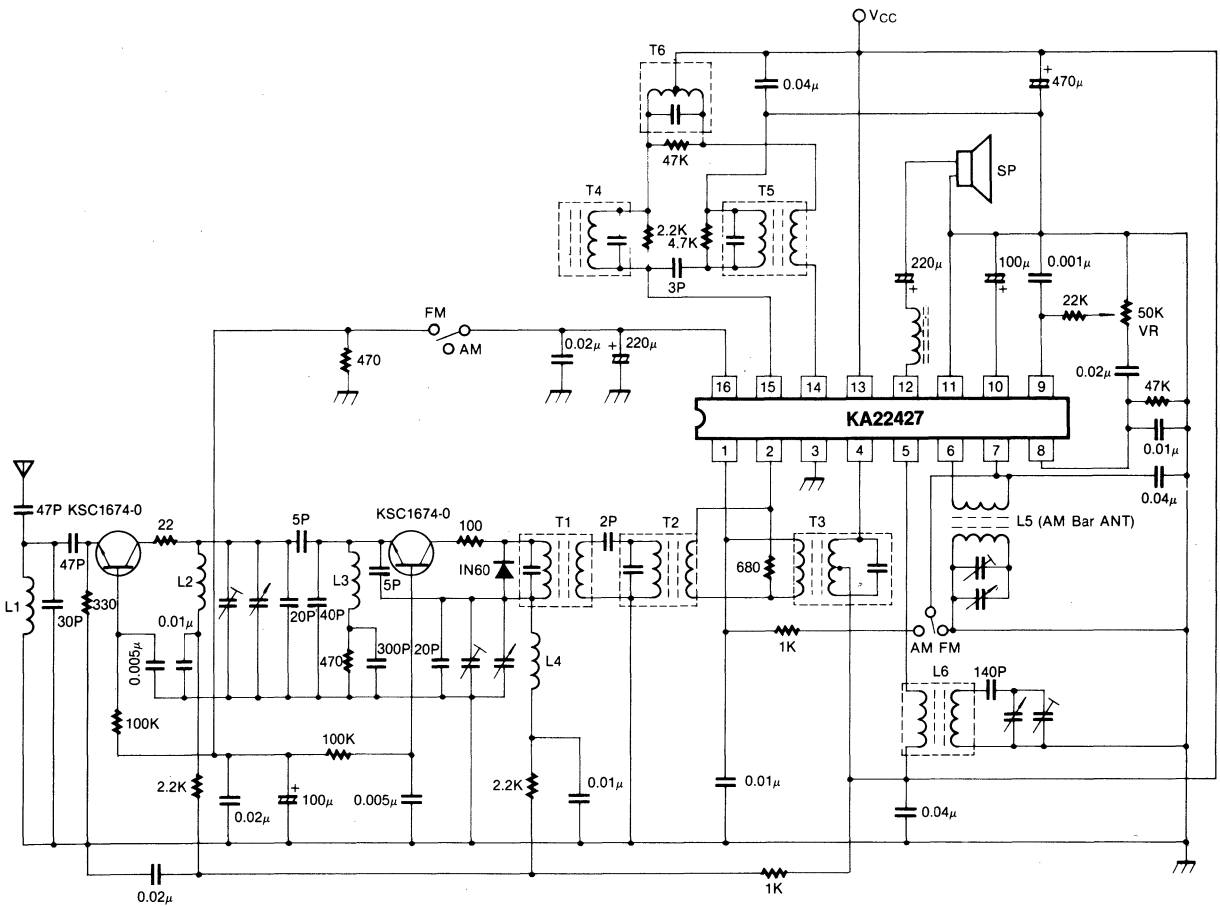
KA22427

LINEAR INTEGRATED CIRCUIT

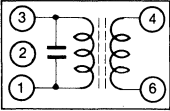
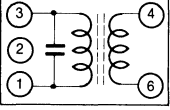
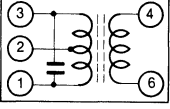
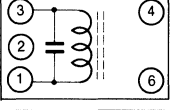
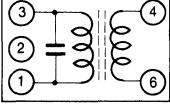
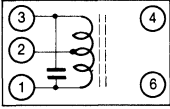
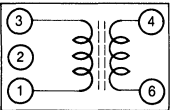
COIL SPECIFICATION 1

Coil No.	f	Q _o	Turns		C _o	Connections
T1	10.7MHz	120	1 – 3	8T	150pF	
T2	10.7MHz	70 min	1 – 3 4 – 6	11T 2T	75 ± 5pF	
T3 (T6)	455KHz	80 min	1 – 2 2 – 3 4 – 6	91T 55T 6T	180 ± 5pF	
T4	10.7MHz	45 min	1 – 3	11T	82 ± 3pF	
T5	10.7MHz	25 min	1 – 3 4 – 6	7T 7T	180pF	
L1	AM Local Oscillator	90 min	1 – 3 4 – 6	86T 7T		
L2	AM ANT	200	1 – 2 (L = 560μH) 3 – 4	138T 9T		Core: 10 mm ø × 55 mm V.C GND Pin 6 GND
L3	FM ANT		0.8 mm ø UEW TAP	5T 0.5T		
L4	Trap		0.32 mm ø UEW	10T		
L5	FM Oscillator		0.8 mm ø UEW	4T	—	

APPLICATION CIRCUIT 2



COIL SPECIFICATION 2

Coil No.	f	Q ₀	Turns		C.L.	Connections
T1	10.7MHz	90	1 - 3	11	82pF	
			4 - 6	3		
T2	10.7MHz	60	1 - 3	5	390pF	
			4 - 6	2		
T3	455KHz	100*	1 - 2	127	180pF	
			2 - 3	28		
			4 - 6	10		
T4	10.7MHz	45 (Min)	1 - 3	11	82pF	
T5	10.7MHz	25 (Min)	1 - 3	7	180pF	
			4 - 6	7		
T6	455KHz	100	1 - 2	50	390pF	
			2 - 3	50		
L6	796KHz	100	1 - 3	100	360μH	
			4 - 6	10		

FM ONE CHIP RADIO

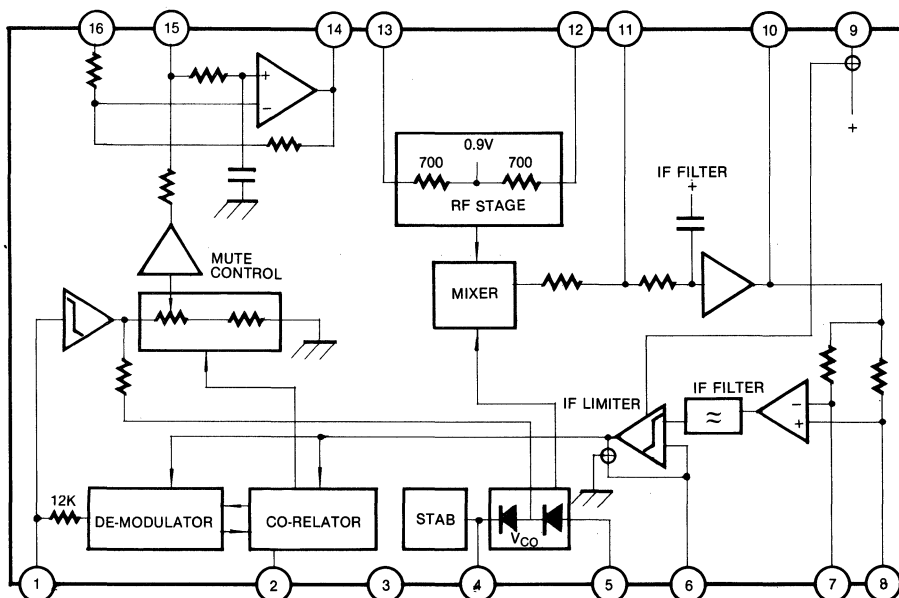
The KA22429 is integrated circuit for FM portable radios, stereo as well as mono, where a minimum periphery is important in terms of small dimensions and low cost. It is fully compatible for applications using the low voltage micro tuning system IC (MTS). The IC has a frequency of 76KHz, locked loop (FLL) system with an intermediate frequency.

The selectivity is obtained by active RC filters. The only function to be tuned is the resonant frequency of the oscillator. Interstation noise as well as noise from receiving weak signals is reduced by a correlation mute system.

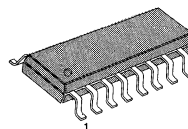
FEATURES

- Rf input stage
- Local oscillator
- Frequency detector
- MTS compatible
- Internal reference circuit
- LF amplifier for mono earphone amplifier or mux filter
- Field strength dependent channel separation control facility
- Mixer
- IF amplifier/limiter
- Mute circuit
- Loop amplifier

BLOCK DIAGRAM



16 SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22429D	16 SOP	- 10 ~ +70°C

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	7	V
Oscillator Voltage	V5	$-0.5 \sim +0.5$	V
Operating Temperature	T_{opr}	$-10 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^\circ\text{C}$
Thermal Resistance	θ_{ja}	300	K/W

DC ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, unless otherwise specified)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	1.8	3.0	6	V
Quiescent Circuit Current	I_{CC}		6.3		mV
Oscillator Current	I_5		250		μA
Voltage at Pin 13	V_{13}		0.9		V
Output Voltage	V_{14}		1.3		V

AC ELECTRICAL CHARACTERISTICS

MONO OPERATION

(f_{RF} = 96MHz, f_m = 1KHz, $\Delta f = \pm 22.5\text{KHz}$, EMF = 300 μV (EMF Voltage at Source Impedance of 75ohm), T_a = 25°C, V_{CC} = 3V unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Sensitivity	EMF ₁	-3dB: Mute Disable		4.0		μV
	EMF ₂	-3dB: Mute Enable		5.0		μV
	EMF ₃	S/N = 26dB: Mute Enable		7.0		μV
Signal Handling	V _{OM}	THD < 10%, $\Delta f = \pm 75\text{KHz}$		200		mV
Signal to Noise Ratio	S/N ₁			60		dB
Total Harmonic Distortion	THD ₁	$\Delta f = \pm 22.5\text{KHz}$		0.7		%
	THD ₂	$\Delta f = \pm 75\text{KHz}$		2.3		%
Am Rejection Ratio	AMR	AM: f _m = 1KHz, m = 80% FM: f _m = 1KHz, $\Delta f = \pm 75\text{KHz}$		50		dB
Ripple Rejection	RR	$\Delta V_{CC} = 100\text{mV}$, f = 1KHz		30		dB
Oscillator Voltage	V _{OSC}			250		mV
Variation of Oscillator Frequency	f _{osc} /ΔV _{CC}	ΔV _{CC} = 1V		5		KHz/V
	f _{osc} /ΔT	With Temperature		0.2		KHz/°C
Selectivity	S + 300	Without Modulation ; Test Circuit Fig. 3		30		dB
	S - 300			46		dB
AFC Range	$\pm \Delta f_{RF1}$			160		KHz
Mute Range	$\pm \Delta f_{RF2}$			120		KHz
Band Width	BW	ΔV _O = 3dB Pre-Emphasis t = 50 μs		10		KHz
AF Output Voltage	V _{O1}			90		mV
AF Output Current	I _O (DC)	Max DC LOAD	- 100		+ 100	μA
	I _O (AC)	THD = 10%, PEAK VALUE		3		mA

STEREO OPERATING

(f_{RF} = 96MHz Modulated with Pilot $\Delta f = \pm 6.75\text{KHz}$ and AF Signal $\Delta f = \pm 22.5\text{KHz}$; f_m = 1KHz; EMF = 1mV (EMF Voltage at a Source Impedance of 75ohm)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Sensitivity	EMF ₄	S/N = 46dB		300		μV
Signal to Noise Ratio	S/N ₂			53		dB
Channel Separation	Sep			20		dB
Pilot Voltage of Pin 14	V _{p14}			13.5		mV
AF Output Voltage	V _{O2}			80		mV
Selectivity	S + 300	Without Modulation ; Test Circuit Fig. 3		22		dB
	S - 300			40		dB

TEST CIRCUIT

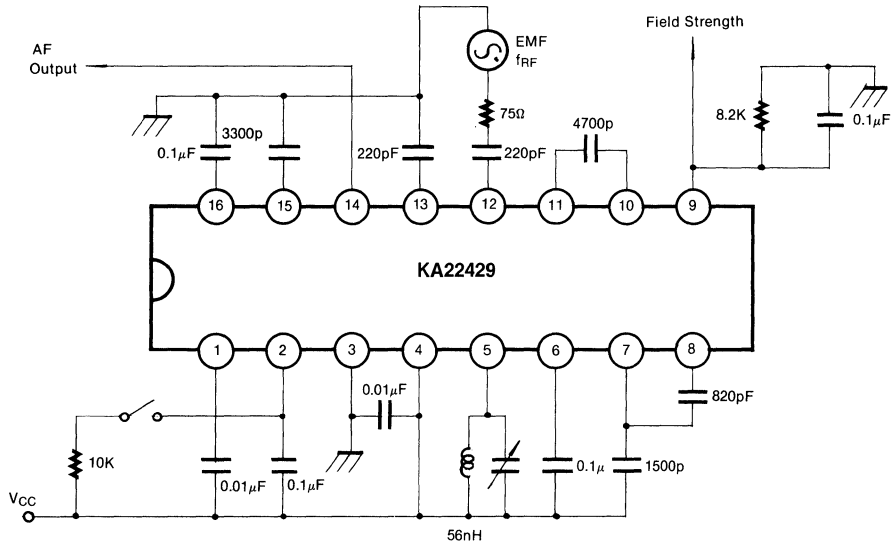


Fig. 1 Test Circuit for Mono Operation

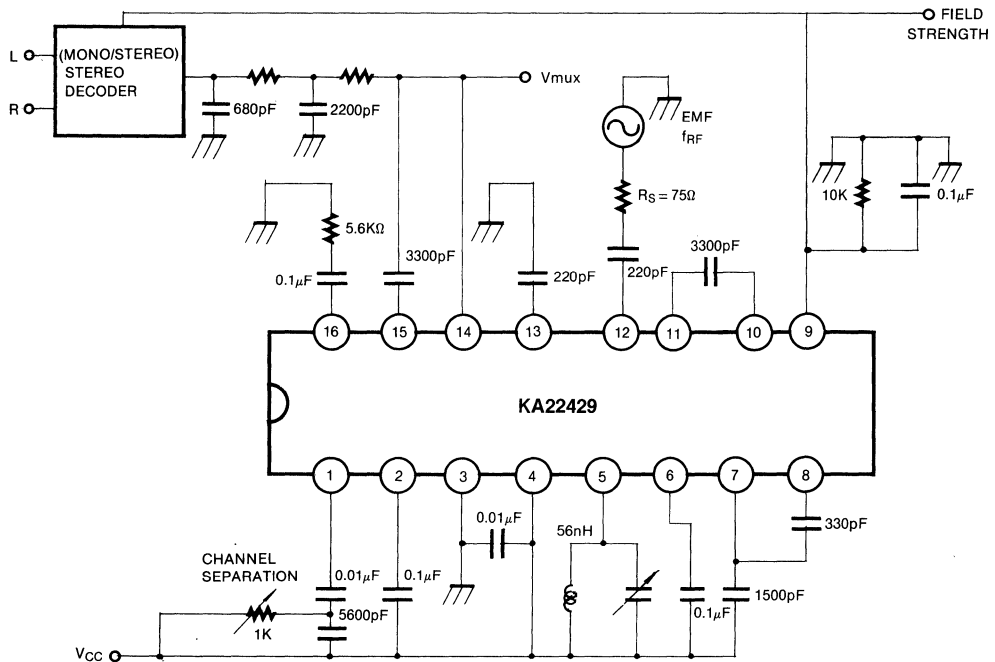


Fig. 2 Test Circuit for Stereo Operation

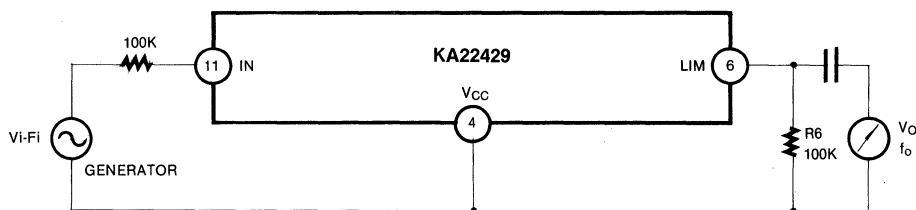


Fig. 3 Test Circuit

NOTES:

Setup with circuitry as Fig. 1 as Fig. 2

C_6 ($0.1\mu\text{F}$) deleted and replaced by $R_6 = 100\text{Kohm}$; $V_i = 30\text{mV}$; $f_i = 76\text{KHz}$ output selective voltmeter $R_1 \geq 1\text{M}\Omega$;

$C_i \leq 8\text{pF}$; $f_o = f_i$

SELECTIVITY

$$S_{+300} = 20\text{Log} \frac{V_{o1}/(300\text{KHz} - f_i)}{V_o/f_i}$$

$$S_{-300} = 20\text{Log} \frac{V_{o1}/(300\text{KHz} + f_i)}{V_o/f_i}$$

AM/FM IF SYSTEM

The KA2243 is a monolithic integrated circuit developed for the radio cassette tape recorder included AM/FM IF amplifier and detector.

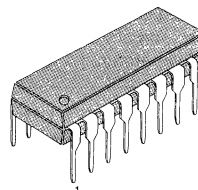
FUNCTIONS

- AM Section:
 - IF amplifier with AGC detector.
 - Signal meter driver circuit.
 - Voltage regulator for RF external circuit.
- FM Section:
 - IF amplifier.
 - Quadrature detector.
 - Post amplifier.
 - Signal meter driver circuit.

FEATURES

- Suitable for radio cassette and home stereo.
- Wide operating supply voltage range. (3.0V ~ 14V).
- Low quiescent circuit current.
- AM section.
 - Simplified input circuit IFT (Ceramic filter type).
 - RF AGC available.
- FM section.
 - High limiting sensitivity (33dB μ , Typ).
 - Low residual noise (45dB at $V_i = -10\text{dB}\mu$).
 - Small side peak of detuned output voltage.

16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2243	16 DIP	-20 ~ +70°C

TEST CIRCUIT

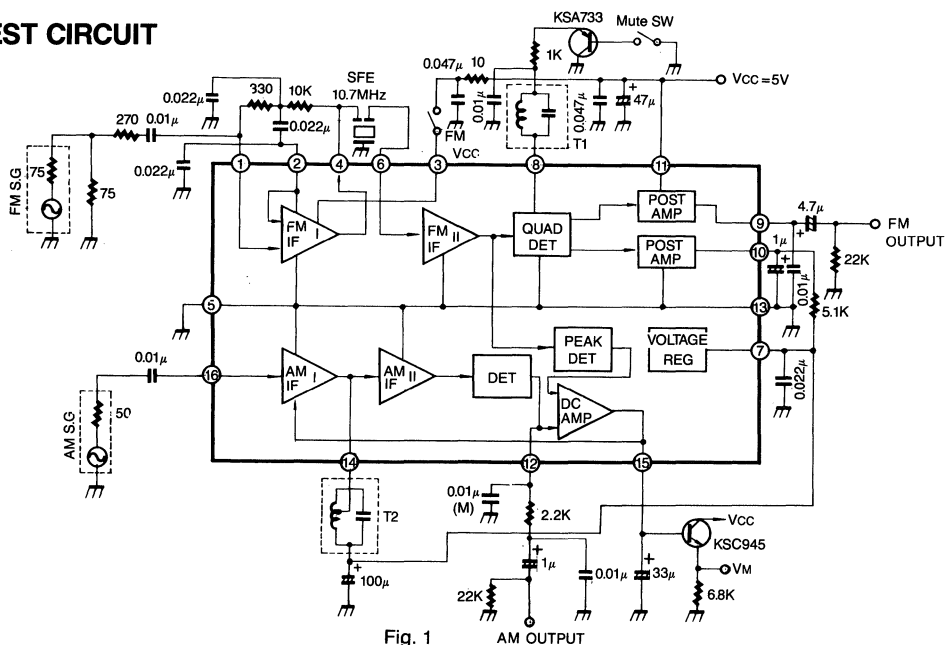


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(T_a = 25°C, V_{CC} = 5.5V, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
----------------	--------	-----------------	-----	-----	-----	------

FM Section (f = 10.7MHz, f_m = 1KHz, Δf = ± 75KHz)

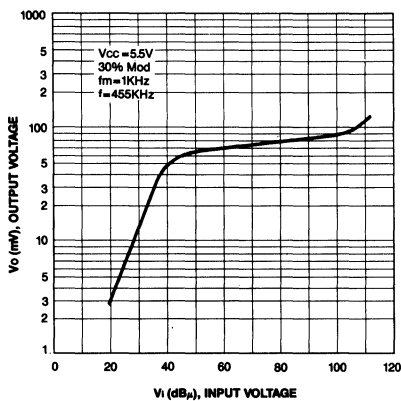
Quiescent Circuit Current	I_{CC}	$V_i = 0$	7	11	16.5	mA
Input Limiting Sensitivity	V_i (lim)	V_o ($V_i = 100\text{dB}\mu$) - 3dB		33	38	dB μ
Detector Output Voltage	V_o	$V_i = 100\text{dB}\mu$	180	245	310	mV
Total Harmonic Distortion	THD	$V_i = 100\text{dB}\mu$		0.3	1.0	%
AM Rejection Ratio	AMR	$V_i = 100\text{dB}\mu$	50	60		dB
Signal to Noise Ratio	S/N	$V_i = 100\text{dB}\mu$	72	83		dB
Signal Meter Output	V_M	$V_i = 100\text{dB}\mu$	1.05	1.5	2.05	V
Residual Noise	V_N	V_o (AF) ($V_i = 100\text{dB}\mu$) : V_o (AF) ($V_i = -10\text{dB}\mu$)		45		dB
Muting Attenuation	M (att)	$V_i = 37\text{dB}\mu$, Mute SW on		35		dB

AM Section (f = 455KHz, f_m = 1KHz, 30% Mod)

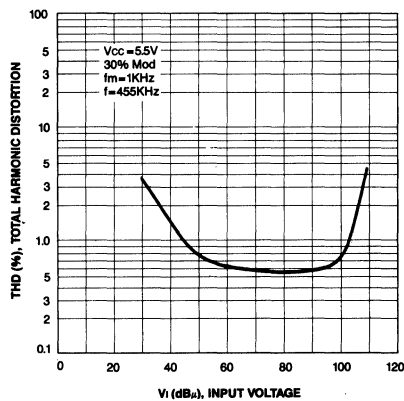
Quiescent Circuit Current	I_{CC}	$V_i = 0$		8		mA
Maximum Sensitivity	V_i (sen)	V_o (AF) = 10mV		29		dB μ
Detector Output Voltage	V_o	$V_i = 74\text{dB}\mu$	45	65	85	mV
Total Harmonic Distortion	THD	$V_i = 74\text{dB}\mu$		0.3	2.0	%
		$V_i = 100\text{dB}\mu$		0.7	3.5	%
Signal to Noise Ratio	S/N	$V_i = 74\text{dB}\mu$	45	55		dB μ
Signal Meter Output	V_M	$V_i = 100\text{dB}\mu$	1.2	1.4	1.6	V
Input Impedance (Pin 16)	R_i	Pin 16 0.8 - 0.9V _{DC}	1.45	2.12	2.8	K Ω

(AM Section)

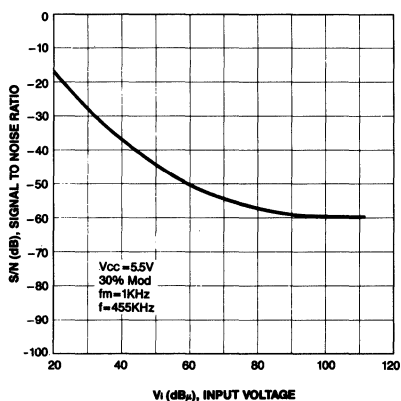
OUTPUT VOLTAGE-INPUT VOLTAGE



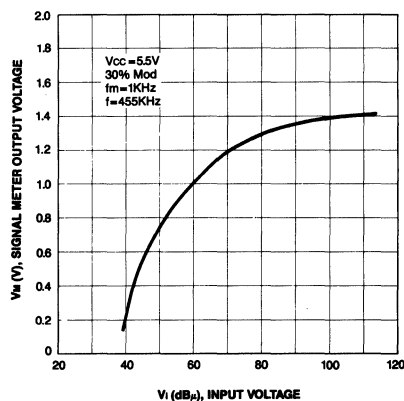
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



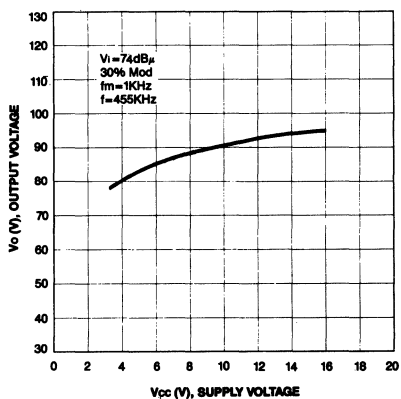
SIGNAL TO NOISE RATIO-INPUT VOLTAGE



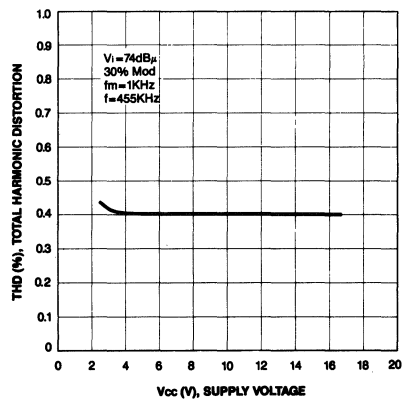
SIGNAL METER OUTPUT VOLTAGE-INPUT VOLTAGE



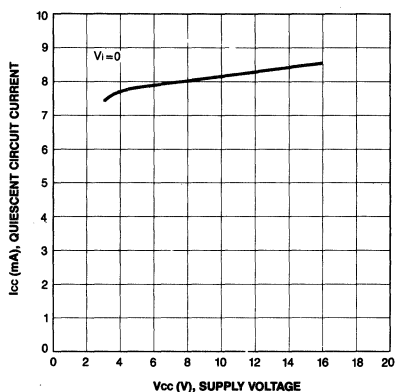
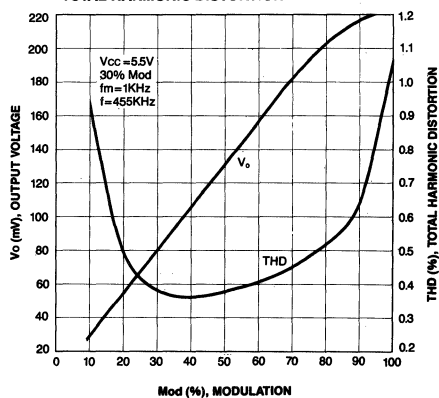
OUTPUT VOLTAGE-SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE

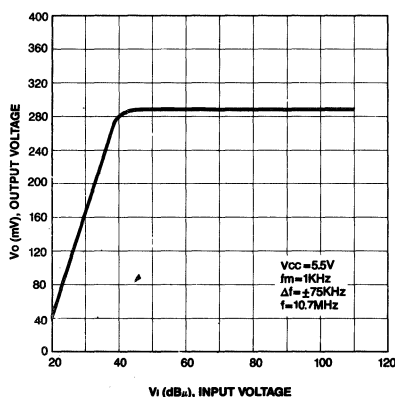


QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE

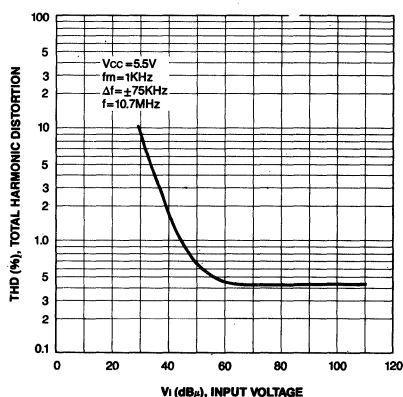
OUTPUT VOLTAGE
TOTAL HARMONIC DISTORTION — MODULATION

(FM Section)

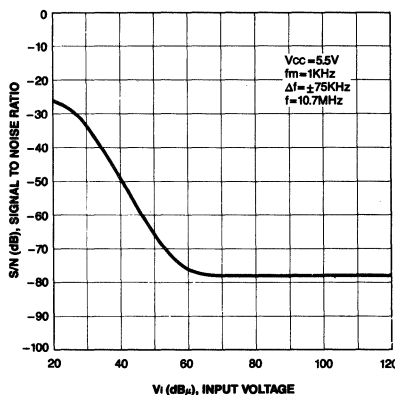
OUTPUT VOLTAGE-INPUT VOLTAGE



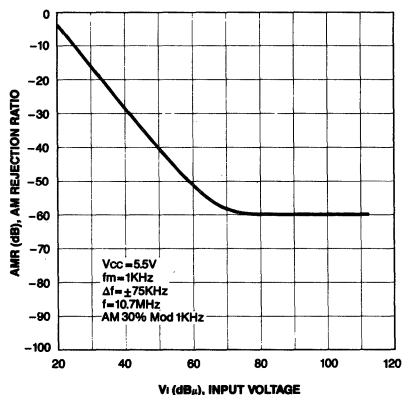
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



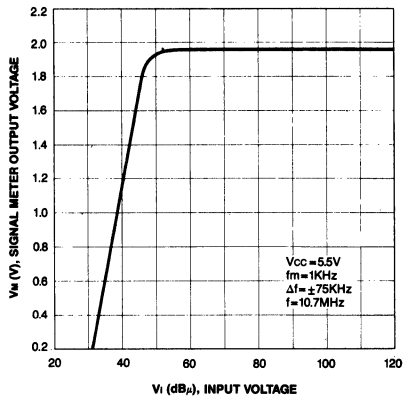
SIGNAL TO NOISE RATIO-INPUT VOLTAGE



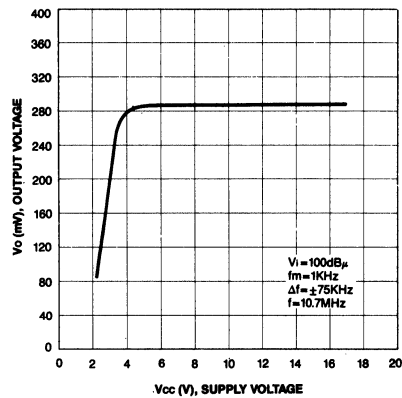
AM REJECTION RATIO-INPUT VOLTAGE



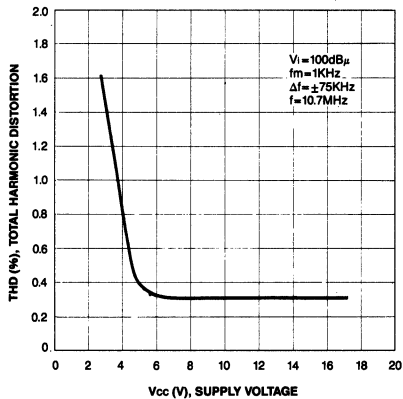
SIGNAL METER OUTPUT VOLTAGE-INPUT VOLTAGE



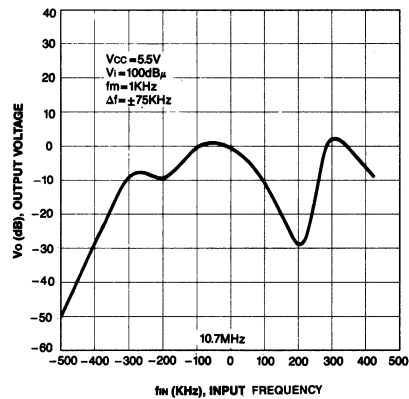
OUTPUT VOLTAGE-SUPPLY VOLTAGE



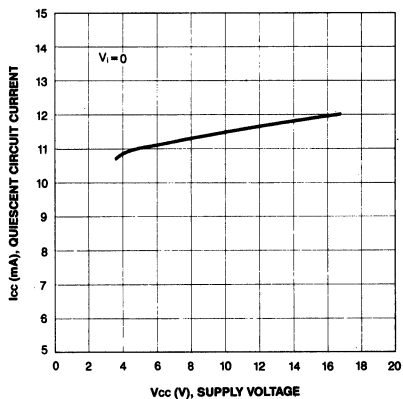
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE



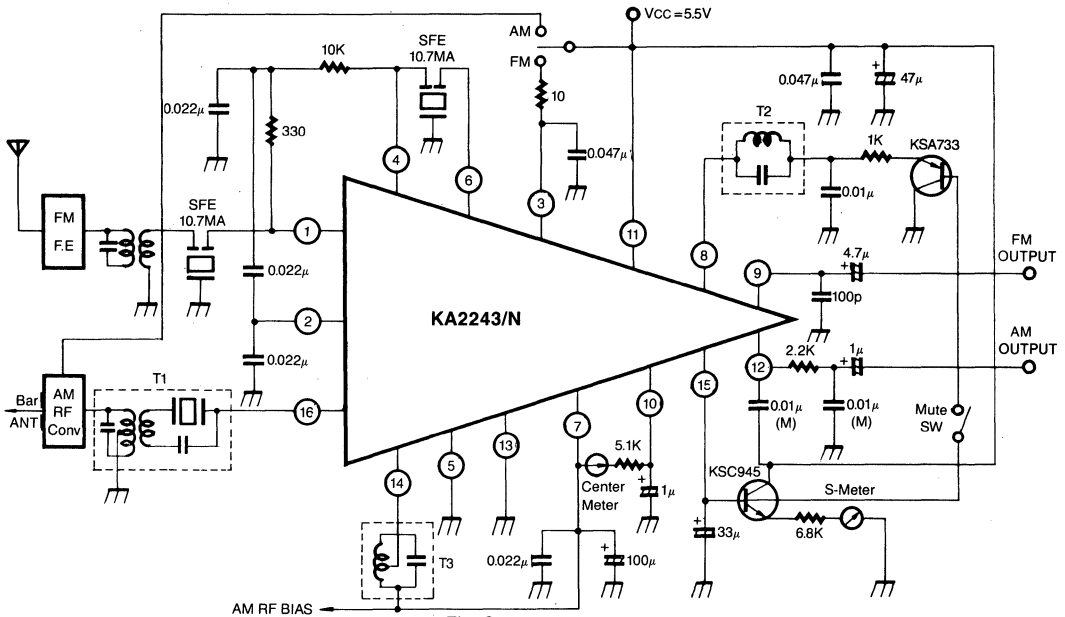
OUTPUT VOLTAGE-INPUT FREQUENCY



QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE

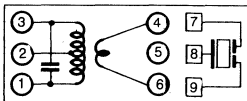


TYPICAL APPLICATION CIRCUIT



COIL SPECIFICATION

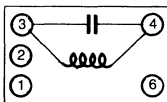
1. T1



C _o (pF)	f (KHz)	Q _o (%)	TURNS		
			4-6	3-2	2-1
180	455	105	6	93	55

Seoul Jupa
SJ-015-552
0.06mmφ UEW

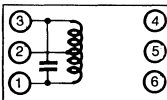
2. T2



C _o (pF)	f (MHz)	Q _o (%)	TURNS		
			3-4		
82	10.7	65	9		

Seoul Jupa
SJ-59JG-043
0.07mmφ UEW

3. T3



C _o (pF)	f (KHz)	Q _o (%)	TURNS		
			1-2	2-3	
180	455	120	51	92	

Seoul Jupa
SJ-015-521
0.07mmφ UEW

FM IF SYSTEM FOR CAR RADIO

The KA2244 is a monolithic integrated circuit consisting of FM IF amplifier, detector, muting circuit and signal meter driver. It is suitable for car radio.

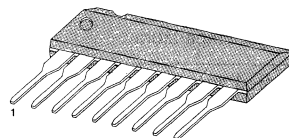
FUNCTIONS

- 3 stage IF amplifiers.
- Peak detector.
- Muting circuit.
- Signal meter drive circuit.

FEATURES

- Suitable for FM car radio.
- Wide operating supply voltage range (8V ~ 15V).
- High detector output voltage ($V_o = 500\text{mV}$, Typ).
- Variable muting level.
- Muting off by pin 4 open.
- Simplified single coil tuning.
- Low distortion (THD=0.1%; Typ).
- Minimum number of external parts required.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2244	9 SIP	- 20 ~ + 70°C

TYPICAL APPLICATION CIRCUIT

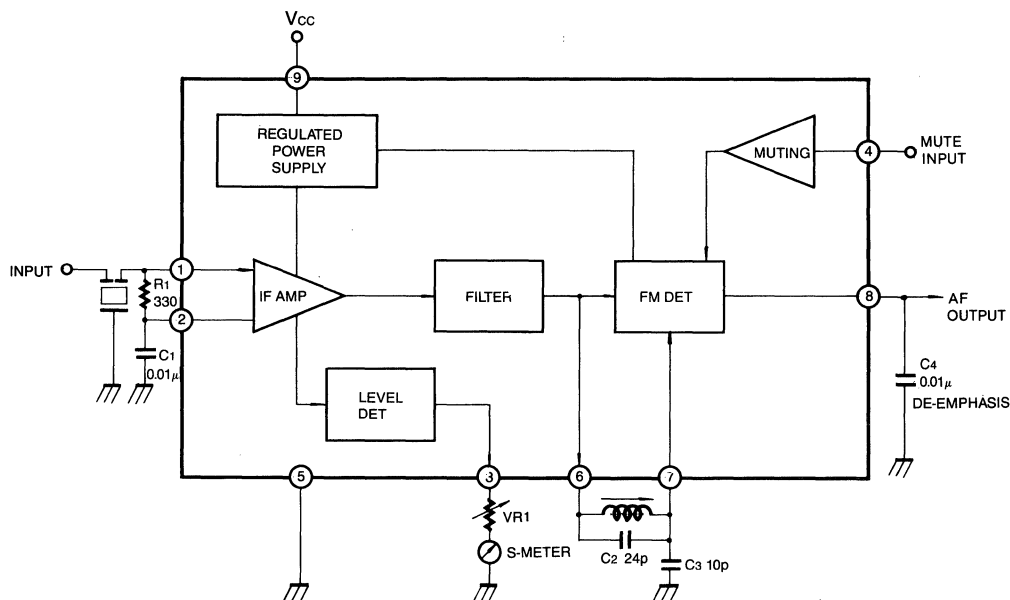


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Input Voltage	V_i	0.7	V
Power Dissipation	P_d	750	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

*: Derated above $T_a = 25^\circ\text{C}$ in the proportion of $4\text{mW}/^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f = 10.7\text{MHz}$, $f_m = 400\text{Hz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	10	14	18	mA
Input Limiting Sensitivity	$V_i (\text{lim})$	-3dB point from V_o ($V_i = 80\text{dB}_\mu$, $\Delta f = \pm 75\text{KHz}$)		50	55	dB_μ
AM Rejection Ratio	AMR	FM: $\Delta f = \pm 75\text{KHz}$ dev AM: 30% Mod, $f_m = 1\text{KHz}$ $V_i = 80\text{dB}_\mu$		50		dB
Detector Output Voltage	V_o	$\Delta f = \pm 75\text{KHz}$ dev $V_i = 80\text{dB}_\mu$	300	500	700	mV
Total Harmonic Distortion	THD	$\Delta f = \pm 22.5\text{KHz}$ dev $V_i = 80\text{dB}_\mu$		0.1		%
Signal to Noise Ratio	S/N	$\Delta f = \pm 75\text{KHz}$ dev $V_i = 80\text{dB}_\mu$		75		dB
Muting Attenuation	M (att)	$\Delta f = \pm 75\text{KHz}$ dev $V_i = 80\text{dB}_\mu$, $V_4 = 0$		70		dB
Meter Driver Voltage	$V_3 (\text{max})$	$V_i = 110\text{dB}_\mu$		4.0		V
Input Impedance	Resistance	$f = 10.7\text{MHz}$ 1 PIN-GND		5		$\text{K}\Omega$
	Capacitance			4.5		pF
Output Impedance	Resistance	$f = 10.7\text{MHz}$ 6 PIN-GND		1.3		$\text{K}\Omega$
	Capacitance			4		pF
Output Resistance	R_o	$f = 400\text{Hz}$ 8 PIN-GND		7.7		$\text{K}\Omega$

TEST CIRCUIT

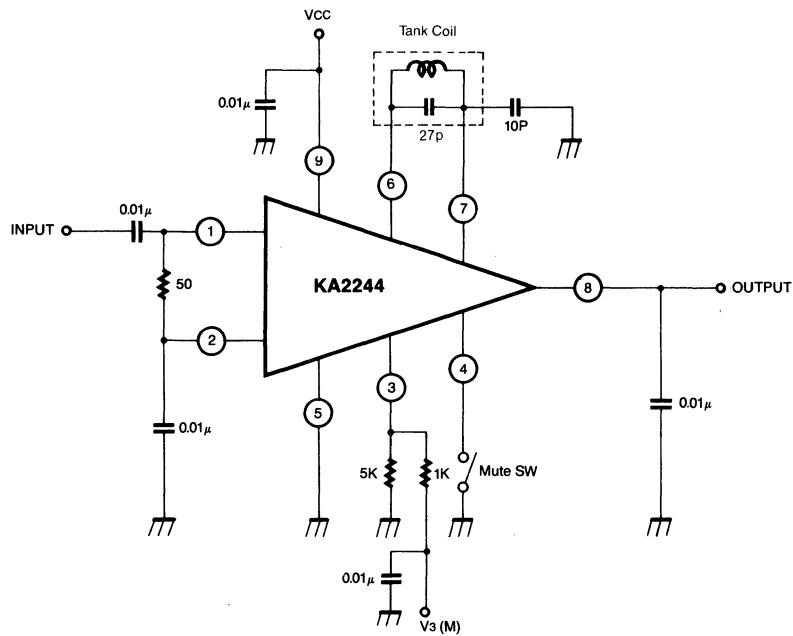
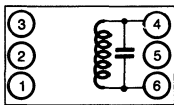


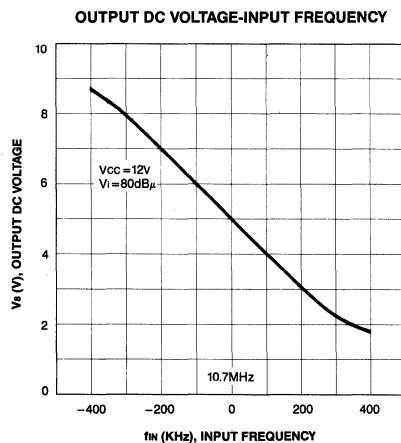
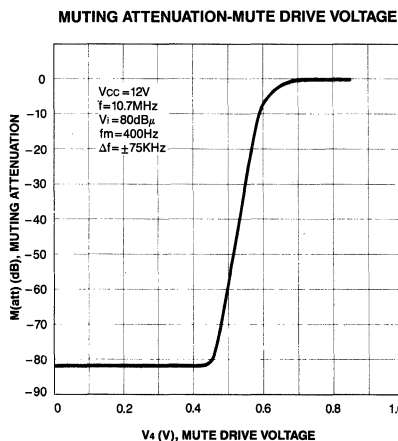
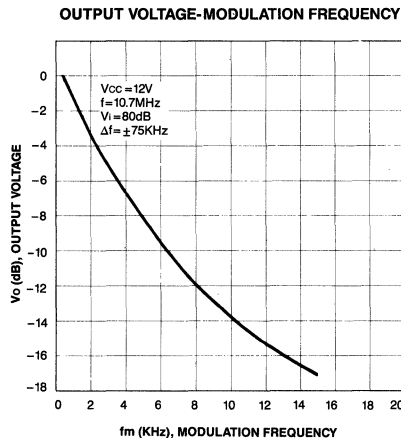
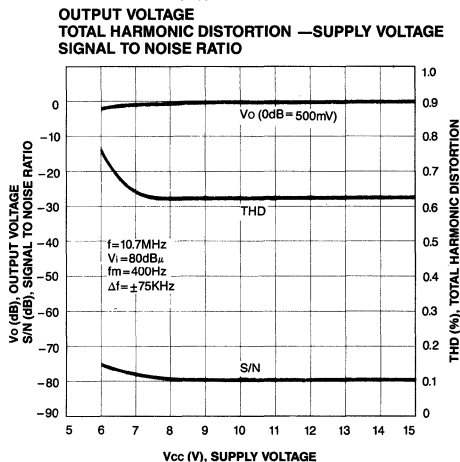
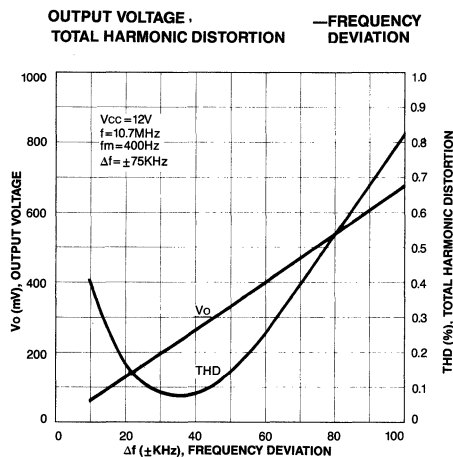
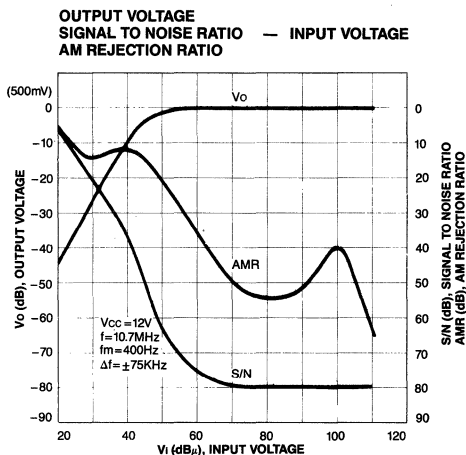
Fig. 2

COIL SPECIFICATION



C _o (pF)	f (MHz)	Q _o (%)	TURNS		
			4-6		
27	10.7	150	18		

Seoul Jupa SJ-59JG-045 0.1mmφ UEW



FM IF SYSTEM FOR CAR STEREO

The KA22441 is a monolithic integrated circuit consisting of FM IF system suitable for use in car stereo and music centers.

It features practically all of the functions for use a FM tuner, including AGC output, AFC output, level meter output in a single package.

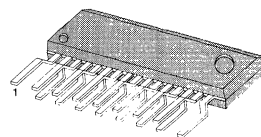
FUNCTIONS

- FM IF amplifier.
- Quadrature detector.
- AFC output.
- AGC output.
- Level meter output.
- Muting for weak signal.
- Muting for detuned condition.

FEATURES

- Soft muting function.
- Variable muting maximum attenuation.
- Variable muting attack input signal.
- Variable muting slope with respect to input signal level.
- Level meter output.
- AFC output.
- AGC output.
- High sensitivity ($V_i(\text{lim})=25\text{dB}\mu$: Typ).
- High output level.
- Good S/N ratio (78dB: Typ).
- Low distortion (0.05%: Typ).
- Wide operating supply voltage range (6V ~ 14V).

16 ZIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22441	16 ZIP	-20 ~ +70°C

BLOCK DIAGRAM

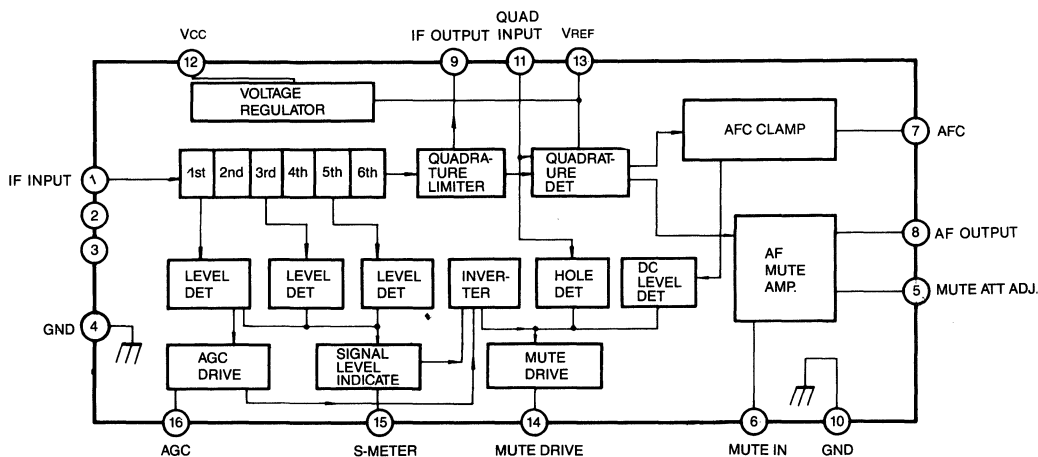


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Power Dissipation	P_d	640	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 8\text{V}$, $\Delta f = \pm 75\text{KHz}$, $V_i = 100\text{dB}_\mu$, $f_m = 400\text{Hz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}		6	8	14	V
Quiescent Circuit Current	I_{CC}	$V_i = 0$	15	21	27	mA
Input Limiting Sensitivity	V_i (lim)	V_o ($V_i = 100\text{dB}_\mu$) -3dB down		25	29	dB_μ
Dectector Output Voltage	V_o		200	260	320	mV
Total Harmonic Distortion	THD			0.05	0.2	%
Signal to Noise Ratio	S/N		70	78		dB
AM Rejection Ratio	AMR	AM: $f_m = 1\text{KHz}$, 30% Mod	50	63		dB
Signal Meter Output Voltage	V_M	$V_i = 0$	0	0.1	0.3	V
		$V_i = 100\text{dB}_\mu$	4.5	5.3	6.0	
AGC Output Voltage	$V_{(AGC)}$	$V_i = 0$	3.5	4.1	4.5	V
		$V_i = 100\text{dB}_\mu$	0	0.02	0.3	
Muting Sensitivity	M (sen)	$V_{14} = 2\text{V}$	22	26	32	dB_μ
Muting Attenuation	$M_{(att)}$	$V_6 = 2\text{V}$	10	15	20	dB
		$V_6 = 5\text{V}$	24	28	32	
Muting Bandwidth	$M_{(BW)}$	$V_{14} = 2\text{V}$	140	210	370	KHz

TEST CIRCUIT

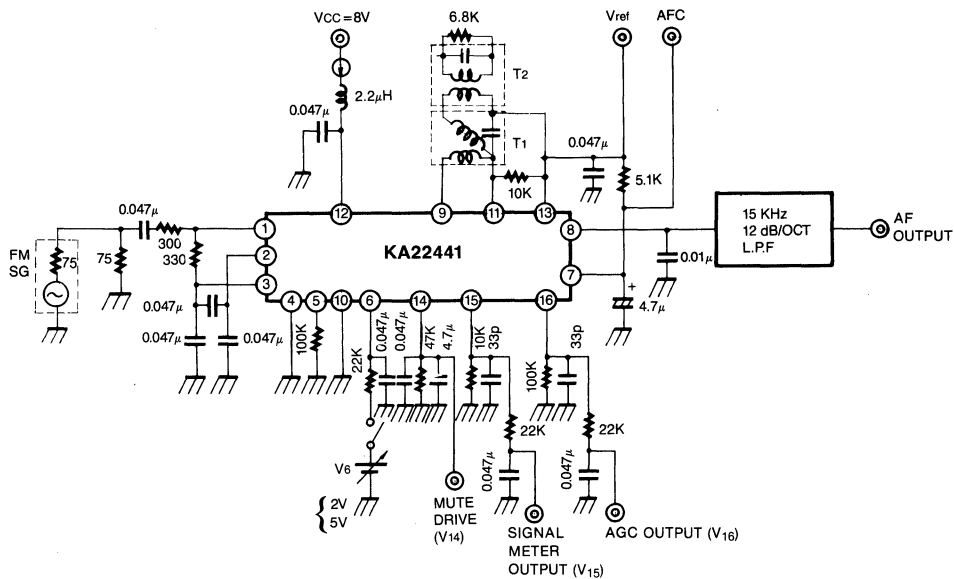
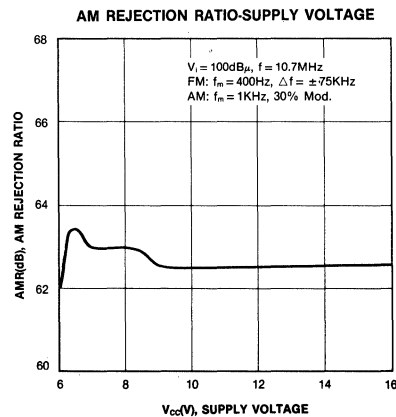
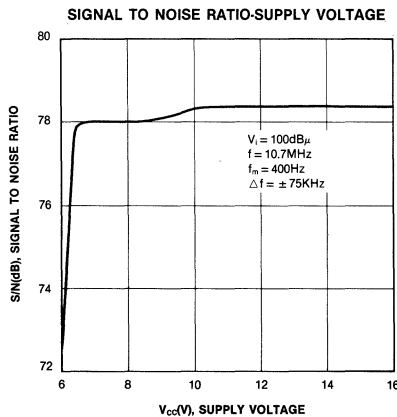
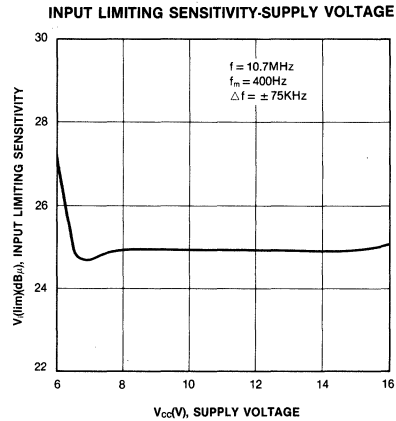
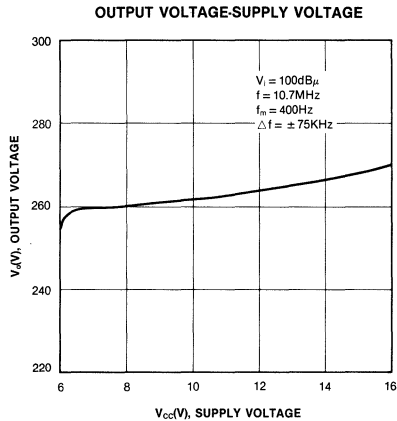
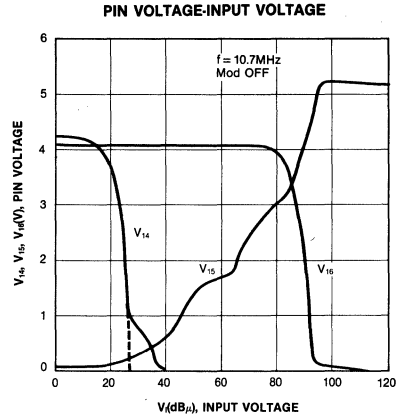
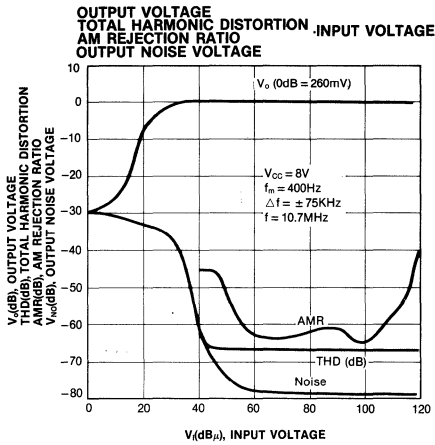
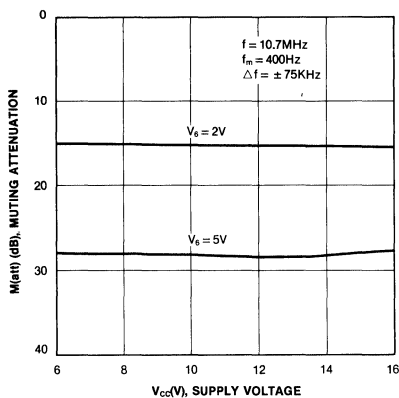


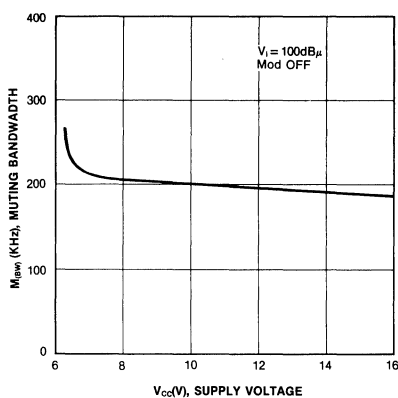
Fig. 2



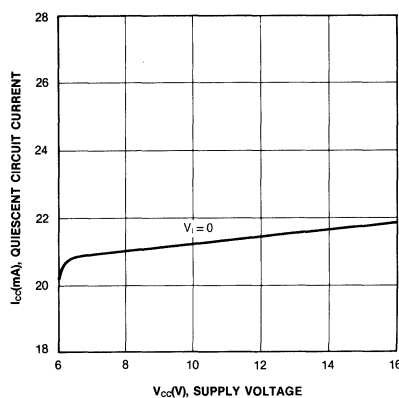
MUTING ATTENUATION-SUPPLY VOLTAGE



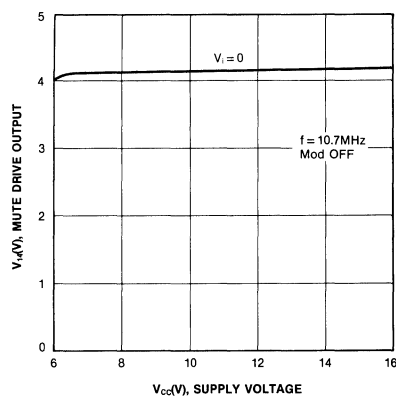
MUTING BANDWIDTH-SUPPLY VOLTAGE



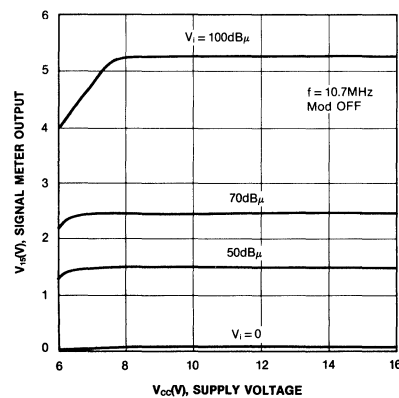
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



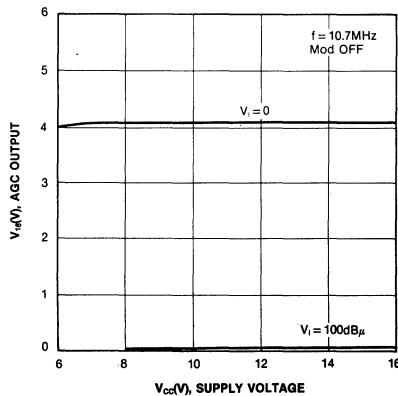
MUTE DRIVE OUTPUT-SUPPLY VOLTAGE



SIGNAL METER OUTPUT-SUPPLY VOLTAGE

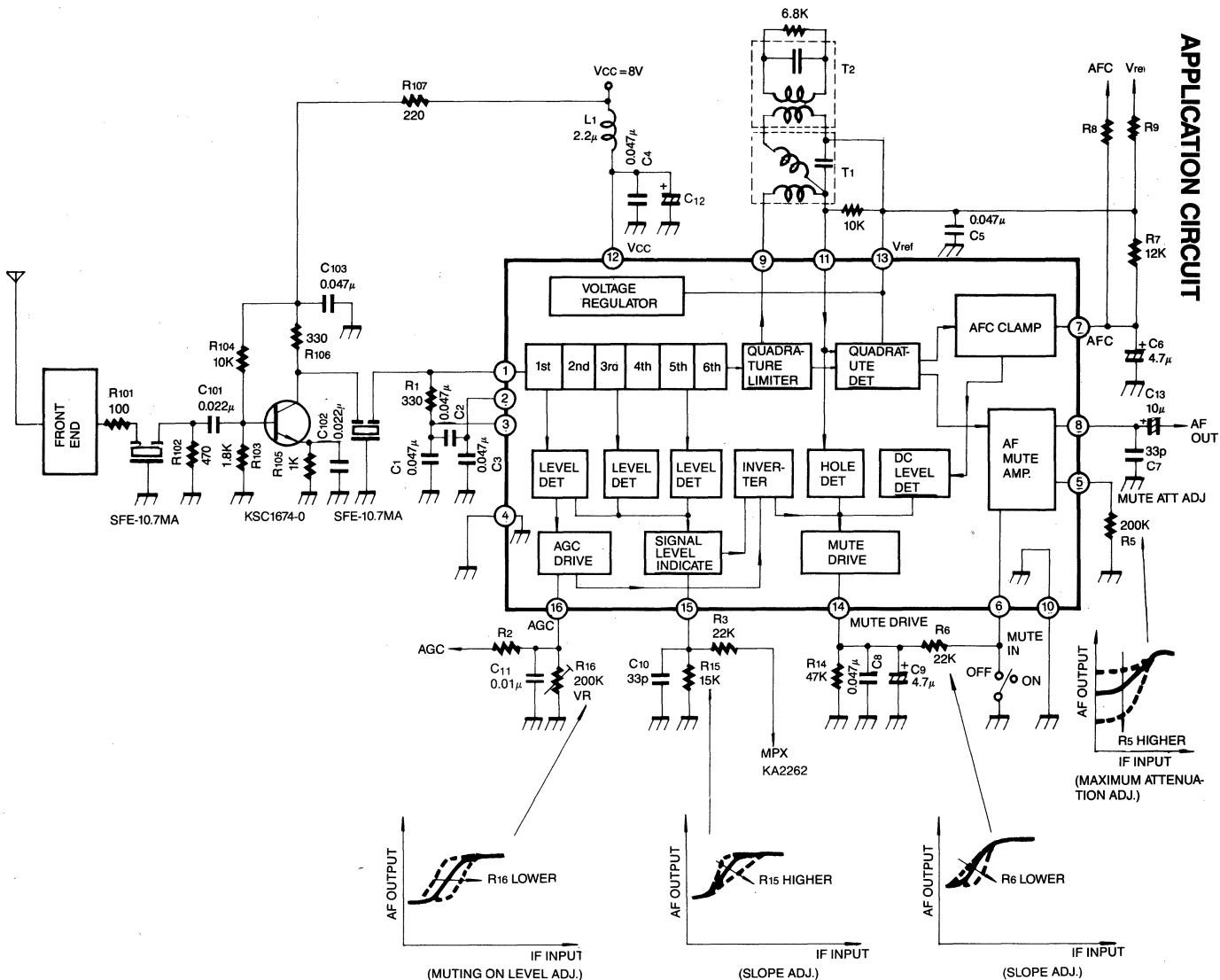


AGC OUTPUT-SUPPLY VOLTAGE



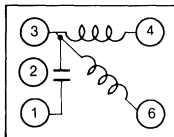
LINEAR INTEGRATED CIRCUIT

APPLICATION CIRCUIT



COIL SPECIFICATION

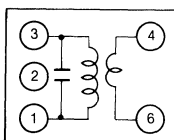
1. T1



C _o (pF)	f (MHz)	Q _o (%)	Turns	
			3 - 4	6 - 3
120	10.7	20 (Min)	89 1/2	17 1/2

KOREA TOKO 292MEA-K5018FKG-KR 0.07 ϕ 2UEW

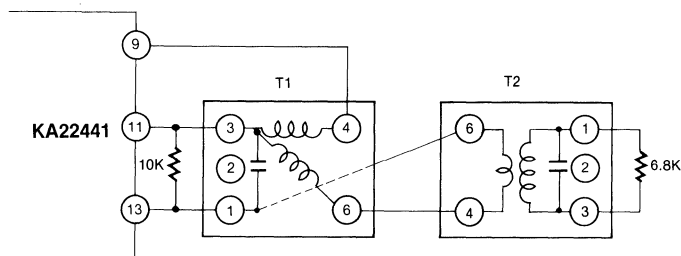
2. T2



C _o (pF)	f (MHz)	Q _o (%)	Turns	
			1 - 3	6 - 4
62	10.7	20 (Min)	24	1

KOREA TOKO 292MEA-K5019AN-KR 0.07 ϕ 2UEW

COIL COMBINATION



EXTERNAL COMPONENTS**C₁, C₂, C₃: IF amplifier bypass capacitors**

These capacitors bypass to ground both the carrier signal and the high-frequency components of the amplifier output.

C₄ : Power supply bypass capacitor**C₅ : Internal regulated power supply bypass capacitor****C₆ : AFC output smoothing capacitor**

This capacitor bypasses to ground the detector signal output at pin 7.

C₇ : De-emphasis capacitor

The value of the C₈ determines the de-emphasis time constant.

C₈ : Mute drive output smoothing capacitor

This capacitor bypass to ground high-frequency noise components included in the muting output.

C₁₀ : Signal meter output voltage smoothing capacitor

This capacitor is used to reduce any IF carrier signal components or other high-frequency components remaining on the level meter output voltage.

C₁₁ : AGC voltage smoothing capacitor

If C₁₁ is not connected, the AGC output will contain residual IF carrier frequency components.

R₁ : IF amplifier resistor

The IF amplifier input impedance is determined by the value of this resistance.

R₅ : Muting maximum attenuation adjustment resistor

The value of this resistor sets the maximum muting attenuation which is used when no signal is present or in the detuned condition. If the value of R₅ is made small, the maximum muting attenuation is decreased.

R₆ : Mute drive current adjusting resistor

This resistor is used to adjust the slope of the muting attenuation. If the value of this resistor is made small, the muting slope for input signal level is increased.

R₇ : Muting bandwidth adjustment resistor

This resistor is capable of adjusting the muting bandwidth and AFC sensitivity. If the value of R₇ is made small, the muting bandwidth widens and the AFC sensitivity decreases.

R₁₁ : Damping resistor

If the value of R₁₁ is made small, the Q of the tuned circuit decreases with an accompanying decrease in gain.

R₁₂ : Damping resistor**R₁₄ : Mute drive load resistor**

If R₁₄ is made large, the time required for muting to be removed will increase.

R₁₅ : Signal meter output load resistor

This resistor is used to adjust the slope of the muting attenuation. If the value of this resistor is made small, the slope of the muting attenuation is increased.

R₁₆ : AGC output load resistor

This resistor is used to set the weak-signal muting starting point. If the value of this resistor is made small, the starting point of input signal level for muting is raised.

L₁ : Power supply chock coil**T₁, T₂ : IF transformer**

The detector output voltage and total harmonic distortion are determined by the Q of this quadrature detector coil.

FM IF SYSTEM FOR CAR RADIO

The KA2245 is a monolithic integrated circuit consisting of FM IF amplifier, detector.

It is suitable for car radio.

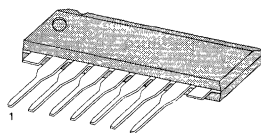
FUNCTIONS

- 3 stage IF amplifiers.
- Peak detector.

FEATURES

- Suitable for FM car radio.
- Wide operating supply voltage range: $V_{CC} = 8V \sim 14V$.
- High detector output voltage ($V_o = 500mV$, Typ).
- Excellent AM rejection: $AMR = 50dB$ (Typ).
- High sensitivity: $V_i (lim) = 50dB\mu V$ (Typ).
- Simplified single coil tuning.
- Low distortion (THD=0.1%: Typ).
- Minimum number of external parts required.

7 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2245	7 SIP	- 20 ~ + 70 °C

BLOCK DIAGRAM

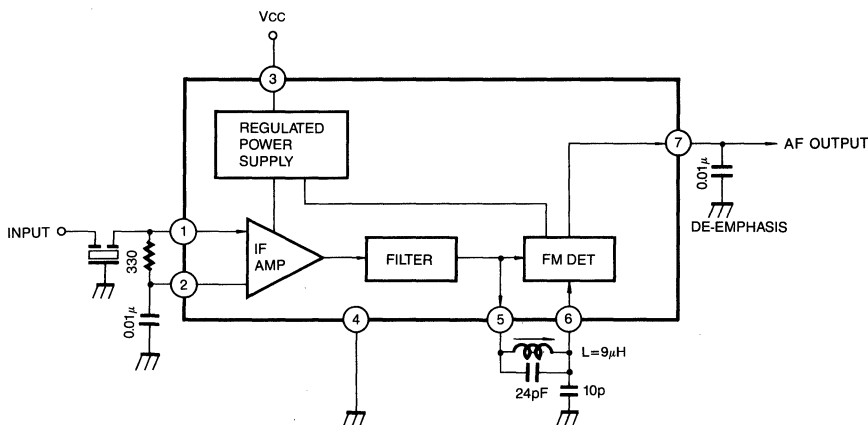


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Input Voltage	V_i	0.7	V
Power Dissipation	$*P_d$	400	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

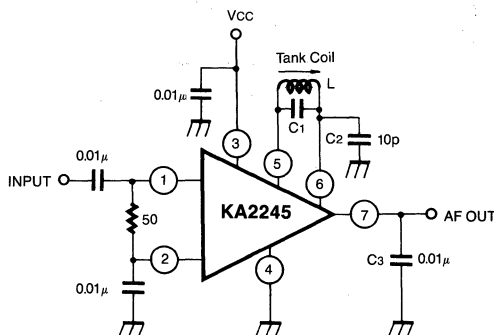
*: Derated above $T_a = 25^\circ\text{C}$ in the proportion of $4\text{mW}/^\circ\text{C}$

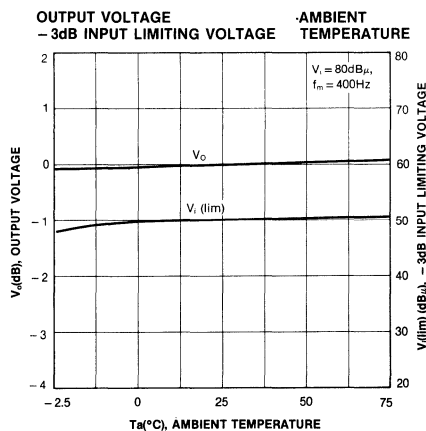
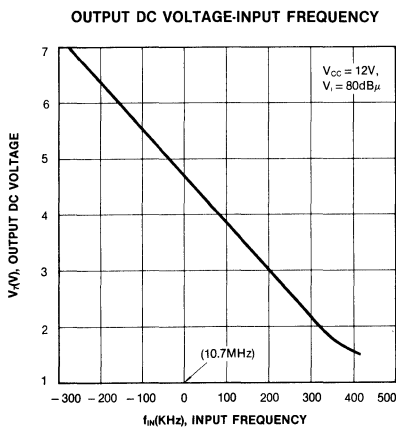
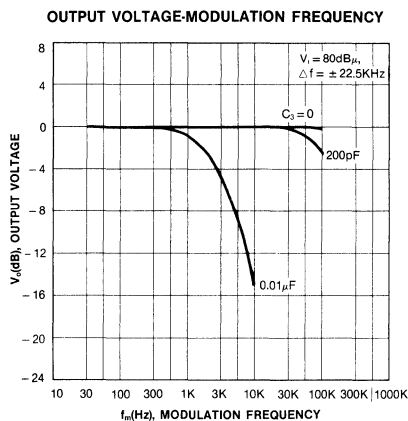
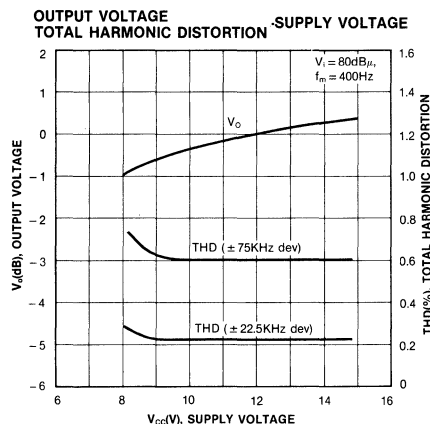
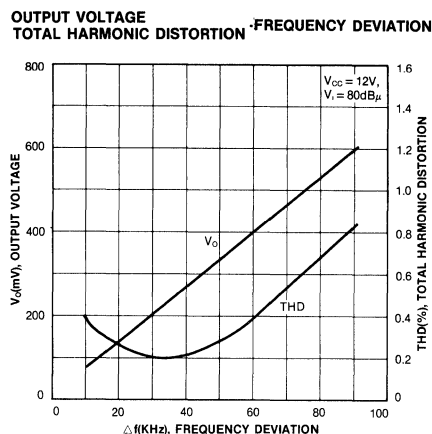
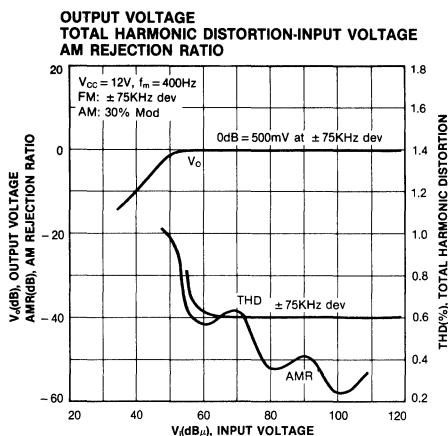
ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f = 10.7\text{MHz}$, $f_m = 400\text{Hz}$)

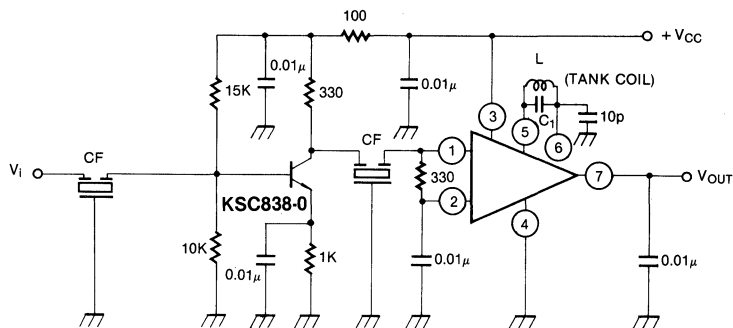
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	8	12	15	mA
Input Limiting Sensitivity	$V_i (\text{lim})$	-3dB point from V_o $V_i = 80\text{dB}\mu$, $\Delta f = \pm 75\text{KHz}$		50	55	$\text{dB}\mu$
AM Rejection Ratio	AMR	FM: $\Delta f = \pm 75\text{KHz}$ dev AM: 30% Mod $V_i = 80\text{dB}\mu$		50		dB
Detector Output Voltage	V_o	$\Delta f = \pm 75\text{KHz}$ dev $V_i = 80\text{dB}\mu\text{V}$	300	500	700	mV
Total Harmonic Distortion	THD	$\Delta f = \pm 22.5\text{KHz}$ dev $V_i = 80\text{dB}\mu\text{V}$		0.2		%
Signal to Noise Ratio	S/N	$\Delta f = \pm 75\text{KHz}$ dev $V_i = 80\text{dB}\mu\text{V}$		60		dB
Input Impedance	Resistance	$f = 10.7\text{MHz}$ 1PIN-GND		5		$\text{K}\Omega$
	Capacitance			4.5		pF
Output Impedance	Resistance	$f = 10.7\text{MHz}$ 5 PIN-GND		1.3		$\text{K}\Omega$
	Capacitance			4		pF
Output Resistance	R_o	$f = 400\text{Hz}$ 7 PIN-GND	6.2	7.7	9.5	$\text{K}\Omega$

TEST CIRCUIT

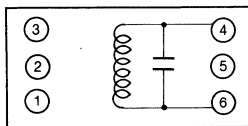




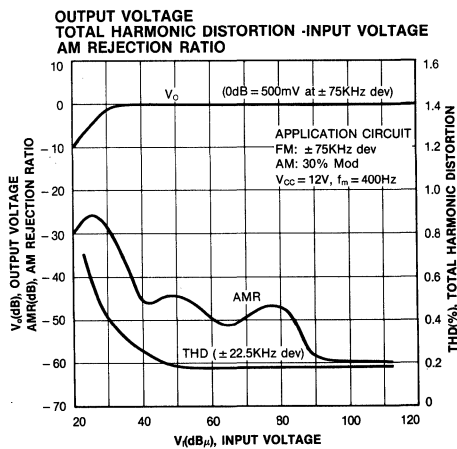
APPLICATION CIRCUIT



COIL SPECIFICATION



C _o (pF)	f (MHz)	O _o (%)	Turns		
			4 - 6		
27	10.7	150	18		



ELECTRONIC TUNING AM RADIO RECEIVER FOR CAR STEREO

The KA22461 is a monolithic integrated circuit for AM tuner system for car stereo.

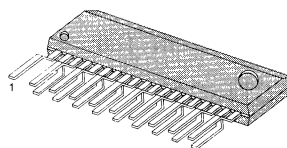
It contains subsystem that provides the mixer, oscillator, IF AMP, detector and ON channel detector for electronic tuning AM radio receiver.

It is suitable for radio receiver in car audio set.

FEATURES

- Varactor-diode tuning
- Excellent overload characteristics
- Wide AGC range and good sensitivity
- On channel detector for auto scan stop
- Local/distance selector
- Oscillator buffer output
- Delayed AGC for RF amplifier
- Special low level oscillator to reduce tracing error
- Wide operating supply voltage range (8V ~ 15V)

19 ZIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22461	19 ZIP	-20 ~ +70°C

BLOCK DIAGRAM

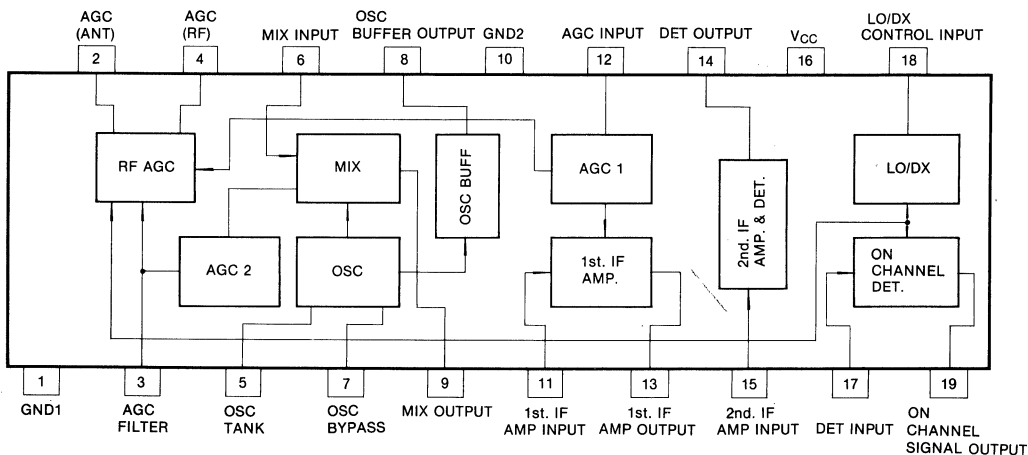


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Input Voltage	V_i	3.0	V
Power Dissipation	P_d	430 (Ta = 75°C)	mW
Operating Temperature	T_{opr}	- 20 ~ + 70	°C
Storage Temperature	T_{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 10V, f = 1MHz, f_m = 400Hz, 30% Mod)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	10	14	21	mA
Maximum Sensitivity	V_i (Sen)	$V_o = 30mV$	14	21	28	dB μ
Signal to Noise Ratio	S/N	$V_i = 21dB\mu$	8	13		dB
Detector Output Voltage	V_o	$V_i = 74dB\mu$	70	100	130	mV
Total Harmonic Distortion	THD1	$V_i = 74dB\mu$		0.3	1.0	%
	THD2	$V_i = 120dB\mu$		0.5	1.0	
ON Channel Signal	V_{19} (L)	$V_i = 0dB\mu$, $R_L = 18K$			0.5	V
	V_{19} (H)	$V_i = 74dB\mu$, $R_L = 18K$	8.0			

TUNER PERFORMANCE CHARACTERISTICS

(Ta = 25°C, V_{CC} = 10V, f = 1MHz, f_m = 400Hz, 30% Mod)

Characteristic	Test Conditions		Value	Unit
Maximum Sensitivity	$V_o = 30mV$		22	dB μ
Usable Sensitivity	S/N = 20dB		28	dB μ
Detector Output Voltage	$V_i = 74dB\mu$		100	mV
Total Harmonic Distortion	$V_i = 74dB\mu$		0.3	%
	$V_i = 126dB\mu$		0.6	
	$V_i = 74dB\mu$, 80% Mod		1.2	
Signal to Noise Ratio	$V_i = 74dB\mu$		52	dB
IF Rejection Ratio	$V_o = 30mV$, IF = 450KHz		56	dB
Image Rejection Ratio	$V_o = 30mV$, f + 2IF		57	dB
Selectivity	$\Delta f = \pm 10KHz$		39	dB
Tweet	$V_i = 74dB\mu$	2IF = 900KHz	40	dB
		3IF = 1350KHz	47	
DX Sensitivity	$V_{19} = 8V$		26	dB μ
ON Channel Bandwidth	$V_i = 74dB\mu$		5	KHz
Oscillation Voltage	at pin 5		150	mV
	at pin 8		4	V

TEST CIRCUIT

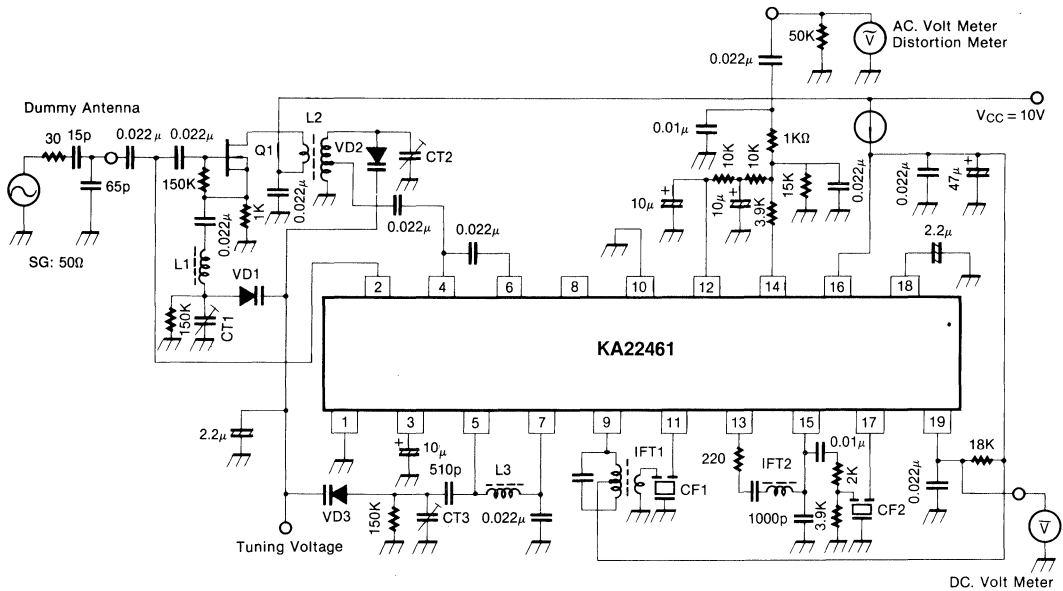


Fig. 2

APPLICATION CIRCUIT

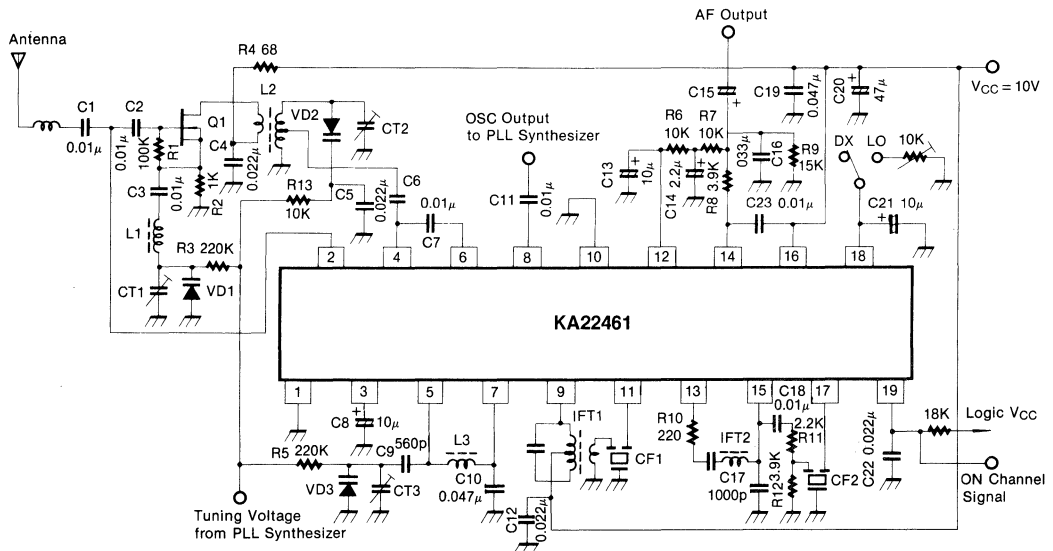
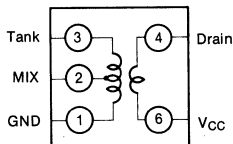


Fig. 3

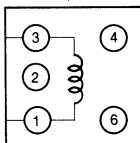
COIL SPECIFICATION

L1 & L2: Ant. & RF Coil



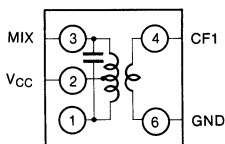
Q_u (%)	L (μ H)	Turns		
80 min	170	1 – 2	2 – 3	4 – 6
		7	62	14

L3: OSC Coil



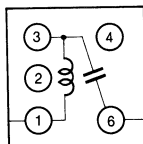
Q_u (%)	L (μ H)	Turns		
60 min	95	1 – 3		
		48		

IFT1: IFT



Q_u (%)	C (pF)	Turns		
115 ± 20	180	1 – 2	2 – 3	4 – 6
		69	77	14

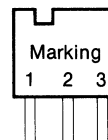
IFT2: IFT



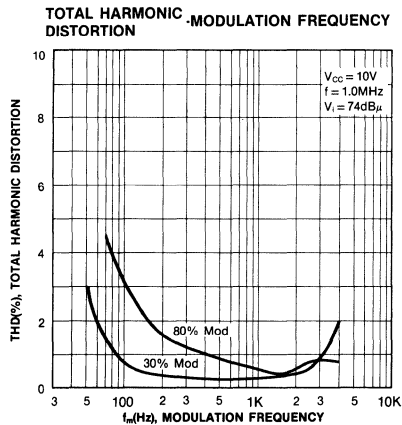
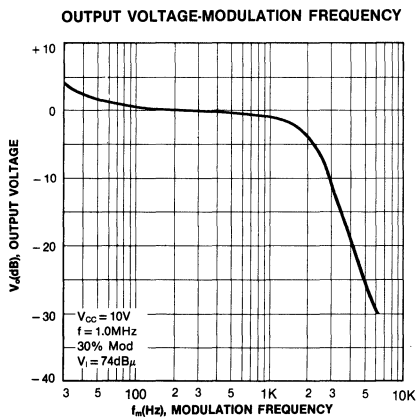
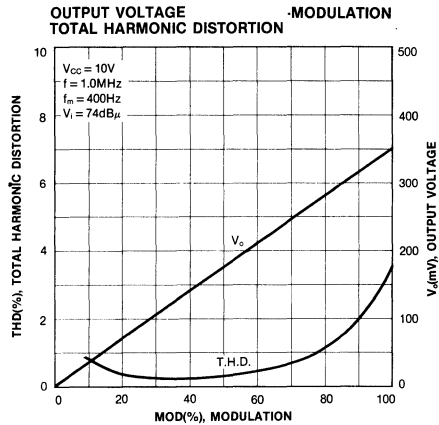
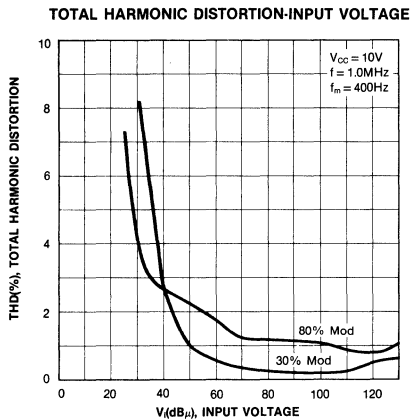
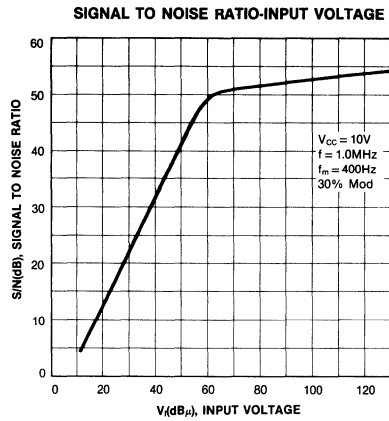
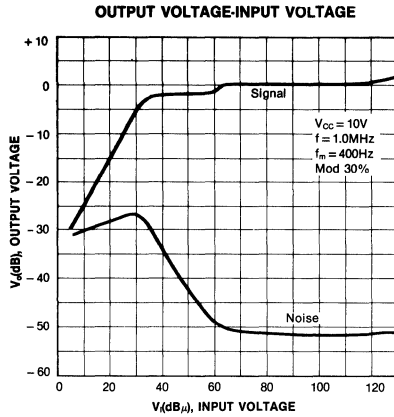
L (μ H)	C (pF)	L (μ H)		
680	180	1 – 3		
		680		

CERAMIC FILTER

	CFM2-450BL	CFM2-450ZL
Center Frequency	450KHz	450KHz
6dB Bandwidth	6KHz min.	4KHz min.
Selectivity ± 9 KHz	16dB min.	18dB min.
Insertion Loss	6dB max.	6dB max.
Input Impedance	1.5K Ω	1.0K Ω
Output Impedance	2.0K Ω	1.5K Ω



1: Input
2: GND
3: Output



FM IF/AM TUNER SYSTEM

The KA2247 is a monolithic integrated circuit developed for the radio cassette tape recorder.

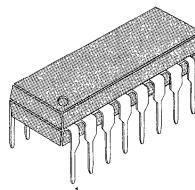
FUNCTIONS

- AM SECTION: RF amplifier, Mixer, OSC (with ALC), IF amplifier, Detector, AGC, Tuning indicator.
- FM SECTION: IF amplifier, Quadrature detector, AF preamplifier, Tuning indicator.

FEATURES

- Minimum number of external parts required.
- Very good S/N: FM (81dB), AM (53dB).
- AM oscillator circuit with ALC: Oscillation output voltage of pin 16.
MW 130mV
SW 70mV ~ 90mV
(7MHz) ~ (24MHz)
- Excellent AM whistle performance: Whistle 1% at $V_i = 100\text{dB/m}$.
- Built-in tuning indicator.
- Built-in AM/FM function switch.
- Operating supply voltage range: $V_{CC} = 3\text{V} \sim 8\text{V}$.

16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2247	16 DIP	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM

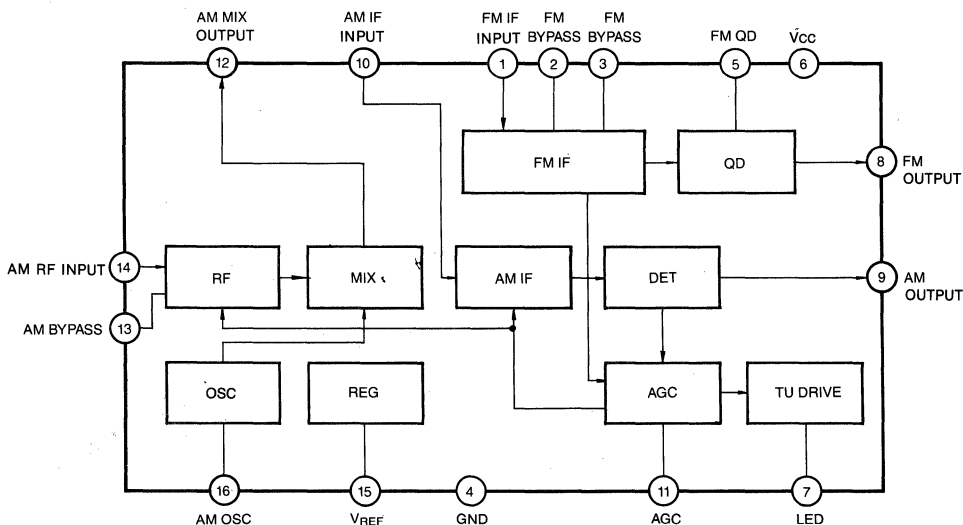


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	9	V
Circuit Current	I_{CC}	50	mA
Input Current (pin 7)	I_7	20	mA
Output Current (pin 15)	I_{15}	0.1	mA
Power Dissipation	P_d	450	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 4.5\text{V}$)FM Section ($f = 10.7\text{MHz}$, $\Delta f = \pm 75\text{KHz}$, $f_m = 400\text{Hz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		8.5	12.0	mA
Input Limiting Sensitivity	V_i (lim)	V_o ($V_i = 80\text{dB}\mu$) -3dB down		35	42	$\text{dB}\mu$
Detector Output Voltage	V_o	$V_i = 80\text{dB}\mu$	183	260	367	mV
Total Harmonic Distortion	THD 1	$V_i = 80\text{dB}\mu$		0.55	1.2	%
	THD 2	$V_i = 80\text{dB}\mu$, $\Delta f = \pm 22.5\text{KHz}$		0.05		
AM Rejection Ratio	AMR	$V_i = 80\text{dB}\mu$, AM: $f_m = 1\text{KHz}$, 30% Mod		60		dB
Signal to Noise Ratio	S/N 1	$V_i = 80\text{dB}\mu$	77	81		dB
	S/N 2	$V_i = 80\text{dB}\mu$, $\Delta f = \pm 22.5\text{KHz}$		71		
Tuning Indication Voltage	V_L	$I_L = 1\text{mA}$		39	49	$\text{dB}\mu$

AM Section ($f = 1\text{MHz}$, $f_m = 400\text{Hz}$, 30% Mod)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		7.5	10.5	mA
Detector Output Voltage	V_o 1	$V_i = 23\text{dB}\mu$	17.3	31	55	mV
Detector Output Voltage	V_o 2	$V_i = 60\text{dB}\mu$	87	122	174	mV
Total Harmonic Distortion	THD 1	$V_i = 60\text{dB}\mu$		0.45	1.3	%
	THD 2	$V_i = 100\text{dB}\mu$		1.5	3.0	
Signal to Noise Ratio	S/N 1	$V_i = 23\text{dB}\mu$	18.0	21.5		dB
	S/N 2	$V_i = 60\text{dB}\mu$	48	53		
Tuning Indication Voltage	V_L	$I_L = 1\text{mA}$	22	30	38	$\text{dB}\mu$
Oscillation Output Voltage	V_{OSC}	$f = 24\text{MHz}$	60	86	120	mV

TEST CIRCUIT

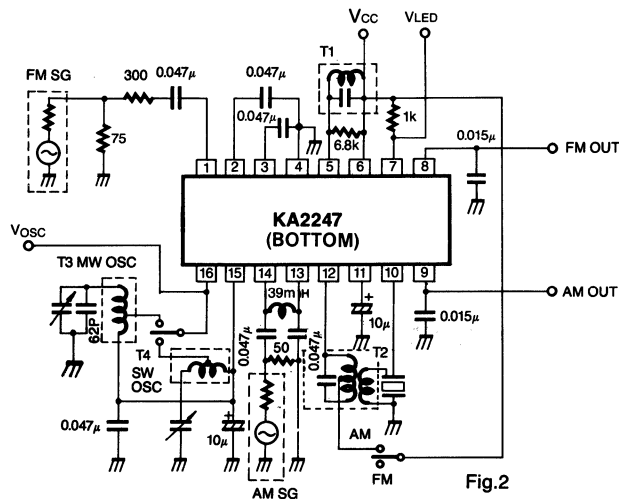
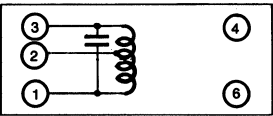


Fig.2

COIL SPECIFICATION

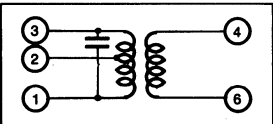
T1 FM IF (DET)



C _o (PF)	f (MHz)	Q _o	URNS
1-3		1-3	1-3
56	10.7	95	12

Seoul Jupa
0.12mmφ UEW

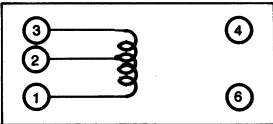
T2 AM IFT (MIX OUT)



C _o (PF)	f (KHz)	Q _o	URNS		
1-3		1-3	1-2	2-3	4-6
180	455	110	90	62	8

Seoul Jupa
0.07mmφ UEW

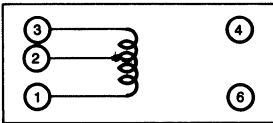
T3 (MW OSC)



f (KHz)	L (μH)	Q _o	URNS	
	1-3	1-3	1-2	2-3
796	140	140	32	32

Seoul Jupa
0.07mmφ UEW

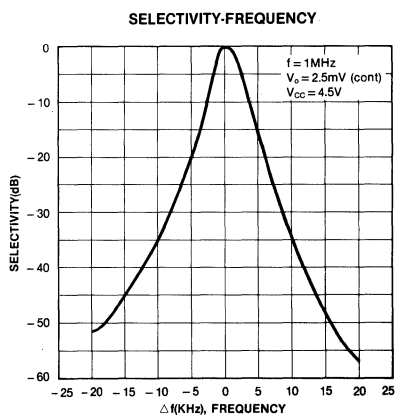
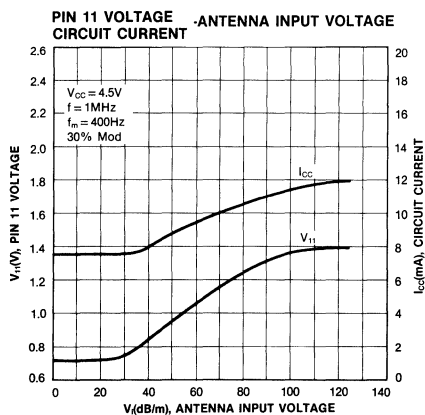
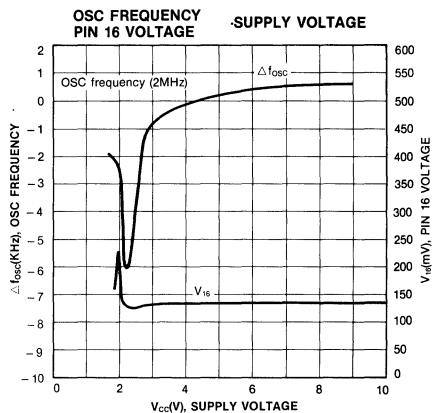
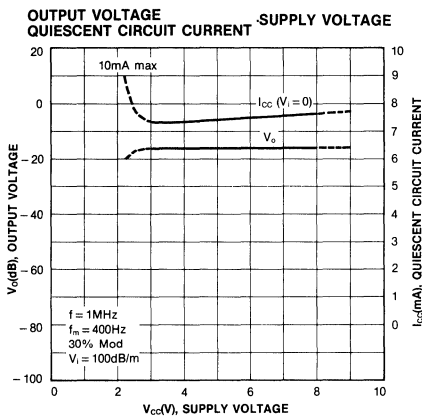
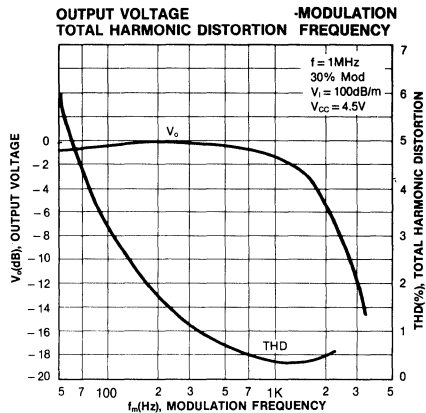
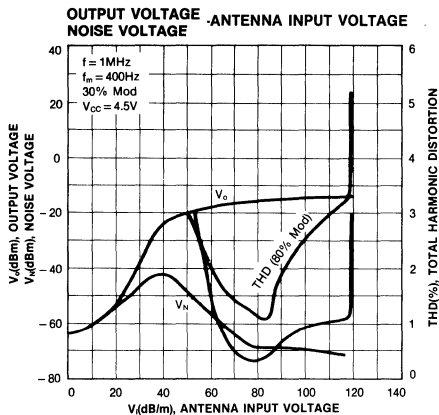
T4 (SW OSC)



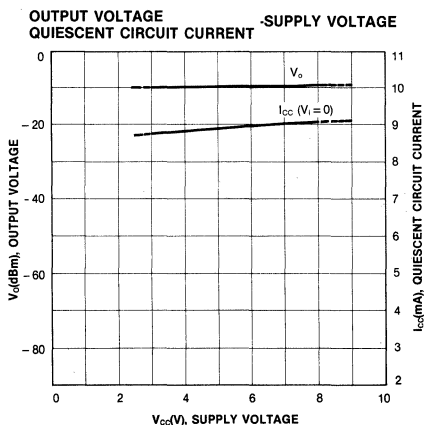
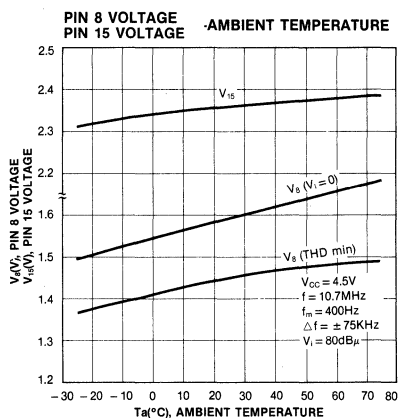
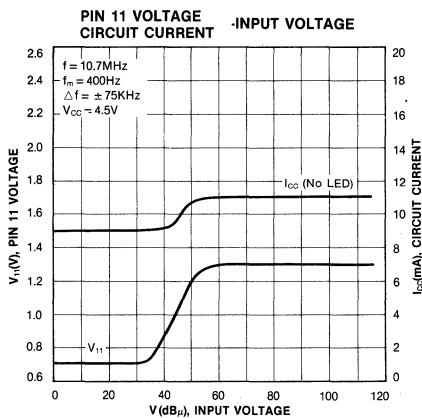
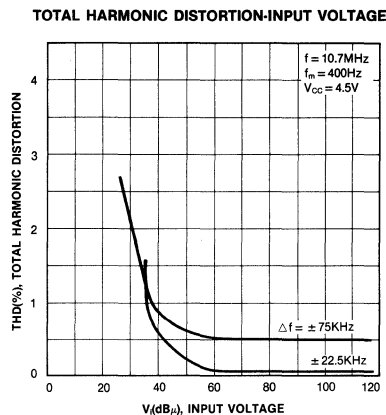
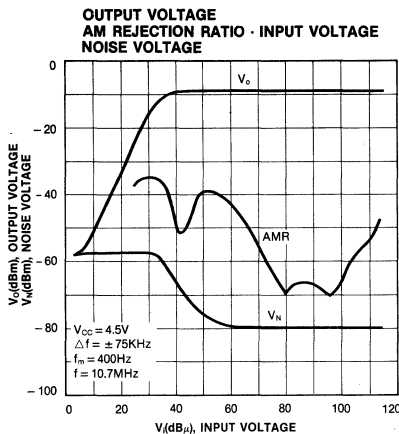
L (μH)	Q _o	URNS	
1-3	1-3	1-2	2-3
12	80	12	12

Seoul Jupa
0.1mmφ UEW

(AM SECTION)



(FM SECTION)



FM IF/AM TUNER SYSTEM

The KA22471 is a monolithic integrated circuit developed for the radio cassette tape recorder.

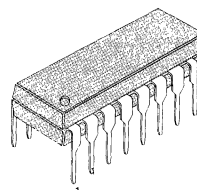
FUNCTIONS

- AM SECTION: Converter, IF amplifier, Detector, Tuning indicator.
- FM SECTION: IF amplifier, Quadrature detector, Tuning indicator.

FEATURES

- Low quiescent circuit current.
AM: 7mA (Typ) FM: 10mA (Typ)
- Minimum number of external parts required.
- Built-in AM/FM function switch.
- Tuning indicator: direct LED driving capability ($I_L = 10\text{mA}_{(\text{MAX})}$).
- One terminal AM/FM detector output.
- Advanced performance at high input signal.
- Operating supply voltage range: $V_{CC} = 3\text{V} \sim 8\text{V}$.

16 DIP



3

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22471	16 DIP	$-20 \sim +70^\circ\text{C}$

BLOCK DIAGRAM

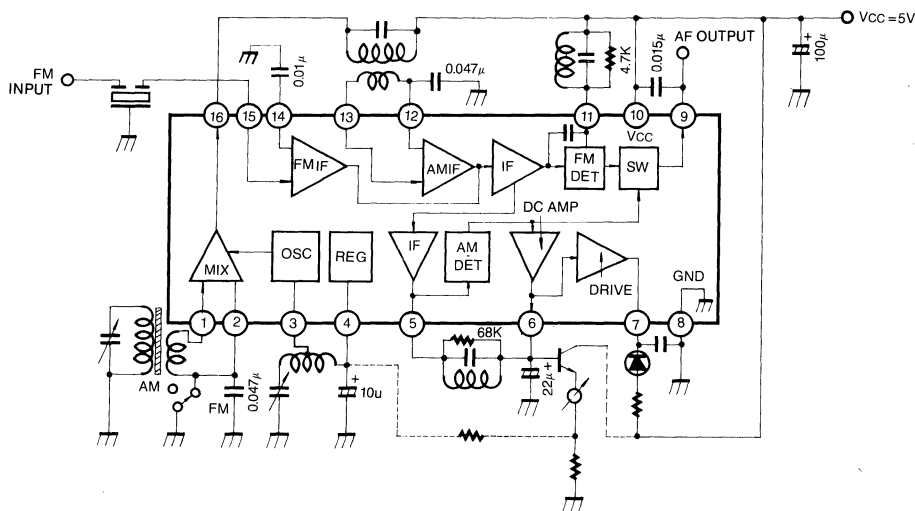


Fig. 1

Note: The dot line denotes a tuning meter application.

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	8	V
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, unless otherwise specified)

FM Section ($f = 10.7\text{MHz}$, $f_m = 400\text{Hz}$, $\Delta f = \pm 22.5\text{KHz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		10	15	mA
Input Limiting Sensitivity	V_i (lim)	V_o ($V_i = 80\text{dB}\mu$) -3dB down		40	46	$\text{dB}\mu$
Detector Output Voltage	V_o	$V_i = 66\text{dB}\mu$, $R_{DUMP} = 4.7\text{K}\Omega$	57	85	114	mV
Total Harmonic Distortion	THD	$V_i = 80\text{dB}\mu$		0.05		%
AM Rejection Ratio	AMR	$V_i = 80\text{dB}\mu$, AM: $f_m = 1\text{KHz}$, 30% Mod		38		dB
Signal to Noise Ratio	S/N	$V_i = 80\text{dB}\mu$		65		dB
Signal Meter Output	V_M	$V_i = 100\text{dB}\mu$	1.55	1.7	1.85	V
Tuning Indication Voltage	V_L	$I_L = 1\text{mA}$		46	52	$\text{dB}\mu$

AM Section ($f = 1\text{MHz}$, 30% Mod, $f_m = 400\text{Hz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		7	10	mA
Voltage Gain	A_v	$V_i = 26\text{dB}\mu$	20	30	60	mV
Detector Output Voltage	V_o	$V_i = 60\text{dB}\mu$	65	95	125	mV
Total Harmonic Distortion	THD	$V_i = 60\text{dB}\mu$		1.0		%
Signal to Noise Ratio	S/N	$V_i = 60\text{dB}\mu$		47		dB
Signal Meter Output	V_M	$V_i = 100\text{dB}\mu$	1.55	1.7	1.85	V
Tuning Indication Voltage	V_L	$I_L = 1\text{mA}$		32		$\text{dB}\mu$
Oscillator Stop Voltage	V_{stop}	$R_{DUMP} = \infty$		1.5		V

TEST CIRCUIT

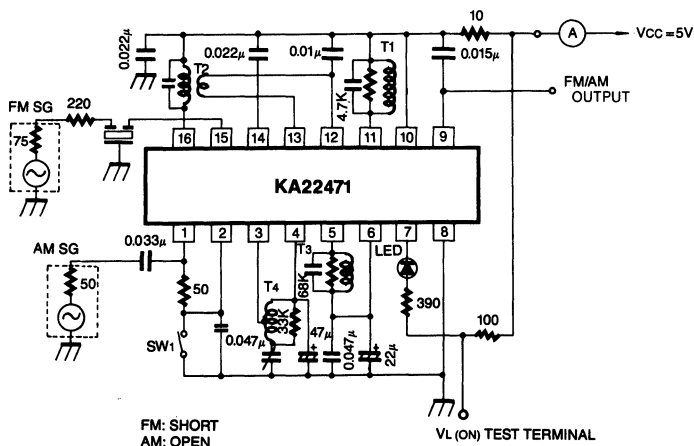
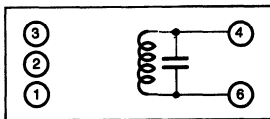


Fig. 2

COIL SPECIFICATION

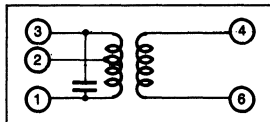
T1 FM IF (DET)



C_o (pF)	f (MHz)	Q_o	URNS
4-6		4-6	4-6
47	10.7	150	14

Seoul Jupa
0.12mmφ UEW

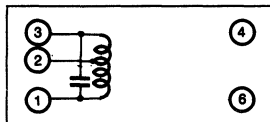
T2 AM IFT (MIX OUT)



C_o (PF)	f (KHz)	Q_o	URNS		
1-3		1-3	1-2	2-3	4-6
180	455	110	90	62	8

Seoul Jupa
0.07mmφ UEW

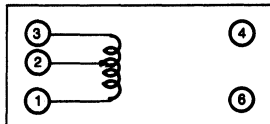
T3 AM IFT (DET)



C_o (pF)	f (KHz)	Q_o	URNS
1-3		1-3	1-3
180	455	110	152

Seoul Jupa
0.07mmφ UEW

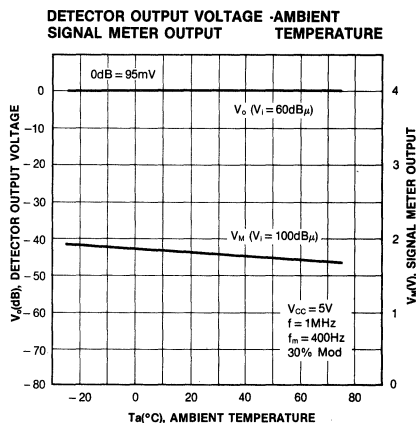
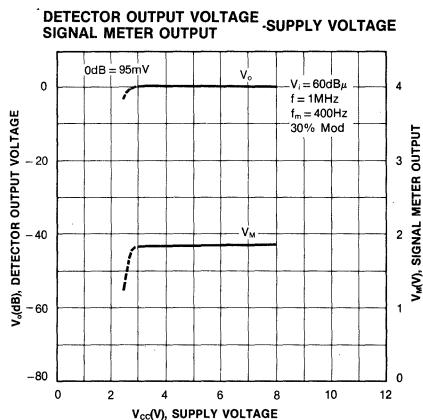
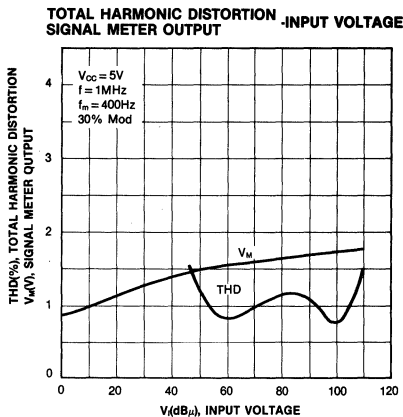
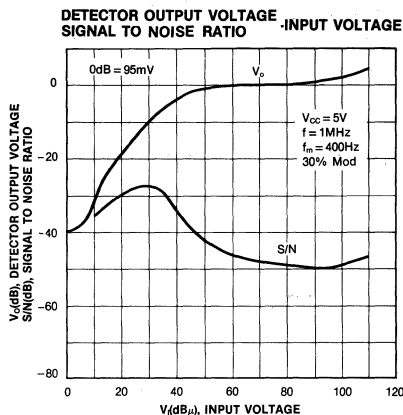
T4 (MW OSC)



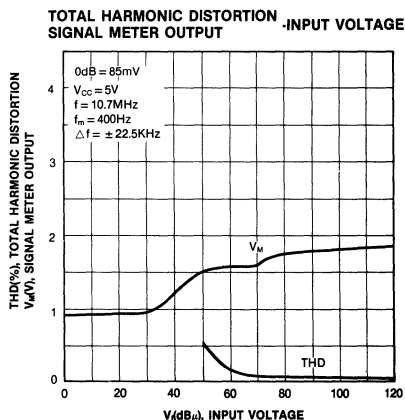
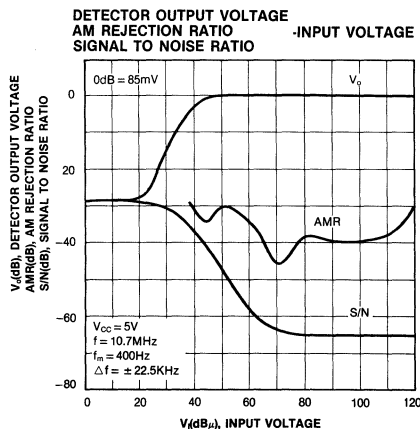
f (KHz)	L (μH)	Q_o	URNS	
	1-3	1-3	1-2	2-3
796	288	120	13	75

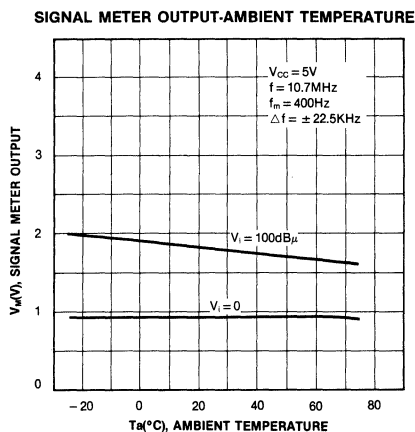
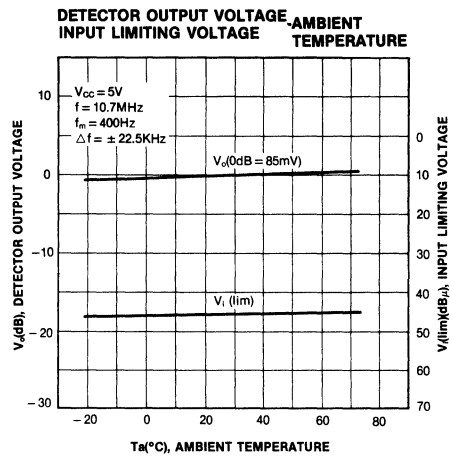
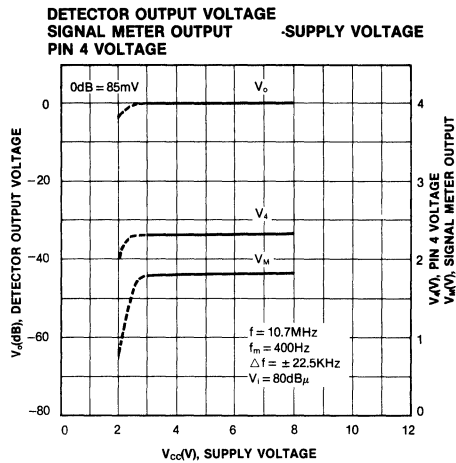
Seoul Jupa
0.08mmφ UEW

(AM SECTION)



(FM SECTION)





3V FM IF/AM TUNER SYSTEM

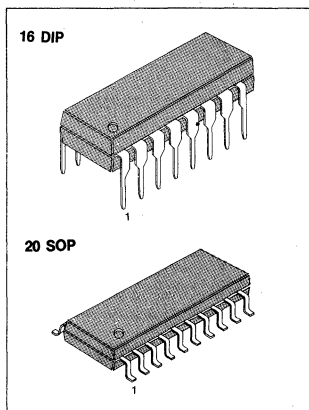
The KA2248 is a monolithic integrated circuit developed for the headphone stereo.

FUNCTIONS

- AM SECTION: Converter, IF amplifier, Detector, Tuning indicator
- FM SECTION: IF amplifier, Quadrature detector, Tuning indicator

FEATURES

- Low quiescent current: AM; $I_{CC} = 3\text{mA}$ (Typ), $V_{CC} = 3\text{V}$
FM; $I_{CC} = 8\text{mA}$ (Typ), $V_{CC} = 3\text{V}$
- Wide operating voltage range: $V_{CC} = 1.8\text{V} \sim 6\text{V}$.
- Built-in AM/FM function switch.
- Tuning indicator: direct LED driving capability: 10mA (Max).
- One terminal AM/FM detector output.
- Minimum number of external parts required.



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2248A	16 DIP	-20 ~ +70°C
KA2248D	20 SOP	

BLOCK DIAGRAM

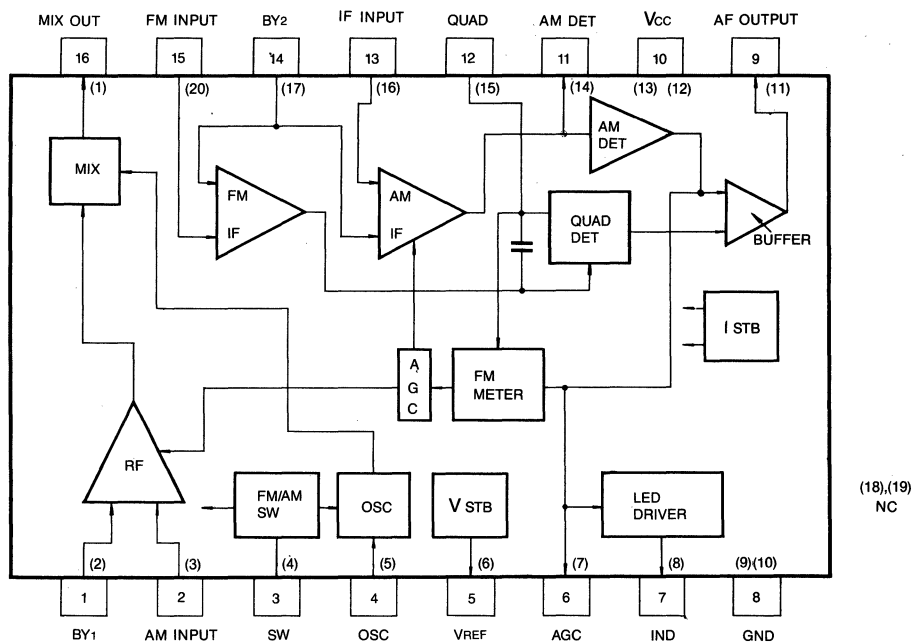


Fig. 1

(): KA2248D

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic		Symbol	Value	Unit
Supply Voltage		V_{CC}	6	V
Power Dissipation	KA2248A	P_d	600	mW
	KA2248D		350	
Operating Temperature		T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature		T_{sig}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, unless otherwise specified)

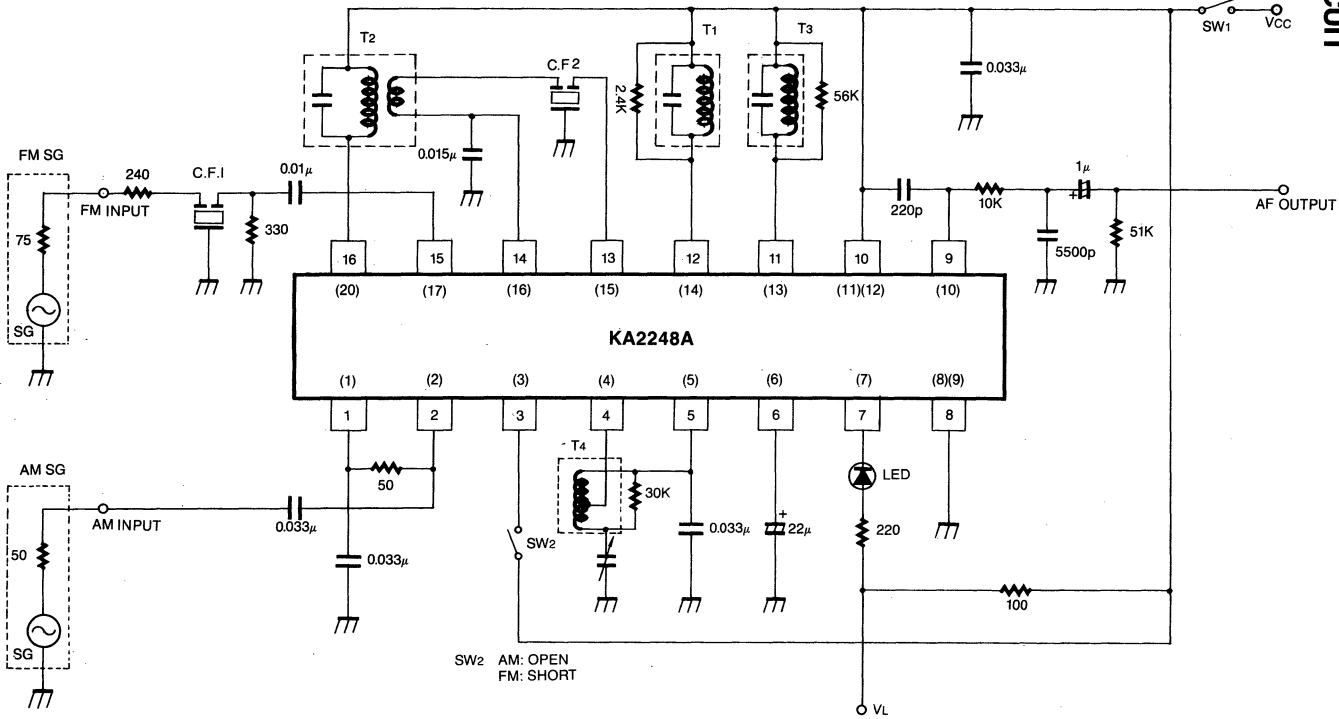
* FM Section ($f = 10.7\text{MHz}$, $f_m = 1\text{KHz}$, $\Delta f = 22.5\text{KHz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		8	13	mA
Input Limiting Sensitivity	$V_i (\text{lim})$	$V_i = 86\text{dB}\mu$		46	52	$\text{dB}\mu$
Detector Voltage	V_o	$V_i = 86\text{dB}\mu$	60	85	120	mV
Signal to Noise Ratio	S/N	$V_i = 86\text{dB}\mu$	50	65		dB
Total Harmonic Distortion	THD	$V_i = 86\text{dB}\mu$		0.1	1.0	%
AM Rejection Ratio	AMR	$V_i = 86\text{dB}\mu$	30	45		dB
Tuning Indication Voltage	V_L	$I_L = 1\text{mA}$		50	58	$\text{dB}\mu$
Output Resistance	R_o	$f = 1\text{KHz}$		0.7		$\text{K}\Omega$

* AM Section ($f = 1\text{MHz}$, $f_m = 1\text{KHz}$, 30% Mod)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Current	I_{CC}	$V_i = 0$		3	7	mA
Voltage Gain	A_v	$V_i = 26\text{dB}\mu$	15	30	50	mV
Detector Voltage	V_o	$V_i = 60\text{dB}\mu$	35	50	70	mV
Signal to Noise Ratio	S/N	$V_i = 60\text{dB}\mu$	35	45		dB
Total Harmonic Distortion	THD	$V_i = 60\text{dB}\mu$		1.0	3.5	%
Oscillator Stop Voltage	V_{stop}			1.2		V
Output Resistance	R_o	$f = 1\text{KHz}$		8.3		$\text{K}\Omega$
Tuning Indication Voltage	V_L	$I_L = 1\text{mA}$		26	40	$\text{dB}\mu$

TEST CIRCUIT

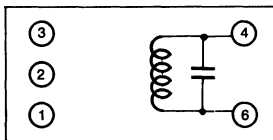


(): KA2248D

Fig. 2

COIL SPECIFICATION (BOTTOM VIEW)

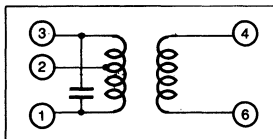
T1 FM IF (DET)



C_o (pF)	f (MHz)	Q_o	URNS
4-6		4-6	4-6
100	10.7	150	14

Seoul Jupa
0.12mm ϕ UEW

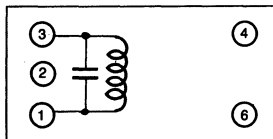
T2 AM IFT (MIX OUT)



C_o (PF)	f (KHz)	Q_o	URNS		
1-3		1-3	1-2	2-3	4-6
180	455	110	90	62	8

Seoul Jupa
0.07mm ϕ UEW

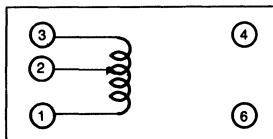
T3 AM IFT (DET)



C_o (pF)	f (KHz)	Q_o	URNS
1-3		1-3	1-3
180	455	110	152

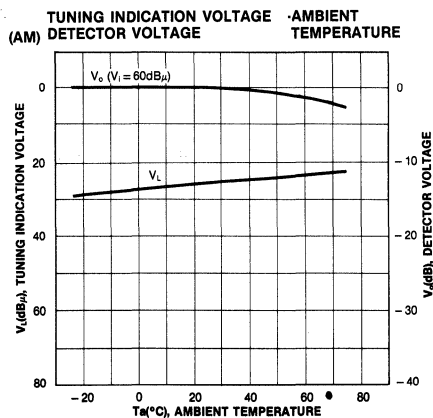
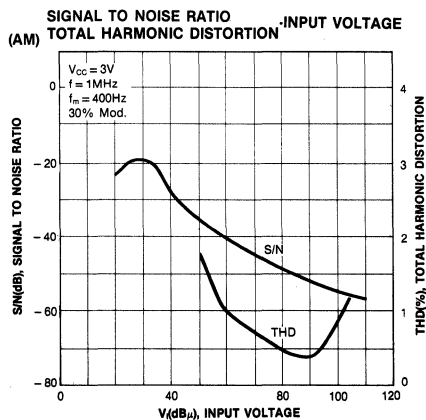
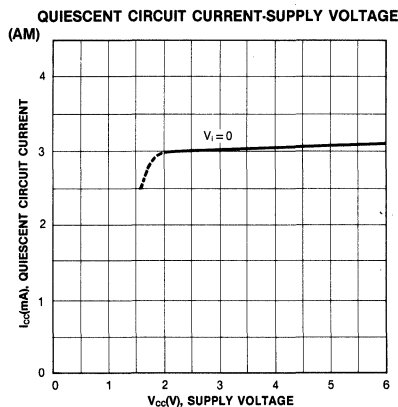
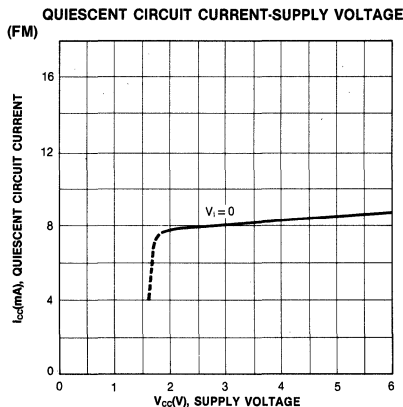
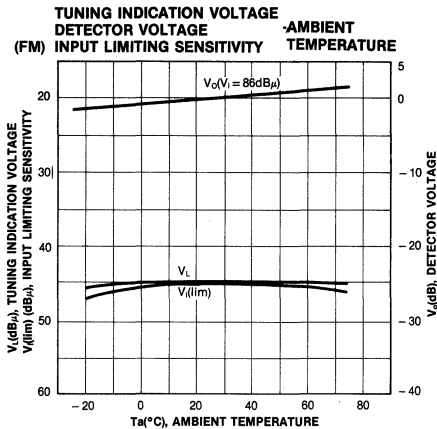
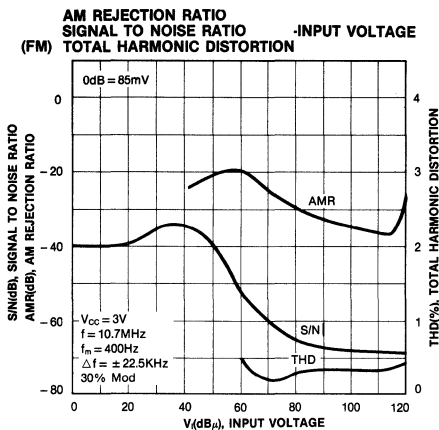
Seoul Jupa
0.07mm ϕ UEW

T4 (MW OSC)



f (KHz)	L (μ H)	Q_o	URNS	
	1-3	1-3	1-2	2-3
796	288	120	13	75

Seoul Jupa
0.08mm ϕ UEW



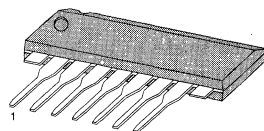
FM FRONT END FOR PORTABLE RADIO

The KA2249 is a monolithic integrated circuit designed for FM front end of the portable radio.

FEATURES

- High frequency amplifier, frequency converter, local oscillator.
- Wide operating voltage: $V_{CC} = 2V \sim 7V$ (KA2249)
 $V_{CC} = 2V \sim 5V$ (KA2249D)
- Low current consumption: Typ. 2mA ($V_{CC} = 4V$).

7 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2249	7 SIP	$-20 \sim +70^{\circ}\text{C}$

SCHEMATIC DIAGRAM

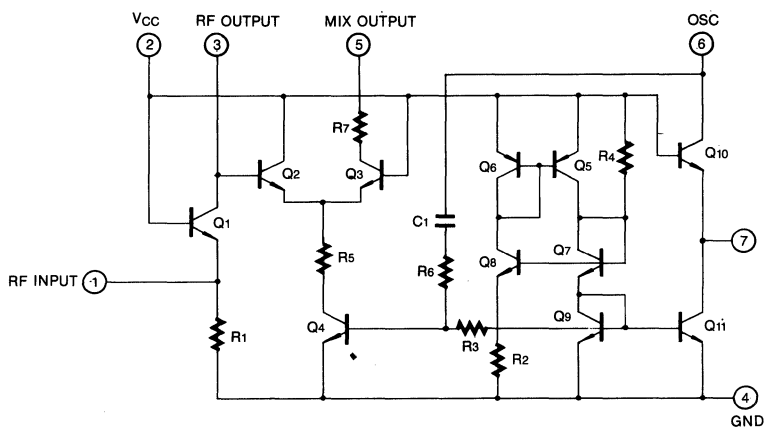


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	7	V
Terminal Voltage	V (3~4)	14	V
	V (5~4)		
	V (6~4)		
Power Dissipation ($T_a = 70^\circ\text{C}$)	P_d	30	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 4\text{V}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Fig
Circuit Current	I_{CC}	$V_i = 0$	1.4		3.0	mA	2
Output Voltage	V_o	$V_i = 70\text{dB}\mu$, 106MHz	30.5		68.5	mV	3
Oscillation Voltage	V_{osc}	$V_{CC} = 2\text{V}$	130			mV	3

TEST CIRCUIT 1

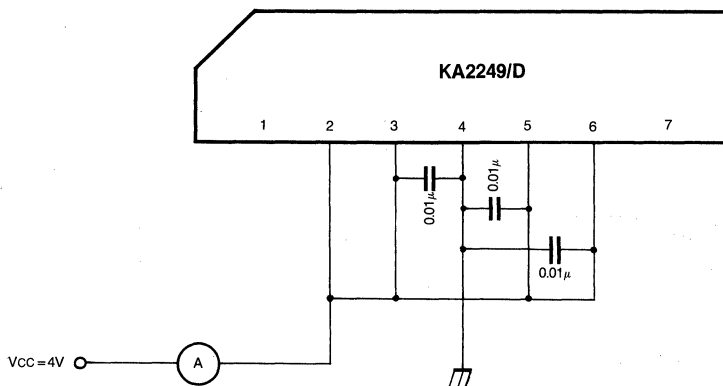
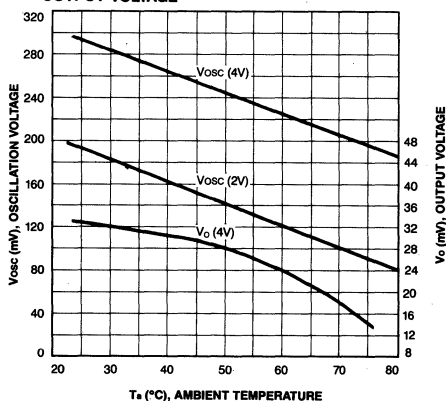
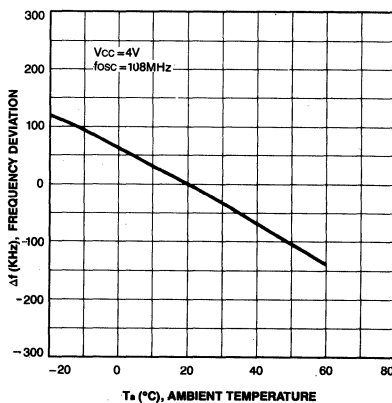


Fig. 2

OSCILLATION VOLTAGE
OUTPUT VOLTAGE — AMBIENT TEMPERATURE

FREQUENCY DEVIATION — AMBIENT TEMPERATURE



APPLICATION CIRCUIT

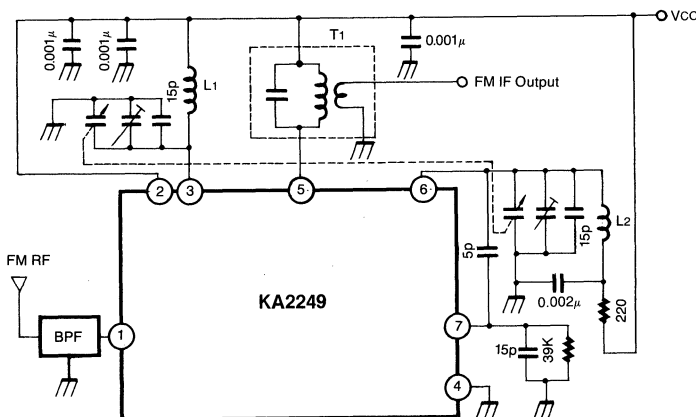
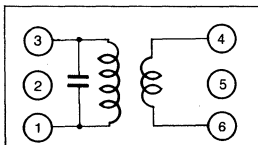


Fig. 4

COIL SPECIFICATION

T1 FM IFT



Co (pF)	f (MHz)	Qo (%)	TURNS	
			1-3	4-6
56	10.7	95	12	2

Seoul Jupa
SJ-015-382
0.1mmφ UEW

FM FRONT END

The KA22495 is a monolithic integrated circuit designed for FM FRONT END of the portable radio cassette or music center.

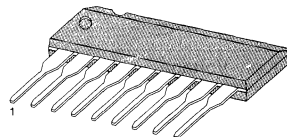
It is consisted of RF AMP, LOCAL OSC, OSC BUFFER and MIXER etc. Compared with conventional type, it has improved following characteristics.

- 1) Low supply voltage characteristic.
- 2) Strong input characteristic.
- 3) Spurious radiation characteristic.

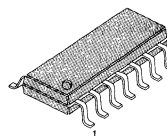
FEATURES

- Wide supply voltage range: $V_{CC} = 1.6V \sim 6.0V$
- Low local oscillation stop voltage: $V_{CC} = 0.9V$ (Typ)
- Improved 2-signal characteristics by double balanced type mixer circuit.
- Low spurious radiation.
- Built-in clamping diode in the mixer output stage.

9 SIP



14 SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA22495	9 SIP	- 25 ~ + 75°C
KA22495D	14 SOP	

BLOCK DIAGRAM

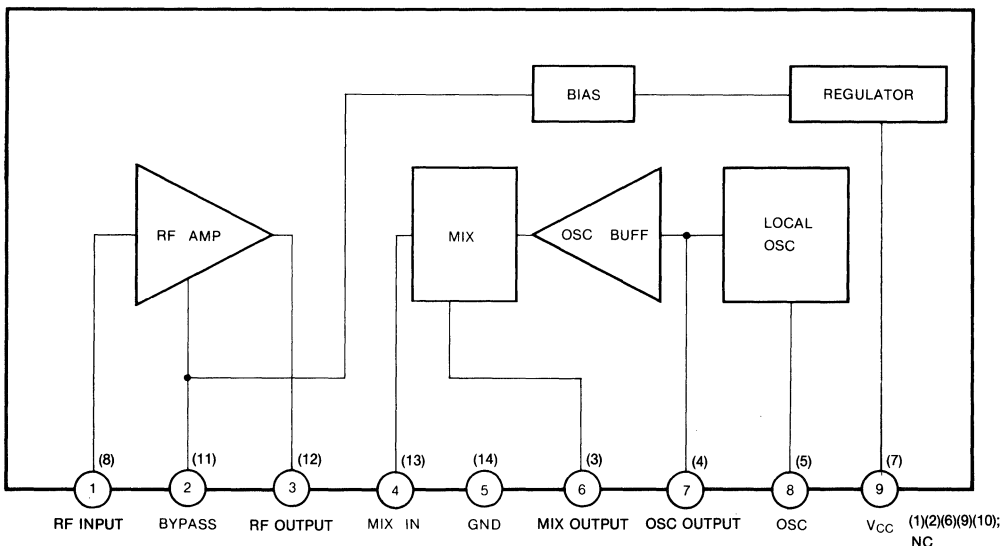


Fig. 1

(): KA22495D

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	8	V
Power Dissipation	P_d	KA22495	mW
		KA22495D	
Operating Temperature	T_{opr}	$-25 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

*: Derated above $T_a = 25^\circ\text{C}$ in the proportion of $4\text{mW}/^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $f = 98\text{MHz}$, $f_m = 1\text{KHz}$, $\Delta f = \pm 22.5\text{KHz}$, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current		I_{CC}	$V_i = 0$		5.2	8.0	mA
– 3dB Limiting Sensitivity		V_i (lim)	V_D ($V_i = 60\text{dB}\mu$) – 3dB Down		3.0	7.0	$\text{dB}\mu$
Conversion Gain		A_{VC}	$V_i = 60\text{dB}\mu$	25	31		dB
Usable Sensitivity		Use (Sen)	$S/N = 30\text{dB}$		11		$\text{dB}\mu$
Oscillation Voltage		V_{OSC}	$f_{OSC} = 108\text{MHz}$	90	165	25	mV
Oscillation Stop Voltage		V_{STOP}			0.9	1.3	V
Pin 1 Impedance	Parallel Input Resistance	R_{IP1}	$f = 98\text{MHz}$		57		Ω
Pin 3 Impedance	Parallel Output Resistance	R_{OP3}			25		$\text{K}\Omega$
	Parallel Output Capacitance	C_{OP3}			2.0		pF
Pin 4 Impedance	Parallel Input Resistance	R_{IP4}			2.7		$\text{K}\Omega$
	Parallel Input Capacitance	C_{IP4}			3.3		pF
Pin 6 Impedance	Parallel Output Resistance	R_{OP6}	$f = 10.7\text{MHz}$		100		$\text{K}\Omega$
	Parallel Output Capacitance	C_{OP6}			4.8		pF

TEST CIRCUIT 1

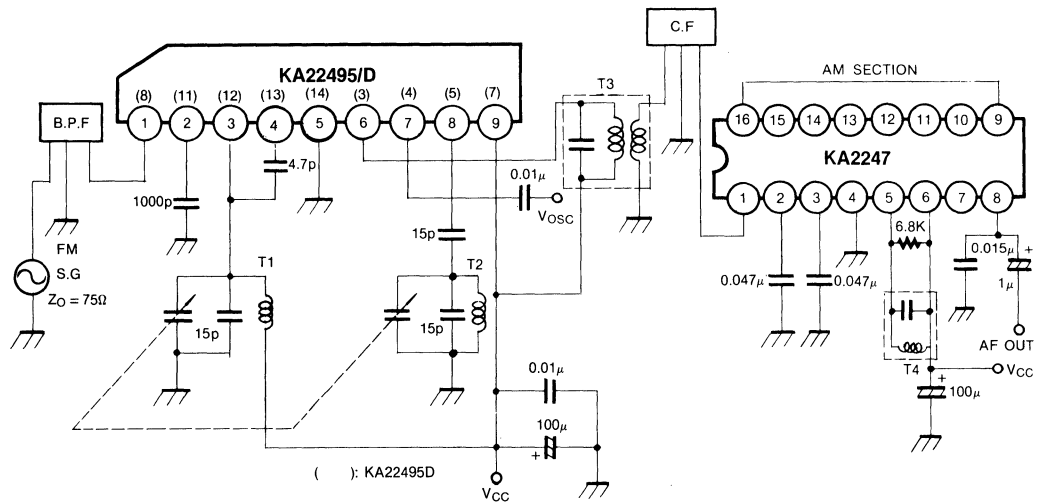
(I_{CC}, V_i(lim), Use (Sen), A_VC, V_{OSC}, V_{STOP})

Fig. 2

In case of using the KA22471 for IF stage.

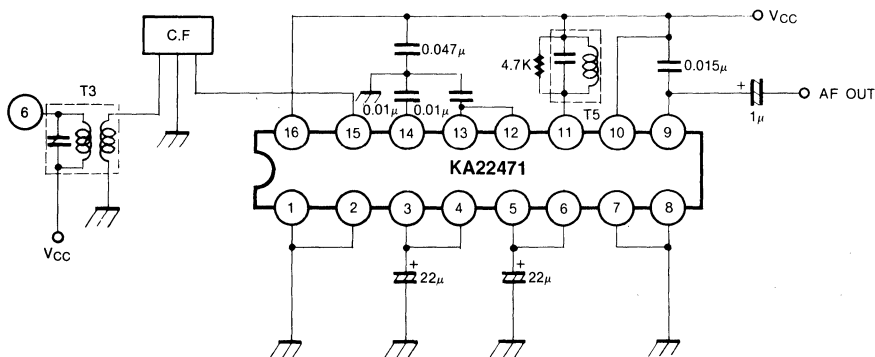


Fig. 3

TEST CIRCUIT 2

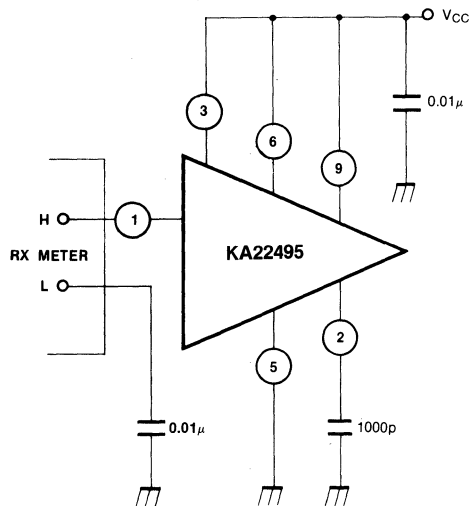
1. R_{ip1} 

Fig. 4

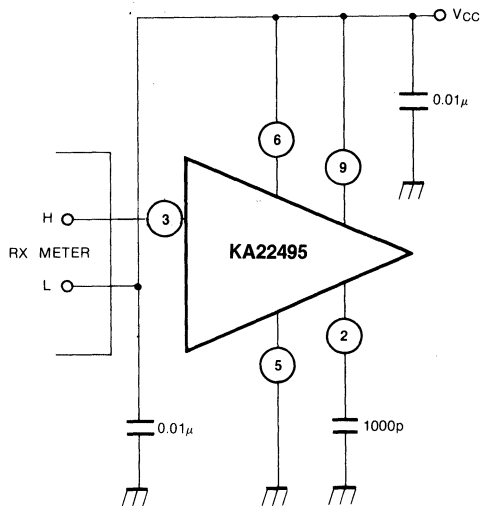
2. R_{op3} , C_{op3} 

Fig. 5

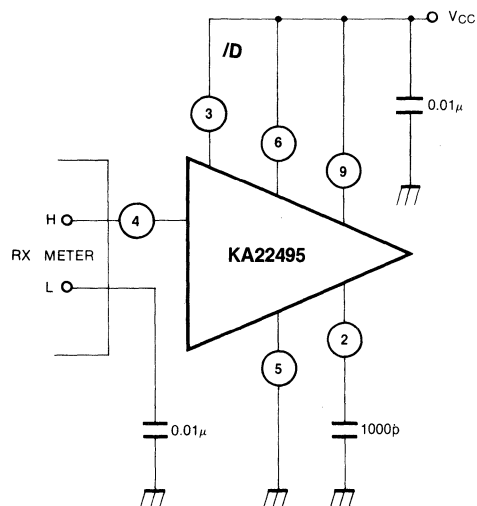
3. R_{ip4} , C_{ip4} 

Fig. 6

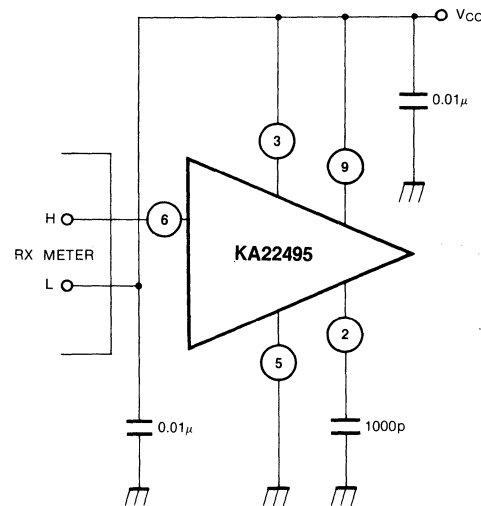
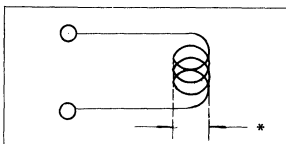
4. R_{op6} , C_{op6} 

Fig. 7

COIL SPECIFICATION (BOTTOM VIEW)

T1 FM RF

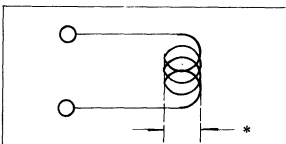


f (MHz)	Q_o	Turns
98	100	4

* In a Diameter: 5.5mm

0.8mm $\varnothing$ UEW

T2 FM OSC

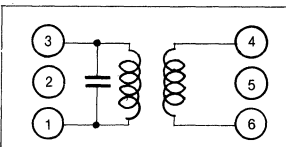


f (MHz)	Q_o	Turns
98	100	3

* In a Diameter: 5.5mm

0.8mm $\varnothing$ UEW

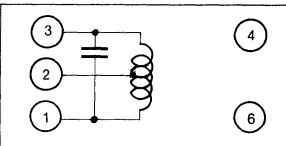
T3 FM IFT



C_o (pF)	f (MHz)	Q_o	Turns	
1-3		1-3	1-3	4-6
75	10.7	115	12	1

KOREA TOKO
0.12mm $\varnothing$ UEW

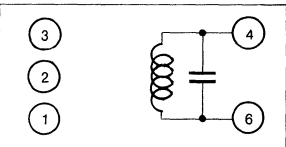
T4 FM IFT (DET)



C_o (pF)	f (MHz)	Q_o	Turns
1-3		1-3	1-3
56	10.7	95	12

KOREA TOKO
0.12mm $\varnothing$ UEW

T5 FM IFT (DET)



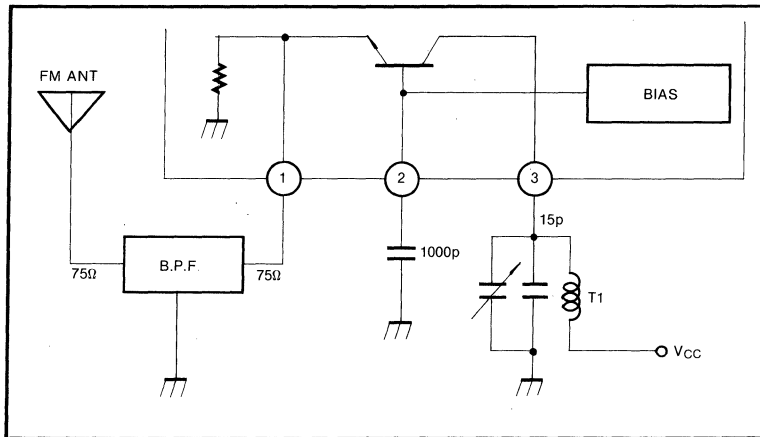
C_o (pF)	f (MHz)	Q_o	Turns
4-6		4-6	4-6
47	10.7	115	14

KOREA TOKO
0.12mm $\varnothing$ UEW

DESCRIPTION

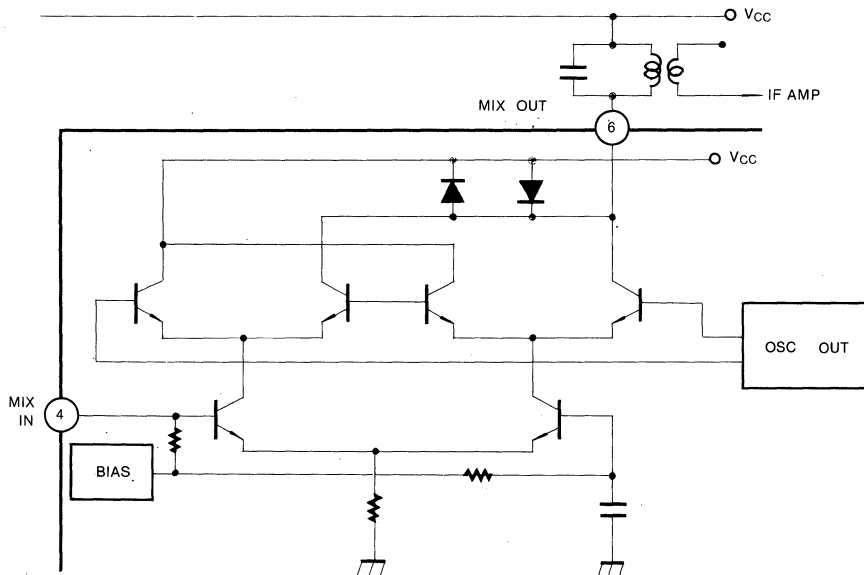
1. RF AMP

The RF AMP is a common base type, so the operating frequency range is improved. The GND of bypass capacitor (Pin2) should be located closely at the pin5 (GND). In case of using the bypass capacitor at V_{CC} -line of pin3, we can expect improvement of S/N ratio.



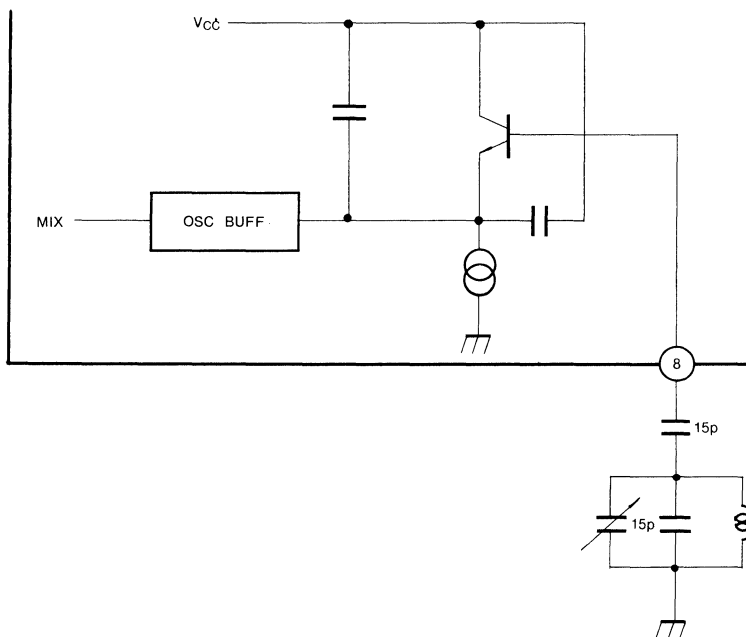
2. MIXER

The MIXER stage used a DOUBLE BALANCED TYPE in order to protect the leakage of OSC and spurious radiation. Also, this is built-in the limiter in order to improve strong input characteristic.

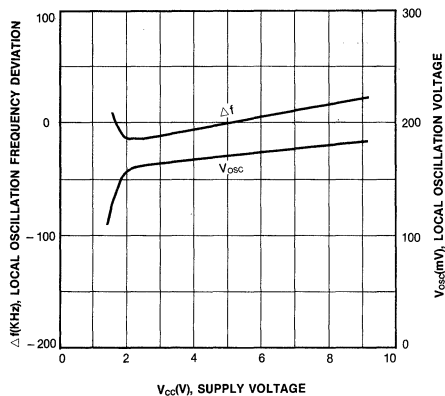


LOCAL OSCILLATION

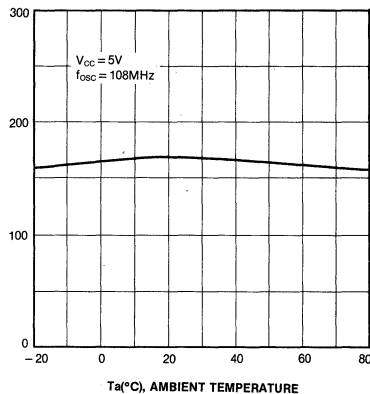
The local oscillator adopted colpitts oscillator for stable oscillation at high frequency. This is built in OSC BUFFER in order to operate stably OSC frequency and OSC voltage at strong input.



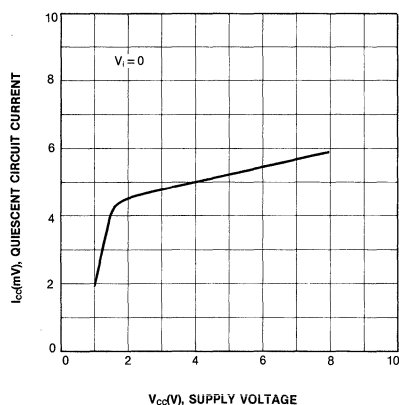
LOCAL OSCILLATION FREQUENCY DEVIATION,
LOCAL OSCILLATION VOLTAGE-SUPPLY VOLTAGE



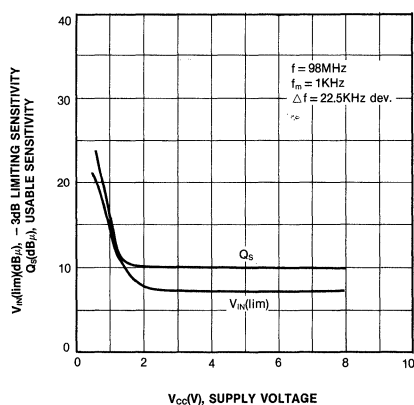
LOCAL OSCILLATION VOLTAGE
-AMBIENT TEMPERATURE



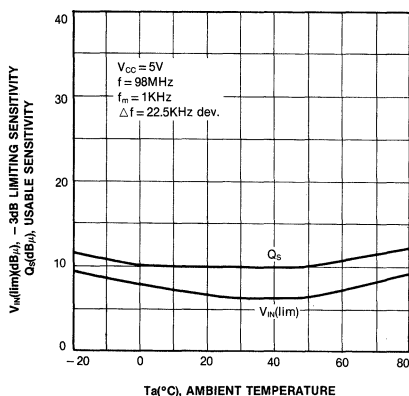
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



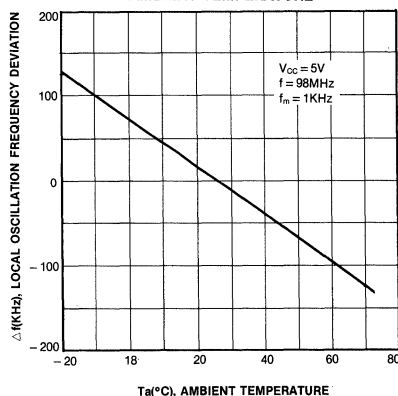
SENSITIVITY-SUPPLY VOLTAGE



SENSITIVITY-AMBIENT TEMPERATURE



LOCAL OSCILLATION FREQUENCY DEVIATION
-AMBIENT TEMPERATURE



FM FRONT END

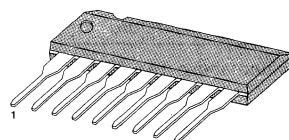
The KA22496 is a monolithic integrated circuit designed for FM FRONT END of the portable radio cassette or music center. It is consisted of RF AMP, LOCAL OSC, OSC BUFFER and MIXER etc. Compared with conventional type, it has improved following characteristics.

- 1) Low supply voltage characteristic.
- 2) Strong input characteristic.
- 3) Spurious radiation characteristic.

FEATURES

- Wide supply voltage range: $V_{CC} = 1.6V \sim 6.0V$
- Low local oscillation stop voltage: $V_{CC} = 0.9V$ (Typ)
- Improved 2-signal characteristics by double balanced type mixer circuit.
- Low spurious radiation.
- Built-in clamping diode in the mixer output stage.
- It can receive TV Band.

9 SIP



3

BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22496	9 SIP	$-25 \sim +75^{\circ}C$

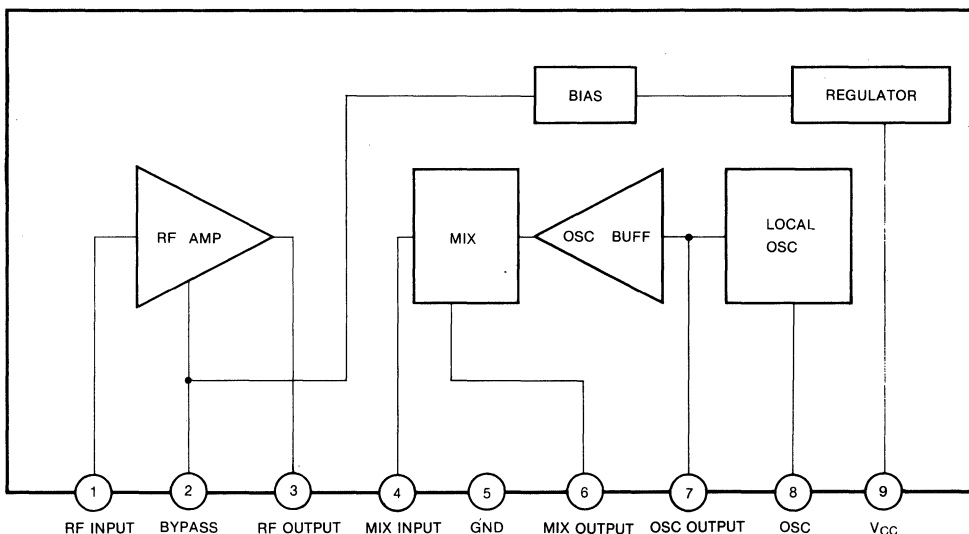


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	8	V
Power Dissipation	P _d *	600	mW
Operating Temperature	T _{opr}	- 25 ~ + 75	°C
Storage Temperature	T _{stg}	- 55 ~ + 150	°C

*: Derated above Ta = 25°C in the proportion of 4mW/°C.

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 5V, f = 98MHz, f_m = 1KHz, Δf = ± 22.5KHz, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current		I _{CC}	V _i = 0		5.2	8.0	mA
- 3dB Limiting Sensitivity		V _i (lim)	V _o (V _i = 60dBμ) - 3dB Down		3.0	7.0	dBμ
Conversion Gain		A _{VC}	V _i = 60dBμ	25	31		dB
Usable Sensitivity		Use (Sen)	S/N = 30dB		11		dBμ
Oscillation Voltage		V _{OSC}	f _{osc} = 108MHz	150	230	350	mV
Oscillation Stop Voltage		V _{STOP}			0.9	1.3	V
Pin 1 Impedance	Parallel Input Resistance	R _{ip1}	f = 98MHz		57		Ω
Pin 3 Impedance	Parallel Output Resistance	R _{Op3}			25		KΩ
	Parallel Output Capacitance	C _{Op3}			2		pF
Pin 4 Impedance	Parallel Input Resistance	R _{ip4}			2.7		KΩ
	Parallel Input Capacitance	C _{ip4}			3.3		pF
Pin 6 Impedance	Parallel Output Resistance	R _{Op6}	f = 10.7MHz		100		KΩ
	Parallel Output Capacitance	C _{Op6}			4.8		pF

$(I_{CC}, V_i(\text{lim}), \text{Use (Sen)}, A_{VC}, V_{OSC}, V_{STOP})$ 

In case of using the KA22471 for IF stage.

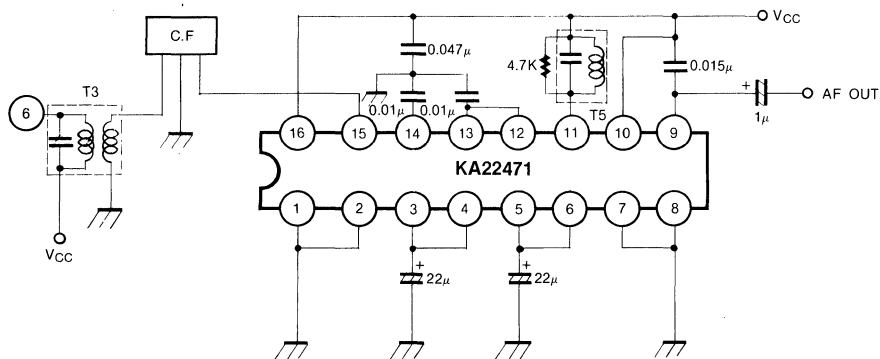


Fig. 3

TEST CIRCUIT 2

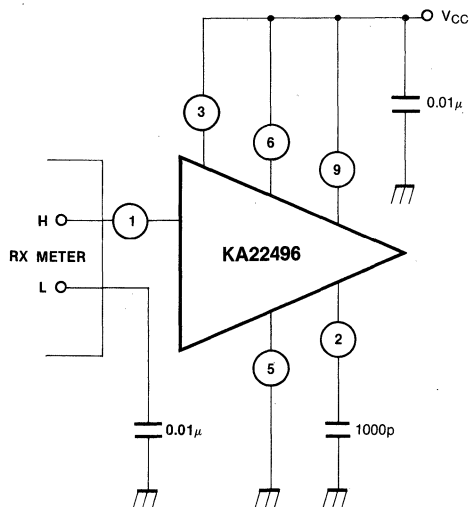
1. R_{IP1} 

Fig. 4

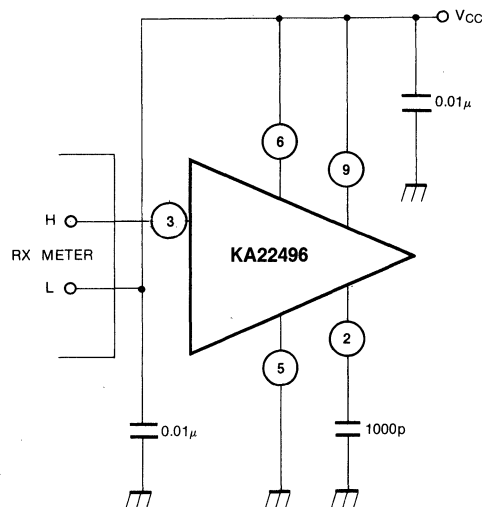
2. R_{OP3} , C_{OP3} 

Fig. 5

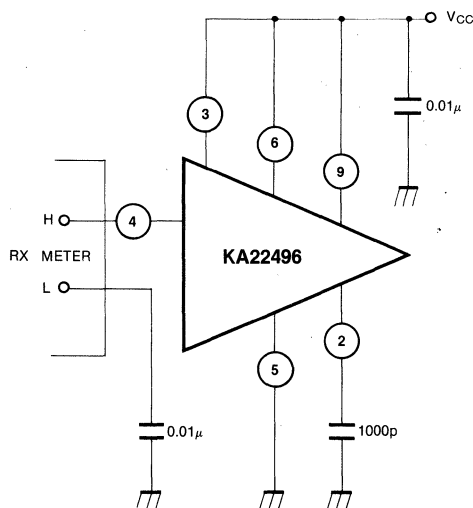
3. R_{IP4} , C_{IP4} 

Fig. 6

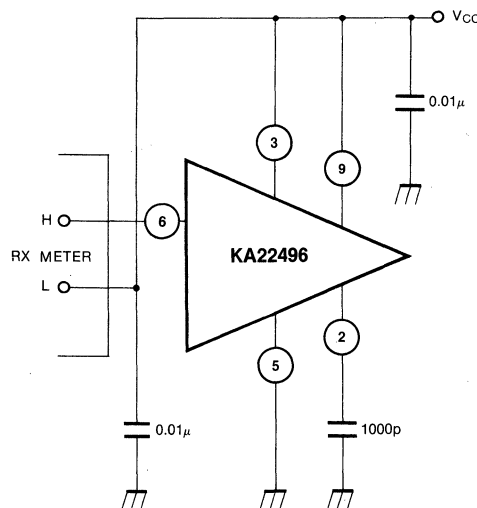
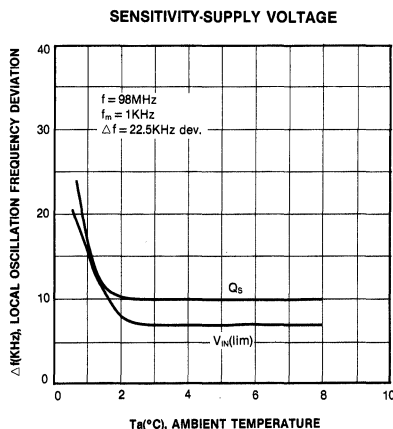
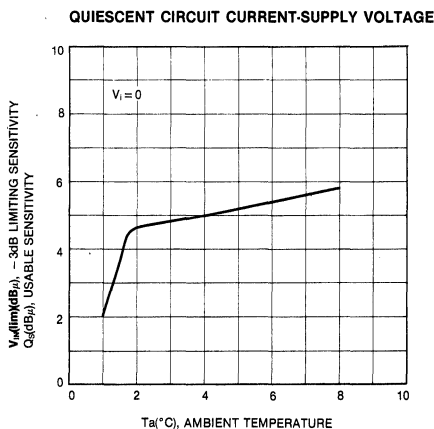
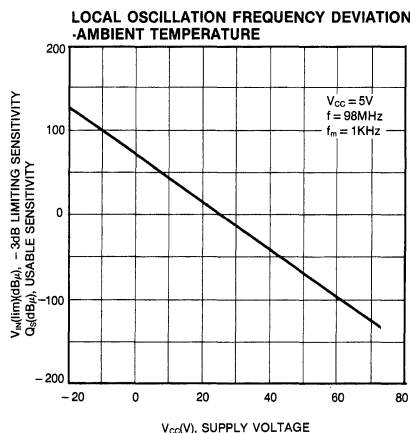
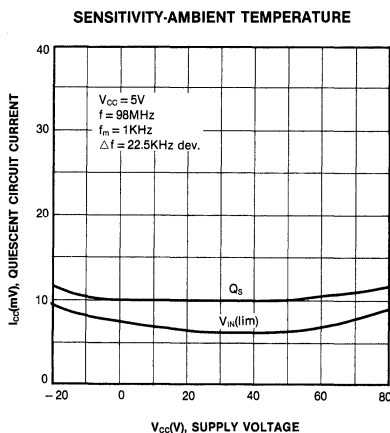
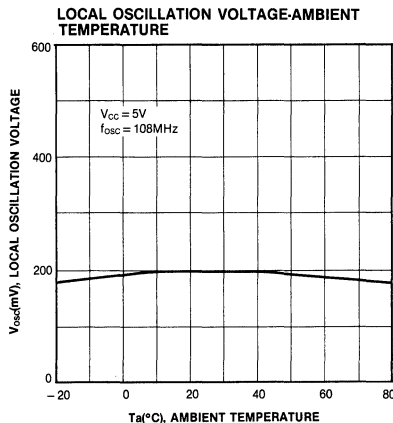
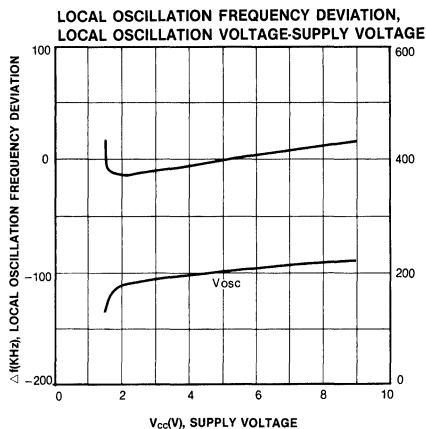
4. R_{OP6} , C_{OP6} 

Fig. 7



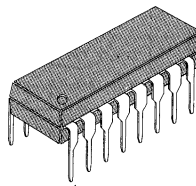
FM STEREO MULTIPLEX DECODER

The KA2261 is a monolithic integrated circuit consisting of a phase locked loop FM stereo demodulator. It was designed for use in car stereo, cassette recorder and other equipment.

FEATURES

- A PLL is used for high multiplexing performance.
- Wide operating supply voltage range (3V ~ 14V).
- Low quiescent circuit current ($I_{CC} = 8.5\text{mA}$, Typ).
- High SCA rejection ratio.
- High channel separation (45dB, Typ) and can be controlled by external resistor.
- Built-in VCO disable and monaural muting circuits.
- Built-in stereo indicator lamp drive circuit.

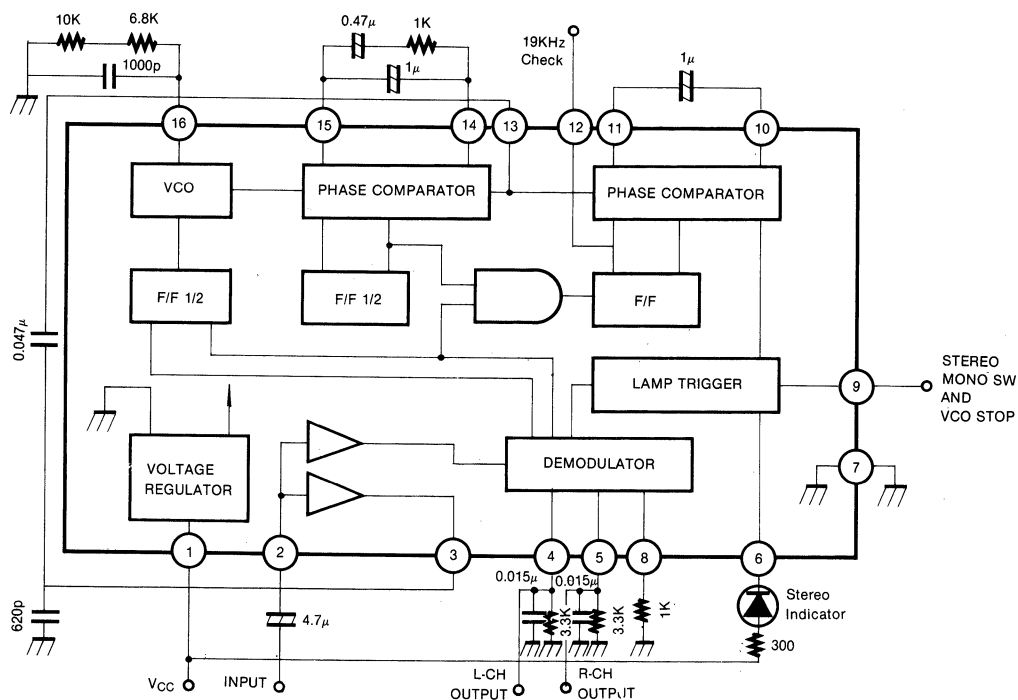
16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2261	16 DIP	-20 ~ +70°C

TYPICAL APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Lamp Current	I_L	40	mA
Power Dissipation	P_d	400	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(T_a = 25°C, V_{CC} = 6V, f = 1KHz, R_L = 3.3KΩ, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current		I_{CC}	$V_i = 0$		8.5	12	mA
Channel Separation		Sep	$V_i = 100\text{mV}$, L+R=90% P=10%, f=1KHz	35	45		dB
Total Harmonic Distortion	Mono	THD 1	$V_i = 100\text{mV}$		0.2		%
	Stereo	THD 2	L+R=90mV, P=10mV		0.7		%
Output Voltage		V_o	$V_i = 100\text{mV}$, f=1KHz	66	85	115	mV
Channel Balance		CB	$V_i = 100\text{mV}$, f=1KHz		0.5	1.5	dB
Lamp on Level		V_L (on)	L+R=90%, P=10%		65		mV
Lamp Hysteresis		HY			3.5	6.0	dB
Maximum Input Level		V_i (max)	THD=2%		450		mV
SCA Rejection Ratio		SCA R _{ej}	L+R=90%, P=10%		70		dB
Signal to Noise Ratio		S/N	$V_i = 100\text{mV}$, f=1KHz		75		dB
Carrier Leak		CL	$V_i = 100\text{mV}$, L+R=90% P=10%		32		dB
Capture Range		CR	$V_i = 100\text{mV}$, L+R=90% P=10%		±3		%
Input Impedance		R_i		15	20		KΩ

TEST CIRCUIT

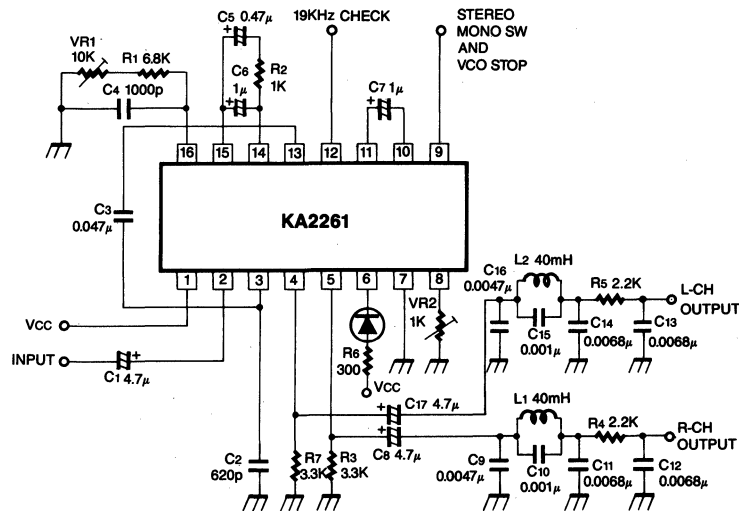
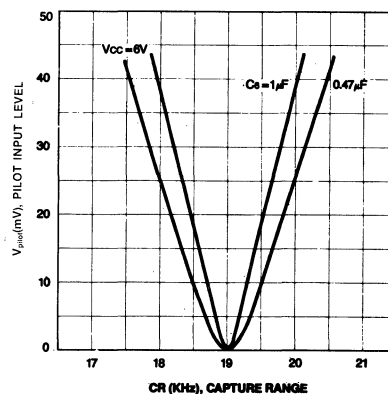
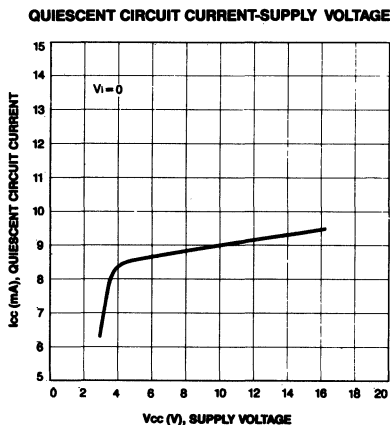
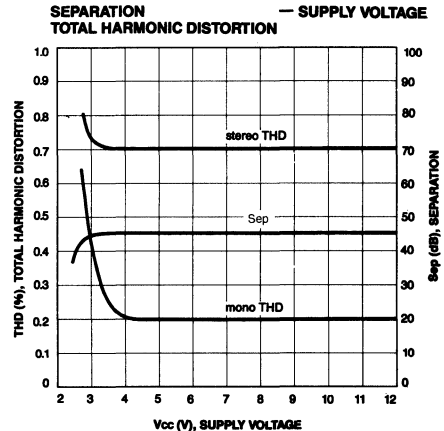
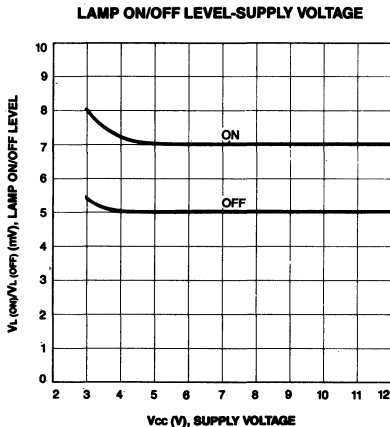
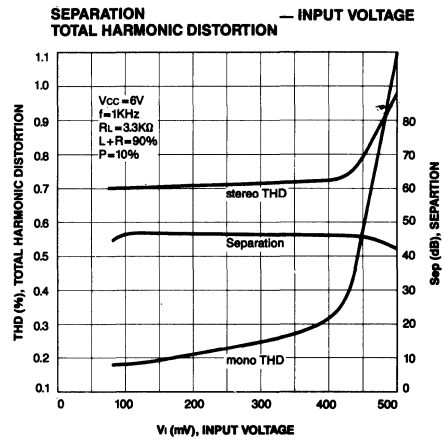
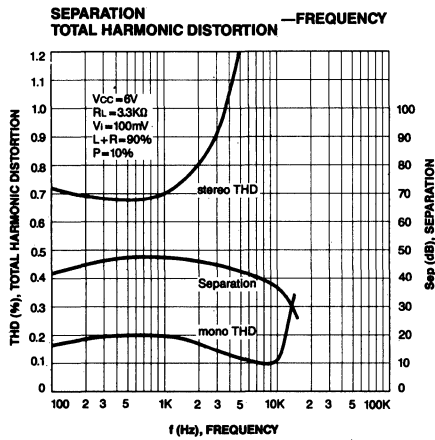
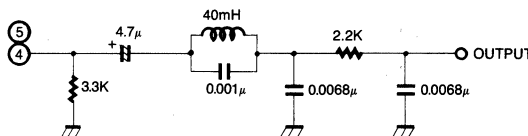


Fig. 2



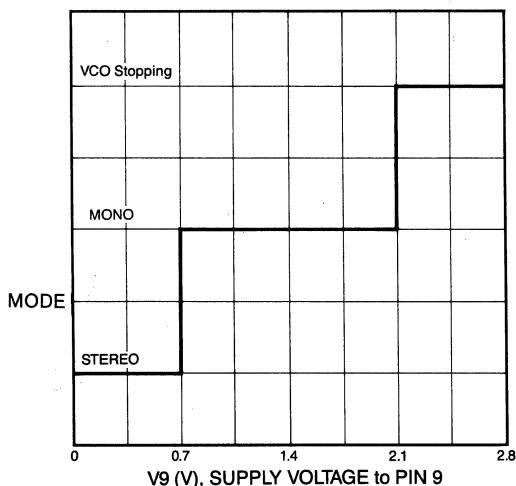
External Components (Refer to test circuit)

1. Input coupling capacitor (Pin 2)
The recommended value is $4.7\mu\text{F}$. If smaller values than $4.7\mu\text{F}$ are used, low frequency separation will be worsen, and if larger values are used, the DC operating point will require time for stabilization.
2. Demodulator output (Pin 4, 5)
These components provide R and L channel output load circuits. The recommended circuits are follows:



3. Separation control (Pin 8)
This component is a variable resistor used to adjust the out signal separation.
4. Low pass filter (Pin 10, 11)
This capacitor is used to filter the 19KHz signal detected by the phase comparator. The recommended value is $1\mu\text{F}$. If made too small, the lamp may light improvely when a large mono input signal or external noise received, too large a capacitance value will take more time to switch between mono and stereo modes.
5. Preamplifier output capacitor (Pin 3, 13)
This capacitor coupled preamplified with phase comparator. The recommended value is $0.047\mu\text{F}$.
6. Phase compensation capacitor (Pin 3, GND)
This capacitor is prepared in order to compensate the phase advanced.
7. Loop filter (Pin 14, 15)
This is the low pass filter for the PLL, which is determined the capture range. The recommended value is follow:
 $V_i \leq 250\text{mV}$ $C_{14-15} = 0.47\mu\text{F}$
 $V_i \geq 250\text{mV}$ $C_{14-15} = 1\mu\text{F}$
8. Control of Pin 9
Function of pin 9 is a change-over of stereo/mono and VCO stopping.

SCHEMATIC DIAGRAM of PIN 9 CONTROL



9. VCO network (Pin 16)
Since the VCO has a negative temperature coefficient, the RC network compensate by using a polyester film capacitor and a resistor.

FM STEREO MULTIPLEX DECODER FOR CAR STEREO

KA2262 is a multiplex IC for FM car stereo, and it has the following 2 functions through its utilization of the IF meter output voltage, etc.

1. Stereo noise control (SNC) under which the noise particular on the FM stereo unit in the weak electric field is reduced smoothly.
2. High-cut control (HCC) under which the high frequency is smoothly attenuated.

In addition, KA2262 can be, due to its low distortion factor, an IC for multiplex stereo demodulator which is appropriate for the car component stereo unit.

FUNCTIONS

- Stereo noise control (SNC Terminal).
- High-cut control (HCC Terminal).
- Stereo/Monaural automatic conversion.
- Stoppage of VCO oscillation.
- With separation control terminal.

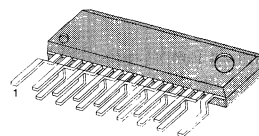
FEATURES

- Low distortion (0.05%: Typ).
- Good ripple rejection (35dB: Typ).
- Wide operating supply voltage range (6.5V ~ 14V).
- The space factor is advantageous because of the ZIP.
- High channel separation (50dB: Typ).

ORDERING INFORMATION

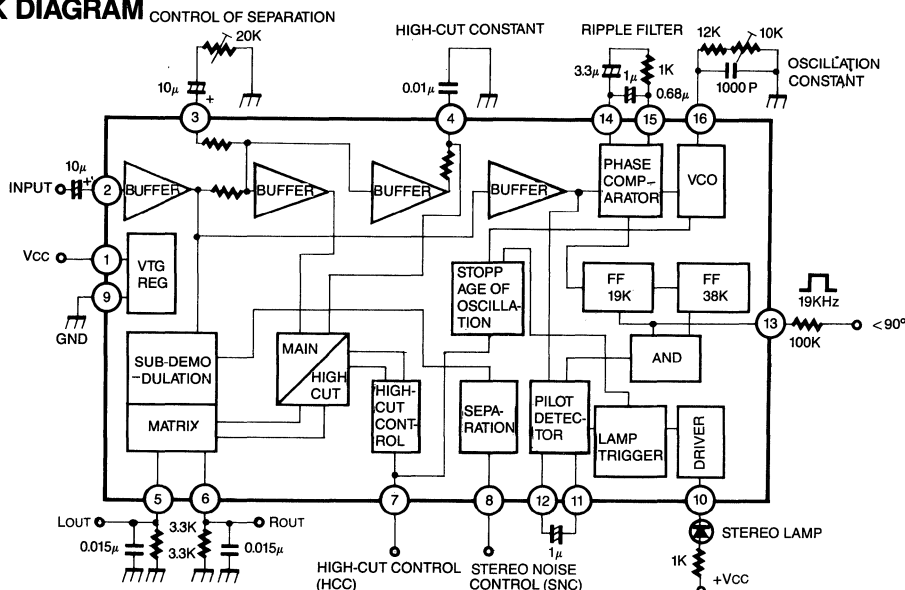
Device	Package	Operating Temperature
KA2262	16 ZIP	- 20 ~ + 70°C
KA2262G	PELLET	

16 ZIP



3

BLOCK DIAGRAM



Note: There exists a possibility of change on the VCO Oscillation Constant.

Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

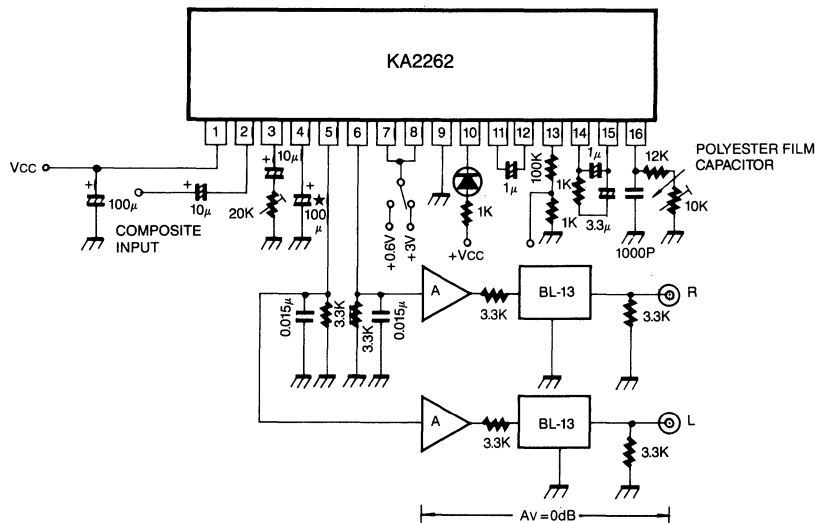
Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Lamp Current	I_L	40	mA
Power Dissipation	P_d ($T_a \leq 45^\circ\text{C}$)	520	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 10\text{V}$, $f = 1\text{KHz}$, $R_L = 3.3\text{K}\Omega$, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current		I_{CC}	$V_i = 0$		21	27	mA
Channel Separation		Sep	$V_i = 300\text{mV}$, $L+R=90\%$, $P=10\%$	40	50		dB
Total Harmonic Distortion	Mono	THD1	$V_i = 300\text{mV}$		0.05	0.2	%
	Stereo	THD2	$V_i = 300\text{mV}$, $L+R=90\%$, $P=10\%$		0.05	0.2	%
Output Voltage		V_o	$V_i = 300\text{mV}$, Sub	140	200	280	mV
Channel Balance		CB	$V_i = 300\text{mV}$		0.5	1.5	dB
Lamp on Level		V_L (on)	$L+R=90\%$, $P=10\%$	60	85	120	mV
Lamp Hysteresis		HY			3	6	dB
Maximum Input Level		V_i (max)	$L+R=90\%$, $P=10\%$, $\text{THD}=1\%$	700	800		mV
SCA Rejection Ratio		SCA Rej	$L+R=90\%$, $P=10\%$		80		dB
Signal to Noise Ratio		S/N	$V_i = 300\text{mV}$	70	78		dB
Ripple Rejection		RR			35		dB
Capture Range		CR	$P=30\text{mV}$		± 3		%
Input Impedance		R_i			20		$\text{K}\Omega$
SNC Output Attenuation		$\text{SNC}_{(ATT)}$	$V_8 = 0.6\text{V}$, $L-R=90\%$, $P=10\%$	-8.5	-3.0	-0.3	dB
SNC Output Voltage		$\text{SNC } V_o$	$V_8 = 0.1\text{V}$, $L-R=90\%$, $P=10\%$			5	mV
HCC Output Attenuation		$\text{HCC}_{(ATT) 1}$	$V_7 = 0.6\text{V}$, $L+R=90\%$, $P=10\%$	-15.0	-6.0	-0.5	dB
		$\text{HCC}_{(ATT) 2}$	$V_7 = 1\text{V}$, $L+R=90\%$, $P=10\%$	-2.0		0	dB

TEST CIRCUIT



★:100 μ F connected between pin 4 and GND is for measurement of SNC output voltage, HCC output voltage.

Fig. 2

SNC (STEREO NOISE CONTROL) AND HCC (HIGH-CUT CONTROL)

In order to ameliorate the signal to noise (S/N) ratio in the weak electric field, both SNC and HCC Terminals are installed in KA2262. When the SNC Terminal is controlled, the noise particular on the stereo reception in the weak electric field can be decreased.

By using the HCC Terminal, the FM noise at the high-frequency level can be reduced, resulting in the effective improvement of S/N ratio. (Refer to Fig. 4)

As shown in Fig. 4 the deterioration of S/N ratio is larger by approx. 21.7dB in the stereo mode than in the Monaural mode, as far as the weak electric field is concerned.

In general, the noise is considerably harsh (offensive) to the ear if the S/N ratio is lower than 30 ~ 40dB. So, the Areas "A", "B" and "C" have, in this study, been prepared, as shown in Fig. 4, according to the intensity of electric field on a provisional criteria of 30 ~ 40dB (S/N ratio).

The procedures of setting SNC and HCC are described below on the presumption of SNC operation in Area "A" and of HCC operation in Area "B".

Regarding the Area "C", a light level of muting is made at the IF stage.

1. SNC (Stereo Noise Control)

The S/N ratio of stereo reception is worse by 21.7dB in comparison with the monaural reception. However, such S/N ratio can be ameliorated if the separation of stereo reception is changed. The effect of S/N-ratio amelioration can become significant when the separation is less than approx. 20dB. The relationships between this separation and the degree of S/N improvement are shown in Fig. 5.

Under the SNC utilized in KA2262, the S/N ratio improvement is accomplished in the weak electric field by the alteration of separation mentioned above. In details, the separation of stereo reception is controlled by changing the demodulation level of this sub-signal.

If the level output of signal meter in IF stage is utilized as the source of control signal, the S/N ratio can be made lower than approx. 40dB in the Area "A" shown in Fig. 4.

In the case of an idealistic S/N-ratio improvement, a gradual conversion should be made from stereo mode to monaural mode so that the S/N ratio may be constant from the point of stereo S/N ratio, 40dB, to that of monaural S/N ratio, 40dB. The procedures of setting control level will be described later.

In Fig. 6, are shown the relationships between the voltage applied to Pin 8 (SNC Terminal) of KA2262 and the characteristics of separation (SNC characteristics).

Since Pin 8 is positioned at the base of common-collector PNP transistor, the unit is set in the stereo mode if Pin 8 is open. In contrast, it is set in the monaural mode when Pin 8 is grounded.

The control through the use of SNC Terminal is available only when the stereo indicator lights on by the locking to the pilot signal.

Since the SNC control current is less large, the constant of outer circuit can be set at a large amount, resulting in no influence on the meter output circuit of IF stage. Thus, the designing work of this circuit can easily be made.

2. Design of Outer Circuit for SNC Characteristics (Setting Characteristics through Drawing)

The SNC characteristics can be set in order to change the separation smoothly from stereo mode to monaural mode in Area A shown in Fig. 4. The following procedures are preferable for such a setting.

Relationships between separation and improvement of S/N ratio Fig. 5
Relationships between voltage applied to SNC terminal and separation characteristics Fig. 6

If both the "graph" showing the relationships between signal meter output (in IF stage) and antenna input and the "graph" which shows the relationships between antenna input and S/N ratio improvement characteristics are obtained by using Figs. 5 and 6, the relationships between antenna input and S/N ratio improvement characteristics can be obtained through the preparation of drawing.

Also, the characteristics of SNC-terminal application voltage can adversely be obtained from the S/N characteristics which is desirable for the user.

An example of drawing preparation is shown in Fig. 8. In order to simplify the recognition, all of "SNC characteristics", "IF meter characteristics" and "stereo S/N-ratio characteristics" are similarized each other with straight lines.

The example of preparation is as follows:

The stereo S/N-ratio improvement characteristics are obtained from the SNC characteristics. In the chart diagram, (a) of the 2nd sector is a base SNC characteristics. Through the projection to the 3rd sector from (a), the separation is 20dB at Point "1" while the level of S/N-ratio improvement is 1dB there at.

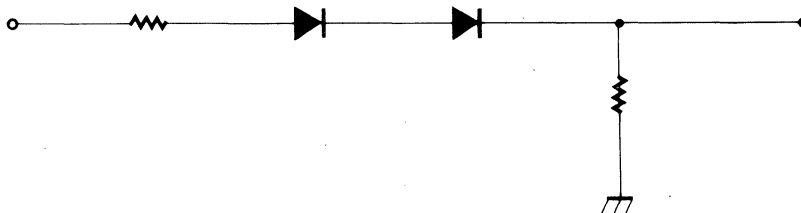
When projection is made from the 1st sector to the 4th sector, the point where S/N ratio is improved by 1dB from the line of stereo S/N ratio in the 4th sector corresponds with Point 1.

Similarly, Point 2 on SNC characteristics in the 2nd sector corresponds with Point 2 in the 4th sector as well as Point 3 in the 2nd sector with Point 3 in the 4th sector. Thus, the individual S/N-ratio improvement characteristics can be obtained.

Similarly to the above, the characteristics (b) of 2nd sector is projected like Characteristics (b) of 4th sector, while the Characteristics (c) of 2nd sector is projected like Characteristics (c) of 4th sector. Thus, the drawing of improvement characteristics can be prepared.

As a result of preparation of drawing, the S/N-ratio improvement characteristics of Fig. (b) in the 4th sector is idealistic. However, the SNC characteristics corresponding therewith becomes the characteristics shown with Fig. (b) of 2nd sector. It is difficult to realize such characteristics.

From the viewpoint of practical characteristics, the one like Fig. (c) seems to be appropriate. The SNC characteristics shown in Fig. (c) are obtained by the use of both the shifting operation made by 2 diodes and 1/2 bleeder.



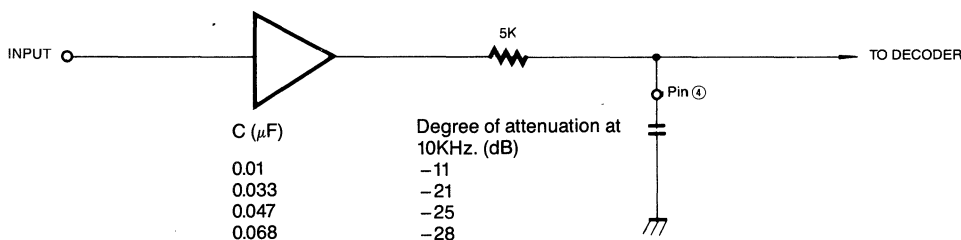
3. HCC (High-Cut Control)

In Area B where the S/N ratio is lower than 40dB even in the monaural mode, the S/N ratio can be improved from the acoustic standpoint if the level of high frequency (at about 7 KHz) is lowered.

When the signal meter output voltage of IF stage is given to the HCC Terminal (Pin 7) of KA2262, a smooth high-level attenuation (high-cut control) can be made according to the meter's voltage.

In Fig. 9, are shown the frequency characteristics (monaural) of MPX output caused from the voltage applied to Pin 7. The frequency characteristics obtained when 100% high cut is made can freely be set by the 4-pin outer capacitor.

The equivalent circuit at this stage is determined by the time constant of "5K Ω " and "C", as shown in the following diagram. By the approx. amount by C, the degree of attenuation at 10KHz. is as follows:



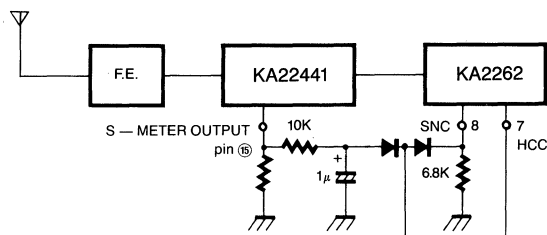
The relationships (HCC characteristics) between Pin 7 applied voltage and high-cut rate (%) are shown in Fig. 10. When the characteristics of IF meter output voltage and the S/N-ratio characteristics of Area B (shown in Fig. 4) are obtained in addition to Fig. 10, the characteristics of S/N-ratio improvement which is implemented by HCC can be drawn.

The output of meter of IF amplifier IC used for quadrature detection is usually the one shown in Fig. 4. (Fig. 3 shows the data of KA22441). Thus, the HCC characteristics (Fig. 10) are set so that the Area B may be ameliorated when the output mentioned above is directly connected with the HCC Terminal (Pin 7) of KA2262.

Being very small similarly to the control current of Pin 8, such control current of Pin 7 gives no influence to the output of meter.

4. SNC/HCC Connection Circuit when they are connected with IF Stage

In Fig. 3, is shown an example of S/N-ratio characteristics caused from the antenna input when SNC and HCC are connected with the IF stage through the outer circuit shown below.



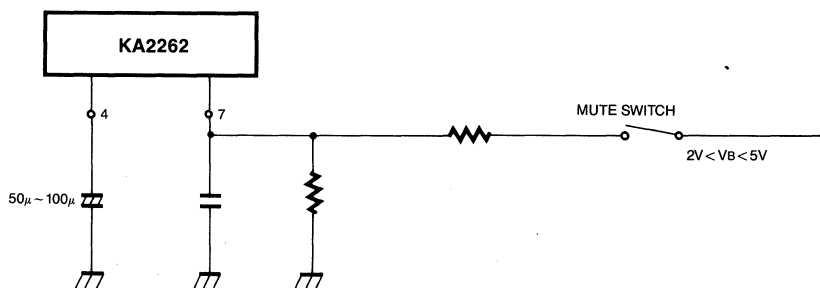
5. Improvement of S/N Ratio in Area C shown in Fig. 3

In Area C shown in Fig. 3, the S/N ratio is further worsened. Its improvement should be performed by the IF muting. The KA22441 can be enumerated as an IC which can vary this IF muting linearly. The S/N-ratio improvement effect of KA2262 can further be enhanced if KA2262 is used together with KA22441.

6. Use of HCC Terminal for the Muting Function

In the event that the removal of high-frequency noise is not required when HCC Terminal is used for a home-enjoyed stereo unit, etc., the muting can be accomplished by approx. 37dB if this HCC function is utilized for the muting function.

If the time constant is applied on the control of Pin 7, the "Fade In" and "Fade Out" operations can be performed on the muting. The muting can be performed without offensiveness to the ear as alien factors such as shock noise, etc. are removed thereby.



7. Stop Method of VCO

When a voltage higher than 7V is applied to the HCC Terminal (Pin 7), the oscillation of VCO can be discontinued, resulting in the Monaural Mode. At this stage, both SNC and HCC are in the OFF status.

The relationships between the incoming current and Pin 7 applied voltage are shown in Fig. 11.

8. Separation Control Terminal

The control of separation is implemented by controlling the level of main signal.

The range of separation of the controllable input compost signal (Sub-signal/main signal ratio) is approx. the one shown in the following formula.

$$m = \frac{\text{Sub signal level}}{\text{Main signal level}} \quad 0.7 < m < 1.25 \quad (\text{At peak level})$$

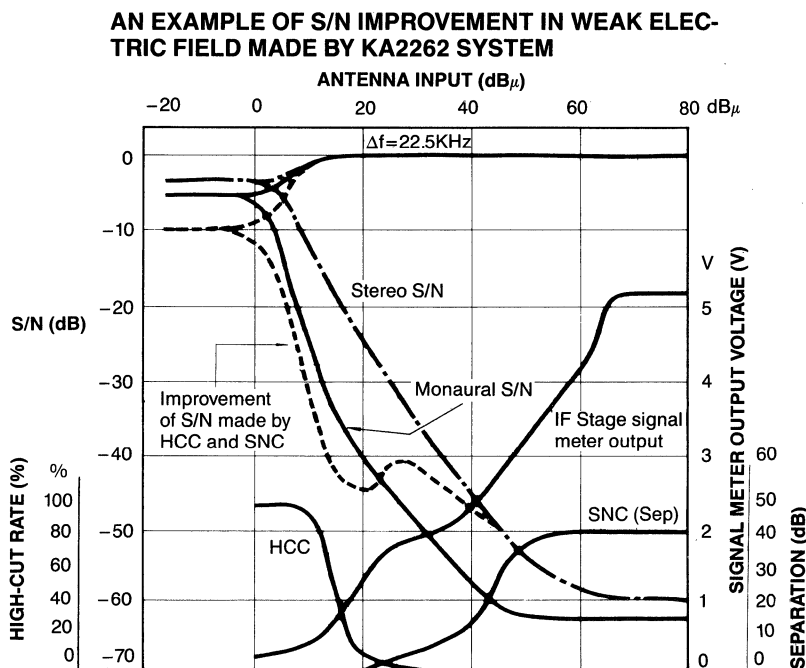


Fig. 3

CHART DIAGRAM USED FOR OBTAINING STEREO CHARACTERISTICS FROM SNC CHARACTERISTICS

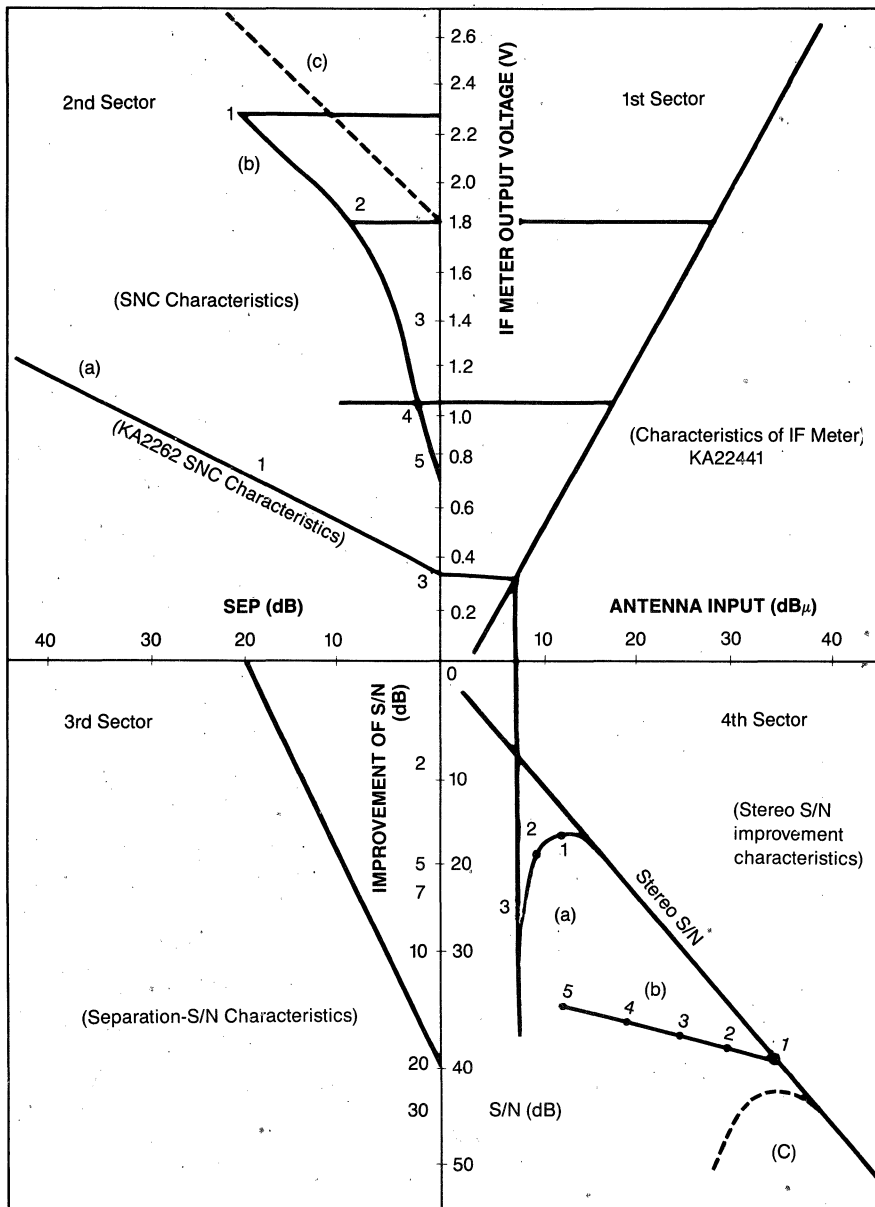
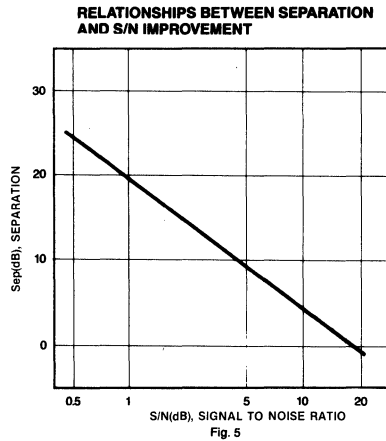
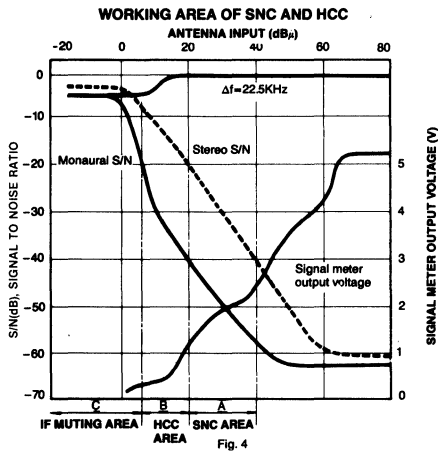


Fig. 8



SNC CHARACTERISTICS (SUB-LEVEL) KA2262 SNC CHARACTERISTICS SNC CHARACTERISTICS (SEPARATION)

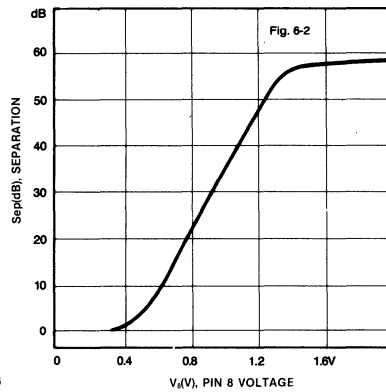
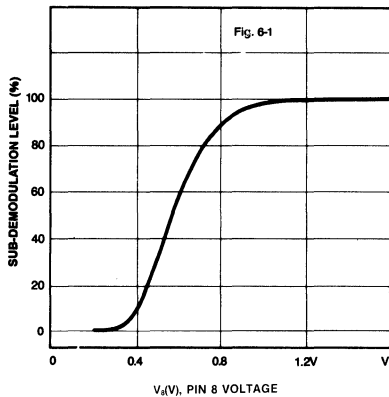
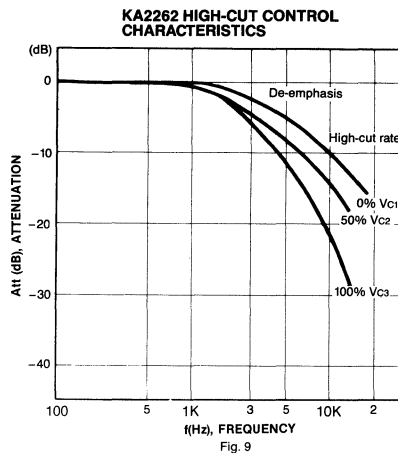
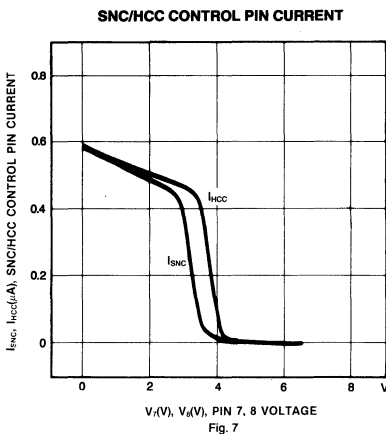


Fig. 6



KA2262 HCC CHARACTERISTICS

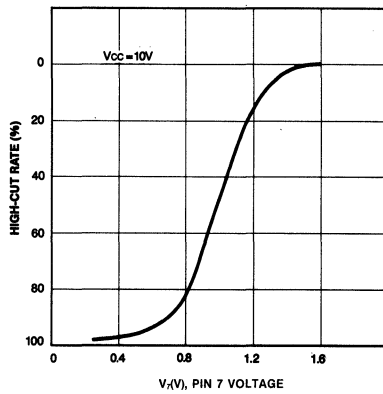


Fig. 10

CHARACTERISTICS OF CURRENT AT VCO STOP FUNCTION CONTROL TERMINAL

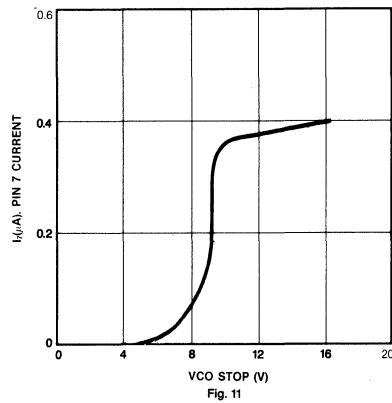


Fig. 11

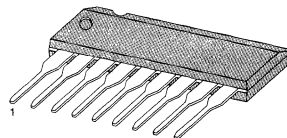
FM STEREO MULTIPLEX DECODER

The KA2263 is a monolithic integrated circuit consisting of a phase locked loop FM stereo demodulator. It was designed for use in car stereo, cassette recorder and other equipment.

FEATURES

- Wide operating supply voltage range (3V ~ 12V).
- High pilot lamp ON sensitivity.
 $V_i(\text{on}) = 9\text{mV}$ (Typ).
- Built-in stereo indicator lamp drive circuit.
Maximum lamp current: 20mA (continuous).
- High channel separation: Sep=45dB (Typ).
- Low distortion
THD=0.08% (Typ) at $V_i = 200\text{mV}$.
- VCO stop and stereo lamp turn off are simultaneously operated by connected pin 7 to V_{CC} .
- Minimum number of external parts required.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2263	9 SIP	- 20 ~ + 70°C
KA2263G	PELLET	

TYPICAL APPLICATION CIRCUIT

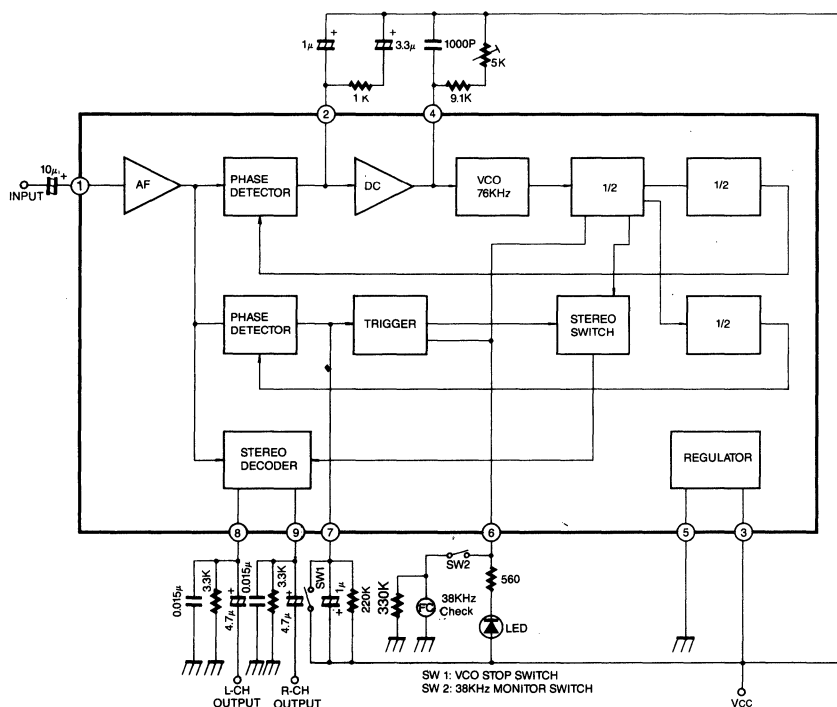


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	12	V
Lamp Voltage	V_{LAMP}	16	V
Lamp Current	I_L	20	mA
(continuous)			
I_L (peak)		40	mA
Power Dissipation	P_d	500*	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

*Deredated above $T_a=25^\circ\text{C}$ in the proportion of $4\text{mW}/^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a=25^\circ\text{C}$, $V_{CC}=8\text{V}$, $f=1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i=0$		11	18	mA
Input Impedance	R_i			33		$\text{K}\Omega$
Maximum Input Level	V_i (max)	$L+R=90\%$, $P=10\%$, THD=1%		550		mV
Channel Separation	Sep	$L+R=180\text{mV}$ $P=20\text{mV}$	36	45		dB
Total Harmonic Distortion	Mono	THD 1	$V_i=200\text{mV}$	0.08	0.3	%
	Stereo	THD 2	$L+R=180\text{mV}$ $P=20\text{mV}$	0.08		%
Voltage Gain	A_v	$V_i=200\text{mV}$	-2.0	0	+2.0	dB
Channel Balance	C B	$V_i=200\text{mV}$		0	1.5	dB
Lamp ON Level	V_L (on)	Pilot only		9	15	mV
Lamp OFF Level	V_L (off)	Pilot only	2	6		mV
Lamp Hysteresis	HY			3		mV
Carrier Leak	19KHz	$L+R=180\text{mV}$ $P=20\text{mV}$		34		dB
	38KHz			42		dB

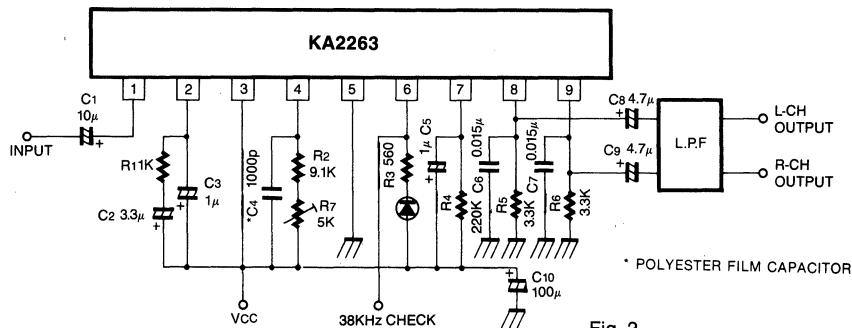
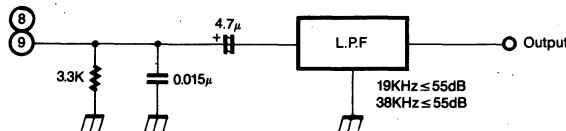
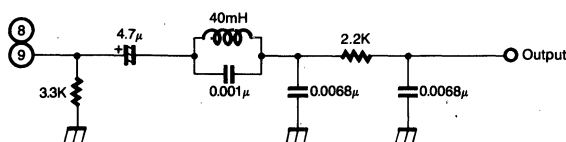


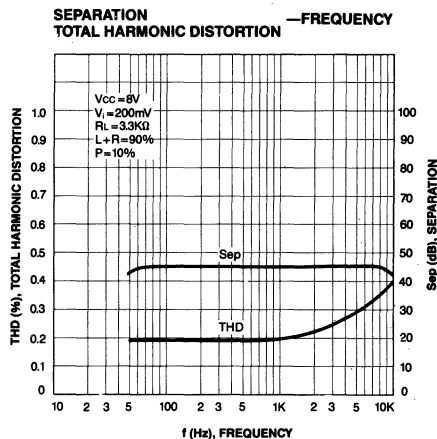
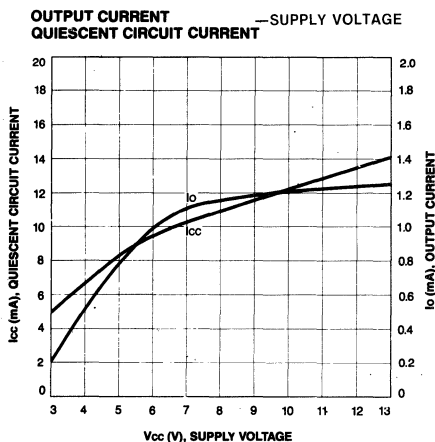
Fig. 2

External Components (Refer to test circuit)

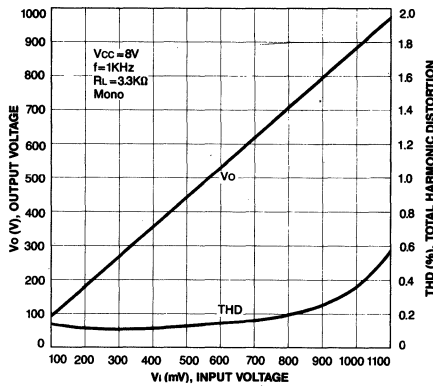
1. Input coupling capacitor (C_1)
The recommended value is $10\mu\text{F}$. If smaller values than $10\mu\text{F}$ are used low frequency separation will worsen, and if larger values are used pop noise occurred high.
2. Low pass filter (C_2, C_3, R_1)
This is the low pass filter for the PLL, which is determined the capture range and THD at low frequency.
3. VCO network (C_4, R_2, R_7)
The VCO free running frequency is adjusted by connecting a frequency counter to monitor the 38KHz output pin 6.
4. Decoder output (Pin 8, 9)
These components provide R and L channel output load circuits. The recommended circuits are follow.



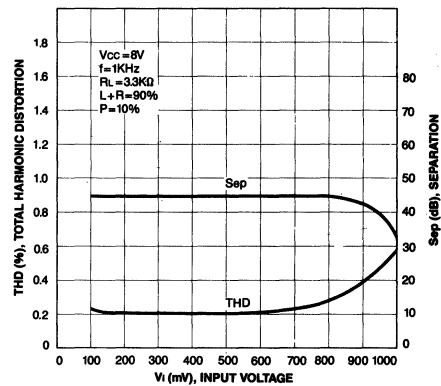
5. Lamp sensitivity control (R_4)
Lamp on level can be controlled by this resistor.



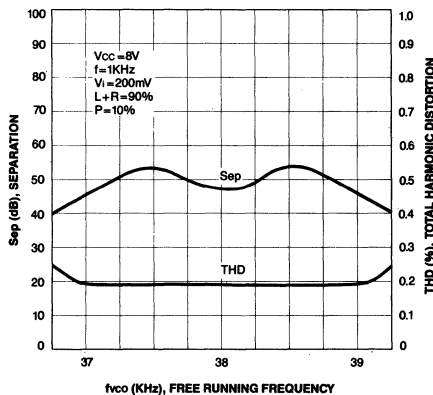
OUTPUT VOLTAGE
TOTAL HARMONIC DISTORTION — INPUT VOLTAGE



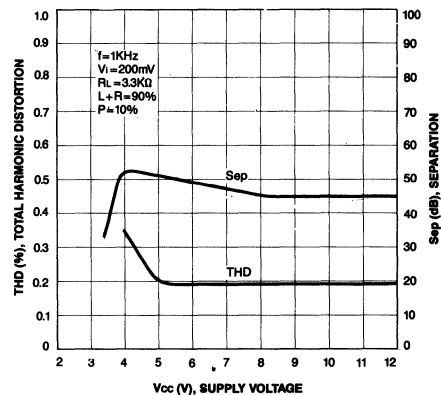
SEPARATION
TOTAL HARMONIC DISTORTION — INPUT VOLTAGE



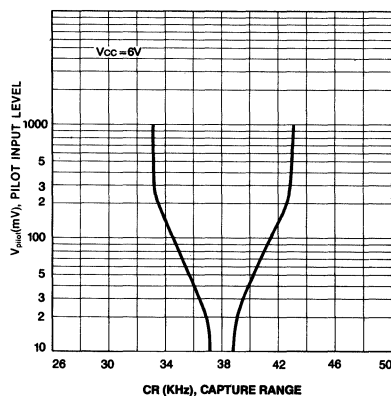
SEPARATION
TOTAL HARMONIC DISTORTION
— FREE RUNNING FREQUENCY



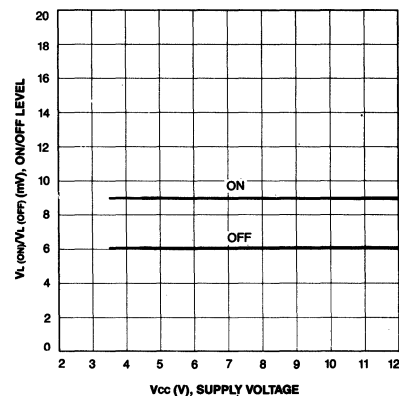
SEPARATION
TOTAL HARMONIC DISTORTION — SUPPLY VOLTAGE



CAPTURE RANGE



LAMP ON/OFF LEVEL—SUPPLY VOLTAGE



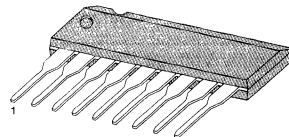
FM STEREO MULTIPLEX DECODER

The KA2264 is a monolithic integrated circuit consisting of a phase locked loop FM stereo demodulator. It is designed for use in 3V radio cassette recorder.

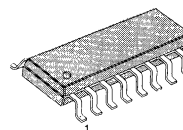
FEATURES

- Low voltage operation: $V_{CC}=1.8V \sim 5V$.
- Excellent space-factor: 9 SIP/16 SOP.
- Minimum number of external parts required.
- Easy monitoring of VCO free running frequency is available at pin 6.
- High pilot sensitivity: $V_L (on)=9mV$ (Typ).
- Lamp drive current: max lamp current=8mA.
- VCO stop and stereo lamp turn-off are simultaneously operated by connecting pin 7 to V_{CC} .

9 SIP



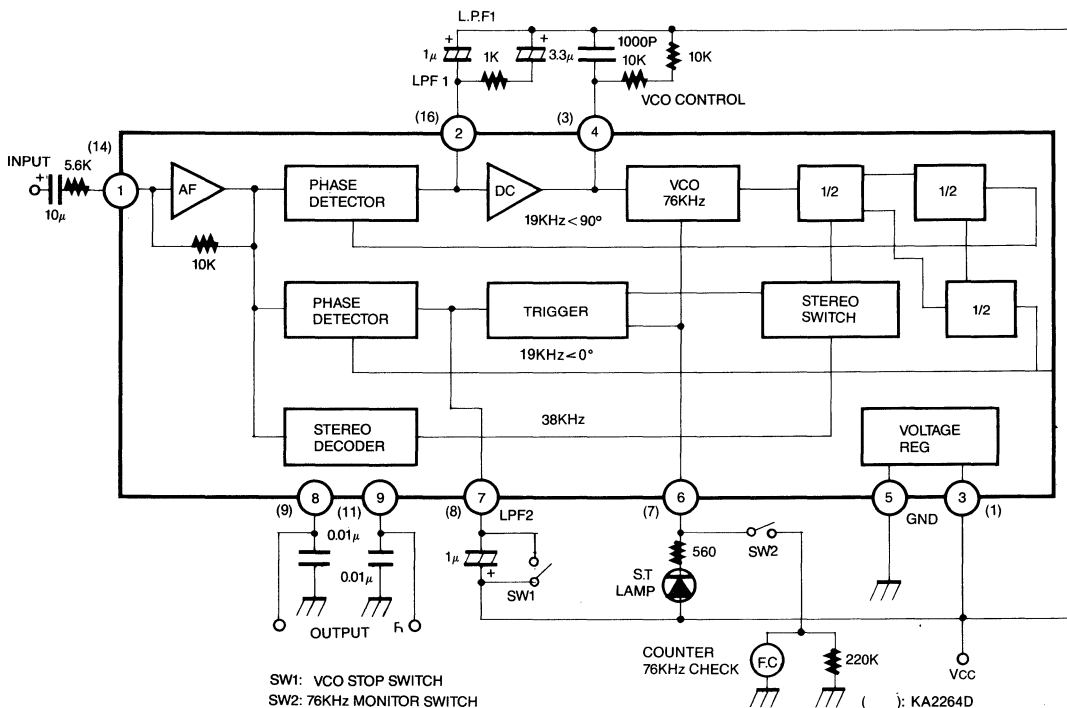
16 SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2264	9 SIP	- 20 ~ + 70°C
KA2264D	16 SOP	
KA2264G	PELLET	

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a=25^{\circ}\text{C}$)

Characteristic		Symbol	Value	Unit
Supply Voltage Lamp Voltage Lamp Current		V_{CC}	6	V
		V_{LAMP}	8	V
		I_{LAMP}	8	mA
Power Dissipation	KA2264	P_d	500	mW
	KA2264D		350	
Operating Temperature		T_{opr}	$-20 \sim +70$	$^{\circ}\text{C}$
Storage Temperature		T_{stg}	$-40 \sim +125$	$^{\circ}\text{C}$

* Derated above $T_a = 25^{\circ}\text{C}$ in the proportion of $4\text{mW}/^{\circ}\text{C}$ (KA2264D: $2.8\text{mW}/^{\circ}\text{C}$)

ELECTRICAL CHARACTERISTICS

($T_a = 25^{\circ}\text{C}$, $V_{CC} = 3\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current		I_{CC}	$V_i = 0$		4.5	8.0	mA
Input Resistance		R_i			10		$\text{K}\Omega$
Output Resistance		R_o		4.0	5.0	6.0	$\text{K}\Omega$
Maximum Input Level		V_i (max) Stereo	$L+R=90\%$, $P=10\%$ $f=1\text{KHz}$, $\text{THD}=5\%$		400		mV
Channel Separation		Sep	$L+R=180\text{mV}$ $P=20\text{mV}$	$f=100\text{Hz}$	35		dB
				$f=1\text{KHz}$	30	35	
				$f=10\text{KHz}$	35		
Total Harmonic Distortion	Mono	THD 1	$V_i = 200\text{mV}$		0.4	1.0	%
	Stereo	THD 2	$L+R=180\text{mV}$, $P=20\text{mV}$		0.5		
Voltage Gain		A_v	$V_i = 200\text{mV}$	-6.5	-5.0	-3.5	dB
Channel Balance		CB	$V_i = 200\text{mV}$		0	1.5	dB
Lamp Level	ON	V_L (on)	Pilot only		9	15	mV
	OFF	V_L (off)		2	6		
Lamp Hysteresis		HY			3		mV
Capture Range		CR	$P=20\text{mV}$		± 3		%
Carrier Leak	19KHz	CL	$P=20\text{mV}$		32		dB
	38KHz		$L+R=180\text{mV}$		60		
SCA Rejection Ratio		SCA R_{ej}	$P=20\text{mV}$ $L+R=160\text{mV}$ $\text{SCA}=20\text{mV}$ $f_{\text{SCA}}=67\text{KHz}$		80		dB
Signal to Noise Ratio		S/N	$V_i=200\text{mV}$ $R_g=620\Omega$		82		dB

TEST CIRCUIT 1

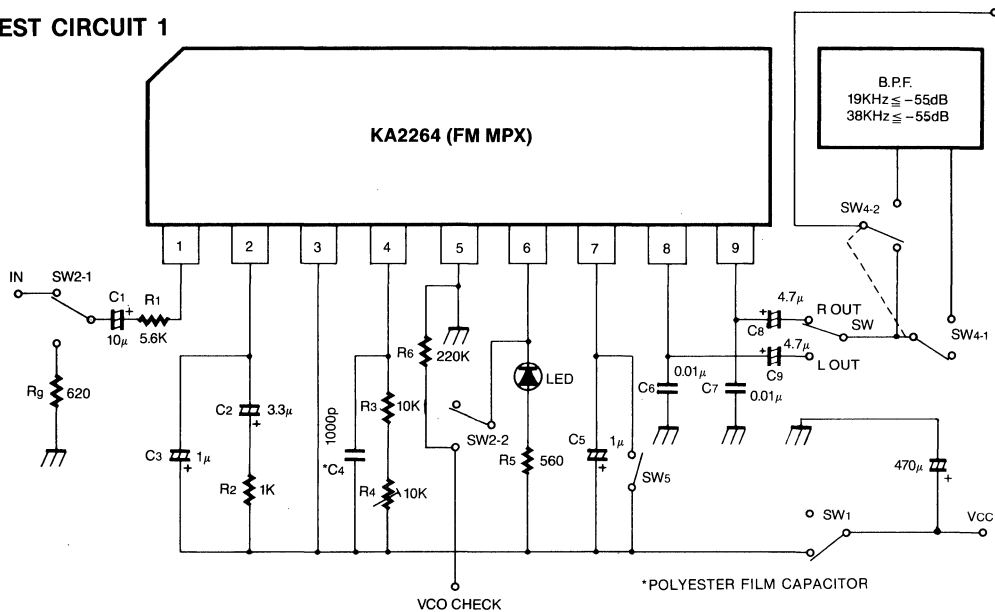


Fig. 2

TEST CIRCUIT 2

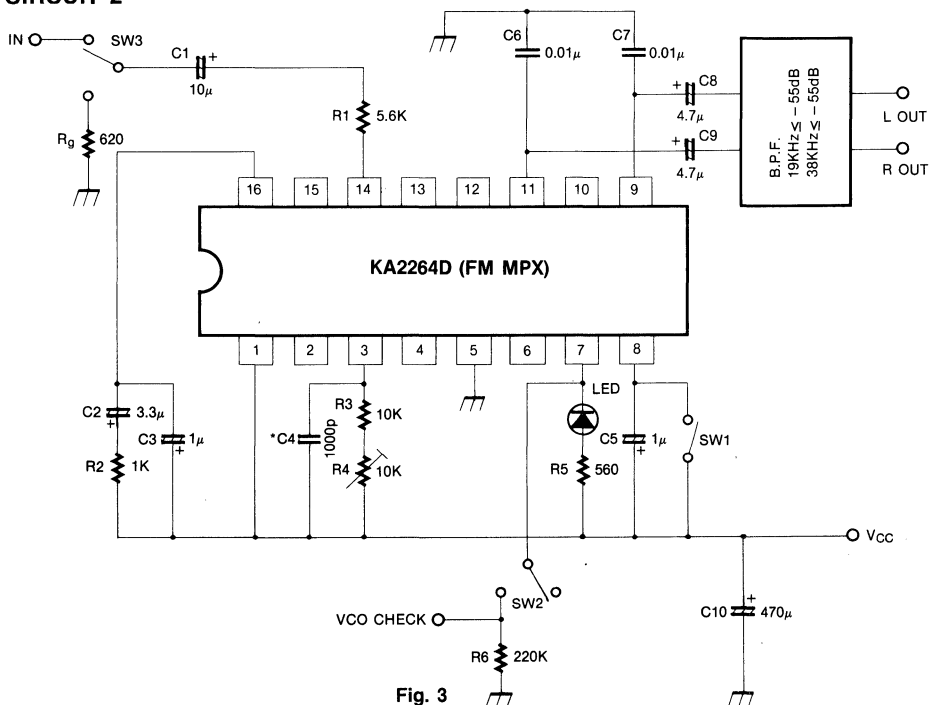
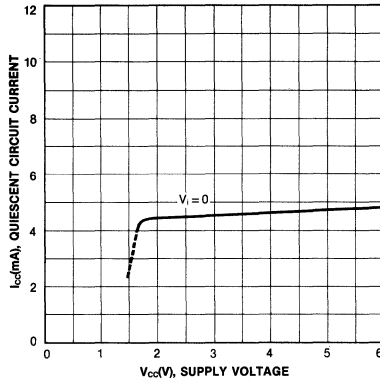
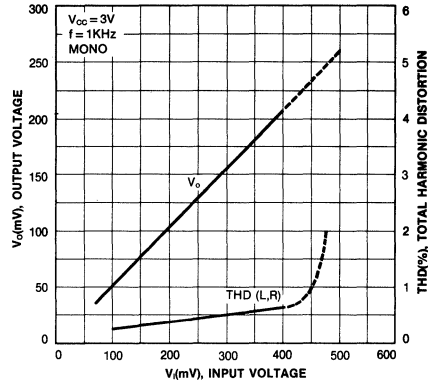


Fig. 3

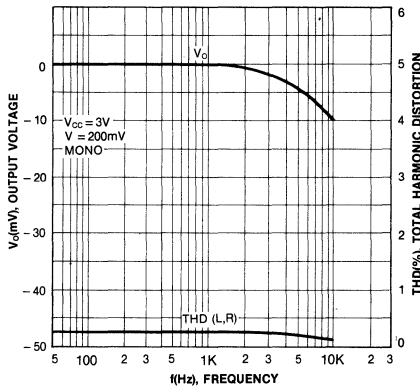
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



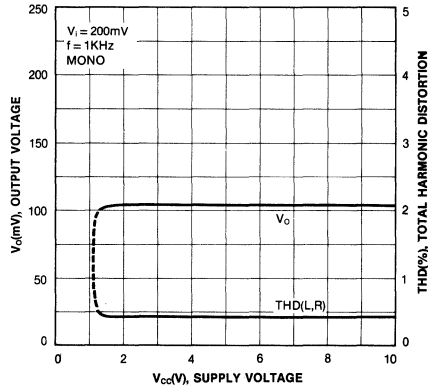
OUTPUT VOLTAGE TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



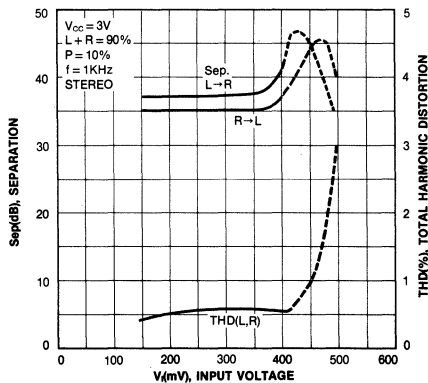
OUTPUT VOLTAGE TOTAL HARMONIC DISTORTION-FREQUENCY



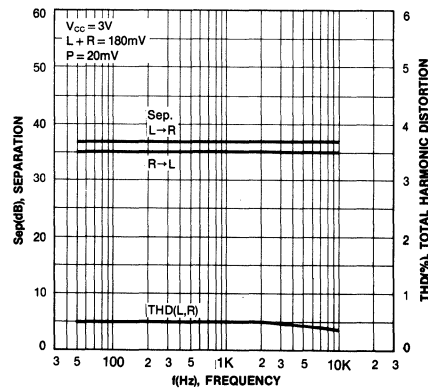
OUTPUT VOLTAGE TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE

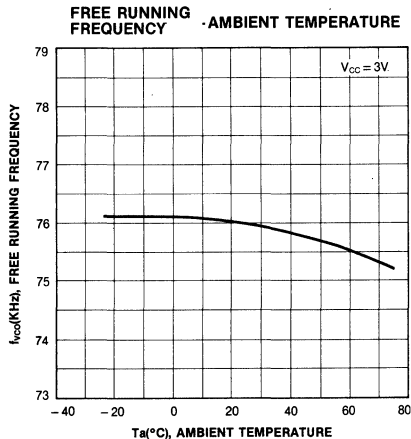
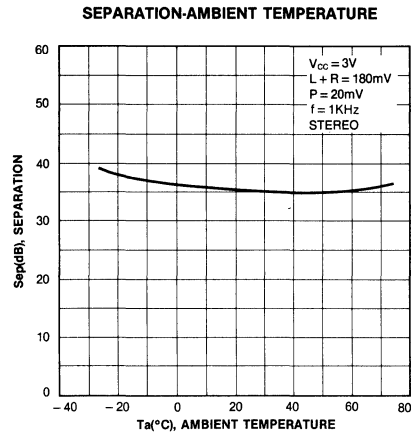
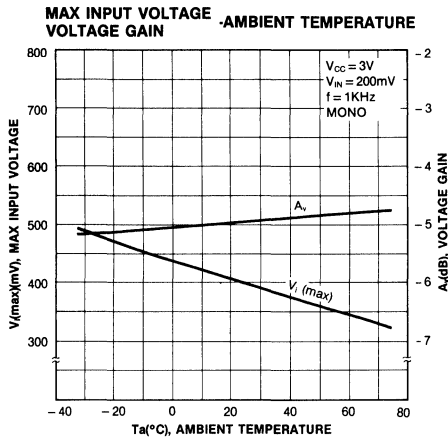


SEPARATION TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



SEPARATION TOTAL HARMONIC DISTORTION-FREQUENCY





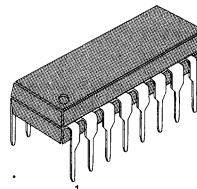
VCO NON-ADJUSTING FM STEREO MULTIPLEX DECODER

The KA2265 is a monolithic integrated circuit consisting of a VCO non-adjusting FM stereo demodulator with a phase locked loop. It is designed for use in home stereo, portable Hi-Fi.

FEATURES

- Non-adjusting VCO: non-adjusting of free-running frequency.
- Excellent temperature characteristics of VCO: $\pm 0.1\%$ (Typ) at $\pm 50^\circ\text{C}$.
- Excellent stereo high frequency distortion. ($f=10\text{KHz}$: 0.06% (Typ)).
- Excellent distortion: $f=1\text{KHz}$, $V_i=300\text{mV}$, mono: 0.025% (Typ).
stereo: 0.02% (Typ).
- High S/N: 91dB (Typ) (mono $V_i=300\text{mV}$, LPF).
 92dB (Typ) (mono $V_i=300\text{mV}$, IHF BPF).
- High gain: about 8.5dB .
- Wide dynamic range: mono 800mV ($f=1\text{KHz}$, $\text{THD}=1\%$)
- Good ripple rejection: 34dB (Typ).
- Operating voltage range: $V_{CC}=6.5\text{V} \sim 14\text{V}$

16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2265	16 DIP	$-20 \sim +70^\circ\text{C}$

BLOCK DIAGRAM

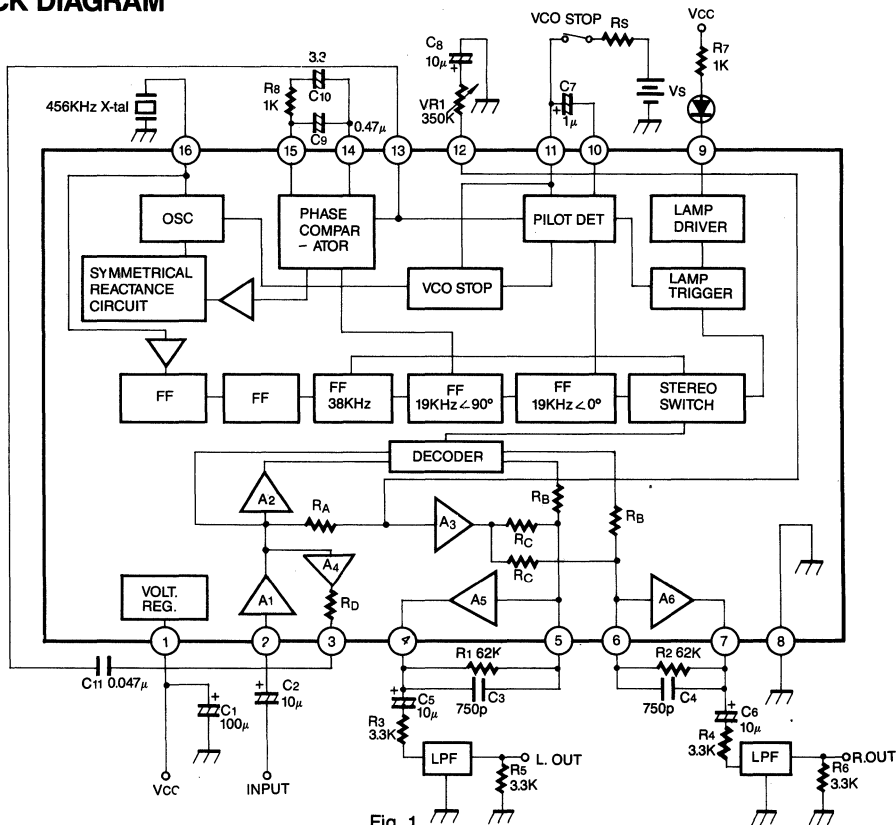


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

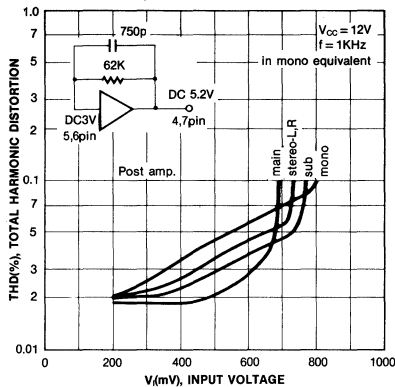
Characteristic	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	16	V
Lamp Current	I_L	30	mA
Power Dissipation	P_d	480	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

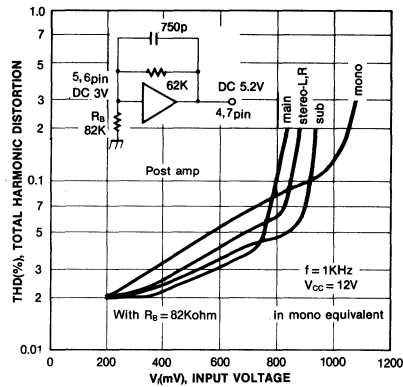
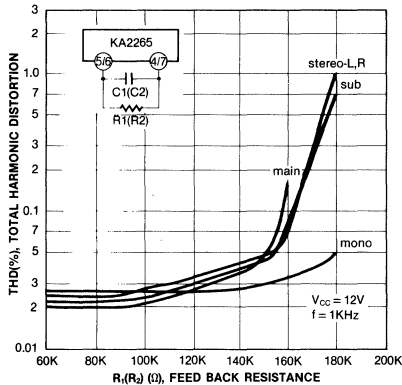
($V_{CC} = 12\text{V}$, $f = 1\text{KHz}$, $T_a = 25^\circ\text{C}$, unless otherwise specified)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current		I_{CC}	$V_i = 0$		18.5	28	mA
Channel Separation		Sep	$P = 30\text{mV}$, $L + R = 270\text{mV}$	$f = 100\text{Hz}$	45		dB
				$f = 1\text{KHz}$	40	55	
				$f = 10\text{KHz}$	42		
Total Harmonic Distortion	Stereo	THD 1	$P = 30\text{mV}$, $L + R = 270\text{mV}$	$f = 100\text{Hz}$	0.025	0.15	%
				$f = 1\text{KHz}$	0.02		
				$f = 10\text{KHz}$	0.06	0.15	
	Mono	THD 2	$V_i = 300\text{mV}$		0.025	0.15	
Output Voltage		V_o	$V_i = 300\text{mV}$	500	730	1000	mV
Channel Balance		CB	$V_i = 300\text{mV}$		0	1	dB
Lamp ON Level		V_L (on)	Pilot Level	4	8	17	mV
Lamp Hysteresis		HY			3		dB
Capture Range		CR	$P = 30\text{mV}$		+0.8 -1.2		%
Signal to Noise Ratio		S/N	$V_i = 300\text{mV}$ $R_g = 5.1\text{K}\Omega$	80	91		dB
Input Impedance		R			20		$\text{K}\Omega$
Maximum Input Level		V_i (max)	Mono, THD=1%	700	800		mV
Carrier Leak		CL	$P = 30\text{mV}$, $L + R = 270\text{mV}$		31		dB
VCO Stop Voltage		$V_{CO\text{stop}}$		5.5		$V_{CC} - 3$	V
Ripple Rejection		RR			34		dB

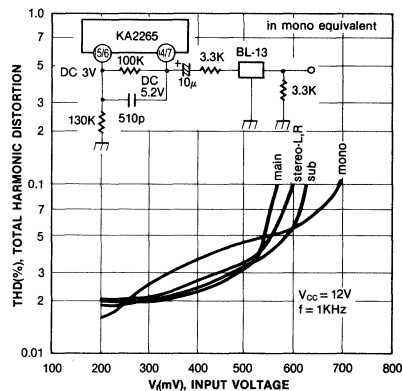
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



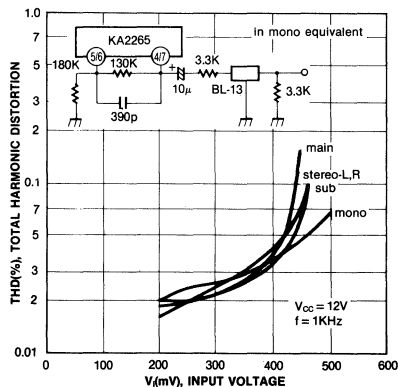
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE

TOTAL HARMONIC DISTORTION - FEED BACK RESISTANCE $R_1(R_2)$ 

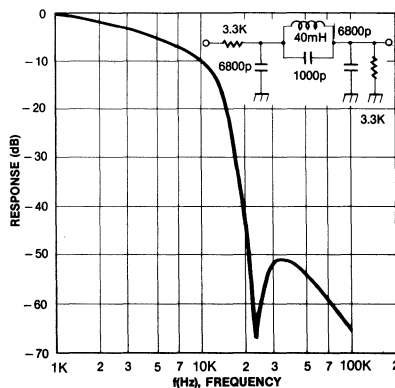
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



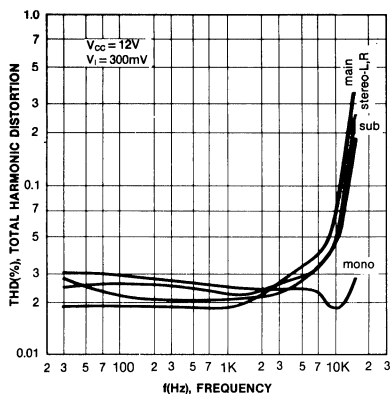
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



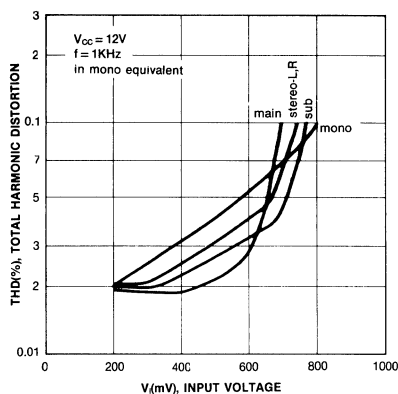
FREQUENCY RESPONSE (INCLUDING DE-EMPHASIS)



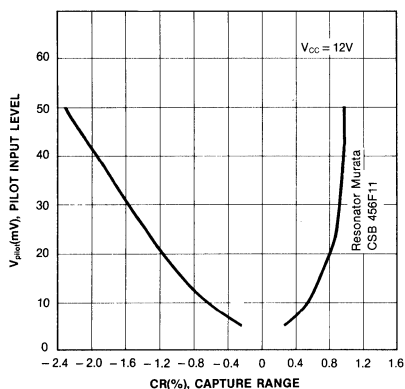
TOTAL HARMONIC DISTORTION-FREQUENCY



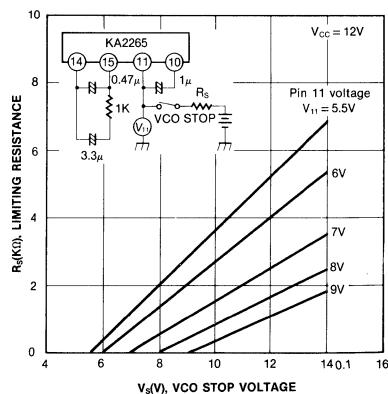
TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



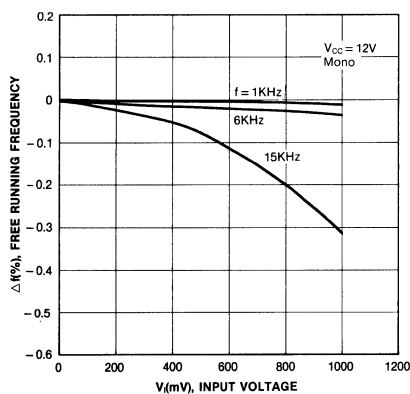
CAPTURE RANGE



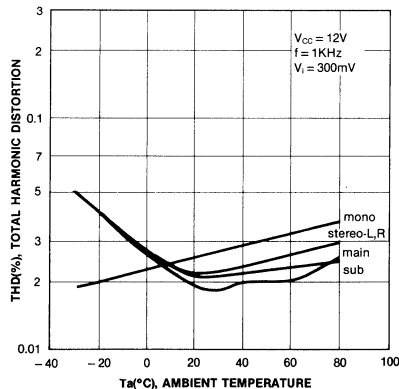
LIMITING RESISTANCE-VCO STOP VOLTAGE



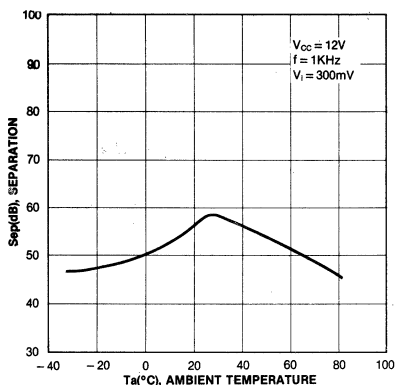
FREE RUNNING FREQUENCY-INPUT VOLTAGE



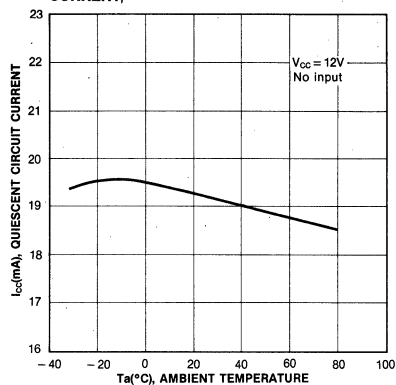
TOTAL HARMONIC DISTORTION-AMBIENT TEMPERATURE



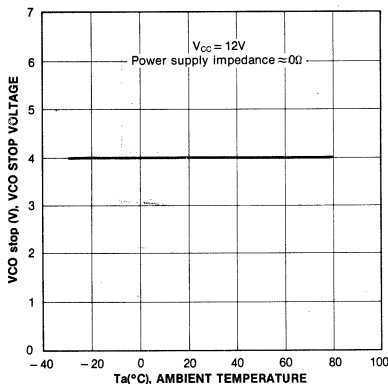
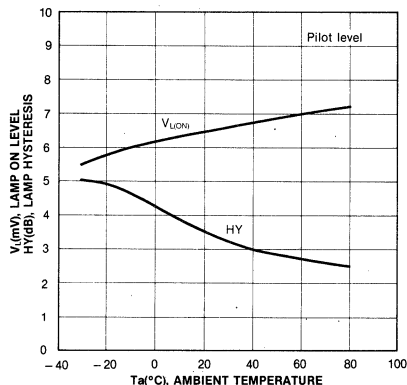
SEPARATION-AMBIENT TEMPERATURE



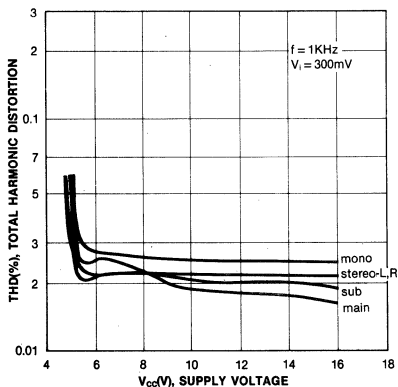
QUIESCENT CIRCUIT CURRENT-AMBIENT TEMPERATURE



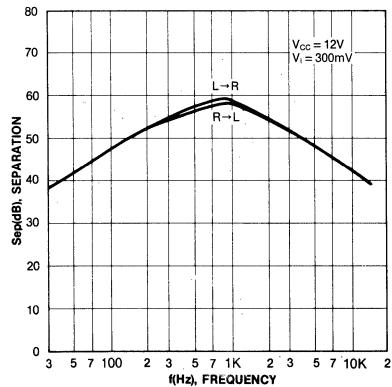
VCO STOP VOLTAGE-AMBIENT TEMPERATURE

LAMP ON LEVEL-AMBIENT TEMPERATURE
LAMP HYSTERESIS

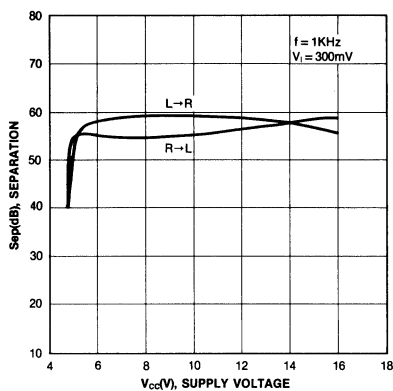
TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE



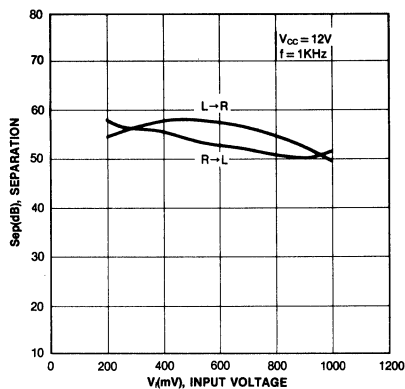
SEPARATION-FREQUENCY



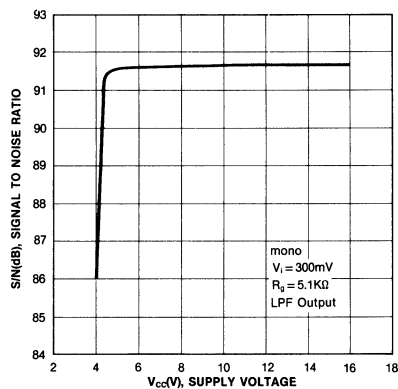
SEPARATION-SUPPLY VOLTAGE



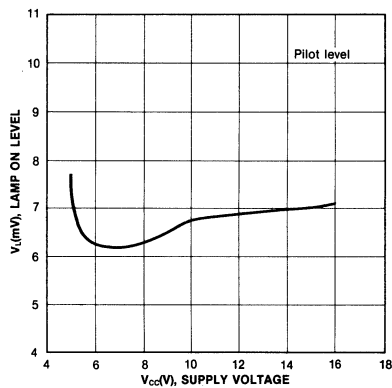
SEPARATION-INPUT VOLTAGE



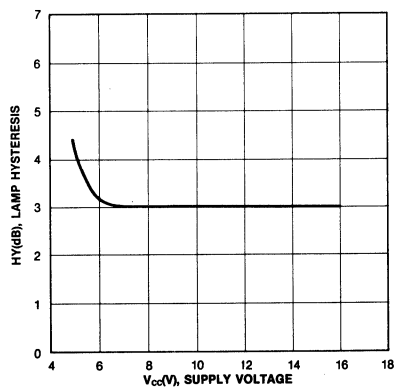
SIGNAL TO NOISE RATIO-SUPPLY VOLTAGE



LAMP ON LEVEL-SUPPLY VOLTAGE



LAMP HYSTERESIS-SUPPLY VOLTAGE



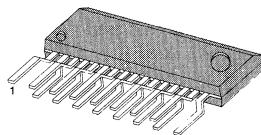
MPX FOR CAR STEREO

The KA2266 is a monolithic integrated circuit consisting of a phase locked loop FM stereo demodulator with pilot canceller. It is designed for use in car stereo.

FEATURES

- Built-in pilot-cancelling circuit
- Stereo noise controlling (SNC)
- High-cut controlling (HCC)
- With separation control terminal
- Stereo-monaural automatic conversion
- Stopping of VCO oscillation
- Power supply ripple rejection: 35dB typ.
- Low distortion: THD = 0.05% typ. at $V_i = 300\text{mV}$, mono.
- Wide operating voltage range: $V_{CC} = 6.5\text{V} \sim 14\text{V}$

16 ZIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2266	16 ZIP	-20 ~ +70°C

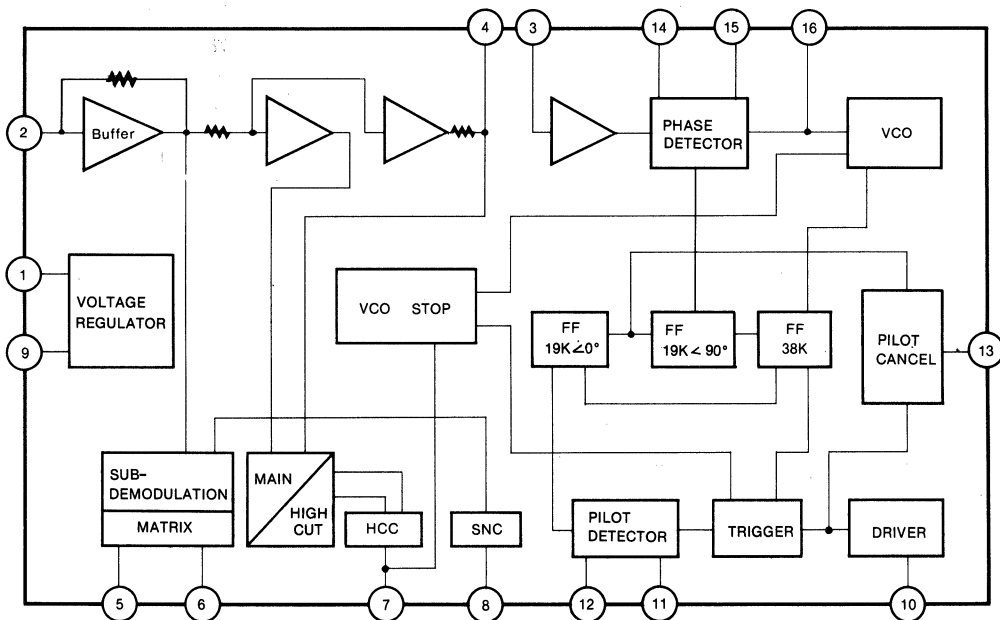


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	16	V
Lamp Driving Current (Ta ≤ 45°C)	I _L	40	mA
Power Dissipation	P _d	520	mW
Operating Temperature	T _{opr}	- 20 ~ + 70	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 10V, f = 1KHz, V_i = 300mV, L + R = 90%, pilot = 10%, R_g = 20KΩ, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current	I _{CC}	V _i = 0		22	28	mA
Channel Separation	Sep		40	50		dB
Total Harmonic Distortion	Mono	THD ₁ V _i = 300mV		0.05	0.2	%
	Stereo	THD ₂ Main		0.05	0.2	%
Lamp on Level	V _L (on)	L + R = 90%, P = 10%	60	85	120	mV
Hysteresis	HY			3	6	dB
Capture Range	CR	P = 30mV		± 3		%
Output Signal Level	V _O	Sub	150	215	300	mV
S/N Ratio	S/N	R _g = 20KΩ	68	74		dB
		R _g = 10KΩ	70	78		dB
Input Resistance (Pin 3)	R _i			20		KΩ
SCA Rejection Ratio	SCA _{Rej}			80		dB
Maximum Input Level	V _i (max)	THD = 1%, R _g = 20KΩ	700	900		mV
		THD = 1%, R _g = 10KΩ		450		mV
SNC Output Attenuation	SNC _(ATT)	V ₈ = 0.6V, L - R = 90% P = 10%	- 8.5	- 3.0	- 0.3	dB
SNC Output Voltage	SNC V _O	V ₈ = 0.1V, L - R = 90% P = 10%			5	mV
HCC Output Attenuation	HCC _{(ATT)1}	V ₇ = 1V, L + R = 90%, P = 10%	- 1.5	- 0.9	- 0.5	dB
	HCC _{(ATT)2}	V ₇ = 1V, L + R = 90%, P = 10%	- 2.0		0	dB
Ripple Rejection	RR			35		dB
VCO Stopping Voltage	VCO _{stop}			7.3		V
Channel Balance	CB			0.5	1.5	dB
Carrier Leak	CL		20	25		dB

TEST CIRCUIT

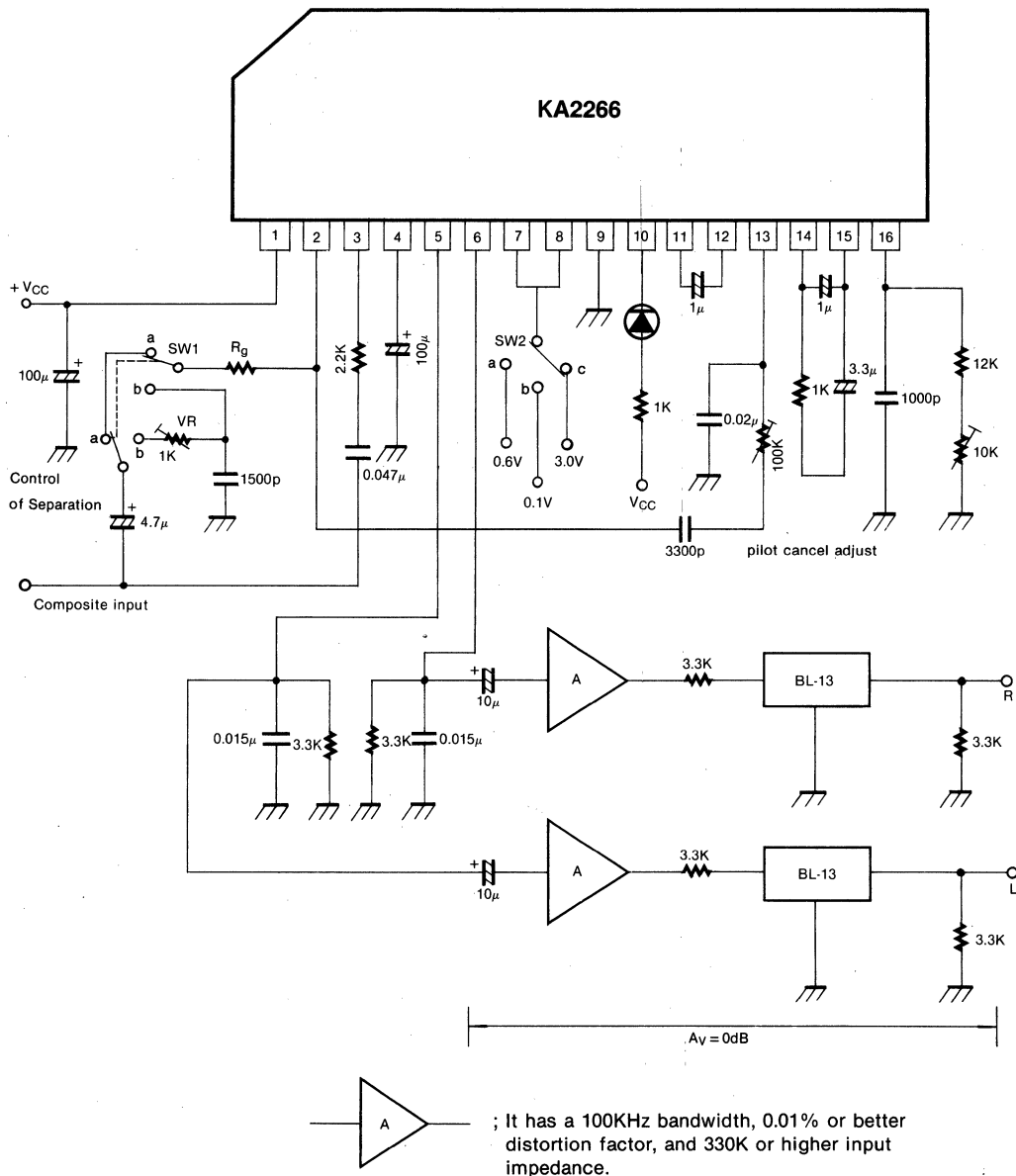


Fig. 2

APPLICATION CIRCUIT

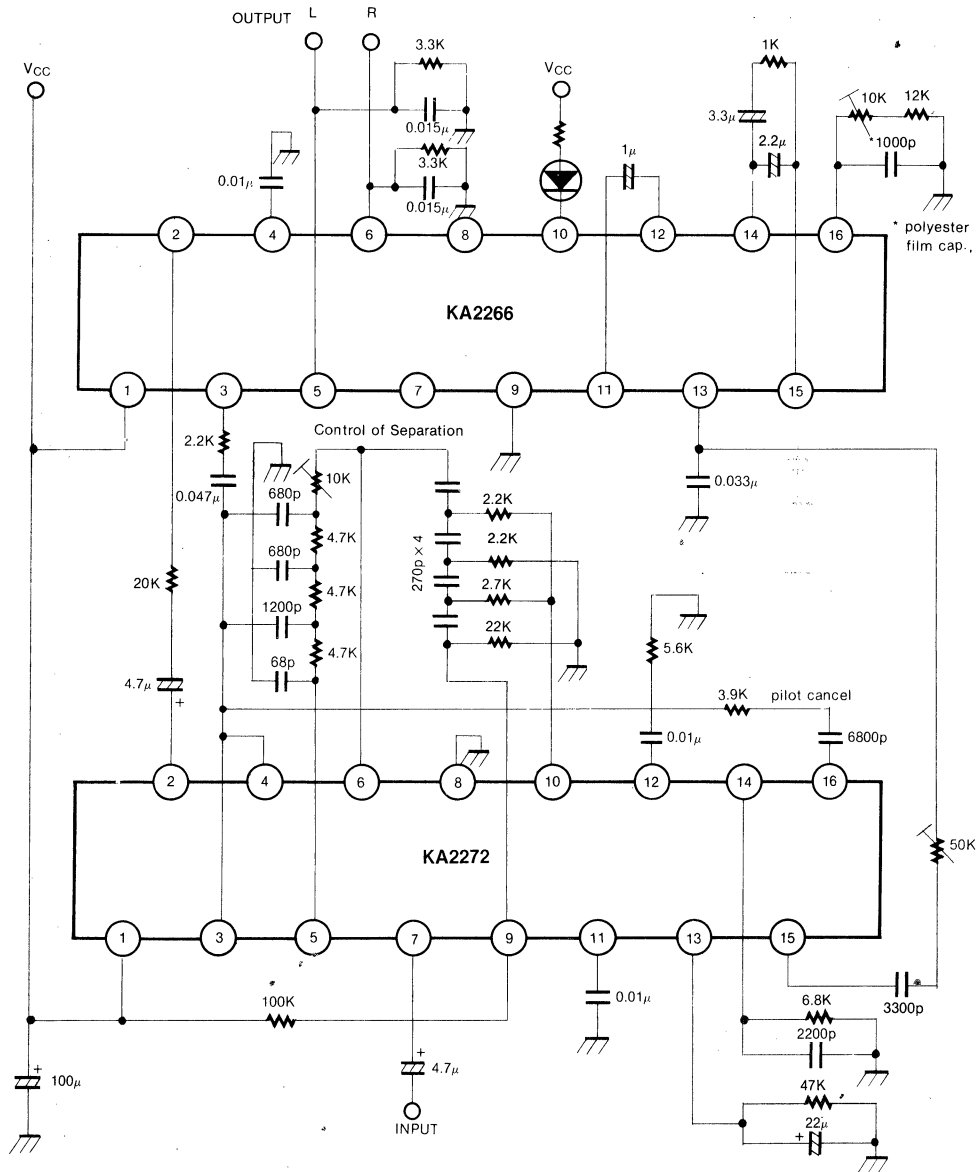


Fig. 3

FM NOISE CANCELLER

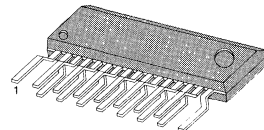
The KA2272 is a monolithic integrated circuit for FM noise canceller used in car stereo.

It is used in combination with a PLL FM multiplex demodulator (such as KA2266) with pilot signal canceller.

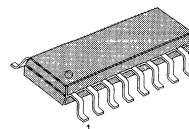
FEATURES

- Operation voltage range: 8V ~ 15V
- Low power dissipation
- Low distortion: THD = 0.02% at $V_i = 300\text{mV}$
- Pilot signal compensation
- The space factor is advantageous because of the signal-end-package.
- Built-in monostable multivibrator.
- Variable input type noise AGC system.

16 ZIP



16 SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2272	16 ZIP	- 20 ~ + 75°C
KA2272D	16 SOP	

BLOCK DIAGRAM

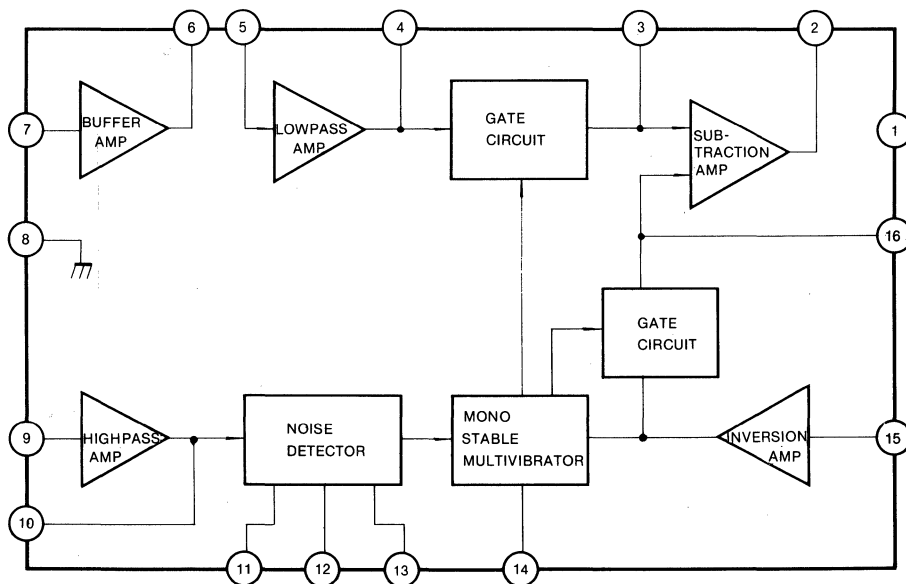


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic		Symbol	Value	Unit
Supply Voltage		V _{CC}	16	V
Power Dissipation	KA2272	P _d	450	mW
	KA2272D		300	mW
Operating Temperature		T _{opr}	- 20 ~ + 75	°C
Storage Temperature		T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{CC} = 12V, V_I = 300mV, f = 1KHz, unless otherwise specified)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
		Input Pin	Output Pin				
Circuit Current	I _{CC}				16	25	mA
Voltage Gain	A _V		Output	- 0.2	0.8	1.8	dB
Output Voltage	V _O		Output THD = 1%	1.3			V
Total Harmonic Distortion	THD		Output		0.01	0.03	%
Input Resistance	R _i			36	51	67	KΩ
Lowpass AMP Gain	A _{VL}		V ₄	0	0.83	1.58	dB
Highpass AMP Gain	A _{VH}	V ₉ = 100mV f = 200KHz	V ₁₀	1.58	2.92	4.35	dB
Inverted Amp Distortion	THD _i	V ₁₅ = 100mV f = 19KHz	Output			0.1	%
Inverted Amp Dynamic Range	Vo _i	V ₁₅ = 100mV f = 19KHz	Output THD = 1%	300			mV
Inverted Amp Gain	A _{Vi}	V ₁₅ = 100mV f = 19KHz	Output	0	2.28	4.08	dB
Output Noise Voltage	V _{NO}	Bypass V ₇ , V ₁₅ to GND, 100KHz LPF	Output, 100KHz LPF		30	60	μV
Gate Time	T _G	V ₇ = 100mV _{p-p} , 1μs,	Output	13	21	30	μsec
Noise Sensitivity	SN		Output			30	mV _{p-0}

TEST CIRCUIT

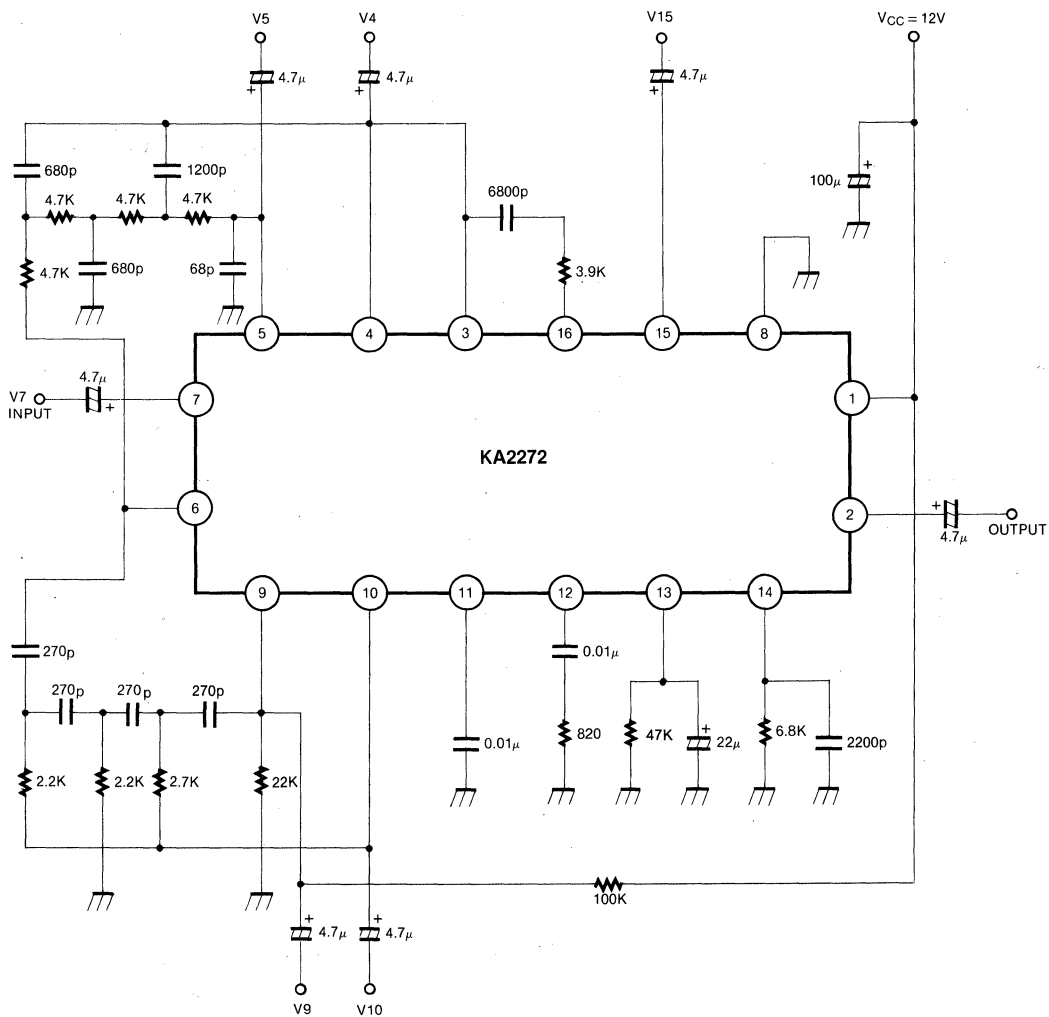
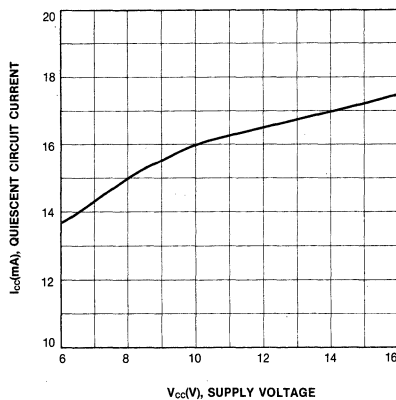
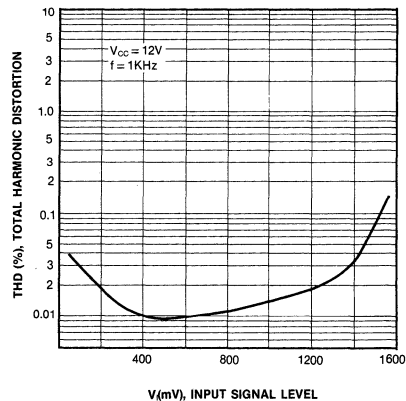


Fig. 2

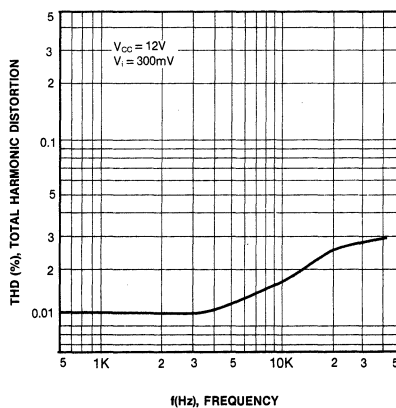
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



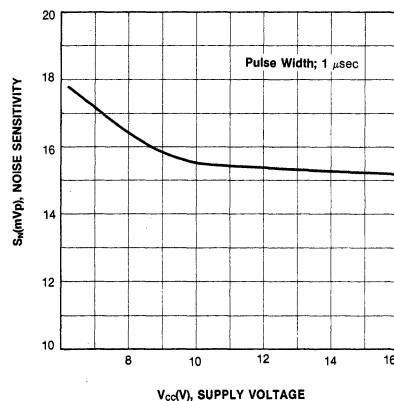
TOTAL HARMONIC DISTORTION-INPUT SIGNAL LEVEL



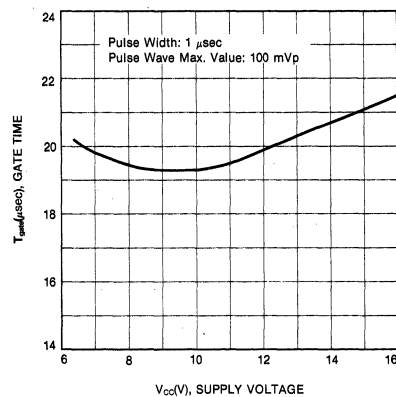
TOTAL HARMONIC DISTORTION-FREQUENCY



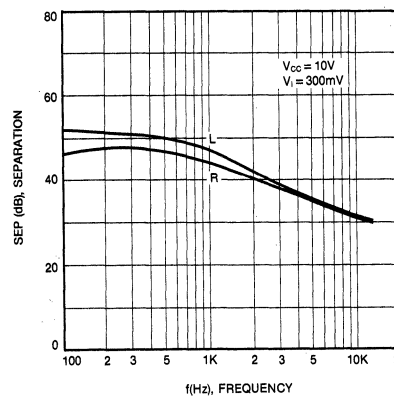
NOISE SENSITIVITY-SUPPLY VOLTAGE

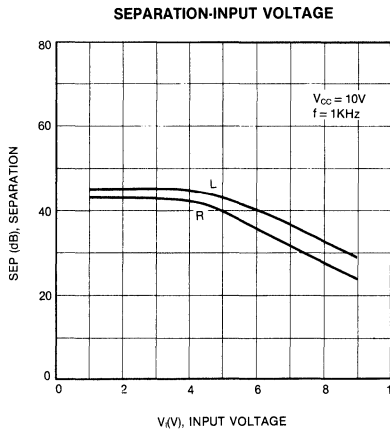


GATE TIME-SUPPLY VOLTAGE



SEPARATION-FREQUENCY





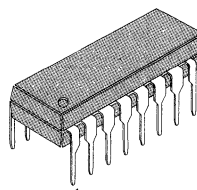
5 DOT DUAL LED LEVEL METER DRIVER

The KA2281 is a monolithic integrated circuit consisting of 2 channel LED level meter driver which was designed for use in stereo radio cassette tape recorder and home stereo.

FEATURES

- Comparator AC level (-16, -11, -6, -3, 0dB)×2.
- Capable of driving red/green/yeallow LEDs.
- Externally adjustable gain of input amplifier.
- Wide operating supply voltage range (5V ~ 14V).
- 10 dot dual output combined with KA2283.
- Applicable to 10 dot mono output.
- High input impedance.
- Minimum number of external parts required.

16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2281	16 DIP	-20 ~ +70°C
KA2281G	PELLET	

TYPICAL APPLICATION CIRCUIT

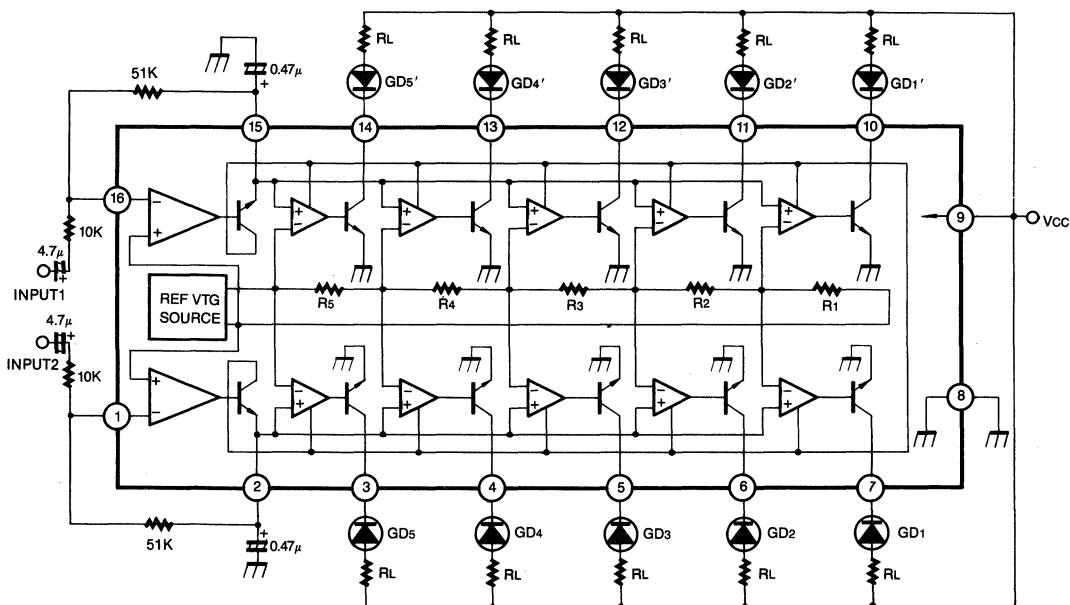


Fig. 1

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	16	V
D Terminal Output Current	I _O	30	mA
Power Dissipation	P _d	600	mW
Operating Temperature	T _{opr}	- 20 ~ + 70	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS

(T_a=25°C, V_{CC}=12V, f=1KHz, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I _{CC}	V _I =0		4		mA
D Terminal ON Voltage	V _{OL}	I _O =20mA		1.5		V
D Terminal Leakage Current	I _O (off)	V _I =0			50	μA
Voltage Gain (Closed Loop)	A _V			13.4		dB
Comparator ON Level	GD ₅ GD ₅ '	A _V =13.4dB	- 1	0	1	dB
	GD ₄ GD ₄ '		- 4	- 3	- 2	
	GD ₃ GD ₃ '		- 7.5	- 6	- 4.5	
	GD ₂ GD ₂ '		- 13	- 11	- 9	
	GD ₁ GD ₁ '		- 19	- 16	- 13	
LED ON Level Difference	ΔGD ₁₋₅	GD ₁₋₅ -GD ₁₋₅ ' A _V =13.4dB	- 1	0	1	dB
Input Impedance of Amp	R _i			200		KΩ

* Definition of 0dB; when the value of Input voltage is 218mVrms

TYPICAL APPLICATIONS

1. 5 dot dual application

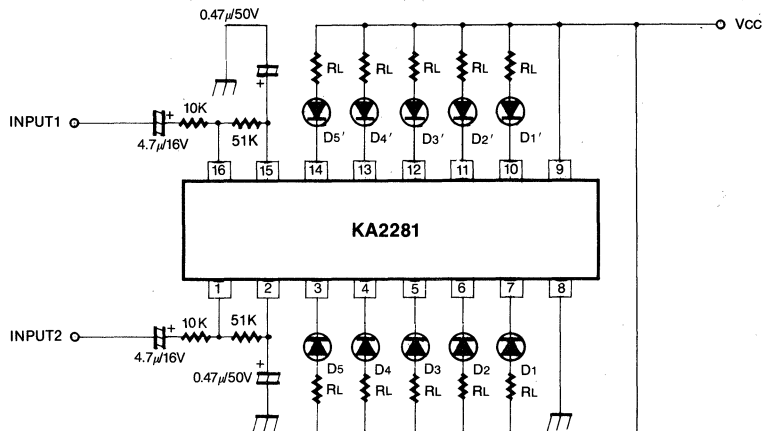


Fig. 2

2. 10 dot mono application

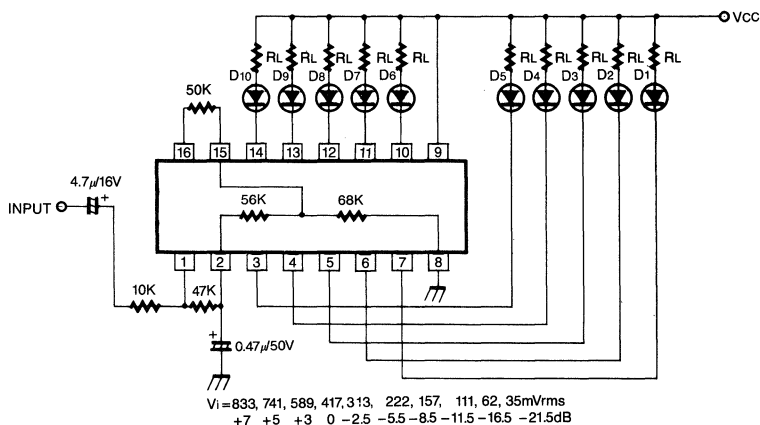


Fig. 3

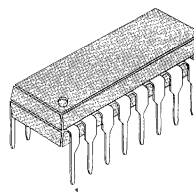
5 DOT DUAL LED LEVEL METER DRIVER

The KA2283 is a monolithic integrated circuit consisting of 2 channel LED level meter driver which was designed for use in stereo radio cassette tape recorder and home stereo.

FEATURES

- Suitable for AC level meter driver.
- Comparator level (−8, −6, −4, −2, 0dB)×2.
- Capable of driving red/green/yellow LEDs.
- Externally adjustable gain of input amp.
- Wide operating supply voltage range (5V ~ 14V).
- 10 dot dual output combined with KA2281.
- Applicable to 10 dot mono output.
- High input impedance.
- Minimum number of external parts required.

16 DIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2283	16 DIP	−20 ~ +70°C

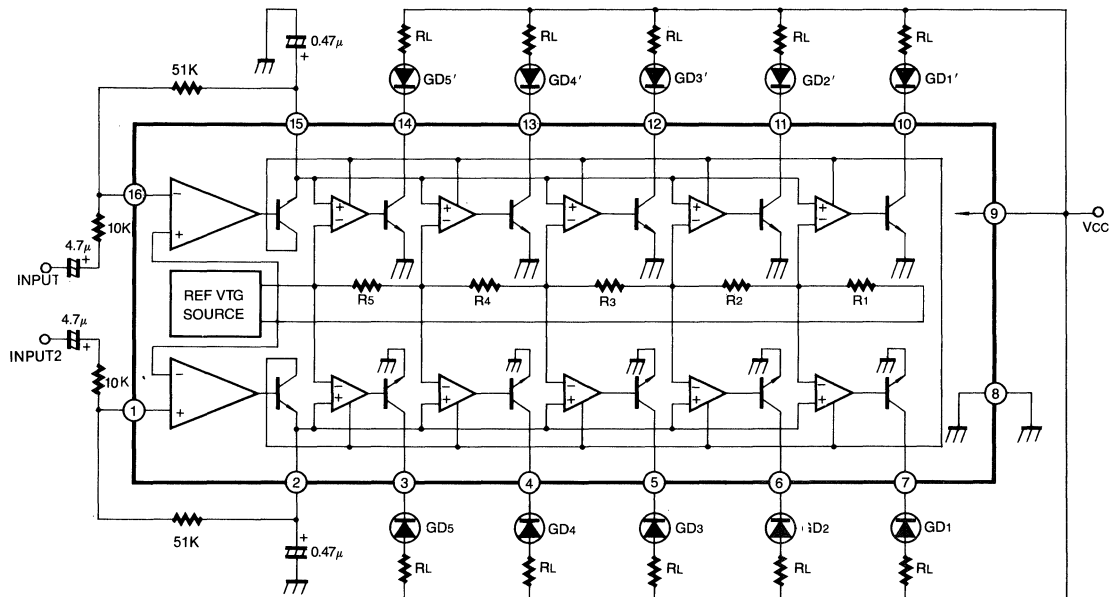


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
D Terminal Output Current	I_D	30	mA
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(T_a = 25°C, V_{CC} = 12V, f = 1KHz, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		4		mA
D Terminal ON Voltage	V_{OL}	$I_O = 20\text{mA}$		1.5		V
D Terminal Leakage Current	I_O (off)	$V_i = 0$			50	μA
Voltage Gain (Closed Loop)	A_V			13.4		dB
Comparator ON Level	$GD_5 GD_5'$	$A_V = 13.4\text{dB}$	-1	0	1	dB
	$GD_4 GD_4'$		-3	-2	-1	
	$GD_3 GD_3'$		-5	-4	-3	
	$GD_2 GD_2'$		-7	-6	-5	
	$GD_1 GD_1'$		-9	-8	-7	
LED ON Level Difference	ΔGD_{1-5}	$GD_{1-5} - GD'_{1-5}$ $A_V = 13.4\text{dB}$	-1	0	1	dB
Input Impedance of Amp	R_i			200		K Ω

* Definition of 0dB; when the value of Input voltage is 218mVrms

APPLICATION CIRCUIT

1. 5 dot dual application

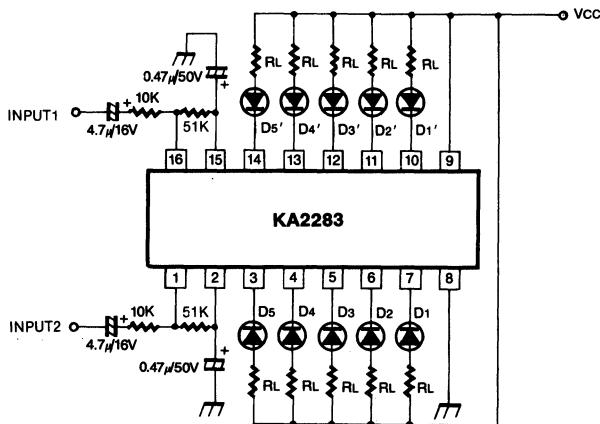
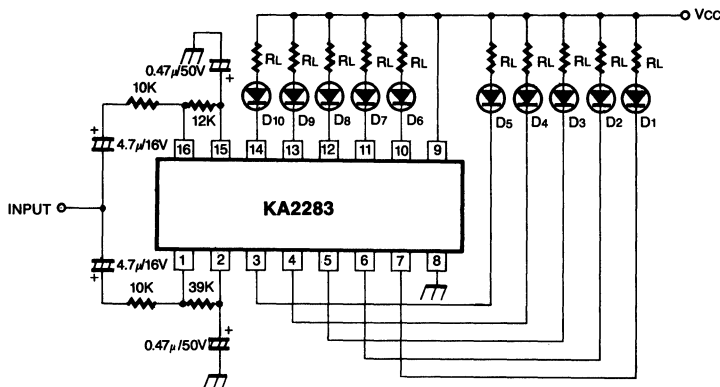


Fig. 2

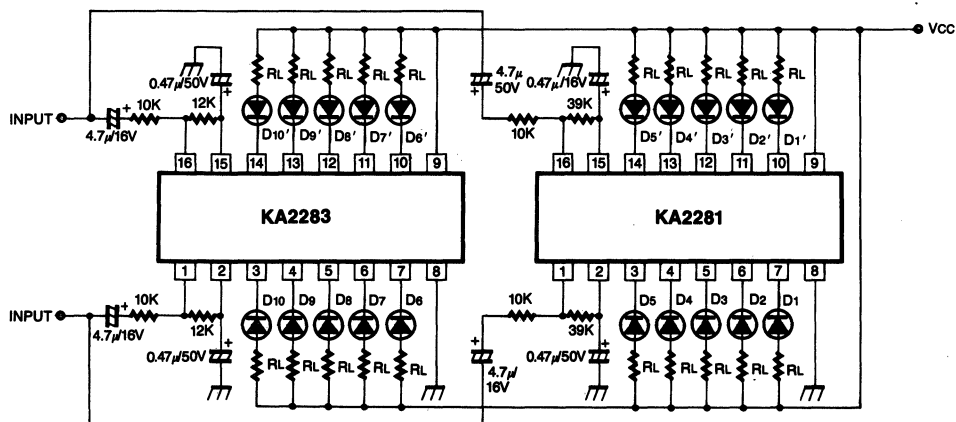
2. 10 dot mono application



$V_I = 822, 653, 519, 412, 327, 260, 206, 163, 129, 102\text{mVrms}$
 $+6, +4, +2, 0, -2, -4, -6, -8, -10, -12\text{dB}$

Fig. 3

3. 10 dot dual application with KA2281



$V_i = 830, 660, 524, 417, 331, 263, 184, 130, 73, 41\text{mVrms}$
 $+8, +4, +2, 0, -2, -4, -7, -10, -15, -20\text{dB}$

Fig. 4

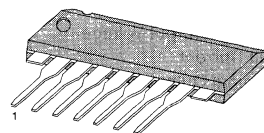
5 DOT LED LEVEL METER DRIVER

The KA2284/KA2285 are a monolithic integrated circuit designed for 5 dot LED level meter driver built-in rectifying amplifier, it is suitable for AC/DC level meter such as VU meter or signal meter.

FEATURES

- High gain rectifying amplifier included ($A_v = 26\text{dB}$).
- Low radiation noise when LED turns on.
- Logarithmic indicator for 5 dot LED of bar type.
($-10, -5, 0, 3, 6\text{dB}$)
- Constant current output.
KA2284: $I_o = 15\text{mA}$ Typ.
KA2285: $I_o = 7\text{mA}$ Typ.
- Wide operating supply voltage range ($3.5\text{V} \sim 16\text{V}$).
- Minimum number of external parts required.

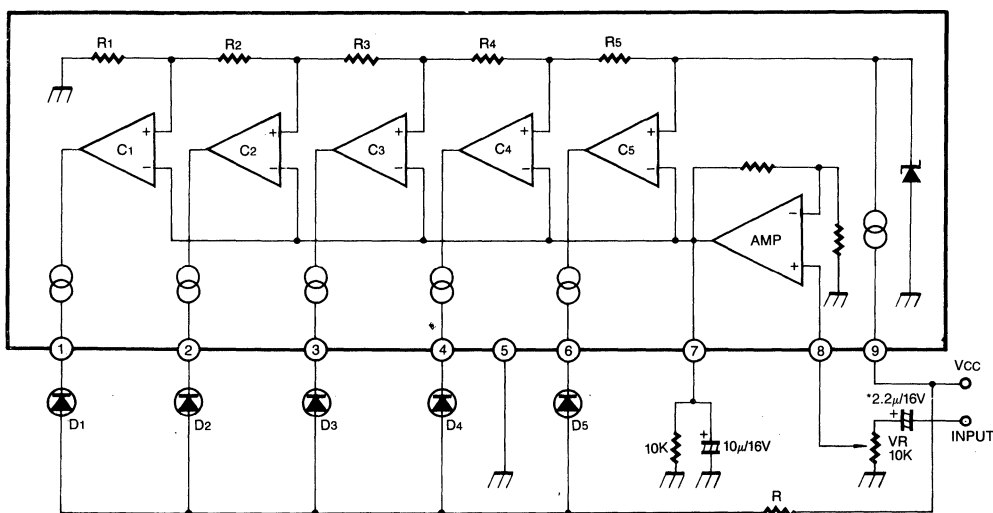
7 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature	I_o
KA2284	7 SIP	$-20 \sim +80^\circ\text{C}$	15 mA
KA2285			7 mA

BLOCK DIAGRAM



*Capacitor to be omitted when used as a DC input signal meter

Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Amp Input Voltage	V_{8-5}	$-0.5 \sim V_{CC}$	V
Pin 7 Voltage	V_{7-5}	6	V
D Terminal Output Voltage	V_D	18	V
Circuit Current	I_{CC}	12	mA
D Terminal Output Current	I_D	20	mA
Power Dissipation	P_d	1100	mW
Operating Temperature	T_{opr}	$-20 \sim +80$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

–11mW/ $^\circ\text{C}$ is decreased at higher temperature than $T_a=25^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

($T_a=25^\circ\text{C}$, $V_{CC}=6\text{V}$, $f=1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Circuit Current	I_{CC}	$V_i=0\text{V}$		6	8.5	mA
D Output Current	KA2284	$V_i=0.15\text{V}$	11	15	18.5	mA
	KA2285		5	7	9.5	
Input Bias Current	I_8		–1		0	μA
Amp Gain	A_v	$V_i=0.1\text{V}$	24	26	28	dB
Comparator ON Level	GD_1		–12	–10	–8	dB
	GD_2		–6	–5	–4	
	GD_3			0		
	GD_4		2.5	3	3.5	
	GD_5		5	6	7	

*Definition of 0dB; input voltage level when GD_3 turn ON. (50mV)

TYPICAL APPLICATION CIRCUIT

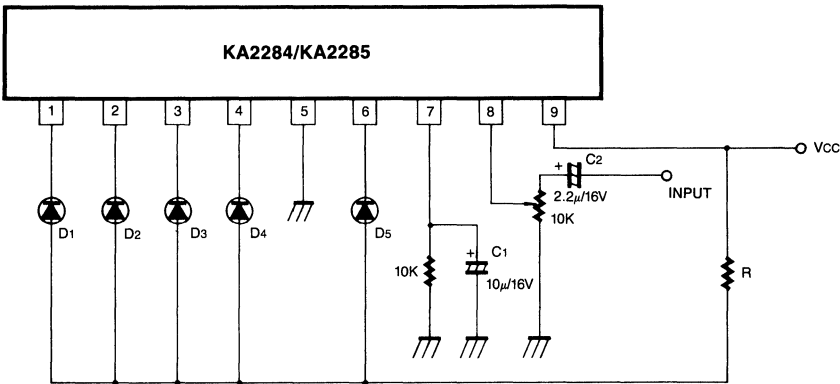


Fig. 2

C2: AC in, 2.2 μ is used.
DC in, 2.2 μ is shorted

The recommended value of R at T_a (max)=60°C.

V _{CC} (V)	8 ~ 12	10 ~ 14	12 ~ 16
R (Ω)	47	68	91

By changing the time constant C₁ and C₂, the response time, attack and release time, may be varied. In case of above application conditions, power dissipation may be operated at higher level than absolute maximum ratings. The wattage of R is to be determined by the total LED current and R value recommended by R table.

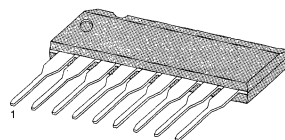
5 DOT LED LINEAR LEVEL METER DRIVER

The KA2286/KA2287 are a monolithic integrated circuit designed for 5 dot LED level meter driver built-in rectifying amplifier, it is suitable for AC/DC level meter such as VU meter or signal meter.

FEATURES

- High gain rectifying amplifier included ($A_v = 26\text{dB}$).
- Low radiation noise when LED turns on.
- Linear indicator for 5 dot LED of bar type.
(0.33, 0.67, 1, 1.33, 1.67)
- Constant current output.
KA2286: $I_o = 7\text{mA}$ Typ.
KA2287: $I_o = 15\text{mA}$ Typ.
- Wide operating supply voltage range (3.5V ~ 16V).
- Minimum number of external parts required.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature	I_o
KA2286	9 SIP	$-20 \sim +80^\circ\text{C}$	7 mA
KA2287			15 mA

BLOCK DIAGRAM

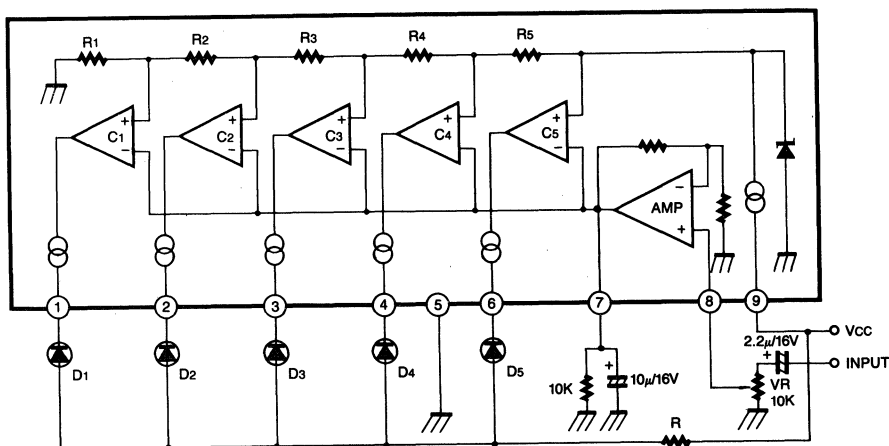


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Amp Input Voltage	V_{8-5}	$-0.5 \sim V_{CC}$	V
Pin 7 Voltage	V_{7-5}	6	V
D Terminal Output Voltage	V_D	18	V
Circuit Current	I_{CC}	12	mA
D Terminal Output Current	I_D	20	mA
Power Dissipation	P_d	1100	mW
Operating Temperature	T_{opr}	$-20 \sim +80$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

–11mW/ $^\circ\text{C}$ is decreased at higher temperature than $T_a=25^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

($T_a=25^\circ\text{C}$, $V_{CC}=6\text{V}$, $f=1\text{kHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i=0\text{V}$		6	8.5	mA
D Output Current	KA2286	$V_i=0.15\text{V}$	5	7	9.5	mA
	KA2287		11	15	18.5	
Input Bias Current	I_b		–1		0	μA
Amp Gain	A_v	$V_i=0.1\text{V}$	24	26	28	dB
Comparator On Level	GD_1		0.28	0.33	0.40	V_3
	GD_2		0.59	0.67	0.75	
	GD_3			1		
	GD_4		1.25	1.33	1.42	
	GD_5		1.48	1.67	1.87	

*Definition of 1; pin 3 voltage when GD_3 turn on. (65mV)

TYPICAL APPLICATION CIRCUIT

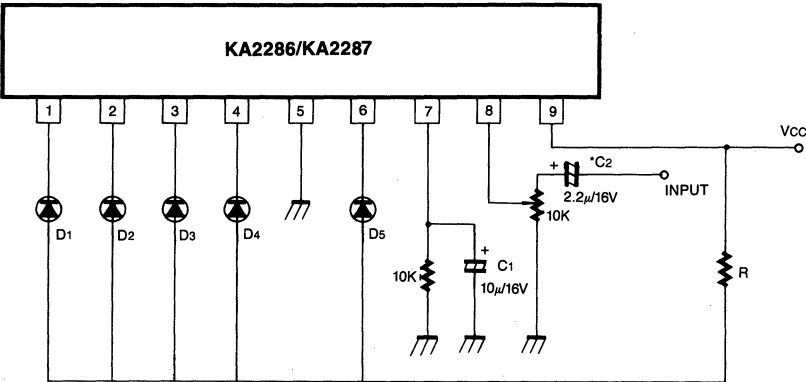


Fig. 2

*C2: AC in, 2.2µ is used
DC in, 2.2µ is shorted

The recommended value of R at T_a (max)=60°C.

V _{cc} (V)	8 ~ 12	10 ~ 14	12 ~ 16
R (Ω)	47	68	91

By changing the time constant C₁ and C₂, the response time, attack and release time, may be varied. In case of above application conditions, power dissipation may be operated at higher level than absolute maximum ratings. The wattage of R is to be determined by the total LED current and R value recommended by R table.

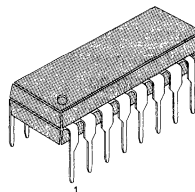
7 DOT LED LEVEL METER DRIVER

The KA2288 is a monolithic integrated circuit designed for 7 dot LED level meter driver. The KA2288 employs a low noise comparator which provides 10dB lower noise in the LW, MW band than previous LED drivers.

FEATURES

- LED current can be set by an external resistor
- Internal detection amplifier
- Internal voltage regulator
- Constant current output
- Fitted with a signal detect output pin
- VU meter scale

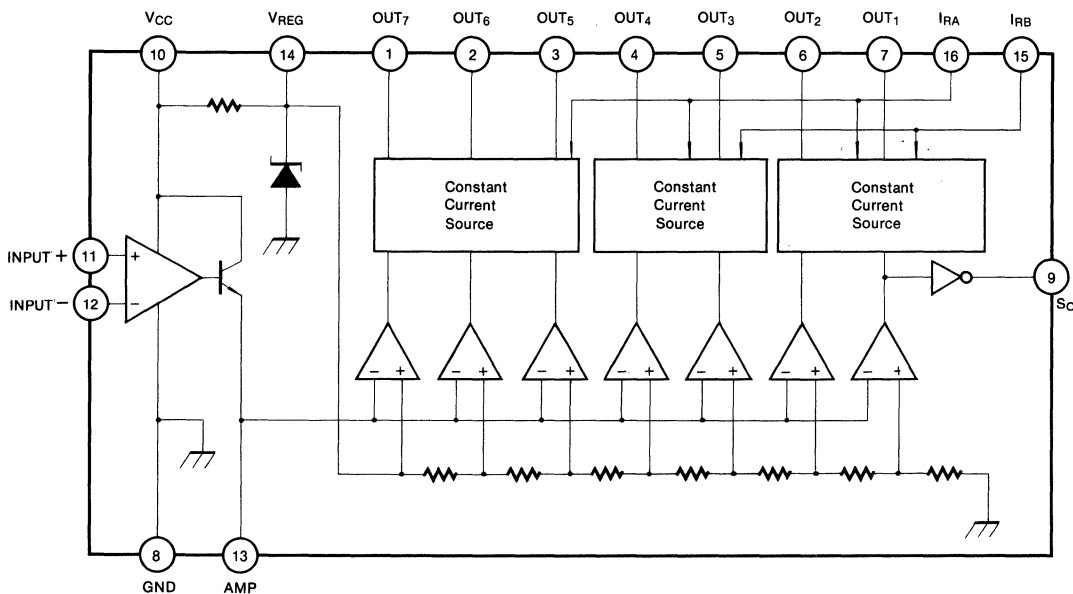
16 DIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2288	16 DIP	- 20 ~ + 70°C



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Input Voltage (AMP)	V_i	$0 \sim V_{CC}$	V
Output Current (AMP)	I_o (AMP)	10	mA
LED Output Current	I_D	30	mA
LED Output Voltage	V_D	V_{CC}	V
Signal Detection Output Current	I_{SO}	10	mA
Input Current	I_{RA}, I_{RB}	10	mA
Reference Voltage Output Current	I_{ref}	10	mA
Power Dissipation	P_d (Ta ≤ +70°C)	650	mW
Operating Temperature	T_{opr}	-20 ~ +70	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

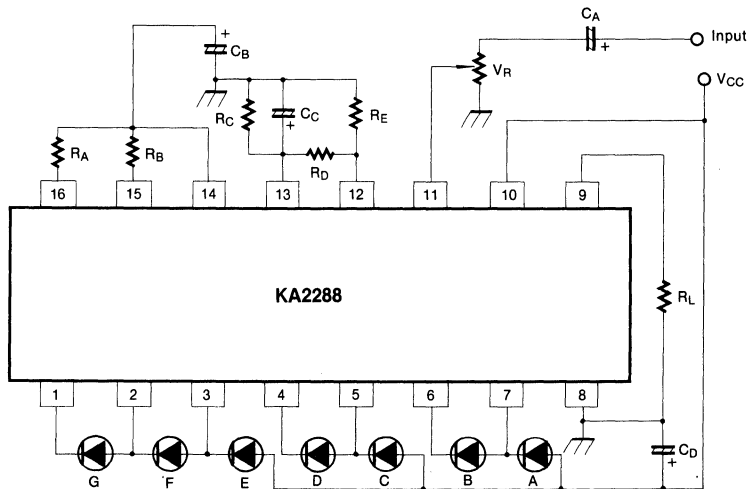
ELECTRICAL CHARACTERISTICS

(Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_{CC} = 12V, R_A = 4.7K, R_B = \infty$		8	12	mA
Input Bias Current	I_b	$V_{CC} = 12V$		-200	-800	nA
Input Offset Voltage	V_{io}	$V_{CC} = 12V$		2	10	mV
In-Phase Input Voltage	V_{ICM}	$V_{CC} = 12V$	0		10	V
Voltage Gain	A_{VO}	$V_{CC} = 12V$, open loop	50	70		dB
Reference Voltage	V_{ref}	$V_{CC} = 6.2 \sim 16V, R_L = 10K$	2.4	2.6	2.9	V
Reference Voltage Fluctuation	ΔV_{ref}	$V_{CC} = 6.2 \sim 16V, R_L = \infty \rightarrow 1K$	-0.5	-0.3		V
Signal Detection Output High Level	V_{oh}	$V_{CC} = 12V, R_L = 10K$	10	10.3		V
Signal Detection Output Leakage Current	I_{DL}	$V_{CC} = 12V, V_{SO} = 0V$			1	μA
Output Current 1	I_o (1)	$V_{CC} = 12V, R_A = 10K, R_B = \infty$	4.2	7.1	10.0	mA
Output Current 2*	I_o (2)	$V_{CC} = 12V, R_A = 10K, R_B = 22K$	6.3	10.6	15.0	mA
Output Leakage Current	I_{OL}	$V_{CC} = 12V, R_A = 4.7K, R_B = \infty$			20	μA
Comparator Level	CL1	$V_{CC} = 6.2V \sim 16V$ CL5 shall be taken for 0dB	-22	-20	-18	dB
	CL2		-11	-10	-9	
	CL3		-6.5	-6	-5.5	
	CL4		-3.5	-3	-2.5	
	CL5			0		
	CL6		+2.5	+3	+3.5	
	CL7		+5	+6	+7	
0dB Level	CL5	$V_{CC} = 6.2 \sim 16V, V_{ref} = 2.4 \sim 2.9V$	1.2	1.3	1.45	V

*: Applied pin: 4, 5, 6, 7

TEST CIRCUIT



* NOTE: Following values of the elements are for a typical test circuit.

R_C : 18K, R_D : 90K, R_E : 10K, V_R : 22K

C_A : 3.3μ , C_B : 10μ , C_C : 4.7μ , C_D : 10μ

INTRODUCTION TO OPERATION

The KA2288 has 7 built-in comparators to each of which is applied the reference voltage corresponding to each step. (The step for this reference voltage is V_U . For the LED switch-over level, refer to the comparator level in the electrical characteristics.)

Each of these comparators compares its reference voltage inherent to the IC and the input DC voltage applied to its input terminal and if the input DC voltage is higher than the internal reference voltage, it will turn on the steady current driver transistor connected to the comparator output to drive the LED.

The output terminal S_o goes "High" when the bottom most LED glows.

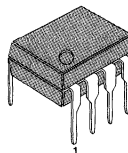
DC MOTOR SPEED CONTROLLER

The KA2401 is a monolithic integrated circuit designed for DC motor speed controllers.

FEATURES

- Suitable for DC motor speed controllers of cassette tape recorder and radio cassette.
- Excellent stability of each characteristics against ambient temperature.
- Low quiescent current (0.8mA; Typ).
- Low reference voltage.
- Wide operating supply voltage range (4V ~ 12V).

8 DIP



EQUIVALENT CIRCUIT BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2401	8 DIP	- 20 ~ + 70°C

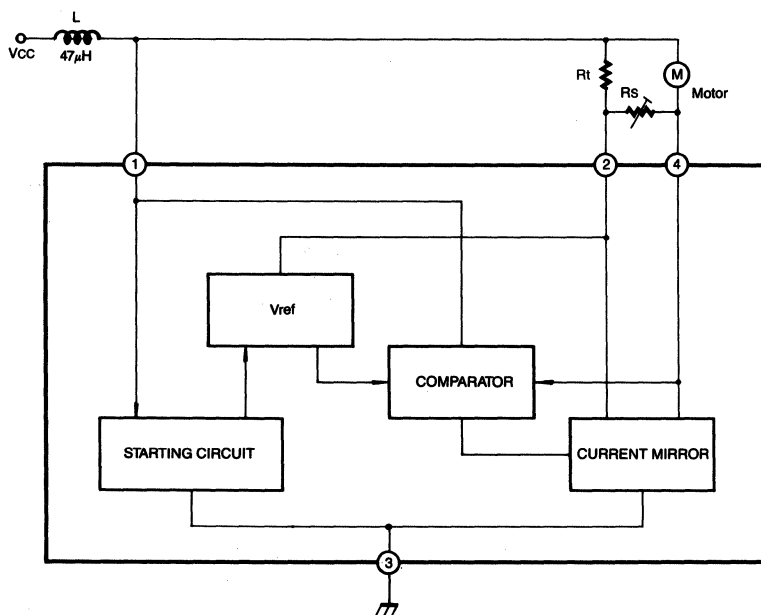


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Circuit Current	I_A	*2	A
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

* $t < 5 \text{ sec}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Flg
Reference Voltage	V_{ref}	$I_A = 10\text{mA}$	1.10	1.27	1.40	V	2
Quiescent Current	I_d	$R_m = 180\Omega$	0.5	0.8	1.2	mA	5
Reflection-Coefficient	K	$R_{m1} = 44\Omega$, $R_{m2} = 33\Omega$	18	20	22		3
Saturation Voltage	$V_A(\text{sat})$	$V_{CC} = 4.2\text{V}$, $R_m = 4.4\Omega$		1.5	20	V	4
Voltage Characteristic	$\frac{\Delta K}{K} / \Delta V_{CC}$	$I_A = 100\text{mA}$, $V_{CC} = 4 \sim 12\text{V}$		0.4		%/V	3
	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{CC}$	$I_A = 100\text{mA}$, $V_{CC} = 4 \sim 12\text{V}$		0.06		%/V	2
Current Characteristic	$\frac{\Delta K}{K} / \Delta I_A$	$I_A = 30 \sim 200\text{mA}$		-0.02		%/mA	3
	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_A$	$I_A = 30 \sim 200\text{mA}$		-0.02		%/mA	2
Temperature Characteristic	$\frac{\Delta K}{K} / \Delta T_a$	$I_A = 100\text{mA}$ $T_a = -20 \sim +75^\circ\text{C}$		0.01		%/ $^\circ\text{C}$	3
	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$	$I_A = 100\text{mA}$ $T_a = -20 \sim +75^\circ\text{C}$		0.01		%/ $^\circ\text{C}$	2

TEST CIRCUIT 1

Reference Voltage

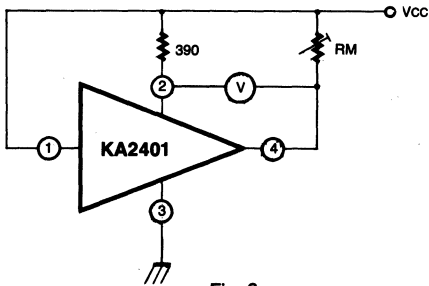


Fig. 2

$$V_{ref}, \frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{cc}, \frac{\Delta V_{ref}}{V_{ref}} / \Delta I_4, \frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$$

TEST CIRCUIT 2

Reflection Coefficient

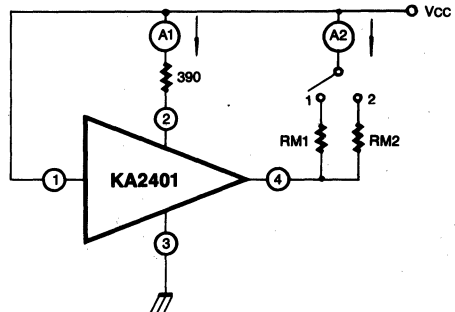


Fig. 3

$$K, \frac{\Delta K}{K} / \Delta V_{cc}, \frac{\Delta K}{K} / \Delta I_4, \frac{\Delta K}{K} / \Delta T_a$$

$$K = \frac{I_4 (\text{SW } 2) - I_4 (\text{SW } 1)}{I_2 (\text{SW } 2) - I_2 (\text{SW } 1)}$$

TEST CIRCUIT 3

Saturation Voltage

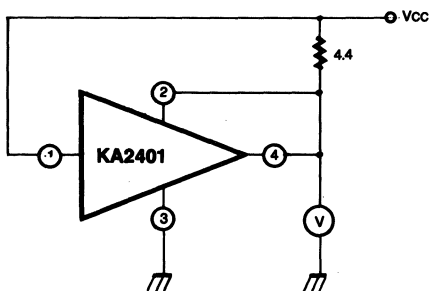


Fig. 4

TEST CIRCUIT 4

Quiescent Current

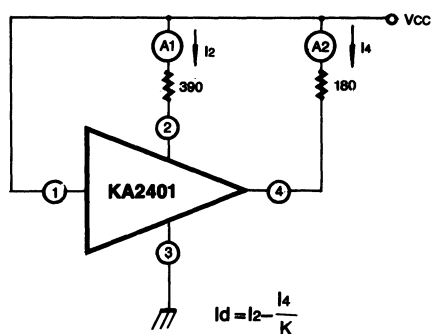


Fig. 5

TYPICAL APPLICATION

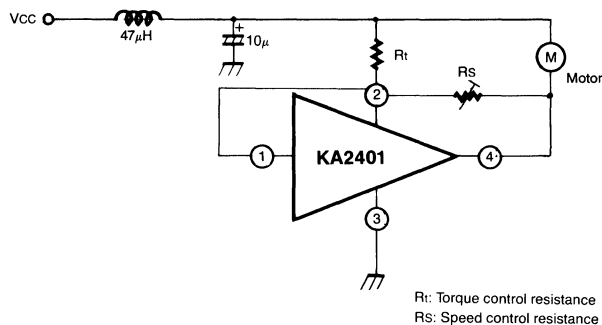


Fig. 6

BASIC EQUATION

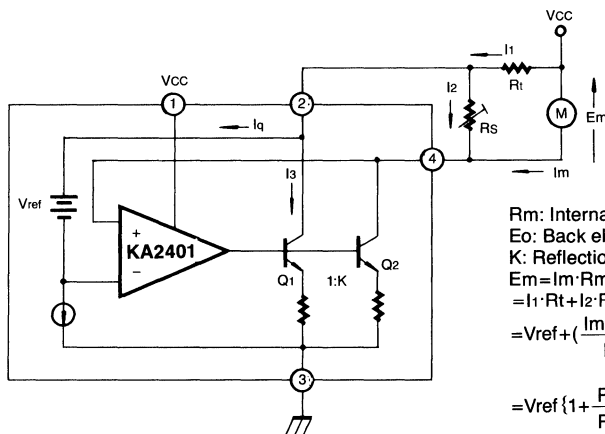


Fig. 7

Rm: Internal resistance of the motor
Eo: Back electronic force
K: Reflection coefficient

$$E_m = I_m \cdot R_m + E_o$$

$$= I_1 \cdot R_t + I_2 \cdot R_s$$

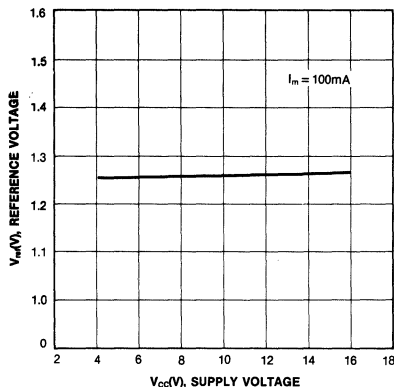
$$= V_{ref} + \left(\frac{I_m + I_2}{K} + I_q + \frac{V_{ref}}{R_s} \right) \cdot R_t$$

$$= V_{ref} \left\{ 1 + \frac{R_t}{R_s} \left(1 + \frac{1}{K} \right) \right\} + R_t \cdot I_q + \frac{R_t}{K} I_m$$

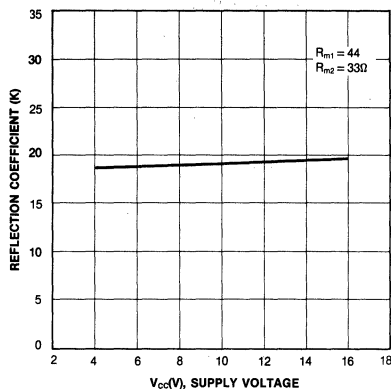
If, $R_m = \frac{R_t}{K}$ then

$$E_o = V_{ref} \left\{ 1 + \frac{R_t}{R_s} \left(1 + \frac{1}{K} \right) \right\} + R_t \cdot I_q$$

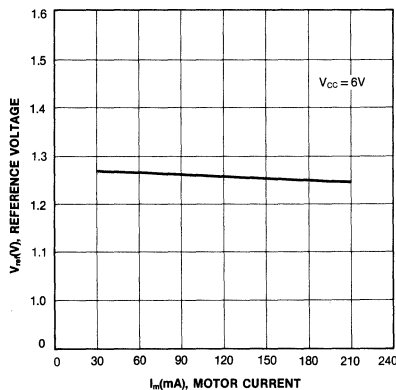
REFERENCE VOLTAGE-SUPPLY VOLTAGE



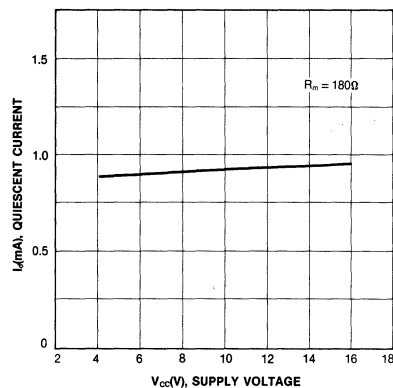
REFLECTION COEFFICIENT-SUPPLY VOLTAGE



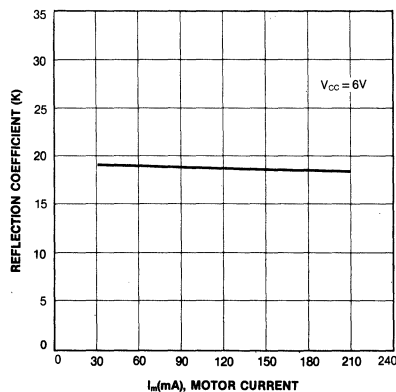
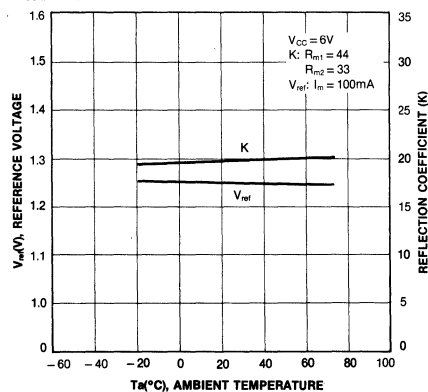
REFERENCE VOLTAGE-MOTOR CURRENT

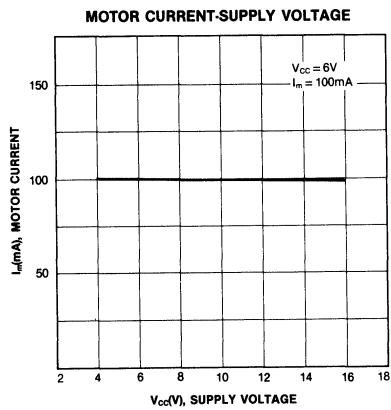


QUIESCENT CURRENT-SUPPLY VOLTAGE



REFLECTION COEFFICIENT-MOTOR CURRENT

REFERENCE VOLTAGE - AMBIENT TEMPERATURE
REFLECTION COEFFICIENT



LOW VOLTAGE DC MOTOR SPEED CONTROLLER

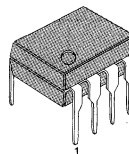
USE

- Speed control or general-purpose low-voltage compact DC motor for microcassette tape recorder, radio cassette, and the equivalent

FEATURES

- Wide operating supply voltage range (1.6V ~ 8V).
- Capable of making the applicable set compact because of minimum number of external parts required and compact package.
- Easy to adjust speed.
- Built-in stable low reference power meeting the requirements for 2 speeds.
- $V_{ref}=0.2V$

8 DIP



EQUIVALENT CIRCUIT BLOCK DIAGRAM

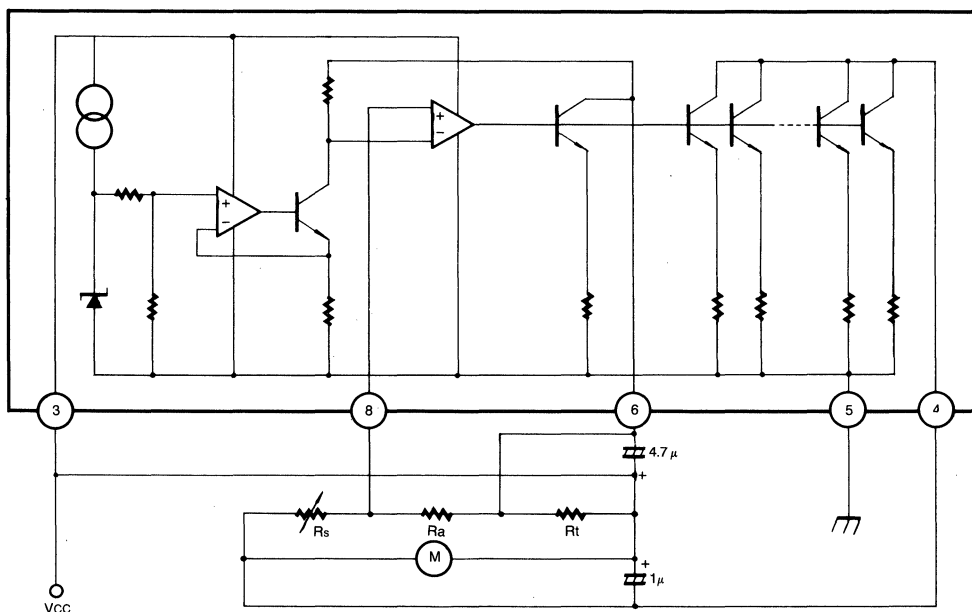


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Maximum Supply Voltage	V_{CC}	10	V
Maximum Motor Current	I_m	700	mA
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +80$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = 25^\circ\text{C}$)

Supply Voltage	V_{CC}	1.8 ~ 8	V
Operating Temperature	T_{opr}	$-20 \sim +60$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Voltage	V_{ref}	$V_{CC} = 3V, I_m = 100\text{mA}$	0.18	0.2	0.22	V
Circuit Current	I_{CC}	$V_{CC} = 3V, I_m = 100\text{mA}$		2.4	6.0	mA
Shunt Ratio	K	$V_{CC} = 3V, I_m = 50\text{mA}$ $I_m = 100\text{mA}$	45	50	55	
Saturation Voltage	$V(\text{sat})$	$V_{CC} = 3V, I_m = 100\text{mA}$		0.13	0.3	V
Voltage Characteristic of Reference Voltage	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{CC}$	$I_m = 100\text{mA}$ $V_{CC} = 1.8 \sim 8V$		0.1		%/V
Voltage Characteristic of Shunt Ratio	$\frac{\Delta K}{K} / \Delta V_{CC}$	$I_m = 50, 150\text{mA}$ $V_{CC} = 1.8 \sim 8V$		0.3		%/V
Current Characteristic of Reference Voltage	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_m$	$V_{CC} = 3V$ $I_m = 20 \sim 200\text{mA}$		0.005		%/mA
Current Characteristic of Shunt Ratio	$\frac{\Delta K}{K} / \Delta I_m$	$V_{CC} = 3V, I_m = 20, 50\text{mA}$ $\sim 170, 200\text{mA}$		-0.07		%/mA
Temperature Characteristic of Reference Voltage	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$	$V_{CC} = 3V, I_m = 100\text{mA}$ $T_a = -20 \sim +80^\circ\text{C}$		-0.008		%/ $^\circ\text{C}$
Temperature Characteristic of Shunt Ratio	$\frac{\Delta K}{K} / \Delta T_a$	$V_{CC} = 3V, I_m = 50, 150\text{mA}$ $T_a = -20 \sim +80^\circ\text{C}$		0.02		%/ $^\circ\text{C}$

TEST CIRCUIT

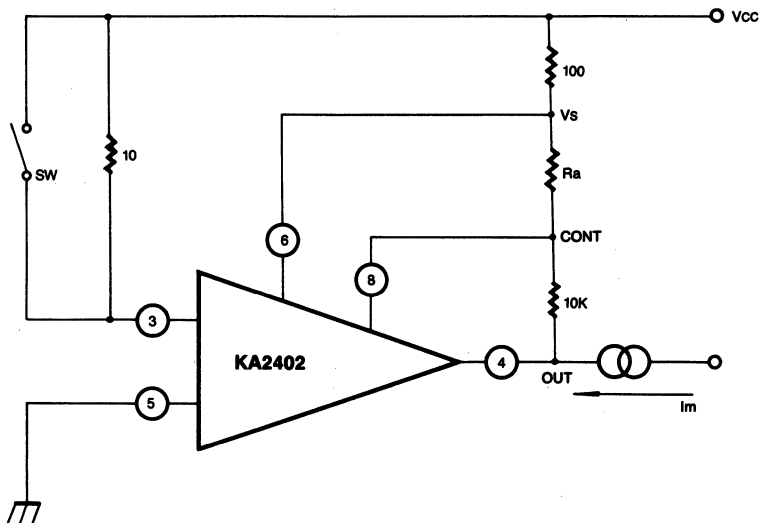


Fig. 2

TEST METHOD

1. V_{ref} : With SW turned on, measure the voltage developed across R_a .
2. I_{cc} : With SW turned off, measure I_{cc} for the voltage developed across resistor 10.00 ohm.
3. K : With SW turned on, measure current I_{50} flowing through resistor 100 ohm at $I_m = 50\text{mA}$ and current I_{150} flowing through resistor 100 ohm at $I_m = 150\text{mA}$, and obtain K by use of the following equation.

$$K = \frac{100\text{mA}}{(I_{150} - I_{50}) (\text{mA})}$$
4. $V(\text{sat})$: With SW turned on, set $V_{CC} = V_S = \text{CONT} = 3\text{V}$ and feed $I_m = 100\text{mA}$, and measure the voltage developed across pins 4 and 5.

Application Circuit 1

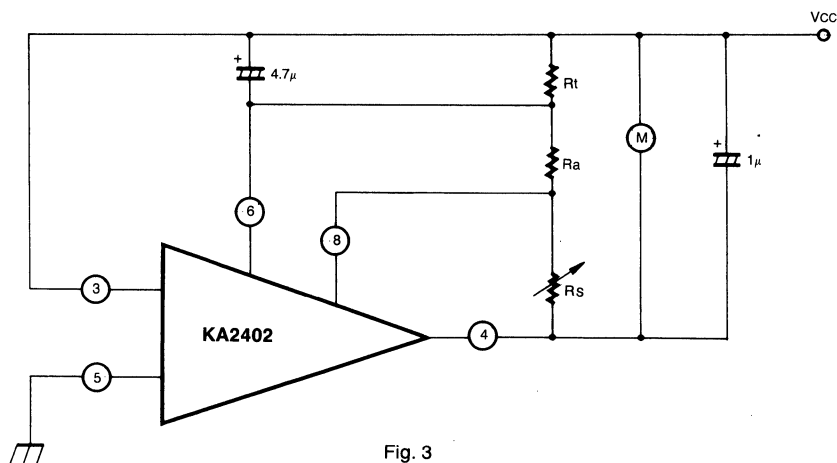
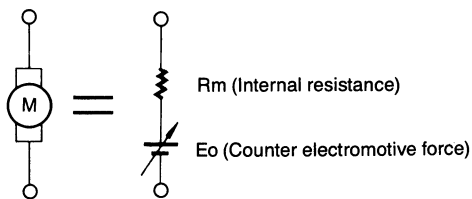


Fig. 3

Unless $R_t (\text{max}) < K \cdot R_m (\text{min})$, the operation become unstable.

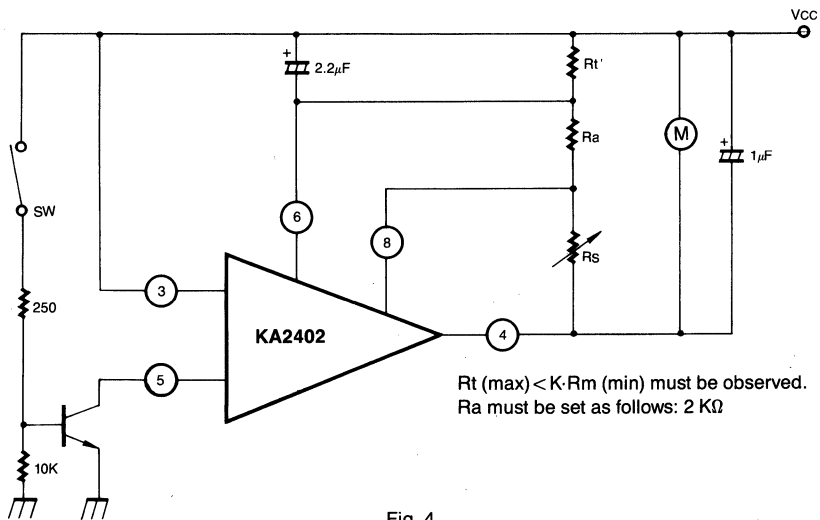
R_a must be set as follows: $2K\Omega$

R_m = Motor internal resistance

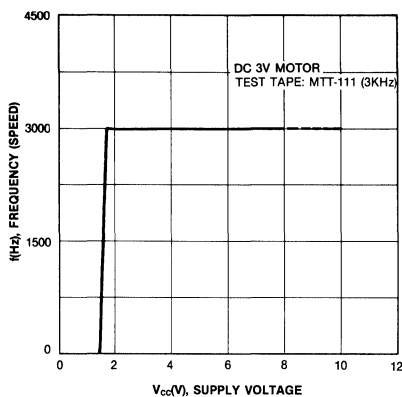


The values of the electrolytic capacitors depend on the type of the motor to be used

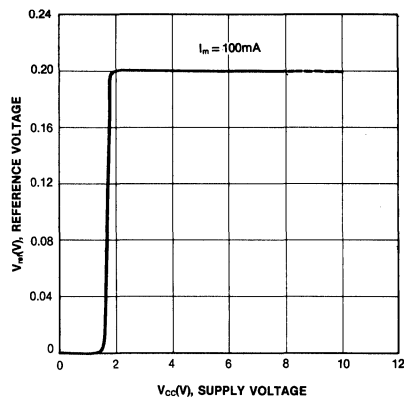
Application Circuit 2: with stop circuit



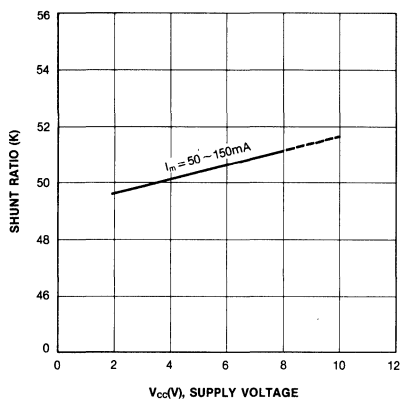
FREQUENCY (SPEED)-SUPPLY VOLTAGE



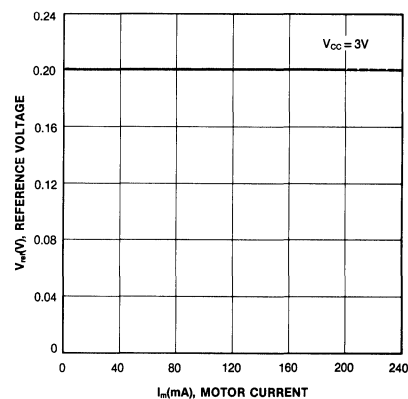
REFERENCE VOLTAGE-SUPPLY VOLTAGE



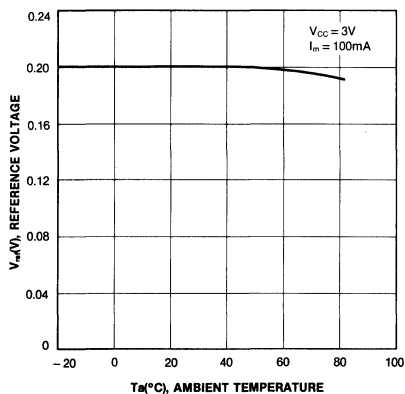
SHUNT RATIO-SUPPLY VOLTAGE



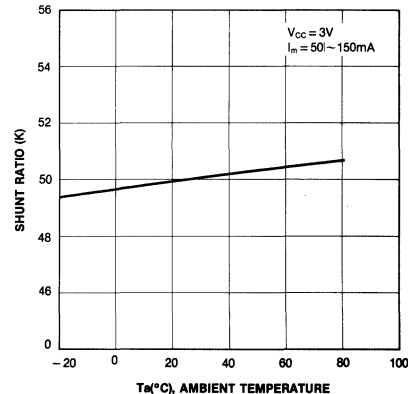
REFERENCE VOLTAGE-MOTOR CURRENT



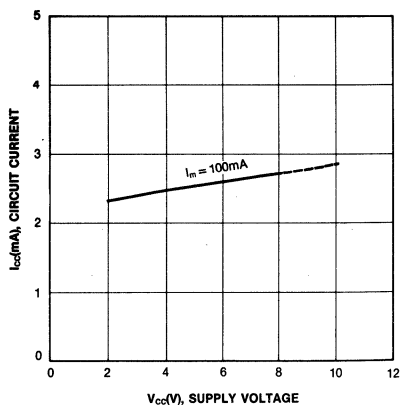
REFERENCE VOLTAGE-AMBIENT TEMPERATURE



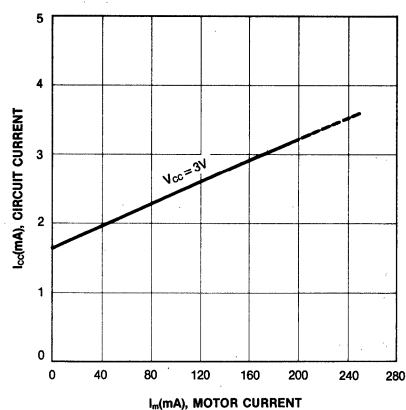
SHUNT RATIO-AMBIENT TEMPERATURE



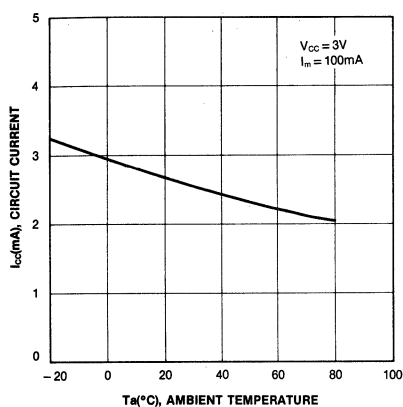
CIRCUIT CURRENT-SUPPLY VOLTAGE



CIRCUIT CURRENT-MOTOR CURRENT



CIRCUIT CURRENT-AMBIENT TEMPERATURE



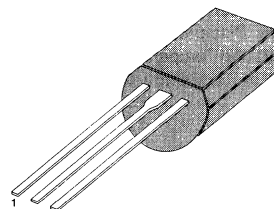
DC MOTOR SPEED CONTROLLER

The KA2404 is a monolithic integrated circuit designed for DC motor speed controllers.

FEATURES

- Suitable for DC motor speed controllers of cassette tape recorder and radio cassette.
- Excellent stability of each characteristics against ambient temperature.
- High output current.
- Low quiescent current (1.3mA: typ).
- Low reference voltage.
- Wide operating supply voltage range (4V ~ 12V).

TO-92L



EQUIVALENT CIRCUIT BLOCK DIAGRAM

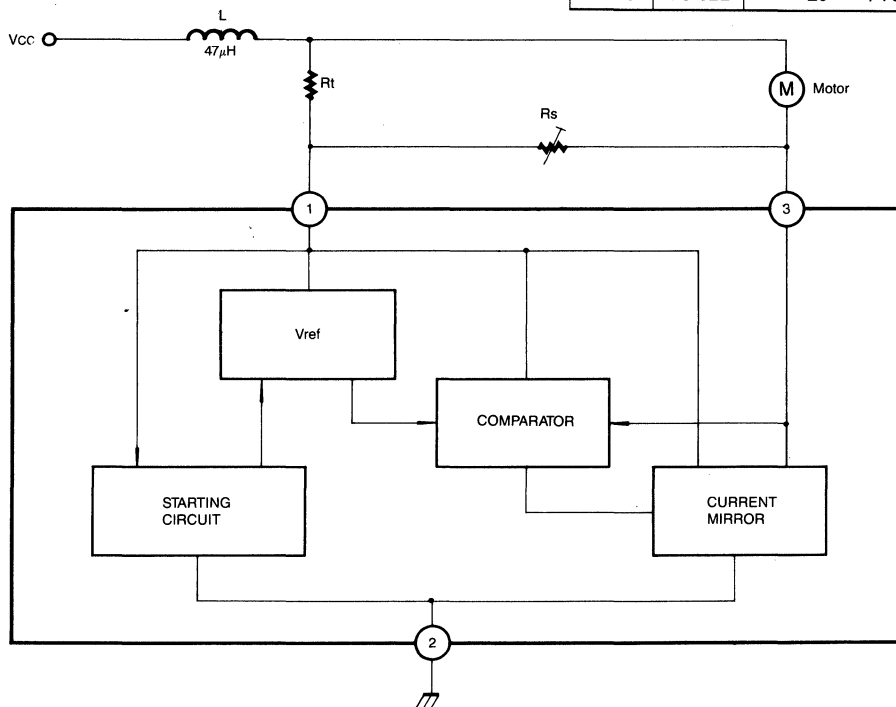


Fig. 1

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2404	TO-92L	- 20 ~ + 70°C

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	16	V
Circuit Current	I ₃	*2	A
Power Dissipation	P _d	800	mW
Operating Temperature	T _{opr}	-20 ~ +70	°C
Storage Temperature	T _{stg}	-40 ~ +125	°C

* t < 5 sec

ELECTRICAL CHARACTERISTICS

(T_a=25°C, V_{CC}=9V unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Fig
Reference Voltage	V _{ref}	I ₃ =10mA	1.10	1.27	1.40	V	2
Quiescent Current	I _d	R _m =180Ω	0.8	1.3	1.8	mA	4
Reflection Coefficient	K	R _{m1} =44Ω R _{m2} =33Ω	16	18	20		3
Voltage Characteristic	$\frac{\Delta K}{K} / \Delta V_{CC}$	I ₃ =100mA V _{CC} =4 ~ 12V		0.4		%/V	3
	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{CC}$	I ₃ =100mA V _{CC} =4 ~ 12V		0.06		%/V	2
Current Characteristics	$\frac{\Delta K}{K} / \Delta I_3$	I ₃ =30 ~ 200mA		-0.02		%/mA	3
	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_3$	I ₃ =30 ~ 200mA		-0.02		%/mA	2
Temperature Characteristics	$\frac{\Delta K}{K} / \Delta T_a$	I ₃ =100mA T _a =20 ~ +75°C		0.01		%/°C	3
	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$	I ₃ =100mA T _a =-20 ~ +75°C		0.01		%/°C	2

TEST CIRCUIT 1

Reference Voltage

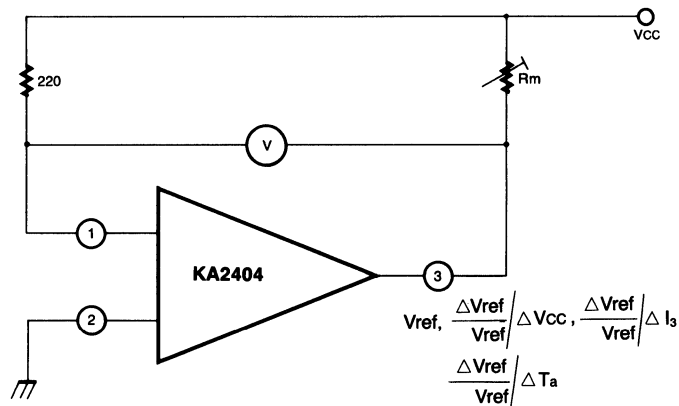


Fig. 2

TEST CIRCUIT 2

Reflection Coefficient

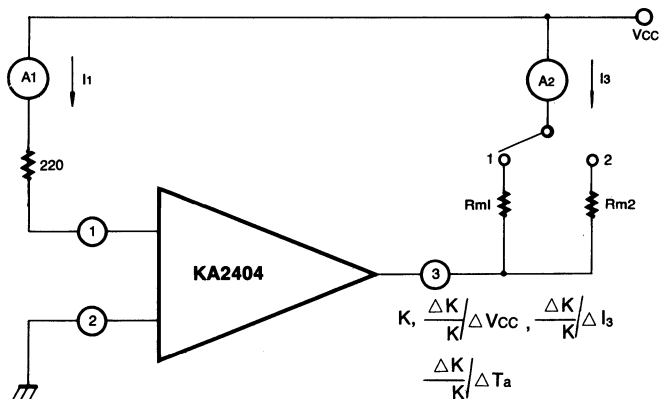


Fig. 3

$$K = \frac{I_3 (\text{SW } 2) - (\text{SW } 1)}{I_1 (\text{SW } 2) - (\text{SW } 1)}$$

TEST CIRCUIT 3

Quiescent Current

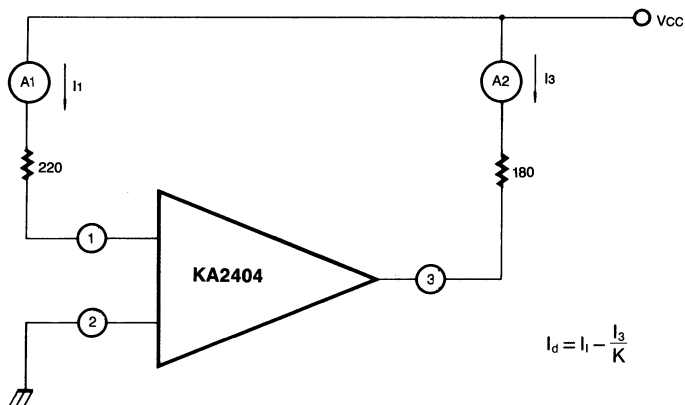


Fig. 4

TYPICAL APPLICATION

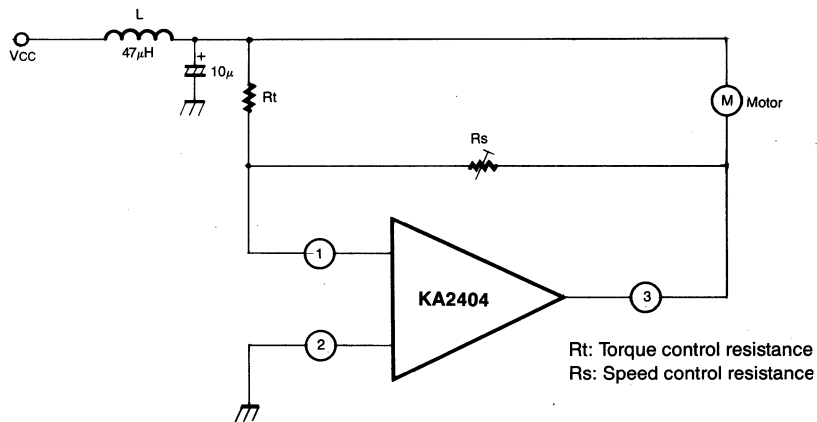
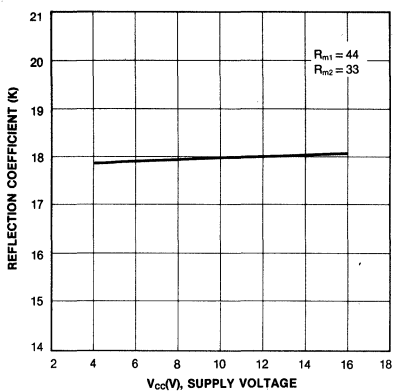
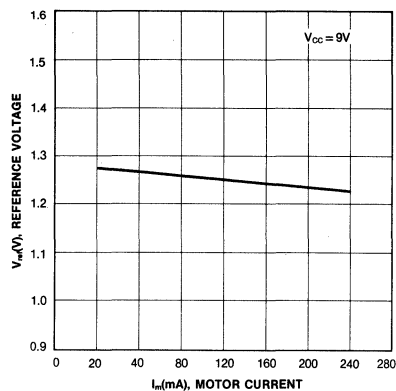


Fig. 5

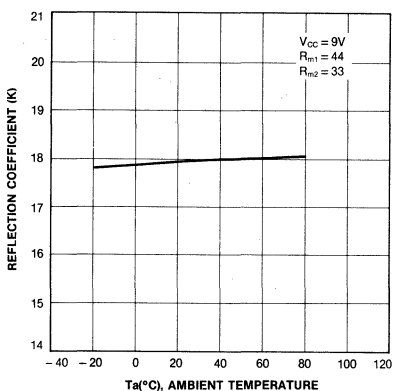
REFLECTION COEFFICIENT-SUPPLY VOLTAGE



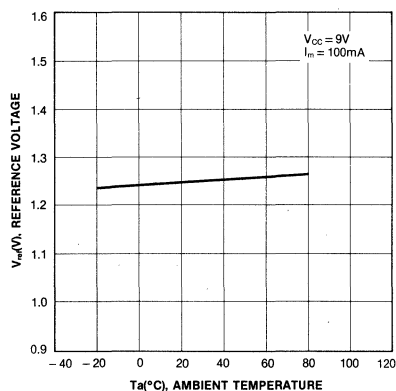
REFERENCE VOLTAGE-MOTOR CURRENT



REFLECTION COEFFICIENT-AMBIENT TEMPERATURE

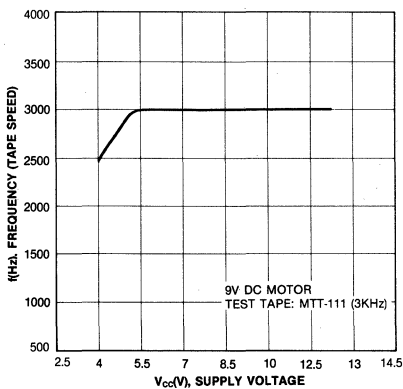


REFERENCE VOLTAGE-AMBIENT TEMPERATURE

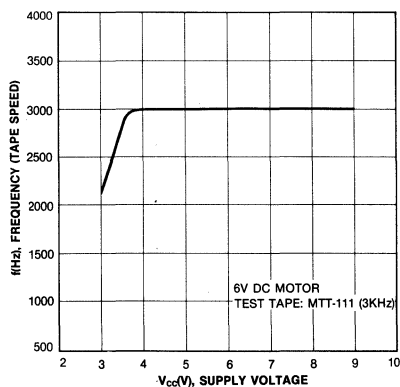


(APPLICATION CHARACTERISTICS)

FREQUENCY (TAPE SPEED)-SUPPLY VOLTAGE



FREQUENCY (TAPE SPEED) SUPPLY VOLTAGE



DC MOTOR SPEED CONTROLLER

The KA2407 is a monolithic integrated circuit designed for DC motor speed controllers.

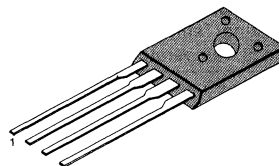
FEATURES

- High stable operation over a wide range of supply voltage;
 $V_{CC} = 3.5V \sim 14.4V$
- Stable low reference voltage (1.0V Typ) for wide motor speed setting
- Minimum number of external parts required
- Small four-lead plastic package for compact motor
- Reverse voltage protection circuit

APPLICATIONS

- Tape recorder & recorder player
- Home stereo
- Car component

TO-126



3

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2407	TO-126	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM

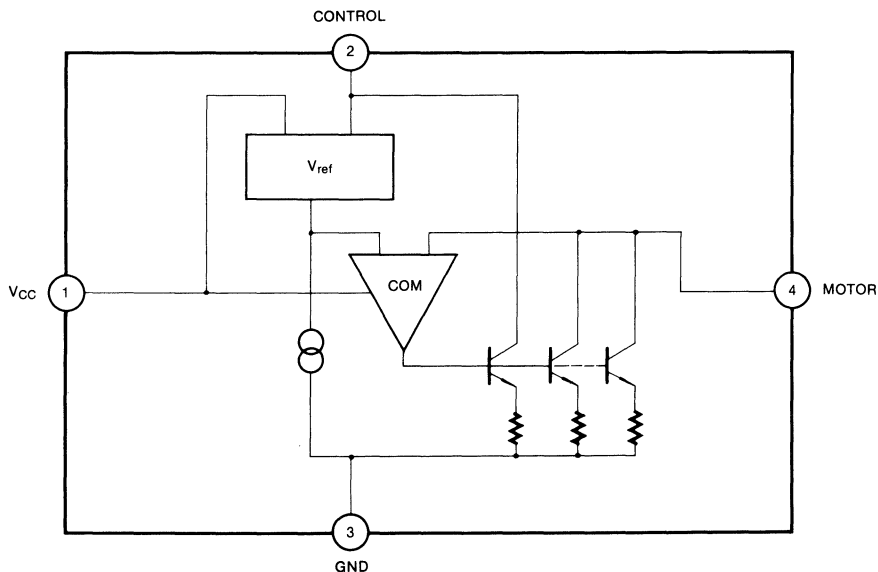


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	14.4	V
Supply Current	I _{CC} (Note 1)	2	A
Power Dissipation	P _d (Note 2)	1.3	W
Operating Temperature	T _{opr}	-20 ~ +75	°C
Storage Temperature	T _{stg}	-40 ~ +150	°C

(Note 1): t ≤ 5 sec

(Note 2): Ta = 25°C, With a 100 × 100mm bakelite printed circuit board (35μm Cu leaf)

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 6V)

Characteristic	Symbol	Test Circuit	Test Conditions	Min	Typ	Max	Unit
Reference Voltage	V _{ref}	1	Ra = 1KΩ	0.85	1.0	1.15	V
Bias Current	I _B	3			0.8	1.8	mA
Current Shunt Ratio	K	2	ΔI ₄ = 40mA	35	40	45	
Saturation Voltage	V _{sat}	1	V _{CC} = 4.2V, Ra = 5Ω		1.15	2	V
Voltage Characteristic 1	$\frac{\Delta V_{ref}}{V_{ref}}/V_{CC}$	1	V _{CC} = 3.5V ~ 14V, Ra = 1KΩ		-0.1		%/V
Voltage Characteristic 2	$\frac{\Delta K}{K}/V_{CC}$	2	V _{CC} = 3.5V ~ 14V, ΔI ₄ = 40mA		0.1		%/V
Current Characteristic 1	$\frac{\Delta V_{ref}}{V_{ref}}/I_4$	1	I ₄ = 50mA ~ 200mA		-0.02		%/mA
Current Characteristic 2	$\frac{\Delta K}{K}/I_4$	2	I ₄ = 50mA ~ 200mA		-0.01		%/mA
Temperature Characteristic 1	$\frac{\Delta V_{ref}}{V_{ref}}/T_a$	1	Ta = -20 ~ +75°C, Ra = 1KΩ		0.01		%/°C
Temperature Characteristic 2	$\frac{\Delta K}{K}/T_a$	2	Ta = -20 ~ +75°C, ΔI ₄ = 40mA		0.01		%/°C

TEST CIRCUIT 1

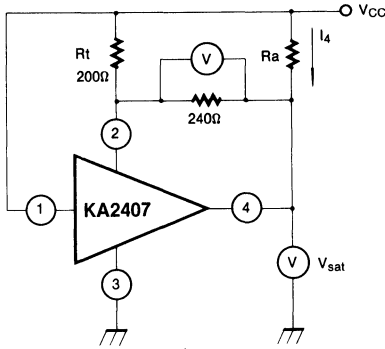


Fig. 2

$$V_{ref}, V_{sat}, \frac{\Delta V_{ref}}{V_{ref}}, \frac{\Delta V_{ref}}{V_{CC}}, \frac{\Delta V_{ref}}{V_{ref}}, \frac{\Delta V_{ref}}{I_4}, \frac{\Delta V_{ref}}{V_{ref}}, \frac{\Delta V_{ref}}{T_a},$$

TEST CIRCUIT 2

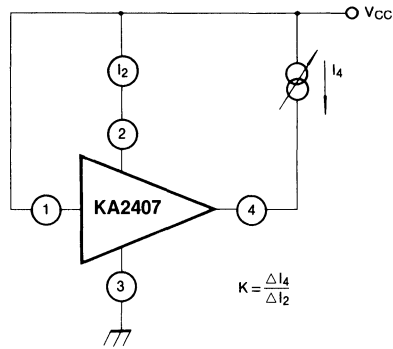


Fig. 3

$$K, \frac{\Delta K}{K}, \frac{\Delta K}{V_{CC}}, \frac{\Delta K}{I_4}, \frac{\Delta K}{T_a}$$

$$K = \frac{\Delta I_4}{\Delta I_2}$$

TEST CIRCUIT 3

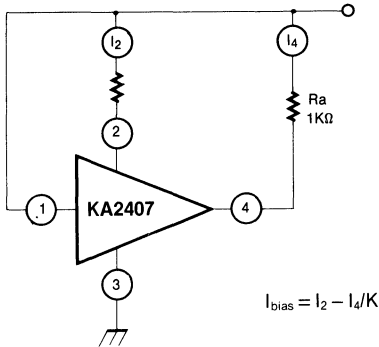


Fig. 4

$$I_{bias} = I_2 - I_4/K$$

APPLICATION CIRCUIT

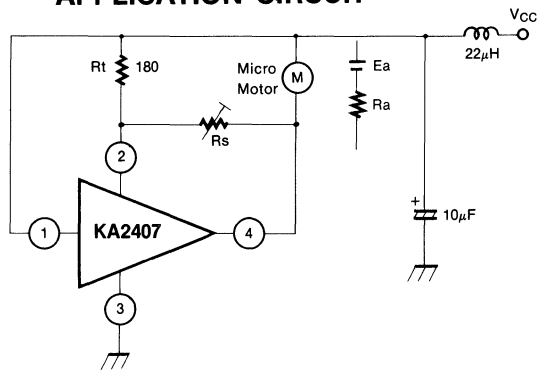
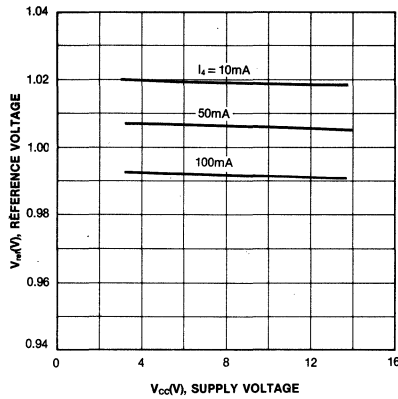


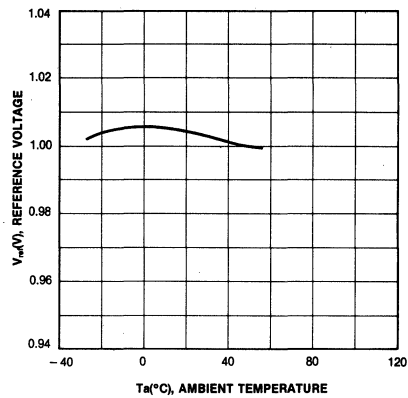
Fig. 5

- * Motor Constant Ka: Electromotive force constant = 1.1mV/rpm
- Ra = Internal Resistance = 5Ω
- Kr: Torque Constant = 100g.cm/A

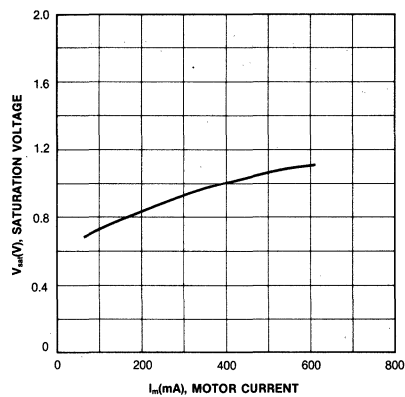
REFERENCE VOLTAGE-SUPPLY VOLTAGE



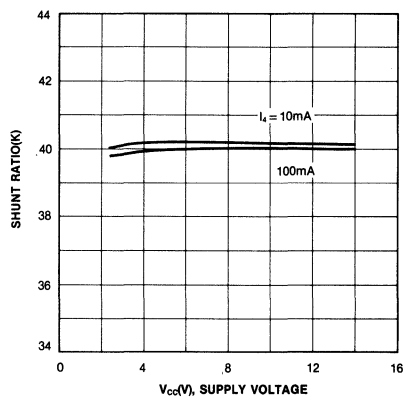
REFERENCE VOLTAGE-AMBIENT TEMPERATURE



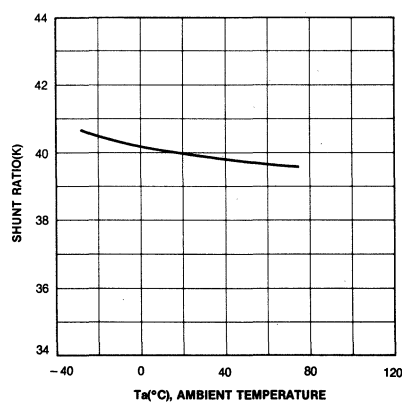
SATURATION VOLTAGE-MOTOR CURRENT



SHUNT RATIO-SUPPLY VOLTAGE



SHUNT RATIO-AMBIENT TEMPERATURE



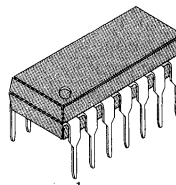
DUAL EQUALIZER AMPLIFIER WITH ALC

The KA7226 is a monolithic integrated circuit consisting of dual equalize amplifier with ALC. It is suitable for use in a record/playback amplifie of stereo radio cassette.

FEATURES

- Dual equalizer amplifier with ALC circuit
- Built-in buffer amplifier
- Non necessary the input coupling capacitor
- Quick stabilization after power on
- High output voltage: $V_o = 1.7V$ (Typ) at THD = 1%
- Wide operating supply voltage range: $V_{CC} = 3V \sim 16V$

14 DIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA7226	14 DIP	- 25 ~ + 75 °C

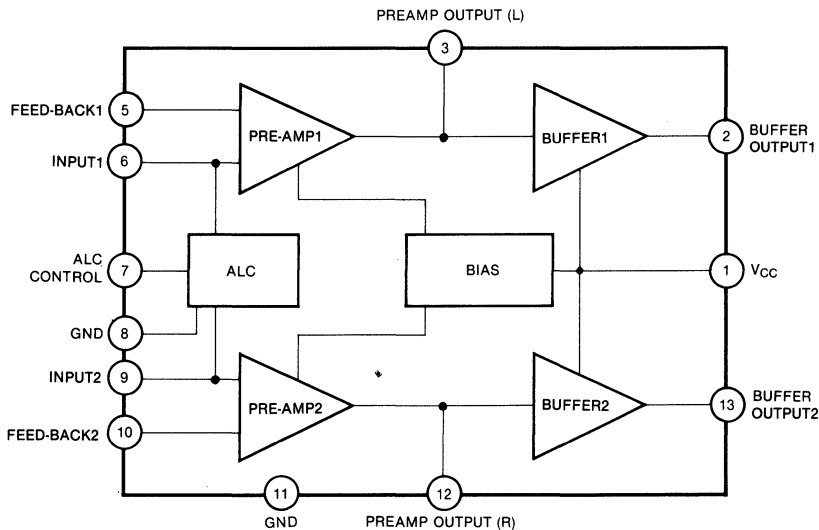


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Output Current (Buffer AMP: Pin 2, 13)	I_2, I_{13}	3	mA
Output Current (Pre AMP: Pin 6, 9)	I_6, I_9	2	mA
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-25 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

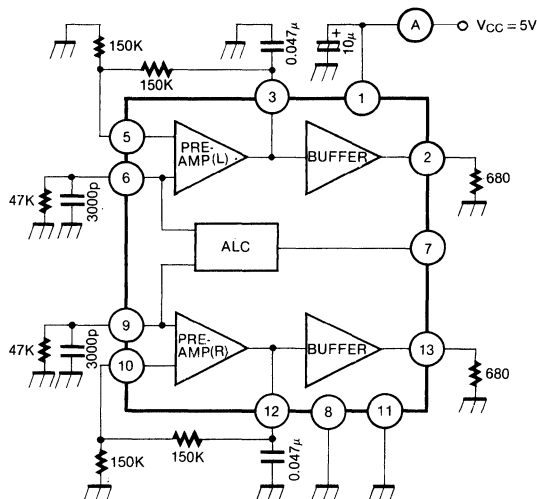
* : Derated above $T_a = 25^\circ\text{C}$ in the propotion of $5\text{mW}/^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Circuit
Quiescent Circuit Current	I_{CC}	$V_i = 0$	6	10	15	mA	1
Input Terminal DC Voltage	V_6, V_9			20	100	mV	1
Output Terminal DC Voltage	V_3, V_{12}		2.2	2.5	2.8	V	1
Buffer Output DC Voltage	V_2, V_{13}		1.4	1.7	2	V	1
ALC Bias Voltage	V_7		0.4	0.55	0.7	V	1
ALC ON Voltage	V_i (ALC)	$V_7 = 1.4\text{V}$		5	30	mV	1
ALC Range	ALC (R)	$V_i = -60\text{dBm}$	35	40		dB	2
ALC Level	ALC (L)	$V_i = -20\text{dBm}$	-3	-1	1	dBm	2
Total Harmonic Distortion	ALC (THD)	$V_i = -20\text{dBm}$		0.6	2.0	%	2
ALC Balance	ALC (B)	$V_i = -20\text{dBm}$		0	2	dB	2
Output Voltage	V_o	THD = 1%	1.3	1.7		V	2
Cross Talk	CT	$R_g = 2.2\text{K}\Omega$, $V_o = 0\text{dBm}$	40	60		dB	2
Open Loop Voltage Gain	A_{VO}	$V_i = -80\text{dBm}$	67	75		dB	2
Equivalent Input Noise Voltage	V_{NI}	$R_g = 2.2\text{K}\Omega$		1.3	2.7	μV	2

TEST CIRCUIT 1



TEST CIRCUIT 2

Fig. 2

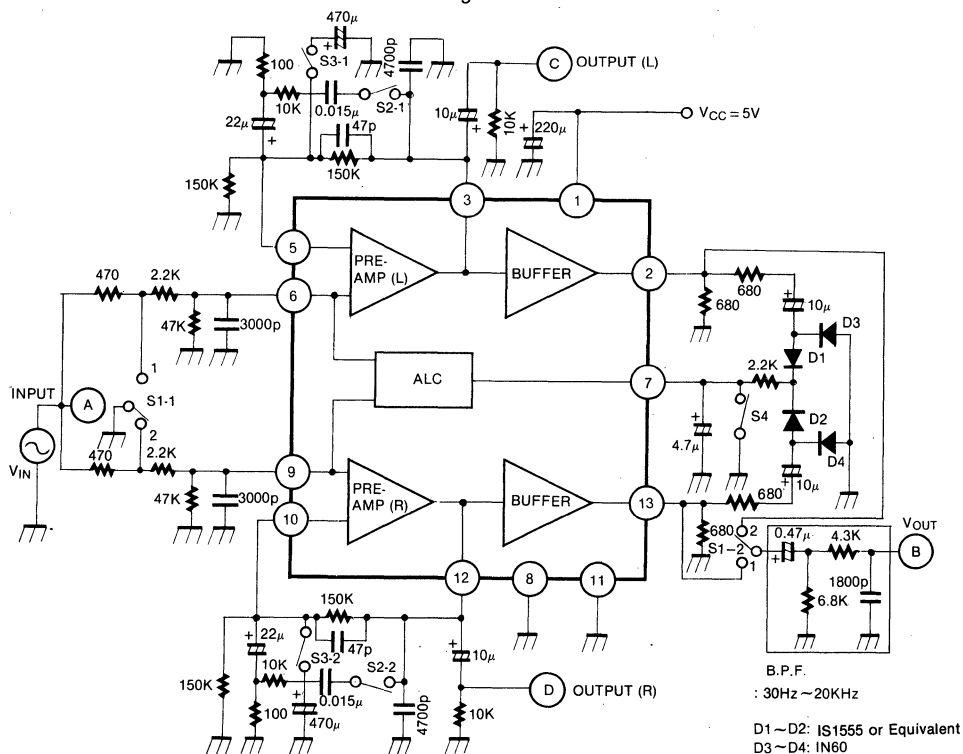
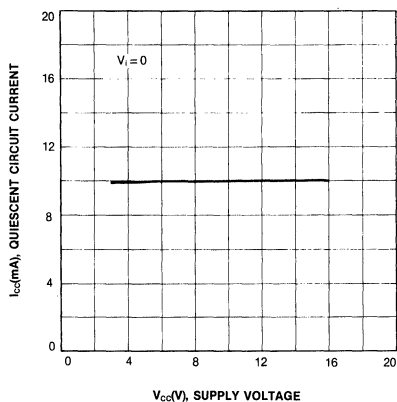


Fig. 3

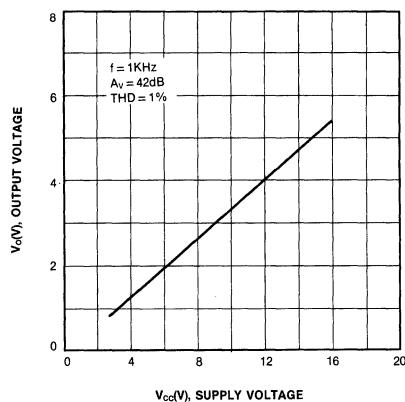
Symbol	S1		S2	S3	S4	Test Point	Test Method
G_{VO}	1	2	OFF	ON	ON	A.C.D.	$G_{VO} = 20 \log V_O/V_I$ (dB) with input voltage V_I , output voltage at V_O
V_O (ALC)	1	2	OFF	OFF	OFF	B	Measure output voltage V_O at input voltage $V_I = -20$ dBm
THD (ALC)	1	2	OFF	OFF	OFF	B	Measure distortion factor at input voltage $V_I = -20$ dBm
V_{NI}	1 = 1 2 = 2	1 = 2 2 = 1	ON	OFF	ON	B	Convert output noise voltage at 1KHz gain when $R_0 = 2.2K\Omega$
V_{OM}	1	2	ON	OFF	ON	C, D	Measure output voltage V_O at THD = 1%
CT	1	2	ON	OFF	ON	B	Measure crosstalk of amplifier 1, 2 at output voltage $V_O = 0$ dBm
ALC Range	1	2	OFF	OFF	OFF	B	Input voltage range from $V_I = -60$ dBm to output voltage V_O 3dB up
ALC Balance	1	2	OFF	OFF	OFF	B	Output voltage V_O level difference of amp 1, 2 when $V_I = -20$ dBm is applied

[illegible]

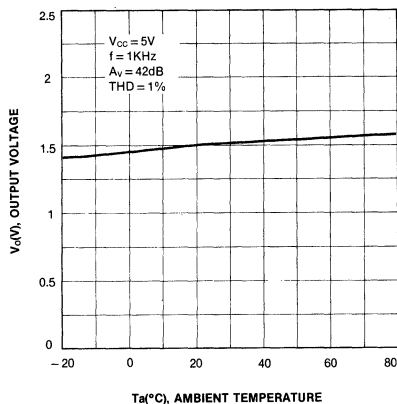
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



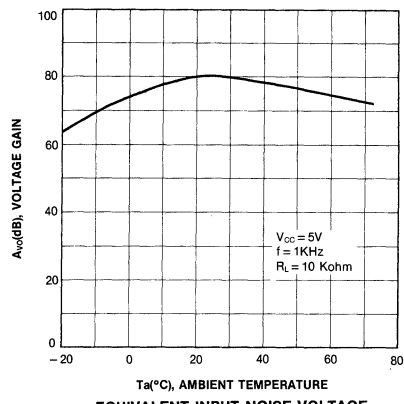
OUTPUT VOLTAGE-SUPPLY VOLTAGE



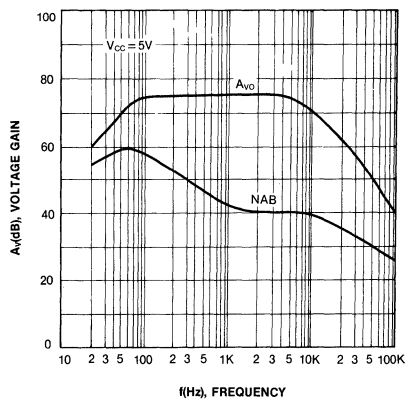
OUTPUT VOLTAGE-AMBIENT TEMPERATURE



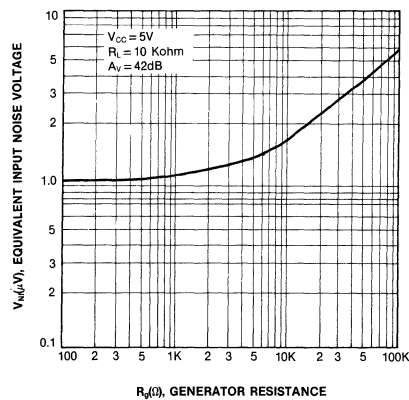
VOLTAGE GAIN-AMBIENT TEMPERATURE



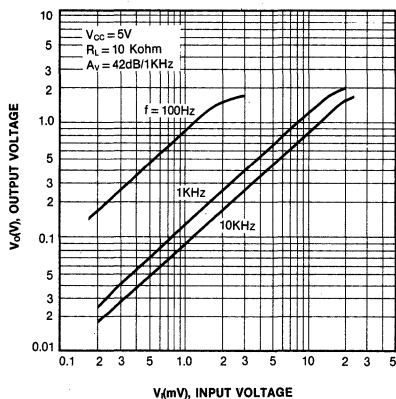
VOLTAGE GAIN-FREQUENCY



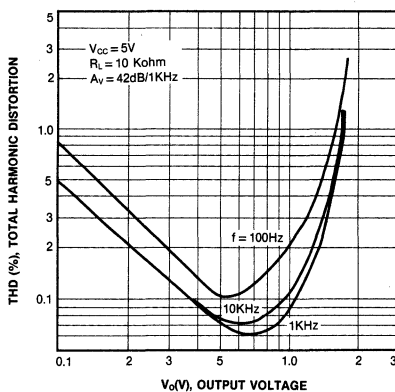
EQUIVALENT INPUT NOISE VOLTAGE-GENERATOR RESISTANCE



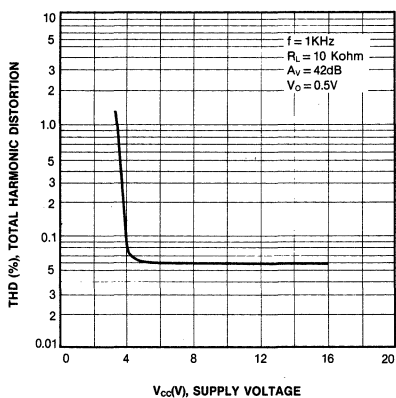
OUTPUT VOLTAGE-INPUT VOLTAGE



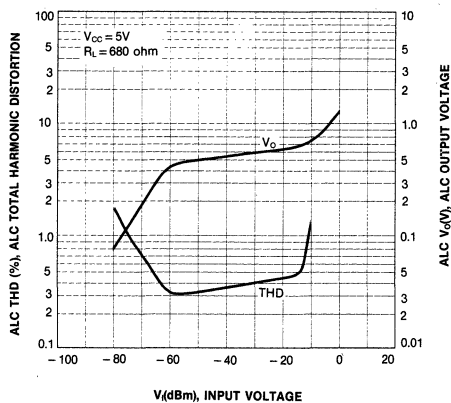
TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE



TOTAL HARMONIC DISTORTION-SUPPLY VOLTAGE



ALC OUTPUT VOLTAGE ALC TOTAL HARMONIC DISTORTION-INPUT VOLTAGE



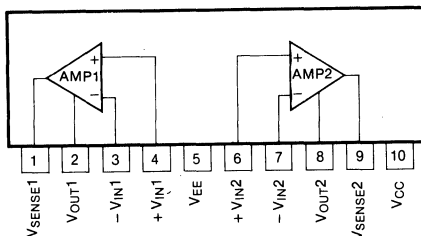
DUAL POWER OPERATIONAL AMPLIFIER

The KA9256 is a dual power operational amplifier and its output maximum current is 1.0A ($V_S = \pm 15V$). It can be used in arm driver for player, driver for brush motors forward and reverse rotation control and output driver for hole motor.

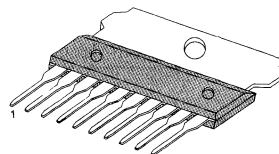
FEATURES

- Internal current limiting: $I_{SC} = 350mA$ ($R_{SC} = 2.2$)
- High output current: $I_o = 500mA$ max
- 10 SIP H/S package
- Internal phase compensation type

BLOCK DIAGRAM



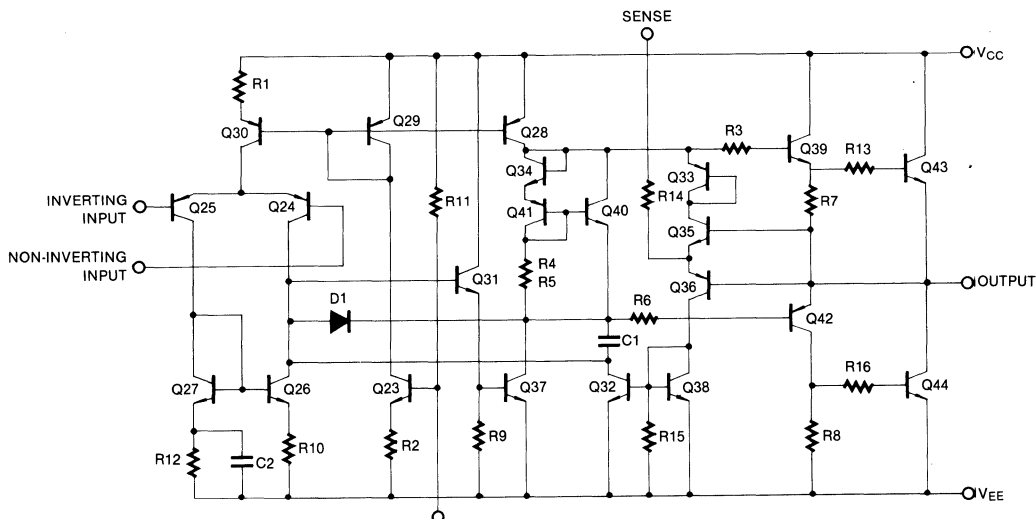
10 SIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA9256	10 SIP H/S	-25 ~ +75°C

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristics	Symbol	Value	Unit
Supply Voltage	V_S	± 18	V
Output Current	I_o	1.0	A
Power Dissipation	P_o	12.5	W
Operating Temperature Range	T_{opr}	$-25 \sim +75$	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	$-65 \sim +150$	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS

(V_{CC} = +15V, V_{EE} = -15V, T_a = 25 $^{\circ}\text{C}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}			2	6	mV
Input Offset Current	I_{IO}			10	200	nA
Input Bias Current	I_{IB}			100	700	nA
Supply Current	I_S			10	20	mA
Output Voltage Swing	V_{OUT}	$R_L = 33\Omega$	± 12	± 13		V
Large Signal Voltage Gain	A_V			100		dB
Input Voltage Range	V_{ICR}		± 12	± 14		V
Common Mode Rejection Ratio	CMRR		70	90		dB
Power Supply Rejection Ratio	PSRR			50	150	$\mu\text{V/V}$
Bandwidth	BW			1.0		MHz
Slew Rate	SR	$A_V = 1, R_L = 33\Omega, R = 10\Omega, C = 0.1\mu\text{F}$		0.15		V/ μs
Limiting Current	I_{OS}	$R_{SC} = 2.2\Omega$		0.35		A
Cross Talk	CT	$R_L = 33\Omega, V_o = 1V_{pp}$		60		dB

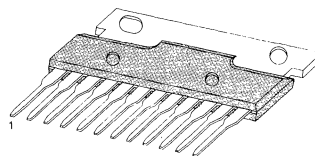
DUAL POWER OPERATIONAL AMPLIFIER

The KA9257, a monolithic integrated circuit, is a dual power operational amplifier with maximum output current of 0.5A. Since it consists of balance transless, both forward and reverse operation of the motor can be a achieved on a single power. The device is suitable for a CD player.

FEATURES

- 2 channel BTL driver
- Low input bias ($I_{IB} = 30nA$)
- Built in phase compensation capacitor
- Housed in a 12SIP H/S package for easy heat discharge
- Improved crosstalk: ($CT = 80dB$)
- High output current: ($I_O = 0.5A$)

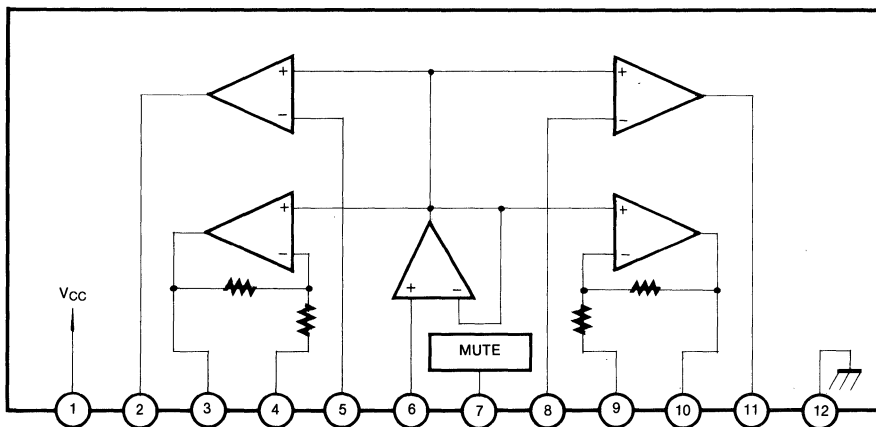
12 SIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA9257	12 SIP H/S	-25 ~ +75°C

BLOCK DIAGRAM



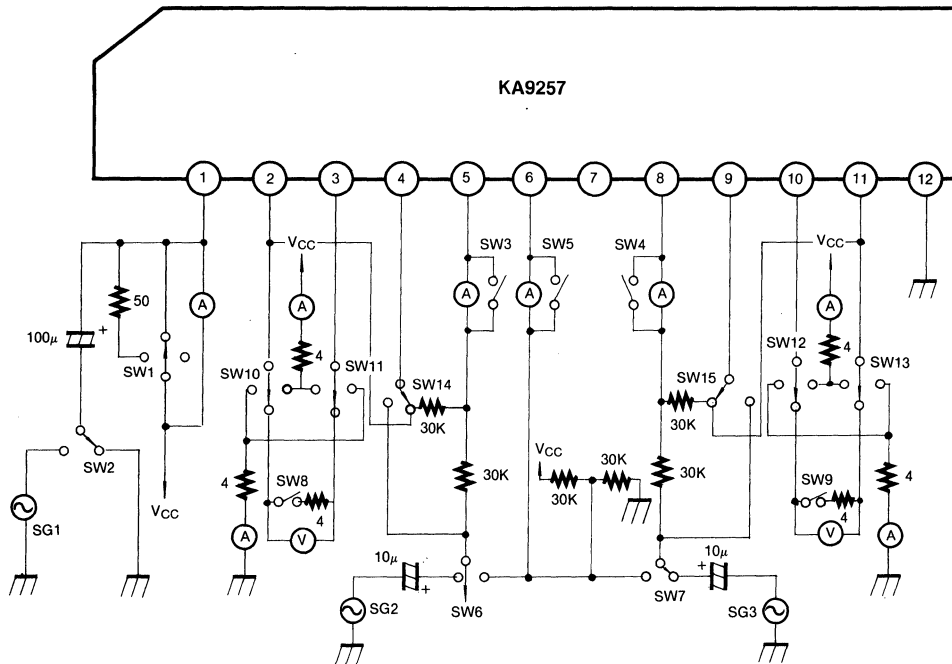
ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Power Dissipation	P_d	15	W
Operating Temperature	T_{opr}	$-25 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

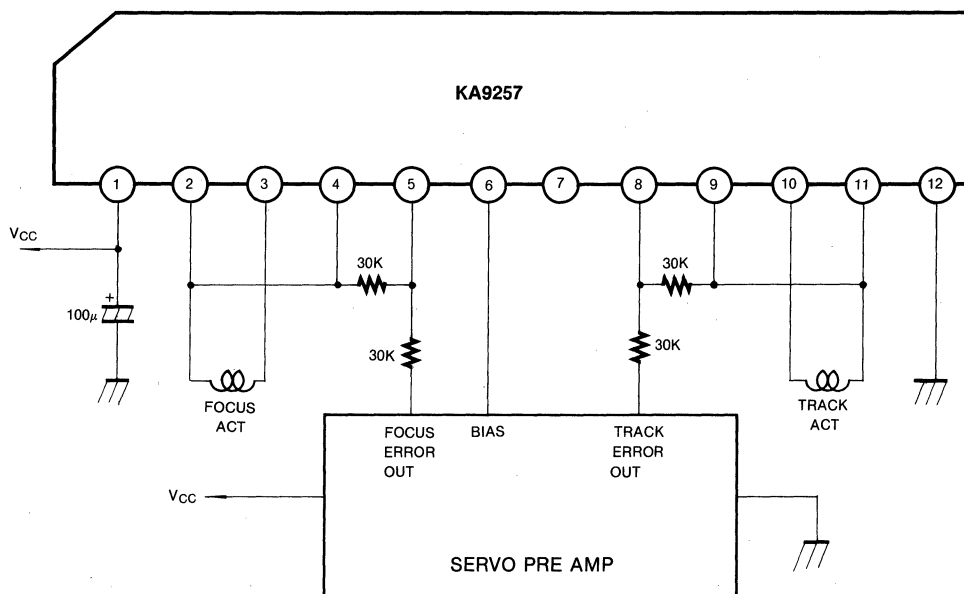
ELECTRICAL CHARACTERISTIC($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f = 1\text{KHz}$, $R_L = 4\text{ohm}$, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_{in} = 0$	—	3	10	mA
Input Bias Current	I_{ib}	$V_{in} = 0$	—	30	100	nA
Input Bias Pin Current	I_b	$V_{in} = 0$	—	100	300	nA
Output Offset Voltage	V_{oo}	$V_{in} = 0$	-50	0	50	mV
Maximum Source Current	I_{sou}	$R_L = 4\text{ohm}$, $V_{out} = \text{GND}$	0.7	1.4	—	A
Maximum Sink Current	I_{snk}	$R_L = \text{ohm}$, $V_{out} = V_{CC}$	0.4	0.8	—	A
Maximum Output Voltage	V_{om}	$V_{in} = 2V_{rms}$	1.8	2.5	—	V_{rms}
Closed Loop Gain	A_{vc}	$V_{in} = 0.1V_{rms}$	5.0	6.0	7.0	dB
Cut-off Frequency	f_T	$V_{in} = 0.1\text{rms}$, 3dB Down	15	20	—	KHz
Cross-Talk	CT	$V_{in} = 0.1\text{rms}$, BPF: 20-20KHz	40	80	—	dB
Ripple Rejection Ratio	RR	$V_{RR} = 0.1V_{rms}$ $F_{RR} = 120\text{Hz}$	30	40	—	dB
Slew-Rate	SR	$V_{in} = 0.3V_{pp}$ squarwave	—	0.3	—	$\text{V}/\mu\text{S}$

TEST CIRCUIT



APPLICATION CIRCUIT



Precautions

1. In designing the board, minimum 6cms of segregation should be allowed between motor drive ICs (KA9257, KA9256) and other components such as Micom and/or Recorder/Player ICs.
2. To get stable supply of voltage and shield effect of radiation, the CD Deck needs to be grounded.

LOW VOLTAGE AUDIO POWER AMPLIFIER

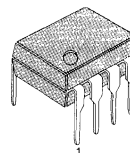
The LM386/S/D is a power amplifier designed for use in low voltage consumer applications. The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value up to 200.

The inputs are ground referenced while the output is automatically biased to one half the supply voltage. The quiescent power drain is only 30 milliwatts when operating from a 6 volt supply, making the LM386 ideal for battery operation.

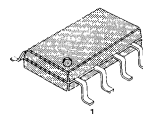
FEATURES

- Battery operation.
- Minimum external parts.
- Wide supply voltage range: 4V ~ 12V (LM386)
4V ~ 9V (LM386S/D)
- Low quiescent current drain (4mA.)
- Voltage gains : 20 ~ 200.
- Ground referenced input.
- Self-centering output quiescent voltage.
- Low distortion.
- 3 kinds of package types
LM386 (8 Dip), LM386S (9 Sip), LM386D (8 Sop)

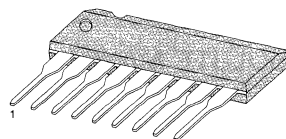
8 DIP



8 SOP



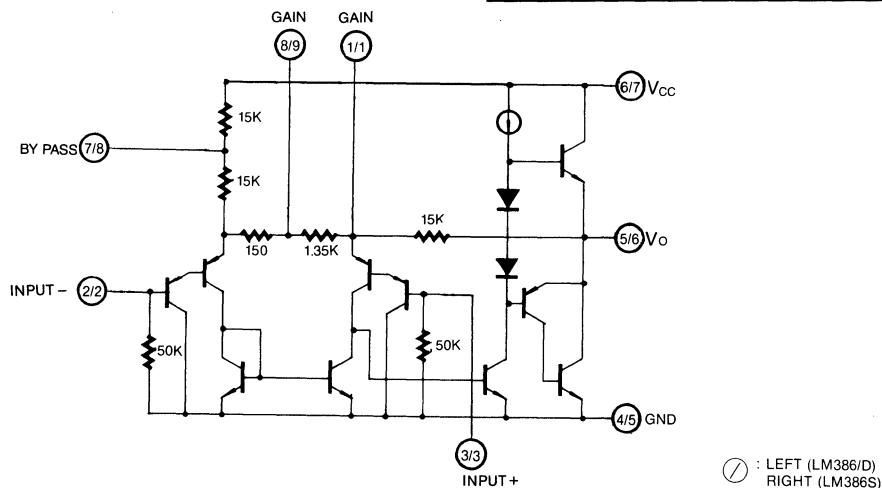
9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
LM386	8 DIP	- 20 ~ + 70°C
LM386S	9 SIP	
LM386D	8 SOP	
LM386G	PELLET	

SCHEMATIC DIAGRAMS



CONNECTION DIAGRAM

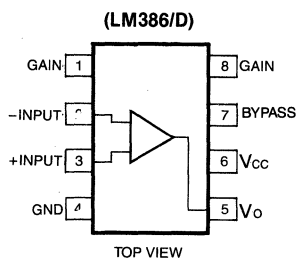


Fig. 2

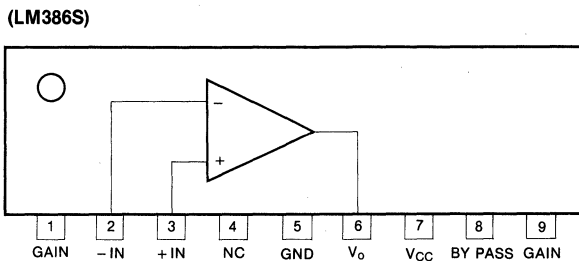


Fig. 3

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic		Symbol	Value	Unit
Supply Voltage		V_{CC}	15	V
Power Dissipation	LM386	P_d	660	mW
	LM386S		500	
	LM386D		300	
Input Voltage		V_i	± 0.4	V
Operating Temperature		T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature		T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$, $R_L = 8\Omega$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_i = 0$		4	8	mA
Output Power	P_o	$V_{CC} = 6\text{V}$, THD = 10%	250	325		mW
		$V_{CC} = 9\text{V}$, THD = 10%	500	700		mW
Voltage Gain (D-Type)	A_v	Pins 1 and 8 Open		26		dB
		$10\mu\text{F}$ from Pin 1 to 8		46		
Bandwidth (D-Type)	BW	Pins 1 and 8 Open		300		KHz
		$10\mu\text{F}$ from Pin 1 to 8		60		
Total Harmonic Distortion (D-Type)	THD	$P_o = 125\text{mW}$, Pins 1 and 8 Open		0.2		%
Input Resistance	R_i			50		K Ω
Input Bias Current	I_b	Pins 1 and 8 Open		250		nA

TYPICAL APPLICATIONS (LM386)

Amplifier with Gain=50 (34 dB)

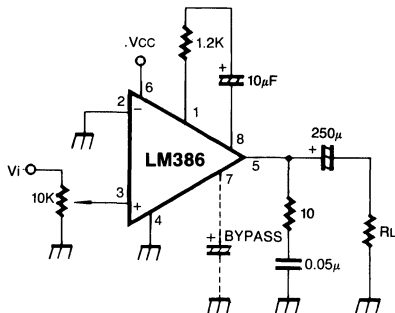


Fig. 4

Low Distortion Power Wienbridge Oscillator

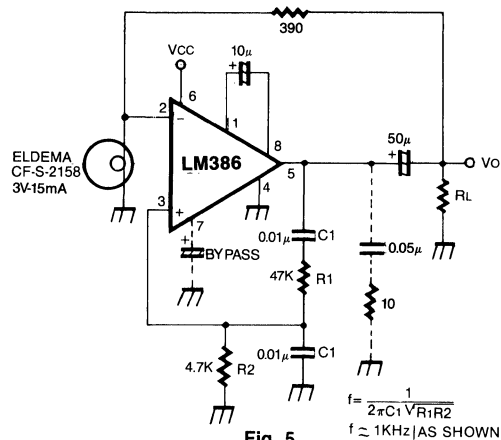


Fig. 5

Square Wave Oscillator

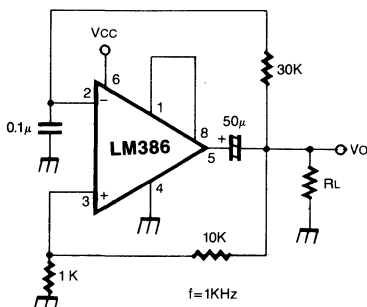


Fig. 6

Amplifier with Bass Boost

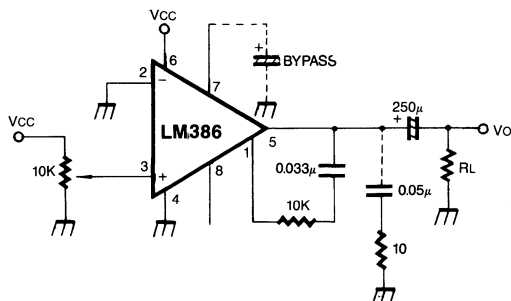


Fig. 7

AM Radio Power Amplifier

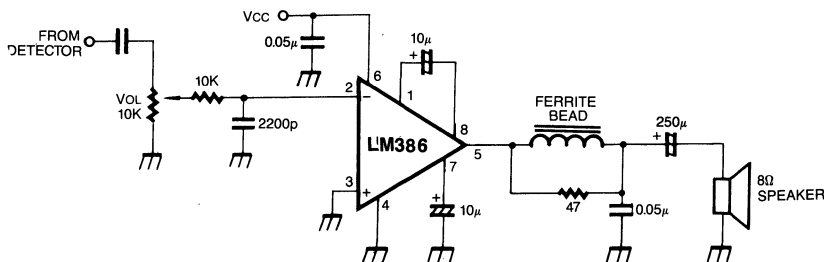
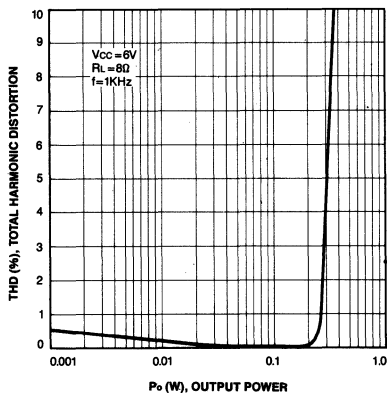
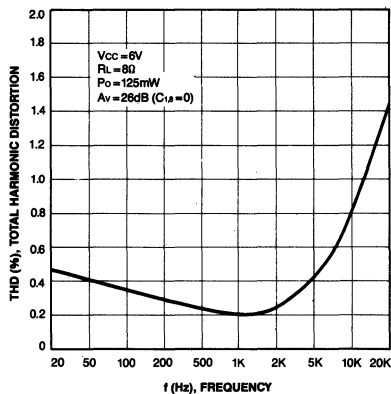


Fig. 8

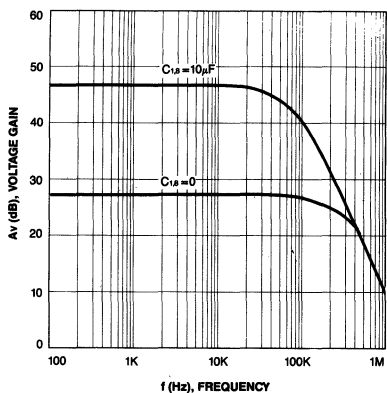
TOTAL HARMONIC DISTORTION-OUTPUT POWER



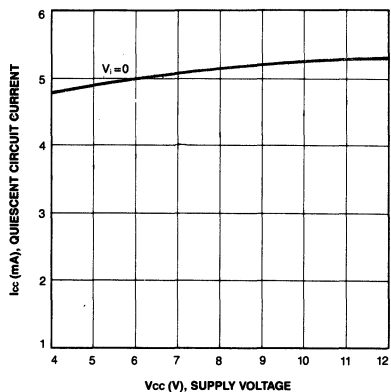
TOTAL HARMONIC DISTORTION-FREQUENCY



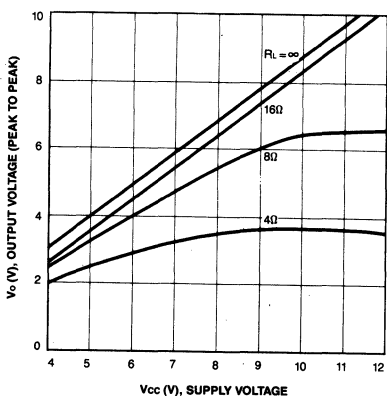
VOLTAGE GAIN—FREQUENCY



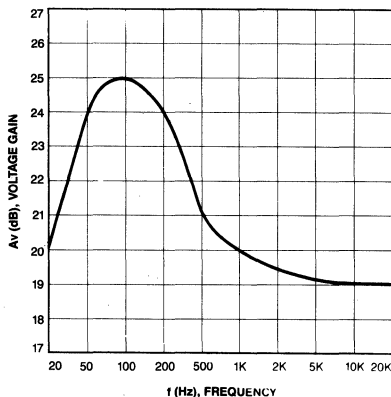
QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE



OUTPUT VOLTAGE SWING-SUPPLY VOLTAGE



FREQUENCY RESPONSE WITH BASS BOOST





VIDEO ICs 4

Video Application

Device	Function	Package	Page
KA2101	TV Sound IF Amplifier	14 DIP	443
KA2102A	TV Sound System	14 DIP H/S	448
KA2103L	Sound Mute System TV	8 SIP	452
KA2104	Auto Power Off and Sound Mute System for TV	9 SIP	455
KA2105	Limiter Amplifier and Detector for A TV SIF	9 SIP	459
KA2106	Dual Sound Multiplex for A TV SIF	16 DIP	463
KA2107	DC Volume Tone Control Circuit	12 SIP	467
KA2130A	TV Vertical Deflection System	10 SIP H/S	471
KA2131	TV Vertical Output Circuit	9 SIP H/S	474
KA2133	1 Chip Deflection System	16 DIP H/S	478
KA2134	Color TV Deflection Signal Processing IC	18 DIP	482
KA2135	Horizontal Signal Processing	12 SIP	487
KA2136	Low-Noise TV Vertical Deflection System	12 ZDIP/F	491
KA2137	TV Horizontal Processor	16 DIP	498
KA2138	Deflection Processor for CRT Display	20 DIP	509
KA2153	Video-Chroma Deflection System for A Color TV (NTSC)	42 DIP	513
KA2154	Video-Chroma-Deflection System for Color Television (PAL/NTSC)	42 DIP	524
KA2155/56	Video Chroma Deflection System for A Color TV (NTSC)	30 SDIP	545
KA2181	Remote Control Preamplifier	8 SIP	551
KA2182/83	Remote Control Preamplifier	8 SIP	554
KA2184	Remote Control Preamplifier	8 SIP	557
KA2186	Video Switching Circuit for TV	8 DIP	561
KA2268N	One Chip TV Sound MPX (Korea Two Carrier System)	28 DIP	563
KA22682	One Chip TV MPX Demodulator (Korea Two Carrier System)	28 DIP	571
KA2269	TV Sound MPX for USA	42 SDIP	579
KA2270	Noise Reduction System for TV Sound	16 DIP	592
KA2605	Sync Separator I	9 SIP	596
KA2606	Sync Separator II	9 SIP	600
KA2615/16	LED and Lamp Driver	9 SIP	607
KA2617/18	LED and Lamp Driver	9 SIP	607
KA2911/16	Video IF System for Color TV	16 DIP	611
KA2912	Video IF Processor for B/W TV	14 DIP H/S	616
KA2913A/17	Video and Sound IF Amplifier for Monochrome TV Receivers	16 DIP	620
KA2914A/18	Video IF + SIF System	24 DIP	629
KA2915	TV VIF & SIF & Deflection System (IC for TV Large Integration)	28 DIP	644
KA2919	(VIF + SIF) System for Color TV	30 SDIP	650
KA2922/23	Video & Sound IF Amplifier for TV Sets VTR's	20 DIP	655
KA2944	Write & Read Amplifier	28 DIP	660
KA2945	Video Amplifier	28 DIP	667
KA2981	VHF Band RF Modulator	16 DIP	673
KA2983	Switchless Recording/Playback Amplifier	18 DIP	680
KA2988	Chroma Signal Processor	28 DIP	683
KA6101/02	Analog Interface Circuit for Teletext System	18 DIP	688
KA6201	Flexible Disk Read Amplifier	18 DIP	694
KA6202	Two Phase Stepping Motor Driver	16 DIP	705
KA8101	Detail Enhancer	9 SIP	709
KA8102	Write & Read Amplifier	22 SDIP	712
KA8103	Luminance Processor	48 SDIP	717
KA8104	Chrominance Processor	30 SDIP	725
KA8301	Motor Driver for VTR	10 SIP H/S	734
KA8302/12	Servo Control AMP	12 SIP	740
KA8303	VTR Digital Servo Controller	42 SDIP	744
KA8304	2-Phase DD Motor Driver	12 SIP H/S	753
KA8306	Dual Bridge Driver	10 SIP H/S	761
KA8308	1-Chip Digital Servo Controller for VTR	30 SDIP	768
KA8401	Switchless Recording/Play Back Amplifier	24 ZIP	775
KA8402	2-Input Switch	7 SIP	781
KA8403	3-Input Switch	9 SIP	786
KS5410	Remote Control Transmitter	20 SOP	789
KS5803/B	Remote Control Transmitter	16 DIP/20 SOP	799

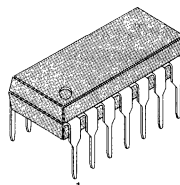
TV SOUND IF AMPLIFIER

The KA2101 is a monolithic integrated circuit for TV sound IF amplifier. It contains a IF amplifier, IF limiting, detection, electronic attenuation, audio amplifier and audio driver capabilities.

FEATURES

- Electronic attenuator replaces conventional DC volume.
- Differential peak detector requires one single tuned coil.
- Internal zener diode regulated supply.
- High stability.
- Excellent AM rejection at 4.5 MHz, 5.5 MHz, 6.0 MHz, 6.5 MHz.
- Low harmonic distortion.
- High sensitivity 200 μ V limiting at 4.5 MHz.
- Audio driver capability 6.0 mA_{p.p.}
- Undistorted audio output voltage 7 V_{p.p.}
- Minimum undesirable output signal at maximum attenuation.

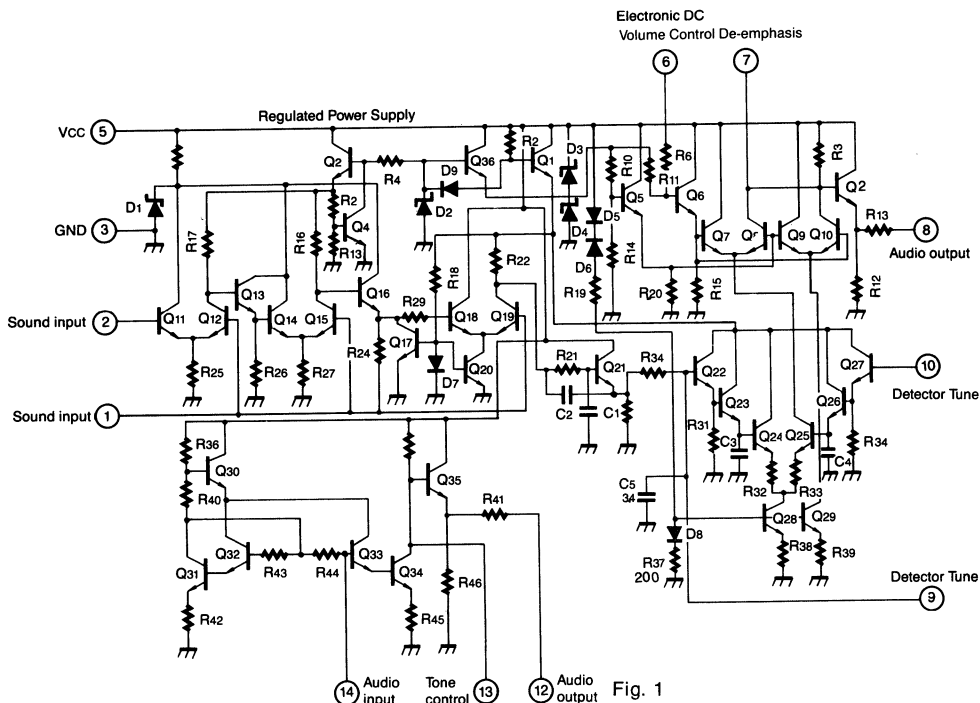
14 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2101	14 DIP	-20 ~ +75°C

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Input Signal Voltage (Pin 1, Pin 2)	V_{in}	± 3	V
Power Supply Current (Pin 5)	I_s (max)	50	mA
Total Power Dissipation	P_d	625	mW
Derate Above $T_a = 25^\circ\text{C}$		5.0	mW/ $^\circ\text{C}$
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-65 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 24\text{V}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Regulated Voltage (Pin 5)	V_5		10.3	11.5	12.2	V	
DC Supply Current (Pin 5)	I_s	$V_{CC} = 9\text{V}$ $R_S = 0$	10	13	24	mA	
Quiescent Output V_{tg} (Pin 12)	V_{12}		4.5	5.1	5.8	V	—
AM Rejection*	AMR	$V_{in} = 2, 10, 100\text{mV}$ $f_o = 4.5\text{MHz}$, $\Delta f = \pm 25\text{KHz}$	40	55	—	dB	4
Input Limiting Threshold Voltage	V_i (lim)	$f_o = 4.5\text{MHz}$, $\Delta f = \pm 25\text{KHz}$	—	200	400	μVrms	4
Recovered Audio Output Voltage	V_o (AF)	$V_{in} = 10\text{mV}$ $f_o = 4.5\text{MHz}$, $\Delta f = \pm 25\text{KHz}$	0.5	0.90	—	Vrms	4
Output Distortion	THD	$V_{in} = 10\text{mVrms}$	—	0.9	2	%	4
Input Resistance (Pin 1 & 2)	R_i (IF)	$f = 4.5\text{MHz}$	—	17	—	$\text{K}\Omega$	
Input Capacitance (Pin 1 & 2)	C_i (IF)	$f = 4.5\text{MHz}$	—	4	—	pF	
Output Resistance (Pin 9 & GND)	R_o (IF)	$f = 4.5\text{MHz}$	—	3.25	—	$\text{K}\Omega$	
Output Capacitance (Pin 9 & GND)	C_o (IF)	$f = 4.5\text{MHz}$	—	7.5	—	pF	
Output Resistance,	Pin 7	R_o	—	7.5	—	$\text{K}\Omega$	
	Pin 8		—	250	—	Ω	
Volume Reduction Range		DC Volume Control = ∞	60	—	—	dB	4
Maximum Undesirable Signal (Note 1)			—	0.02	1	mVrms	4
Audio Amplifier Voltage Gain	A (AF)	$V_{in} = 0.2\text{Vrms}$, $f = 400\text{Hz}$	17.5	20.5	—	dB	5
Total Harmonic Distortion (Pin 12)	THD	$V_o = 2\text{Vrms}$, $f = 400\text{Hz}$	—	1.5	—	%	5
Output Voltage (Pin 12)		THD = 5%, $f = 400\text{Hz}$	2	3.4	—	Vrms	5
Input Resistance (Pin 14 & GND)	R_i (AF)	$f = 400\text{Hz}$	—	70	—	$\text{K}\Omega$	
Output Resistance (Pin 12 & GND)	R_o (AF)	$f = 400\text{Hz}$	—	270	—	Ω	

* 100% FM, 30% AM

Note 1. Undesirable signal is measured at pin 8 when volume control is set for minimum output.

TEST CIRCUIT 1

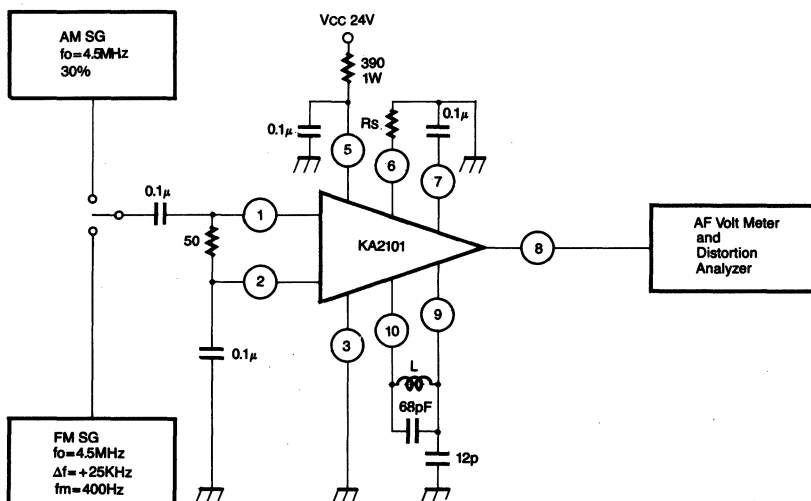


Fig. 4

TEST CIRCUIT 2

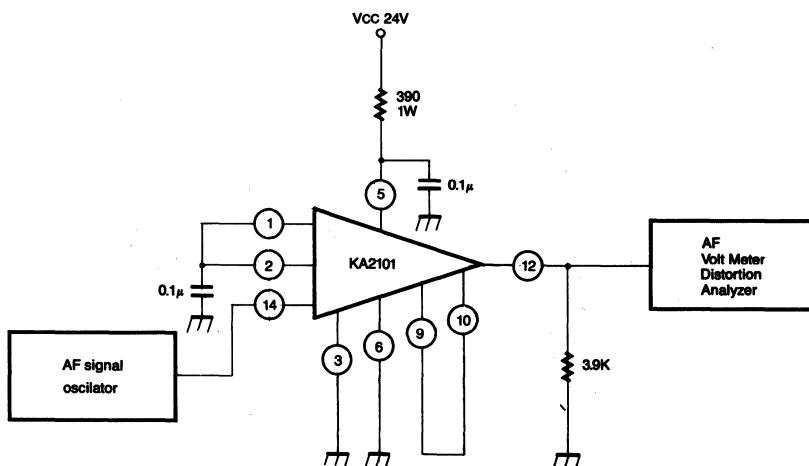


Fig. 5

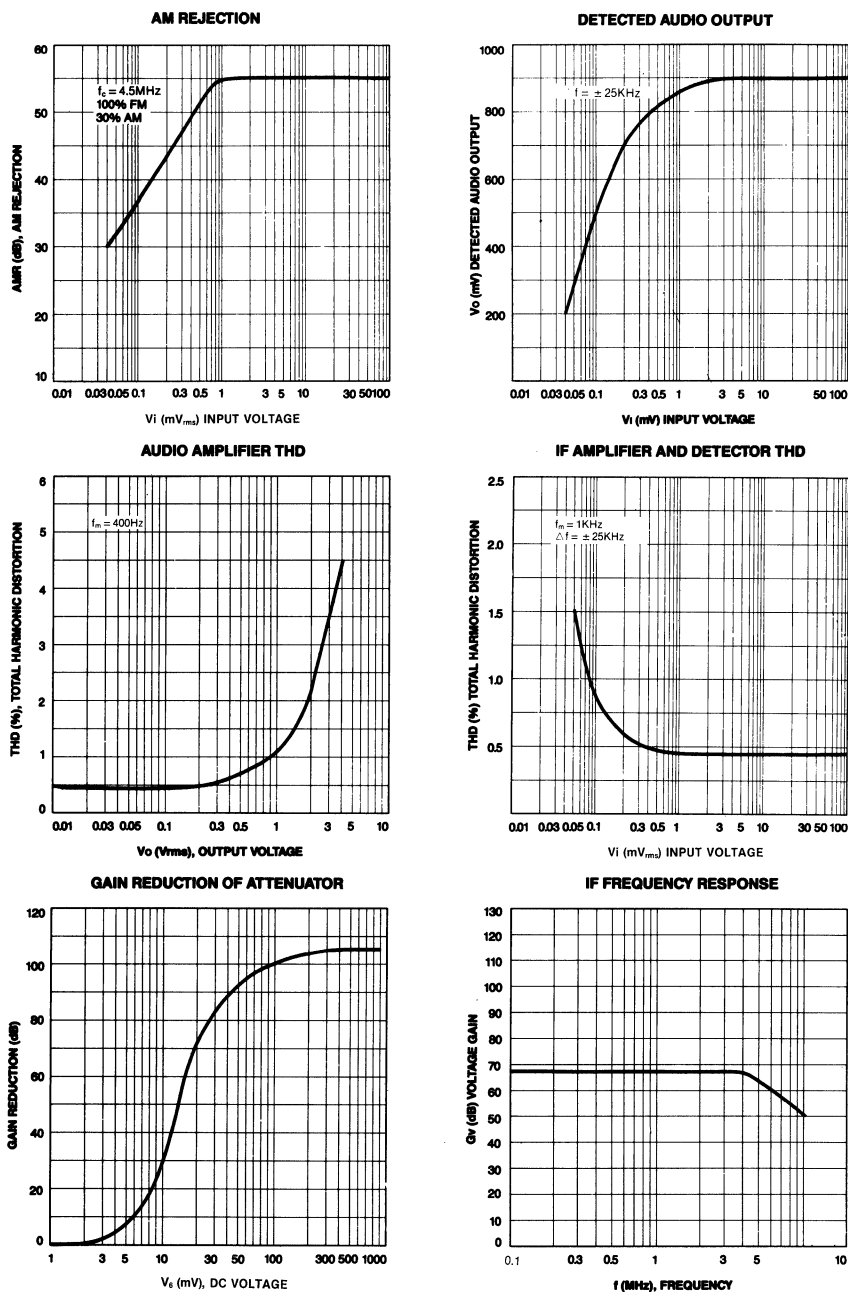


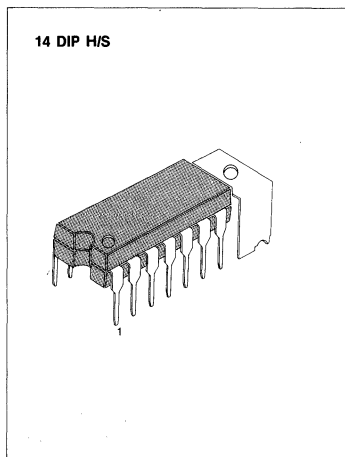
Fig. 6

TV SOUND SYSTEM

The KA2102A is a silicon monolithic integrated circuit designed for SIF and audio section in television receivers. This IC has all functions including sound IF amplifier, FM detector, DC volume control circuit, audio output amplifier with 2.4 Watts output power and voltage regulator. This IC is encapsulated in 14 pin dual in-line package with heat tab.

FEATURES

- Wide power supply range, 9V ~ 18V
2.4 Watt, at $V_{CC}=18V$, $R_L=8\Omega$ (For 17" TV)
1.2 Watt, at $V_{CC}=12V$, $R_L=8\Omega$ (For 12" TV)
- Linear volume control
- Low harmonic distortion
- Differential peak detector
- Enough attenuation (Typ. 80dB) by squelch circuit



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2102A	14 DIP H/S	-20 ~ +75°C

TYPICAL APPLICATION CIRCUIT

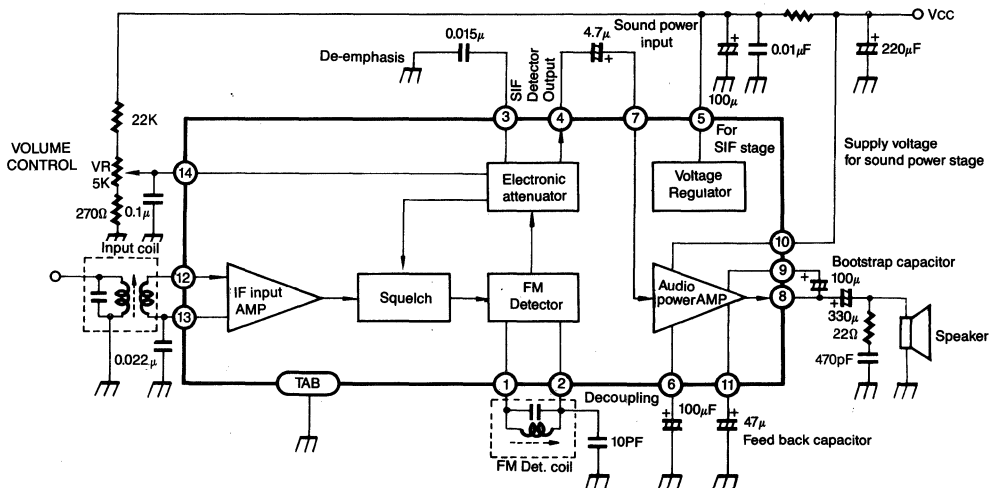


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage (Pin 10)	V_{10}	20	V
Supply Current (Pin 10)	I_{10}	1	A
Supply Current (Pin 5)	I_5	100	mA
Input Signal Voltage	V_i	3	V _{p-p}
Power Dissipation	P_{d1}	0.8 ($T_a = 75^\circ\text{C}$) free air	W
Power Dissipation	P_{d2}	1.4*	W
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

* Printed Circuit Copper Area $50 \times 50 \text{mm}^2$ ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)1. IF STAGE ($V_{CC} = 12\text{V}$, $R_B = 100\Omega$, $V_{14} \geq 1.3\text{V}$, $f_o = 4.5\text{MHz}$, $f_m = 400\text{Hz}$, $f = \pm 25\text{KHz}$, $R_g = 50\mu\Omega$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Pin 5 Voltage	V_{5A}		7.5	8.0	8.5	V
Pin 5 Voltage	V_{5B}	$V_{CC} = 18\text{V}$, $R_B = 330\Omega$	7.5	8.0	8.5	V
Pin 10 Current	I_{10A}	No Input Signal	14	19	24	mA
Pin 10 Current	I_{10B}	$V_{CC} = 18\text{V}$, $R_B = 330\Omega$ No Input Signal	16	28	35	mA
IF Limiting Voltage	V_i (lim)	V_{OAF} ($V_i = 10\text{mVrms}$). -3dB	—	200	400	μVrms
Detector Output Voltage	V_{OAF}	$V_i = 10\text{mVrms}$	300	360	—	mVrms
Detector Distortion	THD_1	$V_i = 10\text{mVrms}$	—	0.7	—	%
AM Rejection	AMR	AM Mod 30% $f_m = 400\text{Hz}$ $V_i = 10\text{mVrms}$	-40	-50	—	dB
Maximum Attenuation	ATTmax	$V_{14} = 0\text{V}$	-60	-80	—	dB

2. SOUND POWER STAGE ($V_{CC} = 12\text{V}$, $R_B = 100\Omega$, $R_L = 8\Omega$, $f = 400\text{Hz}$, $R_G = 600\Omega$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Sound Stage Voltage Gain	G_{VAF}	$V_i = 30\text{mVrms}$	33	37	41	dB
Sound Output Power	P_{oA}	$\text{THD} = 10\%$	0.9	1.2	—	W
Sound Output Power	P_{oB}	$V_{CC} = 18\text{V}$, $R_B = 330\Omega$ $\text{THD} = 10\%$	2.0	2.4	—	W
Sound Output Distortion	THD_{2A}	$P_o = 0.5\text{W}$	—	0.6	2.0	%
Sound Output Distortion	THD_{2B}	$V_{CC} = 18\text{V}$, $R_B = 330\Omega$ $P_o = 0.5\text{W}$	—	0.5	2.0	%
Overall Sound Output Distortion (IF + Sound Power Stage)	THD_3	$P_o = 0.5\text{W}$ $V_i = 10\text{mVrms}$	—	1.5	4.0	%

3. TYPICAL DATA

Characteristic	Symbol	Test Conditions	Value	Unit
Pin 10 Current	I_{10}	THD _{2A} = 10%	200-210	mA
Pin 10 Current	I_{10}	THD _{2B} = 10%	270-280	mA
Sound Output Power	PoA	THD = 3%	1.1	W
Sound Output Power	PoB	V _{CC} = 18V, R _B = 330Ω THD = 3%	2.0	W
Sound Stage Band Width	BW	-3dB	50 ~ 50K	Hz

TEST CIRCUIT

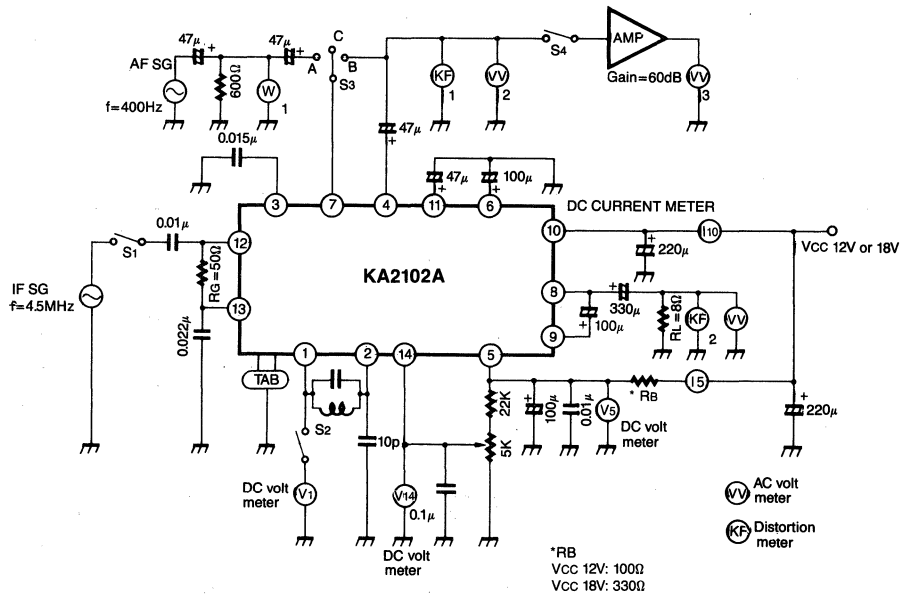
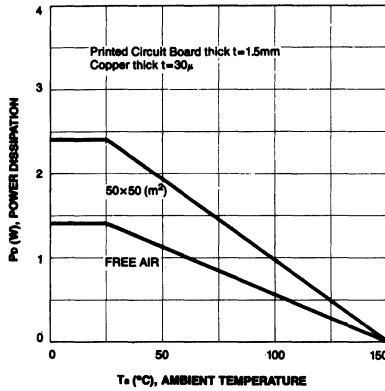
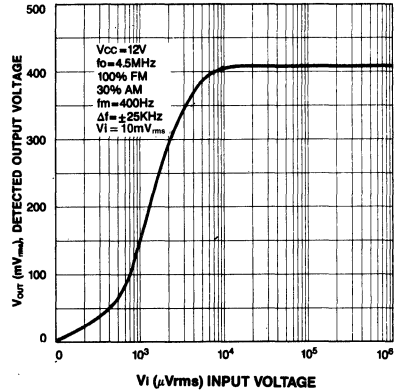


Fig. 2

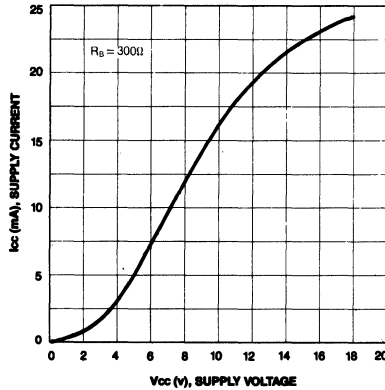
POWER DISSIPATION



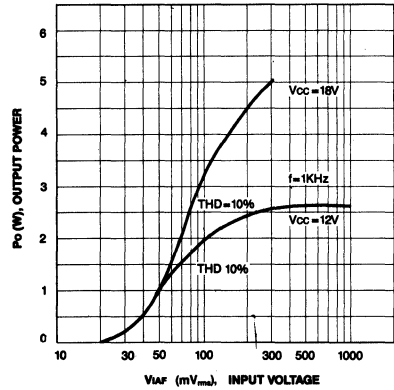
DETECTED OUTPUT VOLTAGE



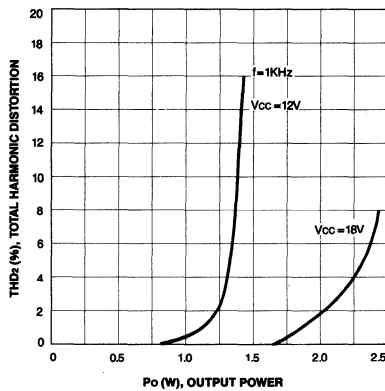
SUPPLY CURRENT



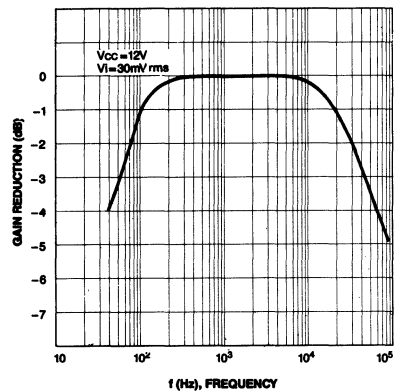
OUTPUT POWER (AUDIO AMPLIFIER)



TOTAL HARMONIC DISTORTION



FREQUENCY RESPONSE (AUDIO AMPLIFIER)



SOUND MUTE SYSTEM FOR TV

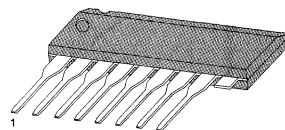
The KA2103L is a monolithic integrated circuit designed for noise sound muting in television receiver.

This IC has all functions including horizontal synchronizing detector, comparator and open collector output terminal.

FEATURES

- Wide operating voltage range.
- Small shock noise at the time of power on/off.
- Good noise sound muting characteristic.
- Capable of being connected to the other IC directed.
- Collector open output.
- Minimum number of external parts required.

8 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2103L	8 SIP	- 20 ~ + 70°C

BLOCK DIAGRAM

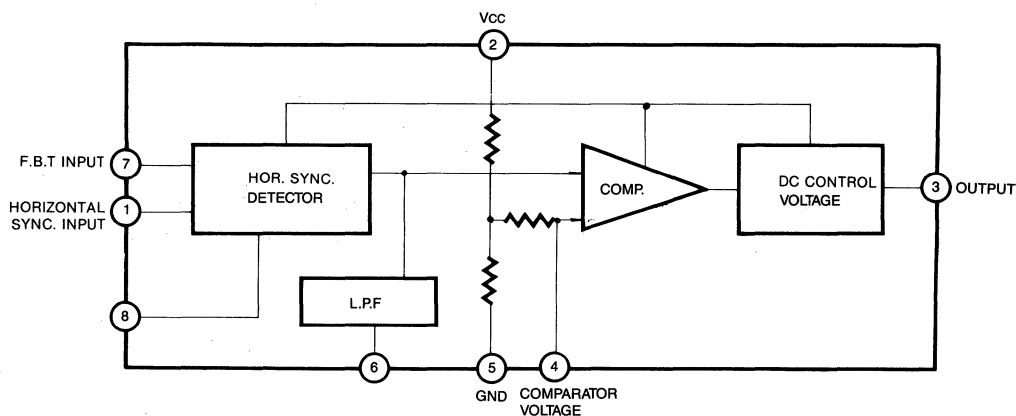


Fig. 1

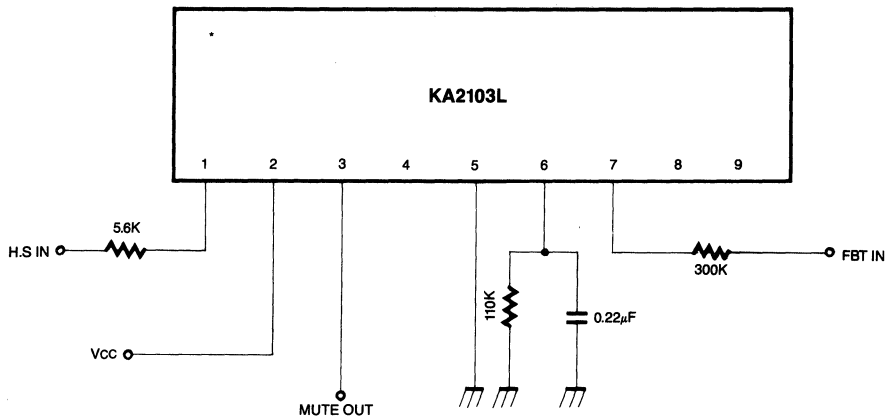
ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Comparator Difference	V_{COMP}	6	V
Power Dissipation	P_d	80	mW
Operating Temperature	T_{opr}	-20 ~ +70	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS ($T_a=25^{\circ}\text{C}$, $V_{CC}=12\text{V}$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}		3.5	5.0	9.0	mA
Input Voltage Level (FBT)	$V_{(FBT)}$	Pin 7	8.5	9	10	V_{P-P}
Input Voltage Level (HS)	$V_{(HS)}$	Pin 1	4.5	5	6	V_{P-P}
Output Saturation Voltage	$V_{(SAT)}$		—	0.33	0.8	V
L.P.F Output Current	I_{O1}		0.5	0.8	1.5	mA
Comparator Voltage Settling Range	BV_A	Pin 4	2	3	4	V
Comparator Voltage Settling Range	BV_B	Pin 8	6	9	10	V

TYPICAL APPLICATION CIRCUIT

**Note**

- F.B.T : Fly back transformer (C.R.T. Heater line)
(Television set F.B.T voltage=110 ~ 130V_{p.p})
- V_{CC} : D.C 12V
- Mute Out : Sound IC Audio signal input
(Active: High)
- H.S : Horizontal Sync (KA2153 Pin=37)
(Television set H.S voltage=8.2 ~ 8.7V_p)

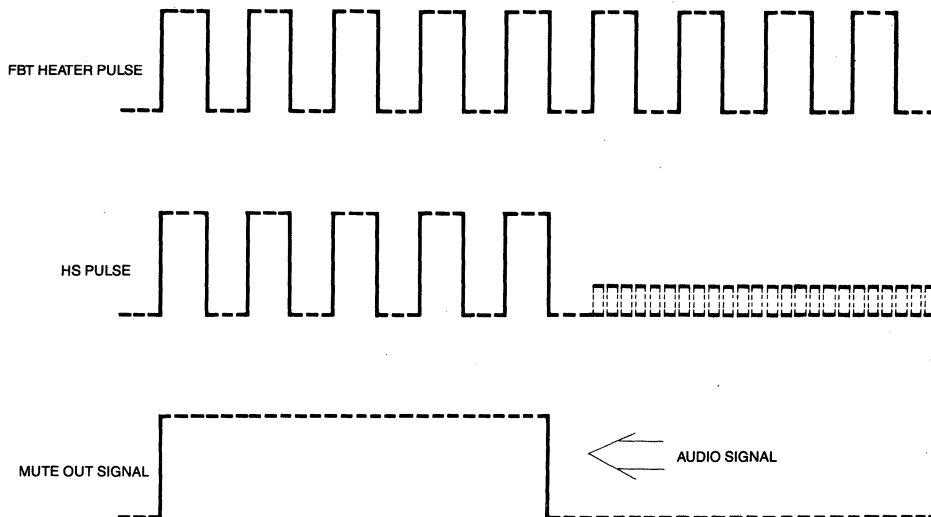
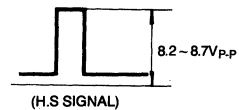
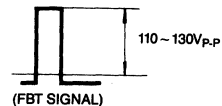


Fig. 2

AUTO POWER OFF AND SOUND MUTE SYSTEM FOR TV

The KA2104 is a monolithic integrated circuit designed for noise sound muting and auto power off when channel without broadcasting selected or broadcasting ended.

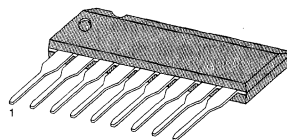
FUNCTIONS

- Horizontal Synchronizing State Detector.
- Comparator.
- Open Collector Output.
- Auto Power off control.

FEATURES

- Wide Operating Voltage Range.
- Good noise sound muting characteristic.
 - Pin 9: open collector out.
- Usable for all kind of TV system.
- Adjustable auto power off time.
- Minimum number of external parts required.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2104	9 SIP	-20 ~ +70°C

BLOCK DIAGRAM

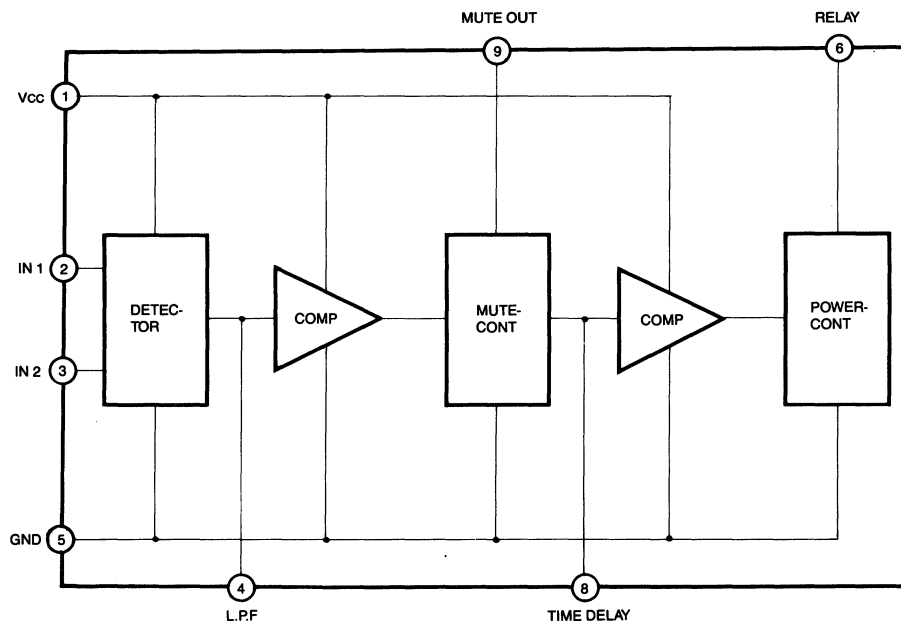


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Comparator Difference	V_{COMP}	6	Vpeak
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CC}	$V_{CC} = 12\text{V}$	5.0	7.0	9.0	mA
Input Threshold Voltage	$V_{th1} (p2)$	$V_{pin3} = 5\text{V}$	7.5	8.0	8.5	Vpeak
	$V_{th2} (p3)$	$V_{pin2} = 9\text{V}$	3.5	4.0	4.5	Vpeak
Output Saturation Voltage	$V_{sat1} (p6)$	$V_{pin2} = 9\text{V}, V_{pin3} = 5\text{V}$	—	0.5	1.0	V
	$V_{sat2} (p9)$	$V_{pin2}, 3 = 0\text{V}$	—	0.3	0.5	V
L.P.F Output Current	$I (L.P.F)$	$R_L = 150\text{k}\Omega$	50	80	100	μA
Time Delay Output Current	$I (T.D)$	$R_L = 150\text{k}\Omega$	50	80	100	μA

TEST CIRCUIT

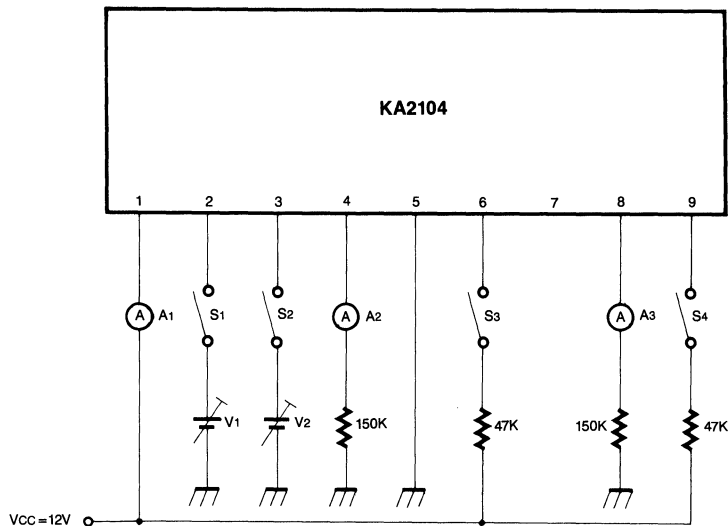
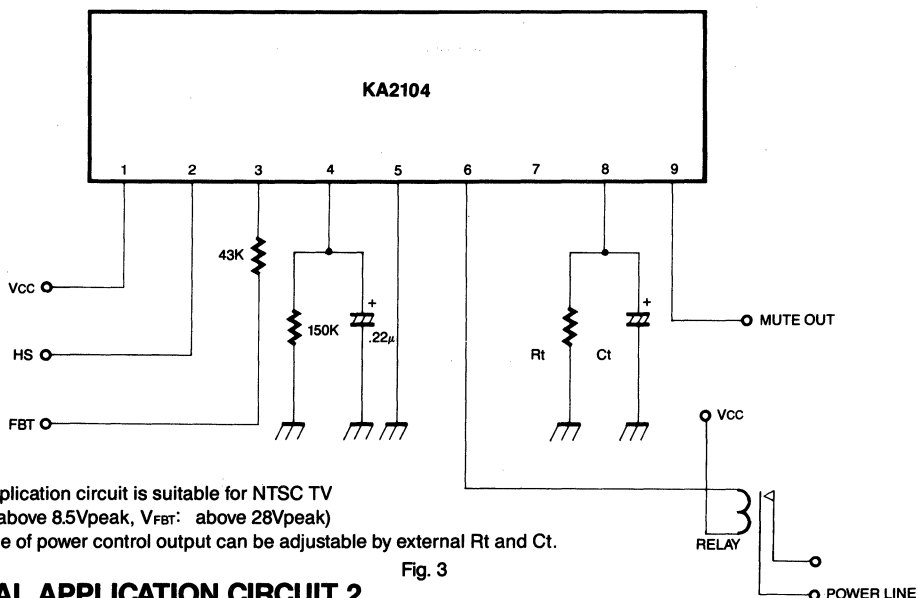


Fig. 2

TEST METHOD

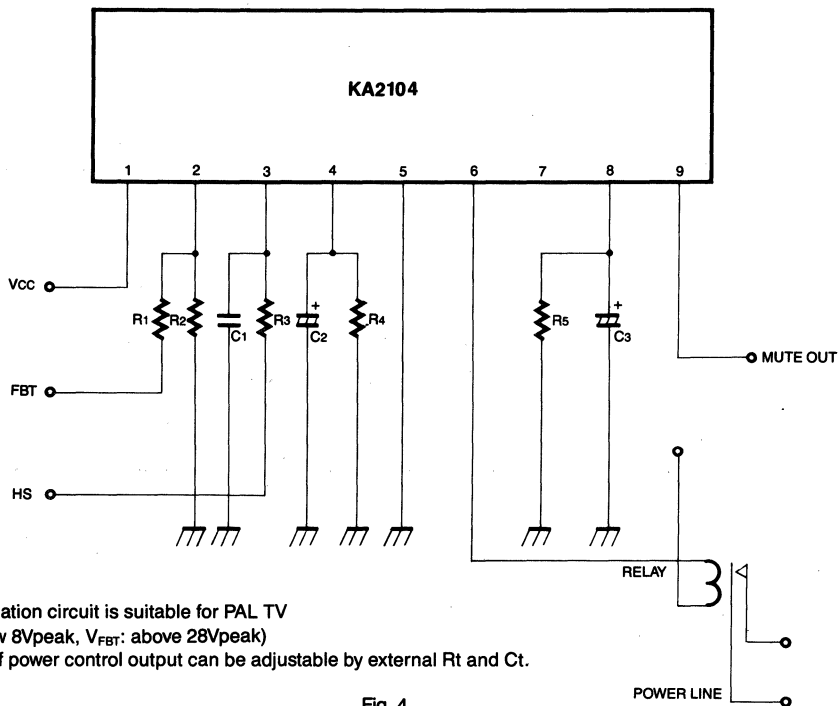
Item	S1	S2	S3	S4	V1	V2	Test Point	Test Method
I _{cc}	x	x	x	x	—	—	Pin 1	Read A1
V _{th1} (Pin 2)	ON	ON	x	x	adjust	5V	V _i 2	At Pin 4 High
V _{th2} (Pin 3)	ON	ON	x	x	9V	adjust	V _i 3	At Pin 4 High
V _{sat1} (Pin 6)	ON	ON	ON	x	9V	5V	Pin 6	Read Pin 6 V _t g.
V _{sat2} (Pin 9)	ON	ON	x	ON	9V	5V	Pin 9	Read Pin 9 V _t g.
I _L PF	ON	ON	x	x	9V	5V	Pin 4	Read A2
ITD	ON	ON	x	x	9V	5V	Pin 8	Read A3

TYPICAL APPLICATION CIRCUIT 1

***Note**

1. This application circuit is suitable for NTSC TV
(V_{HS} : above 8.5Vpeak, V_{FBT} : above 28Vpeak)
2. The time of power control output can be adjustable by external R_t and C_t .

TYPICAL APPLICATION CIRCUIT 2

***Note**

1. This application circuit is suitable for PAL TV
(V_{HS} : below 8Vpeak, V_{FBT} : above 28Vpeak)
2. The time of power control output can be adjustable by external R_t and C_t .

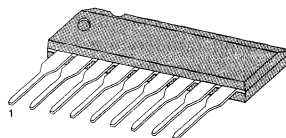
LIMITER AMPLIFIER AND DETECTOR FOR A TV SIF

The KA2105 contains a limiting amplifier and an FM detector in a single-in-line plastic package. This device is especially recommended as a sound multiplex SIF subsystem requiring few external components and only one tuning adjustment for the 4.5 MHz tank circuit.

FEATURES

- Detector with single tuned coil
- Excellent AM rejection ratio; 50dB (Typ.)
- Wide supply voltage range; $V_{CC} \approx 8-15V$
- Minimum numbers of external parts requires.

9 SIP



BLOCK DIAGRAM

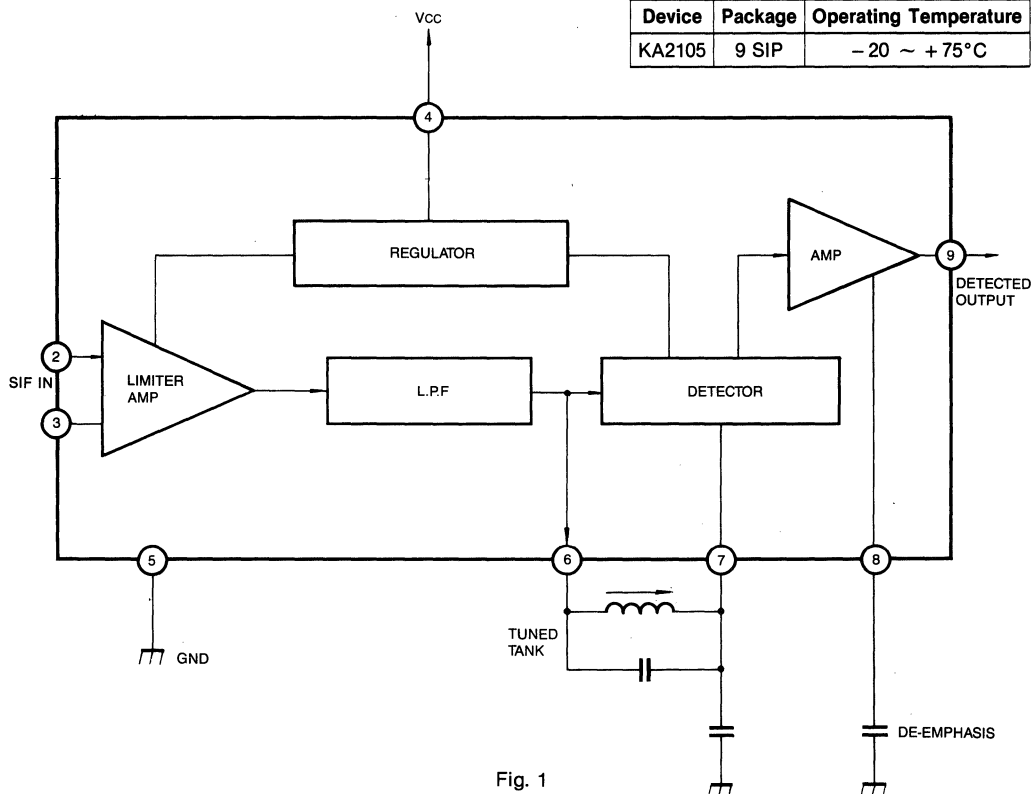


Fig. 1

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2105	9 SIP	$-20 \sim +75^{\circ}C$

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_4	15	V
Input Voltage	V_2	0.7	V_{rms}
Power Dissipation (Note)	P_d	625	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage		V_{CC}	—	8	—	15	V
Supply Current		I_{CC}	—	—	—	25	mA
Output Terminal Voltage		V_9	$V_{IN} = 0$	—	5	—	V
Detected Output Voltage		V_{DD}	$f = 4.5\text{MHz}$, $V_{IN} = 100\text{mV}$	0.8	—	1.6	V_{rms}
Total Harmonic Distortion		THD	FM = $400\text{Hz} \pm 25\text{KHz}$	—	—	2.0	%
Limiting Sensitivity		$V_{IN} (I_{IN})$	-3dB of the Max, Output	—	—	500	μVrms
AM Rejection Ratio		AMR	$V_{IN} = 100\text{mV}_{rms}$, FM 25KHz, 400Hz AM M=0.3, 400Hz	—	50	—	dB
Input Impedance	Parallel Input Resistance	RIP	$f = 4.5\text{MHz}$	—	17	—	K Ω
	Parallel Input Capacitance	CIP	$f = 4.5\text{MHz}$	—	4	—	PF
Output Impedance	Parallel Output Resistance	ROP	$f = 4.5\text{MHz}$	—	2	—	K Ω
	Parallel Output Capacitance	COP	$f = 4.5\text{MHz}$	—	3	—	pF

TEST CIRCUIT

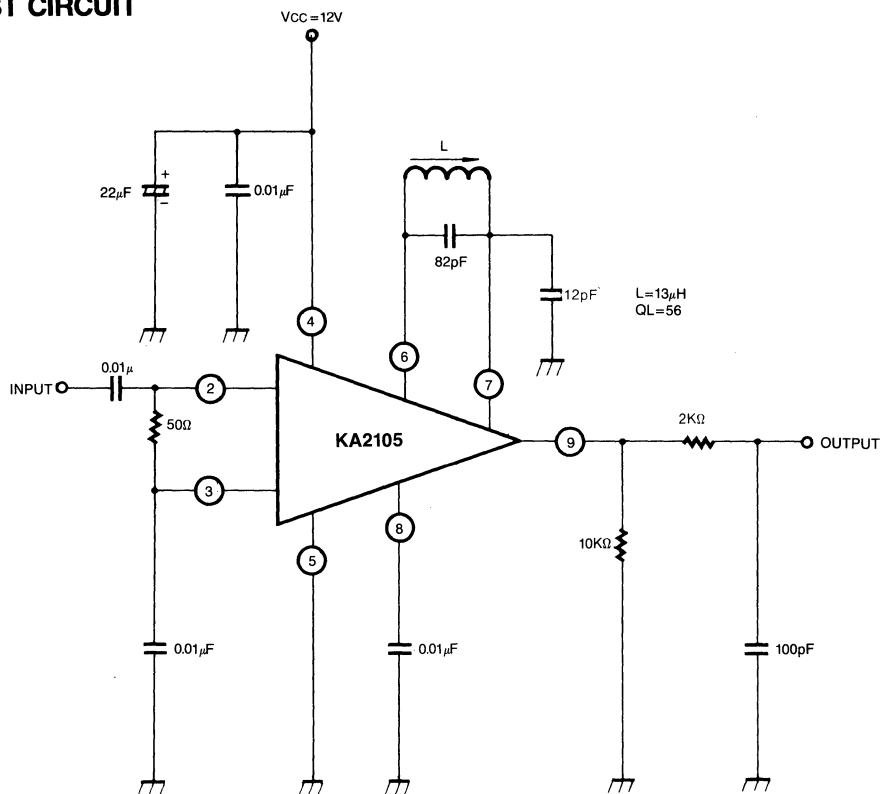
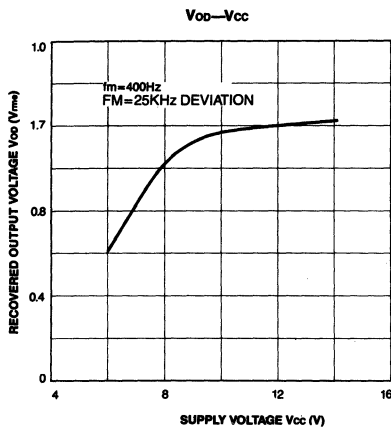
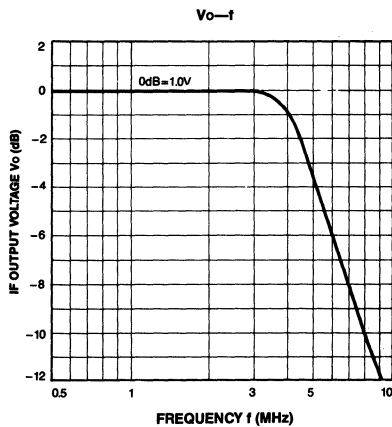
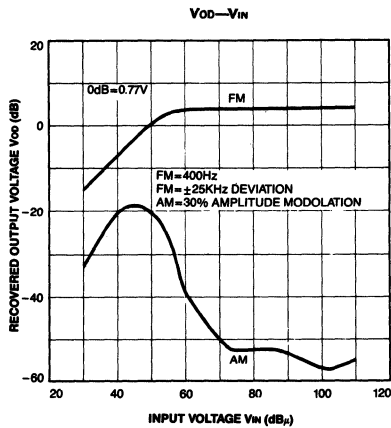


Fig. 2



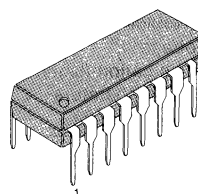
DUAL SOUND MULTIPLEX FOR A TV SIF

The KA2106 contains a dual limiting amplifier and FM detector in 16 dual-in-line plastic package. This device is especially recommended as dual sound multiplex SIF subsystem requiring few external components and each one tuning adjustment for the 4.5 MHz tank circuit.

FEATURES

- Detector with single tuned coil
- Excellent AM rejection ratio; 50dB (Typ).
- Wide supply voltage range; $V_{CC} = 8-15V$
- Minimum numbers of external parts required.

16 DIP



BLOCKDIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2106	16 DIP	-20 ~ +75°C

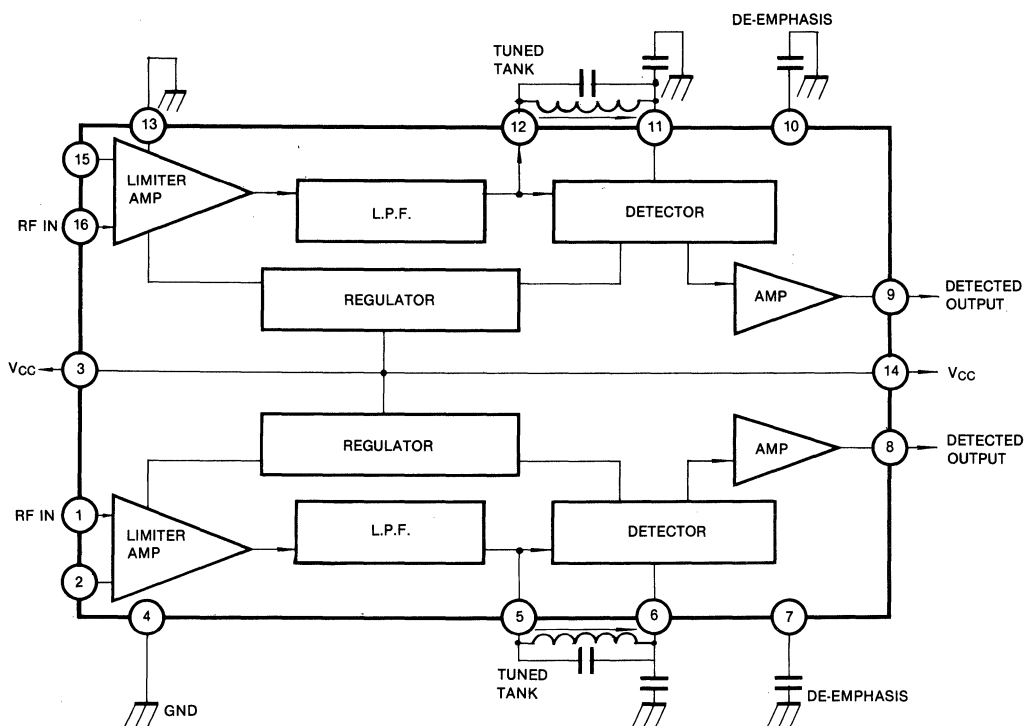


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_3, V_4	15	V
Input Voltage	V_1, V_{16}	0.7	V_{rms}
Power Dissipation (Note)	P_d	1,250	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage		V_{CC}	—	8	—	15	V
Supply Current		I_{CC}	—	—	—	50	mA
Output Terminal Voltage	V_8	$V_{IN} = 0$		—	5	—	V
	V_9						
Detected Output Voltage		V_{DD}	$F = 4.5\text{MHz}$, $FM = 400\text{Hz} + 25\text{KHz}$,	0.8	—	1.6	V_{rms}
Total Harmonic Distortion		THD	$V_{IN} = 100\text{mV}$	—	—	2.0	%
Limiting Sensitivity		$V_{IN} (I_{IN})$	-3dB of the Max, Output	—	—	500	μV_{rms}
AM Rejection Ratio		AMR	$V_{IN} = 100\text{mV}_{rms}$, FM 25KHz, 400Hz AM $m = 0.3$, 400Hz	—	50	—	dB
Input Impedance	Parallel Input Resistance	RIP	$F = 4.5\text{MHz}$	—	17	—	$\text{K}\Omega$
	Parallel Input Capacitance	CIP	$F = 4.5\text{MHz}$	—	4	—	PF
Output Impedance	Parallel Output Capacitance	COP	$F = 4.5\text{MHz}$	—	3	—	PF

TEST CIRCUIT

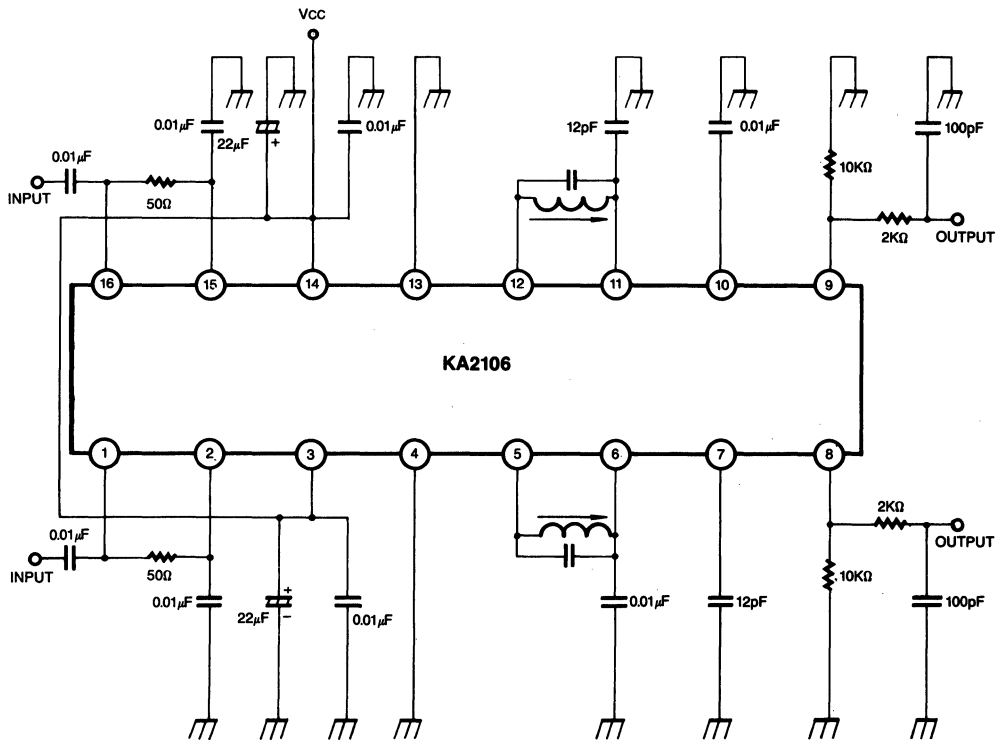
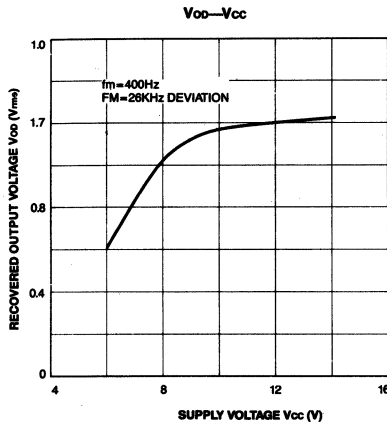
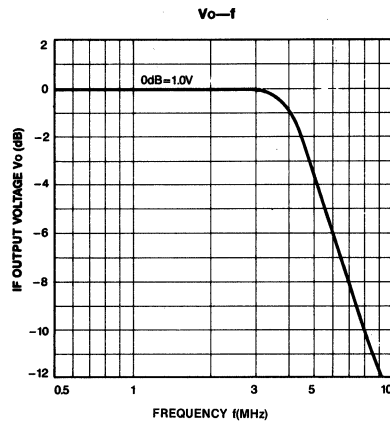
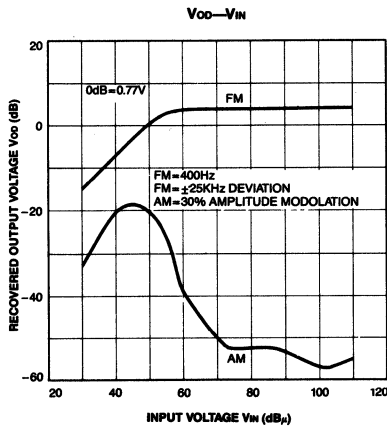


Fig. 2



DC VOLUME, TONE CONTROL CIRCUIT

The KA2107 is a silicon monolithic integrated circuit designed for 2 channel volume and tone control.

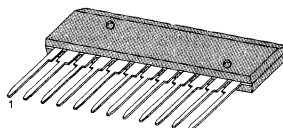
FUNCTIONS

- DC Volume Control
- DC Tone Control (Bass & Treble)
- Balance Control (R, L-Ch)

FEATURES

- Easier compact set design
- All function enable DC controllable

12 SIP



BLOCK DIAGRAM

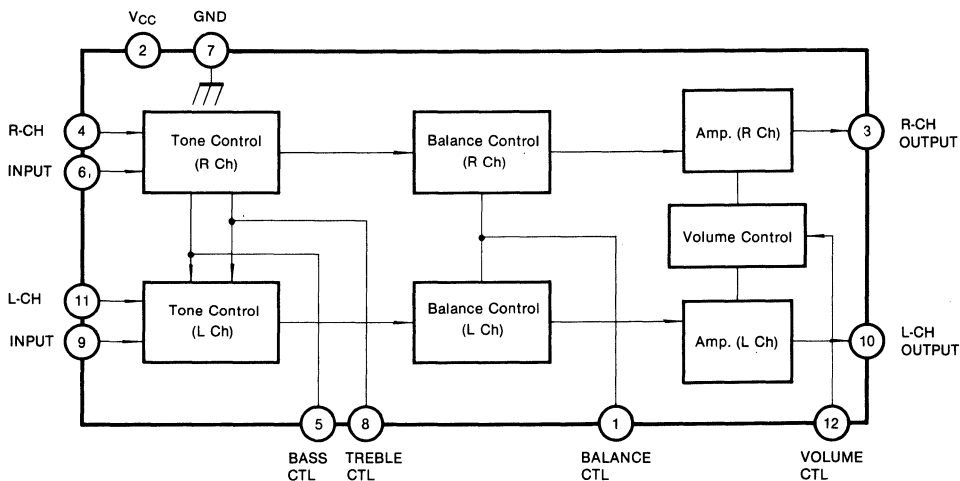


Fig. 1

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2107	12 SIP	-20 ~ +70°C

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic		Symbol	Value		Unit
Voltage	Supply Voltage	V_{CC}	14.4		V
	Circuit Voltage	$V_{1, 4, 5, 6-7}$ $V_{8, 9, 11, 12-7}$	0	V_{2-7}	V
Current	Supply Current	I_2	64		mA
	Circuit Current	I_3, I_{10}	-40	—	mA
Power Dissipation		P_D	920		mW
Temperature	Operating Temperature	T_{opr}	$-20 \sim +70$		$^\circ\text{C}$
	Storage Temperature	T_{stg}	$-55 \sim +150$		$^\circ\text{C}$

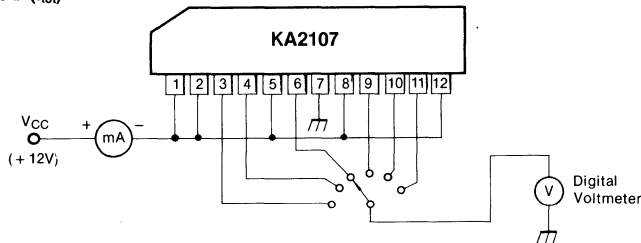
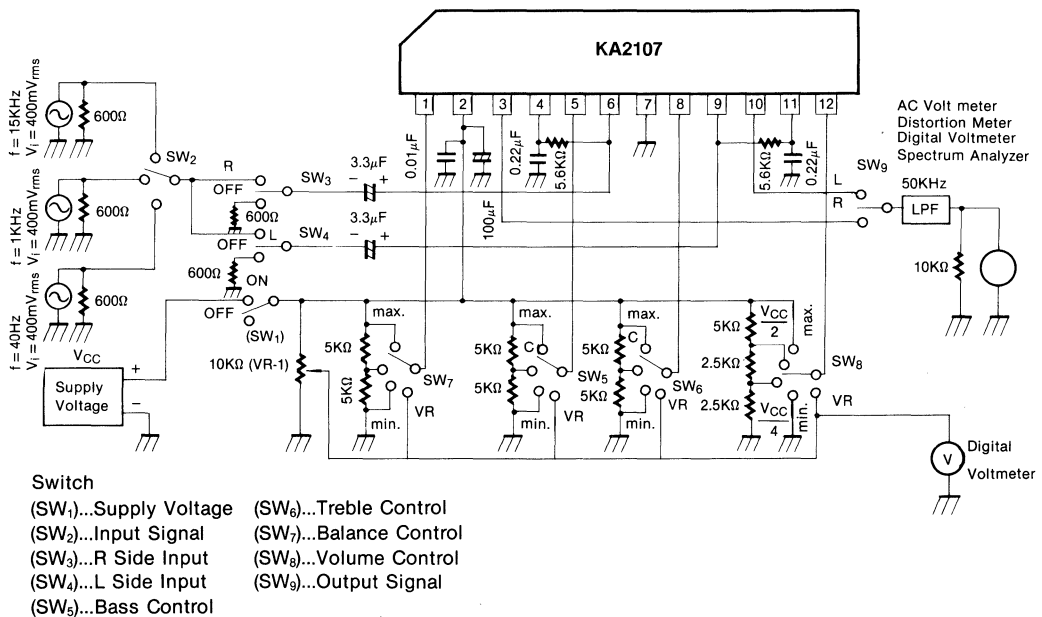
ELECTRICAL CHARACTERISTICS ($V_{CC} = 12\text{V}$, $T_a = 25^\circ\text{C}$)

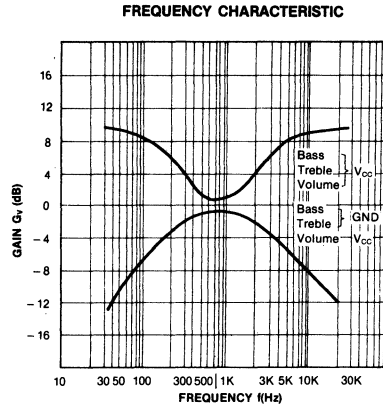
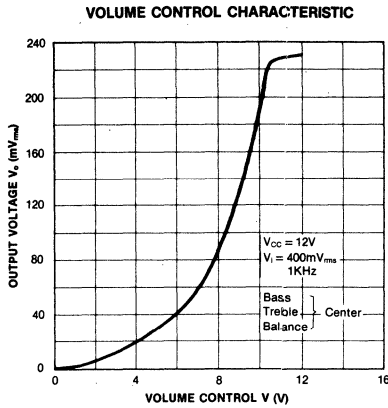
Characteristic		Symbol	Condition	Min	Typ	Max	Unit	Test Circuit
Supply Current		I_{tot}	$V_{CC} = 12\text{V}$	24	38	50	mA	1
Supply Voltage		$V_{3, 10-7}$	No input, $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$	8.0	8.4	8.8	V	2
Volume	Max Output Voltage	V_{omax}	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$	190	230	270	mV_{rms}	2
	Channel Balance	CB	$V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$	—	+0.2	± 1.0	dB	2
	Output Starting Voltage	$V_{(st)}$	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_R$, $V_1 = V_5 = V_8 = V_{CC}/2$	0.40	0.60	0.90	V	2
	Residual Noise Level	V_{min}	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = 0\text{V}$, $V_1 = V_5 = V_8 = V_{CC}/2$	—	25	50	μV_{rms}	2
Balance	Attenuation (R-Ch)	A_{HBR}	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$, $V_{12} = V_{CC}$, $V_5 = V_8 = V_{CC}/2$, $V_{OR1}:V_1 = (5.5/12) \cdot V_{CC}(\text{at } V_R-1)$, $V_{OR2}:V_1 = 0\text{V}$	-32	-45	—	dB	2
	Attenuation (L-Ch)	A_{HBL}	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$, $V_{12} = V_{CC}$, $V_5 = V_8 = V_{CC}/2$, $V_{OL1}:V_1 = (6.5/12) \cdot V_{CC}(\text{at } V_R-1)$, $V_{OL2}:V_1 = V_{CC}$	-32	-45	—	dB	2
Tone	Low Frequency Boost Control	V_{40}/V_{1k}	V_{1k} : Output Voltage at $f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$ V_{40} : Output Voltage at $f = 40\text{Hz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_5 = V_8 = V_{CC}$	8	10	12	dB	2
	Low Frequency Cut Control	V_{40}/V_{1k}	V_{1k} : Output Voltage at $f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$ V_{40} : Output Voltage at $f = 40\text{Hz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_5 = V_8 = 0\text{V}$	-7.5	-12	-16	dB	2
	High Frequency Boost Control	V_{15k}/V_{1k}	V_{1k} : Output Voltage at $f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$ V_{15k} : Output Voltage at $f = 15\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_5 = V_8 = V_{CC}$	7.5	10	13	dB	2
	High Frequency Cut Control	V_{15k}/V_{1k}	V_{1k} : Output Voltage at $f = 1\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$ V_{15k} : Output Voltage at $f = 15\text{KHz}$, $V_i = 400\text{mV}_{rms}$ $V_{12} = V_{CC}$, $V_5 = V_8 = 0\text{V}$	-7.5	-12	-18	dB	2

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit	Test Circuit
Cross Talk	CT	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{\text{rms}}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$	-65	-80	—	dB	2
Output Noise Voltage	V_{no}	No input, $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$	—	80	120	μV_{rms}	2
Total Harmonic Distortion	THD	$f = 1\text{KHz}$, $V_i = 400\text{mV}_{\text{rms}}$ $V_{12} = V_{CC}$, $V_1 = V_5 = V_8 = V_{CC}/2$	—	0.2	0.5	%	2
Input Resistance	$R_{i(6), (9)}$	$f = 1\text{KHz}$	8.2	11.0	13.5	$\text{K}\Omega$	
	$R_{i(4), (11)}$		11.0	16.0	22.0	$\text{K}\Omega$	
Output Resistance	$R_{o(3), (10)}$	$f = 1\text{KHz}$	60	110	160	Ω	

TEST CIRCUIT

Test Circuit 1 (I_{io})Test Circuit 2 ($V_3, 10-7, V_{omax}, CB, V_{(st)}, V_{min}, A_{tBR}, A_{tBL}, V_{40}/V_{1k}, V_{15k}/V_{1k}, CT, V_{no}, THD$)



Note: 0dB is Output Voltage at $f_{in} = 1KHz$, $400mV_{rms}$
 Bass, Treble Control: $V_{CC}/2$
 Volume: V_{CC}

APPLICATION CIRCUIT

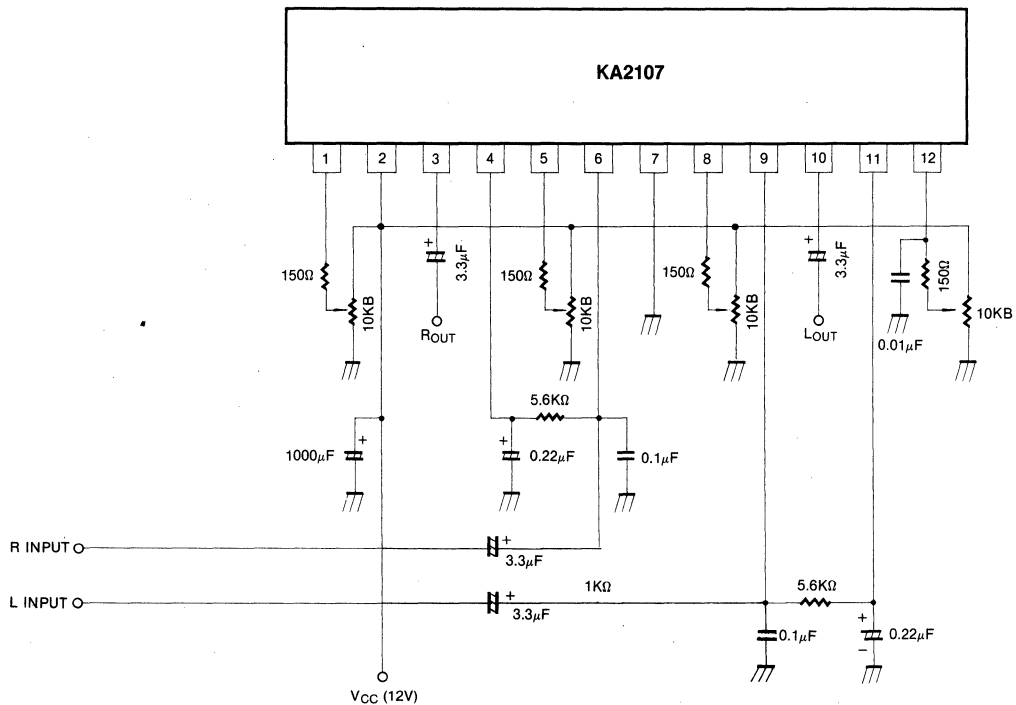


Fig. 3

TV VERTICAL DEFLECTION SYSTEM

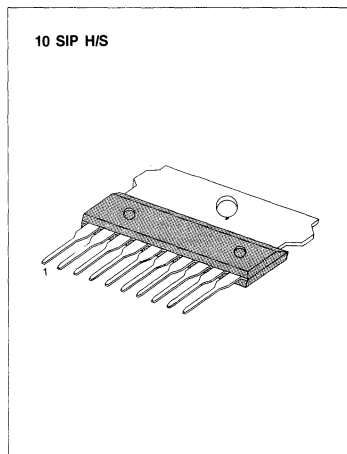
The KA2130A is a monolithic integrated circuit for use in vertical deflection circuit of monochrome and small-sized color television receivers. It oscillates vertical signal synchronizing with vertical synchronization signal and outputs the vertical deflection current with the single chip.

FUNCTIONS

- Vertical synchronization circuit.
- Vertical oscillation circuit.
- Vertical saw-tooth shaper.
- Vertical-output circuit.
- Clamping circuit for blanking pulse.
- Temperature compensating circuit.

FEATURES

- Less number of external components.
- Wide range of operational voltage (9V ~ 18 volts).
- Freely adjustable pull-in range.
- Adjustable blanking pulse-width.
- Large output current-capacity (2 A_{p,p}).
- Built-in adjusting circuit for flyback time.
- Easy mounting on printed circuit board.



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2130A	10 SIP H/S	-20 ~ +75°C

TYPICAL APPLICATION CIRCUIT

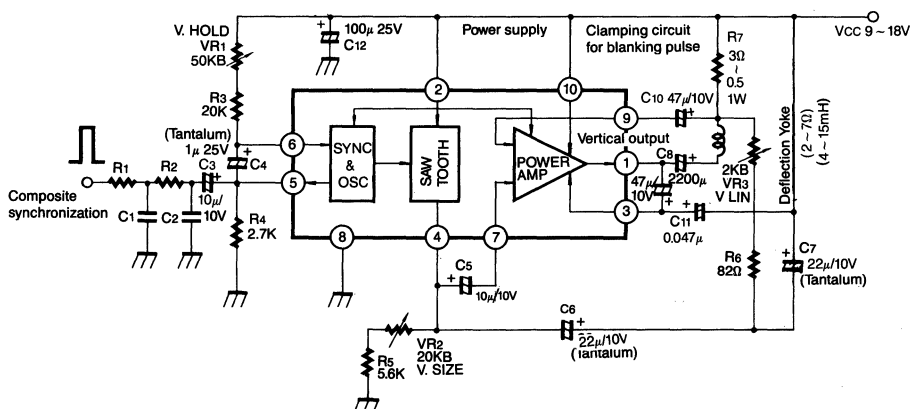


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Output Current	I_{PP}	2	Ap-p
Power Dissipation	P_{d1}	1.5 ($T_a = +75^\circ\text{C}$) With aluminum heatsink	W
Power Dissipation	P_{d2}	2.15 ($T_a = +75^\circ\text{C}$) With aluminium heatsink (31.6×31.6×1mm t)	W
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($V_{CC} = 12\text{V}$, $T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Circuit Current	I_{CC}	No input signal and no load condition	15	30	46	mA	2
Output Terminal Voltage	V_N	No input signal and no load condition	5.6	6.0	6.4	V	2
Vertical Oscillation Frequency	f_v	Synchronization signal voltage applied at terminal 5 is 1.3 V_{PP}	—	50/60	—	Hz	2
Free-running Frequency	f_{VO}	Oscillation capacitor, 1 μF (Tantalum) resistor, 38.1K Ω	53	60	67	Hz	2
Pull-in Range	f_P	With specified integration circuit, applied voltage of synchronization signal is 1.3 V_{PP} at terminal 5	-10	-12	—	Hz	2
Drift of Free-running Frequency vs. Power Supply Voltage	Δf_{VO}	Frequency drift from standard frequency (f_{VO} 60 Hz at $V_{CC} = 12\text{V}$) vs. power supply voltage ($V_{CC} = 12 \pm 2\text{V}$)	—	—	± 1.0	Hz	2
Deviation of Pull-in Range vs. Power Supply Voltage	Δf_P	Deviation from the range for pull in (at $V_{CC} = 12\text{V}$) vs. power supply voltage ($V_{CC} = 12 \pm 2\text{V}$)	—	—	± 3.0	Hz	2
Output Saturation Voltage	V_{sat}	Output current: 0.7A	—	1.3	1.6	V	2
Output Pulse Width of Terminal 4	T_O	Oscillation capacitor, 1 μF (Tantalum) resistor, 38.1K Ω	300	420	600	μsec	2

TEST CIRCUIT

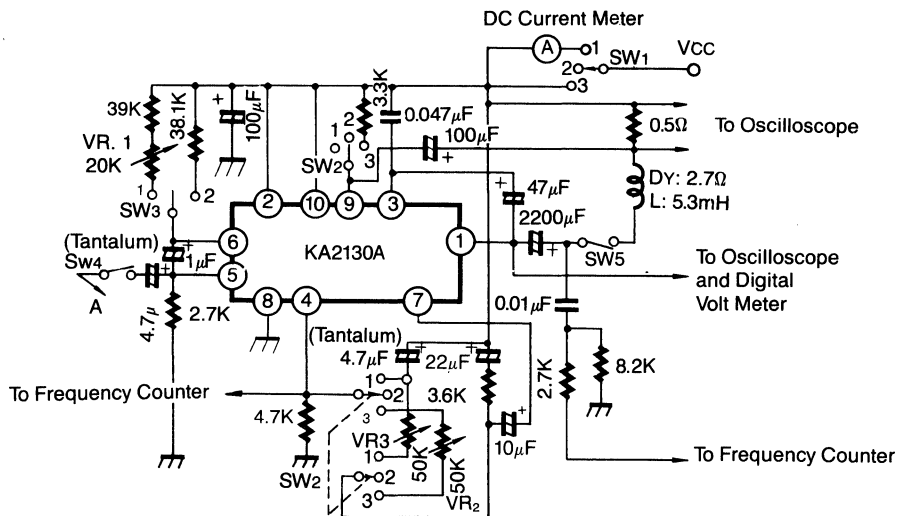


Fig. 2

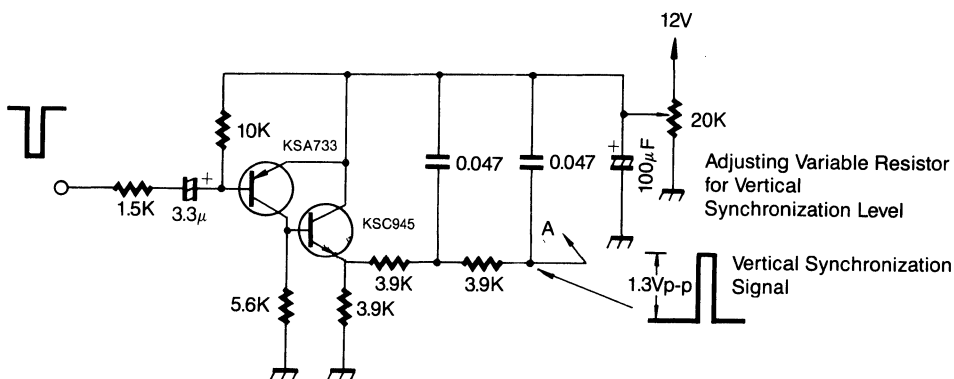


Fig. 3

TV VERTICAL OUTPUT CIRCUIT

The KA2131 is a monolithic integrated circuit designed for vertical output stage in color television receivers.

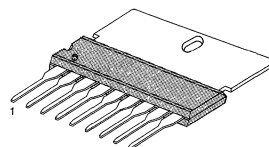
FUNCTIONS

- Driver stage.
- Output stage.
- Flyback generator.
- Pulse shaper.

FEATURES

- Low power consumption, direct deflection coil driving capability (Flyback voltage two times as high as supply voltage is supplied during flyback period only).
- High breakdown voltage: 60V.

9 SIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2131	9 SIP H/S	- 20 ~ + 70°C

BLOCK DIAGRAM

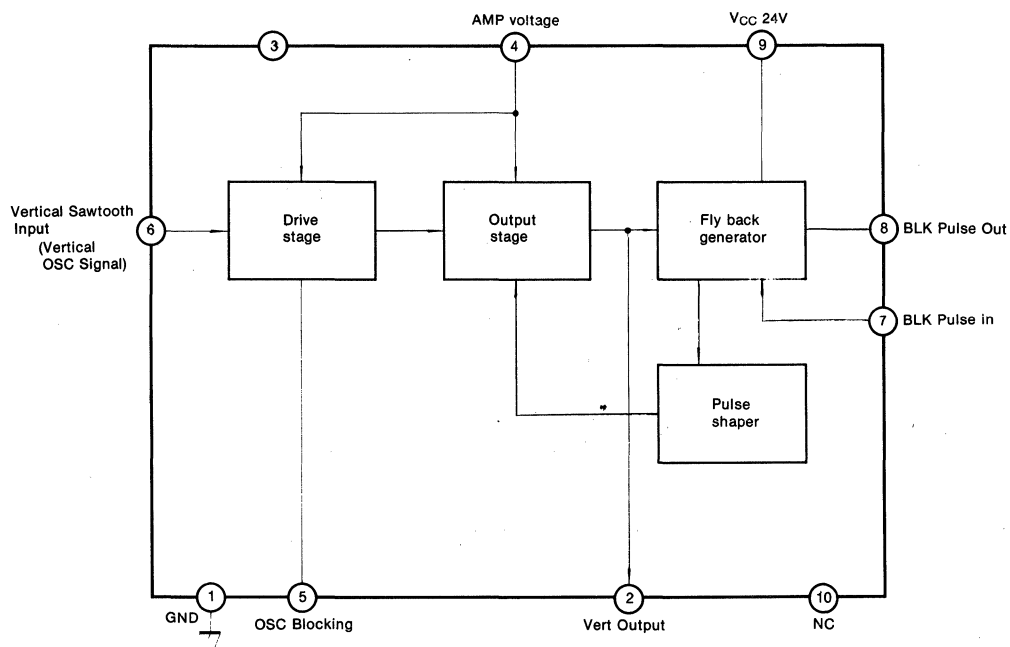
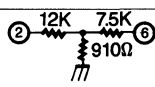


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a=25^{\circ}\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	27.6	V
Circuit Voltage	V_4	60	V
	V_6	2.5	V
	V_7	1.3	V
Supply Current	I_{CC}	250	mA
Power Consumption	P_d	6.66	W
Circuit Current	I_2	-1000 ~ +1000	mA _{p-p}
	I_8	-1000 ~ +1000	mA _{p-p}
Operating Temperature	T_{opr}	-20 ~ +70	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-55 ~ +150	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS ($V_{CC}=24\text{V}$, $T_a=25^{\circ}\text{C}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Deflection Current	I_{y-p}	SW:2	860	930	1000	mA _{p-p}
Deflection Current Linearity	$\Delta I_y (+)$	SW: 1	25	—	75	mA _{p-p}
	$\Delta I_y (-)$	SW:1	22	—	85	mA _{p-p}
Deflection Current vs. Operating Temperature	$\Delta I_y/T_a$	$T_a = -20 \sim +70^{\circ}\text{C}$	-1.5	—	1.5	%
Center Voltage	V_{MID}	SW: 1	12.1	12.6	13.1	V
Flyback Pulse Amplitude	$V(\text{FBP})$	SW: 1	47			V
Flyback Pulse Width	t_{FBP}	SW: 1	850	920	980	μsec
Quiescent Circuit Current	I_{CC}	$V_4 = 24\text{V}$ $V_9 = 24\text{V}$ $V_7 = 0\text{V}$ 	7	13	22	mA
Output TR Saturation Voltage	V_{4-2}	$V_4 = V_9 = 24\text{V}$, $\text{pin}_{2-1} = 56\Omega$ $V_6 = 0.3\text{V}$, $V_7 = 0\text{V}$	—	2.7	3.7	V
	V_2	$V_4 = V_9 = 24\text{V}$, $\text{pin}_{2-4} = 56\Omega$ $V_6 = 1.3\text{V}$, $V_7 = 0\text{V}$	—	0.6	1.0	V
Saturation Voltage	V_8	$V_9 = 24\text{V}$, $R_{\text{pin}_{9-8}} = 1.2\text{K}\Omega$ $V_7 = 0\text{V}$	—	—	0.5	V
Thermal Resistance	$R_{th} (j-c)$		—	—	12	$^{\circ}\text{C/W}$

TYPICAL APPLICATION CIRCUIT

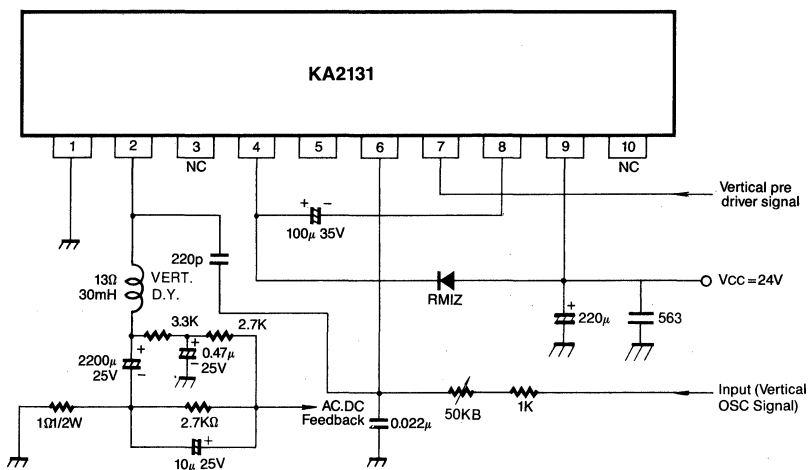


Fig. 2

TEST CIRCUIT

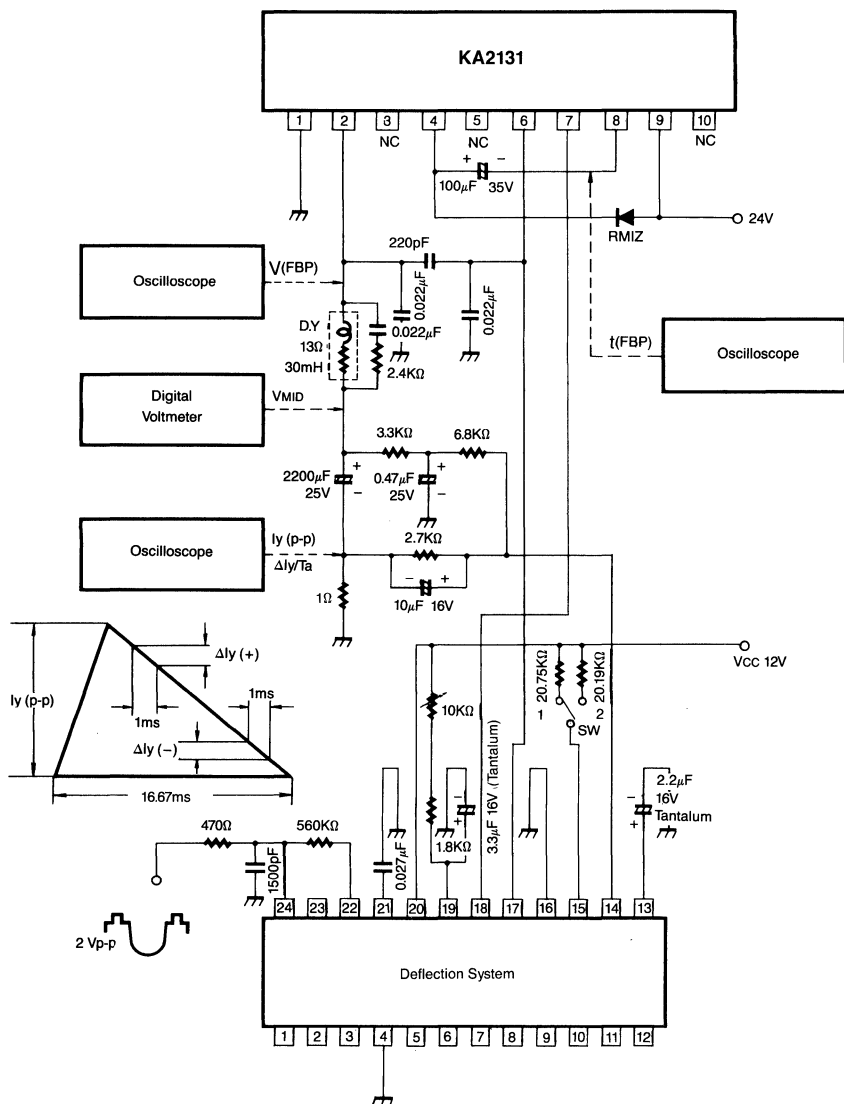


Fig. 3

I CHIP DEFLECTION SYSTEM

The KA2133 consists of vertical system including output function and horizontal system including AFC function. It is for use in small size color TV, B/W TV receivers and monitor designed.

FUNCTIONS

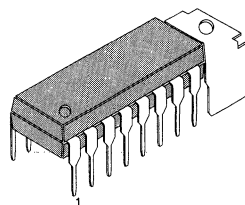
(Horizontal Section)

- SYNC separator
- Horizontal oscillator
- Horizontal predriver
- Horizontal AFC
- Shunt regulator (Typ.: 6.7V)

(Vertical Section)

- Vertical oscillator
- Vertical predriver
- Vertical output
- Flyback generator

16 DIP H/S



FEATURES

- Low power consumption, direct deflection coil driving capability (flyback voltage two times as high as supply voltage is supplied during flyback period only)
- Variable circuit of vertical retrace time on chip.

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2133	16 DIP H/S	- 20 ~ + 75°C

BLOCK DIAGRAM

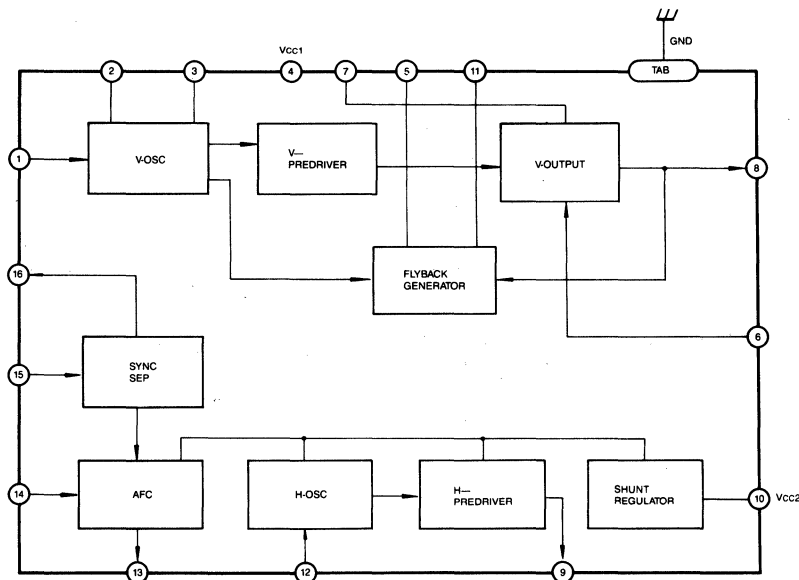


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Vertical Supply Voltage	V_{CC}	15	V
Horizontal Supply Current	I_{10}	30	mA
Vertical Output Current	I_B	- 500 ~ + 500	mA peak
Horizontal Output Current (Pulse)	I_g	15 ~ + 5	mA
Flyback Generator Output Current	I_s	- 500 ~ + 500	mA peak
Power Dissipation	P_d	1.3	W
Operating Temperature	T_{opr}	- 20 ~ + 75	$^\circ\text{C}$
Storage Temperature	T_{stg}	- 40 ~ + 150	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Min	Typ	Max	Unit
Vertical Supply Voltage	V_{CC}	9.6	12.0	14.4	V
Horizontal Supply Current	I_{10}	6.5	12	18	mA

ELECTRICAL CHARACTERISTICS($V_{CC} = 12\text{V}$, $I_{10} = 12\text{mA}$, $T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Vertical Supply Current	$I_{CC} (1)$	$SW_A = 2$	—	85	100	mA	2
Vertical Supply Current	$I_{CC} (2)$	No Input Signal $SW_A = 2$	6	12	20	mA	2
Vertical Free Running Frequency	f_{VO}	$SW_A = 1$	55	60	65	Hz	2
Drift of Vertical Free-Running Frequency	$\Delta f_{RO}(V_{CC})$	$\Delta f_{VO} = 1f_{VO}(14.4\text{V}) - f_{VO}(9.6\text{V})$ $SW_A = 2$	—	0.8	2	Hz	2
	$\Delta f_{VO}(T_a)$	$\Delta f_{VO} = 1f_{VO}(-20^\circ\text{C}) - f_{VO}(+70^\circ\text{C})$ $SW_A = 2$	—	1.5	2	Hz	2
Vertical Output Center Voltage	V_{MID}	$SW_A = 2$	5.3	5.8	6.3	V	2
Vertical Output Current	I_B	$SW_A = 2$	450	500	550	mA _{p-p}	2
Horizontal Supply Pin Voltage	V_{10}	$SW_B = 2$	6.2	6.7	7.2	V	2
Horizontal Free Running Frequency	f_{HO}	$I_{10} = 12\text{mA}$ $SW_B = 1$	15.0	15.75	16.5	KHz	2
Horizontal Output Pulse Width	P_{WH}	$f_{HO} = 15.75\text{KHz}$ $SW_B = 2$	23	25	27	us	2
Horizontal Output Current	I_g	$SW_B = 2$	0.8	1.3	2.0	mA	2

[illegible]

Fig. 3

COLOR TV DEFLECTION SIGNAL PROCESSING IC

The KA2134 is a silicon integrated circuit designed for deflection signal processing circuit for small and medium sized color television receivers.

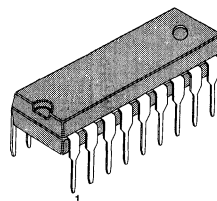
FUNCTIONS

- Vert. Amp Driver
- Hori. Oscillator
- Noise Detector
- X-Ray Protector

FEATURES

- Built-in vertical deflection driver circuit
- Incorporating vertical and horizontal oscillator circuit, operations highly stable against changes in supply voltage and temperature
- Highly stable sync. separation circuit against noise
- Built-in high tension protector circuit (X-ray protection)
- 12V supply voltage operation

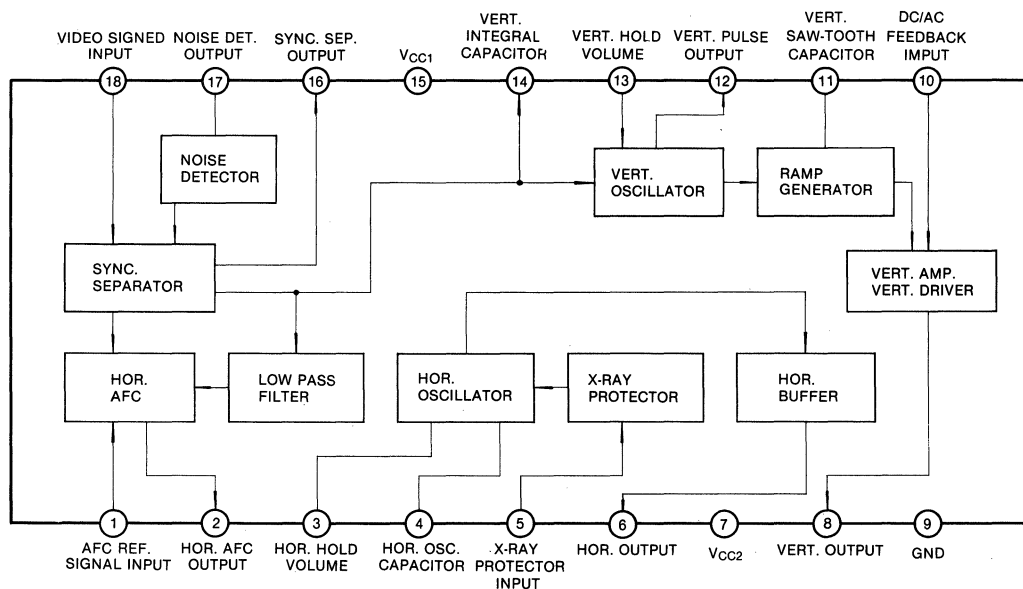
18 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2134	18 DIP	-20 ~ +70°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic		Symbol	Value		Unit
Voltage	Supply Voltage	$V_{\text{pin } 7}$	10.5		V
		$V_{\text{pin } 15}$	14.4		V
	Circuit Voltage	$V_{\text{pin } 1}$	0	10	V
		$V_{\text{pin } 9}$	0	V_{15-9}	V
		$V_{\text{pin } 12}$	0	10	V
		$V_{\text{pin } 17}$	0	6	V
		$V_{\text{pin } 18}$	− 3	2	V
Current	Supply Current	$I_{\text{pin } 7}$	16		mA
		$I_{\text{pin } 15}$	23		mA
	Circuit Current	$I_{\text{pin } 2}$	− 3	3	mA
		$I_{\text{pin } 3}$	− 5	0	mA
		$I_{\text{pin } 4}$	− 3	3	mA
		$I_{\text{pin } 5}$	− 1	1	mA
		$I_{\text{pin } 6}$	− 30	0	mA
		$I_{\text{pin } 8}$	− 30	0	mA
		$I_{\text{pin } 12}$	− 2	1	mA
		$I_{\text{pin } 13}$	0	30	mA
Power Dissipation		P_D	500	mW	
Temp.	Operating Temp.	T_{opr}	− 20 ~ + 70		°C
	Storage Temp.	T_{stg}	− 55 ~ + 150		°C

Note: + 'S and - 'S in the circuit current stand for current directions; + for flow-in and— for flow-out.

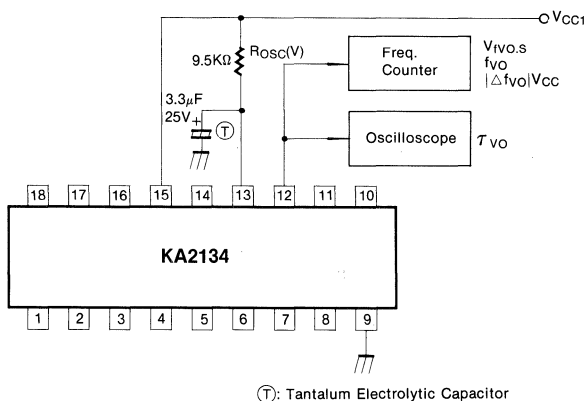
ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

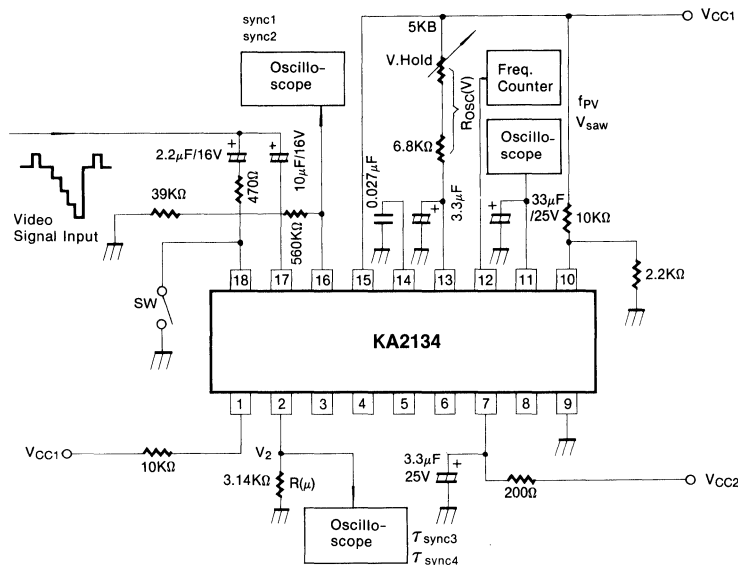
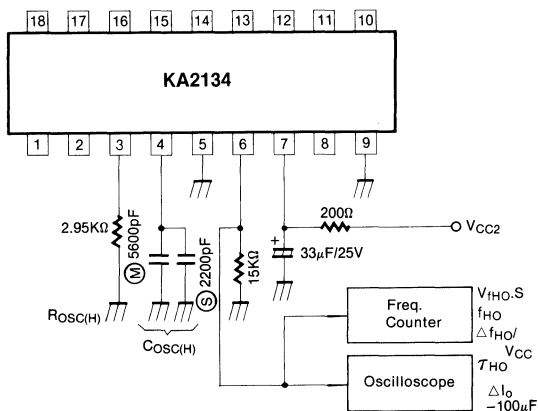
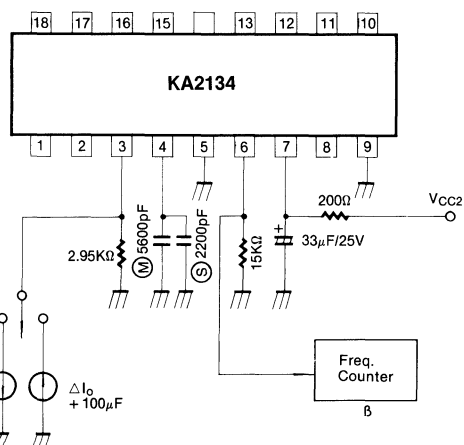
Characteristic	Symbol	Test Circuit	Condition	Min	Typ	Max	Unit
Supply Current	$I_{\text{pin } 7}$		$V_{\text{CC}2} = 12\text{V}$	7.5	12.0	15.5	mA
Supply Current	$I_{\text{pin } 15}$		$V_{\text{CC}1} = 12\text{V}$	13	19	25	mA
Protector Operating Voltage	$V_{\text{pin } 5}$		$V_{\text{CC}2} = 12\text{V}$	0.73	.	0.86	V
Oscillation Beginning Voltage	$V_{\text{OSCS}(1)}$	1	$V_{\text{CC}1}$ at the time f_{VO} is in 40~60Hz range and it's amplitude is over $0.7V_{\text{p-p}}$			6	V
Vertical Free-Running Freq.	f_{VO}	1	$V_{\text{CC}1} = 12\text{V}$, $R_{\text{OSC}}(\text{V}) = 9.5\text{Kohm}$	47	50	53	Hz
f_{VO} Dependence Ratio on Supply Voltage	$\Delta f_{\text{VO}}/V_{\text{CC}}$	1	$f_{\text{VO}}19.6\text{V} \sim f_{\text{VO}}114.4\text{V}$	0	1.0	1.3	Hz

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Circuit	Condition	Min	Typ	Max	Unit
Pulse Width(V_{OSC})	τ	1	$V_{CC1} = 12V$, $R_{OSC}(V) = 9.5K\Omega$	420	600	780	μs
Pull-in Range	f_{VP}	2	$V_{CC1} = 12V$, $R_{OSC}(V) = 9.5K\Omega$		43	47	Hz
Vert. Sawtooth Wave Amplitude	$V(saw)$	2	$V_{CC1} = 12V$, $R_{OSC}(V) = 9.5K\Omega$	0.9	1.2	1.5	V_{p-p}
f_{VO} Dependence Ratio on Temp.	$\Delta f_V/Ta$	1	$Ta = -20 \sim +70^\circ C$		0.8		Hz/ $^\circ C$
$V(saw)$ Dependence Ratio on Temp.	$\Delta V(saw)/Ta$	2	$Ta = -20 \sim +70^\circ C$			30	$mV_{p-p}/^\circ C$
Oscillation Beginning Voltage	$V_{OSC-S(2)}$	3	$V_{7.9}$ at the time f_{HO} is in 10~20KHz range and it's amplitude is over 1 V_{p-p}			6	V
Horizontal Free Running Voltage	f_{HO}	3	$V_{CC2} = 12V$, $R_{OSC}(H) = 2.95K\Omega$	15.0	15.75	16.25	KHz
f_{HO} Dependence Ratio on Supply Voltage	$\Delta f_{HO}/V_{CC}$	3	$f_{HO} 9.6V \sim f_{HO} 14.4V$	0	100	200	Hz
Duty Ratio	τ	3	$V_{CC2} = 12V$	31.5	35.4	38.9	%
Control Sensitivity	β	4	$I_o = \pm 100\mu A$	19	21	23	Hz/ μA
f_{HO} Dependence Ratio on Temp.	$\Delta f_{HO}/Ta$	3	$Ta = -20 \sim +70^\circ C$	-1.67		1.67	Hz/ $^\circ C$
AFC Loop Gain	f_{AFC}		$\beta \times \mu$	5800	7700	9600	Hz/rad

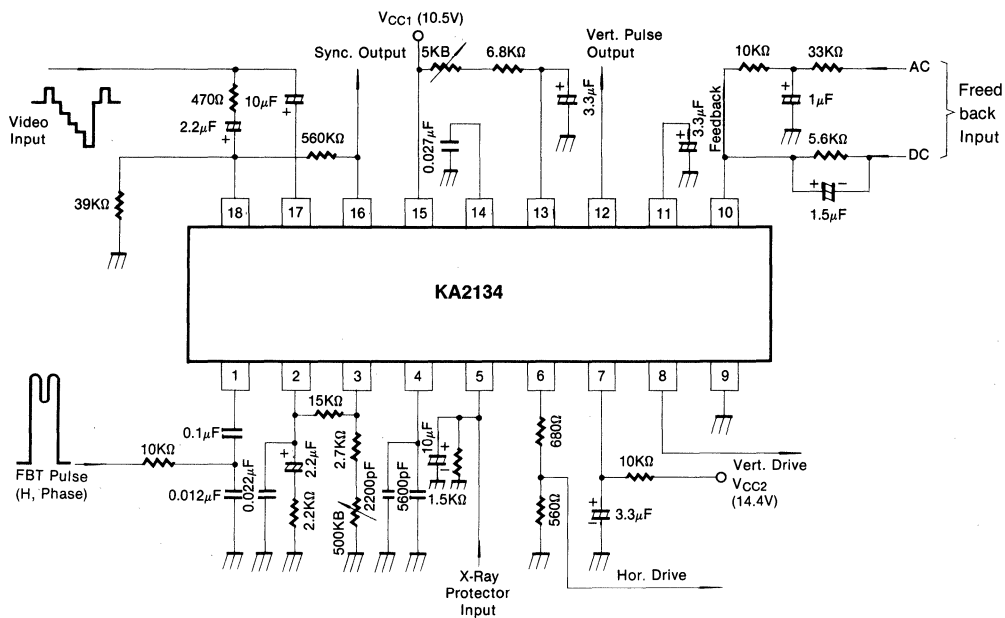
TEST CIRCUIT

Test Circuit 1 ($V_{OSC-S(1)}$, f_{VO} , $\Delta f_{VO}/V_{CC}$, τ , $\Delta f_V/Ta$)

Test Circuit 2 (f_{VP} , $V_{(saw)}$, $\Delta V_{(saw)}/Ta^\circ$)Test Circuit 3 ($V_{OSC(S2)}$, f_{HO} , $\Delta f_{HO}/V_{CC}$, τ , $\Delta f_{HO}/Ta$)Test Circuit 4 (β)

M : Mylar Capacitor
S : Stylen Capacitor

APPLICATION CIRCUIT



HORIZONTAL SIGNAL PROCESSING

The KA2135 is a monolithic integrated circuit designed for horizontal signal processing circuit for CRT display of television receivers, monitors.

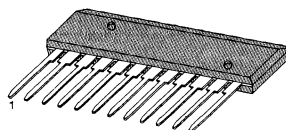
FUNCTIONS

- Polarity Switch
- X-Ray Protector
- AFC
- Hori. OSC
- Pre Amp
- Pulse Width Adjustment

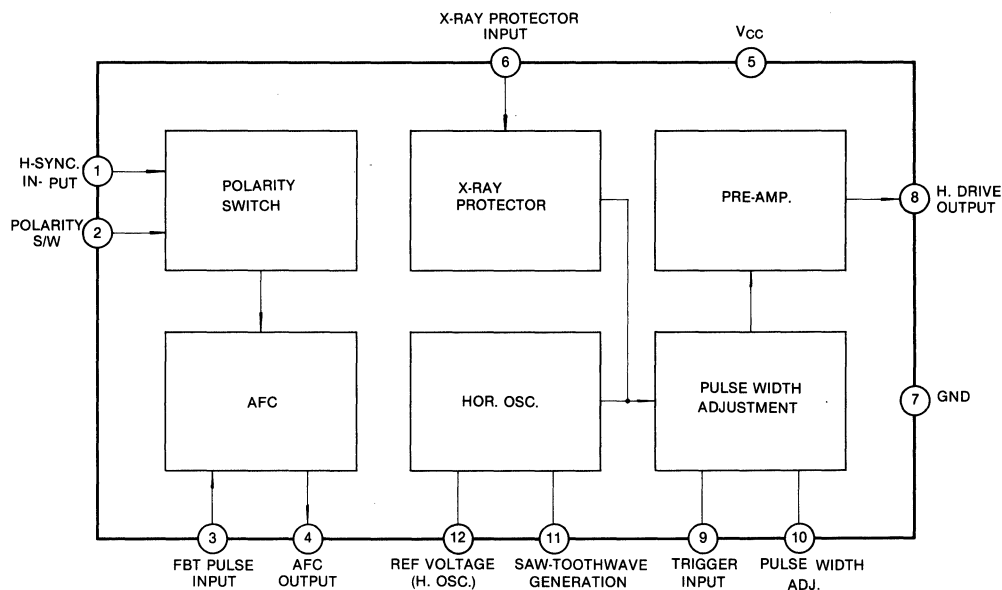
FEATURES

- Processing for both negative & positive SYNC signal
- Wide horizontal oscillation frequency range (14KHz ~ 60KHz)
- Wide output pulse width selection ($2\mu\text{s} \sim 40\mu\text{s}$)

12 SIP



BLOCK DIAGRAM



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2135	12 SIP	- 20 ~ + 70°C

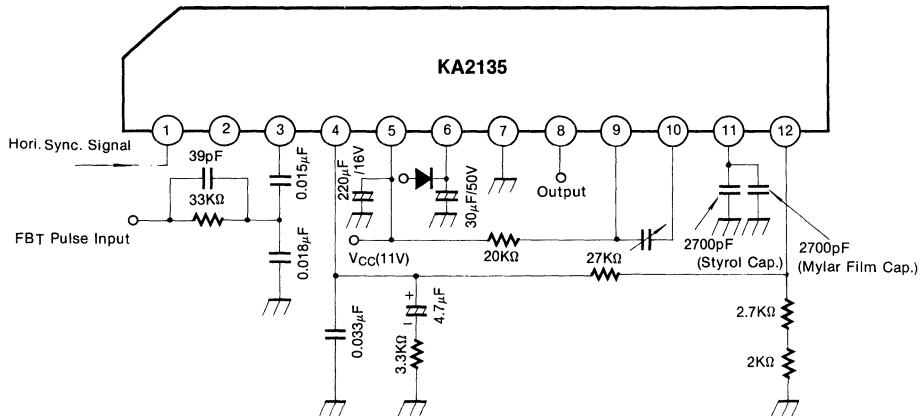
ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	13.2	V
Supply current	I_{CC}	50	mA
Power Dissipation	P_D	1140	mW
Operating Temperature	T_{opr}	-20 ~ +70	°C
Storage Temperature	T_{stg}	-40 ~ +150	°C

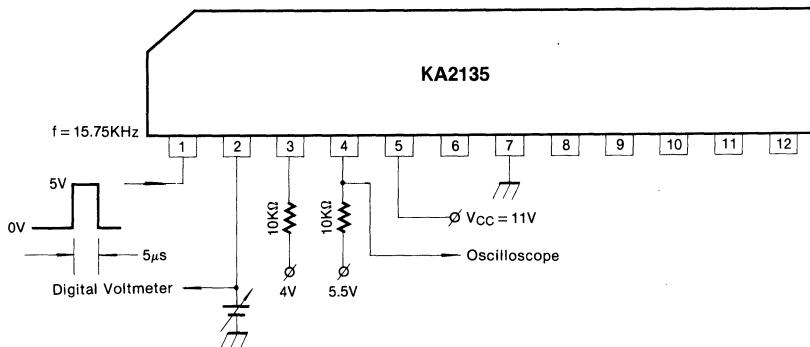
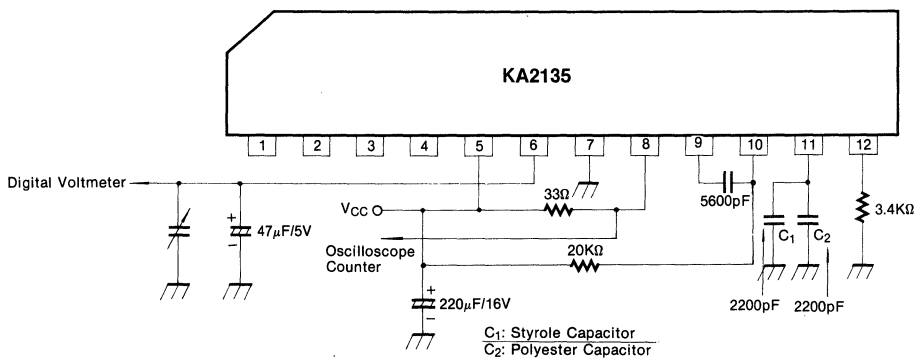
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

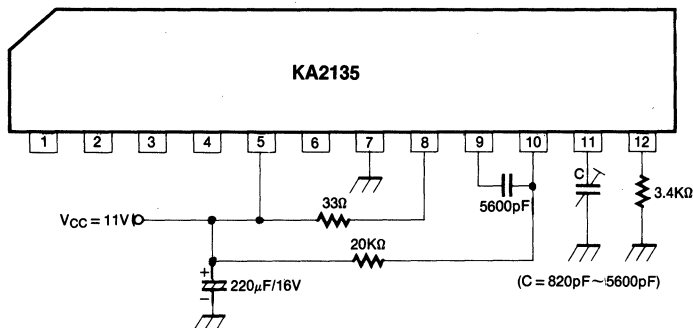
Characteristic	Symbol	Test Circuit	Condition	Min	Typ	Max	Unit
Total Supply Current	I_{CC}		$V_{CC} = 11V$	30	45	60	mA
Polarity Switching Voltage 1	$V_{pin\ 2}$	1	Positive Signal I_N	0		0.4	V
Polarity Switching Voltage 2	$V_{pin\ 2}$	1	Negative Signal I_N			2.5	V
Hori. OSC Starting Voltage	$V_{OSC-S(H)}$	2	$f_{HO} = 12KHz \sim 19KHz$			7.5	V
Hori. OSC Frequency	$f_{HO(1)}$	2	$V_{CC} = 11V, C = 4400pF$	15.0	15.75	16.5	KHz
Hori. OSC Frequency Range	$f_{HO(2)}$	3	$V_{CC} = 11V, C = 820pF, 5600pF$	14		60	KHz
f_{HO} to Supply Voltage Ratio	$\Delta f_{HO}/V_{CC}$	2	$f_{HO} = 15.75KHz, f_{HO} 9.9V - f_{HO} 12.1V$		40	130	Hz
f_{HO} to Ambient Temperature Ratio	$\Delta f_{HO}/Ta$	2	$f_{HO} = 15.75KHz, f_{HO} -20^\circ C - f_{HO} 60^\circ C$			260	Hz
OSC Frequency Control Sensitivity	B	4	$\Delta I_O = \pm 25\mu A$	16.0	17.6	19.3	Hz/ μA
D.C. Loop Gain	f_{DC}		$\mu \times B$		700		Hz/ μs
Output Pulse Width	$\tau_{HO(1)}$	5	$V_{CC} = 11V, R = 20K\Omega, C = 6800pF$	17.8	19.4	21.2	μs
Output Pulse Width Selection	$\tau_{HO(2)}$	5	$V_{CC} = 11V, R = 20K\Omega, C = 330pF, 18000pF$	2		40	μs
Output Pulse Width to Supply Voltage Ratio	$\Delta \tau_{HO}/V_{CC}$	5	$V_{CC} = 9.9V \sim 12.1V$			5	%
Output Pulse Width to Supply Temperature Ratio	$\Delta \tau_{HO}/Ta$	5	$V_{CC} = 11V, Ta = -20^\circ C \sim +60^\circ C$			5	%
OSC Output Saturation Voltage	$V_{pin\ 8}$		$V_{CC} = 11V, V_{10.7} = 1V$			2.0	V
OSC Output Drive Current	$V_{pin\ 8}$		$V_{CC} = 11V, V_{10.7} = 1V$	300			mA
X-Ray Protection Start Voltage	$V_{pin\ 8}$	2	$V_{CC} = 11V$	0.5	0.64	0.75	V

APPLICATION CIRCUIT

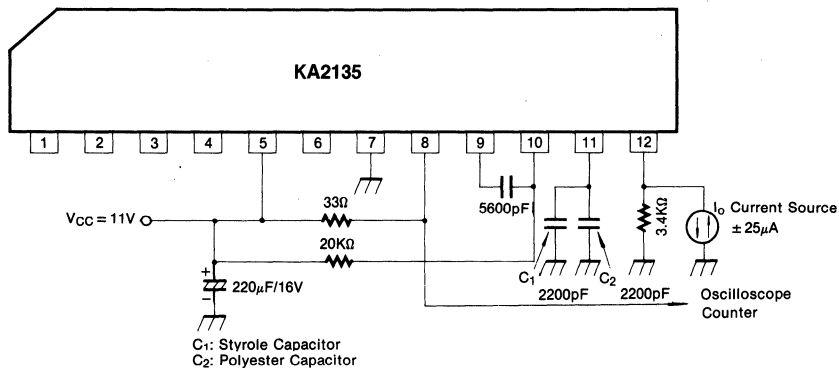
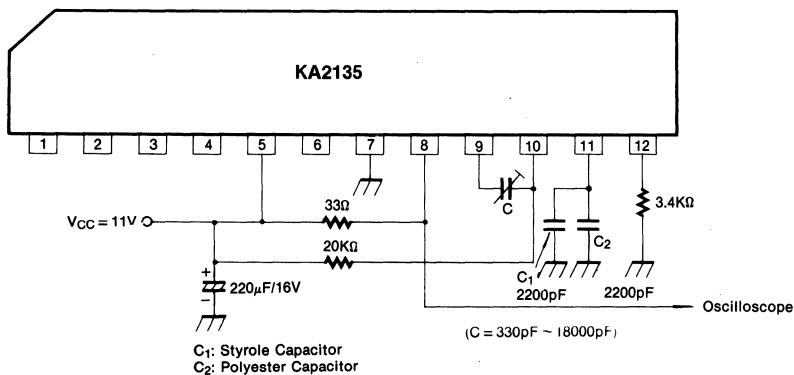


TEST CIRCUIT

Test Circuit 1 (V₂₋₇)Test Circuit 2 (V_{OSC-S(H)}, f_{HO(1)}, f_{HO(2)}, $\Delta f_{HO}/V_{CC}$, $\Delta f_{HO}/T_{a_r}$, V_{B-7})

Test Circuit 3 (f_{HOQ2})

Test Circuit 4 (B)

Test Circuit 5 ($\Delta V_{CC}/\Delta T_a$)

LOW-NOISE TV VERTICAL DEFLECTION SYSTEM

The KA2136 is a monolithic integrated circuit in a 12-lead Quad in-line plastic package. It's intended for use in black & white and color TV receivers. Low noise makes this device particularly suitable for use in monitors.

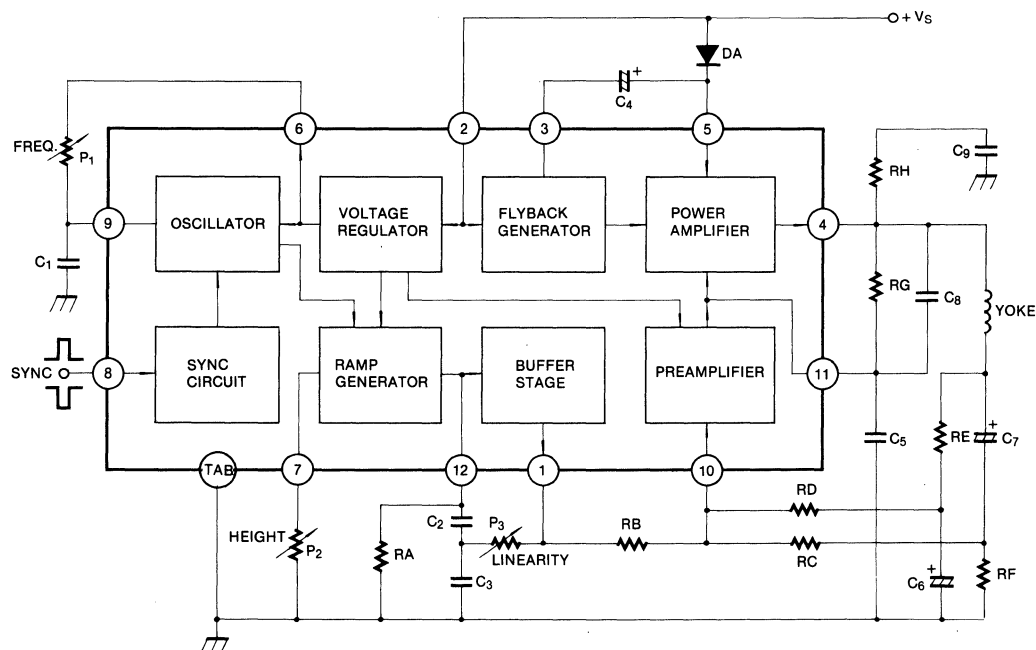
FUNCTIONS

- Synchronization Circuit
- Oscillator and Ramp Generator
- High Power Gain Amplifier
- Flyback Generator
- Voltage Regulator

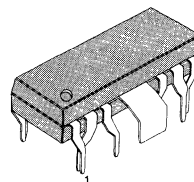
FEATURES

- Complete vertical deflection system
- Low noise
- Suitable for high definition monitors

BLOCK DIAGRAM



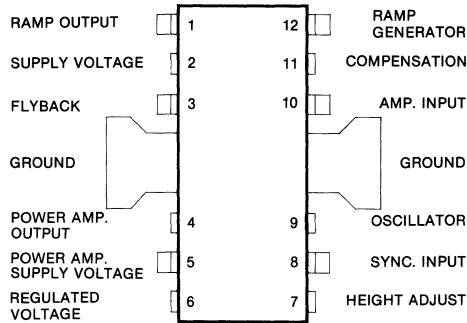
12 ZDIP/F



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2136	12 ZDIP/F	-20 ~ +70°C

PIN CONFIGURATION

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage at Pin 2	V_{CC}	30	V
Flyback Peak Voltage	V_4, V_5	60	V
Power Amplifier Input Voltage	V_{10}	+ 10 - 0.5	V V
Output Peak Current (Non Repetitive) at $t = 2$ msec	I_o	2	A
Output Peak Current at $f = 50\text{Hz}$ $t \leq 10\mu\text{sec}$	I_o	2.5	A
Output Peak Current at $f = 50\text{Hz}$ $t > 10\mu\text{sec}$	I_o	1.5	A
Pin 3 DC Current at $V_4 < V_2$	I_3	100	mA
Pin 3 Peak to Peak Flyback Current for $f = 50\text{Hz}$, $t_{fly} \leq 1.5\text{msec}$	I_3	1.8	A
Pin 8 Current	I_8	± 20	mA
Power Dissipation: at $T_{tab} = 90^\circ\text{C}$ at $T_{amb} = 80^\circ\text{C}$ (free air)	P_{tot}	5 1	W
Storage and Junction Temperature	T_{stg}, T_j	- 40 ~ + 150	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS(Refer to the test circuit $V_{CC} = 30V$, $T_a = 25^\circ C$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Fig.
DC CHARACTERISTICS							
Pin 2 Quiescent Current	I_2	$I_3 = 0$		7	14	mA	1b
Pin 5 Quiescent Current	I_5	$I_4 = 0$		8	17	mA	1b
Oscillator Bias Current	$-I_9$	$V_9 = 1V$		0.1	1	μA	1a
Amplifier Input Bias Current	$-I_{10}$	$V_{10} = 1V$		1	10	μA	1b
Ramp Generator Bias Current	$-I_{12}$	$V_{12} = 0$		0.02	0.3	μA	1a
Ramp Generator Current	$-I_{12}$	$I_7 = 20\mu A$, $V_{12} = 0$	18.5	20	21.5	μA	1b
Ramp Generator Non-linearity	$\frac{\Delta I_{12}}{I_{12}}$	$\Delta V_{12} = 0$ to $12V$ $I_7 = 20\mu A$		0.2	1	%	1b
Supply Voltage Range	V_{CC}		10		35	V	—
Pin 1 Saturation Voltage to Ground	V_1	$I_1 = 1mA$		1	1.4	V	—
Pin 3 Saturation Voltage to Ground	V_3	$I_3 = 10mA$		700	1000	mV	1a
Quiescent Output Voltage	V_4	$V_s = 10V$, $R_1 = 1K\Omega$ $R_2 = 1K\Omega$	4.1	4.4	4.75	V	1a
		$V_s = 35V$, $R_1 = 3K\Omega$ $R_2 = 1K\Omega$	8.3	8.8	9.45	V	1a
Output Saturation Voltage to Ground	V_{4L}	$-I_4 = 0.1A$		0.9	1.2	V	1c
		$-I_4 = 0.8A$		1.9	2.3	V	1c
Output Saturation Voltage to Supply	V_{4H}	$I_4 = 0.1A$		1.4	2.1	V	1d
		$I_4 = 0.8A$		2.8	3.2	V	1d
Regulated Voltage at Pin 6	V_6		6.1	6.5	6.9	V	1b
Regulated Voltage at Pin 7	V_7	$I_7 = 20\mu A$	6.2	6.6	7	V	1b
Regulated Voltage Drift with Supply Voltage	$\frac{\Delta V_6}{\Delta V_{CC}}, \frac{\Delta V_7}{\Delta V_{CC}}$	$\Delta V_s = 10$ to $35V$		1		mV/V	1b
Amplifier Input Reference Voltage	V_{10}		2.07	2.2	2.3	V	—
Pin 8 Input Resistance	R_8	$V_8 \leq 0.4V$	1			M Ω	1a

Fig. 1—DC test circuits

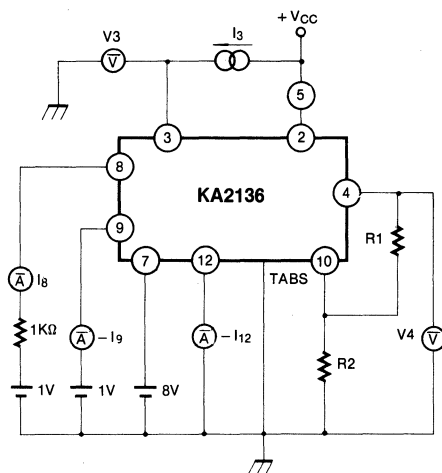


Fig. 1a

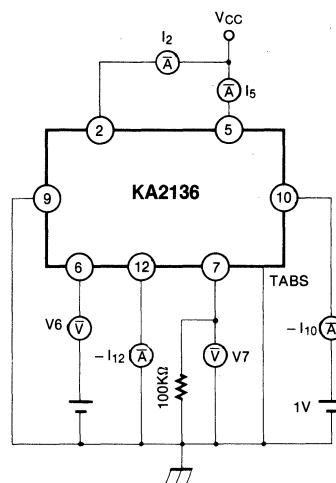


Fig. 1b

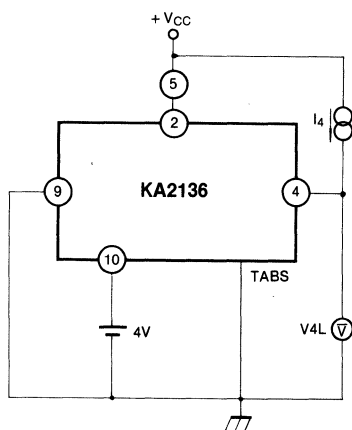


Fig. 1c

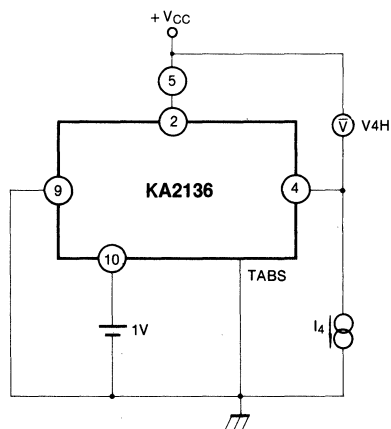


Fig. 1d

ELECTRICAL CHARACTERISTICS

(Refer to the AC test circuit, $V_{CC} = 22V$, $f = 50Hz$, $T_a = 25^\circ C$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
AC CHARACTERISTICS						
Supply Current	I_{CC}	$I_y = 1 \text{ App}$		140		mA
Sync. Input Current (Positive or Negative)	I_s		500			μA
Flyback Voltage	V_4	$I_y = 1 \text{ App}$		45		V
Flyback Time	t_{fly}	$I_y = 1 \text{ App}$		0.7		ms
Peak to Peak Output Noise	V_{on}	Pin 9 Connected to GND			40	mV _{pp}
Free Running Frequency	f_o	$(R1 + R1) = 300K\Omega$ $C2 = 0.1\mu F$		52.4		Hz
		$(R1 + R1) = 360K\Omega$ $C2 = 100nF$		43.7		Hz
Synchronization Range	Δf	$I_s = 0.5mA$	14			Hz
Frequency Drift with Supply Voltage	$\frac{\Delta f}{\Delta V_{CC}}$	$V_s = 10 \text{ to } 35V$		0.005		Hz/V
Frequency Drift with Tab Temperature	$\frac{\Delta f}{\Delta T_{tab}}$	$T_{tab} = 40 \text{ to } 120^\circ C$		0.01		Hz/ $^\circ C$

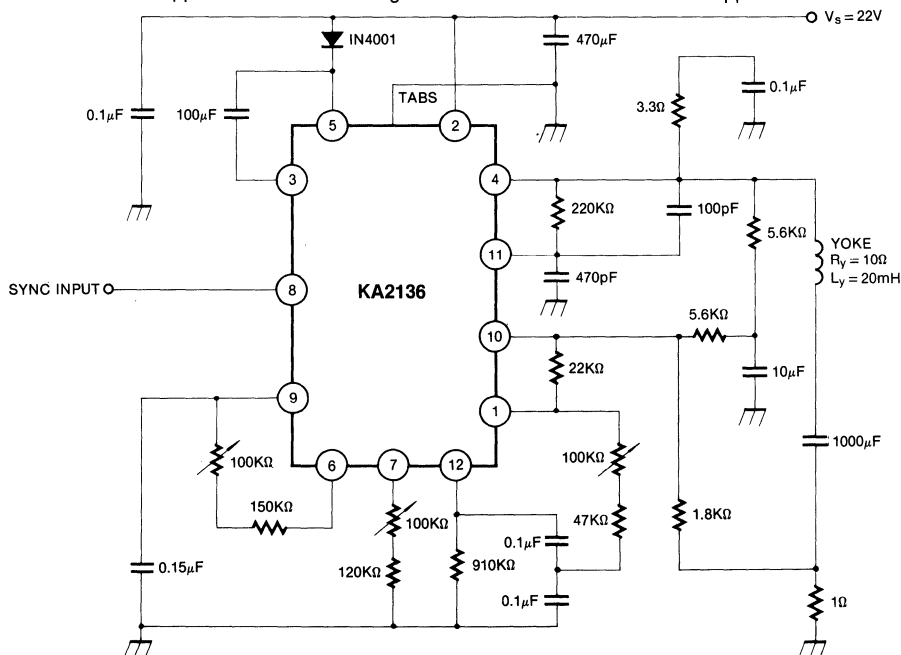
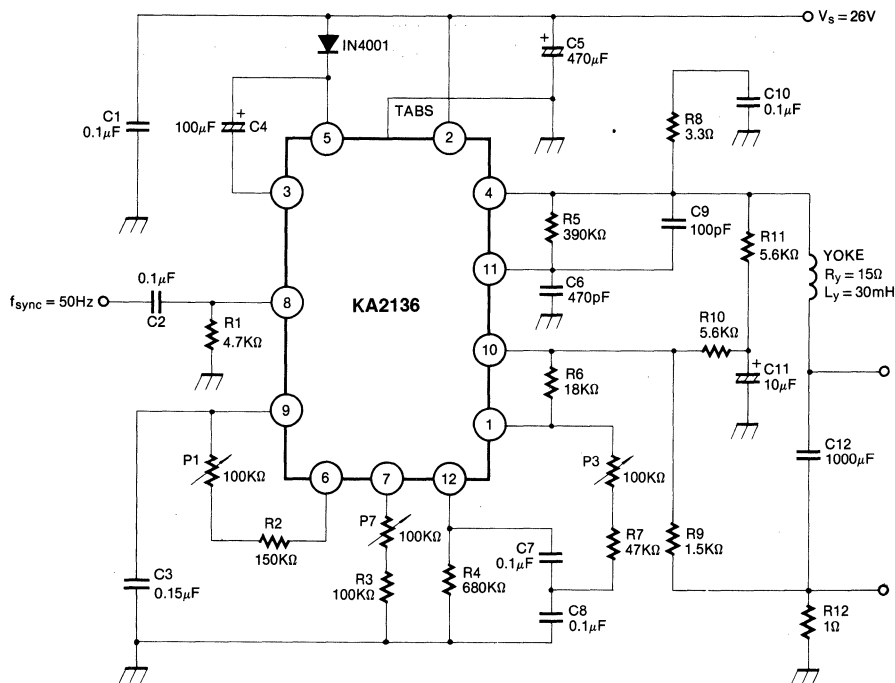
Fig. 2 – AC test and application circuit for large screen B/W TV set 10 Ω /20mH/1 App.

Fig. 3 – Typical application circuit for small screen 90° TV set ($R_y = 15\Omega$, $L_y = 30\text{mH}$, $I_y = 0.82\text{ App.}$)



MOUNTING INSTRUCTIONS

During soldering the tab temperature must not exceed 260°C and the soldering time must not be longer than 12 seconds.

The external heatsink or printed circuit copper area must be connected to electrical ground.

The junction to ambient thermal resistance can be reduced by soldering the tabs to a suitable copper area of the printed circuit board (fig. 4) or to an external heatsink (fig. 5).

The diagram of fig. 6 shows the maximum dissippable power P_{tot} and the $R_{th j-amb}$ as a function of the side "ℓ" of two equal square copper areas having a thickness of 35μ (1.4 mil).

Fig. 4 – Example of P.C. board copper area used as heatsink.

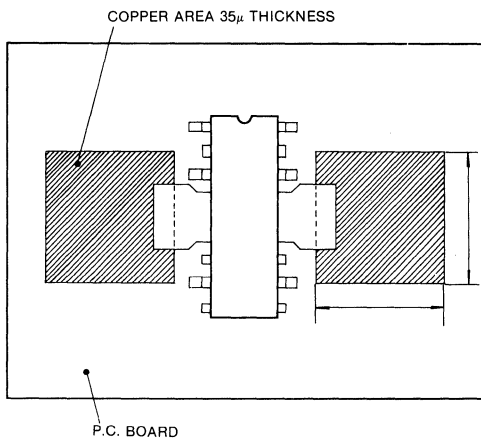


Fig. 5 – Example of external heatsink.

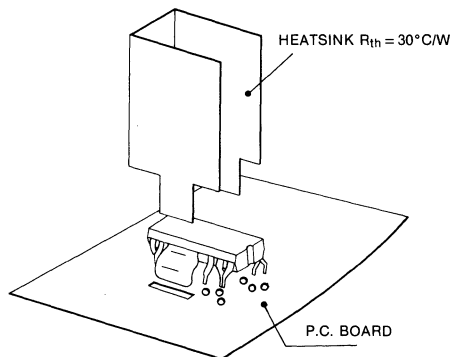


Fig. 6 MAXIMUM POWER DISSIPATION AND JUNCTION-AMBIENT THERMAL RESISTANCE VS. "ℓ"

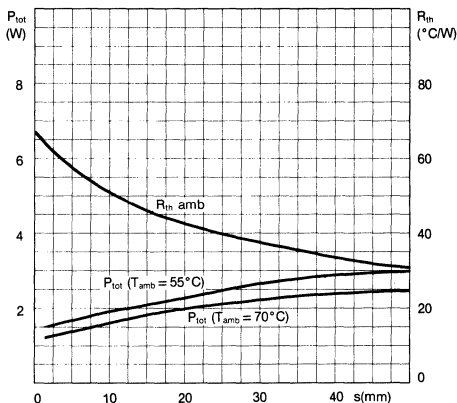
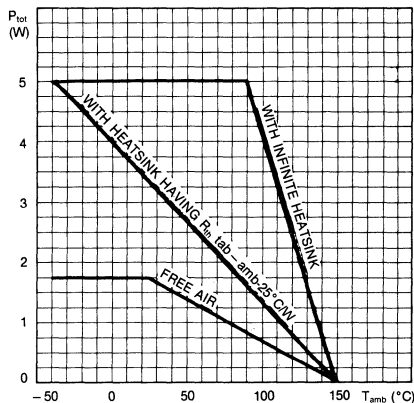


Fig. 7 MAXIMUM ALLOWABLE POWER DISSIPATION VS. AMBIENT TEMPERATURE



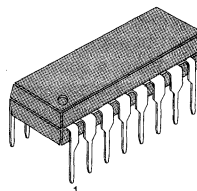
TV HORIZONTAL PROCESSOR

The KA2137 is a horizontal processor circuit for B/W. and color television receiver. It is a monolithic integrated circuit encapsulated in 16-lead dual in-line plastic package.

FEATURES

- Noise gated horizontal sync separator.
- Noise gated vertical sync separator.
- Horizontal oscillator with frequency range limiter.
- Phase comparator between sync pulses and oscillator pulses (PLL).
- Phase comparator between flyback pulses and oscillator pulses (PLL).
- Loop gain and time constant switching (VCR).
- Composite blanking and key pulse generator.
- Protection circuits.
- Output stages with high current capability.

16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2137	16 DIP	-20 ~ +70°C

BLOCK DIAGRAM

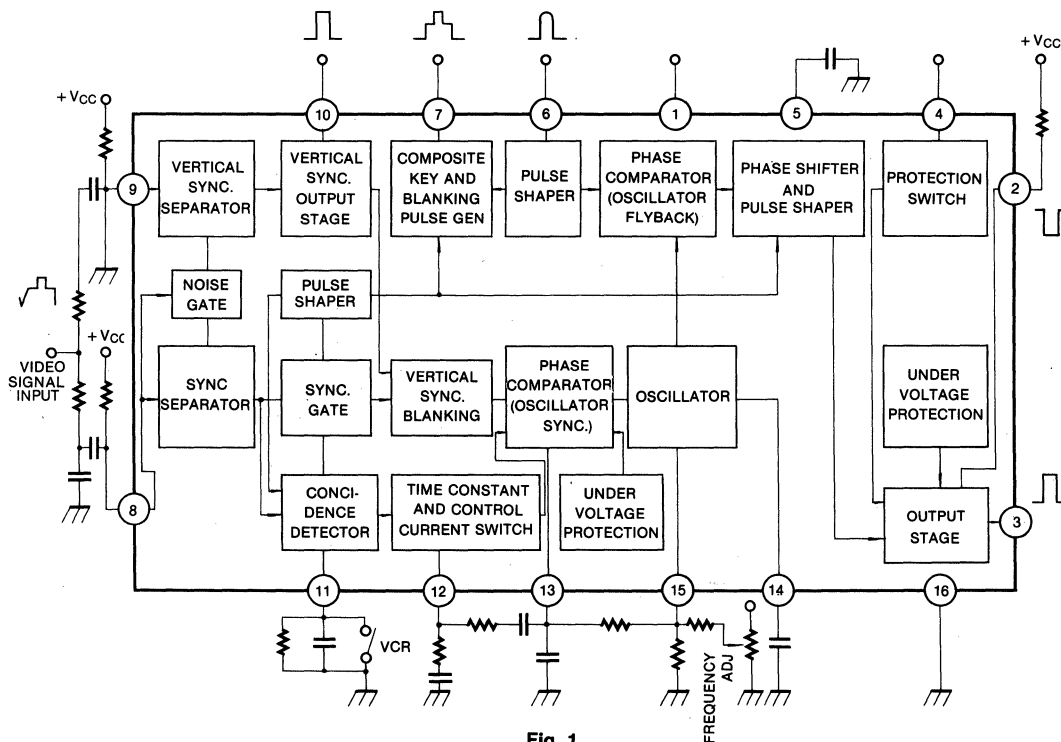


Fig. 1

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage at Pin 1	V_{CC}	15	V
Voltage at Pin 2	V_2	18	V
Voltage at Pin 4	V_4	V_{CC}	
Voltage at Pin 8	V_8	$\begin{cases} V_{CC} \\ -6 \end{cases}$	V
Voltage at Pin 9	V_9	$\begin{cases} +6 \\ -6 \end{cases}$	V
Voltage at Pin 11	V_{11}	V_{CC}	V
Pin 2 Peak Current	I_2	1	A
Pin 3 Peak Current	I_3	0.5	A
Pin 6 Current	I_6	30	mA
Pin 7 Current	I_7	20	mA
Pin 10 Current	I_{10}	30	mA
Total Power Dissipation at $T_a \leq 70^\circ\text{C}$	P_D	1	W
Storage and Junction Temperature	T_{stg}, T_J	$-40 \sim +150$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, $V_{CC} = 12\text{V}$, $T_{amb} = 25^\circ\text{C}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
----------------	--------	-----------------	-----	-----	-----	------

COINCIDENCE DETECTOR

Output Voltage	V_{11}	with coincidence		6.8		V
		without coincidence			4	
Peak Output Current	I_{11}			0.5		mA

VCR SWITCH

Input Voltage	V_{11}		0 to 4 or 8.5 to 12			V
Output Current	$-I_{11}$		35			μA
Output Current	I_{11}		0.4			mA

TIME CONSTANT SWITCH

Output Voltage	V_{12}			3		V
Output Resistance	R_{12}	$4.5\text{V} < V_{11} < 8\text{V}$ $V_{11} > 8.5\text{V}$ or $V_{11} < 4\text{V}$		100		Ω
				40		K Ω

OSCILLATOR

Low Level Threshold Voltage	V_{14}			5.4		V
High Level Threshold Voltage	V_{14}			8.2		V
Charge Current	I_{14}			0.6		mA
Discharge Current	I_{14}			0.3		mA
Current Source Supply Voltage	V_{15}			3		V

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Current Source Supply Current	I_{15}			0.3		mA
Free Running Frequency	f_o			15625		Hz
Adjustment Range	$\frac{\Delta f_o}{f_o}$			± 10		%
Frequency Control Sensitivity	$\frac{\Delta f_o}{\Delta I_{15}}$			52		$\frac{\text{Hz}}{\mu\text{A}}$
Frequency Change when V_{CC} Drops to 4V	Δf_o				± 10	%

FLYBACK PULSE

Input Threshold Voltage of Blanking Generator	V_6			1.5		V
Input Threshold Voltage of Phase Comparator	V_6			7.6		V
Input Switching Current	I_6	$V_6 \geq 1.7\text{V}$		0.23		mA

OUTPUT PULSE

Peak to Peak Output Voltage	V_3	$I_3 = 150\text{mA}_{pp}$		10		V
Output Current	I_3	$V_3 = 5\text{V}$		500		mA
Output Resistance	R_3	at leading edge of output pulse		3		Ω
		at trailing edge of output pulse		20		
Output Pulse Duration	t_p		20	22	26	μs

COMPOSITE BLANKING AND KEY PULSE

Key Pulse Output Peak Voltage	V_{7K}		9	11		V
Blanking Pulse Output Voltage	V_{7B}		4.2	4.5	4.8	V
Output Resistance	R_7			100		Ω
Phase Relation Between Trailing Edge of Key Pulse and Middle of Sync Input Pulse	t_{sk}			2.7		μs
Key Pulse Duration	t_K		3.5	3.8		μs
Delay Between Flyback Pulse and Blanking Pulse	t_{fb}	$V_6 = 1.7\text{V}$			0.2	μs

INTERNAL GATING PULSE

Gating Pulse Duration	t_g			7.5		μs
Phase Relation Between Middle of Sync Pulse and Leading Edge of Gating Pulse	t			3.75		μs

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
----------------	--------	-----------------	-----	-----	-----	------

OSCILLATOR-FLYBACK PULSE PHASE COMPARATOR

Control Voltage Range	V_5		9.4 to 8.2		V
Peak Control Current	I_5			± 0.5	mA
Input Current (blocked phase detector)	I_5			5	μA
Permissible Delay Between Output Pulse Leading Edge and Flyback Pulse Leading Edge	t_d			$t_p - t_f$	μs
Static Control	$\frac{\Delta t}{\Delta t_d}$			0.2	%

SYNC PULSE-OSCILLATOR PHASE COMPARATOR

Control Voltage Range	V_{13}		4.6 to 1.4		V
Control Peak Current	I_{13}			± 2	mA
Phase Lock Loop Gain	$\frac{\Delta f}{\Delta t}$			2	$\frac{KHz}{\mu s}$
Catching and Holding Range	f			± 700	Hz

OVERALL PHASE RELATIONSHIP

Phase Relation Between Middle of Flyback Pulse and Middle of Sync Pulse	t_o			2.6	μs
Adjustment Sensitivity	$\frac{\Delta V_5}{\Delta t_o}$			65	$\frac{mV}{\mu s}$
Adjustment Sensitivity	$\frac{\Delta I_5}{\Delta t_o}$			10	$\frac{\mu A}{\mu s}$

PROTECTION CIRCUIT

Input Voltage for Switching Off the Output Pulses	V_4	Output Pulses OFF			0.5	V
		Output Pulse ON	1			
Input Resistance	R_4			200		K Ω
Input Current	I_4		5			μA
Supply Voltage	V_{CC}		10	12	13.2	V
Supply Current	I_{CC}	$I_3 = 0$		40	52	mA
Supply Voltage at which the Output Pulses (at pin 2 and 3) are Switched Off	V_{CC}				4	V

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
----------------	--------	-----------------	-----	-----	-----	------

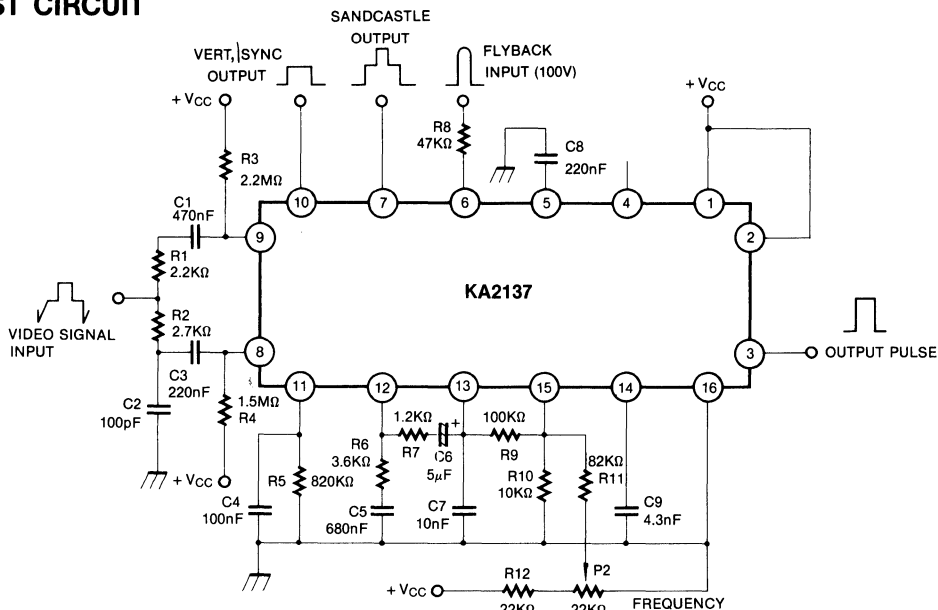
HORIZONTAL SYNC. SEPARATOR AND NOISE GATE

Peak to Peak Input Signal	V_i		1	3	6	V
Input Switching Voltage	V_8	$I_8 = 80\mu\text{A}$		1.5		V
Input Switching Current	I_8	$V_8 = 1.4\text{V}$		10		μA
Input Blocking Current for Noise Suppression	I_8			0.9		mA
Input Switching Voltage for Noise Suppression	V_8			2.1		V
Leakage Current	I_8	$V_8 = -5\text{V}$			1	μA

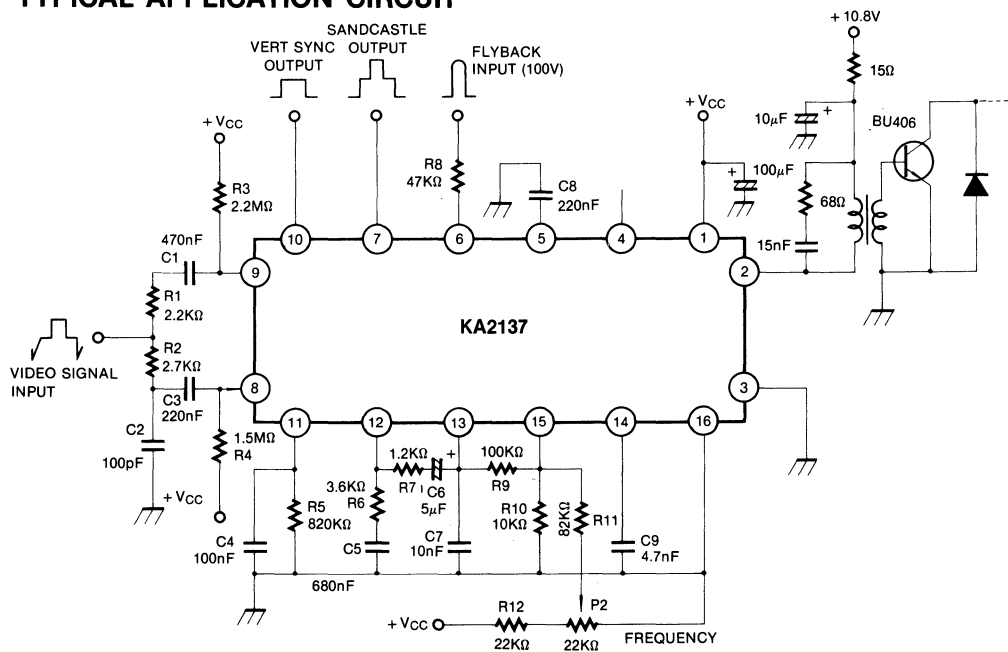
VERTICAL SYNC. SEPARATOR

Peak to Peak Input Signal	V_i		1	3	6	V
Input Switching Voltage	V_9	$I_9 = 80\mu\text{A}$		1.5		V
Input Switching Current	I_9	$V_9 = 1.4\text{V}$		5		μA
Leakage Current	I_9	$V_9 = -5\text{V}$			1	μA
Vertical Sync. Pulse Output Voltage	V_{10}	No load at pin 10	11			V
Output Resistance	R_{10}			10		$\text{K}\Omega$
Delay Between Leading Edge of Input and Output Signals	t_{LV}			17		μs
Delay Between Trailing Edge of Input and Output Signals	t_{TV}			50		μs
Vertical Sync. Pulse Duration	t_V			190		μs

TEST CIRCUIT



TYPICAL APPLICATION CIRCUIT



Application circuit for large screen B/W and color TV

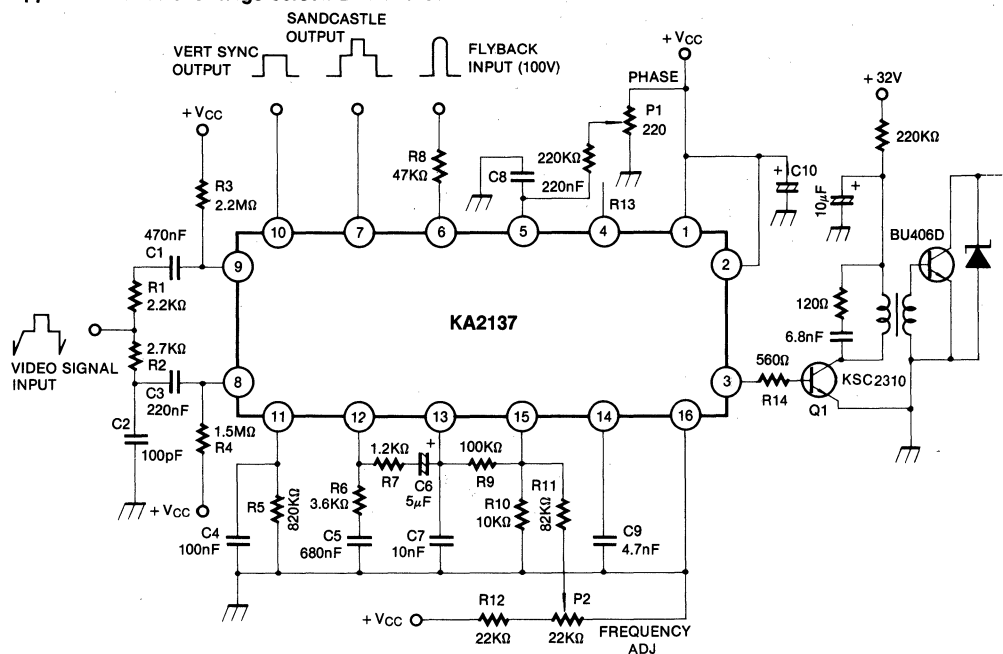


Fig. 4

Application circuit for power mosfet output stage

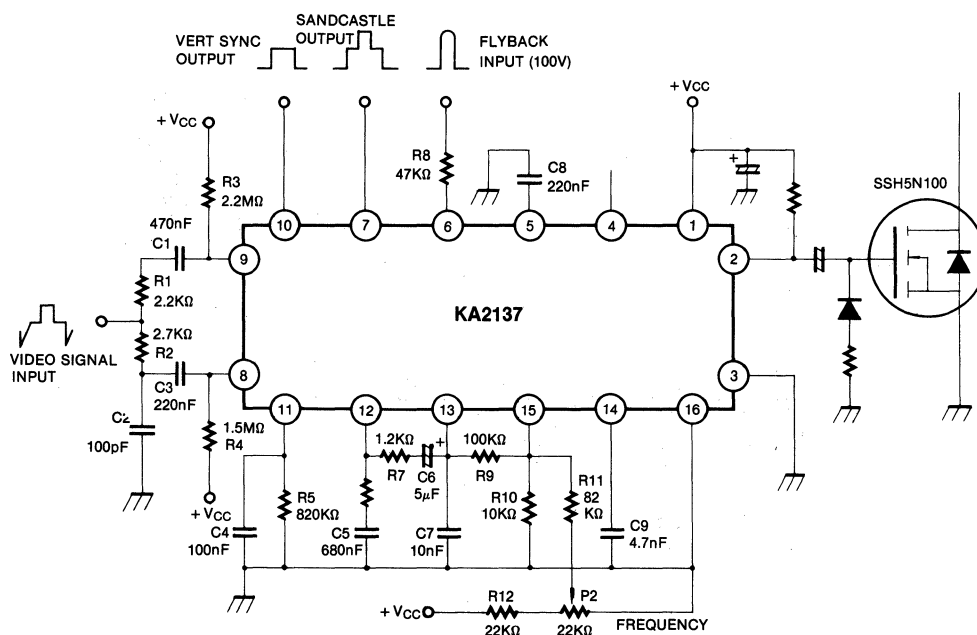


Fig. 5

Vertical sync. output pulse

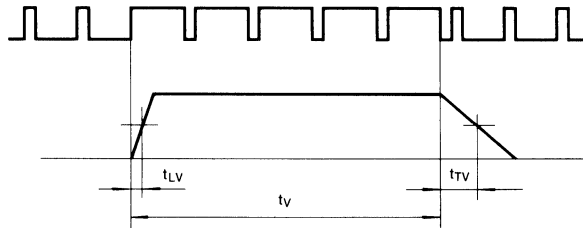


Fig. 6

Relationship of main waveform phases

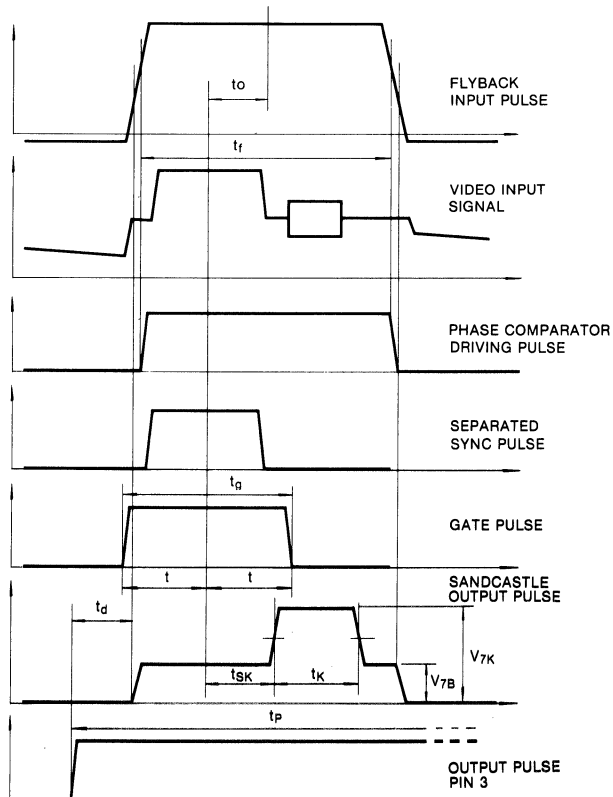


Fig. 7

FREE RUNNING FREQUENCY VS. SUPPLY VOLTAGE

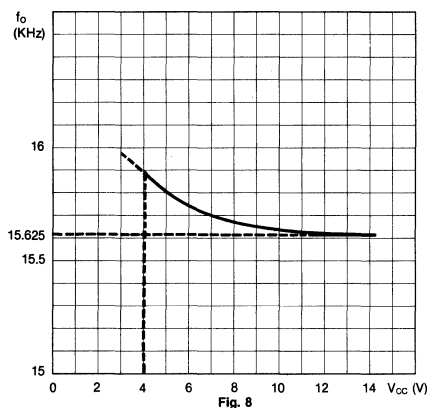


Fig. 8

OVERALL PHASE RELATION VS. SUPPLY VOLTAGE

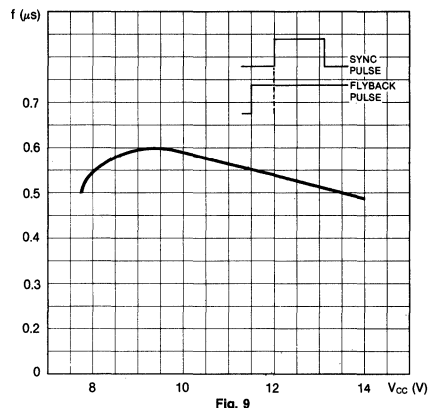


Fig. 9

LOOP GAIN

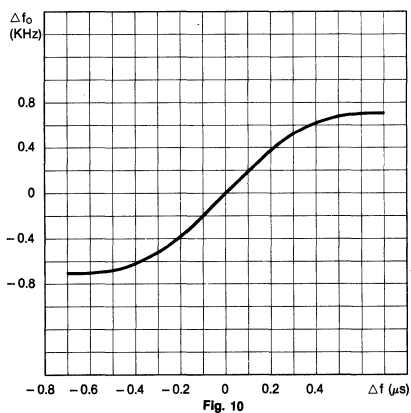


Fig. 10

APPLICATION INFORMATION

Pin 1 — Positive supply

The operating supply voltage of the device ranges from 10V to 13.2V.

Pin 2 and 3 — Output

The outputs of KA2137 are suitable for driving transistor output stages, they deliver positive pulse at pin 3 and negative pulse at pin 2.

The negative pulse is used for direct driving of the output stage, while positive pulse is useful when a driver stage is required. The rise and fall times of the output pulses are about 150 ns so that interference due to radiation are avoided.

Furthermore the output stages are internally protected against short circuit.

Pin 4 — Protection circuit input

By connecting pin 4 of the IC to earth the output pulses at pin 2 and 3 are shut off this function has been introduced to protect the final stages from overloads.

The same pulses are also shut off when the supply voltage falls below 4V.

Pin 5 — Phase shifter filter

To compensate for the delay introduced by the line final stages, the flyback pulses to pin 6 and the oscillator waveform are compared in the oscillator-flyback pulse phase comparator.

The result of the comparison is a control current which, after it has been filtered by the external capacitor connected to pin 5, is sent to a phase shifter which adequately regulates the phase of the output pulses.

The maximum phase shift allowed is:

$$t_d = t_p - t_r$$

where t_r is the flyback pulse duration.

Pin 5 has high input and output resistance (current generator).

Pin 6 — Flyback input

The flyback pulse drives the high impedance input through a resistor in order to limit the input current to suitable maximum values.

The flyback input pulses are processed by a double threshold circuit; this generates the blanking pulses by sensing low level flyback voltage and the pulses to drive the phase comparator by sensing high level flyback voltage, therefore phase jitter caused by ringing normally associated with the flyback pulse, is avoided.

Pin 7 — Key and blanking pulse output

The key pulse for taking out the burst from the chrominance signal is generated from the oscillator ramp and has therefore a fixed phase position with respect to the sync.

The key pulse is then added internally to the blanking pulse obtained by correctly forming the flyback pulse present at pin 6. The sum of the two signals (sandcastle pulse) is available on low impedance at output pin 7.

Pin 8 and 9 — Sync separators inputs

The video signal is applied by means of two distinct biasing networks to pins 8 and 9 of the IC and therefore to the respective vertical and horizontal sync separators.

The latter take the sync pulses out of the video signal and make them available to the rest of the circuit for further processing. An amplitude detector also connected to pin 8, blocks operation of the sync separators when interference or noise peaks exceed a certain preset value.

Pin 10 — Vertical sync output

The vertical sync pulse, obtained by internal integration of the synchronizing signal, is available at this pin. The output impedance is typically 10K Ω and the lowest amplitude without load is 11V.

Pin 11 — Coincidence detector

From the oscillator waveform a gate pulse 7 μ s wide is taken whose phase position is centered on the horizontal synchronism. The gate pulse not only controls a logic block which permits the sync to reach the oscillator-sync phase comparator only for as long as its duration, but also allows the latching and de-latching conditions of the oscillator to be established.

This function is obtained by a coincidence detector which compares the phase of the gate pulses with that of the sync. When the two signals are not accurately aligned in time it means that the oscillator is not synchronized. In this case the detector acts on the logic block to eliminate its filtering effect and on the time constant switching block to establish a high impedance on pin 12 (small time constant of low-pass filter).

This latter block also acts on the oscillator-sync phase detector to increase its sensitivity and with it the loop gain of the synchronizing system.

In this conditions the phase lock has low noise immunity (wide equivalent noise bandwidth) and rapid pull-in time which allows fairly short synchronization times.

Once locking has taken place the coincidence detector enables the logic block, causes a low impedance on pin 12 and reduces the sensitivity of the phase comparator.

In these conditions the phase lock has high noise immunity (narrow equivalent noise bandwidth) due to the complete elimination of interference which occurs during the scanning period and the greater inertia with which the oscillator can change its frequency.

To optimize the behaviour of the IC if a video recorder is used, the state of the detector can be forced by connecting pin 11 to earth or to +V_{CC}. The characteristics of the phase lock thus correspond to the lack of synchronization.

Pin 12 — Time constant switch, (see pin 11)**Pin 13 — Control current output**

The oscillator is synchronized by comparing the phase of its waveform with that of the sync pulses in the oscillator-sync phase comparator and sending its output current I_{13} (proportional to the phase difference between the two signals) to pin 15 of the oscillator after it has been filtered properly with an external low-pass circuit.

The time constant of the filter can be switched between two values according to the impedance presented by pin 12. The voltage limiter at the output of the phase comparator limits the voltage excursion on pin 13 and therefore the frequency range in which the oscillator remains held-in.

The output resistance of pin 13 is:

low when $V_{13} < 4.3V$ or $V_{13} < 1.6V$

high when $1.6V < V_{13} < 4.3V$

To prevent the vertical sync from reaching the oscillator-sync phase comparator along with the horizontal sync, a signal which inhibits the phase detector during the vertical interval is taken from the vertical output stage; inhibition remains even if the video signal is not present.

The free running frequency of the oscillator is determined by the values of the capacitor and of the resistor connected to pins 14 and 15 respectively.

To generate the line frequency output pulses, two thresholds are fixed along the fall ramp of the triangular waveform of the oscillator.

Pin 14 — Oscillator (see pin 13)**Pin 15 — Oscillator control current input (see pin 13)****Pin 16 — Ground**

DEFLECTION PROCESSOR FOR CRT DISPLAY

The KA2138 is a monolithic integrated circuit encapsuled in 20 dual-in-line package designed for vertical, horizontal deflection signal processing for a CRT display.

This IC can be connected to the KA2131 (for vertical output use) to form a deflection processing that uses every requirement for a CRT display.

FUNCTIONS

[Vertical Block]

- Vertical oscillator & Ramp generator
- Sampling type DC voltage control within retrace time

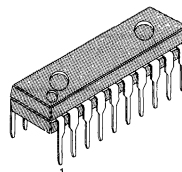
[Horizontal Block]

- Horizontal oscillator & AFC
- X-ray protector
- AFC sawtooth wave generator
- Horizontal pulse duty setting
- Horizontal phase shifter

FEATURES

- Vertical pull-in range 20Hz permits non-adjusting at vertical synchronizing 50Hz or 60Hz.
- Good vertical linearity because DC supplying at the vertical output stage is subjected to sampling type control during retrace time
- The horizontal oscillation frequency is stable from 15KHz to 100KHz.
- The horizontal display can be shifted right or left
- The horizontal/vertical synchronizing pulse input can be used intact regardless of the difference in pulse polarity and pulse width.
- The AFC feedback sawtooth wave can be obtained by simply applying a flyback pulse to the IC as a trigger pulse
- Any duty of horizontal pulse can be set

20 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2138N	20 DIP	- 20 ~ + 70°C

BLOCK DIAGRAM

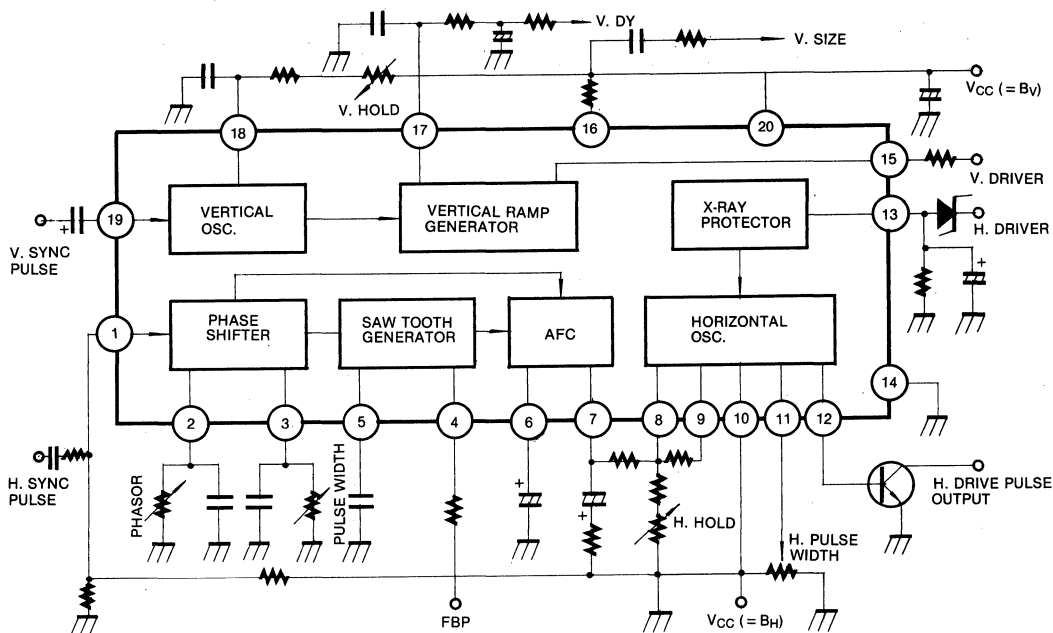


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	$V_{10(\max)}, V_{20(\max)}$	14	V
Power Dissipation	P_d	780	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{10}, V_{20}	9	12	13.5	V
Vert. Pulse Voltage	V_P	2.0	5.0	6.0	V _{p-p}
Horiz. Pulse Voltage	H_P	2.0	5.0	6.0	V _{p-p}

ELECTRICAL CHARACTERISTICS ($V_{CC10} = V_{CC20} = 12V$, $T_a = 25^\circ C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Current	I_{10}	$V_{CC10} = 12V$	12		30	mA
	I_{20}	$V_{CC20} = 12V$	5		12	mA

Vertical Part

Pull-In Range	f_P	Synchronizing pulse frequency 60Hz	21	23		Hz
Free-Running Frequency	f_{VO}		55	60	65	Hz
Frequency Drift with Supply Voltage	$\Delta f_{(V)}$	$V_{20} = 12 \pm 1V$, 60Hz at 12V	-0.1		0.1	Hz
Center Voltage Control Threshold Level			3.8		4.4	V
Frequency Drift with Ambient Temperature	$\Delta f_{(T)}$	$T_a = -10$ to $+60^\circ C$	-0.028		0.028	Hz/ $^\circ C$
Oscillation Start Voltage	$V_{OSC(V)}$				4.0	V
Driver Amplification Factor	ΔA_v		12		18	dB

Horizontal Part

Oscillation Start Voltage	$V_{OSC(H)}$				4.0	V
Free-Running Frequency	f_{HO}	$f_H = 15.734KHz$	-750		750	Hz
AFC DC Loop Current	I_{AFC}		± 0.85		± 1.6	mA
Frequency Drift with Supply Voltage	$\Delta f_{(V(H))}$	$V_{10} = 12 \pm 1V$, 15.734KHz at 12V	-50		50	Hz
Frequency Drift with Ambient Temperature	$\Delta f_{(T(H))}$	$T_a = -10$ to $+60^\circ C$	-2.9		2.9	Hz/ $^\circ C$
Comparison Wave Shaping Input Voltage	V_4		0.6		0.9	V
X-Ray Protector Starting Voltage	V_{13}		0.5		0.8	V
Horizontal Drive Current	I_{12}		6.0		12.0	mA

TYPICAL APPLICATION CIRCUIT

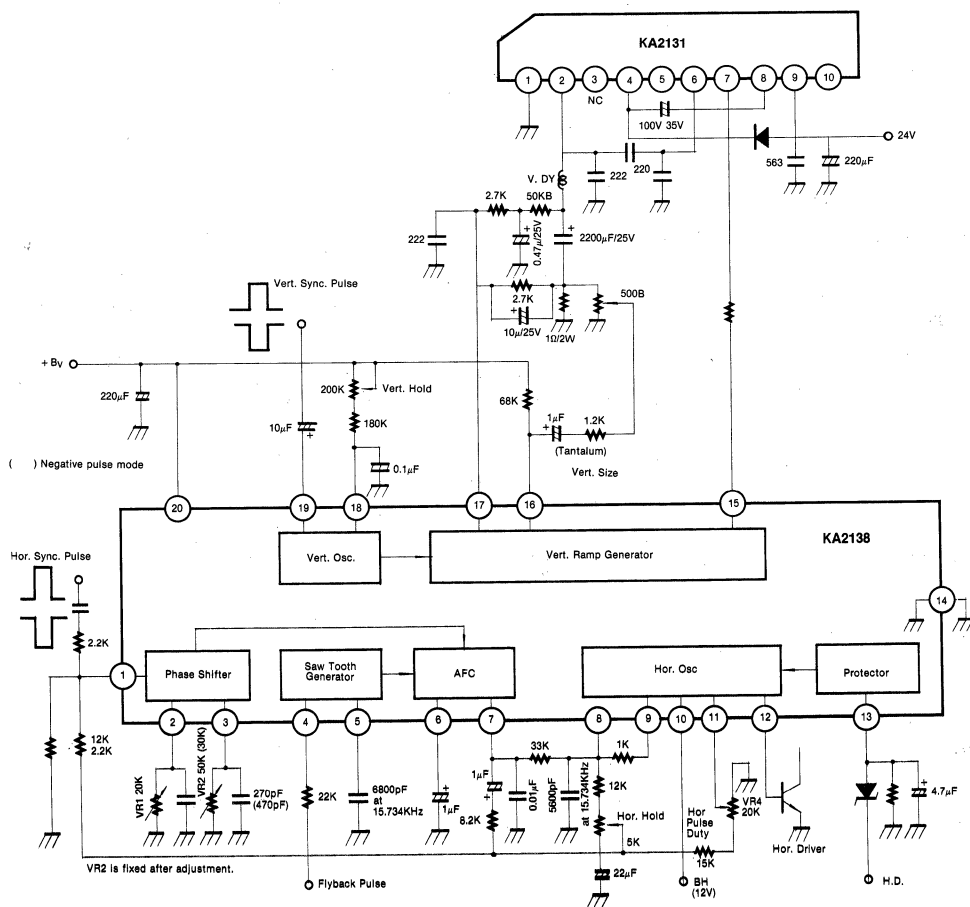
14" color monitor (f_v : 60Hz, f_H = 15.734KHz)

Fig. 2

VIDEO-CHROMA DEFLECTION SYSTEM FOR A COLOR TV (NTSC)

The KA2153 combines the video-chroma sub-system and the deflection combination on a single monolithic integrated circuit to provide a color television video-chroma deflection system.

This device includes a video amplifier, color demodulator that is designed to provide color differential output, and improved sync separator, horizontal oscillator with saw tooth wave type AFC, horizontal pre-driver with X-ray protection circuit, and vertical oscillator, vertical pre-driver in a 42 leads dual in-line type plastic package.

FUNCTIONS

- Inverter-amplifier
- Contrast control
- Pedestal clamp
- Brightness control
- ACC-amplifier
- Tint control
- Uni-color control
- 3.58MHz VCO
- APC
- Color-Killer
- Color demodulator
- Matrix circuit
- Sync-separator (H.V.sync in)
- $2f_H$ horizontal oscillator
- Flip-flop
- Stabilized horizontal V_{CC} by zener diode
- Horizontal pre driver
- Gate pulse generator
- Vertical sync input
- Vertical oscillator
- Ramp generator

FEATURES

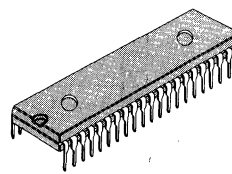
Video-Chroma Section

- Minimum numbers of external parts required.
- Stabilized with respect to variation of temperature and supply voltage.
- A few initial adjustment required.

Deflection Section

- Excellent temperature stability of horizontal oscillator.
- Exact 50% duty cycle output due to the $2f_H$ oscillator and flip-flop circuit.
- Excellent inter-race.
- Stable Sync separator with V/H input terminals.

42 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2153	42 DIP	- 20 ~ + 65°C

BLOCK DIAGRAM

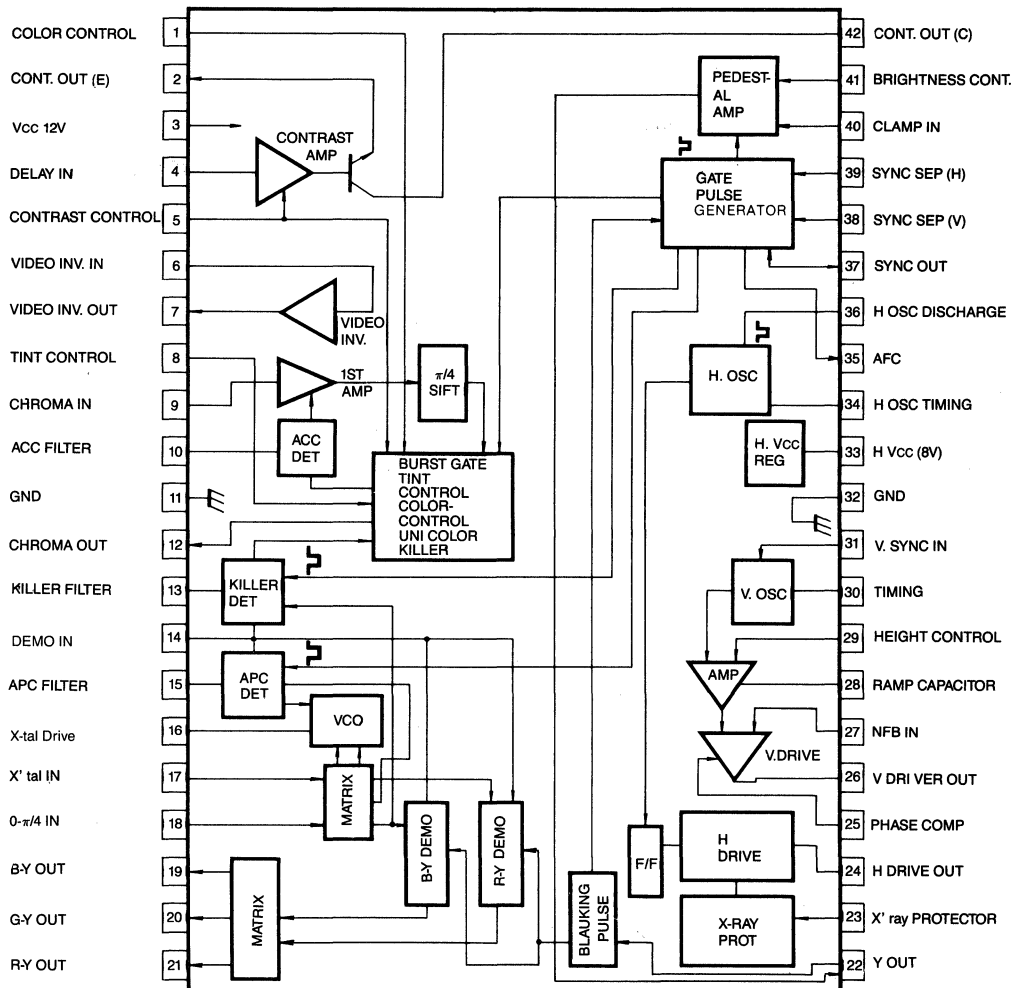


Fig. 1

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_3 Max	15	V
Supply Current	I_{33} Max	40	mA
Input Signal Level	V_{in}	5	V_{p-p}
Demo. Min. Load Resistance	R_{LD}	1.8	$K\Omega$
Horiz. Drive Peak Current	$-I_{24}$ Max	30	mA
Horiz. Drive Operating Current	$-I_{24}$	15	mA
Vert. Output Current	I_{26} Max	-5	mA
Sync separator Input Level	V_{38} Max V_{39} Max	8	V_{p-p}
Term. 7 Max. Operating Current	I_7	5	mA
Term. 2 Max. Operating Current	I_2	4	mA
Power Dissipation (Note)	P_d	2.2	W
Operating Temperature	T_{opr}	-20 ~ 65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 ~ 150	$^\circ\text{C}$

Note: Derated above $T_a = 25^\circ\text{C}$ in the proportion of 17.6mW/ $^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

VIDEO SECTION (Unless otherwise specified, $V_3 = 12\text{V}$, $T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
12V Supply Current	I_{CC3}	Measure term. 3 current	60	82	100	mA	1
Video Gain	U_{22}/U_6	$V_6 = 4.25\text{V}$, U_6 : 4.0MHz, 1.0V _{p-p} , $V_5 = 10\text{V}$, $V_B = 8.0\text{V}$	2.0	3.5	5.0	dB	2
Contrast Gain Control Range	ΔG_V	$V_6 = 4.25\text{V}$, U_6 : 500KHz, 1.0V _{p-p} , V_5 : 5 ~ 10V 20 log (V_{22} (max)/ V_{22} (min))	11.2	12.3	13.4	dB	2
Video Frequency Characteristics	ΔG_{vf}	$V_6 = 4.25\text{V}$, $V_5 = 10\text{V}$, $V_B = 8.0\text{V}$ $U_6 = 4.0\text{MHz}$, 0.5MHz 1.0V _{p-p} 20 log (V_{22} (4MHz)/ V_{22} (0.5MHz))	-3.5	-1.5	0.5	dB	2
DC Restoration Ratio	K	$V_{41} = 4.1\text{V}$ Change APL 10% to 90% Measure pedestal level change of term. 22	63	70	77	%	2
Maximum Video Output	U_V MAX.	Term. 5 open. change V_{40} DC voltage, measure 90% of voltage change at term. 22	5.0	7.5	—	V_{p-p}	2

ELECTRICAL CHARACTERISTICS

VIDEO SECTION (Unless otherwise specified, $V_3=12V$, $T_a=25^\circ C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Video DC Output Therm. Co-effc.	$\partial V_{22}/\partial T$	$V_6=3.25V$, $V_{41}=4.1V$ $T_a=-20 \sim +65^\circ C$	-2.5	0	2.5	mV/ $^\circ C$	2
Inverter Amplifier Gain	V_7/V_6	$V_6=4.25V$, $v_6: 4.0MHz$, $1.0V_{p-p}$, $V_5=10V$, $V_B=8.0V$	2.2	3.5	4.6	dB	2
Inverter Amplifier Differential Gain	DG_R	$V_6: 3.3 \sim 5.2V$ $v_6: 3.58MHz$, $100mV_{p-p}$	—	2.5	10	%	2
Inverter Amplifier Differential Phase	DP_R	The same condition as above	—	3	5	deg	2
Inverter Amplifier Frequency Characteristics	ΔG_{Rf}	$V_6=4.25V$, $V_5=10V$, $V_B=8.0V$, $v_6: 4.0MHz$, $500KHz$, $1.0V_{p-p}$ $20 \log v_7(4MHz)/v_7(0.5MHz)$	-3.5	-0.1	0.5	dB	2
Inverter Amplifier 3.58MHz Linearity	L_7	$V_6=4.0V$, $v_6=3.58MHz$	1.6	—	—	V_{p-p}	2

CHROMA SECTION

(Unless otherwise specified. Gate Pulse and Blanking Pulse of TEST CIRCUIT 2 is Applied)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Maximum Chroma Output	V_{CM}	$V_1=12V$, $V_5=10V$, V_6 : open $v_9: 120mV_{p-p}$ (B:C=1:1) $V_G=8V$, $V_B=15V$, measure term. 12	0.5	0.75	1.05	V_{p-p}	3
Burst Output	V_B	The same condition as above	0.45	0.70	0.95	V_{p-p}	3
ACC Characteristics (1)	V_a	$V_1=12V$, $V_5=10V$, V_6 : open $v_9=15mV_{p-p}$ (B:C=1:1) Measure chroma amplitude term. 12	0.16	0.34	—	V_{p-p}	3
ACC Characteristics (2)	A	$V_9=100mV_{p-p}$, $300mV_{p-p}$ (B:C=1:1) Chroma amplitude ratio at term. 12 $A = \frac{V_{12}(V_9=300mV_{p-p})}{V_{12}(V_9=100mV_{p-p})}$	—	1.0	1.3	—	3
Color Control Residual Signal	V_{CS}	$V_1=0V$, $V_5=10V$, V_6 : open $S_1: 1$, $S_2: 1$, $V_G=8V$, $V_B=15V$, $v_9=120mV_{p-p}$ (B:C=1:1)	—	—	3	mV_{p-p}	3

CHROMA SECTION

(Unless otherwise specified. Gate Pulse and Blanking Pulse of TEST CIRCUIT 2 is Applied)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Uni Color Control Gain Range	Δe_{CU}	$V_1 = 12.0V$, $V_5 = 5 \sim 10V$, V_B : open, S_1 : 1, S_2 : 1, $V_G = 8V$, $V_B = 15V$ $v_9 = 120mV_{p-p}$ (B:C=1:1)	7.5	8.5	9.5	dB	3
Uni Color Control Phase Range	$\Delta \Theta_{cu}$	The same as above. Burst chroma phase change at term. 12	—	4	10	deg	3
HUE Phase Control Range (1)	$\Delta \Theta_{bH1}$	$V_1 = 12V$, $V_5 = 10V$, $V_8 = 0 \sim 12V$, $v_9 = 120mV_{p-p}$, $V_G = 8V$, $V_B = 15V$ Burst chroma phase change at term. 12 S_1 :1, S_2 :1	75	105	—	deg	3
HUE Phase Control Range (2)	$\Delta \Theta_{bH2}$	The same as above. Phase change from V_8 open	37	51	62	deg	3
Color Control Phase Change	$\Delta \Theta_{CC}$	$V_1 = 0 \sim 12V$, V_5 : open, V_B : open $v_9 = 120mV_{p-p}$ (B:C=1:1) $V_G = 8V$, $V_B = 15V$, S_1 :1, S_2 :1	—	3	5	deg	3
Burst-Chroma Phase Difference	$\Delta \Theta_{bc}$	V_1 : open The same as above	-8	0	8	deg	3
APC Pull-in Range	f_p	$ v'_{14} = 0.6V_{p-p}$ (Burst) Measure term. 16 frequency Difference between f_c and f_o when APC is out	± 250	± 350	—	Hz	3
Killer Sensitivity	V_{bk}	v_{14} Burst amplitude when $V_1 = 2V$ S_1 :1, S_2 :2	18	29	45	mV_{p-p}	3
Residual Carrier of Demodulator Output	$V_{car} R$ $V_{car} G$ $V_{car} B$	v_{14} : AC GND 3.58MHz component at term. 19, 20 and 21. S_1 :1, S_2 :2	—	—	300	mV_{p-p}	3
Color Difference Signal Output	V_{OR}	S_1 :1, S_2 :2 v_{14} : 3.56954MHz, $0.2V_{p-p}$ CW: 3.579545MHz	1.45	1.85	2.3	V_{p-p}	3
	V_{OG}		0.49	0.62	0.77		
	V_{OB}		1.55	1.95	2.42		
Color Difference Signal Relative Output	R-Y/B-Y	The same as above	0.85	0.95	1.05	—	3
	G-Y/B-Y		0.25	0.31	0.38		
Color Difference Signal Maximum Output	V_{ORM}	S_1 :1, S_2 :2 v_{14} : 3.56945MHz, $1.2V_{p-p}$ CW: 3.579545MHz	4.5	5.5	—	V_{p-p}	3
	V_{OGM}		1.4	1.8	—		
	V_{OBM}		4.5	5.5	—		

CHROMA SECTION

(Unless otherwise specified. Gate Pulse and Blanking Pulse of TEST CIRCUIT 2 is Applied)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Relative Phase	Θ_{R-Y}	$S_1:1, S_2:2, v_{14}$: Burst $0.6V_{P-P}$ Chroma $0.2V_{P-P}$	100	107	112	deg	3
	Θ_{G-Y}		230	240	250		
Demodulator Band Width	f_{BR} f_{BG} f_{BB}	$S_1:1, S_2:2$ v_{14} : 10KHz ~ 5MHz, $0.2V_{P-P}$ -3dB Frequency (0dB; 10KHz)	1.13	1.77	3.16	MHz	3
Blanking Operation Voltage	$V_{\#22B}$	$S_1:1, S_2:2$ v_{14} : Burst $0.6V_{P-P}$, Chroma $0.2V_{P-P}$ Blanking pulse height when Demo. output is disappear	10.4	11.1	—	V	3
Demodulator Output DC Voltage	V_{OR} V_{OG} V_{OB}	$S_1:1, S_2:2$ v_{14} : AC GND	7.00	7.71	8.35	V	1
Demodulator Output Difference Voltage	$V_{O(R-G)}$ $V_{O(R-B)}$ $V_{O(B-G)}$	The same as above	-0.3	—	0.3	V	1
Demodulator DC Output Thermal Co-efficient	$\Delta V_{OR} \theta$ $\Delta V_{OG} \theta$ $\Delta V_{OB} \theta$	The same as above $T_a = -20^\circ\text{C} \sim 65^\circ\text{C}$	-3	0	2	mV/°C	1
DC Output Voltage Difference Component Thermal Co-efficient	$\Delta V_{O(R-G)} \theta$ $\Delta V_{O(R-B)} \theta$ $\Delta V_{O(B-G)} \theta$	The same as above	-2	0	2	mV/°C	1
Color Control Terminal Voltage	V_1	Measure term. 1 open circuit voltage	5.4	6.0	6.52	V	1
Uni-color Control Terminal Voltage	V_5	Measure term. 5 open circuit voltage	6.9	7.5	8.02	V	1
HUE Control Terminal Voltage	V_8	Measure term. 8 open circuit voltage	5.4	6.0	6.52	V	1

HORIZONTAL SECTION

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Horizontal V_{CC}	V_{33}	$V_B = 20.3V$	7.4	8.2	9.0	V	1
Recommendable Supply Current	I_{33}	—	22	26	30	mA	1
Horizontal Frequency	f_H	$S_{39}:b, S_{38}:b, S_{35}:on, V_X=4V$	15.069	15.569	16.069	KHz	4
f_H Thermal Drift	Δf_{HT}	The same as above $T_a = -20 \sim 60^\circ C$	-70	80	230	Hz	4
AFC Clamping Voltage	V_{CL}	Measure term. 35 open Circuit Voltage $S_1: on$	3.71	4.20	4.75	V	1
AFC Input Current	I_{IN35}	$S_1: on, S_5:2$	2.2	3.62	5.1	mA	1
AFC Output Current	I_{O35}	$S_1: on, S_5:1$	2.4	3.99	5.6	mA	1
Horizontal Drive Saturation Voltage	V_{OL24}	$S_1: on, S_3: on$ measure V_{24}	—	—	0.3	V	1
Horizontal Drive Output Duty Cycle	T_{O24}	$S_{39}:b, S_{38}:b, S_{35}: open$ $V_X=4V.$ $\frac{H \text{ Level Period}}{1 \text{ Cycle Period}} \times 100$ Measure V_{24} wave form	45	50	55	%	4
Oscillator Starting Voltage	$V_{33} (min)$	Minimum V_{33} when output Duty of term. 24 in 50%	—	—	4.0	V	4
Starting Supply Current	$I_{33} (min)$	$V_{33}=4V$, Measure I_{33}	5.5	8.8	11.5	mA	4
AFC Pull-in Range	$\Delta f_{H \text{ PULL}}$	$S_{38}:a, S_{35}:ON, S_{39}:a:$ Changing V_X , measure Pull-in range	—	± 600	—	Hz	4
AFC Hold-in Range	$\Delta f_{H \text{ HOLD}}$	The same as pull-in range. Measure hold-in range.	—	± 1000	—	Hz	4
X-ray Protector Voltage Sensitivity	V_{IN23}	Measure V_{23} when V_{24} Output becomes L. level. $T_a = 25^\circ C$	0.50	0.88	1.10	V	4
X-ray Protector Current Sensitivity	I_{IN23}	Measure I_{23} when V_{24} Output becomes L level. $T_a = 25^\circ C$	0.060	0.178	1.00	μA	4
X-ray Protector Operating Voltage	$V_{IN23} \theta$	The same as V_{IN23} $T_a = -20 \sim 65^\circ C$	0.30	0.88	1.28	V	4
X-ray Protector Operating Current	$I_{IN23} \theta$	The same as I_{IN23} $T_a = -20 \sim 65^\circ C$	0.03	0.178	2.0	μA	4

SYNC SEPARATOR

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Syncseparator Sensitivity (1)	I_{IN39}	Term. 38: open Measure I_{39} when V_{37} is L $\rightarrow$ H.	18.1	35.0	113	μA	4
Syncseparator Sensitivity (2)	I_{IN38}	Term. 39: open Measure I_{38} same as above	13.3	21.4	54.2	μA	4
Sync Output H Level	V_{OH37}	Term. 38: open	7.04	8.19	9.34	V	4
Sync Output L Level	V_{OL37}		0	1.5	2.4	V	4
Sync Clamp Voltage	V_{CL31}	Measure V_{31} at $I_{31} = -1mA$	-0.85	-0.63	-0.5	V	4

VERTICAL (Unless otherwise specified, $V_{CC}=12V$, $T_a=25^\circ C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Vert Freerunning Frequency	f_V	S_{31} : ON, measure term. 28	56	60	64	Hz	4
Retrace Time	T_r	Term. 28 output pulse	500	690	850	μs	4
f_V Pull-in Range	$\Delta f_{V\text{ PULL}}$	S_{31} : ON/OFF, term. 30-VR S_{31} : OFF $f_{OSC28} = 60Hz$ S_{31} : ON measure f_{OSC28} $\Delta f_{V\text{ PULL}} = f_{OSC28} - 60Hz$	11.1	12.1	12.9	Hz	4
Ramp Maximum Voltage	V_{O28}	$V_{30} = 6V$, measure V_{28}	7.05	7.65	8.25	V	1
Ramp Maximum Current	I_{O28}	$V_{30} = 6V$, measure I_{28} , S_6 : ON	16.7	26.8	48.4	mA	1
Maximum Common Mode Input Voltage	V_{IH28}	S_{26} , S_{27} : ON, $V_{30} = 0V$ V_{28} : 6 $\rightarrow$ 12V, measure V_{28} when V_{27} is saturate.	11.9	—	—	V	4
Minimum Common Mode Input Voltage	V_{IL28}	V_{28} : 6 $\rightarrow$ 0V The same as above	—	2.86	3.7	V	4
Terminal 28 Input Current	I_{I28}	S_{26} , S_{27} : ON, $V_{30} = 0V$. Measure I_{28} at $V_{28} = 6V$	0.25	0.98	4.50	μA	4
Terminal 27 Input Current	I_{I27}	The same as above. Measure I_{27} at $V_{28} = 6V$	0.18	0.94	6.21	μA	4
Maximum Vertical Output Voltage	V_{OH26}	S_{26} : OFF, S_{27} : ON, $V_{30} = 6V$ Measure V_{26}	5.6	6.3	7.2	V	4
Minimum Vertical Output Voltage	V_{OL26}	S_{26} , S_{27} : OFF, $V_{30} = 6V$ Measure V_{26}	—	—	0.3	V	4
Terminal 29 Bias Voltage	V_{29}	Measure V_{29} when $I_{29} = -0.2mA$	3.7	3.9	4.1	V	4

TEST CIRCUIT 1 (DC)

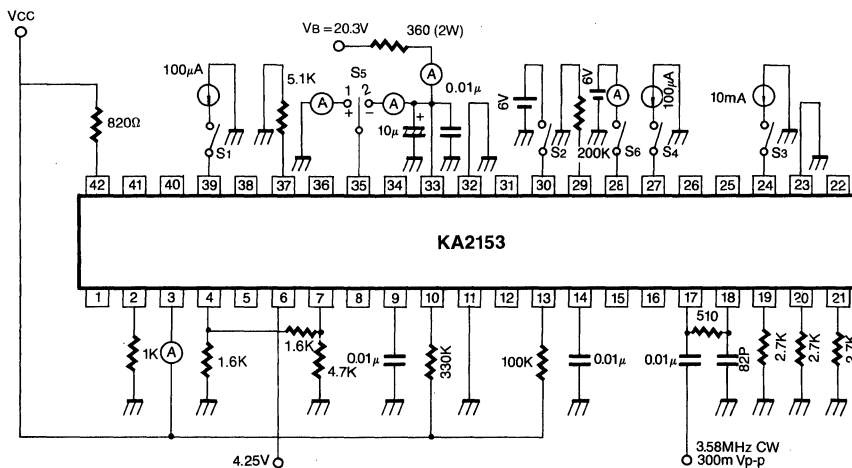


Fig. 2

TEST CIRCUIT 2 (Video)

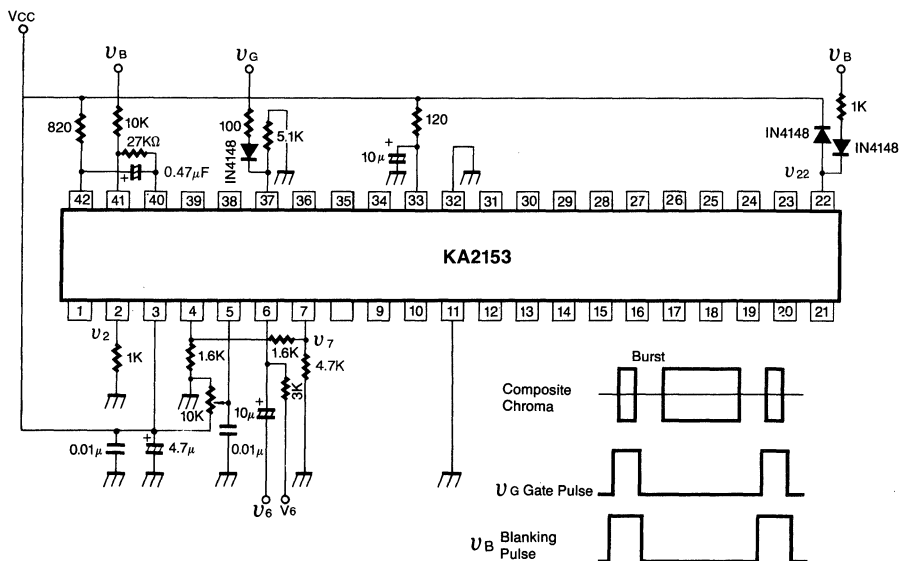


Fig. 3

TEST CIRCUIT 3 (Chroma)

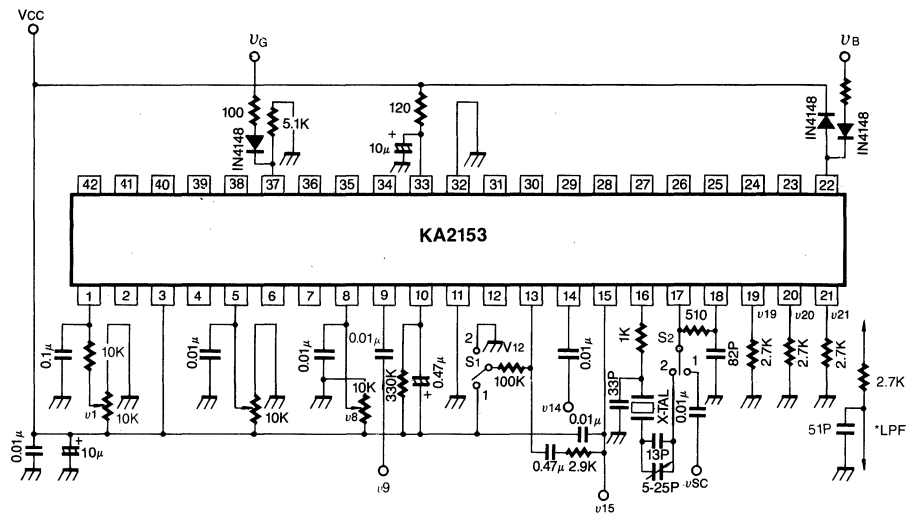
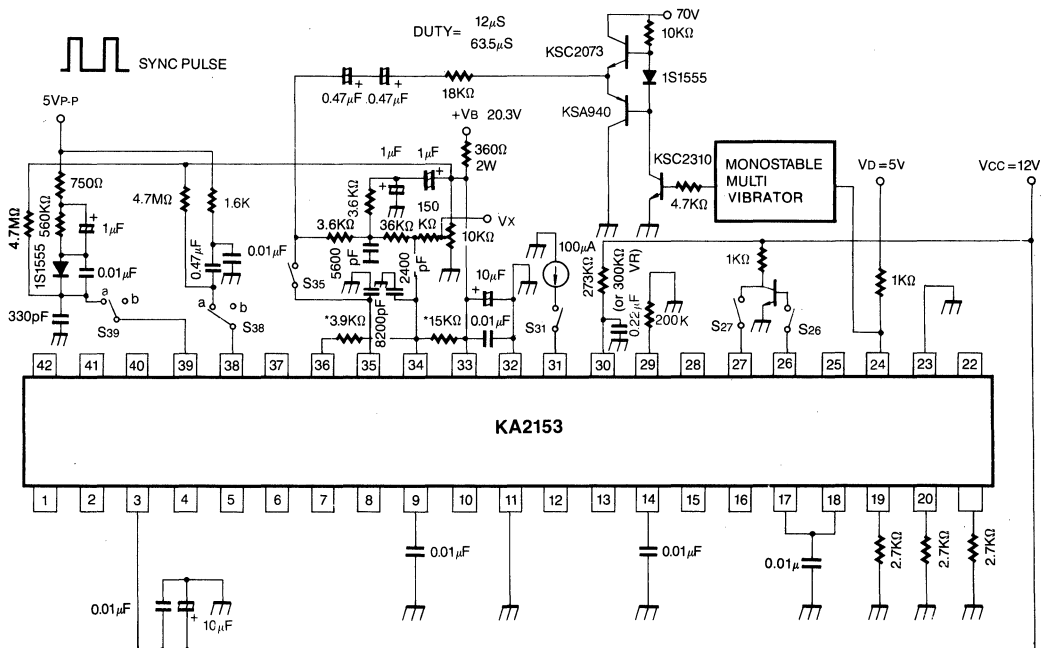
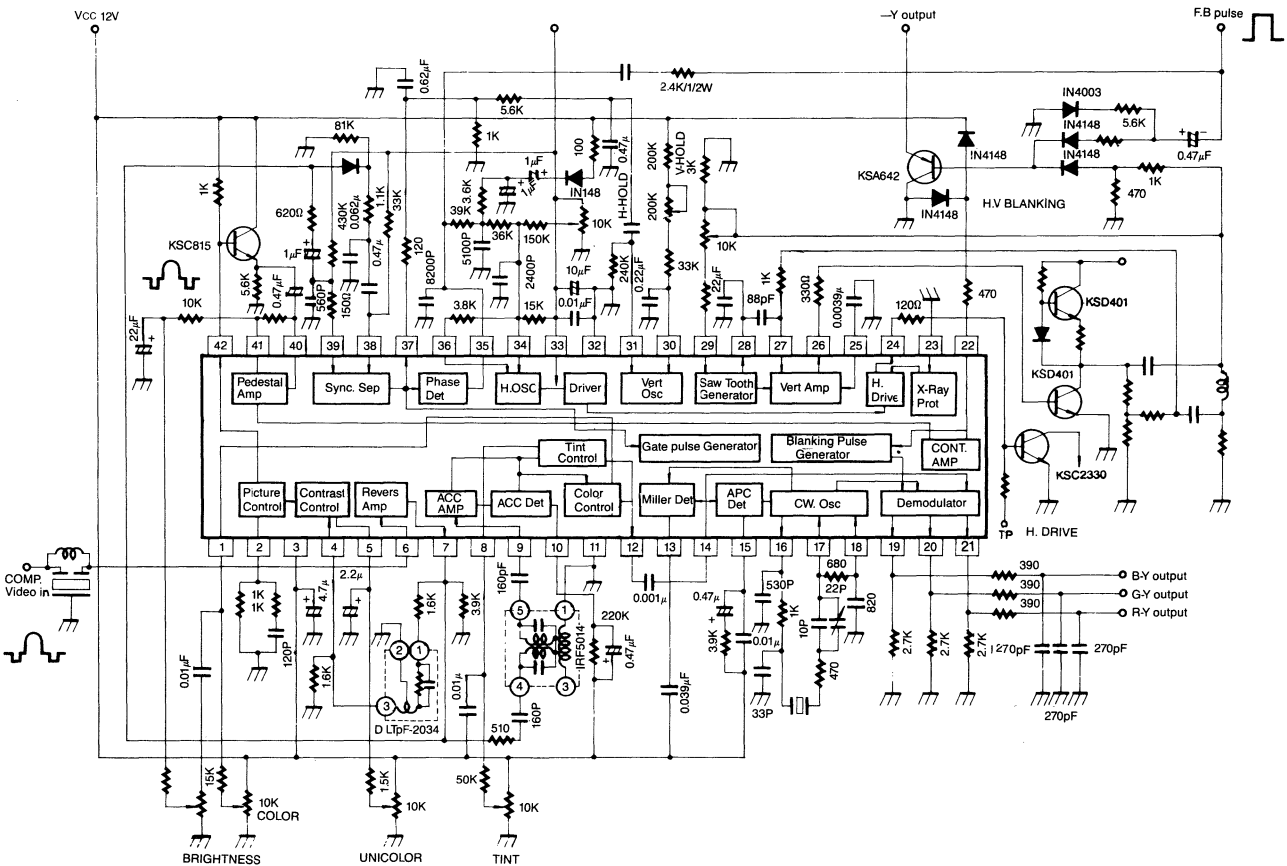


Fig. 4

TEST CIRCUIT 4 (Horizontal, Vertical)



TYPICAL APPLICATION CIRCUIT



VIDEO-CHROMA-DEFLECTION SYSTEM FOR A COLOR TELEVISION (PAL/NTSC)

The KA2154 combines a PAL/NTSC video-chroma subsystem and a deflection combination on a single monolithic integrated circuit to provide a PAL or PAL/NTSC color television.

This device includes a video amplifier, PAL and NTSC color demodulator these are designed to provide color differential signal outputs, and improved sync-separator, horizontal oscillator with saw tooth wave type AFC, horizontal pre-driver with X-ray protection circuit, vertical oscillator and vertical pre-driver in a 42 leads dual-in-line type plastic package.

FUNCTIONS

- Inverter-amplifier
- Contrast control
- Pedestal clamp
- Brightness control
- ACC-amplifier (peak Acc)
- Tint control
- Uni-color control
- fsc VCO
- APC
- Color-Killer
- Color demodulator
- Matrix circuit
- Sync-separator (H.V. sync in)
- $2f_H$ horizontal oscillator
- Flip-flop
- Stabilized horizontal V_{CC} by zener diode
- Horizontal pre driver
- Gate pulse generator
- Vertical sync input
- Vertical oscillator
- Ramp generator

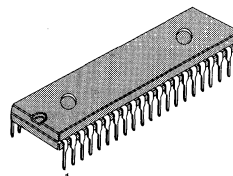
FEATURES

- Video-Chroma Section
- Simple PAL/NTSC System Switch (Demodulator, Flip-flop, Tint control for NTSC).
- Suitable to a Multi-CTV System: KA2154 PAL/NTSC Dual System
- Suitable to a Multi-CTV System: KA2154 SECAM Combination 3 or more System.
- Minimum Numbers of External Parts Required.
- Stabilized with Respect to Variation of Temperature and Supply Voltage.
- A Few Initial Adjustment Required.

DEFLECTION SECTION

- Excellent Temperature Stability of Horizontal Oscillator.
- Exact 50% Duty Cycle Output Due to the $2f_H$ Oscillator and Flip-Flop Circuit.
- Excellent Inter-race.

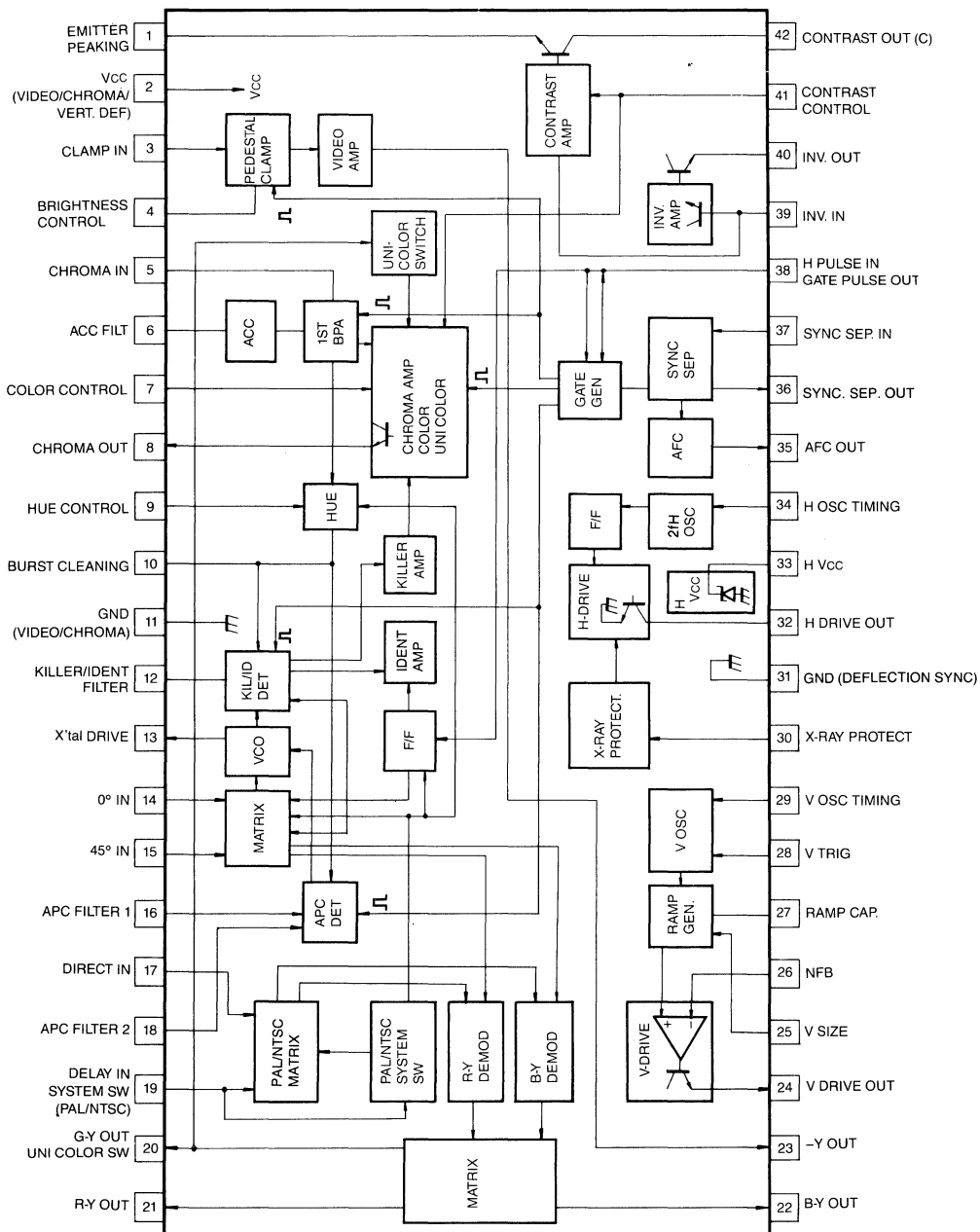
42 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2154	42 DIP	- 20 ~ + 65°C

BLOCK DIAGRAM



MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC} Max	15	V
Horiz. Supply Current	I_{CC} Max	40	mA
Max. Input Signal Level	V_{IN} 5, 14, 15, 17, 19, 28, 37, 39	5	V_{P-P}
Max. Control Terminal Voltage	V_4 MAX, V_5 MAX, V_7 MAX, V_9 MAX	V_{CC}	V
Term. 1 Max. Output Current	I_1 MAX	4	mA
Term. 8 Max. Output Current	I_3 MAX	10	mA
Term. 10 Max. Output Current	I_{10} MAX	4	mA
Term. 13 Max. Output Current	I_{13} MAX	4	mA
Min. Load Resistance	R_{LD}	1.8	$K\Omega$
Term. 23 Max. Output Current	I_{23} MAX	4	mA
Vertical Stage Output Current	I_{24} MAX	20	mA
Term. 25 Max. Output Current	I_{25} MAX	4	mA
Term. 26 Max. Input Voltage	V_{26} MAX	V_{CC}	V
Term. 27 Max. Output Current	I_{27} MAX	50	mA
Term. 30 Max. Input Current	$-I_{30}$ MAX	1	mA
Horiz. Max. Sink Current	$-I_{32}$ MAX	30	mA
Horiz. Ave. Sink Current	$-I_{32}$	15	mA
Term. 35 Max. Input Voltage	V_{35} MAX	V_{CCH}	V
Term. 36 Max. Voltage	V_{36} MAX	V_{CC}	V
Term. 38 Max. Input Voltage	V_{38} MAX	5	V
Term. 40 Max. Output Current	I_{40} MAX	5	mA
Term. 42 Max. Sink Current	$-I_{42}$ MAX	4	mA
Max. Power Dissipation (Note)	P_D MAX	2.2 (Note)	W
Operating Temperature	T_{opr}	-20 ~ 65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 ~ 150	$^\circ\text{C}$

Note: Derated above $T_a = 25^\circ\text{C}$ in the proportion of $17.6\text{mW}/^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS(Unless otherwise specified, $V_{CC} = 12V$, $T_a = 25^\circ C$)**Video Section (1)**

Characteristic	Symbol	Test Pin			Test Conditions	Specification			Unit	Test CCT
			SW 36	SW 41		Min.	Typ.	Max.		
Recommendable Supply Voltage	V_{CC1}					10.8	12	13.2	V	
12V Supply Current	I_{CC1}	2				60	82	106	mA	1
Video Gain	G_V	23 39	Off	On	$V_C = 10V$, $V_X = 4.25V$, $V_Z = 4.0V$ $v_{39} = 500KHz$, $1V_{P-P}$ (Multi Burst) $G_V = 20 \log (v_{23}/v_{39})$	3	6	7	dB	2
Contrast Gain Control Range	ΔG_V	23	Off	On	$V_O = 10V \sim 2V$, $V_X = 4.25V$, $V_Z = 4.0V$, v_{39} , 500KHz, $1V_{P-P}$ (Multi Burst) $\Delta G_V = 20 \log (v_{23 \text{ MAX}}/v_{23 \text{ MIN}})$	40	—	—	dB	2
Video Frequency Characteristics	ΔG_{VF}	23	Off	On	$V_C = 10V$, $V_X = 4.25V$, $V_Z = 4.0V$, v_{39} ; 500KHz, 4.0MHz $1V_{P-P}$ (Multi Burst) $\Delta G_{VF} = 20 \log (V_{23 \text{ 4MHz}}/V_{23 \text{ 5MHz}})$	-3.5	-1.5	0.5	dB	2
DC Restoration Ratio	K	23	Off	On	$V_C = 10V$, $V_Z = 4.0V$ V_X ; Pedestal #39 = 3.25V v_{39} ; 2.5V _{P-P} 10STEP APL 10% ~ 90% $K = (1 - \frac{\Delta V_{23 \text{ pedestal}}}{V_{23} 100\% \text{ APL}}) \times 100$	63	70	77	%	2
Max. Video Output	$v_{23 \text{ MAX}}$	23	Off	Off	$V_X = 4.25V$, v_{39} ; No Signal $V_Z = 2V \sim 7V$ 10% to 90% of Variation	5.0	7.5	—	V_{P-P}	2
Video DC Output Therm Co-effici.	$\partial V_{23}/\partial T$	23	Off	Off	$V_X = 4.25V$, $V_Z = 4.0V$ v_{39} ; No Signal $T_a = -20^\circ C \sim 65^\circ C$	-2.5	0	2.5	mV/ $^\circ C$	2
Inverter Amp. Gain	G_R	40	Off	Off	$V_X = 4.25V$ v_{39} ; 500KHz, $1V_{P-P}$ $G_R = 20 \log (v_{40}/v_{39})$	2.2	3.5	4.6	dB	2
Inverter Amp. Differential	DG_R	40	Off	Off	V_X ; 3.3 ~ 5.3V v_{39} ; 3.58 MHz 100mV _{P-P} $DG_R = (v_{40 \text{ MAX}}/v_{40 \text{ MIN}} - 1) \times 100$	—	2.5	5	%	2
Inverter Amp. Differential Phase	DP_R	40	Off	Off	V_X ; 3.3 ~ 5.3V v_{39} ; 3.58MHz, 100mV _{P-P} $DP_R = \phi_{40 \text{ MAX}} - \phi_{40 \text{ MIN}}$	—	3	5	deg	2

ELECTRICAL CHARACTERISTICS(Unless otherwise specified; $V_{CC} = 12V$, $T_a = 25^\circ C$)**Video Section (2)**

Characteristic	Symbol	Test Pin	SW 36 SW 41		Test Conditions	Specification			Unit	Test CCT
						Min	Typ	Max		
Inverter Amp. Frequency Characteristic	ΔG_{RF}	40	Off	Off	$V_X = 4.25V$ $v_{39} = 500KHz, 4MHz\ 1V_{p-p}$ $\Delta G_{RF} = 20\ log$ ($v_{40}\ 4MHz / v_{40}\ 500KHz$)	-3.5	-0.1	0.5	dB	2
Inverter Amp. 3.58MHz Linearity	v_{39}	39 40	Off	Off	$V_X = 4.25V$ Measure #39 input level at #40 maximum output.	1.6	—	—	V_{p-p}	2
Contrast Control Open Voltage	V_{41}	41	—	—		6.7	7.2	7.7	V	1
Color Control Open Voltage	V_7	7	—	—		5.5	6.0	6.5	V	1
Tint Control Open Voltage	V_9	9	—	—		5.5	6.0	6.5	V	1
Pedstal AMP. Gain	G_P	3 23			$V_X = 4.25V, V_Z = 4V$ $v_{39} = 500KHz\ 1V_{p-p}$ (Multi Burst) $G_P = 20\ log\ (v_{23}/v_3)$	9.5	12.0	13.5	dB	

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_C = 10V$, $V_S = 10V$, SW_{36} : On, SW_{10} : Off, SW_{4A} : On, SW_{4B} : On)

Chroma (1) PAL

Characteristic	Symbol	Test Pin							Test Conditions	Specification			Unit	Test CCT
			SW 41	SW 7	SW 9	SW 12	SW 15	SW 20		Min.	Typ.	Max.		
Max. Chroma Output Voltage	Q_{CMP}	8	On	On	Off	a	b	On	v_5 : 120mV _{P-P} (B:C=1:1)	0.5	0.75	1.05	V _{P-P}	3
Burst Output Voltage	q_{bp}	10	On	On	Off	a	b	On	v_5 : 120mV _{P-P} (B:C=1:1)	0.45	0.70	0.95	V _{P-P}	3
ACC Characteristic (1)	q_{ap}	8	On	On	Off	a	b	On	v_5 : 15mV _{P-P} (B:C= 1:1)	0.2	0.43	—	V _{P-P}	3
ACC Characteristic (2)	A_P	8	On	On	Off	a	b	On	v_5 : 100mV _{P-P} , 300mV _{P-P} (B:C = 1:1) $A_P = \frac{V_8 (v_5=300mV_{P-P})}{V_8 (v_5=100mV_{P-P})}$	—	1.0	1.3	Times	3
Chroma Input Dynamic Range	Q_{Clp}	8	On	On	Off	a	b	On	$v_5=100mV_{P-P} \rightarrow 800mV_{P-P}$	500	600	—	mV _{P-P}	3
Uni Color Control Range (1) Uni Color Switch On	Δq_{CU1p}	8	On	On	Off	a	b	On	$V_C=4 \sim 10V$, $V_S=10V$ $v_5=120mV_{P-P}$ (B:C=1:1) $\Delta q_{CU_P}=20 \log \frac{v_8 (V_C=10V)}{v_8 (V_C=4V)}$	40	—	—	dB	3
Uni Color Control Range (2) (Switch Off)	Δq_{CU2p}	8	On	On	Off	a	b	Off	Same as above	—	0	—	dB	3
Uni Color Control Phase Shift	$\Delta \theta_{Up}$	8	On	On	Off	a	b	On	$V_C=4V \sim 10V$, $V_S=10V$ $v_5=120mV_{P-P}$ (B:C=1:1)	—	—	5	deg	3
Residual Color	q_{CKp}	8	On	On	Off	a	b	On	$V_C=10V$, $V_S=0V$ $v_5=120mV_{P-P}$ (B:C=1:1)	—	—	3	mV _{P-P}	3

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified; $V_C = 10V$, $V_S = 10V$, SW_{36} : On, SW_{10} : Off, SW_{4A} : On, SW_{4B} : On)

Chroma (2) PAL

Characteristic	Symbol	Test Pin	Test Conditions							Specification			Unit	Test CCT
										Min	Typ	Max		
Color Control Phase Shift	$\Delta\theta_{ccp}$	8	On	On	Off	a	b	On	$V_C = 10V$, $V_S = 2 \sim 10V$ $v_5 = 120mV_{p-p}$ (B:C = 1:1) From maximum output of pin 8 to 20dB attenuation	—	3	7	deg	3
Burst-Chroma Phase Difference	$\Delta\theta_{bcp}$	8 10	On	On	Off	a	b	On		45	60	—	deg	3
Tint Control Range	$\Delta\theta_{bH1p}$	10	On	On	On	a	b	On		—	0	—	deg	3
Tint Control Phase Distribution	$\Delta\theta_{bH2p}$	10	On	On	On	a	b	On		—	0	—	deg	3
Killer Det. Sensitivity	qK_P	8 10	Off	On	Off	a	a	On		30	60	110	mV _{p-p}	3
Ident Dept. Sensitivity	qI_P	21 10	Off	On	Off	a	a	On		—	60	—	mV _{p-p}	3
APC Pull-in Range	f_{PP}	13	Off	Off	Off	a	a	On	$v_5 = 120mV_{p-p}$	± 300	± 500	—	Hz	3
Phase Det. Sensitivity	μ_P	16 18	Off	Off	Off	a	c	On	$v_5 = 120mV_{p-p}$	—	25	—	mV/deg	3
Control Sensitivity	β_P	13 16 18	Off	Off	Off	a	a	On	$v_5 = 120mV_{p-p}$	—	2.2	—	Hz/mV	3

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_C = 10V$, $V_S = 10V$, SW_{36} : On, SW_{10} : Off, SW_{4A} : On, SW_{4B} : On)

Chroma (3) PAL

Characteristic	Symbol	Test Pin								Test Conditions	Specification			Unit	Test CCT
			SW 41	SW 7	SW 9	SW 12	SW 15	SW 20	Min.		Typ.	Max.			
Color Differential Output Voltage	QOR _P	21							V ₁₇ , V ₁₉ : 100mV _{P-P} 4.443618 MHz CW: 4.433618MHz	1.8	2.4	3.0	V _{P-P}	3	
	QOG _P	20	On	On	Off	a	a	On		—	—	—			
	QOB _P	22								3.2	4.2	5.4			
Max. Color Differential Output Voltage	QORM _P	21							V ₁₇ , V ₁₉ : 500mV _{P-P} 4.443618MHz CW: 4.433618 MHz	3.8	5.5	—	V _{P-P}	3	
	QOGM _P	20	On	On	Off	a	a	On		—	—	—			
	QOBM _P	22								3.8	5.5	—			
Relative Amplitude	R-Y/B-Y _P G-Y/B-Y _P	21/22 20/22	On	On	Off	a	a	On	V ₁₇ : 200mV _{P-P} 4.443618 MHz CW: 4.433618 MHz	0.46 0.24	0.56 0.34	0.66 0.44	—	3	
Relative Phase	θR-Y _P θG-Y _P	21/22 20/22	On	On	Off	a	a	On	Same as above	77 220	90 230	100 240	deg	3	
Residual Carrier	Q _{RC} R _P	21								—	—	300	mV _{P-P}	3	
	Q _{RC} G _P	20	On	On	Off	a	a	On							
	Q _{RC} B _P	22													
Demodulator Bandwidth	fBR _P	21							V ₁₇ : 200mV _{P-P} 10KHz ~ 5MHz	1.1	2.1	3.2	MHz	3	
	fBG _P	20	On	On	Off	a	a	On							
	fBB _P	22													
Demo. Output DC Voltage	EOR _P	21								6.8	7.4	8.0	V	1	
	EOG _P	20	Off	Off	Off	a	b	On							
	ECB _P	22													
Demo. Output DC Voltage Difference	E _O (R-G) _P	21								−0.2	0	0.2	V	1	
	E _O (R-B) _P	20	Off	Off	Off	a	b	On							
	E _O (B-G) _P	22													
Demo. Output DC Voltage Therm. Co-eff	ΔE _{OR/P}	21							T _a = −20°C ~ +65°C	−3	0	2	mV/°C	1	
	ΔE _{OG/P}	20	Off	Off	Off	a	b	On							
	ΔE _{OB/P}	22													
Demo. Output Diffence Voltage Therm. Co-eff.	ΔE _{O(R-G)/P}	21							T _a = −20°C ~ +65°C	−2	−0.5	2	mV/°C	1	
	ΔE _{O(R-B)/P}	20	Off	Off	Off	a	b	On							
	ΔE _{O(B-G)/P}	22													
System SW Threshold	V _{THS}	19	Off	Off	Off	a	b	On	V ₁₇ : 200mV _{P-P} 4.443618 MHz CW: 4.433618 MHz	2.4	3	3.6	V	3	
DC Change by System SW	ΔE _{OR}	21							V _{IN} : 220mV _{P-P} 4.443618MHz	−100	0	100	mV	3	
	ΔE _{OG}	20	Off	Off	Off	a	b	On							
	ΔE _{OB}	22													

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_C = 10V$, $V_S = 10V$, SW₃₆: On, SW₁₀: Off, SW_{4A}: On, SW_{4B}: On)

Chroma (4) NTSC

Characteristic	Symbol	Test Pin	Test Conditions							Specification			Unit	Test CCT
			SW 41	SW 7	SW 9	SW 12	SW 15	SW 20		Min.	Typ.	Max.		
Max. Chroma Output Voltage	Q_{CMN}	8	On	On	Off	a	b	On	v_5 : 120mV _{P,P} (B:C=1:1)	0.5	0.75	1.05	V _{P,P}	4
Burst Output Voltage	Q_{bN}	10	On	On	Off	a	b	On	v_5 : 120mV _{P,P} (B:C=1:1)	0.45	0.70	0.95	V _{P,P}	4
ACC Characteristic (1)	Q_{aN}	8	On	On	Off	a	b	On	v_5 : 15mV _{P,P} (B:C=1:1)	0.2	0.43	—	V _{P,P}	4
ACC Characteristic (2)	A_N	8	On	On	Off	a	b	On	v_5 : 100mV _{P,P} , 300mV _{P,P} (B:C=1:1) $A_P = \frac{v_8 (v_5 = 300mV_{P,P})}{v_8 (v_5 = 100mV_{P,P})}$	—	1.0	1.3		4
Chroma Input Dynamic Range	Q_{CIN}	8	On	On	Off	a	b	On	$v_5 = 100mV_{P,P} \rightarrow 800mV_{P,P}$	500	600	—	mV _{P,P}	4
Uni Color Control Range (1) Uni Color SW On	Δe_{CU1N}	8	On	On	Off	a	b	On	$V_C = 4 \sim 10V$, $V_S = 10V$ $v_5 = 120mV_{P,P}$ (B:C=1:1) $\Delta Q_{CU_P} = 20 \log \frac{v_8 (V_C = 10V)}{v_8 (V_C = 4V)}$	40	—	—	dB	4
Uni Color Control Range (2) (SW. Off)	ΔQ_{CU2N}	8	On	On	Off	a	b	Off	Same as above	—	0	—	dB	4
Uni Color Control Phase Shift	$\Delta \theta_{UN}$	8	On	On	Off	a	b	On	$V_C = 4V \sim 10V$, $V_C = 10V$ $v_5 = 120mV_{P,P}$ (B:C=1:1)	—	—	5	deg	4
Residual Color	Q_{CKN}	3	On	On	Off	a	b	On	$V_C = 0V$, $V_S = 0V$ $v_5 = 120mV_{P,P}$ (B:C=1:1)	—	—	3	mV _{P,P}	4

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_C = 10V$, $V_S = 10V$, SW_{36} : On, SW_{10} : Off, SW_{4A} : On, SN_{4B} : On)

Chroma (5) NTSC

Characteristic	Symbol	Test Pin							Test Conditions	Specification			Unit	Test CCT	
			SW 41	SW 7	SW 9	SW 12	SW 15	SW 20		Min.	Typ.	Max.			
Color Control Phase Shift	$\Delta\theta_{CCN}$	8	On	On	Off	a	b	On	$V_C=10V$, $V_S=2\sim10V$ $V_5=120mV_{P,P}$ (B:C=1:1)	—	3	7	deg	4	
Burst-Chroma Phase Difference	$\Delta\theta_{bCN}$	8 10	On	On	Off	a	b	On		—	60	—	deg	4	
Tint Control Range	$\Delta\theta_{bH14}$	10	On	On	On	a	b	On	$V_C=10V$, $V_T=2\sim10V$ $V_5=120mV_{P,P}$ (B:C=1:1)	f=4.43MHz	75	95	110	deg	4
									f=3.58MHz	100	120	140			
Tint Control Phase Distruction	$\Delta\theta_{bH2N}$	10	On	On	On	a	c	On	$V_C=10V$, $V_5=120mV_{P,P}$ (B:C=1:1) V_7 : Open	f=4.43MHz	34	47	62	deg	4
									f=3.58MHz	45	60	80			
Killer Det Sensitivity	ϱ_{KN}	8	Off	On	Off	a	a	On	$v_5=100mV_{P,P}$	15	30	75	mV _{P,P}	4	
APC Pull-in Range	f _{PN}	13	Off	Off	Off	a	a	On	$v_5=100mV_{P,P}$	± 300	± 500	—	Hz	4	
Phase Det. Sensitivity	μ _N	16 18	Off	Off	Off	a	c	On	$v_5=100mV_{P,P}$	—	25	—	mV/deg	4	
Control Sensitivity	β _N	13 16 18	Off	Off	Off	a	a	On	$v_5=100mV_{P,P}$	—	2.2	—	Hz/mV	4	

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified; $V_C = 10V$, $V_S = 10V$, SW_{36} : On, SW_{10} : Off, SW_{4A} : On, SW_{4B} : On)

Chroma (6) NTSC

Characteristic	Symbol	Test Pin							Test Conditions	Specification			Unit	Test CCT
			SW 41	SW 7	SW 9	SW 12	SW 15	SW 20		Min	Typ	Max		
Color Difference Output Voltage	ϱOR_N	21	On	On	Off	a	a	On	v_{17} : 100mV _{p-p} 4.443618MHz CW: 4.433618MHz	3.0	4.1	5.3	V _{p-p}	4
	ϱOG_N	20								1.0	1.6	2.2		
	ϱOB_N	22								3.0	4.1	5.3		
Max. Color Differential Output Voltage	ϱCRM_N	21	On	On	Off	a	a	On	v_{17} : 500mV _{p-p} 4.443618MHz CW: 4.433618MHz	4.5	5.5	—	V _{p-p}	4
	ϱCGM_N	20								1.4	1.8	—		
	ϱCBM_N	22								4.5	5.5	—		
Relative Amplitude	R-Y/B-Y _N	21/22	On	On	Off	a	a	On	v_{17} : 100mV _{p-p} 4.443618MHz CW: 4.433618MHz	0.88	1.00	1.11	—	4
	G-Y/B-Y _N	20/22								0.28	0.38	0.48		
Relative Phase	$\theta R-Y_N$	21/22	On	On	Off	a	a	On	Same as above	—	105	—	deg	4
	$\theta G-Y_N$	20/22								—	235	—		
Residual Carrier	ϱrCR_N	21	On	On	Off	a	a	On		—	—	300	mV _{p-p}	4
	ϱrCG_N	20												
	ϱrCB_N	22												
Demodulator Bandwidth	f_{BRN}	21	On	On	Off	a	a	On	v_{17} : 100mV _{p-p} 10KHz ~ 5MHz	1.1	2.1	3.2	MHz	4
	f_{BGN}	20												
	f_{BBN}	22												
Demo. Output DC Voltage	E_{ORN}	21	Off	Off	Off	a	b	On		6.8	7.4	8.0	V	1
	E_{OGN}	20												
	E_{OBN}	22												
Demo. Output DC Voltage Difference	$E_o (R-G)_N$	21	Off	Off	Off	a	b	On		-0.3	0	0.3	V	1
	$E_o (G-B)_N$	20												
	$E_o (B-G)_N$	22												
Demo. Output DC Voltage Therm. Co. Effi.	$\Delta E_{OR\#N}$	21	Off	Off	Off	a	b	On	$T_a = -20 \sim +65^\circ C$	-3	0	2	mV/°C	1
	$\Delta E_{OG\#N}$	20												
	$\Delta E_{OB\#N}$	22												
Demo. Output Diff. Voltage Therm. Co. Effi.	$\Delta E_{OR(B-G)_N}$	21	Off	Off	Off	a	b	On	$T_a = -20 \sim +65^\circ C$	-2	0	2	mV/°C	1
	$\Delta E_{OR(B-M)_N}$	20												
	$\Delta E_{OB(B-G)_N}$	22												

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, SW₂₄, SW₂₇, SW₂₈, Off, SW₂₉; a)

Horizontal Section (1)

Characteristic	Symbol	Test Pin						Test Conditions	Specification			Unit	Test CCT
			SW 34	SW 35	SW 36	SW 37	SW 32		Min.	Typ.	Max.		
Horizontal Regulated Voltage	V ₃₃	33	—	—	—	—			7.4	8.2	9.0	V	1
Recommendable Supply Current	I ₃₃	33							22	26	30	mA	5
Horizontal Free Running Frequency	f _H	34	Off	Off	Off	b	a	V _H = 4V	15.125	15.625	16.125	kHz	5
f _H Thermal Drift	Δf _{HT}	34	Off	Off	Off	b	a	V _H = 4V T _a = -20°C ~ +60°C	-90	70	230	Hz	5
AFC Clamping Voltage	V _{CL}	35	—	—	—	—	a	SW ₁ : a SW ₂ : a	3.9	4.5	5.1	V	1
AFC Sink Current	I _{IN35}	35	—	—	—	—	a	SW ₁ : 1 SW ₂ : b	2.7	3.7	5.0	mA	1
AFC Source Current	I _{O35}	35	—	—	—	—	a	SW ₁ : a SW ₂ : b	2.7	4.0	5.0	mA	1
Horiz. Drive Residual Voltage	V _{OL32}	32	Off	Off	Off	b	a	V _H = 4V Saturation Voltage of #32	—	—	0.3	V	5
Horiz. Output Pulse Duty	T _{O32}	32	Off	Off	Off	b	a	V _H = 4V T _{O32} = Duty cycle of H period.	45	50	55	%	5
Horiz. Osc. Starting Voltage	V _{33START}	33	Off	Off	Off	b	a	V _B : Variable Measure #33 which provides Δ50% duty Output to #32	—	—	4.0	V	5
4V Supply Current	I _{33START}	33	Off	Off	Off	b	a	V _B = 4V Measure I ₃₃	4.6	6.7	8.8	mA	5
AFC Pull-in Range	Δf _H PULL	32 37	On	On	Off	a ↓ b	a	V _H : Variable Observe #32 and #37 wave form. S ₃₇ a → b, Measure the frequency difference.	—	±900	—	Hz	5
AFC Hold Range	Δf _H HOLD	32 37	On	On	Off	a ↓ b	a	Same as above	—	±1800	—	Hz	5

ELECTRICAL CHARACTERISTICS(Unless otherwise specified, SW₂₄, SW₂₇, SW₂₈, Off, SW₂₉; a)**Horizontal Section (2)**

Characteristic	Symbol	Test Pin						Test Conditions	Specification			Unit	Test CCT
			SW 34	SW 35	SW 36	SW 37	SW 32		Min.	Typ.	Max.		
AFC Voltage Sensitivity	β_H	32	Off	Off	Off	b	a	Set V_H so that f_H will be 15.75 KHz. Then, change V_A 4V ~5V, Measure f_H difference.	—	1900	—	Hz/V	5
X-ray protector Voltage Sensitivity	V_{IN30}	30	Off	Off	Off	b	a	Apply variable DC voltage to #30 (V_{30}). Measure V_{30} and I_{30} when #32 output disappears.	0.75	0.93	1.1	V	5
X-ray protector Current Sensitivity	I_{IN30}	30	Off	Off	Off	b	a		0.05	0.18	1.0	μA	5
H. Drive Output Excess Voltage Protector Current Sens.	I_{IN32}	32	Off	Off	Off	b	b	Apply variable DC voltage to #32. Measure V_{32} and I_{32} just before V_{32} goes down.	0.05	0.18	1.0	μA	5
Excess Voltage Protector Voltage Sens.	V_{IN32}	32	Off	Off	Off	b	b		7.1	8.6	9.5	V	5

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, SW₂₄, SW₂₇, SW₂₈, Off, SW₂₉; a)

Vertical Section

Characteristic	Symbol	Test Pin					Test Conditions	Specification			Unit	Test CCT
			SW 24	SW 26	SW 28	SW 29		Min.	Typ.	Max.		
Vertical Frequency	f_v	27	Off	Off	Off	c		47	50	54.1	Hz	5
Retrace Time	T_r	27	Off	Off	Off	c	H period of #27 output pulse	450	690	850	μsec	5
f_v Pull-in Range	$\Delta f_{V \text{ PULL}}$	27	Off	Off	On Off	b	Set f_v to 50Hz at SW ₂₈ Off; $f_{\text{OSC } 28}$ Measure f_v at SW ₂₈ On; $f_{\text{OSC } 28}$ $\Delta f_{V \text{ PULL}} = f_{\text{OSC } 28} - f_{\text{OSC } 28}$	9.0	10.0	11.0	Hz	5
Term. 27 Max. Output Voltage	V_{O27}	27	—	—	—	—	SW ₂₉ ; On SW ₄ ; Off	7.7	8.5	9.2	V	1
Term. 27 Max. Output Current	I_{O27}	27	—	—	—	—	SW ₂₉ ; On SW ₄ ; On	15	27	50	mA	1
Max. Common Mode Input Voltage	V_{IH26}	26	On	On	Off	a	$V_{27} = 6 \rightarrow 12\text{V}$	11.9	—	—	V	5
Min. Common Mode Input Voltage	V_{IL26}	26	On	On	Off	a	$V_{27} = 6 \rightarrow 0\text{V}$	—	2.8	3.7	V	5
Term. 27 Input Current	I_{I27}	27	On	On	Off	a	$V_{27} = 6\text{V}$	0.25	1.0	4.5	μA	5
Term. 26 Input Current	I_{I26}	26	On	On	Off	a	$V_{27} = 6\text{V}$	0.18	1.0	6.3	μA	5
Max. Drive Output Voltage	V_{OH24}	24	Off	On	Off	d		7.3	8.0	8.7	V	5
Min. Drive Output Voltage	V_{OL24}	24	Off	Off	Off	d		—	—	0.3	V	5
Term. 25 Bias Voltage	V_{25}	25	—	—	—	—	$I_{25} = -0.2\text{mA}$	3.7	3.9	4.1	V	5
f_v Thermal Drift	Δf_{VT}	27	Off	Off	Off	c	$T_a = -20^\circ\text{C} \sim +60^\circ\text{C}$	-1.0	—	2.0	Hz	5

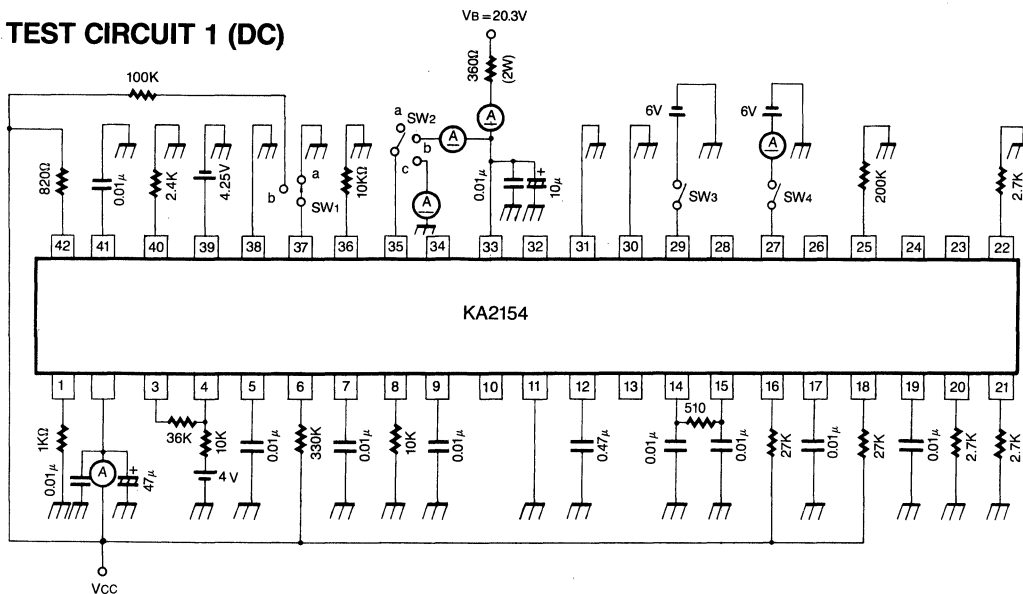
ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, SW₂₄, SW₂₇, SW₂₈, Off, SW₂₉; a)

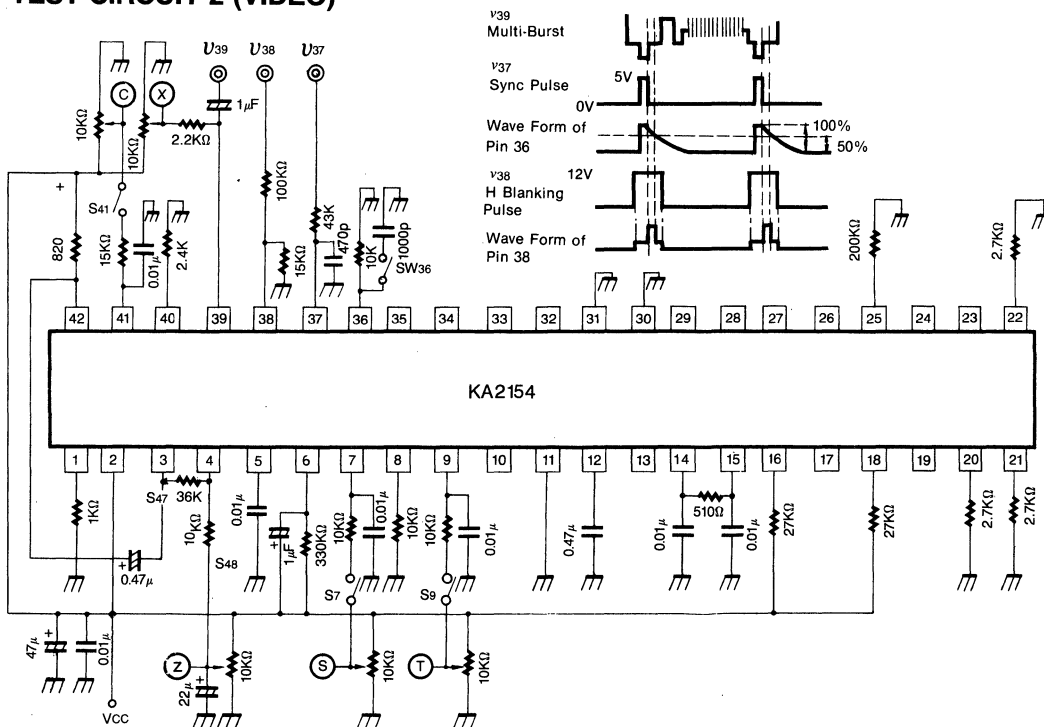
SYNC. Separator

Characteristic	Symbol	Test Pin	Test Conditions				Specification			Unit	Test CCT	
							SW 34	SW 35	SW 36			SW 37
Sync. Separator Current Sensitivity	I _{IN37}	36 37	Off	Off	Off	c	Measure #37 input current when V ₃₆ goes L level to H.	18	35	113	μA	5
Sync. Output H Level	V _{OH36}	36	Off	Off	Off	c	V _S = 2V Measure V ₃₆	7.0	8.2	9.4	V	5
Sync. Outpout L Level	V _{OL36}	36	Off	Off	Off	b	Measure V ₃₆	0	0.2	1.0	V	5
Gate Pulse H Level	V _{OH38}	38	Off	Off	Off	b	V _D = 12V, V ₃₆ = 5V Measure V ₃₈	4.5	5.3	6.1	V	5
Gate Pulse L Level	V _{OL38}	38	Off	Off	Off	b	V _O = 12V Measure V ₃₈	—	1.6	—	V	5
H Pulse Threshold	V _{38ON}	38	Off	Off	Off	b	V _D : Variable 0 → 2V Measure V _D when V ₃₈ goes H to L.	0.7	1	1.5	V	5

TEST CIRCUIT 1 (DC)



TEST CIRCUIT 2 (VIDEO)



[illegible]

The schematic diagram illustrates the internal structure and pin connections of the KA2154 integrated circuit. The chip is represented by a central block labeled "KA2154" with pins numbered 1 through 21 on the bottom and 22 through 42 on the top. Various internal components, including resistors, capacitors, and switches (SW), are shown connected to these pins. Specific pins are labeled with test points (TP8, TP10, TP13, TP20, TP21, TP22) and voltage levels (V₃₅, V₃₇, V₃₈, U₁₅, U₁₇, U₃₉). Timing waveforms are provided for several signals: V₃₅ (Chroma Input), V₃₇ (Sync Pulse), and V₃₈ (H Blanking Pulse). The waveforms show the relationship between these signals and the internal circuitry, with V₃₇ and V₃₈ showing 100% and 50% duty cycles respectively. The diagram also includes a detailed view of the internal circuitry, showing the connection of various components to the pins and the internal signal paths.

LINEAR INTEGRATED CIRCUIT

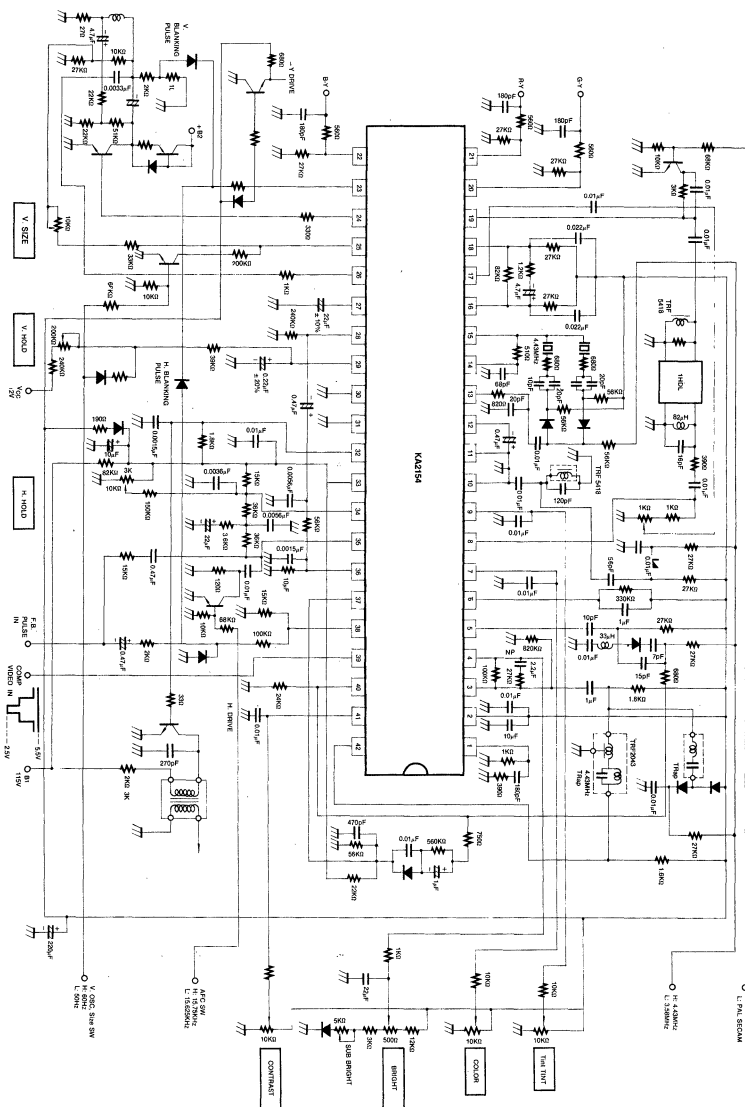
4



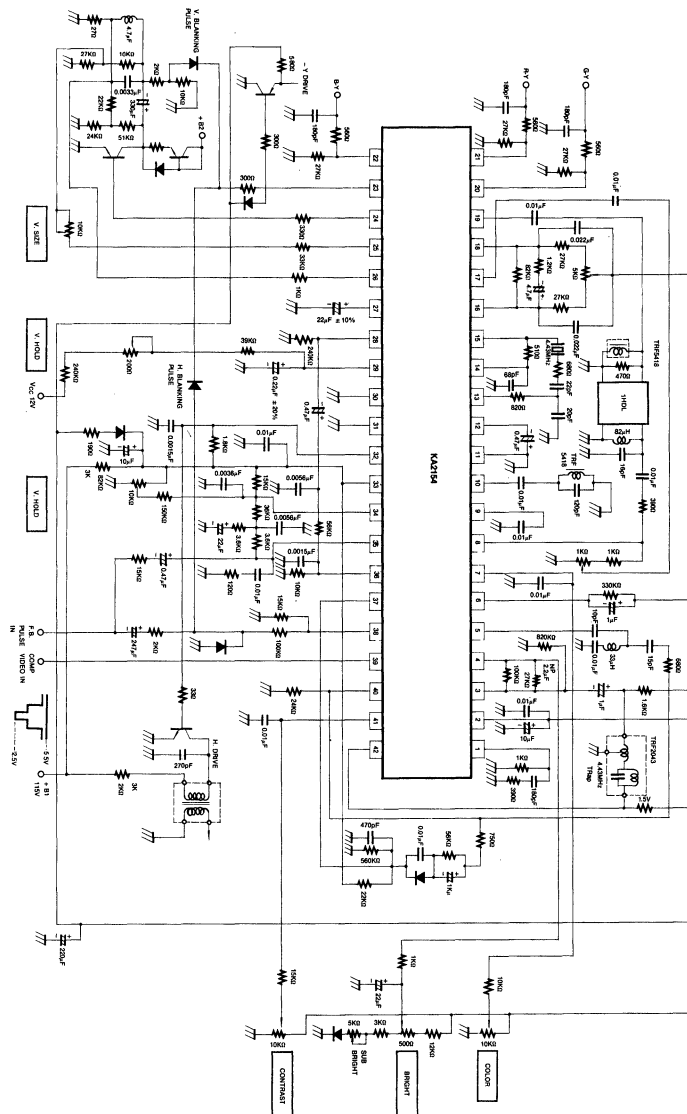
KA2154

LINEAR INTEGRATED CIRCUIT

KA2154 PAL (SECAM)/NTSC APPLICATION CIRCUIT



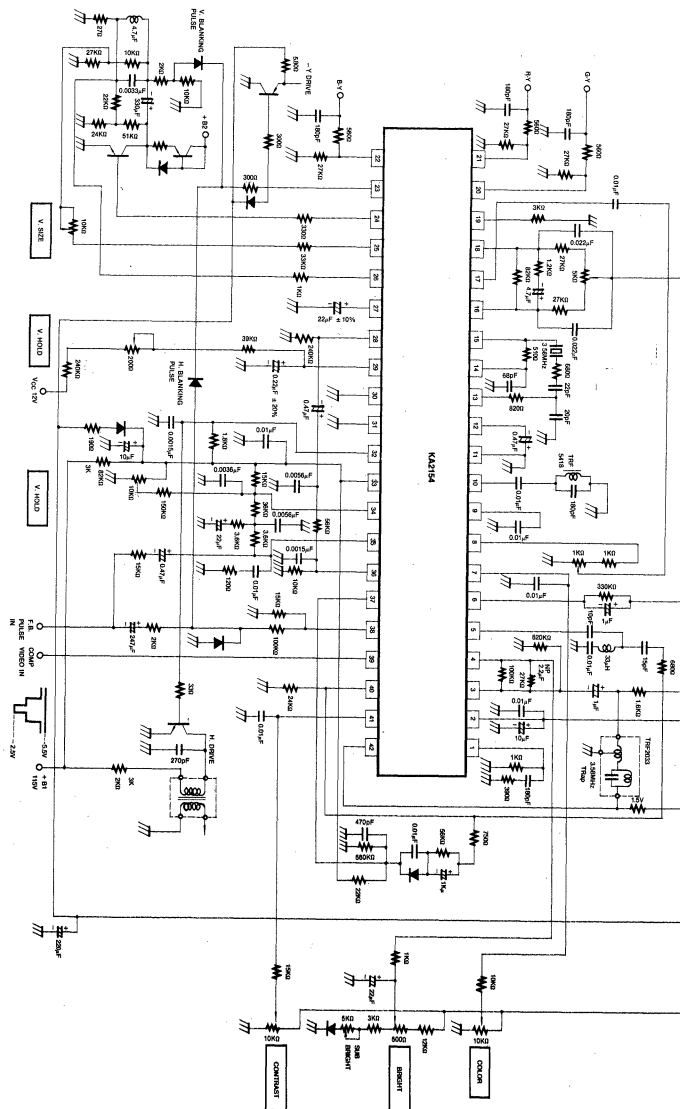
KA2154 PAL APPLICATION CIRCUIT



KA2154

LINEAR INTEGRATED CIRCUIT

KA2154 NTSC APPLICATION CIRCUIT



VIDEO CHROMA, DEFLECTION SYSTEM FOR A COLOR TV (NTSC)

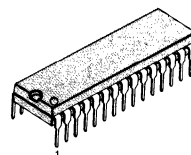
The KA2155/KA2156 are small-sized multifunction IC's containing the video chroma, deflection circuit of NTSC color TV in the SDIP30 of shrink type.

The KA2155 containing a peak clip circuit in the video circuit is well suited for use in small-sized sets.

The KA2156 without a peak clip circuit in the video circuit is well suited for use in the large-sized sets.

Device Name	DC Restoration Ratio	Peak Clip Circuit
KA2155	100%	O
KA2156	100%	X

30 SDIP



FEATURES

- Small-sized package
- Fewer adjustments required
 - Chroma VCO (APC)
 - Horizontal oscillator (H-Hold)
 - Vertical oscillator (V-Hold)
- Minimum number of parts required
- Multifunction

FUNCTIONS

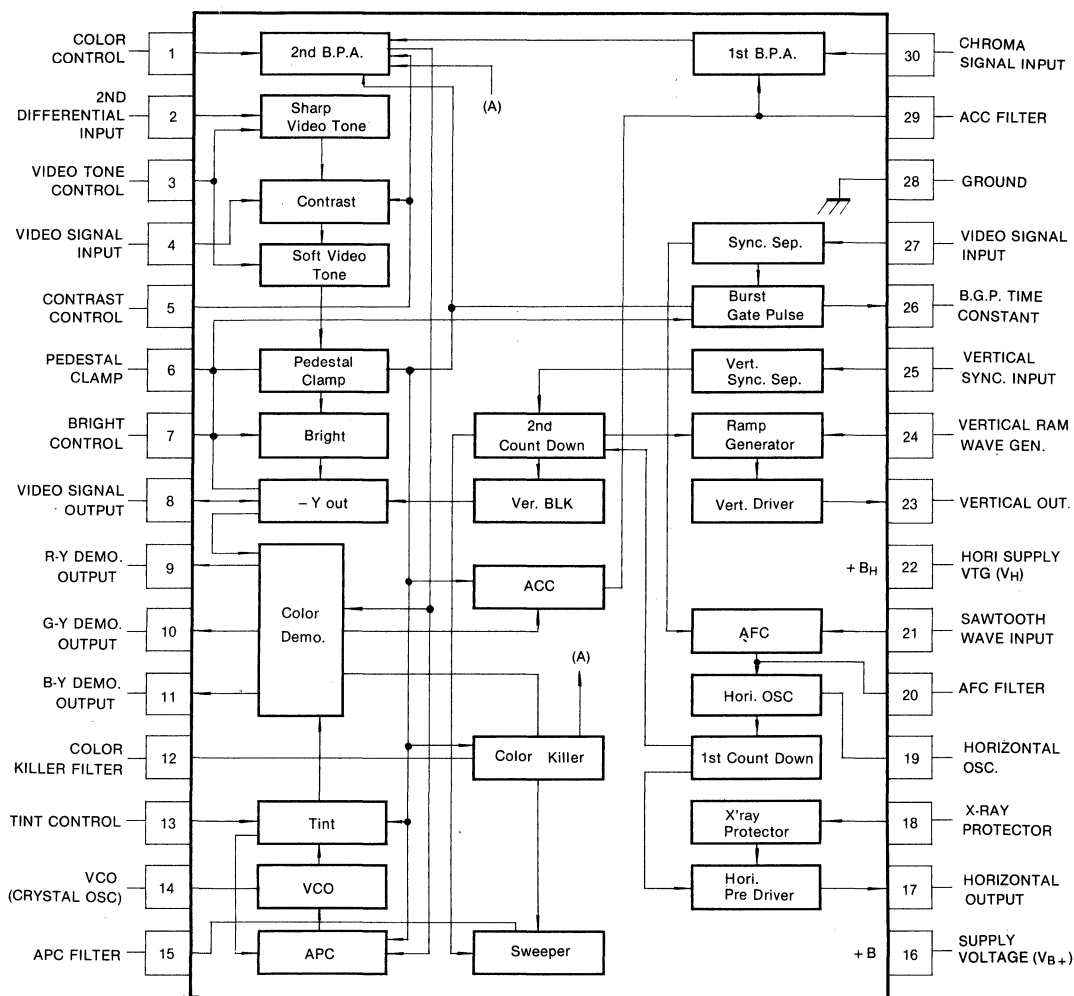
- Video section
 - Sharp & soft video tone control
 - Contrast control
 - Pedestal clamp
 - Bright control
 - Vertical blanking
- Chroma section
 - 1st & 2nd BPA
 - ACC
 - APC
 - VCO
 - Sweeper
 - Color control
 - Tint control
 - Color killer
 - Color demodulator

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2155	30 SDIP	- 20 ~ + 70°C
KA2156		

- Deflection section
 - Sync separator
 - Gate pulse generator
 - Vertical sync input
 - 1st & 2nd count down
 - Ramp generator
 - AFC
 - Horizontal OSC
 - Vertical driver
 - Horizontal pre driver
 - X'ray protector

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	$V_{i6} \text{ max}$	14.0	V
Horizontal Supply Current	$I_{22} \text{ max}$	15.0	mA
Power Dissipation	$P_D \text{ max}$	1100	mW
Operating Temperature	T_{opr}	- 20 ~ + 70	°C
Storage Temperature	T_{stg}	- 55 ~ + 125	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 12.0V, Ta = 25°C)**VIDEO STAGE**

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Voltage Range	V_{B+}		9.0	12.0	14.0	V
Supply Current	I_{CC}	$V_{B+} = 12.0V$	40	53	75	mA
Video Voltage Gain	G_V	$V_{B+} = 12.0V, f = 100KHz$	12	15	18	dB
Video Frequency Characteristic	G_{vf}	$V_{B+} = 12.0V,$ $f = 100KHz \quad 5.0MHz$	- 5			dB
Dependence of Video Output on Supply Voltage	Δe_o	$V_{B+} = 12.0V, f = 100KHz$	- 10		+ 10	%
Tone Control Characteristic (I)	$G_p \text{ min}$	$V_{B+} = 12.0V, f = 2.0MHz$	- 5	- 3	- 1	dB
Tone Control Characteristic (II)	$G_p \text{ max}$	$V_{B+} = 12.0V, f = 2.0MHz$	12	15	18	dB
Contrast Control Characteristic	E_o	$V_{B+} = 12.0V, f = 100KHz$	0.2	0.3	0.4	V_{pp}
Contrast Control Range	ΔG_{CV}	$V_{B+} = 12.0V, f = 100KHz$	16	18	20	dB
DC Restoration Ratio	K	$V_{B+} = 12.0V, \text{Stair Wave}$		100		%

ELECTRICAL CHARACTERISTICS ($V_{CC} = 12.0V$, $T_a = 25^\circ C$)

CHROMA STAGE

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Contrast Color Control Range	ΔG_{CC}	$V_{B+} = 12.0V$, Composite Signal	15.5	17.0	18.5	dB
Demo. Output Voltage	E_o	$V_{B+} = 12.0V$	6.7	7.2	7.7	
Demo. Output Voltage Diff.	ΔE_o	$V_{B+} = 12.0V$	-200		+200	mV
B-Y Demo. Output	e_{oB}	$V_{B+} = 12.0V$, Composite Signal	2.9	4.3	5.5	V_{pp}
Maximum B-Y Demo. Output	e_{oBmax}	$V_{B+} = 12.0V$, Composite Signal	5.5	6.5		V_{pp}
R-Y, B-Y Demo. Output Ratio	e_{oR} e_{oB}	$V_{B+} = 12.0V$, $f = 3.569545MHz$	0.81	0.90	0.98	
G-Y, B-Y Demo. Output Ratio	e_{oG} e_{oB}	$V_{B+} = 12.0V$, $f = 3.569545MHz$	0.24	0.30	0.38	
R-Y, B-Y Demo. Phase Ratio	$\angle e_{oR}$ $\angle e_{oB}$	$V_{B+} = 12.0V$, $f = 3.569545MHz$	96	104	112	deg
G-Y, B-Y Demo. Phase Ratio	$\angle e_{oG}$ $\angle e_{oB}$	$V_{B+} = 12.0V$, $f = 3.569545MHz$	-112	-122	-132	deg
APC Pull-In Range	f_{APC}	$V_{B+} = 12.0V$, $f = 3.5MHz \sim 3.9MHz$	± 300			Hz
Tint Change Range	$\Delta \theta_T$	$V_{B+} = 12.0V$, $f = 3.569545MHz$		110		deg
ACC Amplitude Char. (I)	A (I)	$V_{B+} = 12.0V$, Composite Signal	-3	0	+3	dB
ACC Amplitude Char. (II)	A (II)	$V_{B+} = 12.0V$, Composite Signal	-7	0	+2	dB

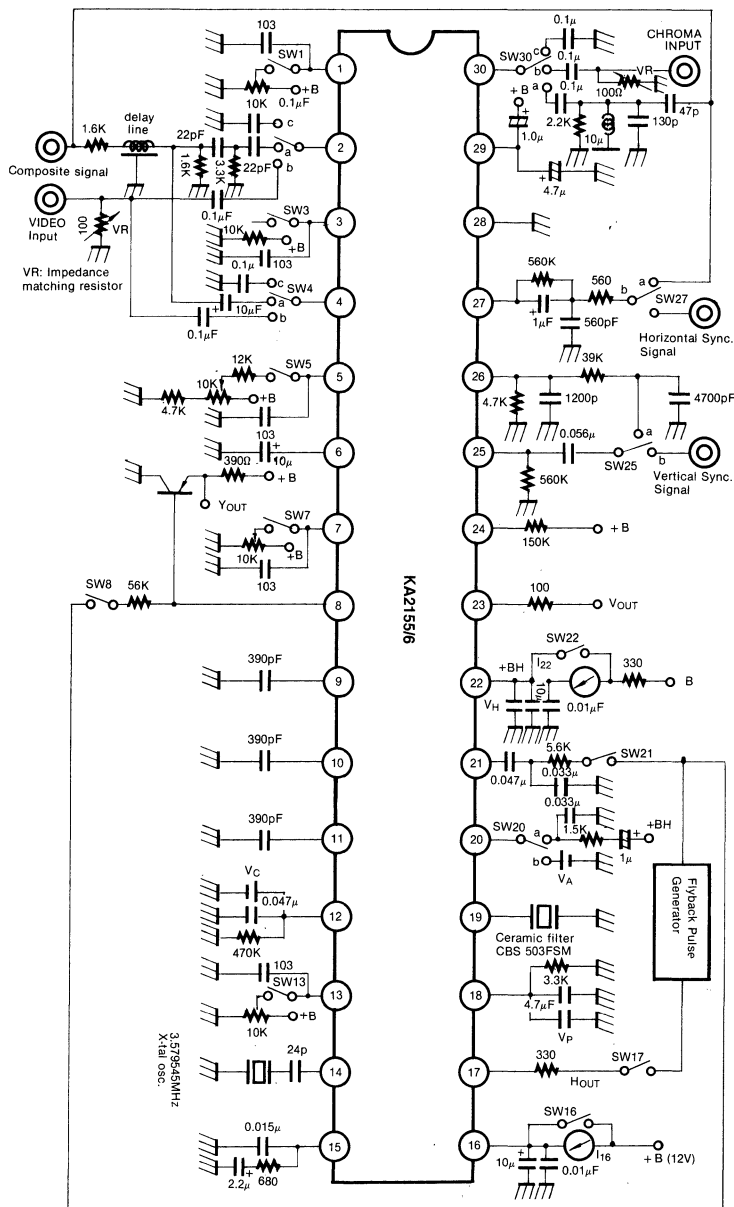
ELECTRICAL CHARACTERISTICS ($V_{B+} = 12.0V$, $I_{22} = 10mA$, $T_a = 25^\circ C$)

DEFLECTION STAGE

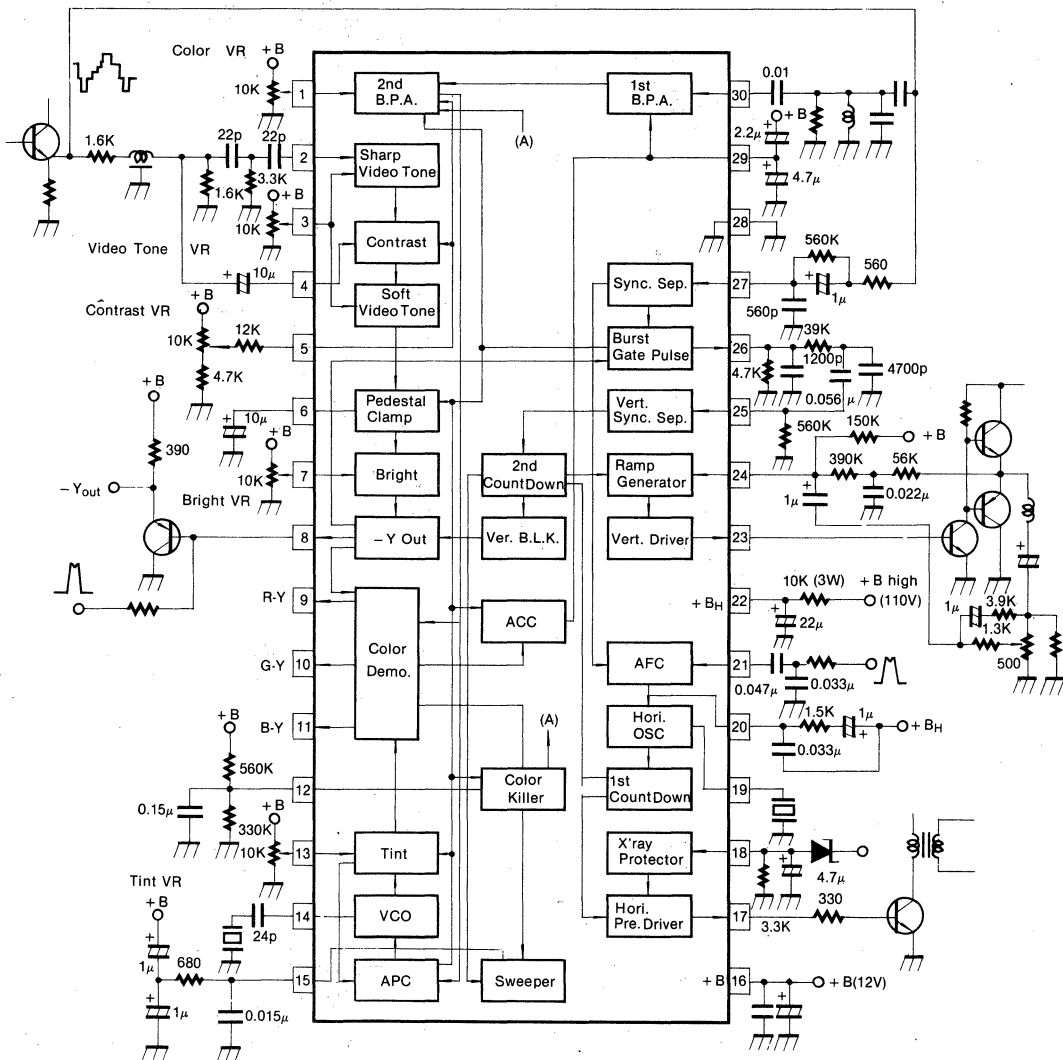
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Current Range	I_{22}		8.5	10.0	15.0	mA
Horizontal Regulating Voltage	V_H	$I_{22} = 10mA$	8.0	8.7	9.4	V
Sync Separator Input Voltage	V_{27}	$I_{22} = 10mA$	9.0	9.3	9.6	V
Hori. Pulse Starting Voltage	V_{HSTR}	$V_H = \text{Variable}$			5.5	V
Hori. Free-Running Freq.	f_H	$I_{22} = 10mA$	15.564	15.734	15.864	KHz
Hori. Output Pulse Width	T_H	$I_{22} = 10mA$	23.5	24.5	25.5	us
X-Ray Protection Voltage	V_{x18}	$I_{22} = 10mA$, $V_p = \text{Variable}$	0.55	0.65	0.75	V
Horizontal Pull-In Range	f_{Hpull}	$I_{22} = 10mA$	+400 -500			Hz
Vert. Free-Running Freq.	f_v	$V_{B+} = 12.0V$	49.15	53.15	57.15	Hz
Vert. Retrace Time	T_R	$V_{B+} = 12.0V$	0.50	0.65	0.80	ms
Vert. Blanking Pulse Width	T_{BL}	$V_{B+} = 12.0V$		1223.5		us
Vert. Pull-In Range	f_{vpull}	$V_{B+} = 12.0V$	11.0			Hz

LINEAR INTEGRATED CIRCUIT

TEST CIRCUIT



TYPICAL APPLICATION CIRCUIT



REMOTE CONTROL PREAMPLIFIER

The KA2181 is a silicon monolithic integrated circuit designed for a remote control preamplifier of infrared signals.

This device has features of low power, high sensitivity and wide supply voltage.

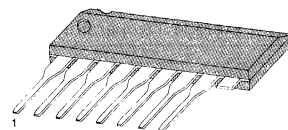
FUNCTIONS

- AMP • ABLC • LIMITER & LEVEL SHIFT
- PEAK DET • SHAPING

FEATURES

- Wide operation voltage $V_{CC} = 6 \text{ to } 14.4\text{V}$
- Low power consumption $I_{CC} = 2.5\text{mA Typ.}$
- High input sensitivity $50\mu\text{V}_{P-P} \text{ Typ.}$
- Peak detector
- Small size package 8 pin-SIP
- Minimum number of external parts required
- Designed for use with the KS5803 remote control transmitter IC.

8 SIP

**BLOCK DIAGRAM****ORDERING INFORMATION**

Device	Package	Operating Temperature
KA2181	8 SIP	$-20 \sim +75^{\circ}\text{C}$

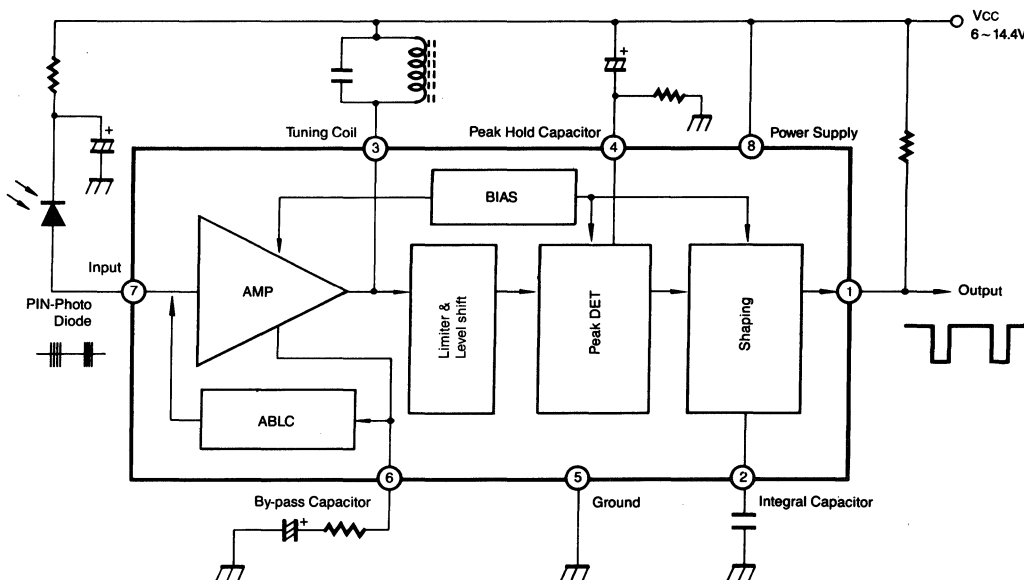


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_D	270	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-45 \sim +125$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Power Supply	V_{CC}	6.0	8.5	14.4	V
Input Frequency	f_{IN}	30	—	50	KHz

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 8.5\text{V}$, $f_{in} = 40\text{KHz}$)

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Supply Current	I_{CC}		1.5	2.5	3.5	mA
Input Terminal Voltage	$V_{IN\ 1}$		2.1	2.6	3.1	V
Input Terminal Voltage	$V_{IN\ 2}$	$I_{IN} = 70\mu\text{A}$	3.4	4.1	4.9	V
1st Stage Voltage Gain	A_{VL}	#7 — #3, $V_{OUT} = 500\text{mV}_{p-p}$	—	60	—	dB
Detection Input Voltage	V_{IN}		—	50	100	μV_{p-p}
Input Impedance	γ_{IN}		40	60	80	$\text{K}\Omega$
Output Voltage	V_{OL}	$I_{OL} = 0.1\text{mA}$, $V_{IN} = 1\text{mV}_{p-p}$	—	—	0.5	V
Output Leak Current	I_{OH}	$V_{OH} = 14.4\text{V}$	—	—	2	μA
Noise		Input Open	Output Terminal is not fall			

TYPICAL APPLICATION CIRCUITS

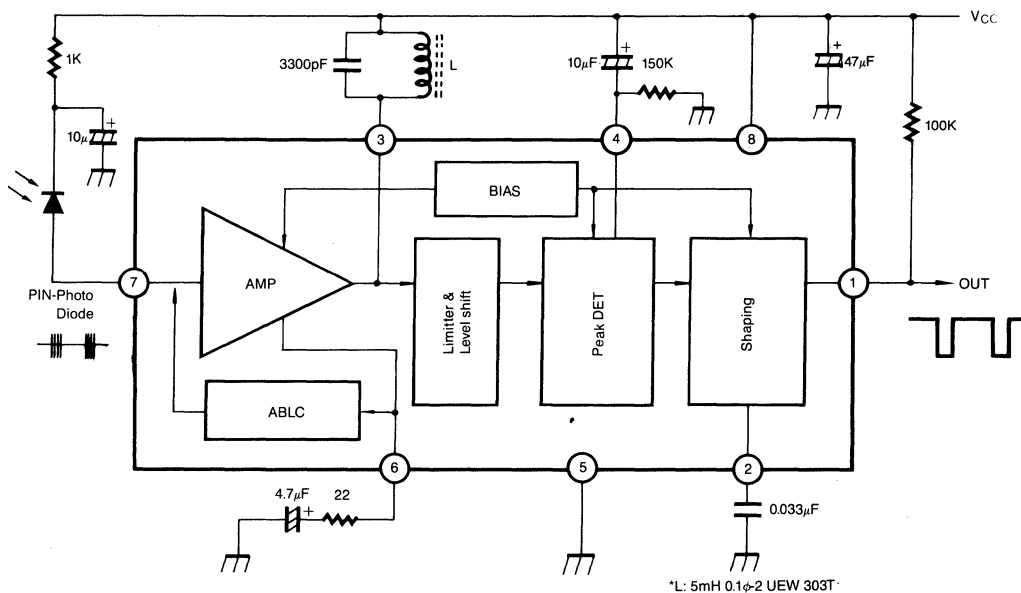


Fig. 2

TEST CIRCUITS

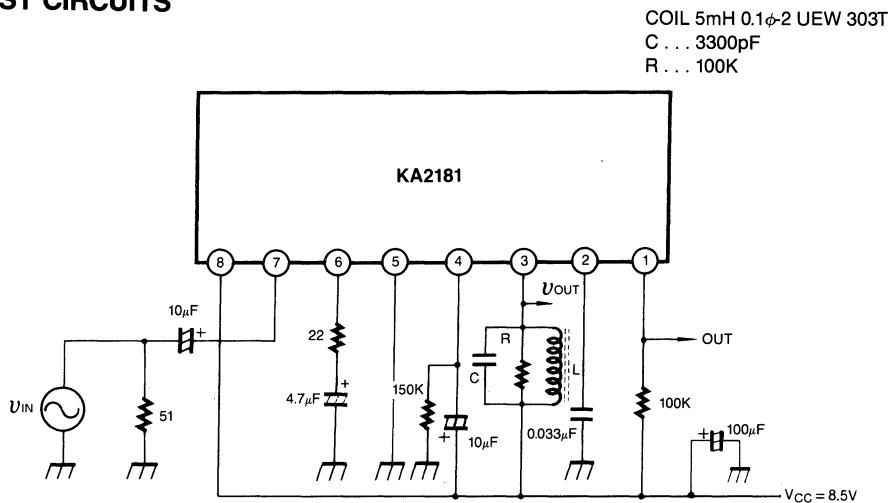


Fig. 3

REMOTE CONTROL PREAMPLIFIER

The KA2182/KA2183 are silicon monolithic integrated circuit designed for a remote control preamplifier of infrared signals. These devices have features of low power, high sensitivity and wide supply voltage.

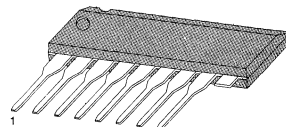
FUNCTIONS

- AMP
- ABLC
- Limiter & Level Shift
- Shaping
- Peak Det

FEATURES

- Wide Operation Voltage: $V_{CC} = 4$ to $8V$
- Low Power Consumption: $I_{CC} = 2.2mA$ Typ. (KA2182)
- High Input Sensitivity: $50\mu V_{pp}$ 2.3mA Typ. (KA2183)
- Peak Detector
- Small Size Package: 8 SIP
- Minimum Number of External Parts Required
- Output: Active Low (KA2182)
Active High (KA2183)

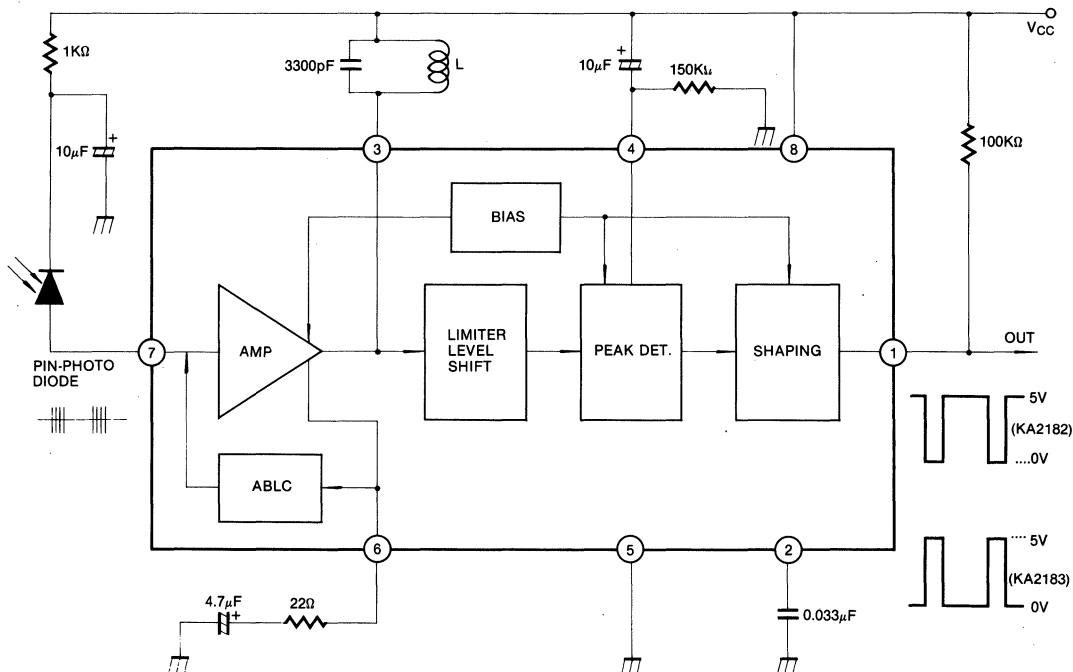
8 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2182	8 SIP	$-20 \sim +75^{\circ}C$
KA2183		

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V _{CC}	8	V
Operating Temperature	T _{opr}	- 20 ~ + 75	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

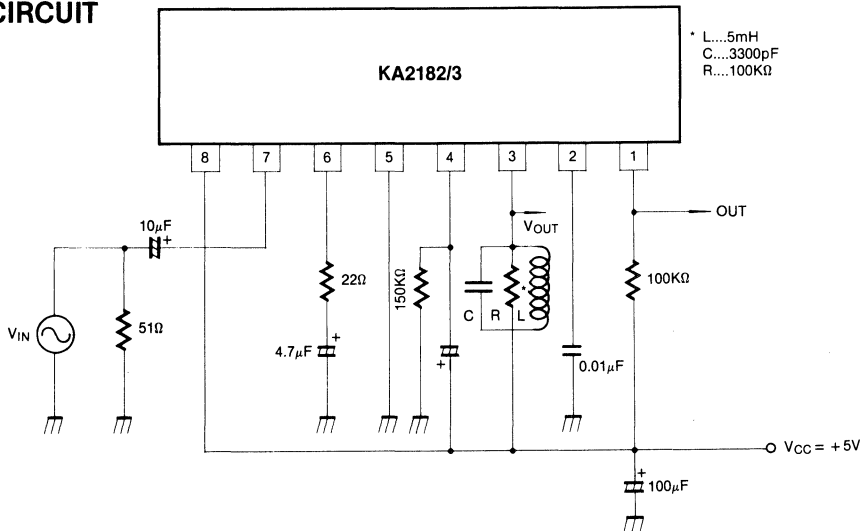
RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min	Typ	Max	Unit
Power Supply	V _{CC}	4.0	5.0	8.0	V
Input Frequency	F _{IN}	30		50	KHz

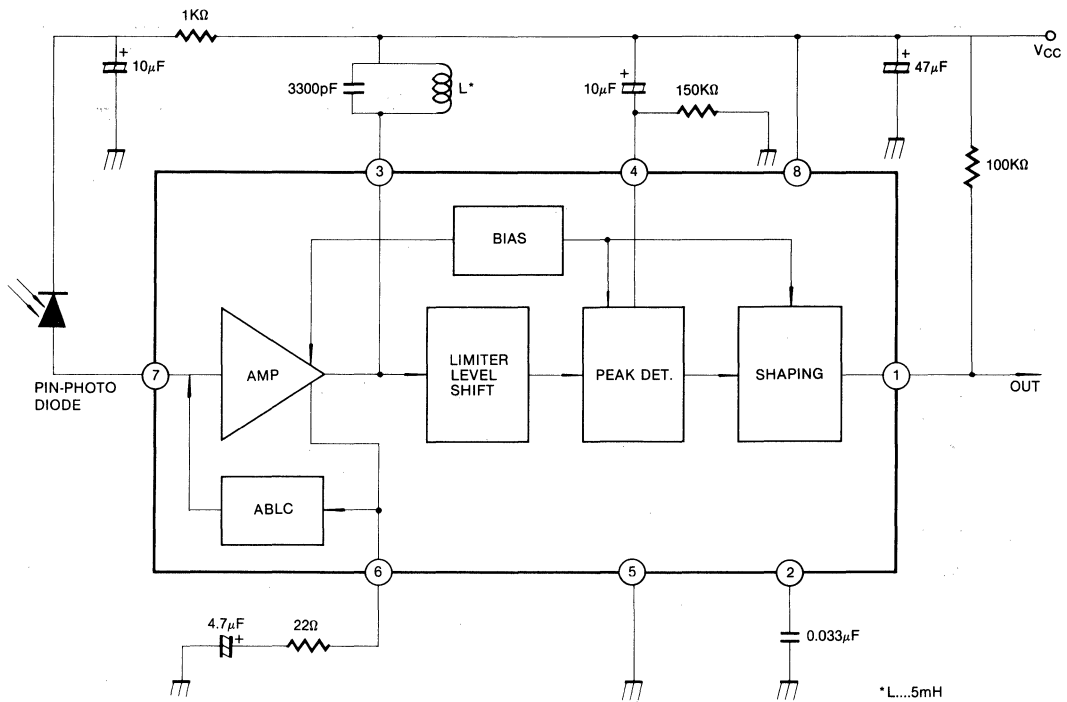
ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 5V, f_{IN} = 40KHz)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Current	I _{CC}	KA2182	1.2	2.2	3.2	mA
		KA2183	1.3	2.3	3.3	mA
Input Terminal Voltage	V _{IN1}		1.0	1.2	1.5	V
Input Terminal Voltage	V _{IN2}	I _{IN} = 70μA	1.7	2.3	3.0	V
1st Stage Voltage Gain	A _{VL}	V _{OUT} = 500mV _{p-p}		60		dB
Detection Input Voltage	V _{IN}			50	100	μV
Output Voltage	KA2182	V _{OL} I _{OL} = 0.1mA, V _{IN} = 1mV _{p-p}			0.5	V
	KA2183					
Output Leak Current	I _{OH}	V _{OH} = 14.4V			2	μA

TEST CIRCUIT



APPLICATION CIRCUIT



REMOTE CONTROL PREAMPLIFIER

The KA2184 is a bipolar IC for receiving pre-amplifier of infra-red remote control system.

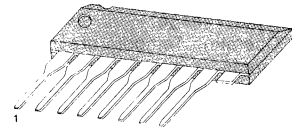
FUNCTIONS

- Primary stage amplifier
- Limiter amplifier
- BPF
- Signal waveform detecting
- Waveform shaping

FEATURES

- Low power consumption ($V_{CC} = 5V$, 9mW typ)
- Low power supply voltage ($V_{CC} = 5V$)
- Built-in filter (Enables to vary center frequency with an externally attached resistor. $f_o = 30KHz$ to $60KHz$, 40KHz typ.)
- It is free from inductance due to magnetic field since it uses no L.
- Possible to direct connection to a photodiode
- Open collector output (possible to direct connection to TTL and CMOS)

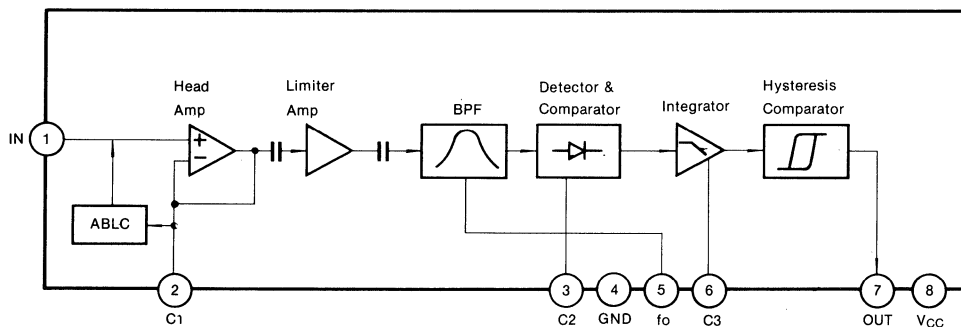
8 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2184	8 SIP	- 20 ~ + 75
KA2184G	Bare Chip	- 20 ~ + 75

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Power Supply Voltage	V _{CC}	+12	V
Input Voltage	V _{IN}	5	V _{p-p} (Pin 1 input)
Operating Temperature	T _{opr}	-20 ~ +75	°C
Storage Temperature	T _{stg}	-55 ~ +150	°C
Allowable Power Dissipation	P _D	0.4	W

RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Power Supply	V _{CC}	4.7	—	5.3	V

ELECTRICAL CHARACTERISTICS (V_{CC} = 5V, Ta = 25°C)

Characteristics	Symbol	Test Conditions			Test Point	Min.	Typ.	Max.	Unit
		Signal	Level	ON-SW					
Input Pin Voltage (1)	V _{IN1}			S1, 8, 11-a	A	2.0	2.5	3.1	V
Input Pin Voltage (2)	V _{IN2}			S1, 2, 4, 8, 11-a	A	0.6	1.0	1.7	V
L level output voltage	V _{OL}			S3, 7-a, 10, 11-a	D	—	0.2	0.4	V
Output Leakage Current	I _{OH}			S3, 7-b, 9, 11-a	C	—	0	2.2	μA
Voltage Gain	A _V	40KHz cw	50μV _{p-p}	S2, 5, 6, 7-c, 11-a	B	74	79	84	dB
BPF Characteristics	A _{VO}	30KHz, 37KHz, 43KHz, 50KHz cw	50μV _{p-p}	S2, 5, 6, 7-c, 11-a	B	4	9	—	dB
Input Impedance	r _{in}	40KHz cw	0.2 V _{p-p}	S1, 2, 6, 8, 11-a	A	27	40	55	KΩ
Detecting Ability (1)	V _{in1}	burst wave	60μV _{p-p}	S2, 5, 6, 8, 10, 11-a	D	440	540	770	μs
Detecting Ability (2)	V _{in2}	burst wave	50mV _{p-p}	S2, 5, 6, 8, 10, 11-b	D	440	660	770	μs
Consumption Current	I _{CC}			S3, 8, 11-a	E	1.0	1.8	2.8	mA

Note 1. The level ratio between AC level of during 37KHz and that of 30KHz denotes A1 (dB).

$$A1 = 20 \log \frac{\text{measure value (f = 37KHz)}}{\text{measure value (f = 30KHz)}}$$

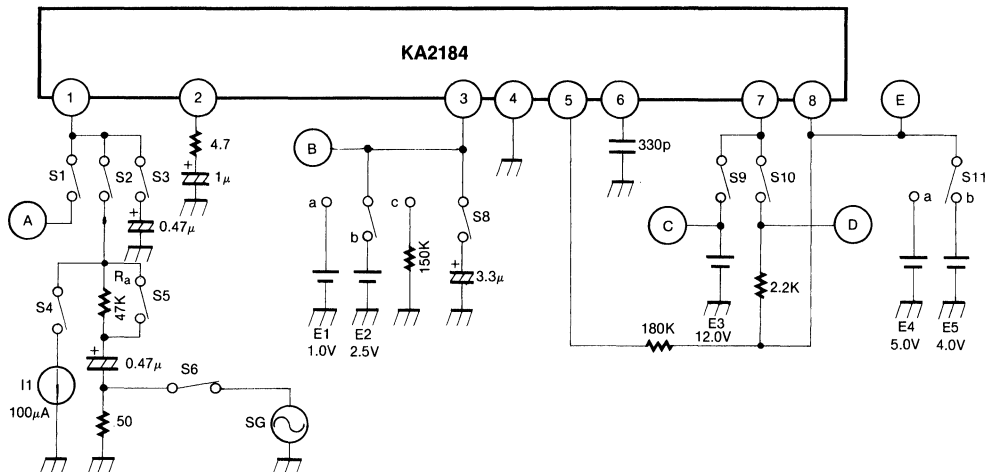
The level ratio between AC level of during 43KHz and that of 50KHz denotes A2 (dB).

$$A2 = 20 \log \frac{\text{measure value (f = 43KHz)}}{\text{measure value (f = 50KHz)}}$$

Note 2.

$$r_{in} = \frac{47K\Omega}{\frac{V_i}{V_x} - 1}$$

TEST CIRCUITS

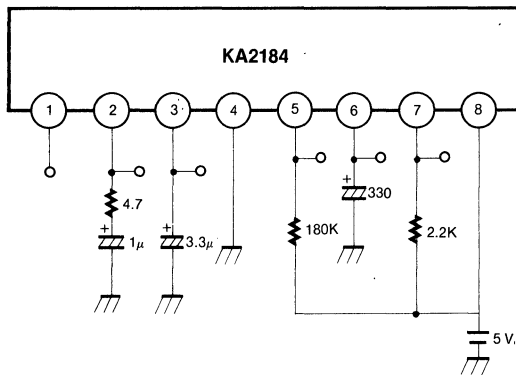


STANDARD CIRCUIT DESIGN DATA

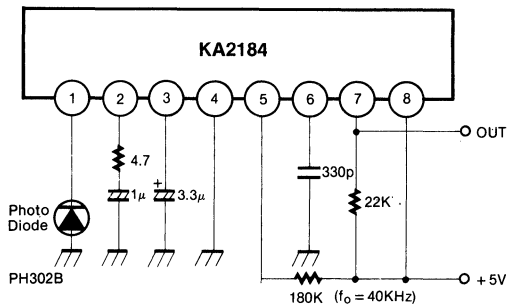
DC Characteristics (See DC Current Measuring Circuit)

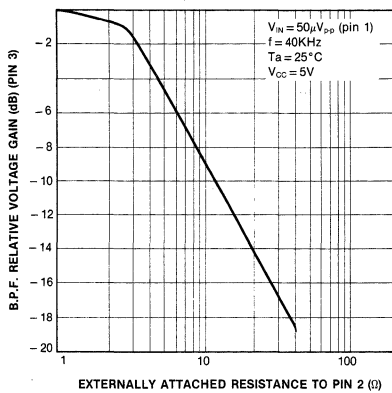
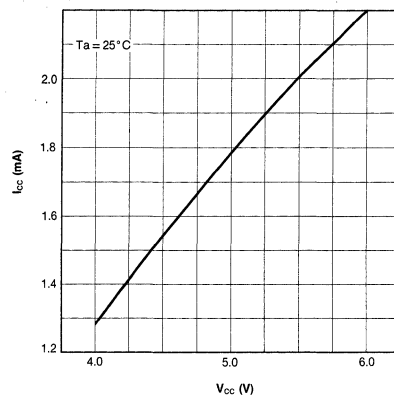
Pin	Pin Voltage	Remark
1	2.5V	
2	2.5V	
3	1.5V	
4	—	GND Pin
5	1.4V	
6	1.0V	
7	5.0V	
8	—	Power Source Pin

DC Characteristics Measuring Circuit

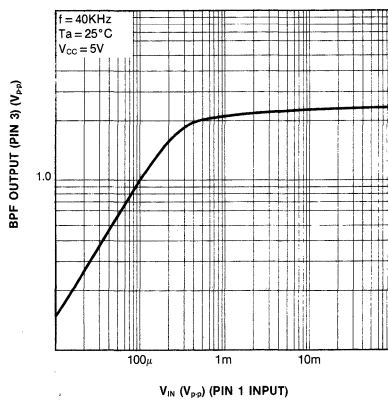
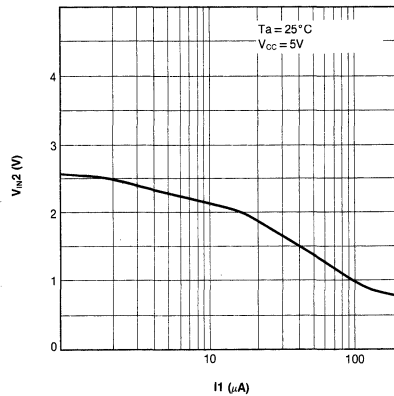
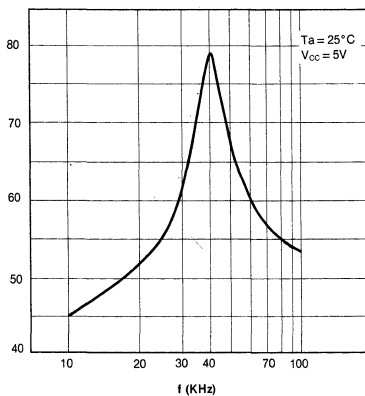


TYPICAL APPLICATION CIRCUITS

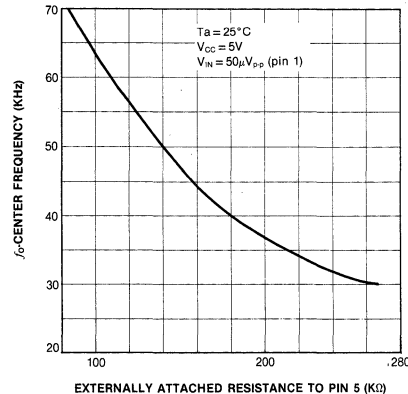


A_v CHARACTERISTICS VS. EXTERNALLY ATTACHED RESISTANCE TO PIN 2I_{CC} VS. V_{CC} CHARACTERISTICS

PIN 3 OUTPUT VOLTAGE CHARACTERISTICS VS. PIN 1 INPUT VOLTAGE

V_{IN2} VS. I₁ CHARACTERISTICSA_v VS. f CHARACTERISTICS

CENTER FREQUENCY CHARACTERISTICS VS. EXTERNALLY ATTACHED RESISTANCE



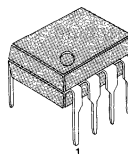
VIDEO SWITCHING CIRCUIT FOR TV

This integrated circuit provides all video switching allowing connections between the peri TV plug and video section in the TV sets.

FEATURE

- 1 Video output 75Ω - $1V_{p-p}$ no switched.
- 1 switched video output $2V_{p-p}$.
- Video cross talk: 50dB typical
- Short circuit protection of inputs and outputs
- Clamped video input.

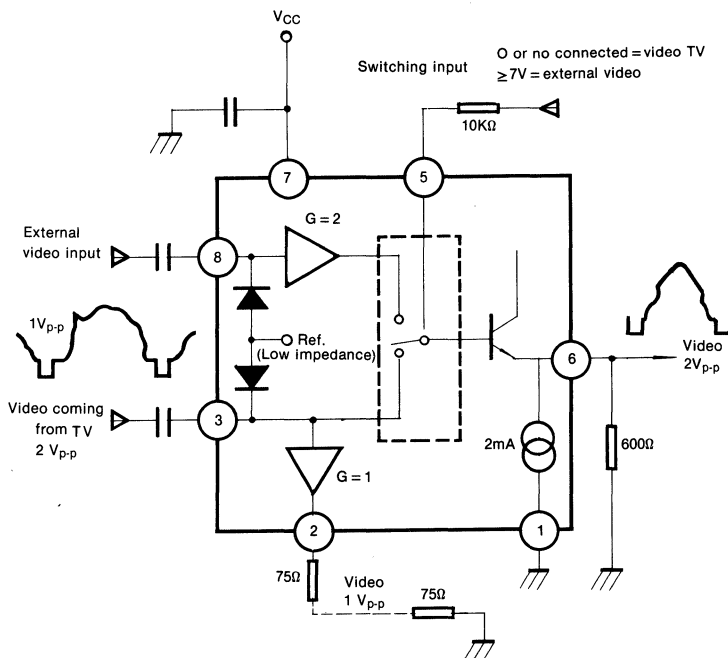
8 DIP



ORDERING INFORMATION

TYPICAL APPLICATION AND TEST CIRCUIT

Device	Package	Operating Temperature
KA2186	8 DIP	-10 ~ +70°C



We advice to protect the 75Ω output through a 75Ω resistor for supply voltage upper than 9V.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Operating Temperature With Load $\geq 150\Omega$ With Load = 75Ω	T_{opr}	$-10 \sim +100$ $-10 \sim +70$	$^{\circ}\text{C}$
Junction Temperature	T_j	$-40 \sim +150$	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +150$	$^{\circ}\text{C}$
Minimum DC Load Resistor P6 Minimum DC Load Resistor P2		600 75	Ω Ω

ELECTRICAL CHARACTERISTICS ($T_a = 25^{\circ}\text{C}$, $V_{CC} = 9\text{V}$)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage Range	V_{CC}	8	—	14	V
Supply Current (no load on Pin 2 and Pin 6)	I_{CC}	—	13	20	mA
Supply Current (with 75Ω between Pin 2-1, with 600Ω between Pin 6-1)	I_{CCL}	—	43	75	mA
Internal Video Input Swing from Picture FI (Positive video)	—	—	—	4.5	V_{pp}
Internal Video Input Impedance (Positive video)	—	50	—	—	$K\Omega$
Internal Video Input Bias Current (Positive video)	—	10	25	40	μA
External Video Input Swing (Positive video)	—	—	—	2	V_{pp}
External Video Input Impedance (Positive video)	—	50	—	—	$K\Omega$
Switched Video Output Swing	—	—	—	4.5	V_{pp}
Switched Video DC Output Voltage (Sync. pulse level, note 1) (600Ω)	—	1.7	2	2.4	V
Switched Video Band Width (— 1dB)	—	6	—	—	MHz
Switched Video Output Gain Pin 6-Pin 8 (gain with 600Ω load) Pin 6-Pin 3 (gain with 600Ω load)	—	+4 —1	+5 —0.5	+6 0	dB
External Video Output Swing (with 75Ω load)	—	—	2	2.2	V
External Video DC Output Voltage (Sync. pulse level, note 1) (75Ω)	—	1.7	2	2.4	V
External Video Output Gain (Pin 2-Pin 3 gain with 75Ω load)	—	—1.8	—1	—0.4	dB
Switching Input Unactive Low Level or Unconnected Pin (TV receiving)	—	0	—	3	V
Switching Input Active Level (ext. receiving)	—	7	—	V_{CC}	V
Video Rejection Between Two Inputs 0 to 5MHz 1KHz	—	— —50	—50 —	— —	dB
Differential Group Delay	—	—	15	—	ns
Linearity Distortion Luma (test line 17) Chroma (test line 331) Intermodulation Luma-Chroma (test line 331)	—	— — —	2 2 5	— — —	%
Supply Voltage Rejection (1KHz)	—	40	50	—	dB

Note 1: Use a video signal with a synchro pulse in order to make the clamp work in a correct way (75Ω to the ground and $10\mu\text{F}$ in serie).

ONE CHIP TV SOUND MPX (KOREA TWO CARRIER SYSTEM)

The KA2268N is a silicon monolithic integrated circuit designed for demodulating Korea two carrier TV-MPX broadcasts. The use of PLL makes reed filters unnecessary.

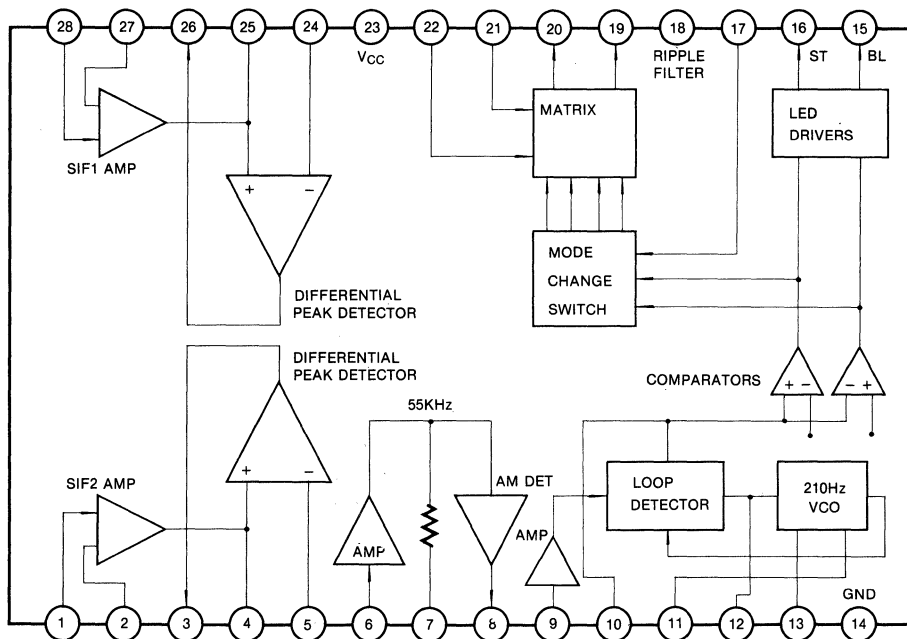
FUNCTIONS

- 1st Sound IF
- 2nd Sound IF
- Matrix for Stereo
- Pilot Amp and Detector
- Pilot Decoder
- Mode Change Switch
- Indicators (Stereo, Bilingual)

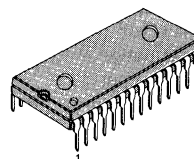
FEATURES

- One input mode change switch
- Auto pilot decoding by phase detector
- Minimum number of external parts required

BLOCK DIAGRAM



28 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2268N	28 DIP	-20 ~ +70°C

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Condition	Value	Unit
Maximum Supply Voltage	V _{CC} max	V _I = 0	15	V
Pin 15 Output Current	I ₁₅		30	mA
Pin 16 Output Current	I ₁₆		30	mA
Maximum Mode SW Voltage	V ₁₇		- 0.3 ~ V _{CC}	V
Power Dissipation	P _D		1.5	W
Operating Temperature	T _{opr}		- 20 ~ + 70	°C
Storage Temperature	T _{stg}		- 40 ~ + 125	°C

RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min	Typ	Max	Unit
Operating Voltage	V _{opr}	9	12	15	V

ELECTRICAL CHARACTERISTIC

SIF SECTION (V_{CC} = 12V, f_m = 400Hz, V_I = 100dBμ, Ta = 25°C Δf = ± 30KHz, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Total Circuit Current	I _{CC}	V _I = 0		40	60	mA
Input Limiting Voltage 1	V _{lim1}	f ₀ = 4.5MHz, V _o = - 3dB			52	dBμ
Input Limiting Voltage 2	V _{lim2}	f ₀ = 4.72MHz, V _o = - 3dB			52	dBμ
Detector Output 1	V _{o1}	f ₀ = 4.5MHz	0.7	0.9	1.3	V _{rms}
Detector Output 2	V _{o2}	f ₀ = 4.72MHz	0.7	0.9	1.3	V _{rms}
T.H.D. 1	THD1	f ₀ = 4.5MHz	—	0.5	2	%
T.H.D. 2	THD2	f ₀ = 4.72MHz	—	0.5	2	%
AM Rejection Ratio 1	AMR1	f ₀ = 4.5MHz, AM = 30%	35	45	—	dB
AM Rejection Ratio 2	AMR2	f ₀ = 4.72MHz, AM = 30%	35	45	—	dB
Input Impedance of Pin 28	Z _{in28}	f = 4.5MHz		40		Kohm
Input Impedance of Pin 1	Z _{in1}	f = 4.72MHz		40		Kohm
Output Resistance of DET Output	Z26			1.2		Kohm
Output Resistance of DET Output	Z3			1.2		Kohm
Cross Talk (SIF1→SIF2)	CT1	SIF1 f ₀ = 4.5MHz, f _m = 400Hz-5KHz	50	55	—	dB
		SIF2 f ₀ = 4.72MHz Δf = 0				

ELECTRICAL CHARACTERISTIC (Continued)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Cross Talk (SIF1→SIF2)	CT1	SIF1 $f_0 = 4.5\text{MHz}$, $f_m = 400\text{Hz-5KHz}$	50	55	—	dB
		SIF2 $f_0 = 4.72\text{MHz}$ $\Delta f = 0$				
Cross Talk (SIF2→SIF1)	CT2	SIF1 $f_0 = 4.5\text{MHz}$	50	55	—	dB
		SIF2 $f_0 = 4.72\text{MHz}$ $f_m = 400\text{Hz-5KHz}$				
Frequency Response of Detector	F_1	$f_0 = 4.5\text{MHz}$ $f_m = 40\text{Hz-55KHz}$	-3	0	1.5	dB
Frequency Response of Detector	F_2	$f_0 = 4.724\text{MHz}$ $f_m = 40\text{Hz-55KHz}$	-3	0	1.5	dB
Detector Output Balance	C.B.	SIF1 = 4.5MHz SIF2 = 4.724MHz	-2	0	2	dB

PILOT AMP AND DETECTOR

(V_{CC} = 12V, f_c = 55.125KHz, f_m = 150 or 276Hz, AM = 50%, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Input Resistance of Pin 6	Z _{in6}		—	30	—	Kohm
Maximum Pilot Input	V _{in} , P _{max}	V _o = -3dB, 0dB: V _i = 10mV		100	—	mV
Detector Gain	A _{VD}		30	36		dB
Detector Output	V _{OD}	V _{in} = 10mV		270		mV
Output Resistance of Pin 8	Z _{out8}		—	700	—	ohm

PILOT DECODER (V_{CC} = 12V, f = 150 or 276Hz, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Input Sensitivity	V _{sens}	f = 150 or 276Hz		10	20	mV _{rms}
Input Resistance of Pin 9	Z _{in9}		—	47	—	Kohm
Capture Range	f _c	V _i = 50mV		± 5		Hz
Lock Range	f _L	V _i = 50mV		± 10		Hz
Stereo Range	f _{ST}	V _i = 100mV		150 ± 10		Hz
Bilingual Range	f _{BL}	V _i = 100mV		276 ± 10		Hz

INDICATOR ($V_{CC} = 12V$)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Saturation Voltage	V_{sat}	$I_{15}, I_{16} = 30mA$		0.7		V
LED On Time	t_{ON}	$f = 150, 276Hz$ $V_i = 0mV \rightarrow 50mV$	—	100	200	mS
LED Off Time	t_{OFF}	$f = 150, 276Hz$ $V_i = 50mV \rightarrow 0mV$	—	100	200	mS

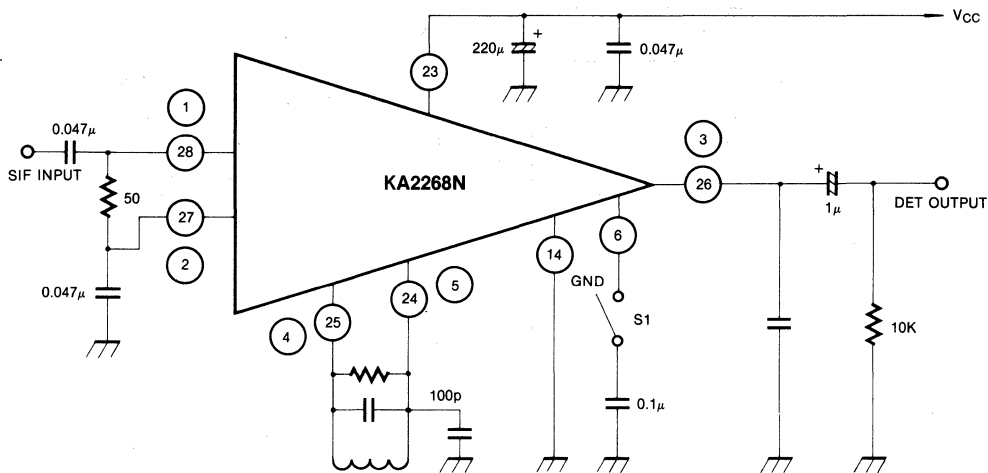
MODE CHANGE SWITCH CIRCUIT

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Main/Main Resistance	R (m/m)	SW = 2	3.1	4.7	7.0	Kohm
Forced Mono Voltage	V_{mono}	SW = 1		0	1.0	V
Main/Sub Supply Current	$I_{m/s}$	SW = 3	- 0.2	0	0.2	mA
Sub/Sub Supply Voltage	$V_{s/s}$	SW = 4	11	12		V

MATRIX CIRCUIT

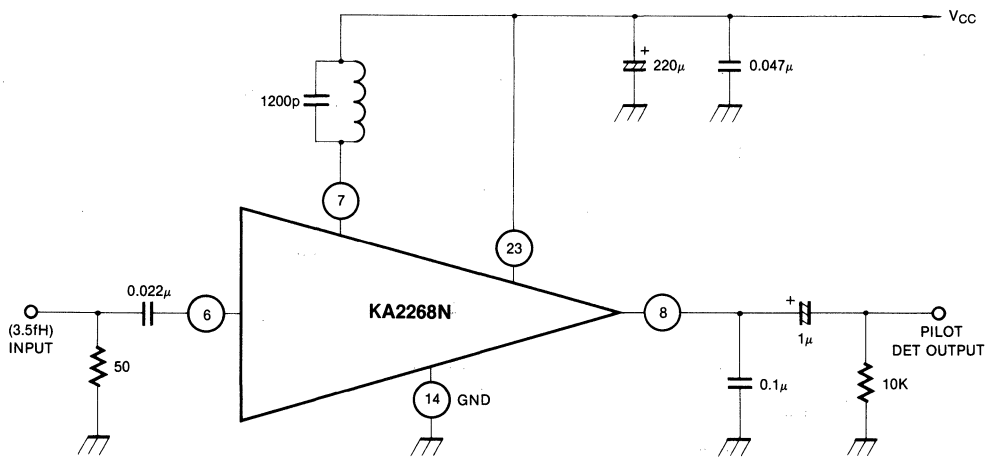
Characteristics	Symbol	Condition	Min	Typ	Max	Unit
T.H.D. In Main Mode	THD_M	$V_i = 50mV$	—	0.3	1.0	%
T.H.D. In Sub Mode	THD_S	$V_i = 50mV$	—	0.3	1.0	%
T.H.D. In Stereo Mode	THD_{ST}	$V_i = 50mV$	—	0.3	1.0	%
Cross Talk (M/M $\rightarrow$ S/S)	$CT_{MM \rightarrow SS}$	$V_i = 50mV$	50	55	—	dB
Cross Talk (S/S $\rightarrow$ M/M)	$CT_{SS \rightarrow MM}$	$V_i = 50mV$	50	55	—	dB
Cross Talk (M $\rightarrow$ S)	$CT_{M \rightarrow S}$	$V_i = 50mV$	50	55	—	dB
Cross Talk (S $\rightarrow$ M)	$CT_{S \rightarrow M}$	$V_i = 50mV$	50	55	—	dB
Separation (L $\rightarrow$ R)	$SEP_{L \rightarrow R}$	$V_i = 50mV$	30	35	—	dB
Separation (R $\rightarrow$ L)	$SEP_{R \rightarrow L}$	$V_i = 50mV$	30	35	—	dB
Voltage Gain of Matrix	A_V	$V_i = 50mV$	8	10	12	dB

TEST CIRCUIT 1 SIF SECTION

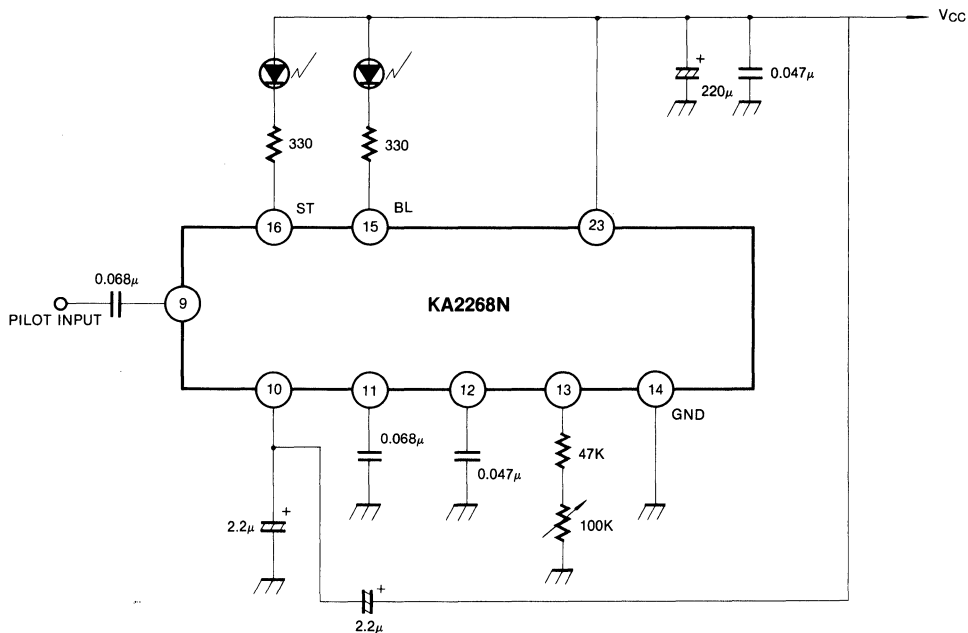


S1: PILOT INPUT NOISE BYPASS

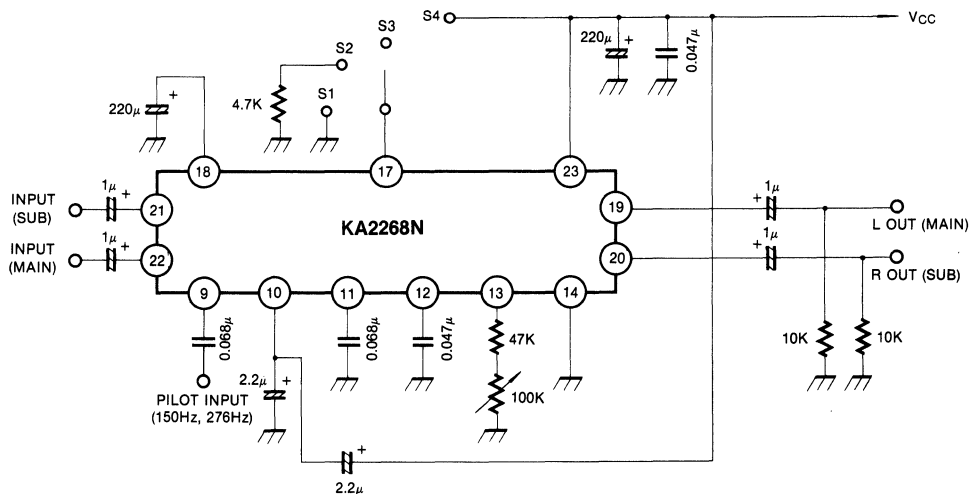
TEST CIRCUIT 2 PILOT AMP/DET SECTION



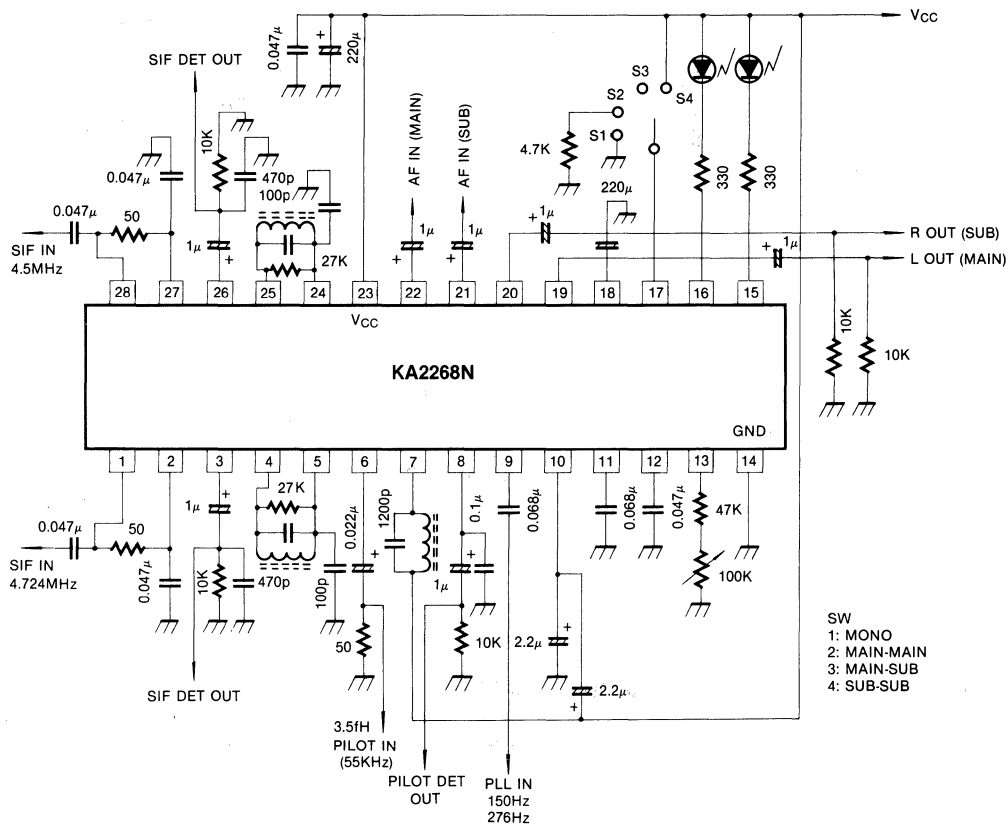
TEST CIRCUIT 3 PILOT PLL/INDICATOR SECTION



TEST CIRCUIT 4 MATRIX MODE SECTION



TEST CIRCUIT 5



ONE CHIP TV MPX DEMODULATOR (KOREA TWO CARRIER SYSTEM)

The KA22682 is a silicon monolithic integrated circuit designed for demodulating Korea two carrier TV-MPX broadcasts. The use of PLL makes reed filters unnecessary.

FUNCTIONS

- 1st Sound IF Amp & Det.
- 2nd Sound IF Amp & Det.
- Matrix for Stereo
- Pilot Amp and Detector
- Pilot Decoder
- Mode Change Switch
- LED Drivers (Stereo, Bilingual)

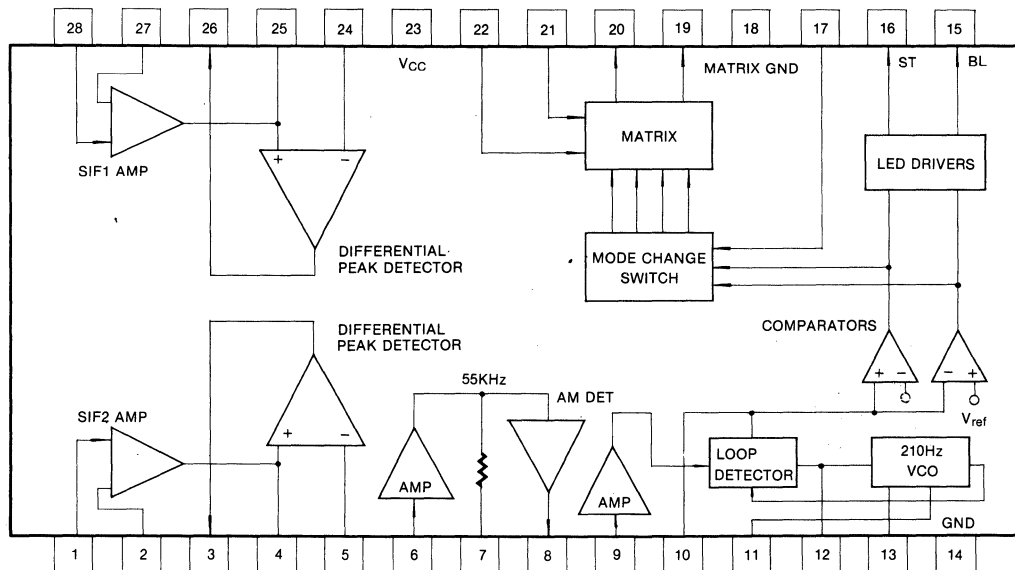
FEATURES

- One input mode change switch
- Auto pilot decoding by phase detector
- Minimum number of external parts required

ORDERING INFORMATION

Device	Package	Operating Temperature
KA22682	28 DIP	-20 ~ +70°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Condition	Value	Unit
Maximum Supply Voltage	V_{CC} max	$V_i = 0$	15	V
Pin 15 Output Current	I_{15}		30	mA
Pin 16 Output Current	I_{16}		30	mA
Maximum Mode SW Voltage	V_{17}		$-0.3 \sim V_{CC}$	V
Power Dissipation	P_D		1.5	W
Operating Temperature	T_{opr}		$-20 \sim +70$	°C
Storage Temperature	T_{stg}		$-40 \sim +125$	°C

RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min	Typ	Max	Unit
Operating Voltage	V_{opr}	9	12	15	V

ELECTRICAL CHARACTERISTIC

SIF SECTION ($V_{CC} = 12V$, $f_m = 400Hz$, $V_i = 100dB\mu$, $T_a = 25^\circ C$ $\Delta f = \pm 25KHz$, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Total Circuit Current	I_{CC}	$V_i = 0$		40	60	mA
Input Limiting Sens Voltage 1	V_{lim1}	$f_0 = 4.5MHz$	—	52		$dB\mu$
		$V_o = -3dB$				
Input Limiting Sens Voltage 2	V_{lim2}	$f_0 = 4.7MHz$	—	52		$dB\mu$
		$V_o = -3dB$				
Detector Output Voltage 1	V_{o1}	$f_0 = 4.5MHz$	0.7	0.9	1.2	V_{rms}
Detector Output Voltage 2	V_{o2}	$f_0 = 4.7MHz$	0.7	0.9	1.2	V_{rms}
T.H.D. 1	THD1	$f_0 = 4.5MHz$	—	0.5	1	%
T.H.D. 2	THD2	$f_0 = 4.7MHz$	—	0.5	1	%
AM Rejection Ratio 1	AMR1	$f_0 = 4.5MHz$, AM = 30%	35	45	—	dB
AM Rejection Ratio 2	AMR2	$f_0 = 4.7MHz$, AM = 30%	35	45	—	dB
Input Impedance of Pin 28	Z_{in28}	$f = 4.5MHz$	—	40	—	Kohm
Input Impedance of Pin 1	Z_{in1}	$f = 4.7MHz$	—	40	—	Kohm
Output Resistance of Det Output	Z_{o26}		—	1.2	—	Kohm
Output Resistance of Det Output	Z_{o3}		—	1.2	—	Kohm

ELECTRICAL CHARACTERISTIC (Continued)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Cross Talk (SIF1→SIF2)	CT1	SIF1 $f_0 = 4.5\text{MHz}$ $f_m = 400\text{-}5\text{K}$	50	55	—	dB
		SIF2 $f_0 = 4.7\text{MHz}$ $\Delta f = 0$				
Cross Talk (SIF2→SIF1)	CT2	SIF1 $f_0 = 4.5\text{MHz}$ $\Delta f = 0$	50	55	—	dB
		SIF2 $f_0 = 4.7\text{MHz}$ $f_m = 400\text{-}5\text{K}$				
Frequency Response of Detector	F_1	$f_0 = 4.5\text{MHz}$ $f_m = 40\text{Hz-}55\text{KHz}$	-3	0	1.5	dB
Frequency Response of Detector	F_2	$f_0 = 4.7\text{MHz}$ $f_m = 40\text{Hz-}55\text{KHz}$	-3	0	1.5	dB
Detector Output Balance	C.B.	SIF1 = 4.5MHz SIF2 = 4.7MHz	-2	0	2	dB

PILOT AMP AND DETECTOR(V_{CC} = 12V, f_c = 55.125KHz, f_m = 150 or 276Hz, AM = 50%, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Input Resistance of Pin 6	Z_{i6}		—	30	—	Kohm
Maximum Pilot Input Voltage	$V_{in(max)}$	$V_o = -3\text{dB}$, 0dB: $V_i = 10\text{mV}$		100	—	mV
Detector Gain	A_{VD}		30	36		dB
Detector Output Voltage	V_{OD}	$V_{in} = 10\text{mV}$		270		mV
Output Resistance of Pin 8	Z_{out}		—	700	—	ohm

PILOT DECODER (V_{CC} = 12V, f = 150 or 276Hz, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Input Sensitivity	V_{sens}	f = 150 or 276Hz		10	20	mV
Input Resistance of Pin 9	Z_{i9}		—	47	—	Kohm
Capture Range	f_c	$V_i = 50\text{mV}$		± 5		Hz
Lock Range	f_L	$V_i = 50\text{mV}$		± 10		Hz
Stereo Range	f_{ST}	$V_i = 100\text{mV}$		150 ± 10		Hz
Bilingual Range	f_{BL}	$V_i = 100\text{mV}$		276 ± 10		Hz

INDICATOR ($V_{CC} = 12V$, unless otherwise specified)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Saturation Voltage of Pin 15 & 16	V_{sat}	$I_{15}, I_{16} = 30mA$		0.7		V
LED On Time	t_{ON}	$f = 150, 276Hz$ $V_i = 0mV \rightarrow 50mV$	—	100	200	mS
LED Off Time	t_{OFF}	$f = 150, 276Hz$ $V_i = 50mV \rightarrow 0mV$	—	100	200	mS

MODE SWITCH SECTION

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Main/Main Resistance	R (m/m)	$SW = 2$	3.1	4.7	7.0	Kohm
Forced Mono Voltage	V_{mono}	$SW = 1$		0	1.0	V
Main/Sub Supply Current	$I_{m/s}$	$SW = 3$	-0.2	0	0.2	mA
Sub/Sub Supply Voltage	$V_{s/s}$	$SW = 4$	11	12		V

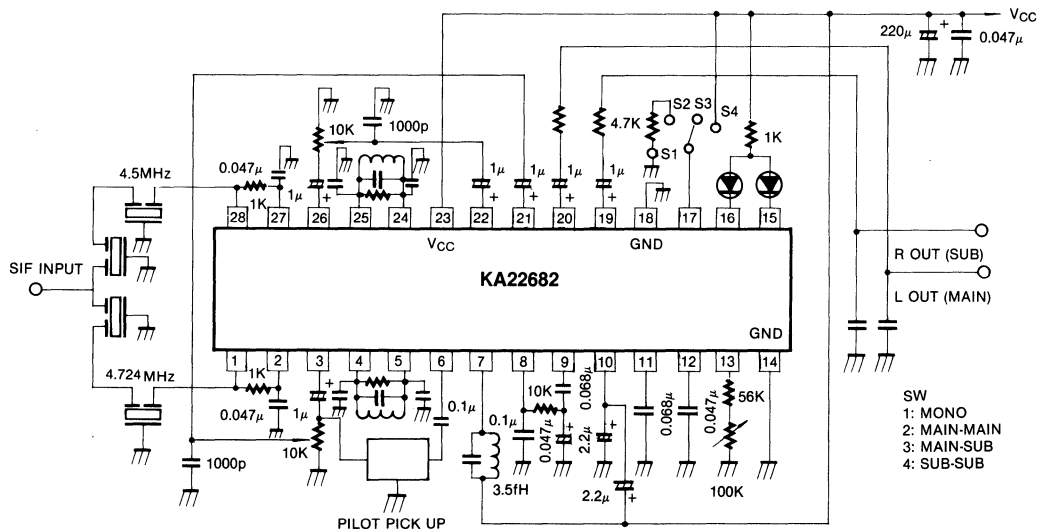
MATRIX SECTION

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
T.H.D. In Main Mode	THD_M	$V_i = 50mV$	—	0.3	1.0	%
T.H.D. In Sub Mode	THD_S	$V_i = 50mV$	—	0.3	1.0	%
T.H.D. In Stereo Mode	THD_{ST}	$V_i = 50mV$	—	0.3	1.0	%
Cross Talk (M/M $\rightarrow$ S/S)	$CT_{MM \rightarrow SS}$	$V_i = 50mV$	50	55	—	dB
Cross Talk (S/S $\rightarrow$ M/M)	$CT_{SS \rightarrow MM}$	$V_i = 50mV$	50	55	—	dB
Cross Talk (M $\rightarrow$ S)	$CT_{M \rightarrow S}$	$V_i = 50mV$	50	55	—	dB
Cross Talk (S $\rightarrow$ M)	$CT_{S \rightarrow M}$	$V_i = 50mV$	50	55	—	dB
Separation (L $\rightarrow$ R)	$SEP_{L \rightarrow R}$	$V_i = 50mV$	40	50	—	dB
Separation (R $\rightarrow$ L)	$SEP_{R \rightarrow L}$	$V_i = 50mV$	40	50	—	dB
Voltage Gain of Matrix	A_v	$V_i = 50mV$	10	12	16	dB
Output Impedance	Z_D (M)			600		ohm

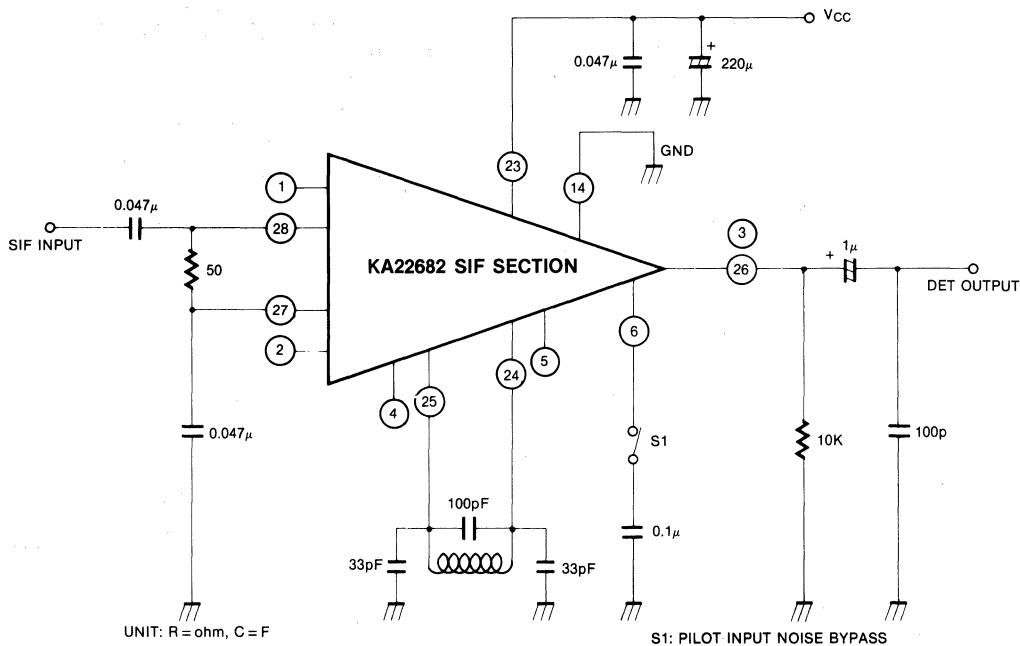
PIN CONFIGURATION

Pin No	Description	Pin No	Description
1	SIF2 Input	15	Indicator (Bilingual)
2	SIF2 Bias	16	Indicator (Stereo)
3	SIF2 Det Output	17	Mode Change Switch
4	SIF2 Coil	18	Matrix GND
5	SIF2 Coil	19	R (Sub) Output
6	Pilot Input	20	L (Main) Output
7	3.5fH Coil	21	Sub Input
8	Pilot Det Output	22	Main Input
9	PLL Input	23	V _{CC}
10	Phase Det Filter	24	SIF1 Det Coil
11	Loop Filter	25	SIF1 Coil
12	C-Time	26	SIF1 Det Output
13	R-Time	27	SIF1 Bias
14	GND	28	SIF1 Input

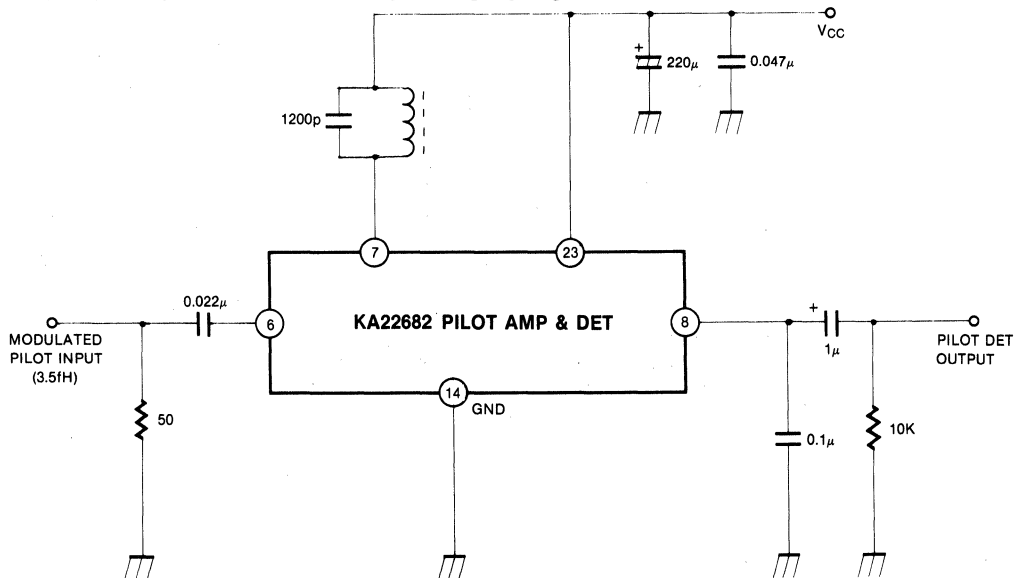
TYPICAL APPLICATION CIRCUIT



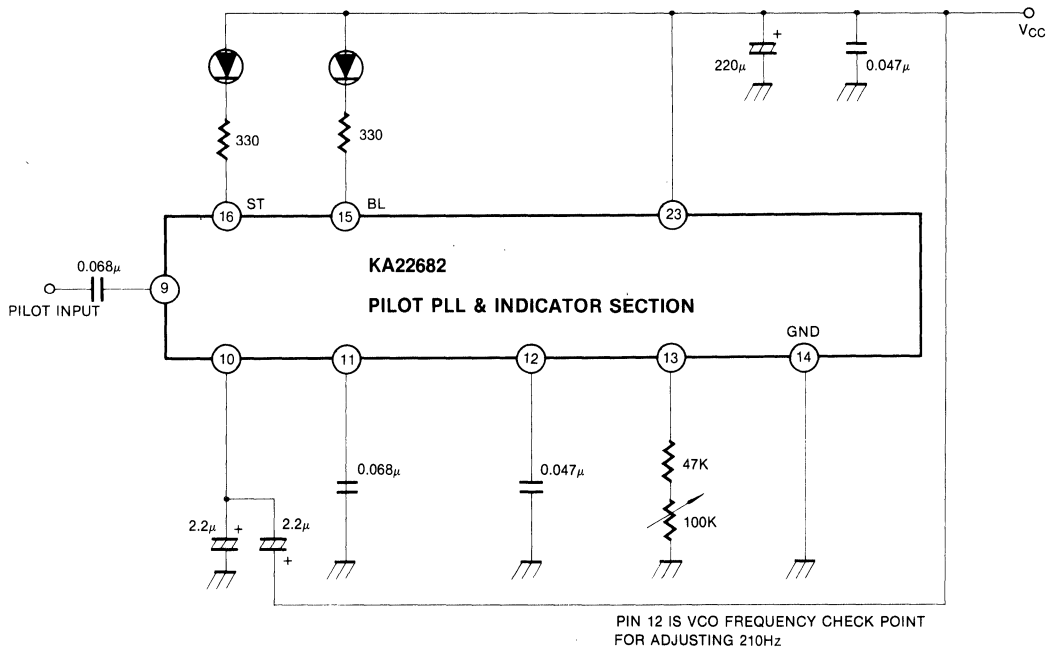
TEST CIRCUIT 1 SIF SECTION



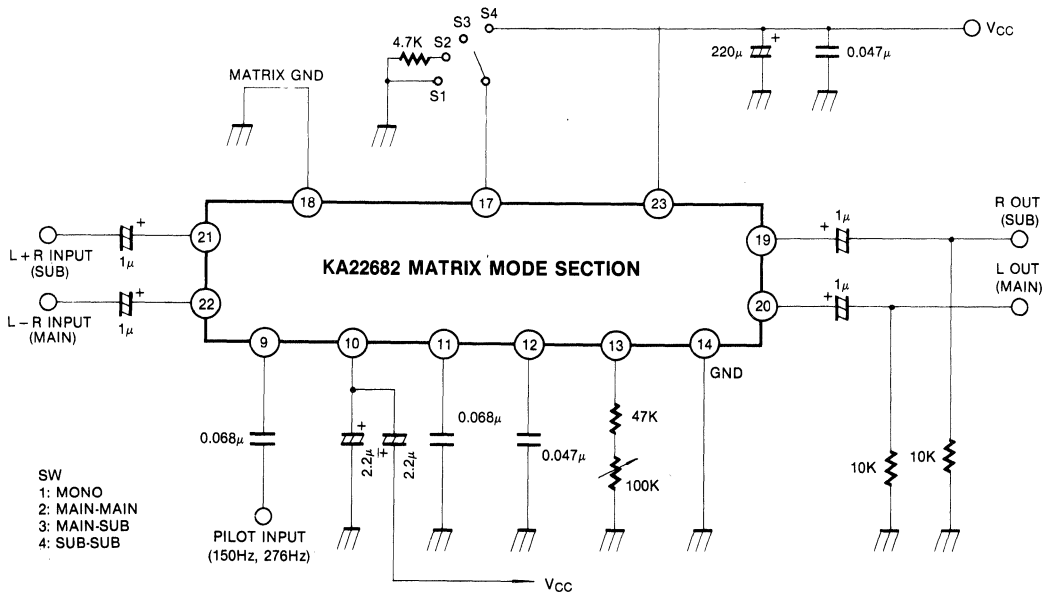
TEST CIRCUIT 2 PILOT AMP/DET SECTION



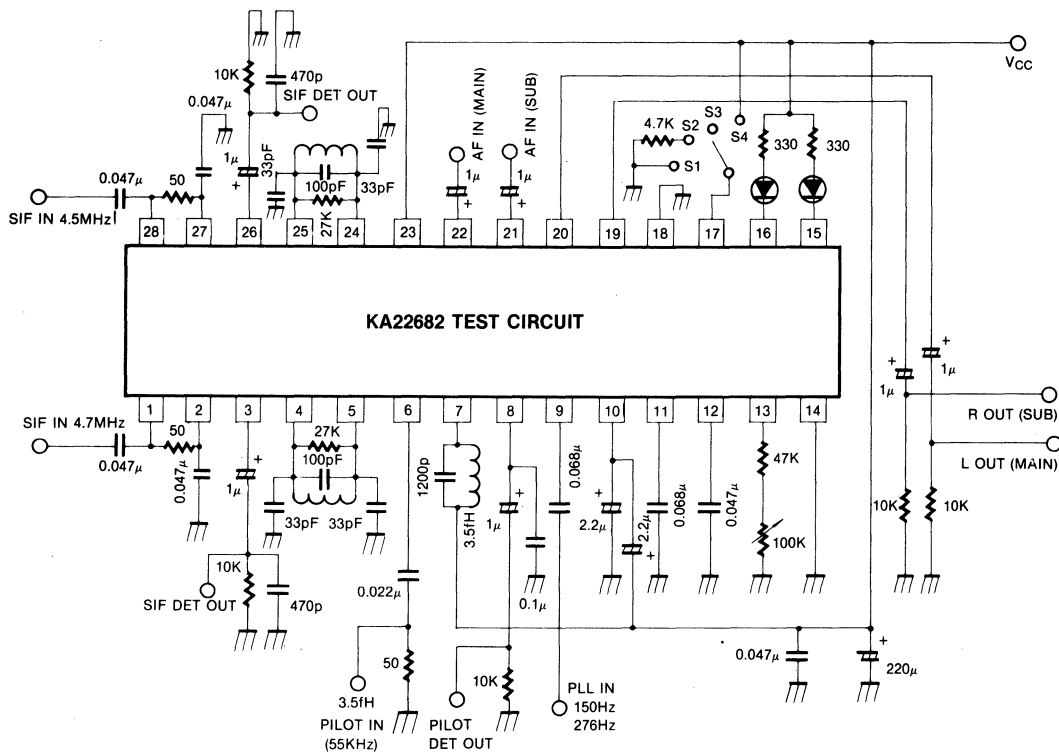
TEST CIRCUIT 3 PILOT PLL/INDICATOR SECTION



TEST CIRCUIT 4 MATRIX MODE SECTION



TEST CIRCUIT 5



TV SOUND MPX FOR USA

The KA2269 is a monolithic integrated circuit designed for demodulating the zenith system of US TV sound multiplexing on a single chip in the 42 DIP of shrink type. In combination with the KA2270 for dbx-TV NR-IC, a US sound multiplexing demodulating system can easily be realized.

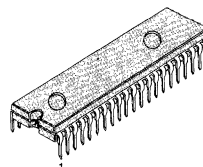
FUNCTIONS

- Stereo LPF
- L + R LPF
- L - R/SAP LPF
- SAP LPF
- SAP BPF
- Mode switch (Main, stereo, dual sound)
- Stereo disci and SAP disci inhibit
- Indicator (Stereo, SAP)

FEATURES

- Incorporation of various kinds of filters within the IC, permits a marked reduction in the number of parts to be externally attached to it.
- Permits selection of individual modes of MAIN/SAP/BOTH
- Excellent channel separation characteristics when stereo playing.
- Permits directly driving mode display LED

42 SDIP

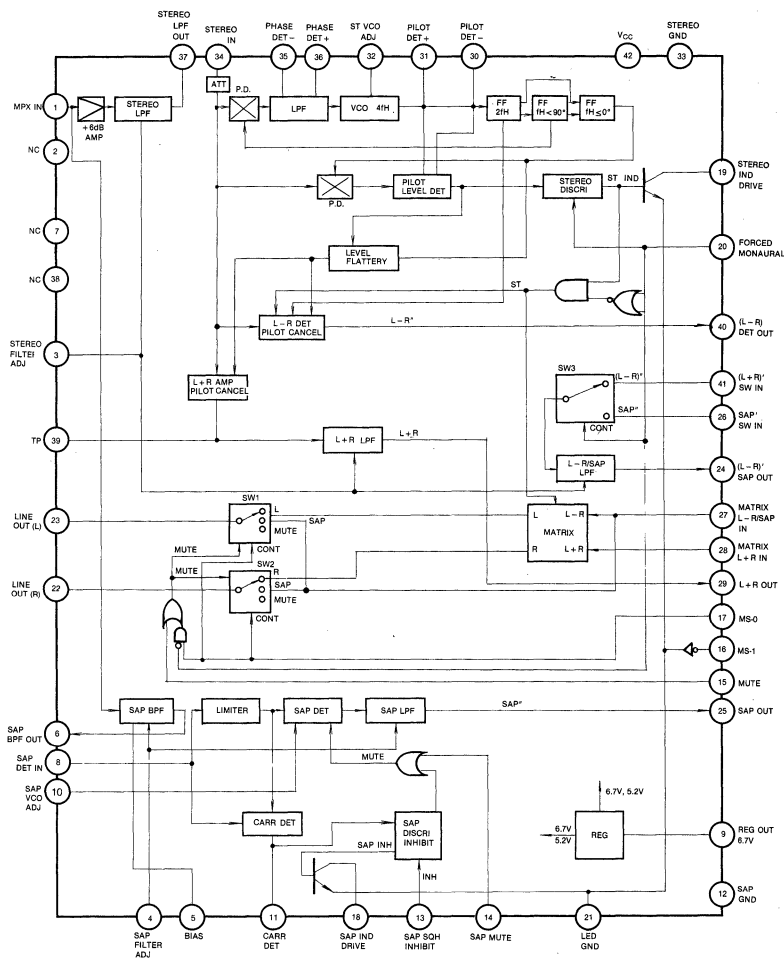
**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA2269	42 SDIP	- 10 ~ + 65°C

KA2269

PRELIMINARY LINEAR INTEGRATED CIRCUIT

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V _{CC}	17	V
Individual Controlling Pins	V ₁₄ to 17, V ₂₀	V _{CC} ± 0.3	V
LED Driving Current	I _{LED}	25	mA
Allowable Power Dissipation	P _d	1800	mW
Operating Temperature	T _{opr}	-10 ~ +65	°C
Storage Temperature	T _{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $0\text{dBm} = 0.775\text{V}_{\text{rms}}$)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Circuit Current	I_{CC}	Value of inflowing current into Pin 42	25	36	48	mA
Regulator Voltage	V_{REG}	Pin 9 DC VTG	6.0	6.7	7.4	V
SAP BPF Frequency Characteristics 5FH	ABP_{5FH}	Pin 1 input 5FH (– 14.4dBm) Pin 6 output	– 16	– 13.5	– 11.5	dBm
SAP BPF Frequency Characteristics 3FH	ABP_{3FH}	Pin 1 input 3FH (– 14.4dBm) Pin 6 output	—	– 32.5	– 29.5	dBm
SAP BPF Frequency Characteristics 6.5FH	$ABP_{6.5FH}$	Pin 1 input 6.5FH (– 14.4dBm) Pin 6 output	—	– 31.6	– 29.5	dBm
SAP Carrier Detecting Sensitivity	S_{CARR}	Pin 1 input 5FH Input level during LED of Pin 18 is lighting on	– 29.0	– 25.0	– 21.5	dBm
SAP Detecting Characteristic	$V_{SAP\ FM}$	Pin 8 input $V_{S1} = 63.37\text{KHz}$ (– 14.4dBm) $V_{S2} = 93.67\text{KHz}$ (– 14.4dBm) Pin 25 output (1)	100	110	118	mV/KHz
SAP Output Level	V_{SAP}	Pin 1 input SAP 1KHz 100% (– 14.4dBm) Pin 25 output 15KHz LPF is attached	– 0.8	– 0.1	0.6	dBm
SAP Frequency Characteristics 10KHz	A_{SAP}	Pin 1 input SAP 10KHz 100% (– 14.4dBm) Pin 25 output 15KHz LPF is attached	– 4.0	– 1.5	2.0	dBm
SAP Noise Level	$V_{SAP, N}$	Pin 1 input 5FH (– 14.4dBm) Pin 25 output 15KHz LPF is attached	—	– 40	– 36	dBm
SAP Carrier Leakage	CL_{SAP}	Pin 1 input 5FH (– 14.4dBm) Pin 25 output	—	– 33	– 30	dBm
SAP Distortion Ratio	THD_{SAP}	Pin 1 input SAP 1KHz 100% (– 14.4dBm) Pin 25 output 15KHz LPF is attached	—	4.0	8.0	%
SAP Muting Attenuation Amount	AT_{SAP}	Pin 8 input SAP 1KHz 100% (– 14.4dBm) Pin 25 output 15KHz LPF is attached	—	– 68	– 65	dBm

ELECTRICAL CHARACTERISTICS (Continued)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Pin 13 Low Controlling Voltage	V13 _L	Pin 1 input SAP 1KHz 100% (– 27dBm) Pin 25 output 15KHz LPF is attached (2)	GND	—	2.5	V
Pin 13 High Controlling Voltage	V13 _H	Pin 1 input (3) SAP 1KHz 100% (– 14.4dBm)	5.5	—	V _{CC}	V
Pin 14 High Controlling Voltage	V14 _H	Pin 1 input SAP 1KHz 100% (– 14.4dBm) Pin 25 output 15KHz LPF is attached (4)	1.0	—	V _{CC}	V
Stereo LPF Frequency Characteristics 6FH	ALP1 _{6FH}	Pin 1 input 6FH, (– 10dBm) Pin 37 output	—	– 45	– 36	dBm
(L + R) LPF Frequency Characteristics 12KHz	ALP2 _{12K}	Pin 34 input 12KHz (– 4dBm) Pin 29 output	– 5.2	– 4.3	– 2.8	dBm
(L + R) LPF Frequency Characteristics 2FH	ALP2 _{2FH}	Pin 34 input 2FH (– 4dBm) Pin 29 output	—	– 52	– 43	dBm
(L – R) LPF Frequency Characteristics 2FH	ALP3 _{2FH}	Pin 26 input 2FH (– 4dBm) Pin 24 output	—	– 52	– 43	dBm
(L – R) LPF Frequency Characteristics 12KHz	ALP3 _{12K}	Pin 26 input 12KHz (– 4dBm) Pin 24 output	– 6.5	– 5.3	– 4.0	dBm
Monaural Noise Level	V _{ST NM}	Non input Pin 23 output 15KHz LPF is attached	—	– 75	– 70	dBm
Main Output Level	V _{Main}	Pin 1 input 1KHz (– 10dBm) Pin 23 output 15KHz LPF is attached	– 5.6	– 5.0	– 4.6	dBm
Monaural Distortion Ratio	THD _{Mono}	Pin 1 input 1KHz (– 10dBm) Pin 23 output 15KHz LPF is attached	—	0.25	0.5	%
Stereo Noise Level	V _{ST NS}	Non input Pin 24 output 15KHz LPF is attached	—	– 70	– 66	dBm
SUB Detecting Level	V _{SUB}	Pin 1 input SUB 1KHz 100% (– 6.9dBm) Pin 24 output 15KHz LPF is attached	– 9	– 7.5	– 6	dBm
Stereo Distortion	THD _{STE}	Pin 1 input SUB 1KHz 100% (– 6.9dBm) Pin 24 output 15KHz LPF is attached	—	0.75	1.2	%

ELECTRICAL CHARACTERISTICS (Continued)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Pilot Cancel (L + R)	PC_{L+R}	Pin 1 input f_H (– 24dBm) Pin 23 output f_H BPF is attached	—	– 57.0	– 51.5	dBm
Pilot Cancel (L – R)	PC_{L-R}	Pin 1 input f_H (– 24dBm) Pin 24 output f_H BPF is attached	—	– 41	– 35	dBm
Main Balance of Between Channel	CB_{Main}	Pin 34 input f_H (– 18dBm) input 1KHz (– 4dBm) to Pin 28 and find the output level difference between Pins 22 and 23 by measuring the output (15KHz LPF is attached) of Pin 22 and 23 independently	– 0.3	0	0.3	dB
SUB Balance of Between Channels	CB_{SUB}	Input 1KHz (– 4dBm) to Pin 27 and find the output level difference between Pins 22 and 23 by measuring the output (15KHz LPF is attached) of Pins 22 and 23 independently. The above applicable to Pin 28 except that non-input to Pin 28	– 0.3	0	0.3	dB
Separation Check 1KHz	SEP_{IK}	Pin 1 input (– 10.9dBm) L-CH 100% DSB 1KHz Pin 24, 29 output (15KHz LPF is attached) measure the output level difference between the outputs of Pin 24 and 29	46	60	—	dB
Stereo Discriminating Level	STE_{VTH}	Pin 1 input f_H (variable level) Pin 19 output (5)	12	26	39	mV _{rms}
Stereo Capture Range Low	CR_{LO}	Pin 34 input – 18dBm (variable freq.) Pin 19 output (6)	15.74	—	14.95	KHz
Stereo Capture Range High	CR_{HI}	Pin 34 input – 18dBm (variable freq.) Pin 19 output (7)	16.52	—	15.74	KHz
Crosstalk (L – R)' SAP	$CT_{L-R, SAP}$	Pins 26, 41 inputs 1KHz (– 4dBm) Pin 24 output 1KHz BPF is attached (8)	—	– 80	– 67	dBm

ELECTRICAL CHARACTERISTICS (Continued)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Crosstalk L, SAP	$CT_{L, SAP}$	Pins 27, 28 inputs 1KHz (– 4dBm) Pin 23 output 1KHz BPF is attached (9)	—	– 80	– 74	dBm
Crosstalk R, SAP	$CT_{R, SAP}$	Pins 27 and 28 inputs 1KHz (– 4dBm) Pin 22 output 1KHz BPF is attached (10)	—	– 80	– 74	dBm
During Forced Monaural Crosstalk L	CT_L	Pin 27 input 1KHz (– 4dBm) input f_H (– 18dBm) to Pin 34 Pin 23 output 1KHz BPF is attached	—	– 80	– 74	dBm
During Forced Monaural Crosstalk R	CT_R	Pin 27 input 1KHz (– 4dBm) input f_H (– 18dBm) to Pin 34 Pin 22 output 1KHz BPF is attached	—	– 80	– 74	dBm
Muting SW High Muting Attenuation Amount	AT_{STL}	Pin 27 input 1KHz (– 4dBm) input f_H (– 18dBm) to Pin 34 Pin 22 and 23 output 15KHz LPF is attached	—	– 80	– 74	dBm
Pin 15 High Controlling Voltage	V_{15H}	Pin 1 input 1KHz (– 10dBm) Pin 23 output 15KHz LPF is attached (11)	1.0	—	V_{CC}	V
Pin 17 High Controlling Voltage	V_{17H}	Pin 1 input 1KHz (– 10dBm) Pin 23 output 15KHz LPF is attached (12)	1.0	—	V_{CC}	V
Pin 20 High Controlling Voltage	V_{20H}	Pin 27 input 1KHz (– 4dBm) input f_H (– 18dBm) to Pin 34 (13)	5.5	—	V_{CC}	V
Pin 16 High Controlling Voltage	V_{16H}	Pin 26 input 1KHz (– 4dBm) Pin 24 output 1KHz BPF is attached (15)	1.0	—	V_{CC}	V
Pin 20 Middle Controlling Voltage	V_{20M}	Pin 27 input 1KHz (– 4dBm) input f_H (– 18dBm) to Pin 34 (14)	1.0	—	8.0	V

Note: $f_H = 15,734\text{Hz}$

- (1) Measure the DC voltage of Pin 25 "V2" when V_{S2} is inputting measure the DC voltage of Pin 25 "V1" when V_{S1} is inputting

$$V_{SAP, FM} = \frac{V2 - V1}{93.67 - 63.37} \text{ [mV/KHz]}$$

- (2) First, set the level of Pin 13 higher enough than 2.5V. Next, lowering the DC voltage of Pin 13, measure $V13_L$ during output level (at output meter point) is squelching.
- (3) First, set the level of Pin 13 lower enough than 5.5V at that time, SAP indicator is lightening. Next, raising the DC voltage of Pin 13, measure $V13_H$ during SAP indicator is turning off.
- (4) First, set the DC level of Pin 14 lower enough than 1.0V. Next, raising the DC voltage of Pin 14, measure $V14_H$ during output level (at output meter point) is muting.
- (5) Measure the signal source level during the LED of stereo indicator is lightening on.
- (6) First, input the frequency to signal source, lower enough than 14.95KHz at that time stereo indicator is off. Next, change the frequency upwards, and measure the frequency during LED of Pin 19 is lightening on.
- (7) First, input the frequency to signal source higher enough than 16.52KHz, at that time stereo indicator is off. Next, change the frequency downwards, and measure the frequency during LED of Pin 19 is lightening on.
- (8) First, input signal to Pin 41, lowering the $V16$, measure the output level at output meter point, which is the (L - R) → (SAP) crosstalk. Next, input to Pin 26, raising $V16$, measure the output level, which is the (SAP) → (L - R) crosstalk.
- (9) First, input signal to Pin 28, setting $V17 \geq 2.5\text{V}$, $V16 \leq 1.0\text{V}$, measure the output level at output meter point, which is (L) → (SAP) crosstalk. Next, input signal to Pin 27, setting $V17 \leq 1.0\text{V}$ measure the output level, which is (SAP) → (L) crosstalk.
- (10) First, input signal to Pin 28, setting $V16 \leq 1.0\text{V}$ measure the output level at output meter point, which is (R) → (SAP) crosstalk. Next, inputting signal to Pin 27, setting $V16 \geq 2.5\text{V}$ and $V17 \leq 1.0\text{V}$, measure the output level, which is (SAP) → (R) crosstalk.
- (11) First, set the DC level of Pin 15 lower enough than 1.0V at that time, level of output meter point is about -5.0dBm. Next, raising the DC voltage of Pin 15, measure $15 f_H$ during output level is muting.
- (12) First, set the DC voltage of Pin 17 lower enough than 1.0V at that time output meter level is about -5.0dBm. Next, raising the DC voltage of Pin 17, measure $V17_H$ during output level of output meter point is diminishing.
- (13) First, set the DC level of Pin 20 lower enough than 5.5V, at that time, ST indicator is lightening on. Next, raising the $V20$, measure the $V20$ during ST indicator is off.
- (14) First, set the DC level of pin 20 lower enough than 1.0V at that time, level of output meter is about -4dBm next raising the DC voltage of pin 20 measure V_{20M} during output level is muting.
- (15) First, set DC voltage of Pin 16 lower enough than 1.0V at that time, output level at output meter level is about -4dBm. Next raising the DC voltage of Pin 16, measure $V16_H$ during output level is diminishing.
- (16) Switch, controlling voltage and volume control table.

Characteristics	REG-SW	SAP-SW	ST-SW1	ST-SW2	ST-SW3	V13	V14	V15	V16	V17	V20
Circuit Current	OPEN	X	X	X	X	X	X	X	X	X	X
Regulator Voltage	OPEN	X	X	X	X	X	X	X	X	X	X
SAP BPF Frequency Characteristics 5 f_H	SHORT	OPEN	X	X	X	X	X	X	X	X	X
SAP BPF Frequency Characteristics 3 f_H	SHORT	OPEN	X	X	X	X	X	X	X	X	X
SAP BPF Frequency Characteristics 6.5 f_H	SHORT	OPEN	X	X	X	X	X	X	X	X	X
SAP Carrier Detecting Sensitivity	SHORT	SHORT	X	X	X	M	X	X	X	X	X
SAP Detecting Characteristics	SHORT	OPEN	X	X	X	X	L	X	X	X	X
SAP Output Level	SHORT	SHORT	X	X	X	X	L	X	X	X	X
SAP Frequency Characteristics 10KHz	SHORT	SHORT	X	X	X	X	L	X	X	X	X
SAP Noise Level	SHORT	SHORT	X	X	X	X	L	X	X	X	X
SAP Carrier Leakage	SHORT	SHORT	X	X	X	X	L	X	X	X	X
SAP Distortion Ratio	SHORT	SHORT	X	X	X	X	L	X	X	X	X
SAP Muting Attenuation Amount	SHORT	OPEN	X	X	X	X	H	X	X	X	X
Pin 13 Low Controlling Voltage	SHORT	SHORT	X	X	X	()	L	X	X	X	X
Pin 13 High Controlling Voltage	SHORT	SHORT	X	X	X	()	X	X	X	X	X
Pin 14 High Controlling Voltage	SHORT	SHORT	X	X	X	X	()	X	X	X	X
Stereo LPF Frequency Characteristics 6 f_H	SHORT	X	OPEN	X	X	X	X	X	X	X	X
(L + R) LPF Frequency Characteristics 12KHz	SHORT	X	OPEN	OPEN	X	X	X	X	X	X	X
(L + R) LPF Frequency Characteristics 2 f_H	SHORT	X	OPEN	OPEN	X	X	X	X	X	X	X
(L - R) LPF Frequency Characteristics 2 f_H	SHORT	X	X	X	X	X	X	L	L	X	X
(L - R) LPF Frequency Characteristics 12KHz	SHORT	X	X	X	X	X	X	L	L	X	X
Monaural Noise Level	SHORT	X	SHORT	SHORT	X	X	X	L	X	L	X

Characteristics	REG-SW	SAP-SW	ST-SW1	ST-SW2	ST-SW3	V13	V14	V15	V16	V17	V20
Main Output Level	SHORT	X	SHORT	SHORT	X	X	X	L	X	L	X
Monaural Distortion Ratio	SHORT	X	SHORT	SHORT	X	X	X	L	X	L	X
Stereo Noise Level	SHORT	X	SHORT	X	SHORT	X	X	L	H	X	L
SUB Detecting Level	SHORT	X	SHORT	X	SHORT	X	X	L	H	X	L
Stereo Distortion	SHORT	X	SHORT	X	SHORT	X	X	L	H	X	L
Pilot Cancel (L + R)	SHORT	X	SHORT	SHORT	X	X	X	L	X	L	L
Pilot Cancel (L - R)	SHORT	X	SHORT	X	SHORT	X	X	L	H	X	L
Main Balance of Between Channels	SHORT	X	OPEN	OPEN	X	X	X	L	H	L	X
SUB Balance of Between Channels	SHORT	X	OPEN	X	X	X	X	L	H	L	L
Separation Check 1KHz	SHORT	X	SHORT	OPEN	SHORT	X	X	X	H	X	L
Stereo Discriminating Level	SHORT	X	SHORT	X	X	X	X	X	X	X	L
Stereo Capture Range Low	SHORT	X	SHORT	X	X	X	X	X	X	X	L
Stereo Capture Range High	SHORT	X	SHORT	X	X	X	X	X	X	X	L
Crosstalk (L - R)", SAP	SHORT	X	X	X	OPEN	X	X	L	()	X	X
Crosstalk L, SAP	SHORT	X	X	OPEN	X	X	X	L	L	()	X
Crosstalk R, SAP	SHORT	X	X	OPEN	X	X	X	L	()	L	X
During Forced Monaural Crosstalk L	SHORT	X	OPEN	OPEN	X	X	X	L	L	H	(M)
During Forced Monaural Crosstalk R	SHORT	X	OPEN	OPEN	X	X	X	L	L	X	(M)
Muting SW High Muting Attenuation Amount	SHORT	X	OPEN	OPEN	X	X	X	(H)	H	L	L
Pin 15 High Controlling Voltage	SHORT	X	SHORT	SHORT	X	X	X	()	X	L	X
Pin 17 High Controlling Voltage	SHORT	X	SHORT	SHORT	X	X	X	L	X	()	X
Pin 20 Middle Controlling Voltage	SHORT	X	OPEN	OPEN	X	X	X	L	L	H	()
Pin 20 High Controlling Voltage	SHORT	X	OPEN	OPEN	X	X	X	X	X	X	()
Pin 16 High Controlling Voltage	SHORT	X	X	X	OPEN	X	X	L	()	X	X

(X: Don't care condition)

Supplemental Description of Signal

- SAP 10KHz 100% MOD
78.67KHz $\pm$ 10KHz FM modulation, - 14.4dBm
- SAP 1KHz 100% MOD
78.67KHz $\pm$ 10KHz FM modulation, - 14.4dBm
- SUB 1KHz 100%
1KHz DSB ($2f_H$, $1.4V_{p-p}$) + $f_H(0.14V_{p-p})$
- L-ch 100% DSB 1KHz
1KHz DSB ($2f_H$, $1.4V_{p-p}$) + $f_H(0.14V_{p-p})$ + 1KHz ($0.35V_{p-p}$)
- f_H vicinity (- 18dBm) burst signal
A burst signal which enables variation of frequencies around the center frequency of 15.734KHz and with time intervals over 0.5 second.

Description of Filters for Measurement

- A Low-pass filter [Tertiary butterworth 15KHz (- 3dB)]
- B Band-pass filter [Secondary f_H (15.734KHz), bandwidth 1.5KHz]
- C Band-pass filter [Secondary 1KHz, bandwidth 100Hz]
- D Through

Notes on Measuring

Adjustment before measurement

1. ST FILTER ADJ

Adjust at the trapping point of stereo low-pass filter.

Input a signal ($0.42 V_{p-p}$) of $5f_H$ (78.67KHz) to MPX IN (Pin 1) and adjust so that the output of ST LPF OUT (Pin 37) becomes minimum.

2. SAP BPF ADJ

Adjust at the trapping point of SAP band-pass filter.

Input a signal ($0.42 V_{p-p}$) of $4f_H$ (62.936KHz) to MPX IN (Pin 1) and adjust so that the output of SAP BPF OUT (Pin 6) becomes minimum.

3. ST VCO ADJ

Examine the connected portion () of the solid resistance and variable resistance, which are being connected to Pin 32 in a non-input state, by using a probe of low capacity high impedance, and adjust its free-running frequency within $4f_H$ (62.936KHz $\pm$ 100Hz).

Specification of the probe is high impedance ($\geq 1M\Omega$) and low capacity ($\leq 10pF$).

4. SAP VCO ADJ

Measure the DC voltage of Pin 25 when $V_X H$ (2.5V to 5.5V) is applied to Pin 14, and denotes the measured voltage as V_{25} . Then, applying $V_X L$ to Pin 14 input a signal ($0.42 V_{p-p}$) of $5f_H$ (78.67KHz) to MPX IN (Pin 1). At this point, adjust so that the DC voltage of SAP, OUT (Pin 25) becomes within $V_{25} \pm 0.1V$.

5. Regarding channel separation measurement

The channel separation measurement can be conducted by connecting the outputs of Pins 24 and 23 to X and Y axes of a synchroscope and by either using a resurge graph or to read the phase difference directly. If a gain phase meter is available, more precise separation measurements than the above can be achieved by using it.

6. Regarding measurement of the balance between channels L and R

To measure the balance between L channel and R channel, it is necessary to measure Pins 22 and 23 separately. At first, turn relay SW24 for output on and read the values of Pins 23, and turn relay SW24 for outputs off, and then turn relay SW25 for output on and read the values of Pins 22. The specification is that the difference value between Pins 23 and 22.

MODE MATRIX**Mode Function**

Pin No.		LINE OUT	
17	16	L	R
L	L	L+R	SAP
L	H	L	R
H	L	SAP	SAP
H	H	(MUTE)	

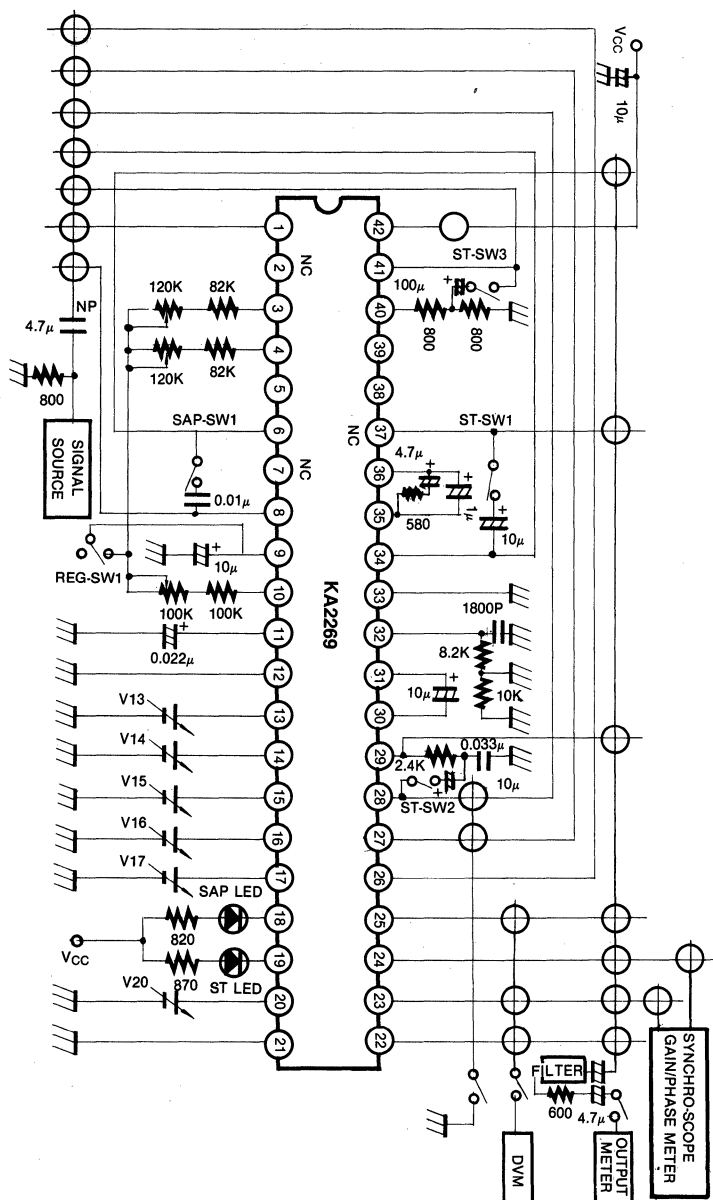
Forced Monaural Function

Pin No.	LINE OUT		STEREO INDICATOR
20	L	R	
L	L	R	ON
M	L+R	L+R	ON
H	L+R	L+R	OFF

**SAP SQH (squelch) inhibit
Function**

Pin No.	SQH	SAP
13		INDICATOR
L	ON	ON
M	OFF	ON
H	OFF	OFF

TEST CIRCUIT



[illegible]

*Metallic foil resistor

NOISE REDUCTION SYSTEM FOR TV SOUND

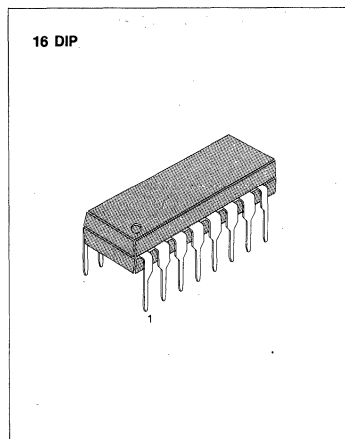
The KA2270 is a silicon monolithic integrated circuit designed for the dbx-TV noise reduction decode circuit for the multichannel USA TV sound system on a single chip in the DIP 16 package.

FUNCTIONS

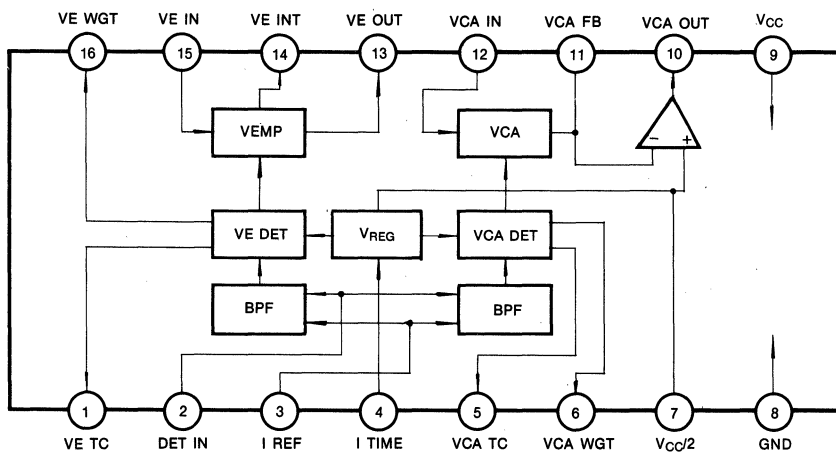
- VCA (Voltage controlled amplifier)
- VEMP (Variable de-emphasis circuit)
- RMS detector

FEATURES

- Integrated band pass filters using active filtering technique and thin film structure with high capacitance
- Variable de-emphasis circuit with new circuit configuration
- Minimum number of external components
- Wide operation voltage range (4.7 to 16V)

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA2270	16 DIP	- 20 ~ + 70°C

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_d	750	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

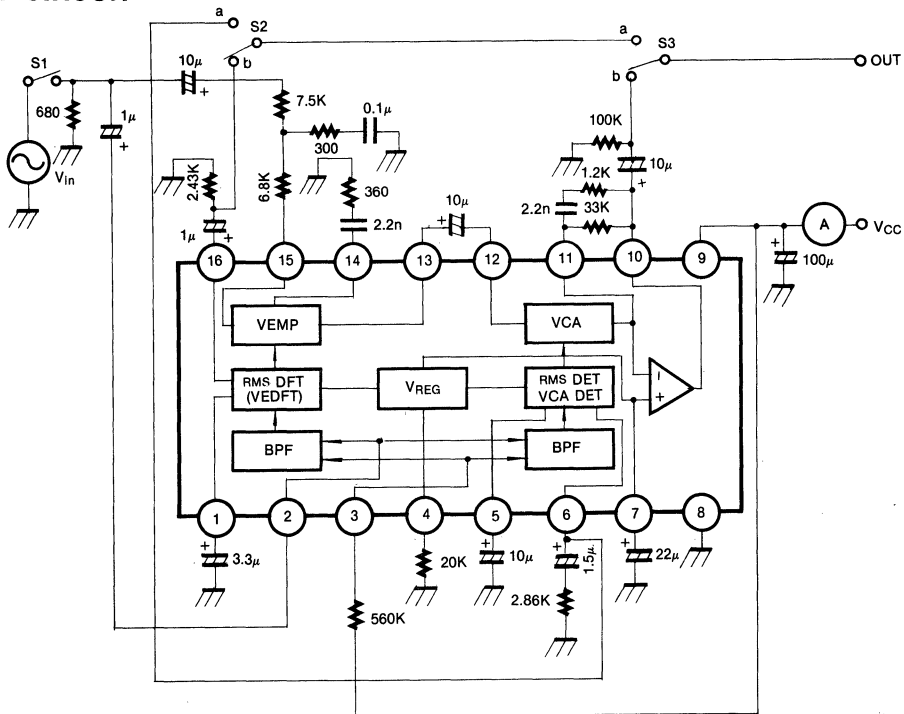
ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $0\text{dBm} = -5\text{dBm}$ (436mV_{rms}))

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Current	I_{CC}	$V_i = 0$	4.0	5.0	6.3	mA
Decode Characteristics						
Output Level 1	V_{od1}	$f = 300\text{Hz}$, $V_i = -5\text{dB}$	5.5	7.0	8.5	dB
Output Level 2	V_{od2}	$f = 300\text{Hz}$, $V_i = -15\text{dB}$	-14.5	-13.0	-11.5	dB
Output Level 3	V_{od3}	$f = 300\text{Hz}$, $V_i = -30\text{dB}$	-44.5	-43.0	-41.5	dB
Output Level 4	V_{od4}	$f = 1\text{KHz}$, $V_i = 0\text{dB}$	1.3	3.3	5.3	dB
Output Level 5	V_{od5}	$f = 1\text{KHz}$, $V_i = -10\text{dB}$	-19.4	-17.4	-15.4	dB
Output Level 6	V_{od6}	$f = 1\text{KHz}$, $V_i = -20\text{dB}$	-39.6	-37.6	-35.6	dB
Output Level 7	V_{od7}	$f = 8\text{KHz}$, $V_i = 0\text{dB}$	-4.3	-1.8	0.7	dB
Output Level 8	V_{od8}	$f = 8\text{KHz}$, $V_i = -10\text{dB}$	-30.9	-28.4	-25.9	dB
Output Level 9	V_{od9}	$f = 8\text{KHz}$, $V_i = -15\text{dB}$	-45.2	-42.7	-40.2	dB
VCA Filter Characteristics						
Output Level 1	V_{fp1}	$f = 3\text{KHz}$, $V_i = 0\text{dB}$	-5.5	-4.0	-2.5	dB
Output Level 2	V_{fp2}	$f = 8\text{KHz}$, $V_i = 0\text{dB}$	-13.0	-11.0	-9.5	dB
VEMP Filter Characteristics						
Output Level 1	V_{fg1}	$f = 5\text{KHz}$, $V_i = 0\text{dB}$	-9.4	-7.4	-5.4	dB
Output Level 2	V_{fg2}	$f = 2\text{KHz}$, $V_i = 0\text{dB}$	-32.3	-28.8	-25.3	dB
Total Harmonic Distortion	THD	$f = 1\text{KHz}$, $V_i = -3\text{dB}$	—	0.1	0.3	%
Max. Output Level 1	V_{om1}	$f = 300\text{Hz}$, $\text{THD} = 1.5\%$	11.0	12.0	—	dB
Max. Output Level 2	V_{om2}	$f = 8\text{KHz}$, $\text{THD} = 1.5\%$	-2.0	1.0	—	dB
Output Noise Level	V_{NO}	$V_i = 0$	—	-104	-80	dB
Center Potential	$V_{CC}/2$	—	4.3	4.5	4.7	V

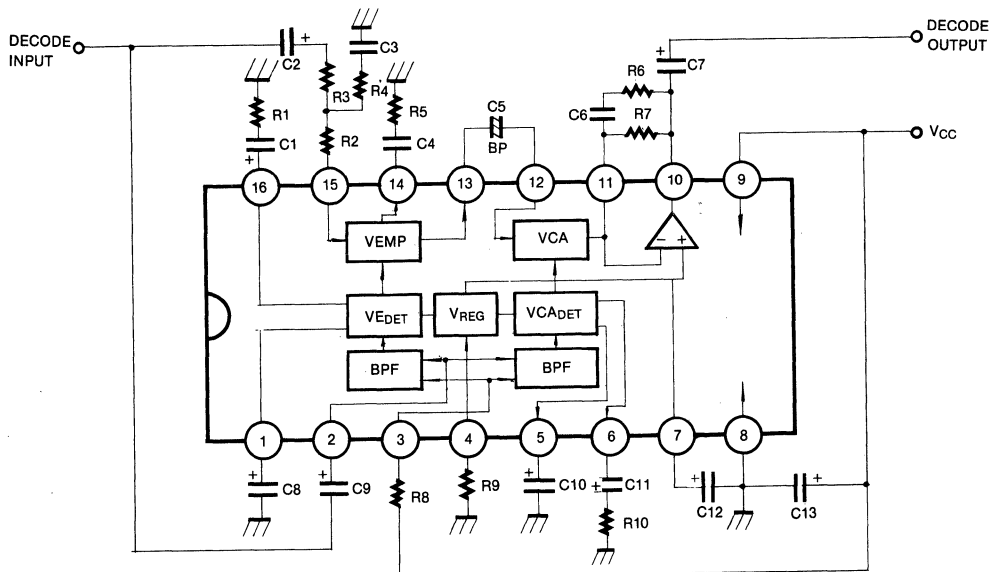
Note) Switch Control Table

Characteristics	Symbol	Switch Condition		
		S1	S2	S3
Circuit Current	I_{cc}	X	X	X
Decode Characteristics				
Output Level 1	V_{od1}	ON	b	b
Output Level 2	V_{od2}	ON	b	b
Output Level 3	V_{od3}	ON	b	b
Output Level 4	V_{od4}	ON	b	b
Output Level 5	V_{od5}	ON	b	b
Output Level 6	V_{od6}	ON	b	b
Output Level 7	V_{od7}	ON	b	b
Output Level 8	V_{od8}	ON	b	b
Output Level 9	V_{od9}	ON	b	b
VCA Filter Characteristics				
Output Level 1	V_{fp1}	ON	a	a
Output Level 2	V_{fp2}	ON	a	a
VEMP Filter Characteristics				
Output Level 1	V_{fg1}	ON	b	a
Output Level 2	V_{fg2}	ON	b	a
Total Harmonic Distortion	THD	ON	b	b
Max. Output Level 1	V_{om1}	ON	b	b
Max. Output Level 2	V_{om2}	ON	b	b
Output Noise Level	V_{No}	OFF	a or b	a or b

TEST CIRCUIT



TYPICAL APPLICATION CIRCUIT



SYNC SEPARATOR I

The KA2605 is a monolithic integrated circuit designed for all kinds of sync separation from composite video signal.

Regardless of input signal (C. Video Signal) variations, the KA2605 can generate fully stabilized sync pulses.

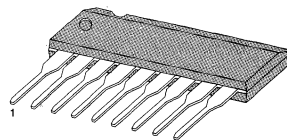
FUNCTIONS

- Phase Inverter.
- Horizontal Synchronization Separator.
- Vertical Synchronization Separator.
- Composite Synchronization Separator.
- Low Pass Filter Included.
- Open Collector Output.

FEATURES

- Requiring few external components.
- Wide supply voltage range: $V_{CC} = 8V - 15V$
- All kinds of sync separation in composite video signal.
- Usable for a basis signal in digital system.
- Separated synchronization are accurate and stable.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2605	9 SIP	$-20 \sim +80^{\circ}\text{C}$

BLOCK DIAGRAM

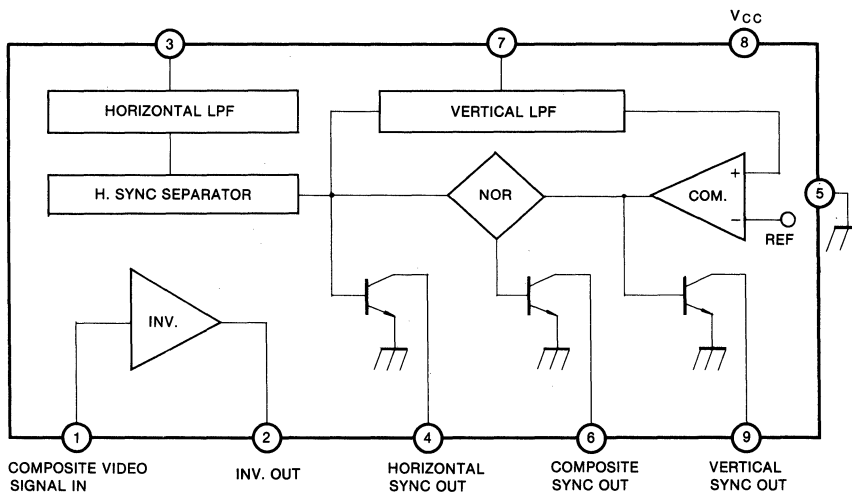


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	15	V
Power Dissipation	P _d	500	mW
Operating Temperature	T _{opr}	- 20 ~ + 80	°C
Storage Temperature	T _{stg}	- 65 ~ + 150	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 12V)

Characteristic	Symbol	Test Pin	Test Condition	Min	Typ	Max	Unit
Supply Current	I _{CC}	8	SW1, SW2: OFF	16	22	28	mA
Input Offset Voltage	V _{ofs}	1	V _{CC} = 12V SIG-1:2V _{p-p} C. VIDEO	2.5	4.5	8.5	V
Input Signal Voltage	V _{in}	1	V _{CC} = 12V V _{ofs} = 3.5V-8V	0.6	2.0	3.5	V _{p-p}
Horizontal Sync Delay	T _{HD}	4	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	0.4	0.5	μS
Horizontal Sync Width	D _H	4	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	4.4	4.6	4.9	μS
Vertical Sync Delay	T _{VD}	9	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	9	12	μS
Vertical Sync Width	D _V	9	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	185	190	195	μS
Horizontal Sync Delay in Composite Sync	T _{CHD}	6	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	0.4	0.5	μS
Horizontal Sync Width in Composite Sync	D _{CH}	6	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	4.4	4.6	4.9	μS
Vertical Sync Delay in Composite Sync	T _{CVd}	6	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	0.4	1.0	μS
Vertical Sync Width in Composite Sync	D _{CV}	6	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	195	200	205	μS

* This spec. is used 10:1 probe. Measure point is 2V of output.

NOTE ($T_a = 25^\circ\text{C}$)

Supply Voltage (V_{CC})	Input Signal Voltage (V_{in})	Input Offset Voltage (V_{ofs})
8V	0.6V _{p-p}	2.0V – 5.0V
	2.0V _{p-p}	2.0 – 5.5V
	3.5V _{p-p}	3.0V – 5.5V
12V	0.6V _{p-p}	2.0V – 8.0V
	2.0V _{p-p}	2.5V – 8.5V
	3.5V _{p-p}	3.5V – 8.5V
15V	0.6V _{p-p}	2.5V – 9.0V
	2.0V _{p-p}	3.0V – 10.5V
	3.5V _{p-p}	4.0V – 10.5V

PIN ASSIGNMENT

Pin 1: Composite Video Signal In

Pin 2: Inverter Out

Pin 3: Horizontal Low Pass Filter Out

Pin 4: Horizontal Synchronization Out
(Open Collector)

Pin 5: Ground

Pin 6: Composite Synchronization Out (Open Collector)

Pin 7: Vertical Low Pass Filter

Pin 8: V_{CC} (+12V)

Pin 9: Vertical Synchronization Out (Open Collector)

TEST CIRCUIT

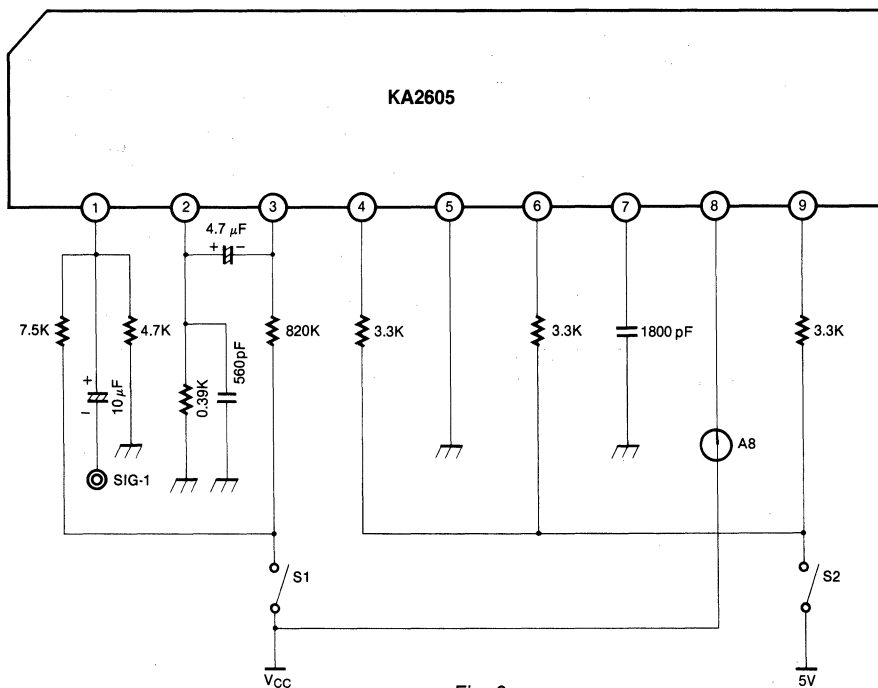


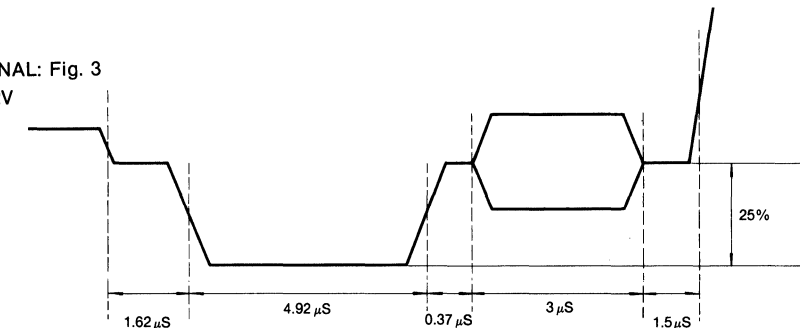
Fig. 2

NOTE

INPUT SIGNAL: Fig. 3

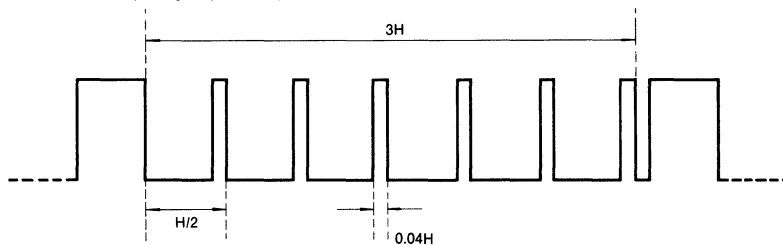
 V_{CC} : DC 12V

(a)



The white level of input signal (C. VIDEO) is 100 percent.

(b)

Fig. 3 $2V_{p-p}$ Positive composite video signal

(a) Horizontal sync pulse.

(b) Vertical sync pulse. H equals $63.5 \mu s$.

APPLICATION CIRCUIT

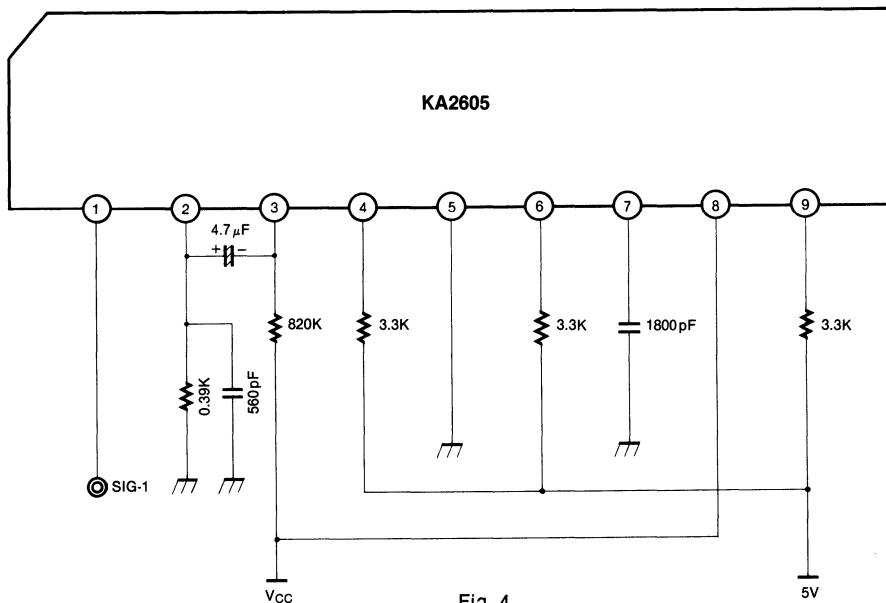


Fig. 4

SYNC SEPARATOR II

The KA2606 is a monolithic integrated circuit designed for sync (Horizontal sync and composite sync) separation from composite video signal.

Regardless of input (C. Video Signal) variations, the KA2606 can generate fully stabilized sync pulse. Especially, horizontal sync delay can be minimized because the KA2606 has a delay compensation.

FUNCTIONS

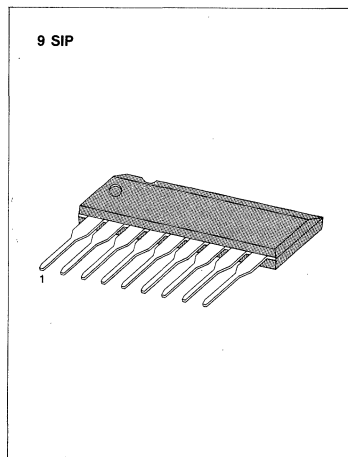
- Phase Inverter.
- Horizontal Synchronization Separator.
- Composite Synchronization Separator.
- Horizontal Synchronization Delay Compensation.
- Low Pass Filter Included.
- Open Collector Output.

FEATURES

- Requiring few external components.
- Wide supply voltage range: $V_{CC} = 10V - 15V$
- Usable for a basis signal in digital system.
- Separated synchronization are accurate and stable.
- Synchronization delay is very small.

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2606	9 SIP	$-20 \sim +80^{\circ}\text{C}$



BLOCK DIAGRAM

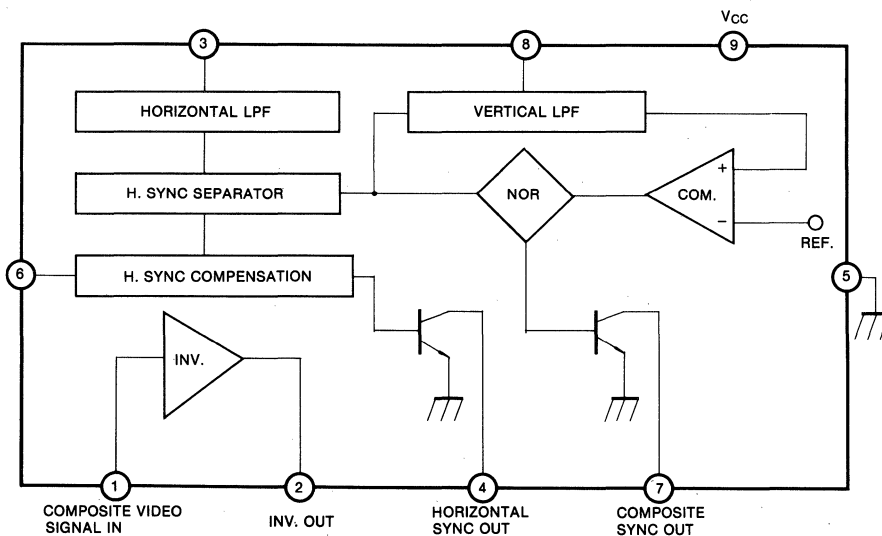


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	15	V
Power Dissipation	P _d	500	mW
Operating Temperature	T _{opr}	-20 ~ +80	°C
Storage Temperature	T _{stg}	-65 ~ +150	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 12V)

Characteristic	Symbol	Test Pin	Test Condition	Min	Typ	Max	Unit
Supply Current	I _{CC}	9	SW1, SW2: OFF	16	22	28	mA
Input Offset Voltage	V _{ofs}	1	V _{CC} = 12V SIG-1:2V _{p-p} C. VIDEO	2.5	4.5	8.5	V
Input Signal Voltage	V _{in}	1	V _{CC} = 12V V _{ofs} = 6.5V-8V	0.5	2.0	3.5	V _{p-p}
Horizontal Sync Delay	T _{HD}	4	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	0.3	0.5	μS
Horizontal Sync Width	D _H	4	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	4.4	4.7	4.9	μS
Horizontal Sync Delay in Composite Sync	T _{CHD}	7	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	0.3	0.5	μS
Horizontal Sync Width in Composite Sync	D _{CH}	6	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	4.6	4.8	5.1	μS
Vertical Sync Delay in Composite Sync	T _{CVD}	7	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	0	0.4	0.8	μS
Vertical Sync Width in Composite Sync	D _{CV}	7	SW1, SW2: ON SIG-1:2V _{p-p} C. VIDEO	193	197	202	μS

* This spec. is used 10:1 probe. Measure point is 2V of output.

NOTE (Ta = 25°C)

Supply Voltage (V _{CC})	Input Signal Voltage (V _{in})	Input Offset Voltage (V _{ofs})
10V	0.5V _{p-p}	2.0V – 6.5V
	2.0V _{p-p}	2.5 – 7.0V
	3.5V _{p-p}	5.0V – 7.0V
12V	0.5V _{p-p}	3.0V – 8.0V
	2.0V _{p-p}	2.5V – 8.5V
	3.5V _{p-p}	6.5V – 8.5V
15V	0.5V _{p-p}	3.5V – 9.5V
	2.0V _{p-p}	3.0V – 10.0V
	3.5V _{p-p}	3.5V – 10.5V

PIN ASSIGNMENT

Pin 1: Composite Video Signal In
 Pin 2: Inverter Out
 Pin 3: Horizontal Low Pass Filter Out
 Pin 4: Horizontal Synchronization Out
 (Open Collector)

Pin 5: Ground
 Pin 6: Horizontal Synchronization Delay Compensation
 Pin 7: Composite Synchronization Out (Open Collector)
 Pin 8: Vertical Low Pass Filter
 Pin 9: V_{CC} (+12V)

TEST CIRCUIT

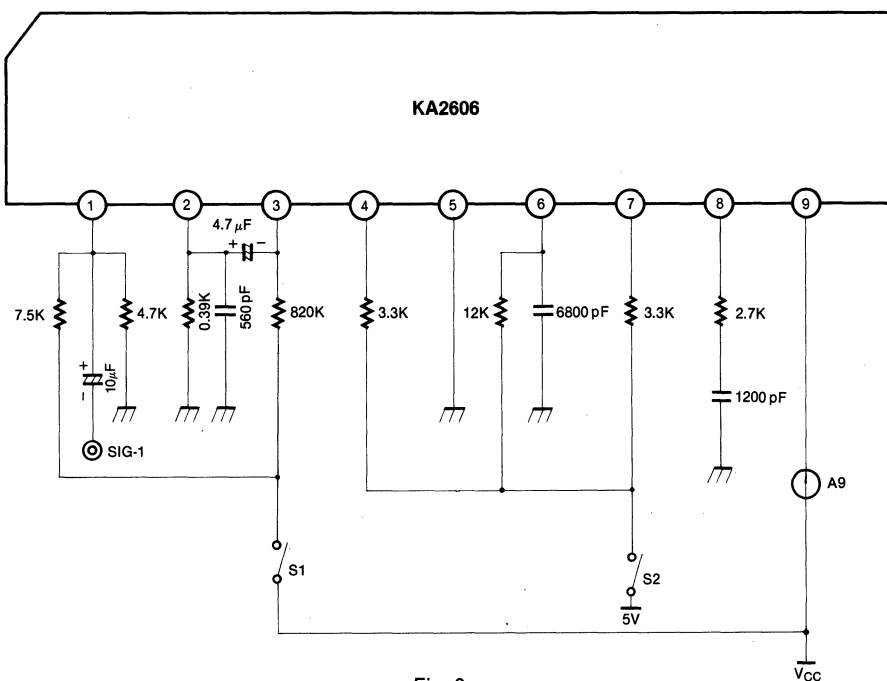
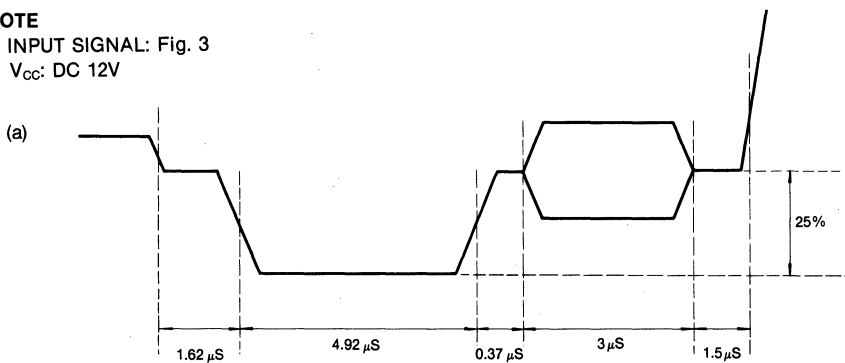


Fig. 2

NOTE

INPUT SIGNAL: Fig. 3
 V_{CC} : DC 12V



The white level of input signal (C. VIDEO) is 100 percent.

(b)

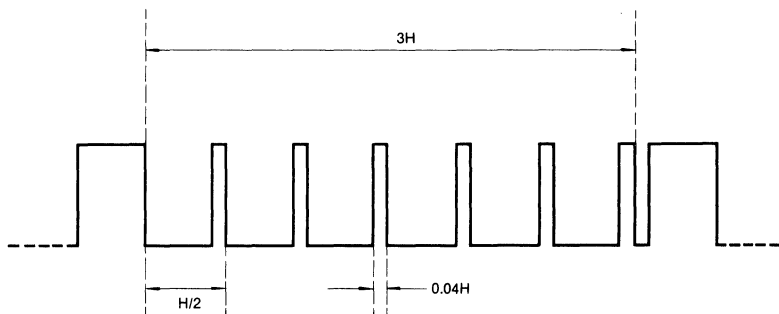


Fig. 3 2V_{p-p} Positive composite video signal
 (a) Horizontal sync pulse.
 (b) Vertical sync pulse. H equals 63.5 μ S.

4

APPLICATION CIRCUIT

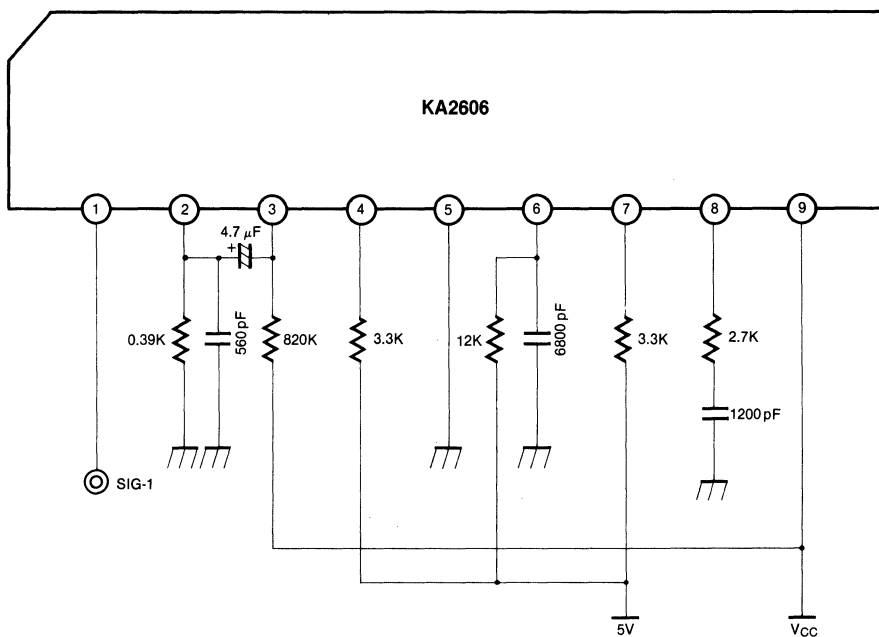


Fig. 4

NOTE

Horizontal synchronization width depends on the PIN-6 voltage, as shown in Fig. 5.

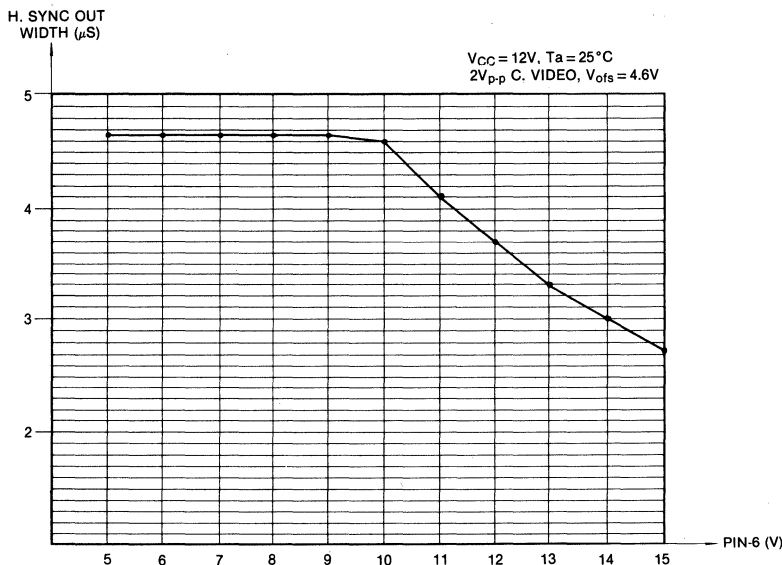


Fig. 5

APPLICATION 2

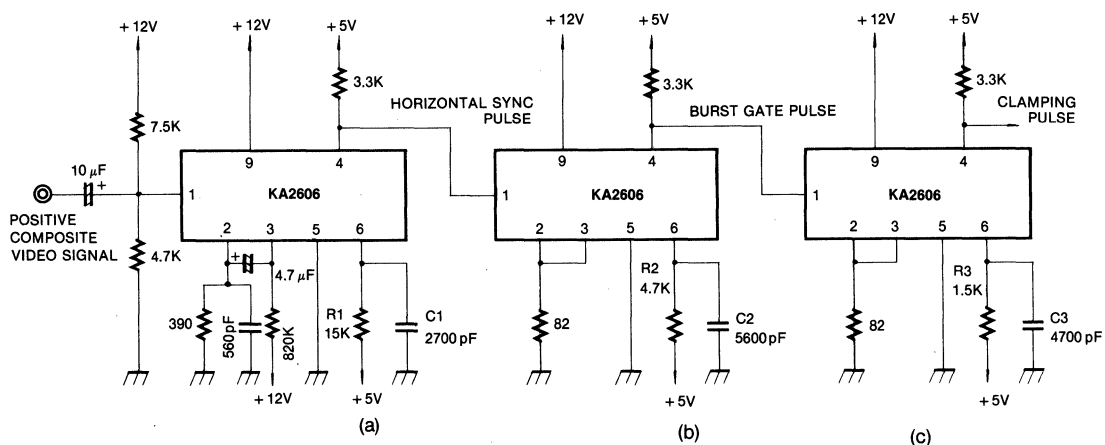
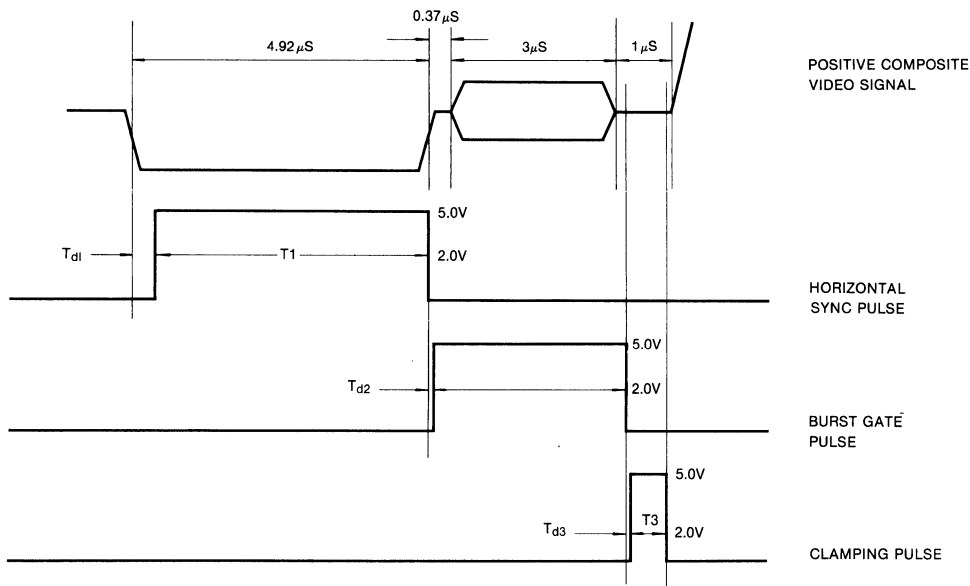


Fig. 6



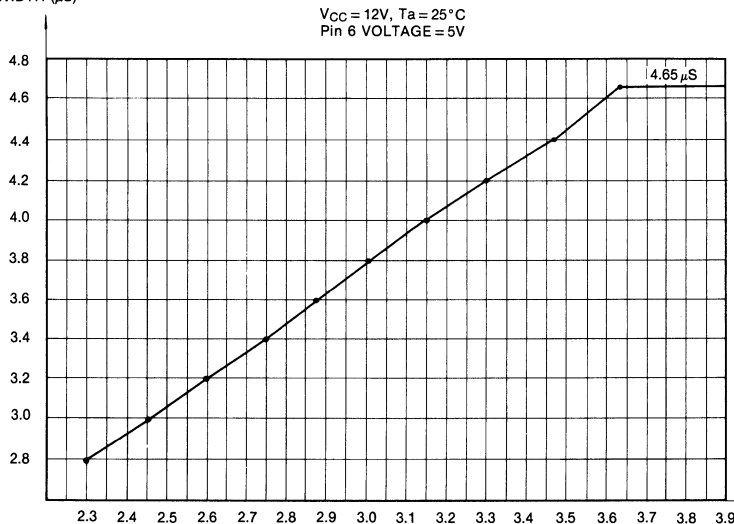
Delay times are independent of time constant.

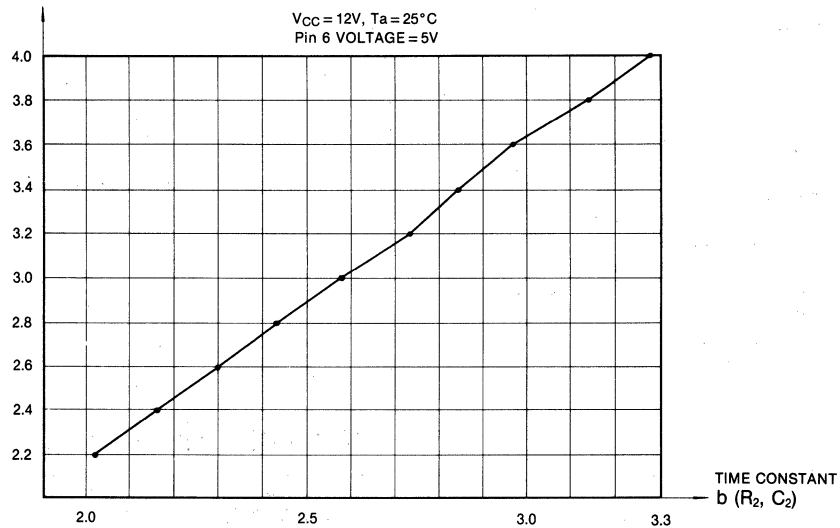
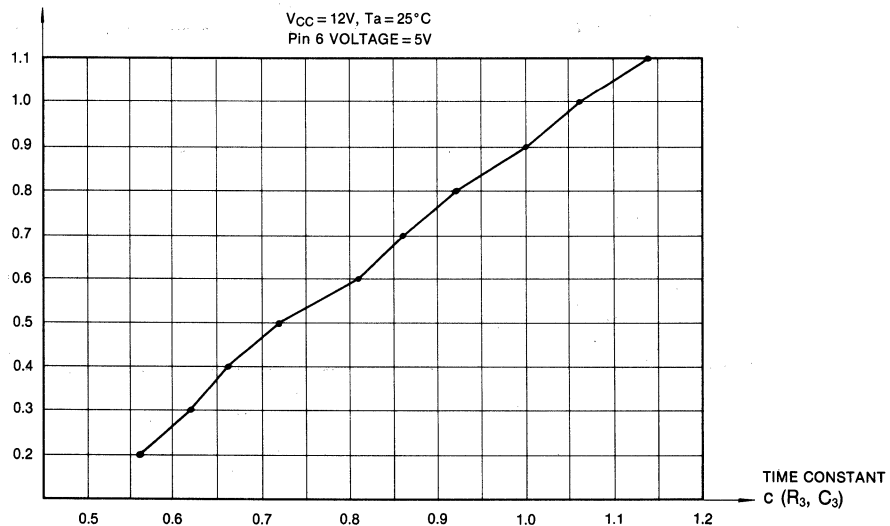
$$T_{d1} = 0.4 \mu\text{S}, T_{d2} = 0.13 \mu\text{S}, T_{d3} = 0.13 \mu\text{S}$$

The positive edge of burst gate pulse depends on the negative edge of horizontal sync pulse.

That is, negative edge of previous pulse is the start point of the positive edge of next pulse.

HORIZONTAL SYNC WIDTH (μS)



BURST GATE
PULSE WIDTH (μs)CLAMPING PULSE
WIDTH (μs)

KA2615/KA2616 KA2617/KA2618

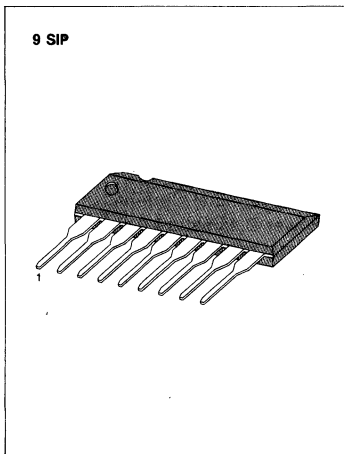
LINEAR INTEGRATED CIRCUIT

LED AND LAMP DRIVER

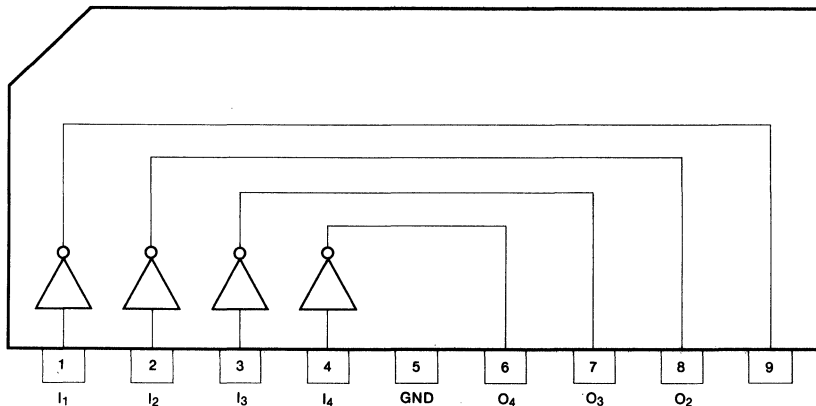
The KA2615 series are comprised of four NPN transistor arrays.
This devices are specifically designed for LED and LAMP drive.

FEATURES

- Output current: 150mA
- High voltage output: 25V
- Input compatible with various types of logic
 - KA2615: Using external resistor: General purpose
 - KA2616: Rin 2.7K: TTL, 5V CMOS
 - KA2617: Rin 10.5K: 6~15V, PMOS, CMOS
 - KA2618: Rin 20.0K: 14~20V, PMOS
- Single driver: Common emitter
- Four NPN transistor



BLOCK DIAGRAM



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2615, KA2616 KA2617, KA2618	9 SIP	-30 ~ +75°C

ABSOLUTE MAXIMUM RATINGS

Characteristics	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	25	V
Collector-Base Voltage	V_{CBO}	35	V
Collector Current	I_C	150	mA
Input Voltage	V_{in}^*	20	V
Input Current	I_{in}^{**}	10	mA
GND Terminal Current	I_{GND}	400	mA
Power Dissipation	P_D	0.75	mW
Operating Temperature	T_{opr}	-30 ~ +75	°C
Storage Temperature	T_{stg}	-55 ~ +150	°C

* KA2615 exception

** KA2615

RECOMMENDED OPERATING CONDITIONS ($T_a = -30 \sim +75^\circ\text{C}$)

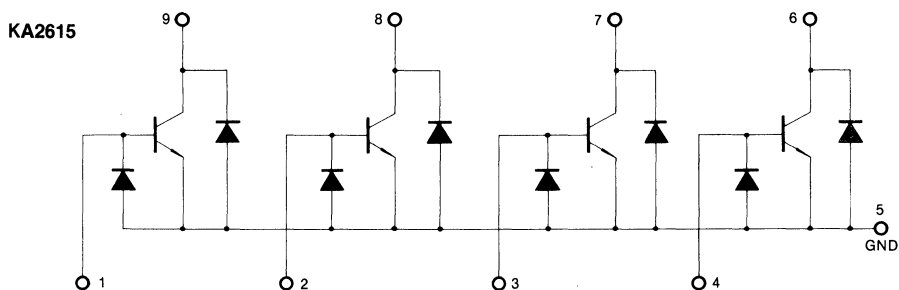
Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Collector-Emitter Voltage	V_{CEO}				25	V
Collector-Base Voltage	V_{CBO}				35	V
Collector Current	I_C	KA2615, KA2616			100	mA
		KA2617			80	
		KA2618			60	
Input Voltage	V_{in}	KA2616			20	V
		KA2617				
		KA2618				
Input Current	I_{in}	KA2615			5	mA
Power Dissipation	P_D				0.33	W

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

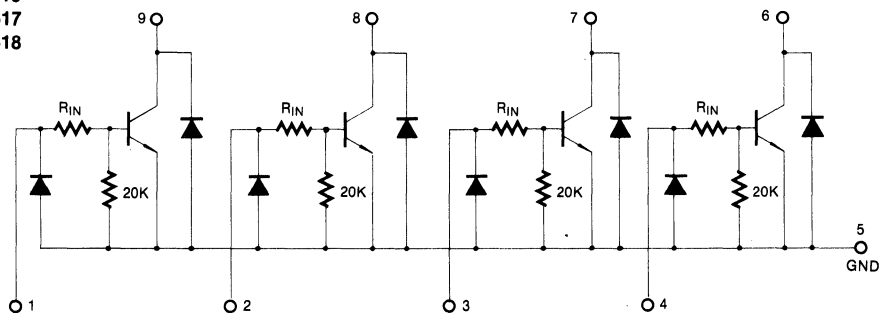
Characteristics	Symbol	Test Condition		Min	Typ	Max	Unit
Output Leak Current	I_{CEX}	1	$V_{CE} = 25V, V_{in} = 0$			10	μA
Collector-Emitter Saturation Voltage 1	$V_{CE(sat)}$	2	$I_{in} = 0.5\text{mA}, I_C = 10\text{mA}$		0.15	0.20	V
Collector-Emitter Saturation Voltage 2	$V_{CE(sat)}$	2	$I_{in} = 2.5\text{mA}, I_C = 50\text{mA}$		0.35	0.50	V
DC Forward Current Transfer Ratio	h_{FE}	2	$V_{CE} = 5V, I_C = 10\text{mA}$	*	60	400	
				**	50	400	
Input Voltage	$V_{in(On)}$	3	$I_{in} = 0.5\text{mA}, I_C = 10\text{mA}$	KA2616	1.7	2.1	V
				KA2617	4.4	6.0	
				KA2618	7.7	10.7	
Turn-On Delay	t_{on}	4	$V_{out} = 25V, R_L = 0.5K, C_L = 15\text{pF}$		100		nS
Turn-Off Delay	t_{off}				500		

* KA2615 ** KA2616, KA2617, KA2618

SCHEMATIC DIAGRAM



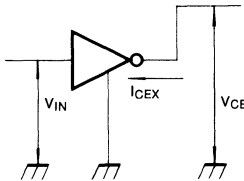
KA2616
KA2617
KA2618



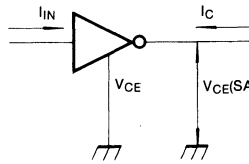
R_{IN} :
KA2616 = 2.7K
KA2617 = 10.5K
KA2618 = 20.0K

TEST CIRCUIT

1. I_{CEX}

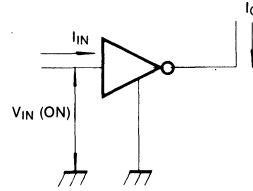


2. H_{FE} , $V_{CE(SAT)}$

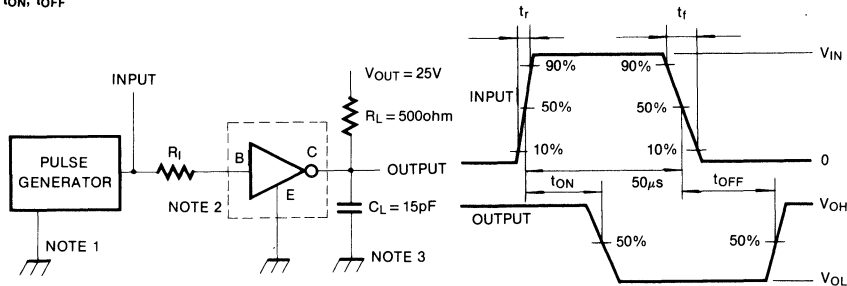


$$H_{FE} = \frac{I_C}{I_{IN}}$$

3. $V_{IN(ON)}$



4. t_{ON} , t_{OFF}



NOTES: 1. Pulse width $50\mu s$
Duty cycle 10%
Output impedance 50ohm
 $t_r \leq 5$ ns, $t_f \leq 10$ ns

2. See below
Input conditions

Type Number	R_i	V_{IN}
KA2615	2.7K Ω	3V
KA2616	0	3V
KA2617	0	10V
KA2618	0	14V

3. C_L Includes probe and JIG capacitance

VIDEO IF SYSTEM FOR COLOR TV

The KA2911, KA2916 are silicon monolithic integrated circuits designed for VIF stage in color and B/W television receivers.

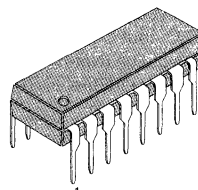
KA2911 for Reverse AGC Type.

KA2916 for Forward AGC Type.

FUNCTIONS

- Three controlled IF amplifier stages
- Video demodulator controlled by picture carrier
- Black noise and white noise inverter
- Peak AGC
- DC amplifier for RF AGC out
- Quadrature detector for AFT
- DC amplifier for AFT

16 DIP



FEATURES

- High gain wide band IF amplifier
- Gain reduction with excellent stability
- Excellent DG/DP characteristics
- Excellent S/N characteristics due to delayed 3 stages AGC action
- Negative video output signal
- Fast AGC action due to noise inverter and peak AGC
- Switch off the video part with VTR SW
- Dual differential AFT output

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2911	16 DIP	- 20 + 65°C
KA2916		

BLOCK DIAGRAM

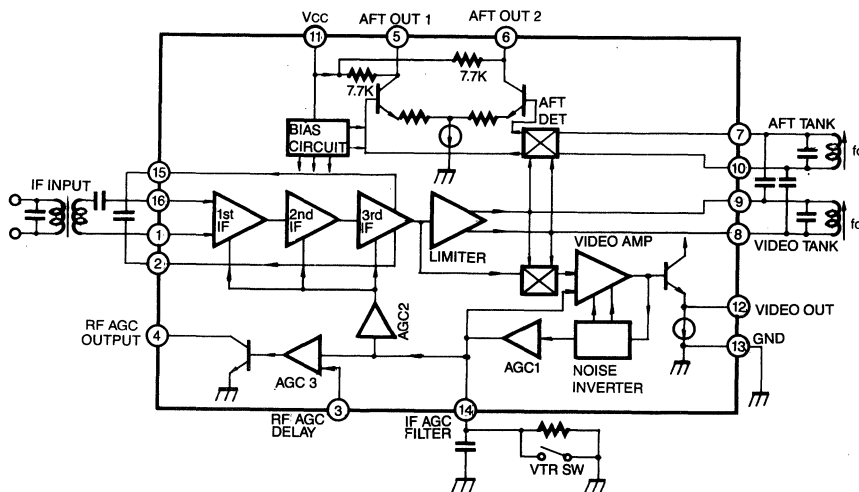


Fig. 2

ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC} (Pin 11)	15	V
Open Loop Voltage	V_4 (Pin 4)	15	V
Video DC Output Current	I_{12} (Pin 12)	6	mA
Power Dissipation (Note)	P_d	1.4	W
Operating Temperature	T_{opr}	$-20 \sim +65$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^\circ\text{C}$

Note: Derated above $T_a=25^\circ\text{C}$ in the proportion of 11.2mW/ $^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test C'CT
Recommended Supply Voltage	V_{CC} (V_{11})		10.8	12.0	13.2	V	
Supply Current	I_{CC} (I_{11})	$V_{CC}=12\text{V}$	42	51	63	mA	1
Video DC Output Voltage	V_{12}	$V_{CC}=12\text{V}$	5.2	5.5	5.8	mA	1
AFT DC Output Voltage	V_5, V_6	$V_{CC}=12\text{V}$ SW_1 : ON, SW_2 : ON	5.3	6.8	8.3	V	1
AFT Output Offset Voltage	V_5-V_6	$V_{CC}=12\text{V}$ SW_1 : ON, SW_2 : ON	-1.5	0	1.5	V	1
RF AGC Residual Output Voltage	V_4 (sat)	$V_{CC}=12\text{V}$, SW_3 : 2, SW_4 : 2 KA2916 SW_4 : 1 KA2911	—	—	0.5	V	1
RF AGC Leak Current	I_4 (Leak)	$V_{CC}=12\text{V}$, SW_3 : 1, SW_4 : 2 KA2911 SW_4 : 1 KA2916	—	—	1	μA	1
Video Sensitivity	U_1 Pin (1-16)	$V_{CC}=12\text{V}$, $V_{12}=0.8\text{V}_{p-p}$ $f_o=45.75\text{MHz}$ AM: 30%	100	200	300	μVrms	2
AGC Range	ΔA (IF)	$V_{CC}=12\text{V}$, $f_o=45.75\text{MHz}$ $V_{14}=11.5\text{V} \rightarrow 4.0\text{V}$	60	64	—	dB	2
Sync Tip Level Voltage	V_{SYNC} (V_{12})	$V_{CC}=12\text{V}$ $f_o=45.75\text{MHz}$	2.3	2.5	2.7	V	2
Maximum IF Input Voltage	U_{IN} (Max)	$V_{CC}=12\text{V}$ $f_o=45.75\text{MHz}$	100	120	—	mVrms	2
White Noise Threshold	V_{WTH} (V_{12})	$V_{CC}=12\text{V}$ $f_o=45.75\text{MHz}$	5.8	6.2	6.6	V	2
White Noise Clamp Level	V_{WCL} (V_{12})	$V_{CC}=12\text{V}$ $f_o=45.75\text{MHz}$	3.7	4.1	4.5	V	2
Black Noise Threshold	V_{BTH} (V_{12})	$V_{CC}=12\text{V}$ $f_o=45.75\text{MHz}$	1.4	1.6	1.8	V	2
Black Noise Clamp Level	V_{BCL} (V_{12})	$V_{CC}=12\text{V}$ $f_o=45.75\text{MHz}$	2.9	3.3	3.7	V	2
Video Frequency Response	F_{BW}	Input 45.75MHz Sweep generator	4.5	5.5	—	MHz	2

TEST CIRCUIT 1 (DC Characteristics)

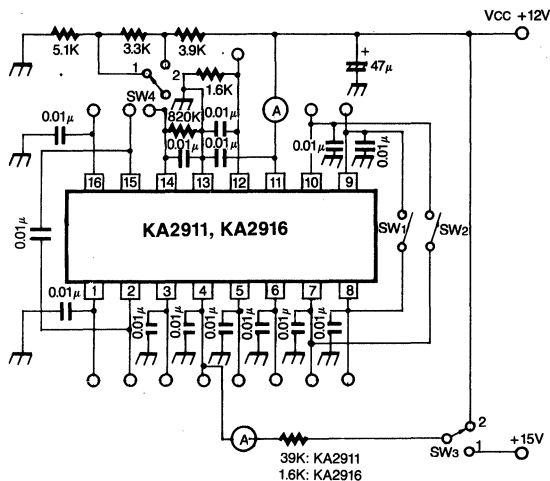


Fig. 3

TEST CIRCUIT 2 (Dynamic Characteristics)

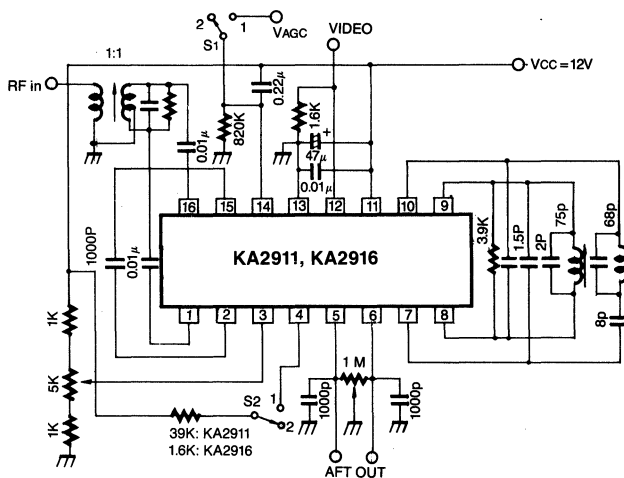


Fig. 4

TEST CIRCUIT 3 (DP, DG)

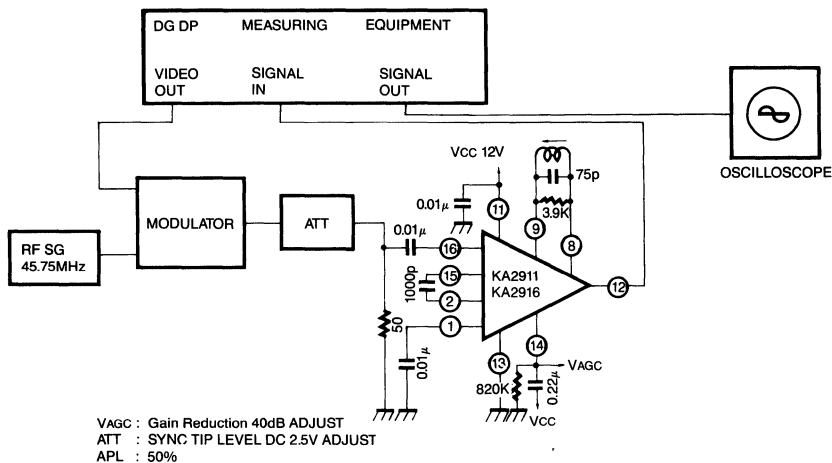


Fig. 4

TEST CIRCUIT 4 (Inter Modulation)

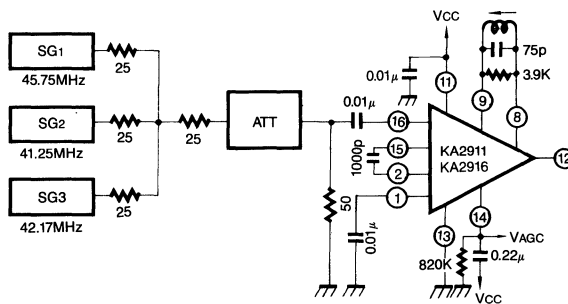


Fig. 5

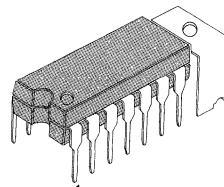
VIDEO IF PROCESSOR FOR B/W TV

The KA2912 is a silicon monolithic integrated circuit designed for VIF stage in B/W television receivers. This IC has all functions including video IF amplifier, video low-level detector, RF AGC, IF AGC and noise canceller. This IC is encapsulated in 14 pin dual in-line package with heat sink.

FEATURES

- High input sensitivity: Typ 30 dB μ .
- It can be used both of keyed type AGC and peak type AGC.
- It can be operated with the power supply voltage above 7V.
- Since the video detector has wide bandwidth, it's suitable for the sound carrier frequency of 4.5, 5.5, 6.0, 6.5 MHz.
- As input is differential mode, it can be used with SAW filter.
- All function of VIF stage are provided by this single chip IC will realize reduction of assembly cost as well as reduction of number of external components.

14 DIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2912	14 DIP H/S	- 20 ~ + 75°C

BLOCK DIAGRAM

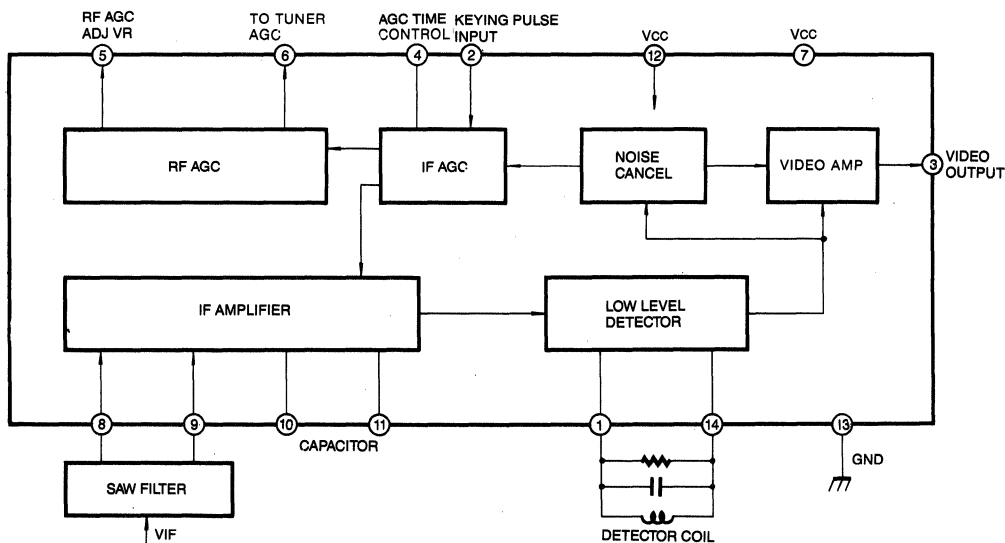


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC} (Pin 7)	15	V
Input Singnal Voltage	V_B, V_g	3	V_{P-P}
Power Dissipation	P_d	875 ($T_a = 75^\circ\text{C}$) free air	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_m = 400\text{Hz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Total Supply Current	I_{CC}	$I_7 + I_{12}$, $R_A = 150\Omega$	40	50	60	mA
Input Sensitivity	(sens)	MOD=80%, $v_O = 1.4V_{P-P}$	—	30	35	$\text{dB}\mu$
Maximum Input Voltage	V_i (max)	MOD=80%, -1dB Point	100	—	—	$\text{dB}\mu$
Video Output Voltage	v_O	MOD=80%, $v_i = 3\text{mVrms}$	1.0	1.4	1.7	V_{P-P}
Video Output DC Voltage	v_O	No Signal	3.3	3.8	4.3	V
Signal to Noise Ratio	S/N	MOD=80%-0% $v_i = 3\text{mVrms}$	40	50	—	dB
RF AGC Voltage (High)	V_{6H}	$V_5 = 0\text{V}$	8	9	11	V
RF AGC Voltage (Low)	V_{6L}	$V_5 = 7\text{V}$	—	0	0.5	V
Differential Gain	D.G.	Stair step $F_M = 3.58\text{MHz}$	—	—	10	%
Differential Phase	D.P.	Stair step $F_M = 3.58\text{MHz}$	—	—	10	deg
Video Detector Band Width	BW	-3dB Point	5.5	—	—	MHz
Input Resistance	R_{in}		—	1.5	—	$\text{K}\Omega$
Input Capacitance	C_{in}		—	3.3	—	pF

TYPICAL APPLICATION CIRCUIT

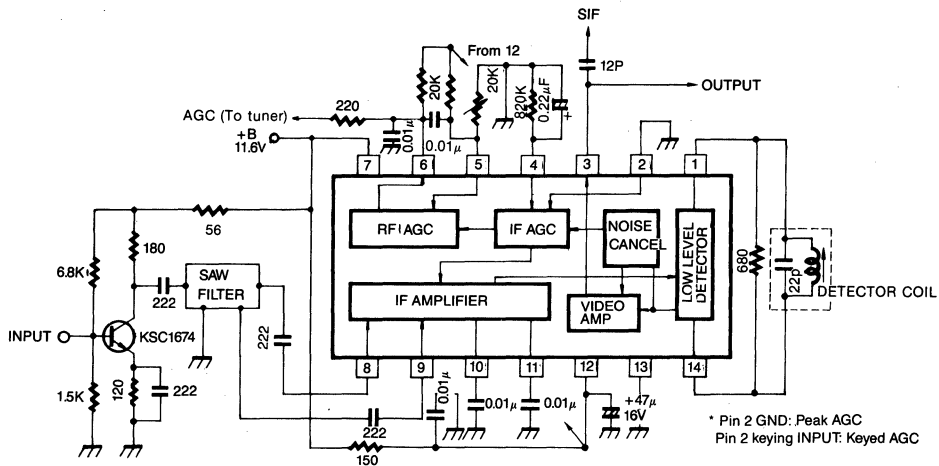


Fig. 2

TEST CIRCUIT

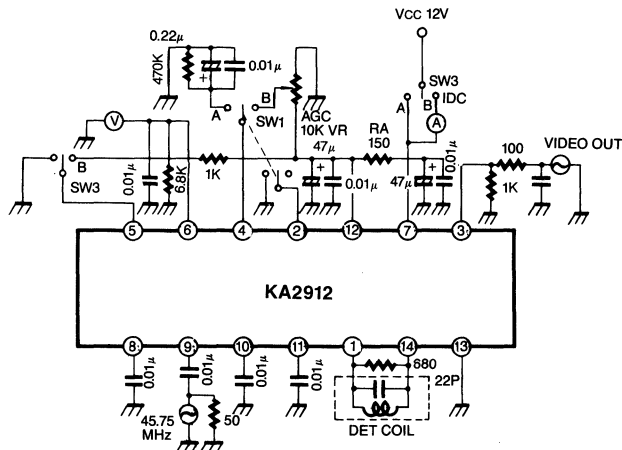
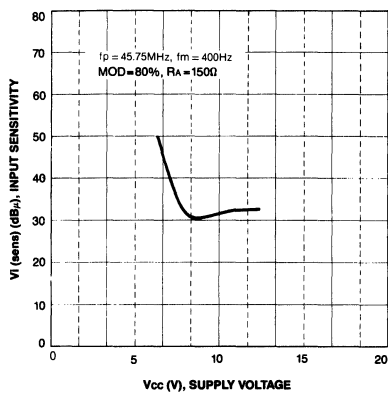
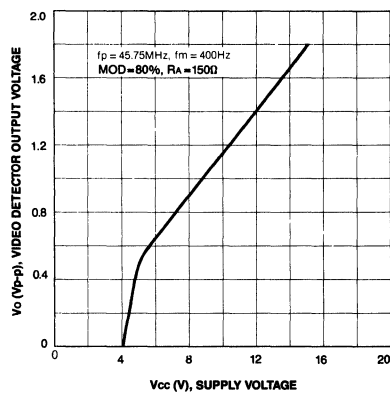
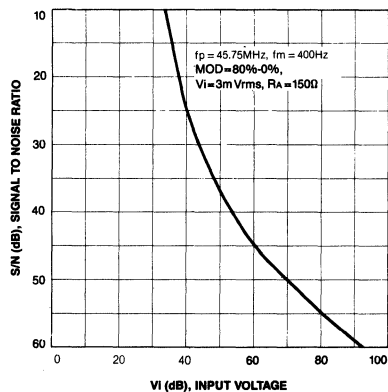
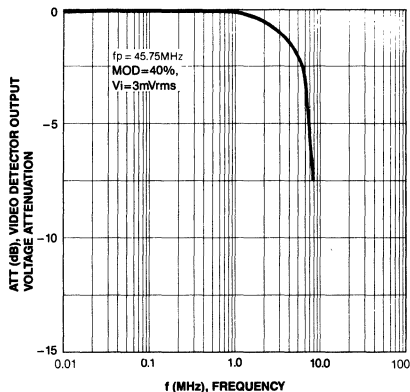


Fig. 3

INPUT SENSITIVITY

VIDEO DETECTOR OUTPUT VOLTAGE
Vs SUPPLY VOLTAGE

S/N Vs INPUT VOLTAGE

VIDEO DETECTOR OUTPUT VOLTAGE
ATTENUATION VS FREQUENCY

VIDEO AND SOUND IF AMPLIFIER FOR MONOCHROME TV RECEIVERS

The KA2913A, KA2917 are silicon monolithic integrated circuits designed for VIF and SIF stage in B/W television receivers.

KA2913A: for Forward AGC type

KA2917: for Reverse AGC type

FUNCTION

VIF stage

- Three controlled iF amplifier stages
- Video demodulator controlled by picture carrier
- Black noise and white noise inverter
- DC amplifier for RF AGC output
- Peak AGC

SIF stage

- Three controlled IF amplifier stages
- Quadrature detector

FEATURE

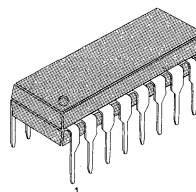
VIF stage

- High gain, wide band IF amplifier: 50dB (Typ.) at 45MHz
- Gain reduction with excellent stability: 55dB (Typ.) at 45MHz
- Excellent DG/DP characteristics: DG 7% (Typ.), DP 3.5 deg. (Typ.)
- Excellent S/N characteristics due to delayed 3 stage AGC action.
- Fast AGC action due to noise inverter and peak AGC.
- Switch off the video part with VTR switch.
- Dual differential AFT output

SIF stage

- Excellent limiter characteristics.
- Excellent AM rejection.
- Large undistorted audio output voltage with quadrature detector.

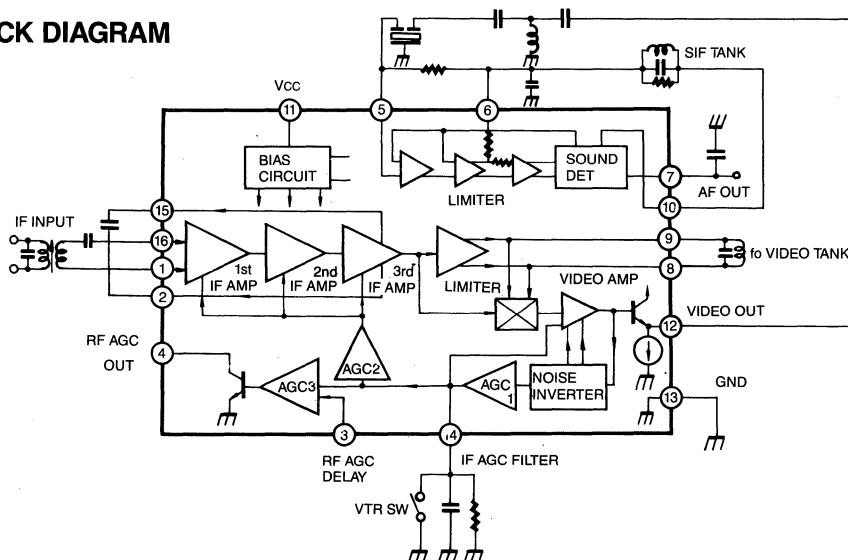
16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2913A	16 DIP	- 20 ~ + 65°C
KA2917		

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage (Pin 11)	V_{CC}	15	V
Open Loop Voltage (Pin 4)	V_4	15	V
Video DC Output Current (Pin 12)	I_{12}	6	mA
Power Dissipation (Note)	P_D	1.4	W
Ambient Temperature	T_a	-20 ~ 65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 ~ 150	$^\circ\text{C}$

Note: Derated above $T_a = 25^\circ\text{C}$ in the proportion of 11.2 mW/ $^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

VIF Stage ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Recommended Supply Voltage	$V_{CC} (V_{11})$	—	10.8	12.0	13.2	V	—
Supply Current	$I_{CC} (I_{11})$	S_1 : On, S_3 : 2, S_5 : 2, S_4 : 1	35	50	65	mA	1
Video DC Output Voltage	V_{12}	S_1 : Off, S_3 : 2, S_5 : 2, S_4 : 1	5.2	5.5	5.8	V	1
Terminal Voltage 5	V_5	S_1 : On, S_3 : 2, S_5 : 2, S_4 : 1	3.5	4.4	5.3	V	1
Terminal Voltage 7	V_7	S_1 : On, S_3 : 2, S_5 : 2, S_4 : 1	4.6	6.0	7.2	V	1
RF AGC Residual Output Voltage	$V_4 \text{ Sat}$	S_1 : Off, S_3 : 2, S_5 : 2, S_4 : 1	—	—	0.5	V	1
RF AGC Leak Current	$I_4 \text{ Leak}$	S_1 : Off, S_3 : 1, S_5 : 1, S_4 : 2	—	—	1	μA	1
Video Sensitivity	$v_1 \text{ Pin-16}$	(Note 1)	60	150	250	μV_{rms}	2
AGC Range	$\Delta A \text{ (IF)}$	(Note 2)	60	64	—	dB	2
SYNC TIP Level Voltage	$V_{\text{SYNC}} (V_{12})$	(Note 3)	2.3	2.5	2.7	V	2
Maximum IF Input Voltage	$v_{\text{IN Max PIF}}$	(Note 4)	100	120	—	mV_{rms}	2
White Noise Threshold	$V_{\text{W TH}} (V_{12})$	(Note 5)	5.8	6.2	6.6	V	2
White Noise Clamp Level	$V_{\text{WCL}} (V_{12})$	(Note 5)	3.7	4.1	4.5	V	2
Black Noise Threshold	$V_{\text{B TH}} (V_{12})$	(Note 5)	1.4	1.6	1.8	V	2

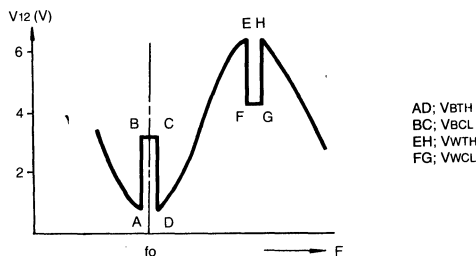
ELECTRICAL CHARACTERISTICS**VIF Stage** ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit	Test Fig
Black Noise Clamp Level	$V_{B\ CL}$ (V_{12})	(Note 5)		2.9	3.3	3.7	V	2
Video Frequency Response	f_{ew}	(Note 6)		4.5	5.5	—	MHz	3
Suppression of Carrier	CL	(Note 7)		40	50	—	dB	4
Suppression of 2nd Carrier	I_{2nd}	(Note 8)		40	50	—	dB	4
Suppression of Sound Carrier/ Color Subcarrier	I_{920}	(Note 9)		33	38	—	dB	4
Differential Phase	DP	(Note 10)		—	3.5	5	deg	5
Differential Gain	DG	(Note 10)		—	7	10	%	5
VIF Input Impedance	R_{IN} (VIF)	(Note 11)		1.5	3.0	6.0	K Ω	6
	C_{IN} (VIF)			—	3.0	10.0	pF	
Max. Available Current	$I_{4\ MAX}$	(Note 12)	KA2917	0.3	—	—	mA	1
			KA2913A	7	—	—	mA	
RF AGC Delay Point Range	V_{IN} Delay	(Note 13)		5.0	7.0	9.0	V	2
Video Output Level	V_{OUT}	(Note 14)		2.25	2.5	2.75	V	2

ELECTRICAL CHARACTERISTICS**SIF Stage** ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit	Test Fig
SIF Output Voltage	S_{OUT}	(Note 15)		200	400	600	mV _{rms}	3
Input Limiting Voltage	V_{IN} (Lim)	(Note 16)		—	200	400	μV_{rms}	8
AM Rejection Ratio	AMR	(Note 17) $R_L = \infty$ $R_D = \infty$		40	45	—	dB	8
Recovered Output Voltage	V_{OD}	(Note 18) $R_L = \infty$ $R_D = \infty$		0.5	0.75	—	V _{rms}	8
Total Harmonic Distortion	THD	(Note 18) $R_L = \infty$ $R_D = \infty$		—	1.0	2.0	%	8
Max. Audio Output Voltage	V_{OM}	(Note 19)		4.0	—	—	V _{P-P}	8
SIF Input Impedance	R_{IN} (SIF)			10	20	30	K Ω	7
	C_{IN} (SIF)			—	3	10	pF	
Audio Output Impedance	$R_{O\ (AF)}$	(Note 20)		10	15	20	K Ω	9

- Note 1) V_{AGC} (TP14 EXT. Applying voltage)=11.5V
 VIF in: $f=45.75\text{MHz}$, 1kHz 30% AM modulation
 Adjust VIF input level U_i so that the detected output of TP12C with high impedance probe will be $0.8V_{P-P}$ and measure the input level.
- Note 2) $V_{AGC}=4V$
 Measure VIF input level U_i same as note 1
- $$\Delta A = 20 \log \frac{U_i'}{U_i} \text{ (dB)}$$
- Note 3) VIF in: $f=45.75\text{MHz}$ CW 15mVrms
 Measure DC level of TP12A
- Note 4) VIF in: $f=45.75\text{MHz}$ APL100%, 87.5% AM modulation.
 TP14: open
 (1) Adjust VIF input level 50mV_{P-P} and measure the detected output level U_{OIP-P}
 (2) Then increase the input level so that the detected output level will be $1.1 \times U_{OIP-P}$ and measure the input level.
- Note 5) $V_{AGC}=8V$
 VIF in: $f=45.75\text{MHz} \pm 10\text{MHz}$ variable or sweep 15mVrms measure DC level of TP12A



- Note 6) $V_{AGC}=8V$
 SG_1 : 45.75MHz CW
 SG_2 : 45.65-27MHz variable
 (1) Setting output of SG_1 so that DC level of TP12A will be 4.0V
 (2) Setting output of SG_2 (45.65MHz) so that AC level of TP12A will be $0.5V_{P-P}$
 (3) Decreasing frequency of SG_2 until AC level of TP12A will be $0.35V_{P-P}$ (-3dB of $0.5V_{P-P}$) then read $f_{SG2}=F$
 $f_{BW}=45.75-F \text{ MHz}$
- Note 7) SG_1 : 45.75MHz, 1kHz 80% AM modulation 100mVrms
 SG_2, SG_3 : off
 Setting V_{AGC} so that output AC level of TP12A will be $2.7V_{P-P}$
 Measure CL of TP12A after setting to 0% AM of SG_1
- Note 8) Measure 2nd of TP12A same as Note 9
- Note 9) $V_{AGC}=8V$
 SG_1 : 45.75MHz (P: picture) 100mVrms
 SG_2 : 41.25MHz (S: sound) 32mVrms (-10dB of SG_1)
 SG_3 : 42.17MHz (C: chroma) 32mVrms (-10dB of SG_1)
 (1) Setting V_{AGC} so that the output tip level (lower) of TP12A will be 3.0V DC
 (2) Measure the level difference (dB) between C-level and 920kHz level
- Note 10) $V_{AGC}=8V$
 VIF in: $f=45.75\text{MHz}$ video signal (RAMP) 87.5% AM 100mV_{P-P}
 Setting ATT so that the SYNC TIP level of TP12A will be 2.5V DC measure DP and DG.

Note 11) $V_{AGC} = 5V$ $f = 45.75MHz$

Measure R_{IN} , C_{IN}

Note 12) S_1 : On, S_3 : 2, S_5 : 1 S_4 : 1 for 2917

2 for 2913A

Note 13) TP14: Open

VIF in: 45.75MHz CW 20mVrms

(1) Adjust the voltage of terminal 3 so that the voltage of terminal 4 will be 6.0V DC

(2) Measure the terminal voltage 3

Note 14) TP14: Open

VIP in: 45.75MHz 100% APL 87.5% AM modulation signal amplitude 50mV_{R-P} measure detected output voltage (white peak to SYNC TIP)

Note 15) TP14: Open

SG₁: 45.75MHz CW 100mVrms

SG₂: 41.25MHz CW 25mVrms

Measure SIF (4.5MHz) output voltage at TP12A

Note 16) SIF IN: $f = 4.5MHz$ FM $f_{MOD} = 400Hz$ $\Delta f = \pm 25kHz$

(1) Adjust SIF input level 100mV_{R-P} and measure the detected output level V_{OS}

(2) Then decrease the input level so that the detected output level will be 3dB down of V_{OS} and measure the input level.

Note 17) SIF IN: $f = 4.5MHz$ FM $f_{MOD} = 400Hz$ $\Delta f = \pm 25kHz$

AM 30%

Input level $V_{INS} = 100dB\mu$

Note 18) SIF IN: $f = 4.5MHz$ FM $f_{MOD} = 400Hz$ $\Delta f = \pm 25kHz$

Input level $V_{INS} = 80dB\mu$

Note 19) SIF in: $f = 4.4-4.6MHz$ variable or sweep measure the output DC voltage change

Note 20) SIF IN: $f = 4.5MHz$ FM $f_{MOD} = 400Hz$ $\Delta f = \pm 25kHz$

Input level $V_{INS} = 80dB\mu$

(1) Measure the detected output voltage V_{OA} with $R_X = \infty$

(1) Then, adjust R_X so that the detected output voltage will be $\frac{V_{OA}}{2}$ and measure R_X .

3. VIDEO FREQUENCY RESPONSE & SIF OUTPUT VOLTAGE TEST CIRCUIT

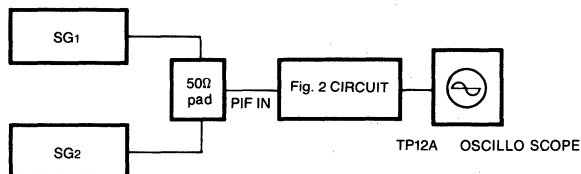


Fig. 3

4. INTER MODULATION TEST CIRCUIT

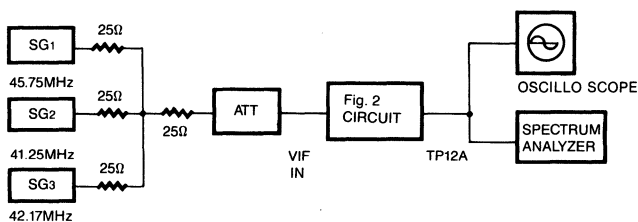
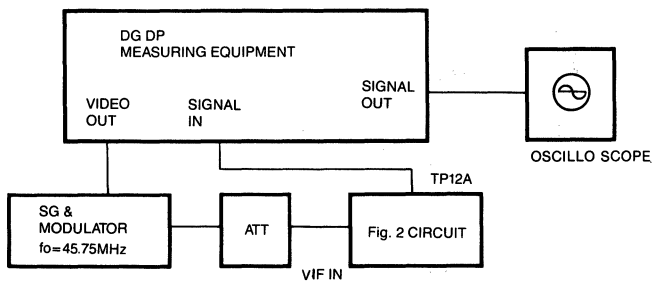


Fig. 4

5. DG, DP TEST CIRCUIT



APL: 50%
ATT: ADJUST SYNC TIP LEVEL TO DC2.5V

Fig. 5

6. INPUT IMPEDANCE TEST CIRCUIT

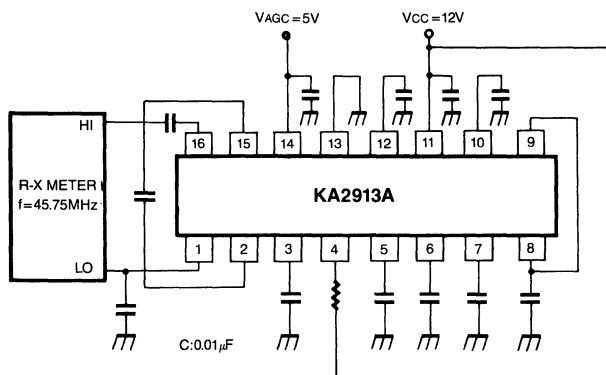


Fig. 6

7. SIF INPUT IMPEDANCE TEST CIRCUIT

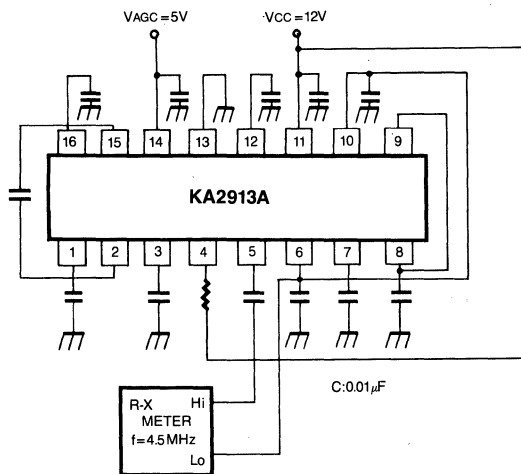


Fig. 7

8. V_{IN} (LIM), AMR, V_{OD} , THD, V_{OM} TEST CIRCUIT

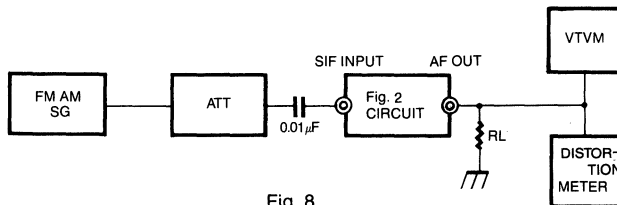


Fig. 8

9. AUDIO OUTPUT IMPEDANCE TEST CIRCUIT

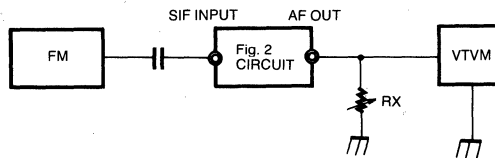
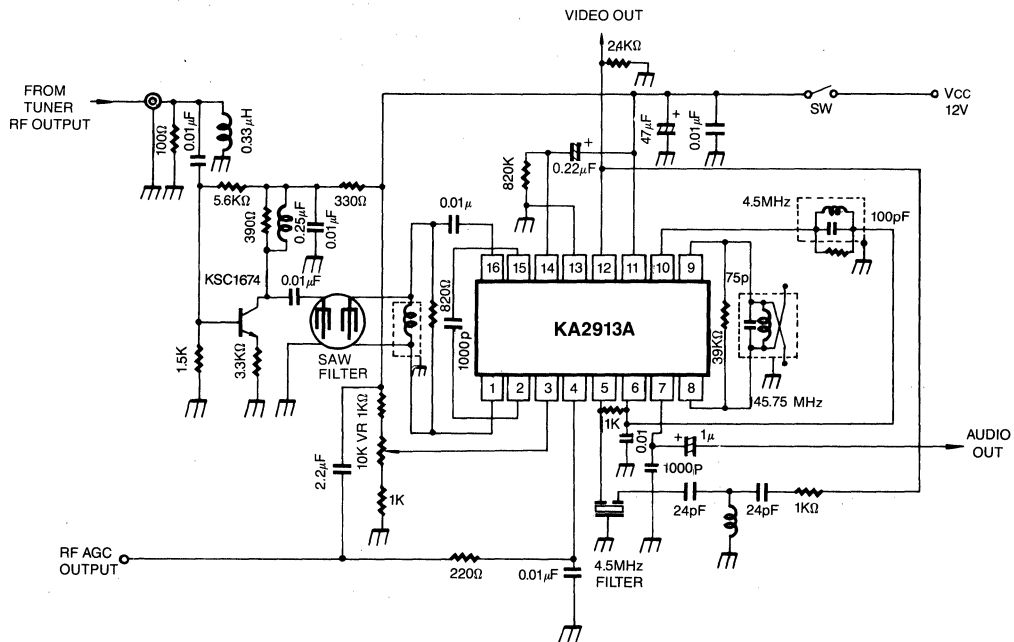


Fig. 9

TYPICAL APPLICATION CIRCUIT



VIDEO IF+SIF SYSTEM

The KA2914A, KA2918 are silicon monolithic integrated circuits designed for VIF and SIF stage in color and B/W television receivers.

KA2914A: for Reverse AGC type

KA2918: for Forward AGC type

FUNCTIONS**VIF**

- Three controlled IF amplifier stages
- Video demodulator controlled by picture carrier
- Black noise and white noise inverter • Peak AGC.
- DC amplifier for RF AGC out

SIF

- Three differential IF amplifier stages • Phase detector
- DC controlled attenuator
- Audio amplifier stage with NFB terminal

FEATURES

- PIF, SIF, ATT audio driver
- 2 chip color TV system is possible with KA2153 or KA2154

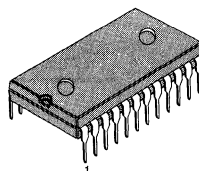
VIF

- High gain, wide band IF amplifier
- AGC characteristics with excellent stability
- Excellent DG/DP characteristics
- Excellent S/N characteristics due to delayed 3 stages AGC action
- Negative video output signal
- Switch off the video part with VTR SW

SIF

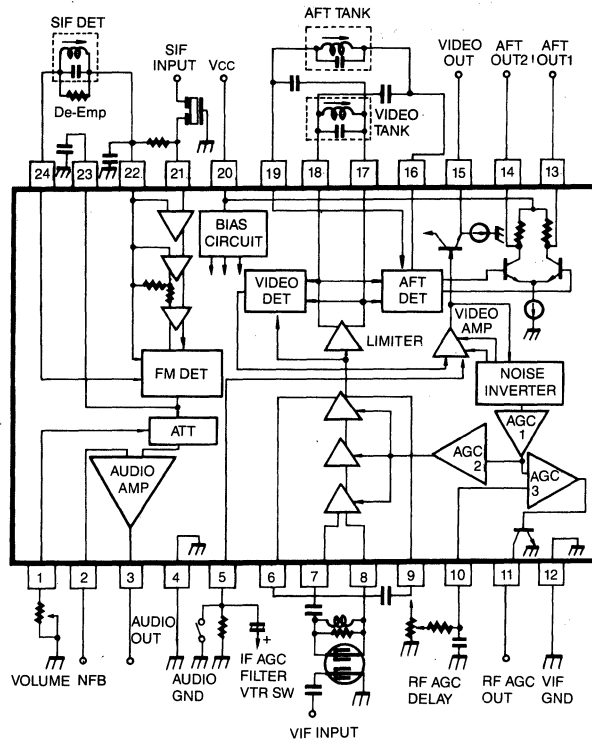
- Excellent limiter characteristics
- Excellent attenuator characteristics

24 DIP

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA2914A	24 DIP	- 20 ~ + 65°C
KA2918		

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Terminal 11 Open Voltage	V_{11}	15	V
Video DC Output Current	I_{15}	6	mA
Audio DC Output Current	I_3	3	mA
Terminal 2 Voltage	V_2	15	V
Power Dissipation (Note)	P_d	1.6	W
Operating Temperature	T_{opr}	$-20 \sim 65$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim 150$	$^\circ\text{C}$

Note: Derated above $T_a = 25^\circ\text{C}$ in the proportion of 12.8 mW/ $^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

PIF Section ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Recommended Supply Voltage	V_{CC}	—	10.8	12.0	13.2	V	—
Supply Current	I_{CC}	—	50	72	95	mA	1
Video DC Output Voltage	V_{15}	SW ₁ : 1 (KA2914A) 2 (KA2918) SW ₂ : 2	5.2	5.5	5.8	V	1
AFT DC Output Voltage	V_{13}	SW ₁ : 1 (KA2914A) 2 (KA2918) SW ₂ : 2	5.3	6.8	8.3	V	1
	V_{14}	SW ₁ : 1 (KA2914A) 2 (KA2918) SW ₂ : 2	5.3	6.8	8.3	V	1
AFT DC Offset Voltage	ΔV_{13-14}	SW: 1 (KA2914A) 2 (KA2918) SW: 2	-1.5	0	1.5	V	1
RF AGC Residual Output Voltage	$V_{11 \text{ Sat}}$	SW ₁ : 1 (KA2914A) 2 (KA2918) SW ₂ : 2	—	—	0.5	V	1
RF AGC Leak Current	$I_{11 \text{ LEAK}}$	SW ₁ : 1 (KA2918) 2 (KA2914A) SW ₂ : 1	—	—	1	μA	1
Video Sensitivity	V_I Pin 7-8	(Note 1)	60	150	250	μV _{rms}	2
AGC Range	ΔA_{VIF}	(Note 2)	60	64	—	dB	2
SYNC TIP Level Voltage	V_{SYNC} (V_{15})	(Note 3)	2.3	2.5	2.7	V	2
Max. IF Input Voltage	$V_{IN \text{ Max}}$ PIF	(Note 4)	100	120	—	mV _{rms}	2
White Noise Threshold Level	V_{WTH} (V_{15})	(Note 5)	5.8	6.2	6.6	V	2
White Noise Clamp Level	V_{WCL} (V_{15})	(Note 5)	3.7	4.1	4.5	V	2

ELECTRICAL CHARACTERISTICS

PIF Section ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Black Noise Threshold Level	V_{BTH} (V_{15})	(Note 5)	1.4	1.6	1.8	V	2
Black Noise Clamp Level	V_{BCL} (V_{15})	(Note 5)	2.9	3.3	3.7	V	2
Video Frequency Response	f_{BW}	(Note 6)	4.5	5.5	—	MHz	3
Suppression of Carrier	CL	(Note 7)	40	50	—	dB	4
Suppression of 2nd Carrier	I_{2nd}	(Note 8)	40	50	—	dB	4
920KHz Beat Level	I_{920}	(Note 9)	33	38	—	dB	4
Differential Phase	DP	(Note 10)	—	3.5	5	deg	5
Differential Gain	DG	(Note 10)	—	7	10	%	5
VIF Input Impedance	R_{IN} (VIF)	(Note 11)	1.5	3.0	6.0	K Ω	6
	C_{IN} (VIF)		—	3.0	10.0	pF	
AFT Sensitivity	$\Delta F/V_{13-14}$	(Note 12)	—	16	—	kHz/V	2
AFT Output Voltage	Upper V_{13U} V_{14U}	(Note 13)	11.7	11.9	12.0	V	2
	Lower V_{13L} V_{14L}	(Note 13)	1.8	2.3	2.8	V	2
RF AGC Max Available Current	I_A Max	$SW_1: 1$ (KA2914A) $SW_2: 1$	0.3	—	—	mA	1
		$SW_1: 2$ $SW_2: 1$ (KA2918)	7.0	—	—		
RF AGC Delay Setting Range	V_{IN} Delay	(Note 14)	5	7	9	V	
AFT Band width	ΔF_W	(Note 13)	1.4	—	—	MHz	2
Video Output Voltage	V_{OUT}	(Note 15)	2.25	2.50	2.75	V	2

ELECTRICAL CHARACTERISTICS

SIF Section ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$)

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
SIF Output Voltage		S_{OUT}	(Note 16)	200	400	600	mV_{rms}	3
Input Limiting Voltage		$V_{IN(LIM)}$	(Note 17) $R_D = \infty$	—	200	400	uV_{rms}	8
AM Rejection Ratio		AMR	SIF IN: $f = 4.5\text{MHz}$ $f_m = 400\text{Hz}$, $\Delta f = \pm 25\text{kHz}$ AM 30%, $V_{IN} = 100\text{dBu}$	40	45	—	dB	8
Recovered Output Voltage		V_{OD}	SIF IN: $f = 4.5\text{MHz}$ $f_m = 400\text{Hz}$, $\Delta f = \pm 25\text{kHz}$ $V_{IN} = 80\text{dBu}$, $R_D = 12\text{k}\Omega$	0.5	0.75	—	V_{rms}	8
Total Harmonic Distortion		THD_{DET}	SIF IN: $f = 4.5\text{MHz}$ $f_m = 400\text{Hz}$, $\Delta f = \pm 25\text{kHz}$ $V_{IN} = 80\text{dBu}$	—	1.0	—	%	8
Max. Audio Output Voltage		V_{OM}	SIF IN: $f = 4.4 \sim 4.6\text{MHz}$	4.0	—	—	V_{p-p}	8
SIF Input Impedance		$R_{IN(SIF)}$	$f = 4.5\text{MHz}$	10.0	20.0	30.0	$\text{K}\Omega$	7
		$C_{IN(SIF)}$		—	3.0	—	pF	
DET Output Impedance		$R_{O(DET)}$	(Note 18)	10.0	15.0	20.0	$\text{K}\Omega$	9
DC Voltage	Terminal 21	V_{21}	SW_1 : 1 (KA2914A) 2 (KA2918) SW_2 : 2	3.5	4.4	5.3	V	1
	Terminal 23	V_{23}		4.8	6.0	7.2	V	
	Terminal 1	V_1		6.0	6.7	7.4	V	
Max. Attenuation		ATT Max	(Note 19)	60	—	—	dB	10
DC Volume Gain		$G_{ATT \text{ Min}}$	$R_A = 0$ $G_{ATT \text{ Min}} = 20 \log \frac{V_2}{V_{23}}$	−5.5	−3.5	−1.5	dB	10
ATT Characteristics	1	$V_1(1)$	*	3.4	3.8	4.2	V	10
	2	$V_1(2)$	**	4.5	4.9	5.3	V	10
Signal Leakage		V_{PT}	(Note 20)	—	1.0	3.0	mV_{rms}	11
AF AMP. Gain		$G_v \text{ AF}$	(Note 21)	—	20	—	dB	13
AF AMP. Distortion		THD AF	$P_{23A} = 1\text{V}_{pp}$, 400Hz SW_3 : On ATT: −26dB Setting	—	1.5	—	%	12
AF AMP. Max. Output Voltage		$V_{OAF \text{ Max}}$	(Note 21) $THD_{AF} 5\%$	1.5	2.0	—	V_{rms}	13
AF Output DC Voltage		V_3	SW_1 : 1 (KA2914A) 2 (KA2918) SW_2 : 2	6.7	7.7	8.8	V	1

* Read the 400Hz component of V_{A1} at P_2 with $R_A = 0$, set R_A so that $V_{A1'} = 1/2 V_{A1}$ (−6dB), then read DC voltage of terminal 1 (V_1).

** Read the 400Hz component of V_{A1} at P_2 with $R_A = 0$. Set R_A so that $V_{A1'} = 3.16 \times 10^{-3} V_{A1}$ (−50dB) then read DC voltage of terminal 1 (V_1).

TEST CIRCUIT

1. DC Characteristic

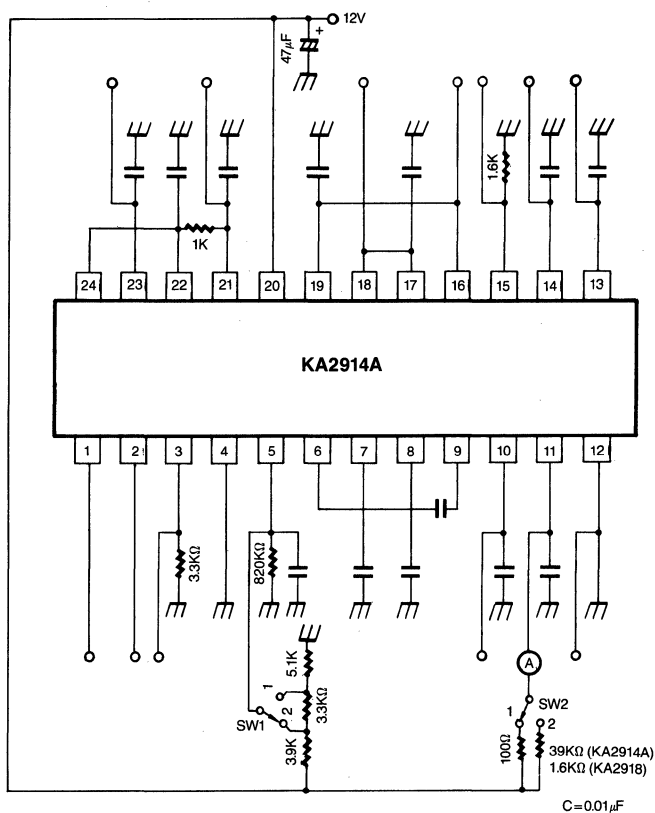


Fig. 1

2. AC Characteristic

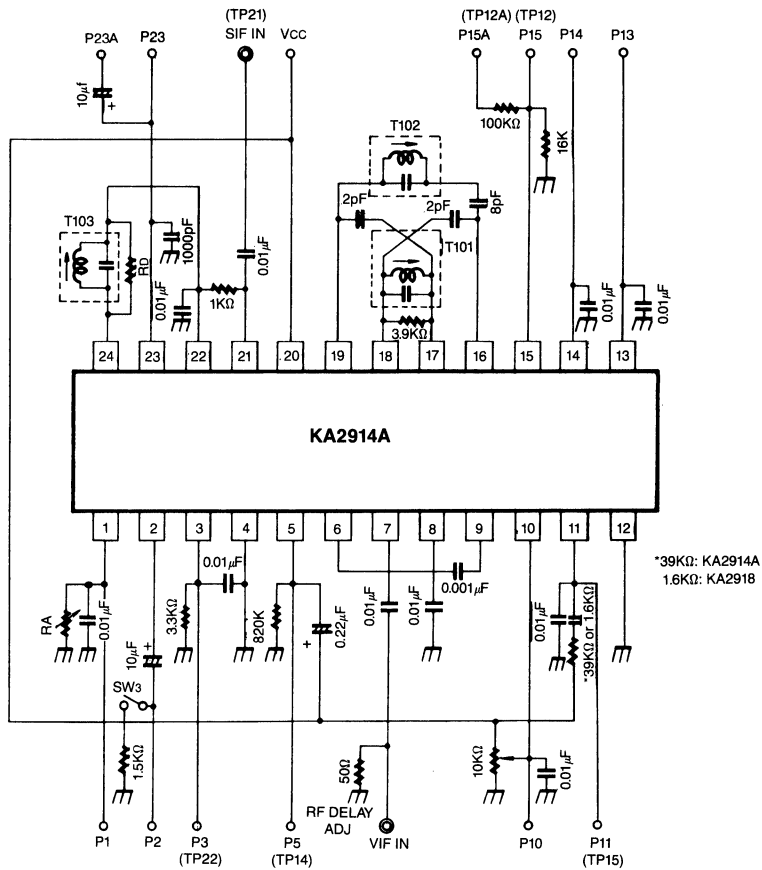


Fig. 2

3. Video Frequency Response and SIF Output Voltage

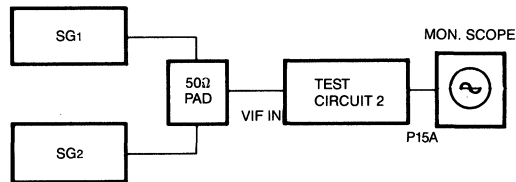


Fig. 3

4. Inter Modulation

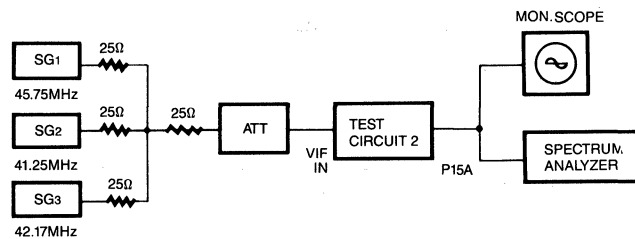
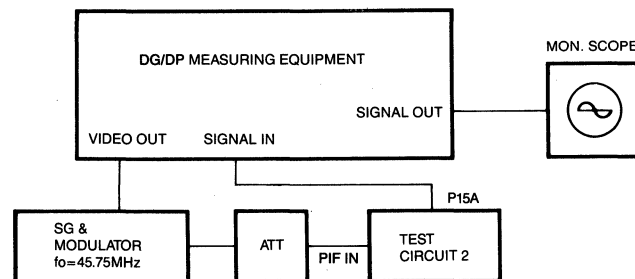


Fig. 4

5. DG, DP



APL=50%
ATT: ADJUST SYNC TIP LEVEL TO DC 2.5V

Fig. 5

6. VIF Input Impedance

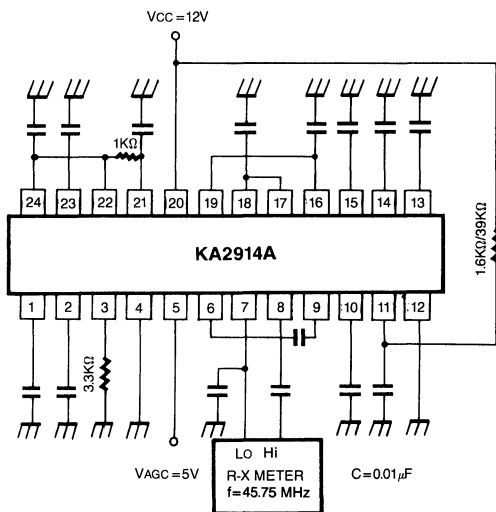


Fig. 6

7. SIF Input Impedance

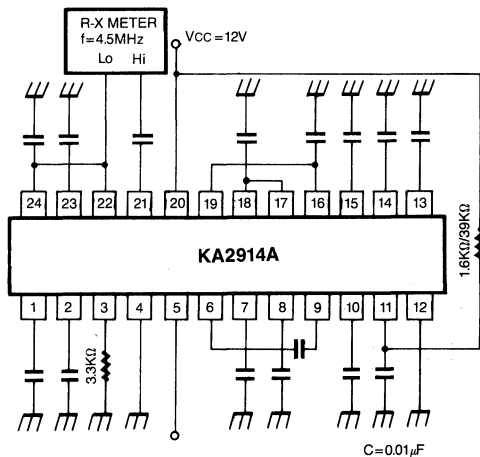


Fig. 7

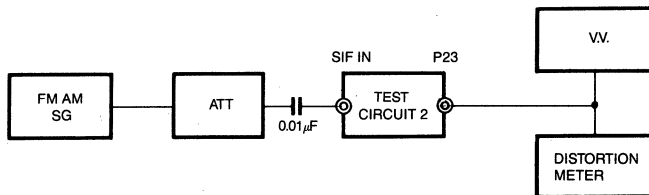
8. $v_{IN(LIM)}$, AMR, V_{OD} , THD, v_{OM} 

Fig. 8

9. Audio Output Impedance

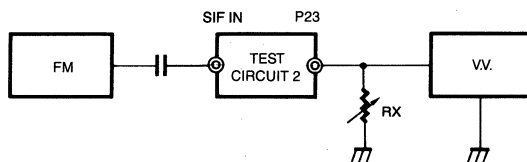


Fig. 9

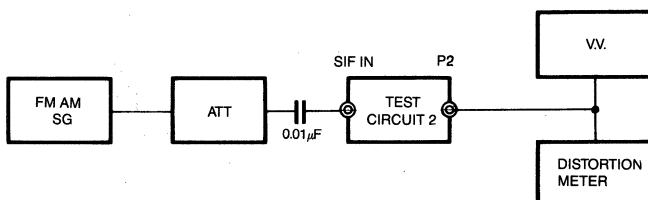
10. $ATT_{MAX.}$, $G_{ATT MIN.}$, $V_1(1)$, $V_1(2)$ 

Fig. 10

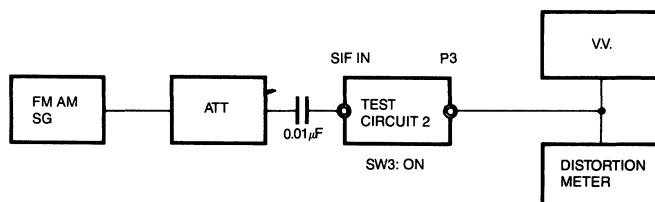
11. U_{PT} 

Fig. 11

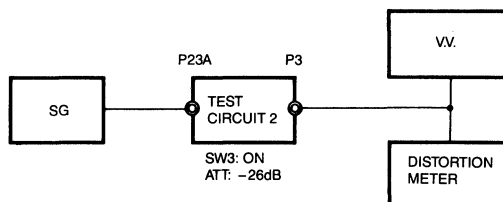
12. THD_{AF} 

Fig. 12

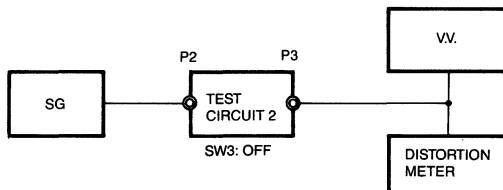
13. $G_v AF, U_{OAF MAX}$ 

Fig. 13

TEST CONDITION

Note 1) V_{AGC} (P5 EXT. Applying voltage)=11.5V

VIF in: $f=45.75\text{MHz}$ 1kHz 30% AM modulation

Adjust VIF input level U so that the detected output of P15A with high impedance probe will be $0.8V_{P-P}$ and measure the input level.

Note 2) $V_{AGC}=4V$

Measure VIF input level U same as note 1

$$\Delta A = 20 \log \frac{U}{U_0} \text{ (dB)}$$

Note 3) VIF IN: $f=45.75\text{MHz}$ CW 15mVrms

Measure DC level of P15

Note 4) VIF IN: $f=45.75\text{MHz}$ APL 100%, 87.5% AM modulation.

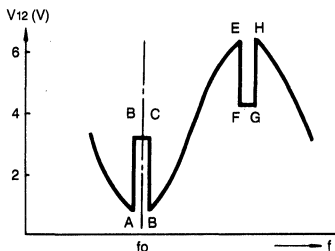
P5: open

(1) Adjust VIF input level 50mV_{P-P} and measure the detected output level U_{01P-P}

(2) Then increase the input level so that the detected output level will be $1.1 \times U_{01P-P}$ and measure the input level.

Note 5) $V_{AGC}=8V$

VIF in: $f=45.75\text{MHz} \pm 10\text{MHz}$ variable or sweep 15mVrms measure DC level of P15.



Note 6) $V_{AGC}=8V$ ($GR \approx 30\text{dB}$)

SG_1 : 45.75MHz CW

SG_2 : 45.75 ~ 40MHz variable

(1) Setting output of SG_1 so that DC level of P15 will be 4.0V

(2) Setting output of SG_2 (45.75MHz) so that AC level of P15 will be $0.5V_{P-P}$

(3) Decreasing frequency of SG_2 until AC level of P15 will be $0.35V_{P-P}$ (-3dB of $0.5V_{P-P}$) then read $f_{SG2}=F$
 $f_{BW}=45.75-F \text{ MHz}$

- Note 7) SG₁: 45.75MHz, 1kHz 80% AM modulation 100mVrms
 SG₂, SG₃: off
 Setting V_{AGC} so that output AC level of P15 will be 2.7V_{P-P}
 Measure CL of P15 after setting to 0% AM of SG₁

$$CL = 20 \log \frac{2.7}{V_{CR} (V_{P-P})} \text{ (dB)}$$

- Note 8) Measure I_{2nd} of P15 same as note 7

- Note 9) V_{AGC} = 8V

SG₁: 45.75MHz (P: picture) 100mVrms

SG₂: 41.25MHz (S: sound) 32mVrms (-10dB of SG₁)

SG₃: 42.17MHz (C: chroma) 32mVrms (-10dB of SG₁)

(1) Setting V_{AGC} so that the output tip level (lower) of P15 will be 3.0V DC

(2) Measure the level difference (dB) between C-level and 920kHz level

- Note 10) V_{AGC} = 8V

VIF IN: f = 45.75MHz video signal (RAMP) 87.5% AM 100mV_{P-P}

Setting ATT so that the SYNC TIP level of P15 will be 2.5V DC.

Measure DP and DG

- Note 11) V_{AGC} = 5V f = 45.75MHz

Measure R_{IN}, C_{IN}

- Note 12) AFT sensitivity $\Delta F/\Delta (V_{13}-V_{14})$

(1) INT, AGC (P5 open)

(2) VIF input: 45.75MHz $\pm$ 1.0MHz, CW 15mVrms

(3) Read the frequency (f₁) of VIF when V₁₃-V₁₄ = -1V

(4) Read the frequency (f₂) of VIF when V₁₃-V₁₄ = 1V then calculate

$$\Delta F/\Delta (V_{13}-V_{14}) = |f_1 - f_2|$$

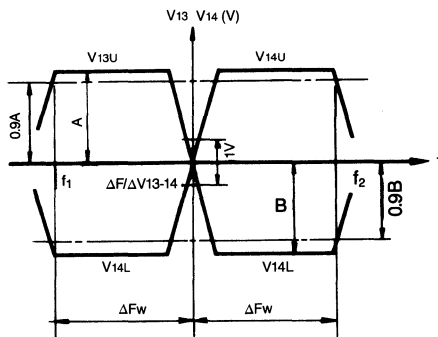
- Note 13) ΔF_W , V_{13U}, V_{14U}, V_{13L}, V_{14L}

(1) INT AGC (P5 open)

(2) VIF IN: 45.75MHz $\pm$ 10MHz CW 15mVrms

(3) 8pF at PIN 16 should be shorted

(4) Read the frequency (f₁ or f₂) when the V₅ or V₆ reduced to 90% level of A or B with varying the frequency. Then band width is the difference from center frequency (f₀).



Note 14) P5: Open

VIF IN: 45.75MHz CW 20mVrms

- (1) Adjust the voltage of terminal 3 so that the voltage of terminal 4 will be 6.0V DC
- (2) Measure the terminal voltage 3

Note 15) P5: Open

VIF in: 45.75MHz 100% APL 87.5% AM modulation signal amplitude 50mV_{P-P} Measure detected output voltage (White peak to sync tip)

Note 16) P5: Open

SG₁: 45.75MHz CW 100mVrmsSG₂: 41.25MHz CW 25mVrms

Measure SIF (4.5MHz) output voltage at P15

Note 17) SIF IN: f=4.5MHz FM f_{MOD}=400Hz Δf=±25kHz,

- (1) Adjust SIF input level 100mV_{P-P} and measure the detected output level V_{OS}
- (2) Then decrease the input level so that the detected output level will be 3dB down of V_{OS} and measure the input level

Note 18) Output impedance

- (1) SIF IN: f=4.5MHz f_{MOD}=400Hz, Δf=±25kHz, 80dB_μ

- (2) At P23 read the V₀₁ at R_X=∞, then read the R_X when recovered output become V_{01/2} with varying the R_X. The R_X is the output impedance.

Note 19) ATT MAX

- (1) SIF in: f=4.5MHz, f_{MOD}=400Hz, Δf=±25kHz, 80dB_μ

- (2) Read the 400Hz component of V_{A1} at P2 with R_A=0, then read V_{A1}' with R_A=|∞

$$\text{ATT MAX} = 20 \log \frac{V_{A1}}{V_{A1}'}$$

Note 20) U_{PT}

- (1) SIF IN: f=4.5MHz, f_{MOD}=400Hz, Δf=±25kHz, 80dB_μ

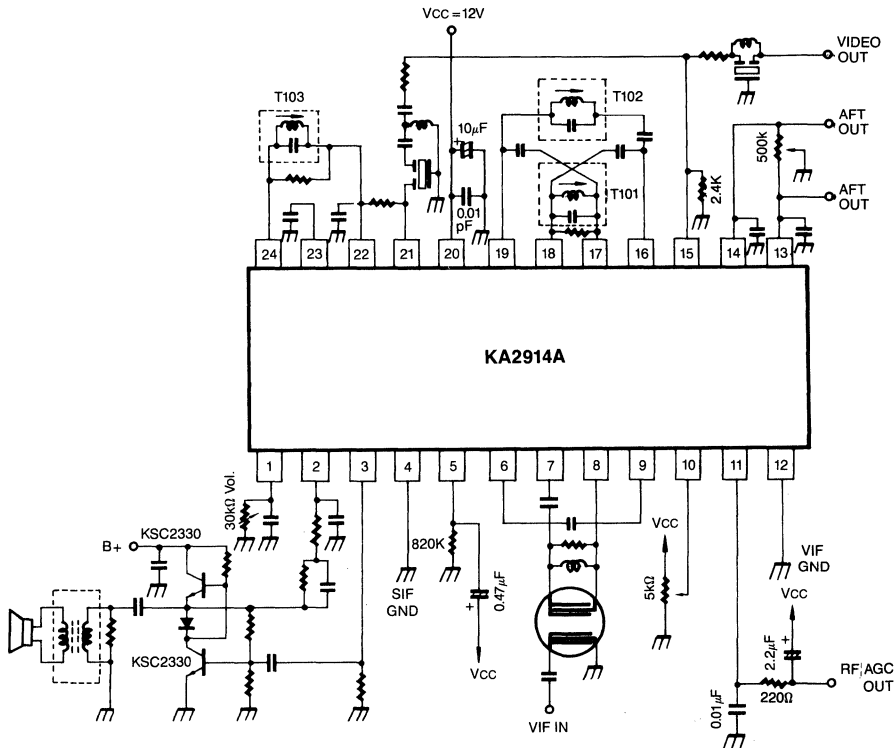
- (2) Read the 400Hz component at P3

Note 21) G_V AF

- (1) Apply 400Hz 0.1Vrms signal to P2

- (2) Read the output voltage at P3

TYPICAL APPLICATION CIRCUIT



TV VIF & SIF & DEFLECTION SYSTEM (IC FOR TV LARGE INTEGRATION)

The KA2915 is a monolithic integrated circuit containing all stages for the VIF, SIF and Deflection for television receivers.

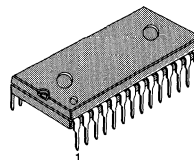
FUNCTIONS

- IF Amp.
- Video Amp.
- IF AGC
- Tuner AFT
- Sound DET. (FM DET.)
- Vertical trig.
- Vertical drive
- Horizontal drive
- Video DET. (AM DET.)
- Noise canceller
- Forward RF AGC
- SIF Amp.
- Sync separation
- Vertical oscillation
- Horizontal oscillation
- Horizontal AFC

FEATURES

- High integration technology makes possible integration of video IF circuit, tuner AFC circuit, sound IF circuit and deflection-jungle circuit on a single chip.
- Supply voltage range: 8 ~ 12V (Typ. 10V).

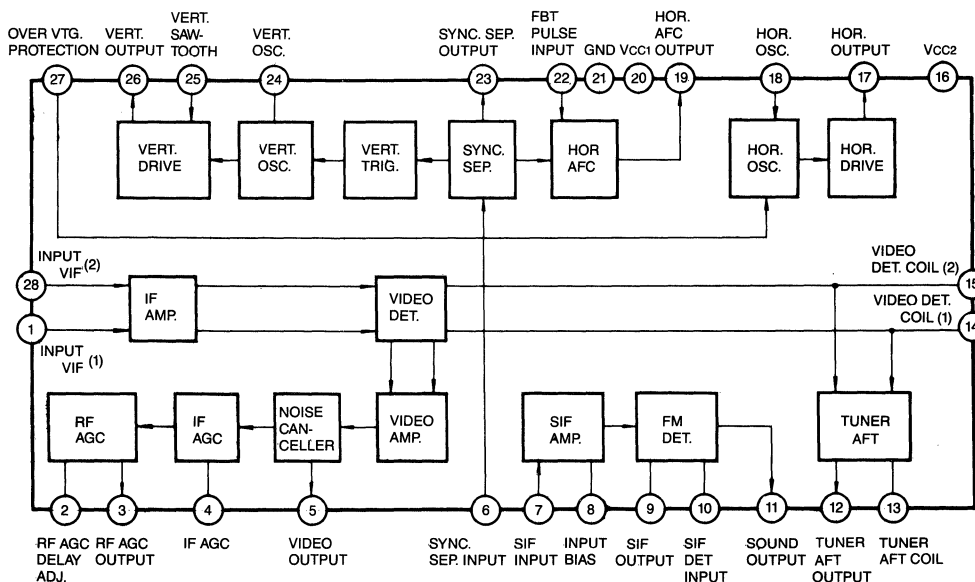
28 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2915	28 DIP	-20 ~ +70°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value		Unit
Supply Voltage	$V_{CC} (V_{20-21})$	12		V
Supply Current	I_{20}	85		mA
	I_{16}	15		mA
Circuit Voltage	$V_{2, 3, 4, 24-21}$	V_{20-21}	0	V
	V_{8-21}	5.5	0	V
	V_{13-21}	4.2	0	V
	V_{17-21}	V_{16-21}	0	V
Circuit Current	$I_{5, 6, 11, 23, 26}$	+ 0.3	- 10	mA (peak)
	I_{19}	+ 0.6	- 0.6	mA (peak)
	I_{25}	+ 10	0	mA (peak)
	I_{17}	+ 10	- 4	mA (peak)
Power Dissipation ($T_a = 70^\circ\text{C}$)	P_d	1100		mW
Operating Temperature	T_{opr}	- 20 ~ + 70		$^\circ\text{C}$
Storage Temperature	T_{stg}	- 55 ~ + 150		$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

($V_{CC1}=10\text{V}$, $V_{CC}=9.5\text{V}$, $T_a=25^\circ\text{C}$)

(Video Section)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Video Det. Output	V_O	$m=87.5\%$	2.0	2.3	2.6	V_{pp}
Input Sensitivity	V_S	$V_O = -3\text{dB}$	—	50	55	$\text{dB}\mu$
Maximum Input	V_{MAX}	$V_O > +0\text{dB}$	105	110	—	dB
SN Rating	S/N	$V_i = 80\text{dB}\mu$	51	56	—	dB
Differential Gain	DG	$m=87.5\%$	—	4	8	%
Differential Phase	DP	$m=87.5\%$	—	3	6	deg
Video Freq. Characteristic	f_C	$V_O = -3\text{dB}$	4.5	6.0	8.0	MHz
Sync. Peak Voltage	V_P		1.9	2.3	2.7	V
Noise Inverter Output Level	V_{NT}		1.0	1.4	1.8	V
Noise Inverter Capture Level	V_{NI}		3.0	4.0	5.0	V
Sound IF Output	V_{SIF}	$P/S=20\text{dB}$	100	104	107	$\text{dB}\mu$
Input Resistor	R_{i1}	$f=45.75\text{MHz}$	0.8	1.0	1.2	Kohm
Input Capacitor	C_{i1}	$f=45.75\text{MHz}$	3.0	3.4	3.8	pF
Output Resistor	R_{O5}	$f=500\text{kHz}$	30	50	150	ohm
RF AGC Gain	$G_{RF AGC}$	$f=10\text{kHz}$, $V_4=5\text{mV}$	36	42	48	dB
RF AGC Max. Voltage	$V_3 (\text{Max.})$		8.2	8.8	9.4	V
RF AGC Min. Voltage	$V_3 (\text{Min.})$		3.6	4.2	4.8	V
AFT Center Voltage	V_2		4.0	5.4	6.0	V

(Continued)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
AF SW Operating Voltage	$V_{ART\ SW}$	$R_S = 10K\Omega$	0.5	2.6	3.0	V
AF Maximum Output Voltage	$V_{12} (Max.)$		8.5	9.6	10.0	V
AF Minimum Output Voltage	$V_2 (Min.)$		0	0.7	1.2	V
Selection Sensitivity	μ	$R_L = 68K\Omega/82K\Omega$	30	50	90	mV/kHz

(Sound Section)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Sound Det. Output	V_O	$f_O = 4.5MHz, f_M = 400Hz$ $\Delta f = \pm 25kHz, V_i = 100mVrms$	200	300	440	mVrms
Input Limit Voltage	$V_i (lim)$	$f = 4.5MHz, f_M = 400Hz$ $\Delta f = \pm 25kHz$	—	280	450	$\mu Vrms$
Total Harmonic Distortion	THD	$f_O = 4.5MHz, f_M = 400Hz$ $\Delta f = \pm 25kHz, V_i = 100mVrms$		0.6	1.0	%
AM Rejection Ratio	AMR		43	55	—	dB
Input Impedance	R_{17}	$f = 4.5MHz$	6	20	100	$K\Omega$
	C_{17}		1.3	4.3	7.3	pF
Detector Input Impedance	R_{D9}	$f = 4.5MHz$	2.0	3.0	4.0	$K\Omega$
	C_{D9}		2.1	5.1	8.1	pF
	R_{D10}		50	200	—	$K\Omega$
	C_{D10}		2.9	3.4	3.9	pF

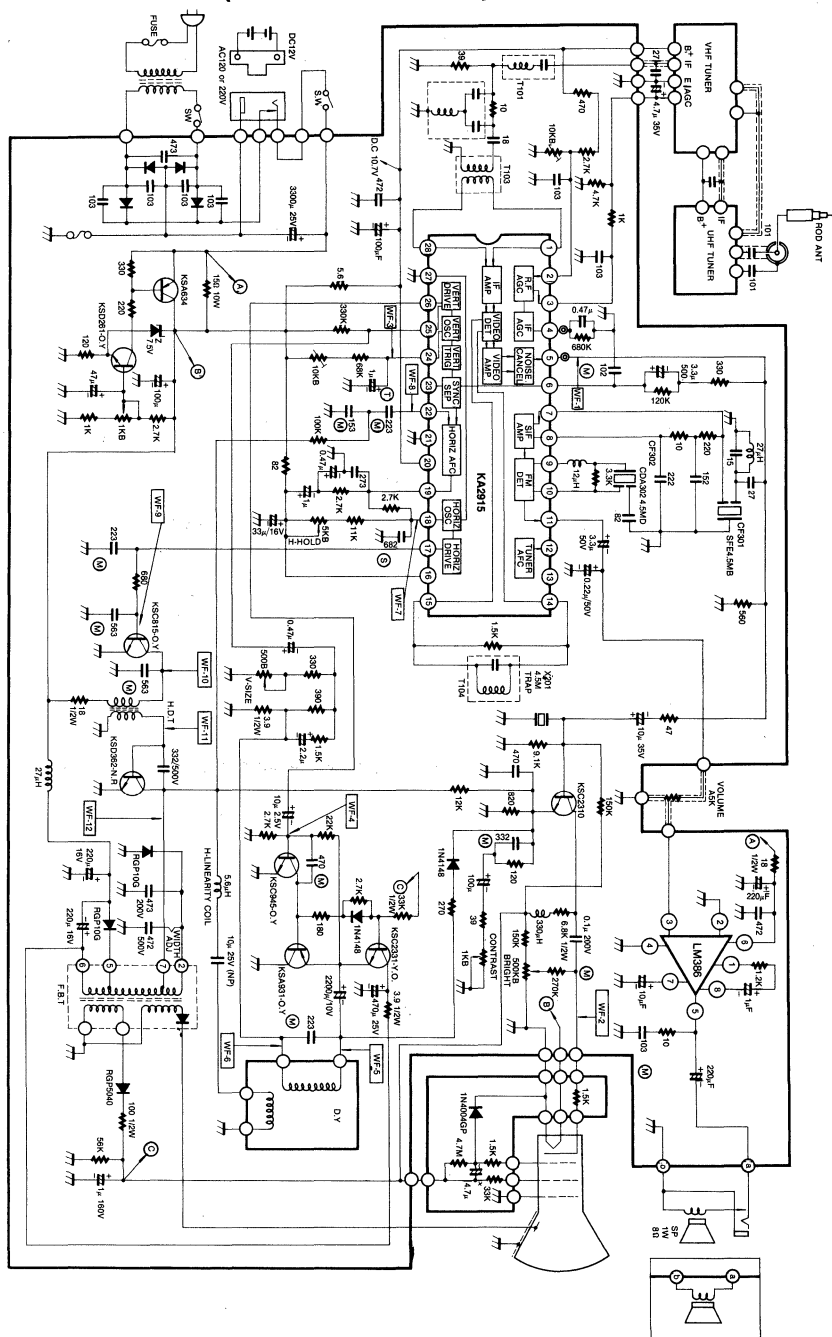
(Deflection Section)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Sync Sep. Hori. Pulse Width (1)	T_{SYNC1}	Video Input 2.5V _{P-P} , APL=50%, $V_{CC1} = 10V$	4.8	5.1	5.4	μs
Sync Sep. Hori. Pulse Width (2)	T_{SYNC2}	Video Input 1.0V _{P-P} , APL=50% $V_{CC1} = 10V$	4.9	5.2	5.5	μs
Hori. AFC Hori. Pulse Width (1)	T_{SYNC3}	Video Input 2.5V _{P-P} , APL=50% $V_{CC1} = 10V$	4.8	5.1	5.4	μs
Hori. AFC Hori. Pulse Width (2)	T_{SYNC4}	Video Input 1.0V _{P-P} , APL=50% $V_{CC1} = 10V$	4.9	5.2	5.5	μs
Vert Osc. Start Supply Voltage	V_{FVOS}	$f_{VO} = 50 \sim 70Hz$ Output=0.7V _{P-P}	—	—	6	V
Vert. Free Running Frequency	f_{VO}	$R_{OSC(V)} = 31.5K\Omega$	57	60	63	Hz

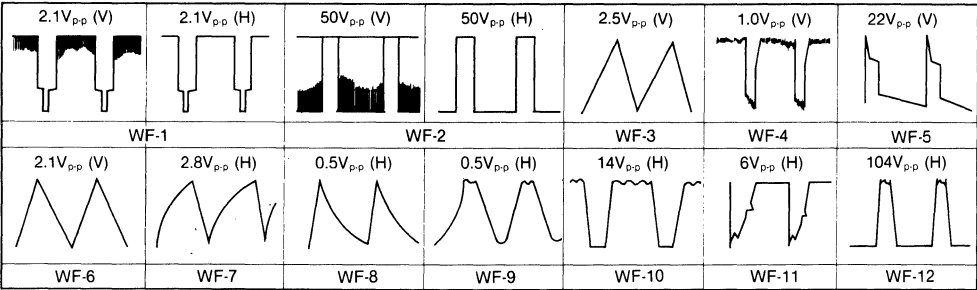
(Continued)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Vert. OSC. Pulse Width	T_{VO}	$R_{OSC(V)} = 31.5K\Omega$	470	650	830	μs
Vert. OSC. Freq. Voltage Dependent	$\Delta f_{VO}/V_{CC}$	$V_{CC1} = 12V, 8V$ $\Delta f_{VO}/V_{CC} = f_{VO}(12V) - f_{VO}(8V)$	0	1.0	1.3	Hz
Vert. Full in Range	f_{PV}	Composite Signal Input $2V_{P-P}$	—	44	48	Hz
Hori. OSC. Start Supply Voltage	$V_{FHO.S}$	$f_{HO} = 10 \sim 20kHz$ Output = $1V_{P-P}$ Pin 16 Voltage	—	—	5	V
Hori. OSC. Freq.	f_{HO}	$R_{OSC(H)} = 21K\Omega$	15.0	15.75	16.25	kHz
Hori. OSC. Pulse Width	T_{HO}	$R_{OSC(H)} = 21\Omega$	23	26	29	μs
Hori. OSC. Freq. Voltage Dependent	f_{HO}/V_{CC}	$V_{CC2} = 10V, 8V$ $\Delta f_{HO}/V_{CC} = f_{HO}(10V) - f_{HO}(8V)$	0	50	100	Hz
Hori. OSC. Control Sensitivity	β	$\Delta I_1 \pm 100\mu A$ Input Variable OSC. Freq. Variable	73	81	89	Hz/ μA
Phase Det. Sensitivity	μP	TV Input $2V_{P-P}$, $R_{(U)} = 31.4K\Omega$, $\mu = V19 \times 10$	13.5	16.5	19.5	$\mu A/\mu s$
X-Ray Protector Operating Voltage	$V_{27.21}$		0.81	0.87	0.93	V
X-Ray Protector Input Resistor	R_{27}		16	19	22.5	$K\Omega$

APPLICATION CIRCUIT (12" or 14" B/W TV)



APPLICATION CIRCUIT (12" or 14" B/W TV) (Continued)



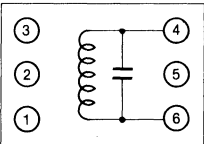
Change the SPEC as follow Table for Your System

Location	System				
	B	D	I	IRELAND	AUSTRALIA
X201	5.5	6.5	6.0	6.0	5.5
CF301	SFE	SFE	SFE	SFE	SFE
	5.5	6.5	6.0	6.0	5.5
CF302	CDA	CDA	CDA	CDA	CDA
	5.5	6.5	6.0	6.0	5.5

- NOTES: 1. All resistance values in ohm K = 1,000 M = 1,000,000.
2. All capacitors not noted in schematic diagram are in pF the 3rd numeral of capacitance value indicated 10³ multiplier (EX: 683→68,000 pF).
3. Voltage reading taken with V.T.V.M. from point indicated to chaassis ground tuner on unused channel at max other controls at normal line voltage 120 volts.
4. All waveforms measured with strong signal input contrast set give normal picture.
5. Voltage reading may vary 10%.
6. This fundamental circuit diagram some production changes may be made without revision of the diagram.

COIL SPECIFICATION

T104 Video Detector Coil



Bottom View

C _o (pF)	f (MHz)	Q _o	Turns
4-6	45.75	4-6	4-6
51		100	5 7/8t

Wire: 0.3mm ϕ

(VIF + SIF) SYSTEM FOR COLOR TV

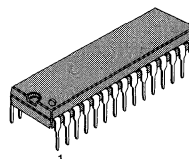
The KA2919 is a silicon monolithic integrated circuit containing the VIF section and SIF section on a single chip in the DIP 30S package (equivalent to the DIP 22 package heretofore in use) of shrink type. Since the KA2919 is capable of performing video detection and sound detection independently or simultaneously, it can be applied to various sets from popular type to high-grade type according to the designer's policy.

FUNCTIONS**VIF**

- VIF Amp
- Video Det
- Peak IF AGC
- B/W Noise Canceller
- RF AGC
- AFT
- SIF Det

SIF

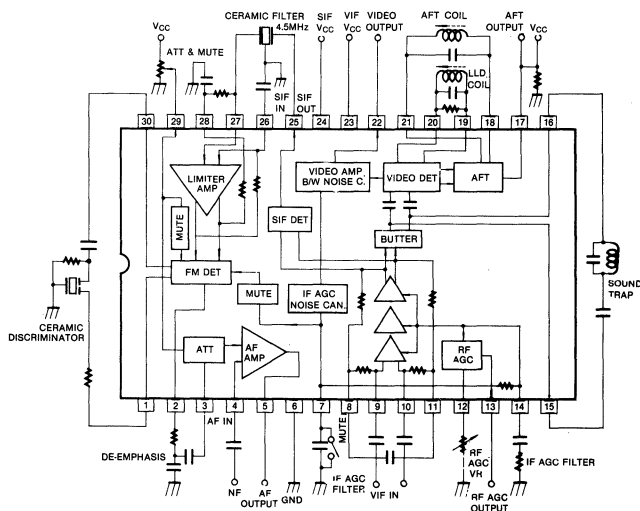
- SIF Limiter Amp
- FM Det
- DC ATT
- AF Driver

30 SDIP**FEATURES**

- High-gain VIF amp requiring no preamp
- High AGC speed
- Provides wide-band detection characteristic and meets sound MPX demodulation requirements because of FM detection being quadrature detection
- Possible to use sound REC pin (pin 2), AUX pin (pin 3)
- Possible to mute video, sound for VTR
- Pin 7 GND: Muting of both video and sound
- Pin 29 GND: Muting of sound only

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2919	30 SDIP	- 20 ~ + 70°C

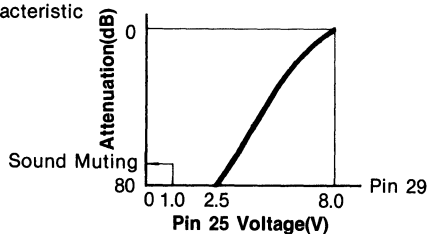
BLOCK DIAGRAM

ELECTRICAL CHARACTERISTICS

VIF SECTION ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$ (VIF), $f_o = 4.5\text{MHz}$ (SIF))

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit	Test FIG.
Total Circuit Current	$I_{23} + I_{24}$	DC	59	74	98	mA	1
Maximum RF AGC Voltage	V_{13H}	DC	8.5	8.9	9.2	V	1
Minimum RF AGC Voltage	V_{13L}	DC		0	0.5	V	1
Quiescent Video Output Voltage	V_{22}	DC	5.6	6.1	6.6	V	1
Quiescent AFT Output Voltage	V_{17}	DC	4.5	6.5	7.5	V	1
Input Sensitivity	V_i	$f_m = 400\text{Hz}$ 40% AM, $V_o = 0.8V_{pp}$	30	36	42	$\text{dB}\mu$	2
AGC Range	G_R	$f_m = 15\text{KHz}$ 78% AM, $V_o = \pm 1\text{dB}$	60	74		dB	2
Maximum Allowable Input	$V_{i \max}$ $V_{i \max}$	$f_m = 15\text{KHz}$ 78% AM, $V_o = \pm 1\text{dB}$	100	500		mV_{rms}	2
Video Output Amplitude	$V_{O(22)}$	$V_i = 10\text{mV}_{\text{rms}}$, $f_m = 15\text{KHz}$ 78% AM	1.9	2.2	2.5	V_{pp}	2
Output S/N	S/N	$V_i = 10\text{mV}_{\text{rms}}$ CW	48	54		dB	2
Carrier Leakage	C_L	$V_i = 100\text{mV}_{\text{rms}}$, $f_m = 15\text{KHz}$ 78% AM	50	57		dB	2
Maximum AFT Voltage	V_{17H}	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	11	11.5	12.0	V	2
Maximum AFT Voltage	V_{17L}	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	0	0.4	1.0	V	2
AFT Detection Sensitivity	S_f	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	70	100	140	mV/KHz	2
White Noise Threshold Level	V_{WTH}	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	6.4	6.8	7.2	V	2
White Noise Clamp Level	V_{WCL}	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	4.2	4.6	5.0	V	2
Black Noise Threshold Level	V_{BTH}	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	1.9	2.2	2.5	V	2
Black Noise Clamp Level	V_{BCL}	$V_i = 10\text{mV}_{\text{rms}}$ SWEEP	3.8	4.2	4.6	V	2
SIF Output Signal Voltage	$V_{O(25)}$	P/S = 20dB	40	60	100	mV_{rms}	2
Frequency Characteristic	f_c	-3dB	6	8		MHz	2
Differential Gain	DG	$V_i = 10\text{mV}_{\text{rms}}$ 87.5% VIDEOMOD		4	10	%	2
Differential Phase	DP	$V_i = 10\text{mV}_{\text{rms}}$ 87.5% VIDEOMOD		3	6	deg	2
Input Resistance	R_i		1.0	1.5	2.0	Kohm	2
Input Capacitance	C_i			3.5	7.0	pF	2

*Electronic Volume Control Characteristic



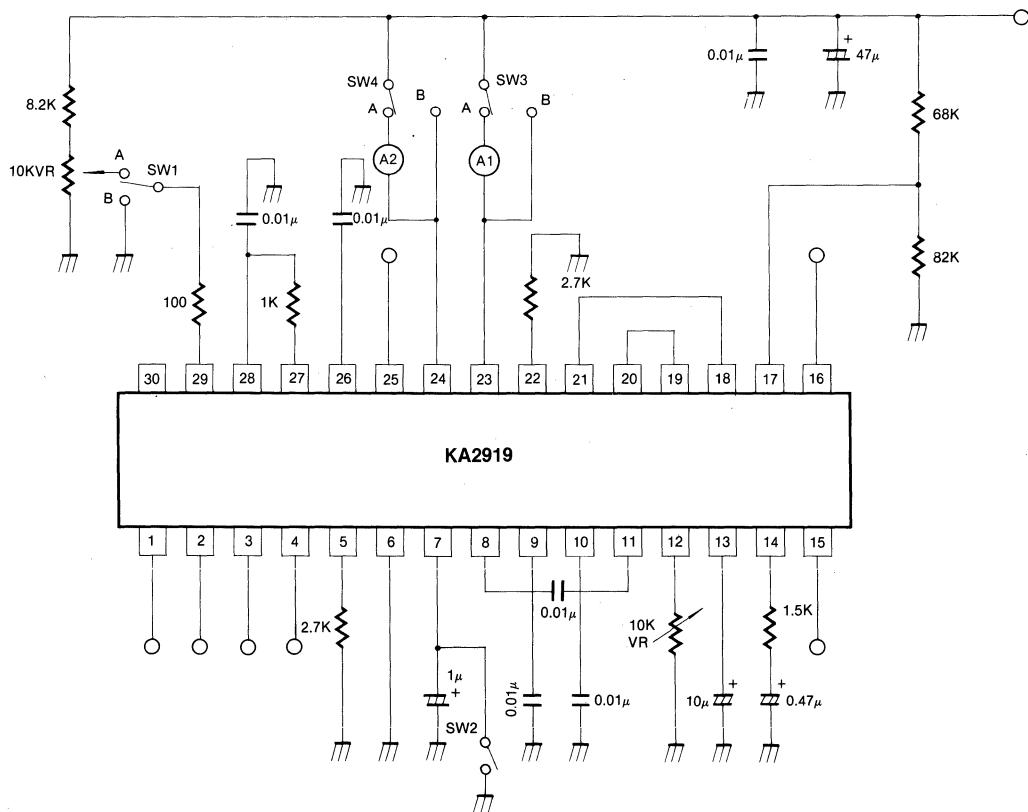
LINEAR INTEGRATED CIRCUIT

SIF SECTION ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $f_p = 45.75\text{MHz}$, $f_s = 41.25\text{MHz}$ (VIF), $f_o = 4.5\text{MHz}$ (SIF))

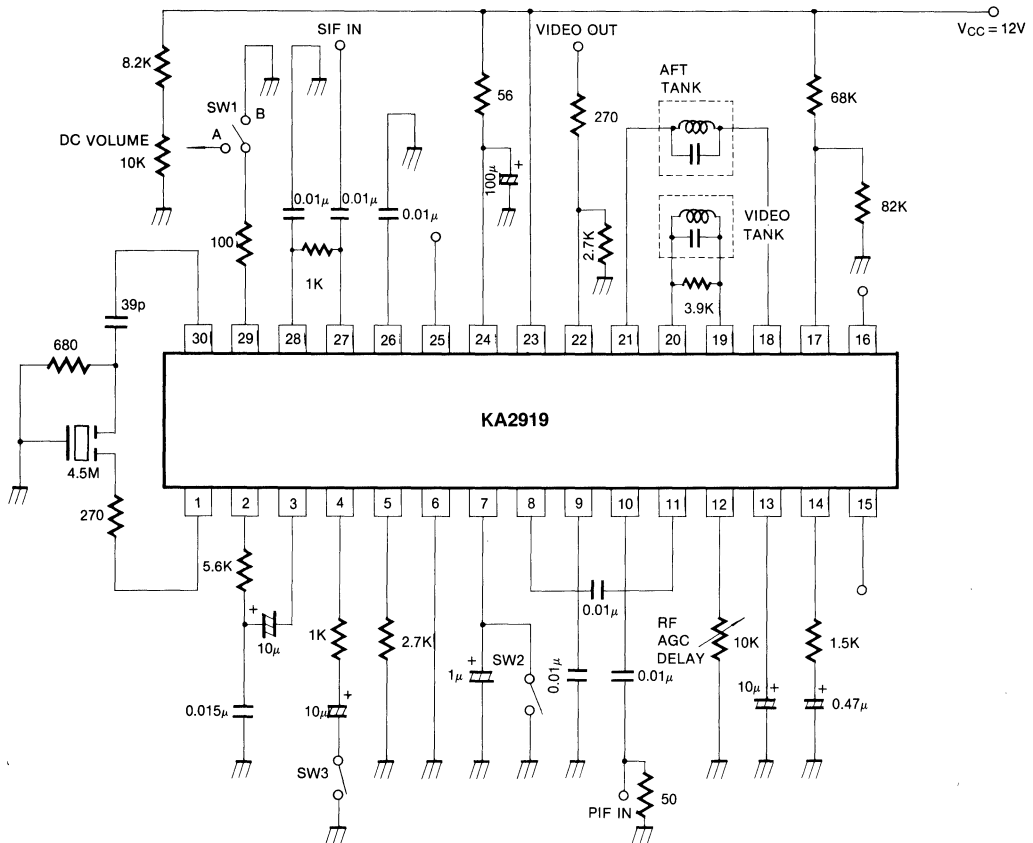
Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit	Test PIG.
SIF Limiting Voltage	V_i lim	- 3dB		200	400	μV_{rms}	2
Detection Output Voltage	V_o (2)	$V_i = 100mV_{rms}$, $f_m = 400Hz$, $f = \pm 25KHz$	450	680	850	mV_{rms}	2
Distortion	THD (2)	$V_i = 100mV_{rms}$, $f_m = 400Hz$, $f = \pm 25KHz$		0.5	1.0	%	2
AM Rejection	AMR	$V_i = 100mV_{rms}$, $f_m = 400Hz$, $f = \pm 25KHz$ 30% AM	50	60		dB	2
DCVR Maximum Attenuation	A_{TT}	$V_i = 200mV_{rms}$, $f = 400Hz$	70	80		dB	2
AF Amp Gain	G_{AF}	$V_i = 100mV_{rms}$, $f = 400Hz$	18	20	22	dB	2
AF Amp Output Voltage	V_o (5)	V_o (5) THD = 10%, $f = 400Hz$	3	4		V_{rms}	2

TEST CIRCUIT

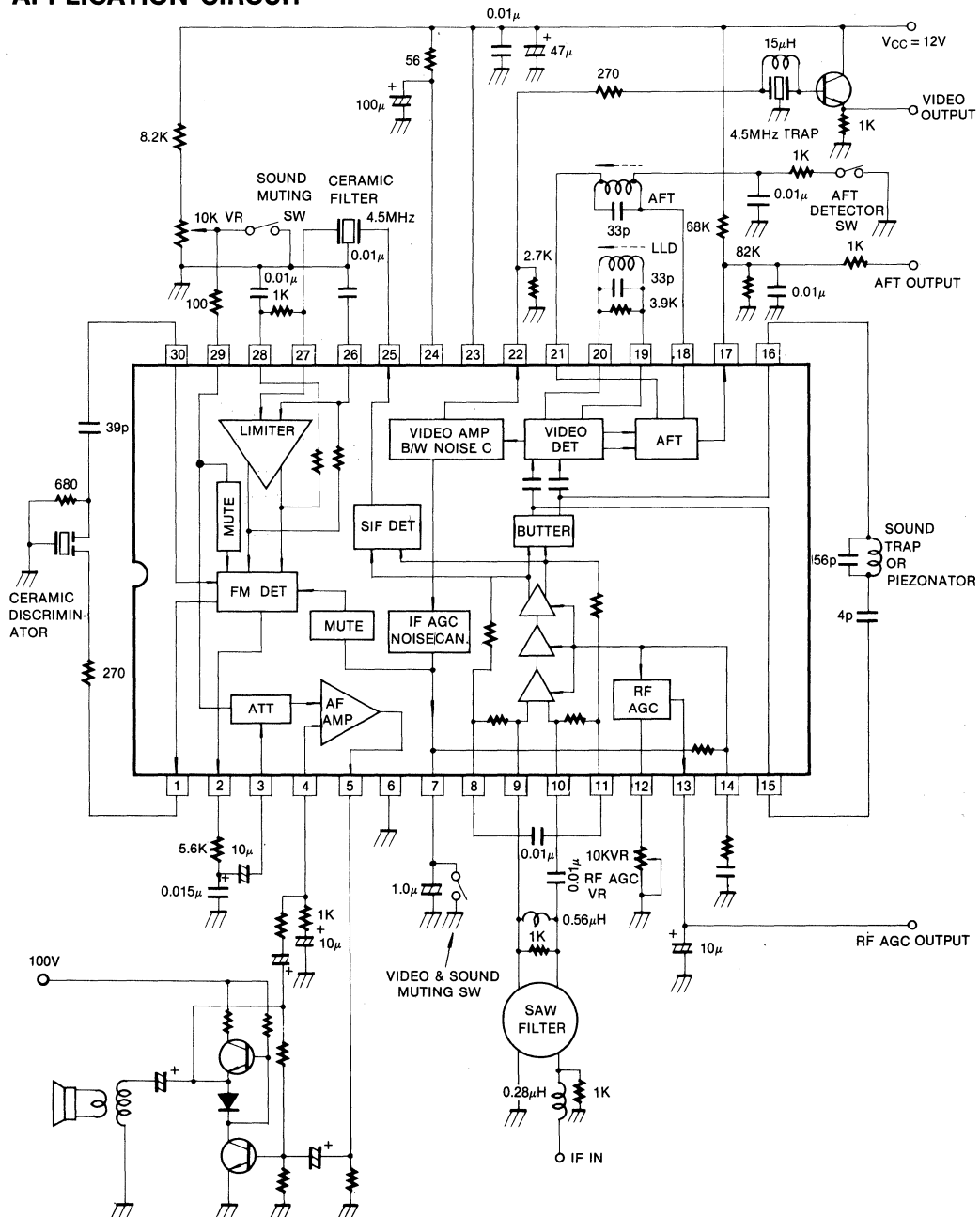
1. DC TEST



2. AC TEST



APPLICATION CIRCUIT



VIDEO & SOUND IF AMPLIFIER FOR TV SETS, VTR'S

The KA2922/23 is a monolithic integrated circuit containing the VIF stage & SIF stage on a single chip in the 20 dual in-line package.

The use of the small sized package serves to make VCR tuner units smaller.

*KA2922: for forward AGC Type

*KA2923: for reverse AGC Type

FUNCTION

VIF Stage

- VIF Amplifier
- Video Det. (AM DET)
- AFT
- Video Mute
- VIF AGC Noise canceller
- RF AGC
- Band width Noise canceller

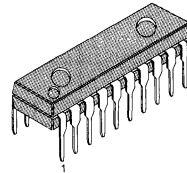
SIF Stage

- Sound Mute
- SIF limiter Amp
- FM Detector

FEATURES

- High-Gain VIF requiring no pre AMP
- Higher AGC Speed
- Non-Adjusting can be attained by using a ceramic discriminator because of FM detection being quadrature detection.
- Possible to mute video, sound for VTR
- Small-sized package
- Minimum number of external parts required
- Operable from 9V supply

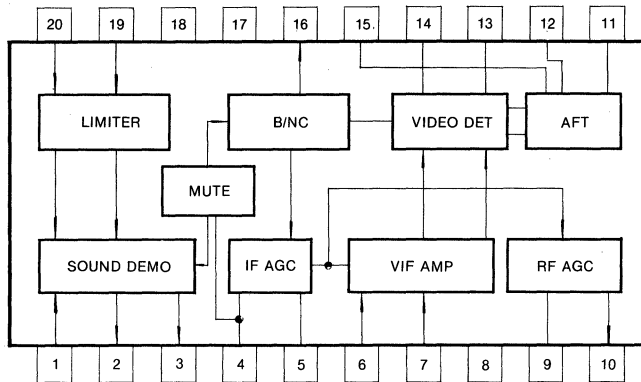
20 DIP



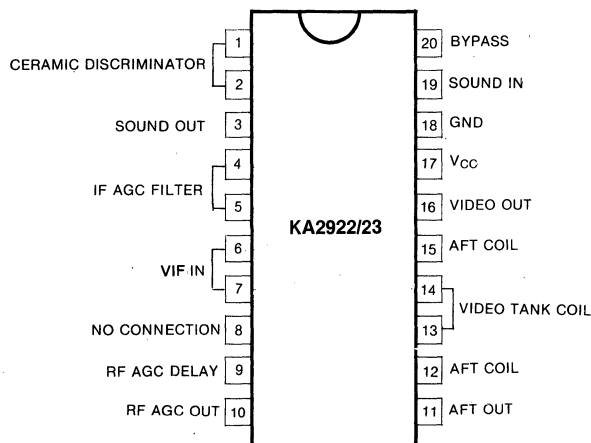
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2922	20 DIP	- 20 ~ + 70 °C
KA2923		

BLOCK DIAGRAM



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Maximum Voltage	V _{CC} (Pin 17)	14	V
Minimum Voltage	V _{CC} (Pin 17)	9	V
Maximum Power Dissipation	P _D	1.0	W
Maximum Operating Temperature	T _{opr}	-20 ~ +70	°C
Storage Temperature	T _{stg}	-55 ~ +150	°C

ELECTRICAL CHARACTERISTICS

PIF Section (Ta = 25°C, V_{CC} = 12V, fp = 45.75MHz, fm = 15KHz)

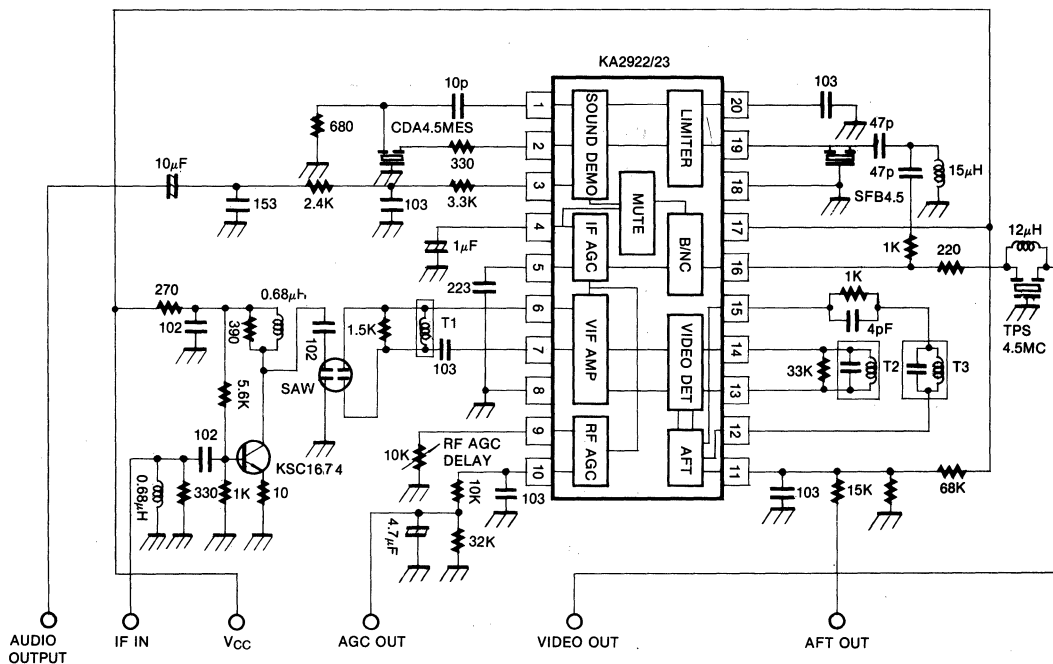
*KA2923

Characteristic	Symbol	Test Condition	Spec			Unit
			Min	Typ	Max	
Total Supply Current	I ₁₇	V _I = 0	42	58	74	mA
Maximum RF AGC Voltage	V _{10H}	Pin 4 (1.5V)	10	10.5	11	V
		Pin 4 (7V)*	8.5	8.9	9.2	V
Minimum RF AGC Voltage	V _{10L}	Pin 4 (7V)		0	0.5	V
		Pin 4 (1.5V)*		0	0.5	V
Video Output Voltage	V ₁₆	DC	5.6	6.1	6.6	V
AFT Output Voltage	V ₁₁	DC	4.5	6.58	7.5	V
Input Sensitivity	V _I	AM = 40%, V _O = 0.8V _{p-p}	30	36	42	dBμ
AGC Range	G _R	AM = 40%, V _O = 0.8V _{p-p}	57	65		dB
Video Output Amplitude	V _O (16)	V _I = 10mV _{rms} , AM = 78%	1.9	2.2	2.5	V _{p-p}
Carrier Leakage	C _L	V _I = 100mV _{rms} , AM = 78%	50	55		dB
Maximum AFT Voltage	V _{11H}	V _I = 10mV _{rms} , 45.75MHz ± 1.5MHz	11	11.4		V
Minimum AFT Voltage	V _{11L}	V _I = 10mV _{rms} , 45.75MHz ± 1.5MHz		0.5	1.0	V
AFT Det. Sensitivity	S _I	V _I = 10mV _{rms} , Sweep	80	110	150	mV/KHz
White Noise Thres. Level	VW _{TH}	V _I = 10mV _{rms} , Sweep	6.4	6.8	7.2	V
White Noise Clamp Level	VW _{CL}	V _I = 10mV _{rms} , Sweep	4.2	4.6	5.0	V
Black Noise Thres. Level	VB _{TH}	V _I = 10mV _{rms} , Sweep	2.1	2.4	2.7	V
Black Noise Clamp Level	VB _{CL}	V _I = 10mV _{rms} , Sweep	3.8	4.2	4.6	V
Sync Tip Level Voltage	V _{sync}	V _I = 10mV _{rms}	3.3	3.6	3.9	V

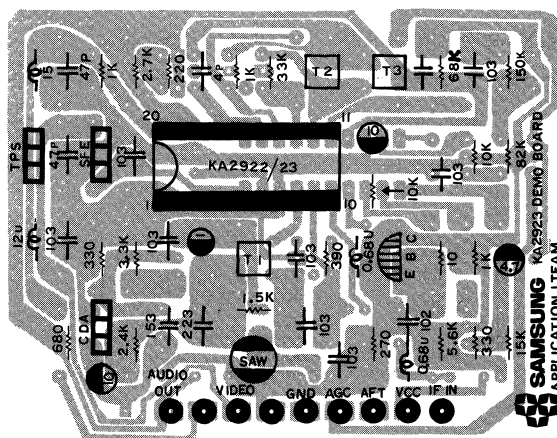
SIF Section (Ta = 25°C, V_{CC} = 12V, fs = 4.5MHz, fm = 400Hz, f = ± 25KHz)

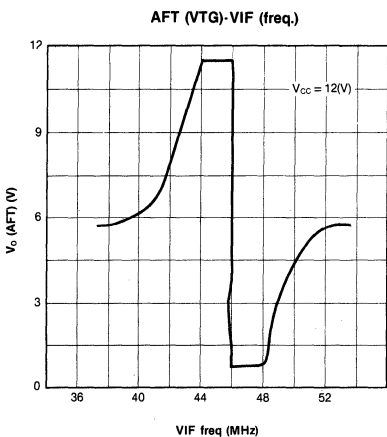
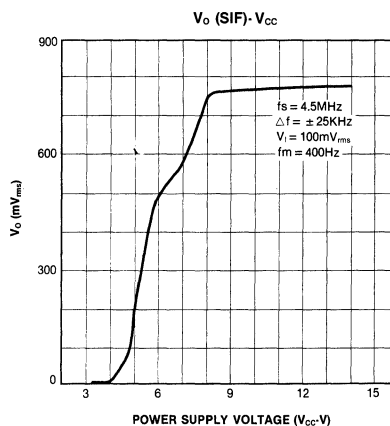
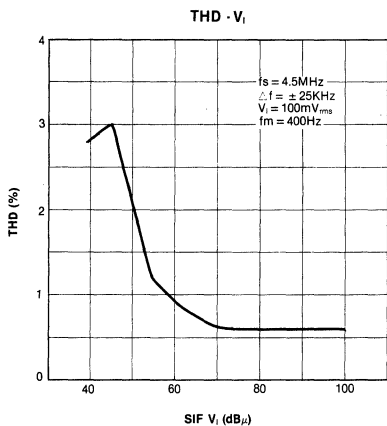
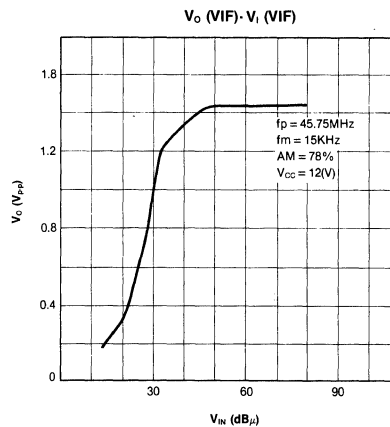
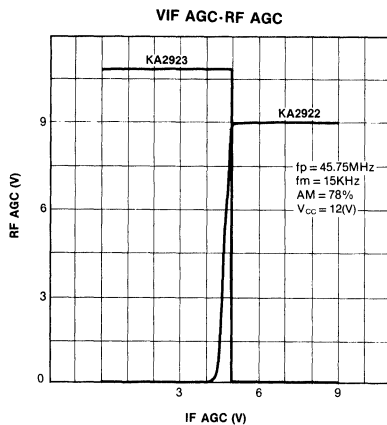
Characteristic	Symbol	Test Condition	Spec			Unit
			Min	Typ	Max	
SIF Det. Output Voltage	V _O (5)	f = ± 25KHz, fm = 400Hz V _I = 100mV _{rms}	450	680	850	mV _{rms}
Distortion	THD	f = ± 25KHz, fm = 400Hz V _I = 100mV _{rms}		0.5	1.3	%
AM Rejection	AMR	f = ± 25KHz, AM = 30% V _I = 100mV _{rms}	50	60		dB
SIF Limiting Voltage	V _{lim}	V _O = - 3dB		200	500	μV _{rms}

APPLICATION CIRCUIT



DEMO. PC BOARD (SCALE 1:1)





WRITE & READ AMPLIFIER

The KA2944 is a silicon integrated circuit designed for write and read amplifier in a VTR system.

FUNCTIONS

Recording

- Sync tip clamp
- Dynamic emphasis (nonlinear emphasis)
- Main pre-emphasis
- White and Dark clip
- Frequency modulation
- REC buffer amplifier

Playback

- Pre-Amp (CH1/CH2)
- Switch Amp
- FM AGC
- DOC

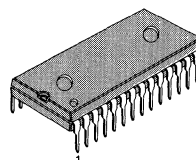
FEATURES

- Single power supply
- REC/PB mode change by micro computers
- FM output and pre-amp output terminals are separated.
- SW signal input terminal for SW Amp (Deleting DO detecting pulse output terminal)

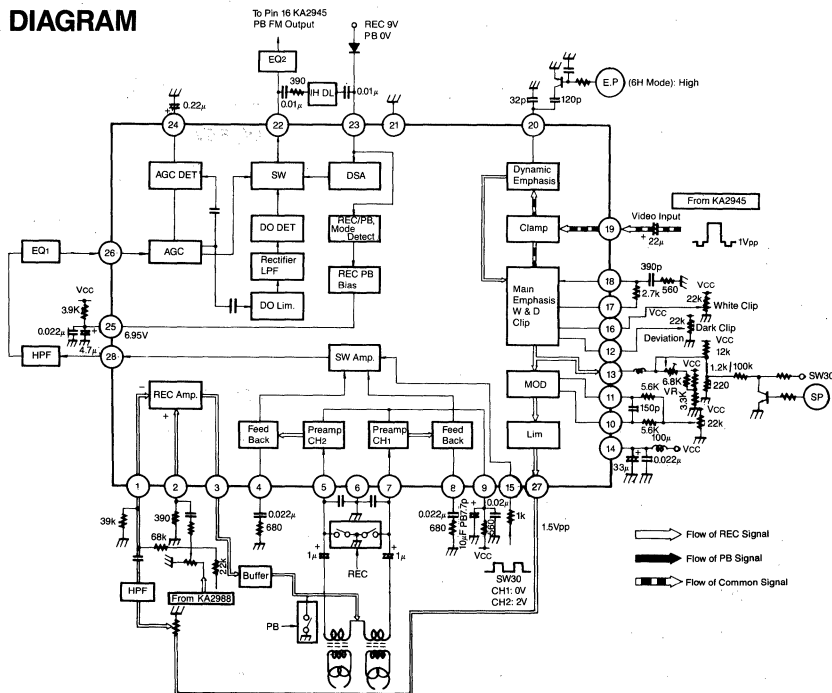
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2944	28 DIP	- 10 ~ + 75°C

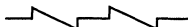
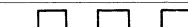
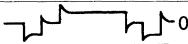
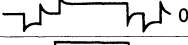
28 DIP



BLOCK DIAGRAM



PIN FUNCTIONS

Pin No.	Functions	Signals	Note
1	Recording Buffer Amp Input Terminal 1	FM (+Color is Possible)	
2	Recording Buffer Amp Input Terminal 2	Color	
3	Recording Buffer Amp Output Terminal	FM+Color 5V _{p-p}	DC 4.4V
4	CH-2 Pre-amp. Feedback Terminal	FM+Color	2.2K Ω
5	CH-2 Pre-amp. Input Terminal	FM+Color	
6	Pre-amp. GND		
7	CH-1 Pre-amp. Input Terminal	FM+Color	
8	CH-1 Pre-amp. Feedback Terminal	FM+Color	2.2K Ω
9	V _{CC} for Pre-amp.	$\approx 7.7V$	
10	Capacitor Terminal for FM modulation		
11	Capacitor Terminal for FM modulation		
12	Dark Clip Adjustment Terminal	DC 4.5V	
13	FM Demodulation, Demodulated Waveform Output Terminal		
14	V _{CC}	9V	
15	Pre-amp. CH Switch Signal Input Terminal		
16	White Clip Adjusting Terminal	DC 6.5V	
17	Main Pre-emphasis Output Terminal	 0.46V _{p-p}	
18	Main Pre-emphasis Feedback Terminal	 0.46V _{p-p}	
19	Recording Luminance Signal Input	 1V _{p-p}	
20	Dynamic Pre-emphasis Adjusting Terminal		2K Ω
21	GND		
22	FM AGC & DOC Output Terminal	FM 0.8V _{p-p}	
23	1H Delay Signal Input Terminal REC/REC Modes Switching Terminal	FM=DC REC 6.7 to 9.0V REC OPEN 4.36	730 Ω
24	FM AGC Filter Terminal	DC ($\approx 0.8V$)	5K Ω
25	Stabilize Voltage Terminal	DC 6.95V	
26	FM AGC Input Terminal	FM 0.3V _{p-p}	5.6K Ω
27	FM Demodulation Output Terminal	FM 1.5V _{p-p}	200 Ω
28	Pre-amp. Output Terminal	FM+Color	22 Ω

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	14.2	V
Power Dissipation	P_d	800*	mW
Operating Temperature	T_{opr}	-10 ~ +75	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

*Value at $T_a = 61^\circ\text{C}$, Recommended supply voltage: $9 \pm 1\text{V}$.

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Current at PB	$I_{CC}(\text{PB})$	PB Mode, at $V_{CC} = 9\text{V}$ Current flowing to pin 14	22.5	29.0	38.5	mA
Pre-amp. Open Gain CH-1	GPO 1	Pin 7 Sine wave (0.53mV _{p-p} 0.6MHz) Input, Measure Output at pin 28	58.8	61.8	64.8	dB
Pre-amp. Open Gain CH-2	GPO 2	Pin 5 Sine wave (0.53mV _{p-p} 0.6MHz) Input, Measure Output at pin 28	58.8	61.8	64.8	dB
Pre-amp. Open Gain Difference	GPO	GPO 1 — GPO 2	-1.2	0	1.2	dB
Pre-amp. Feedback Gain CH-1	GPF 1	Pin 7 Sine wave (0.53mV _{p-p} 0.6MHz) Input, Measure Output at pin 28	57.0	60.0	63.0	dB
Pre-amp. Feedback Gain CH-2	GPF 2	Pin 5 Sine wave (0.53mV _{p-p} 0.6MHz) Input, Measure Output at pin 28	57.0	60.0	63.0	dB
Pre-amp. Feedback Gain Difference	GPF	GPF 1 — GPF 2	-1.5	0	1.5	dB
Pre-amp. S/N CH-1	SN 1	S/N ratio at pin 28 with and without pin 7 Sine wave (0.13mV _{p-p} 0.6MHz) Input. (Noise measuring band 1.1MHz)	33.0	35.0	—	dB
Pre-amp. S/N CH-2	SN 2	S/N ratio at pin 28 with and without pin 5 Sine wave (0.13mV _{p-p} 0.6MHz) Input. (Noise measuring band 1.1MHz)	33.0	35.0	—	dB
Pre-amp. Channel Switch Offset	O_{SP}	Output DC potential difference at pin 28 when CH-1 ON and CH-2 ON	-100	0	100	mV
Pre-amp. Channel Switching Voltage	V_{SW}	Pin 15 DC Voltage with pin 7 Sine wave (0.53mV _{p-p} 0.6MHz) input, pin 15 DC voltage changed and pin 28 output changed	—	0.65	0.95	V
AGC Amp. Gain	G_A	Pin 26 Sine wave (20mV _{p-p} 0.5MHz) Input, Measure Output at pin 22	24.0	26.5	29.0	dB
AGC Detecting Voltage	V_D	Pin 26 Sine wave (0.3V _{p-p} 4MHz) Input, Measure DC Voltage at pin 24	0.70	0.85	1.00	V
AGC Control Characteristics 1	V_{A1}	Change in output at pin 22 when changing Sine wave of pin 26 input 4MHz from 0.3V _{p-p} to 1V _{p-p}	0	0.3	1.0	dB

(to be continued)

ELECTRICAL CHARACTERISTICS (continued)

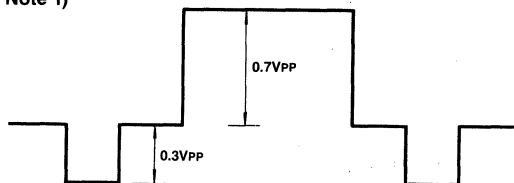
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
AGC Control Characteristics 2	V_{A2}	Change in output at pin 26 when changing Sine wave of pin 26 input 4MHz from 0.3V _{p-p} to 0.1V _{p-p}	-1.0	-0.3	0	dB
Dropout Detection Level	L_{DOC}	Level at pin 26 when applying V_D at pin 24, changing pin 26 input 4MHz to make pin 22 output zero	-22.5	-20.0	-16.5	dB
Dropout Return Hysteresis	L_{HYS}	Pin 26 level when applying V_D on pin 24, increasing pin 26 input 4MHz from 0 to find pin 22 output	2.9	5.4	8.4	dB
DS Amp. Gain	G_{DS}	Pin 23 Sine wave (0.1V _{p-p} 4MHz) Input, Measure Output at pin 22	10.2	12.7	15.3	dB
DS Amp. SW Output DC Offset	OS_{DS}	Difference in DC potential at pin 22 of pin 22 DC output components with and without pin 26 Sine wave (0.2V _{p-p} 4MHz)	-210	0	210	mV
Quiescent Current at REC	$I_{CC} (REC)$	REC Mode, at $V_{CC}=9V$ current flowing to pin 14	22.4	31.6	46.8	mA
Dynamic Emphasis Response Characteristics 1	D_{EM1}	Pin 19 Sine wave (1V _{p-p} 10KHz) Input Measure Output at pin 17	-7.8	-6.8	-5.8	dB
Dynamic Emphasis Response Characteristics 2	D_{EM2}	Pin 19 Sine wave (1V _{p-p} 3MHz) Input Measure Output at pin 17 (DEM1=0dB)	0.8	2.0	3.8	dB
Dynamic Emphasis Response Characteristics 3	D_{EM3}	Pin 19 Sine wave (0.32V _{p-p} 3MHz) Input Measure Output at pin 17 (DEM1=0dB)	3.3	4.8	6.3	dB
Dynamic Emphasis Response Characteristics 4	D_{EM4}	Pin 19 Sine wave (0.1V _{p-p} 3MHz) Input Measure Output at pin 17 (DEM1=0dB)	5.5	7.5	9.5	dB
Main Emphasis Gain	G_{ME}	Pin 19 Sine wave (50mV _{p-p} 0.5MHz) Input Measure Output at pin 13	18.0	20.5	23.0	dB
FM MOD Input Signal Voltage	V_{MOD}	Pin 19 1V _{p-p} Video Signal Input Measure Output at pin 13 (Note 1)	0.39	0.45	0.51	V _{p-p}
White Clip Adjusting Voltage	V_{16A}	Pin 19 1V _{p-p} Video Signal Input Measure DC voltage at pin 16 to make white clip level of pin 13 like (Note 1, 2)	5.8	6.5	7.2	V
Dark Clip Adjusting Voltage	V_{12A}	Pin 19 1V _{p-p} Video Signal Input Measure DC voltage at pin 12 to make dark clip level of pin 13 like (Note 1, 2)	3.9	4.5	5.1	V
FM MOD Oscillating Frequency Adjustment	F_{MOD}	Adjust VR6 at no input to make output frequency at pin 27 to be 3.4MHz	—	3.4	—	MHz

(to be continue)

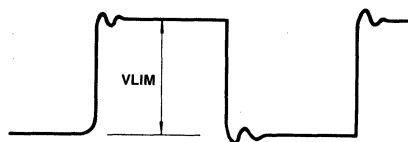
ELECTRICAL CHARACTERISTICS (continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
FM MOD Translate Linearity	L_{MOD}	Calculate $\frac{f_{6.2} - (f_{7.2} + f_{5.2})/2}{f_{7.2} - f_{5.2}} \times 100$ by measuring pin 27 frequency when adjusting pin 19 5.2V, 6.2V, 7.2V	-5	0	5	%
FM MOD Second THD	H_{MOD}	Rate of 8MHz components to 4MHz base wave at pin 27 when adjusting DC voltage at pin 19 to make pin 27 output 4MHz	—	-43	-40	dB
FM MOD Limiter Output Swing	V_{LIM}	No input at pin 19. Measure output at pin 27 (Note 3)	1.3	1.5	1.7	V_{p-p}
REC AMP GAIN	G_{RA}	Pin 1 Sine wave (0.1V _{p-p} 1MHz) Input, Measure Output at pin 3	18.5	20.5	22.5	dB

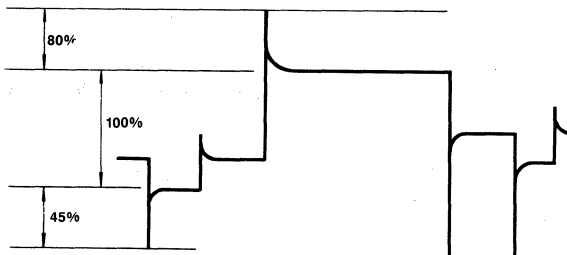
Note 1)



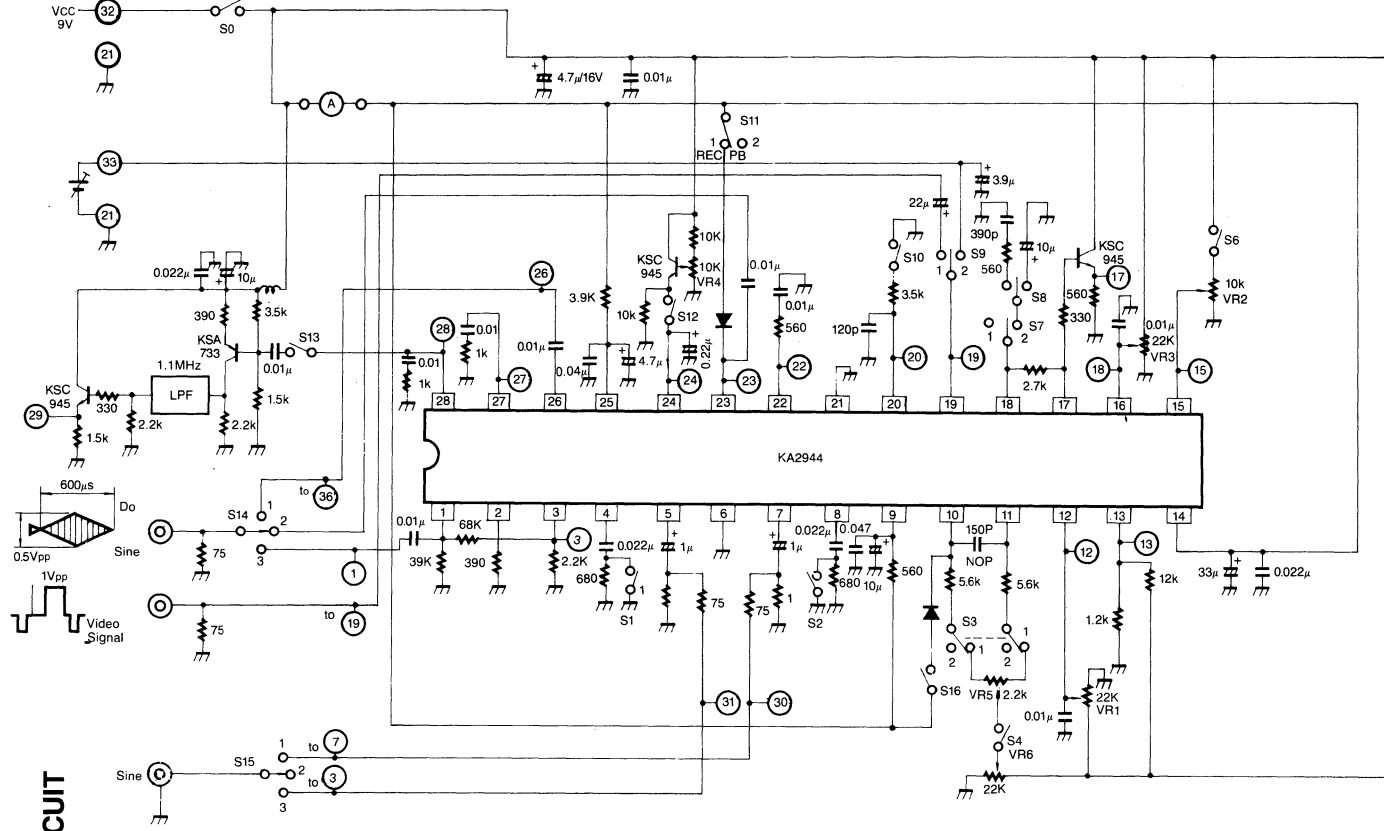
Note 3)



Note 2)

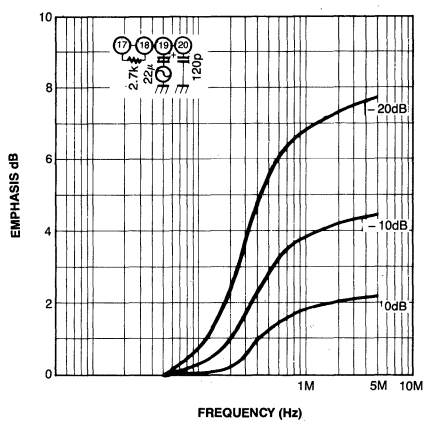


TEST CIRCUIT

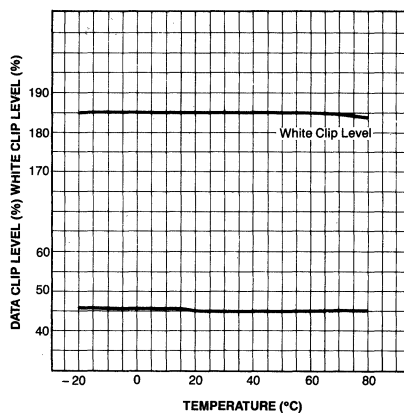


TYPICAL PERFORMANCE CURVES

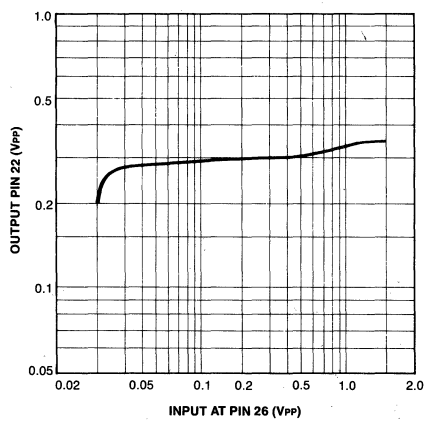
DYNAMIC EMPHASIS CHARACTERISTICS



CLIP LEVEL TEMPERATURE CHARACTERISTICS



AGC CHARACTERISTICS



VIDEO AMPLIFIER

The KA2945 is a silicon monolithic integrated circuit designed for the home video tape recorder.

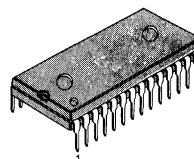
FUNCTIONS

Recording

- Video AGC (Keyed plus peak detection method)
- EE Monitor squelch

Playback

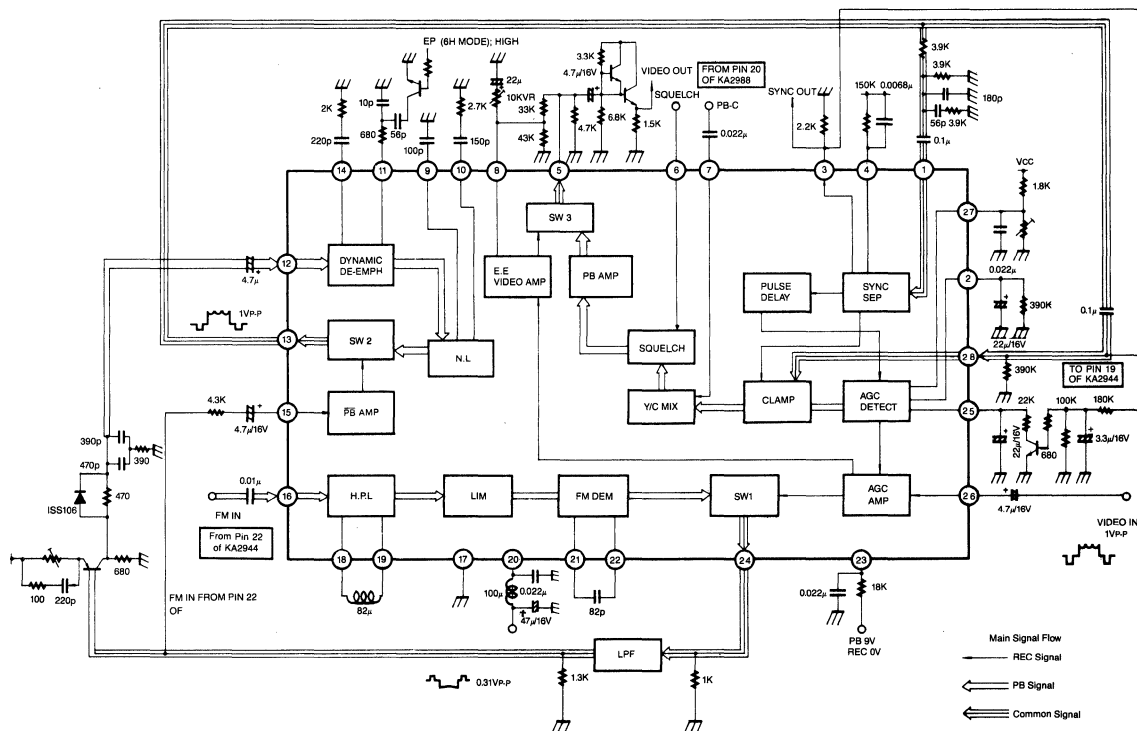
- FM limiter
- FM demodulation
- Dynamic de-emphasis
- Noise cancel
- Y/C mix
- Squelch



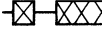
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2945	28 DIP	- 10 ~ + 75°C

BLOCK DIAGRAM



PIN FUNCTIONS

Pin No.	Functions	Signals	Note
1	SYNC SEP Input Terminal	 $\approx 0.5V_{p-p}$	$Z_{IN} = 50k\Omega$
2	Video AGC Filter 1 at Recording		
3	SYNC SEP Output Terminal	 $\approx 8.0V_{p-p}$	
4	SYNC SEP Filter Terminal		
5	EE PB Video Output Terminal	 $\approx 2V_{p-p}$	
6	Squelch Signal Input Terminal at Playback		
7	Playback Color Signal Input Terminal	 $\approx 0.1V_{p-p}$	
8	EE Video Amp. Feedback Terminal		
9	HPF for Noise Cancel		
10	Filter for Noise Cancel		
11	Dynamic De-emphasis Adjusting Terminal		
12	Dynamic De-emphasis Input Terminal		$Z_{IN} = 10k\Omega$
13	Recording and Playback Luminance Signal Output Terminal	 $\approx 1V_{p-p}$	
14	Dynamic De-emphasis Filter		
15	Recording Luminance Signal Input Terminal	 $\approx 0.3V_{p-p}$	Base Grounded Amp
16	Playback FM Limiter Input Terminal	FM Signal	$Z_{IN} = 4.5k\Omega$
17	GND		
18	FM Limiter HPF		
19	FM Limiter HPF		
20	V_{CC}		
21	Capacitor Terminal for FM Demodulation		
22	Capacitor Terminal for FM Demodulation		
23	Bias Terminal for Playback	$\approx 1.8V$	
24	Recording Video AGC and FM Demodulation Output Terminal	 $\approx 0.3V_{p-p}$	Open Collector
25	Video AGC Filter at Recording 2	$\approx 1.45V$	
26	Video AGC Input Terminal at Recording	 $\approx 1V_{p-p}$	$Z_{IN} = 20k\Omega$
27	Video AGC Adjustment Terminal at Recording	DC	Base Input
28	Video AGC Detection Input Terminal at Recording Playback Luminance Signal Input Terminal	 $\approx 1V_{p-p}$	

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	14.2	V
Power Dissipation	P_d	800*	mW
		875**	
Operating Temperature	T_{opr}	-10 ~ +75	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

*Value at $T_a=61^\circ\text{C}$, **Value at $T_a=75^\circ\text{C}$, Recommended supply voltage: $9 \pm 1\text{V}$.

ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$, $V_{CC}=9\text{V}$)

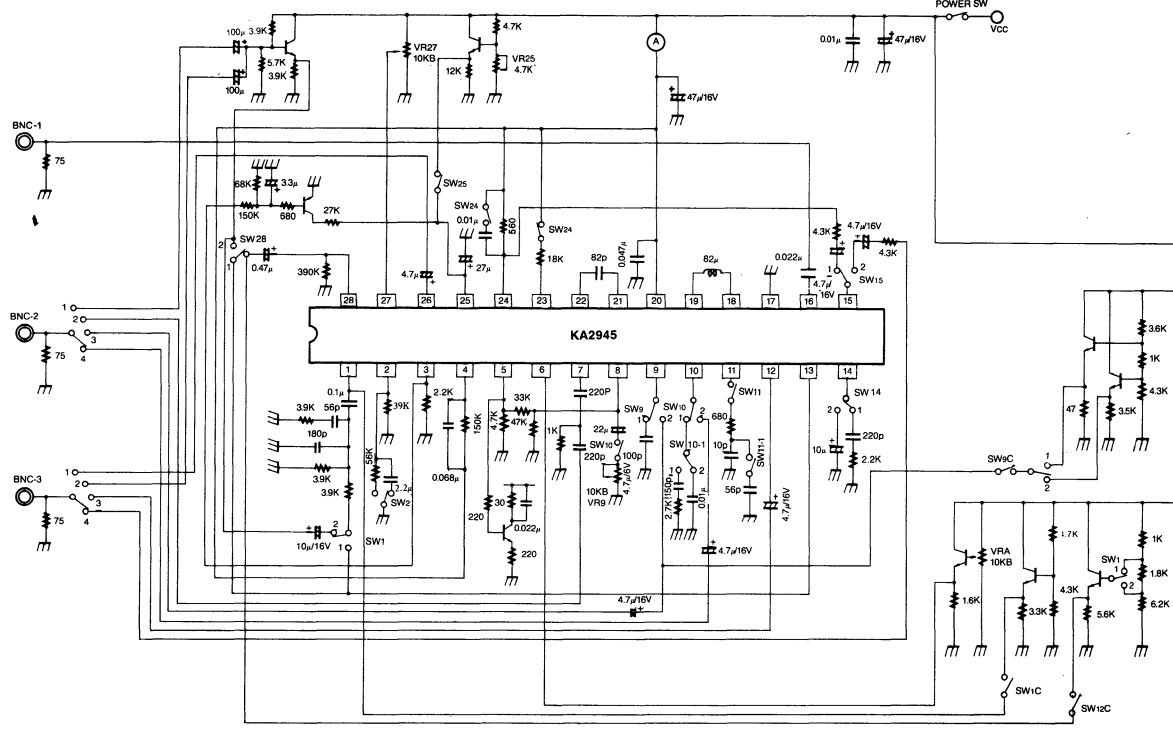
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Current at REC	I_{CCR}	at pin 23=0V, Current flowing to pin 20	19.5	24.3	32.1	mA
AGC Control Characteristics 1	AGC-6	Pin 26 $0.5V_{p-p}$ Video Signal, pin 28 level (Reference to $1V_{p-p}$)	-7	-3	+2	%
AGC Control Characteristics 2	AGC+6	Same as above but pin 26 $2V_{p-p}$	-2	4	10	%
AGC Control Characteristics 3	AGC-s	Same as above but pin 26 Video 0.7V, SYNC 0.15V	-2	5	12	%
REC Amp Gain	G_{REC}	Pin 15 Sine wave 0.5MHz, $0.3V_{p-p}$ Input pin 13 Output	8.4	10.2	12.0	dB
AGC DET Amp Gain	G_{AD}	Pin 28 Sine wave 0.5MHz, $1V_{p-p}$ Input pin 2 Output	—	5.5	—	dB
AGC DET Adding Pulse Width	PW_{AD}	Pin 28, $1V_{p-p}$ Video Signal Input	—	2.0	—	μs
AGC DET Front Edge Delay Time	t_{AD}	Same as above	—	1.0	—	μs
SYNC SEP Output Level	V_{SYC}	Same as above	7.5	8.1	8.5	V_{p-p}
SYNC SEP Output Pulse Width	PW_{SYC}	Same as above	5.25	5.75	6.20	μs
SYNC SEP Front Edge Delay Time	T_{SYC}	Same as above	—	0.30	—	μs
SYNC SEP Threshold	TH_{SYC}	Input level to reduce pin 1 input video signal level and increase pins output	—	-7	—	dB
Quiescent Current at PB	I_{CCP}	at pin 23 High, Current flowing to pin 20	34.2	43.0	55.9	mA
FM Demodulation Voltage	V_{DEM}	Pin 16 Sine wave 4MHz $50mV_{p-p}$ Input at pin 24 DC Voltage	7.60	7.78	7.96	V
FM Demodulation Sensitivity	S_{DEM}	Pin 16 Sine wave 3.5MHz $50mV_{p-p}$ Input	0.26	0.314	0.36	V

(to be continued)

ELECTRICAL CHARACTERISTICS (continued)

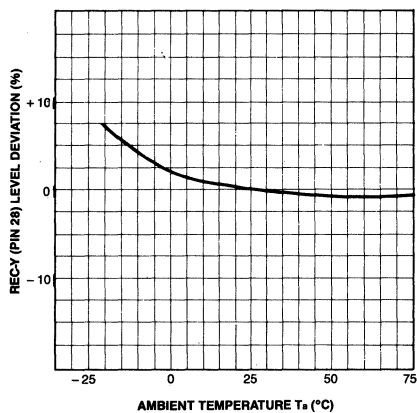
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
FM Demodulation Linearity	L_{DEM}	Linearity of pin 24 Output	-3.5	0.0	+3.5	V
Carrier Leak	CL4	Pin 16 Sine wave 4MHz 0.5V _{p-p} Input (0dB = 0.7 × S _{DEM})	—	-22	—	dB
PB Amp Gain	G _{PB}	Pin 28 Sine wave 0.5MHz 1V _{p-p} Input	5.6	6.5	7.4	dB
PB Color Amp Gain	G _C	Pin 7 Sine wave 3.58MHz 0.1V _{p-p}	15.2	16.5	17.8	dB
PB Squelch Threshold Voltage	V _{SQ}	Pin 6 DC voltage where squelch on	0.9	1.35	2.20	V
DD to NC Main Amp Gain	G _{DN}	Pin 12 Sine wave 0.5MHz 1V _{p-p} Input	0.7	1.6	2.5	dB
Dynamic De-emphasis Response Characteristics 1	G _{D1}	Pin 12 Sine wave 0.25MHz 1V _{p-p} Input pin 13 Output	-0.4	0.3	1.0	dB
Dynamic De-emphasis Response Characteristics 2	G _{D2}	Same as above but 2MHz 1V _{p-p}	-0.1	0.0	1.0	dB
Dynamic De-emphasis Response Characteristics 3	G _{D3}	Same as above but 0.25MHz 0.1V _{p-p}	-3.1	-2.1	-1.1	dB
Dynamic De-emphasis Response Characteristics 4	G _{D4}	Same as above but 2MHz 0.1V _{p-p}	-6.7	-5.5	-4.3	dB
Noise Canceller Response Characteristics 1	G _{N1}	Same as above but 0.25MHz 0.7V _{p-p}	0.2	1.1	2.0	dB
Noise Canceller Response Characteristics 2	G _{N2}	Same as above but 2MHz 0.7V _{p-p}	0.1	1.0	1.9	dB
Noise Canceller Response Characteristics 3	G _{N3}	Same as above but 0.25MHz 70mV _{p-p}	-1.4	-0.5	0.4	dB
Noise Canceller Response Characteristics 4	G _{N4}	Same as above but 2MHz 70mV _{p-p}	-1.9	-1.0	-0.1	dB

TEST CIRCUIT

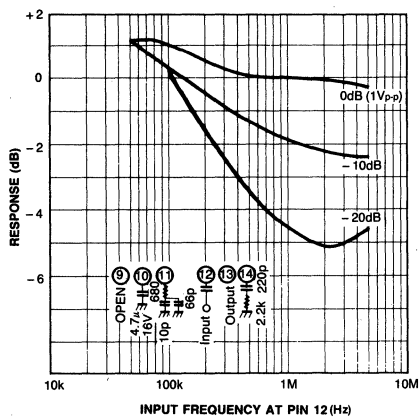


TYPICAL PERFORMANCE CURVES

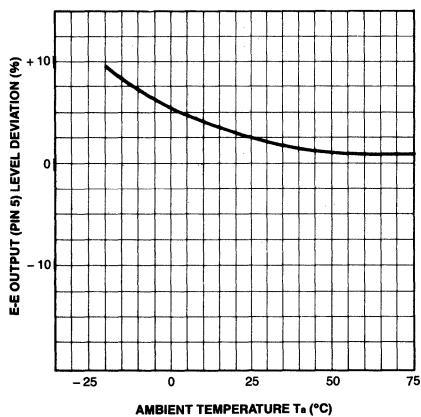
AGC TEMPERATURE CHARACTERISTIC



DYNAMIC DE-EMPHASIS CHARACTERISTIC



EE AMPLIFIER CHARACTERISTIC



VHF BAND RF MODULATOR

The KA2981 is a monolithic integrated circuit in a 16-lead dual in-line package designed for use in VHF RF converter for VCR & video game machine and so on.

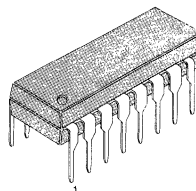
FUNCTIONS

- Video clamp
- White clip
- Video AM modulator
- FM modulator
- Sound carrier modulator
- RF carrier oscillator

FEATURES

- Output level & picture/sound ratio can be controlled by external resistor

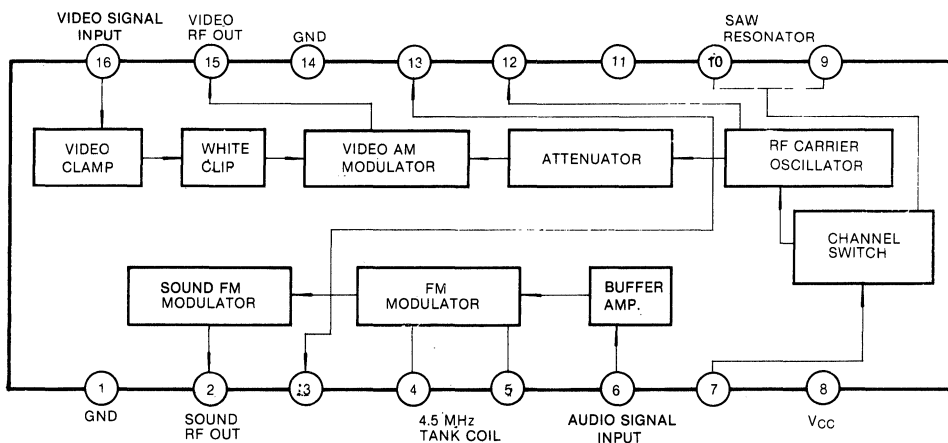
16 DIP



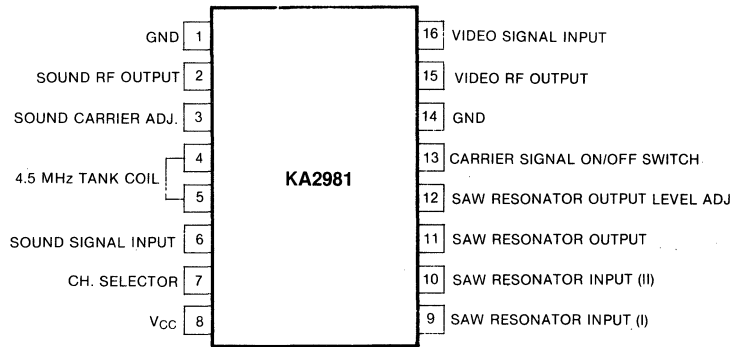
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2981	16 DIP	- 10 ~ + 70°C

BLOCK DIAGRAM



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	10	V
Power Dissipation	P _d	330	mW
Input Pin Signal Voltage	E _{in}	2.5	V _{p-p}
Input Pin Supply Voltage	V _{in}	GND ~ 0.3 ~ V _{CC} + 0.3	V
Operating Temperature	T _{opr}	- 10 ~ + 70	°C
Storage Temperature	T _{stg}	- 55 ~ + 155	°C

ELECTRICAL CHARACTERISTICS

A. DC Characteristics (V_{CC} = 6.2V, Ta = 25°C)

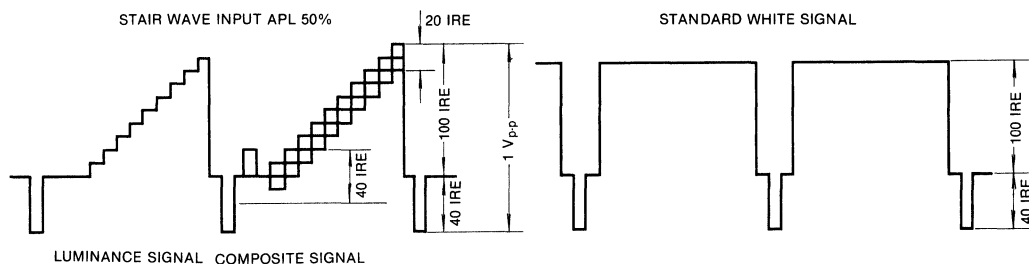
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Quiescent Current	I _Q	S ₂ = OFF S ₁ = S ₃ = ON	16.5	21.5	28.0	mA
Video Signal Input Voltage	V ₆ - V ₁₄	S ₂ = OFF S ₁ = S ₃ = ON		3.45		V
Sound Signal Input Voltage	V ₁ - V ₆			3.0		V
Video Output Pin Voltage	V ₁₅ - V ₁₄			4.3		V
Sound Output Pin Voltage	V ₁ - V ₂			4.25		V
SAW Input (1) Pin Voltage (1)	V ₉ - V ₁₄	S ₂ = OFF S ₁ = S ₃ = ON		2.25		V
SAW Input (1) Pin Voltage (2)		S ₁ = OFF S ₂ = S ₃ = ON			0.3	V
SAW Input (2) Pin Voltage (2)	V ₁₀ - V ₁₄	S ₂ = OFF S ₁ = S ₃ = ON			0.3	V
SAW Input (2) Pin Voltage (2)		S ₁ = OFF S ₂ = S ₃ = ON		2.25		V

B. AC Characteristics ($V_{CC} = 6.2V$, $T_a = 25^\circ C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V_{CC}	—	5.7	6.2	6.7	V
Video Output Level	V_O (fp)	$V_{CC} = 6.2V$, $V_{i1} = \text{No Signal}$	85	87	89	$dB\mu$
Thermal Sensitivity of Video Output Level	V_b (fp)	$T_a = -10^\circ C \sim 70^\circ C$	—	—	± 2	$dB\mu$
Video Modulation	mP	$V_{i1} = 1.0V_{p-p}$	73	76	79	%
Interchannel Video Modulation Difference	ΔmP	$V_{i1} = 1.0V_{p-p}$, $\Delta mP = mP_1 \sim mP_2$	—	—	± 3	%
Maximum Video Modulation	mP ₁ (max)	$V_{i1} = 2.0V_{p-p}$	92	96	—	%
Audio RF Output Level	V_O (fs)	$V_{CC} = 6.2V$, $V_{i2} = \text{No Signal}$	81	83	85	$dB\mu$
Audio FM Modulation Sensitivity	β_s	$V_{i3} = \pm 0.2V$, $\beta_s = \Delta F_O / 400mV$	0.35	0.45	0.55	KHz/mV
Maximum Sound FM Modulation	mS (max)	$V_{i3} = \pm 1.0V$, $mS (\text{max}) = \frac{\Delta F_O}{50(KHz)} \times 100(\%)$	800	1200	—	%
Video Output Synchronous Signal Ratio	V_s	$V_{i1} = 1V_{p-p}$, Sync./Video = 3/10	2.6	3.0	3.3	—
Audio Modulation	mS	$V_{i2} = 136mV_{p-p}$, 1KHz	—	± 25	—	KHz
Video Input Impedance	Z_{inV}	$V_{i4} = 1.0V_{rms}$, 200KHz $\sim$ 4.2MHz sweep	0.3	1	1.5	K Ω
Audio Input Impedance	Z_{inA}	$V_{i3} = 1.4V_{p-p}$, 100Hz $\sim$ 10KHz sweep	50			K Ω

Remark 1) FM modulation $\Delta f \pm 25KHz = 100\%$

Remark 2) Input Signal

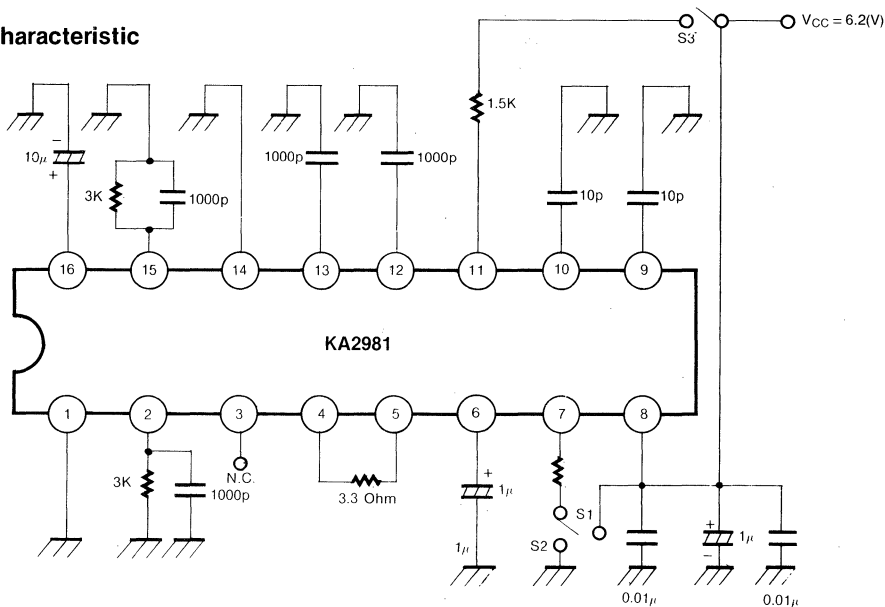


Remark 3) Switch operating for channel selection

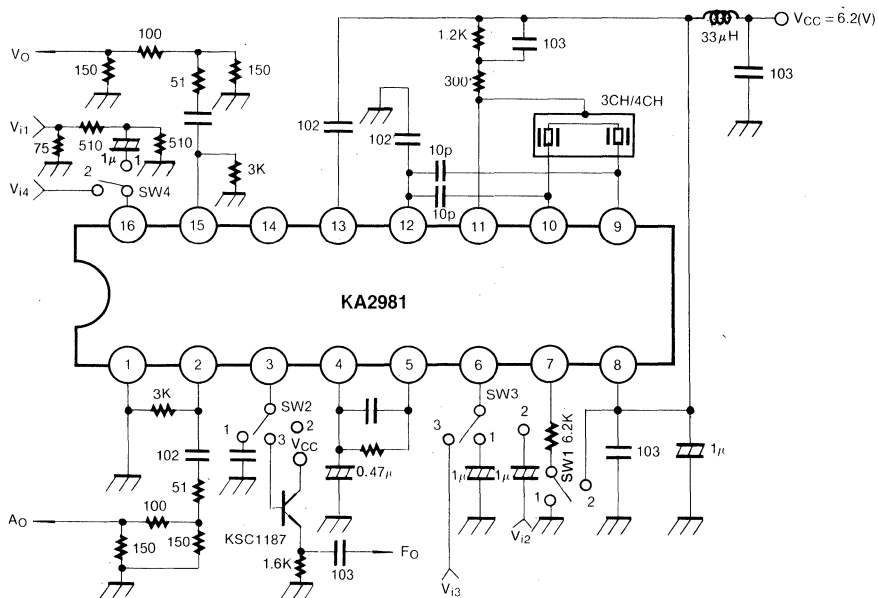
Channel	Saw Oscillator	
	Pin 9	Pin 10
High	On	Off
Low	Off	On

TEST CIRCUIT

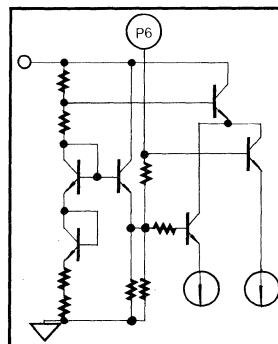
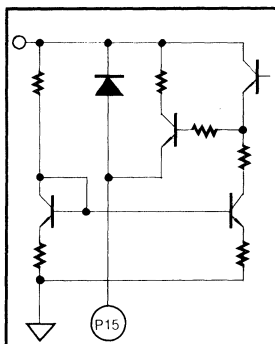
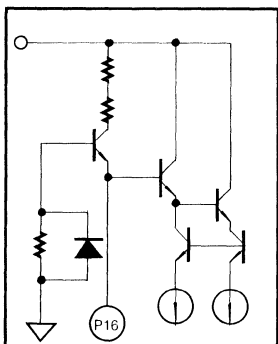
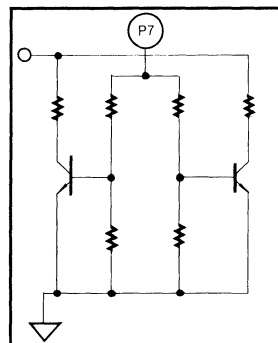
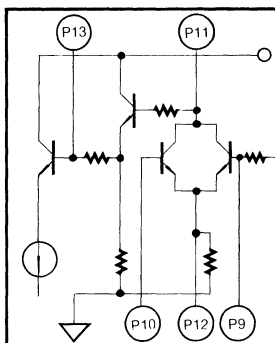
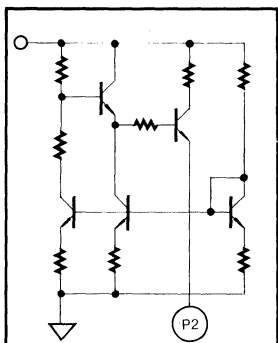
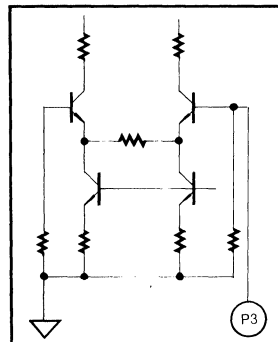
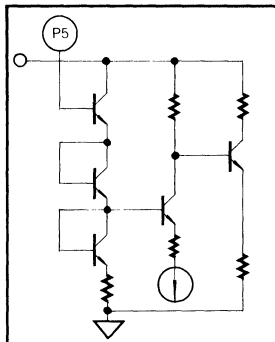
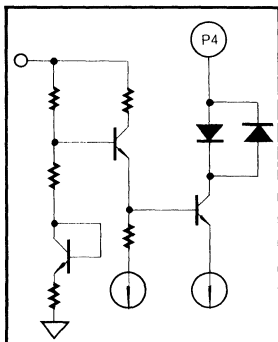
A. DC Characteristic



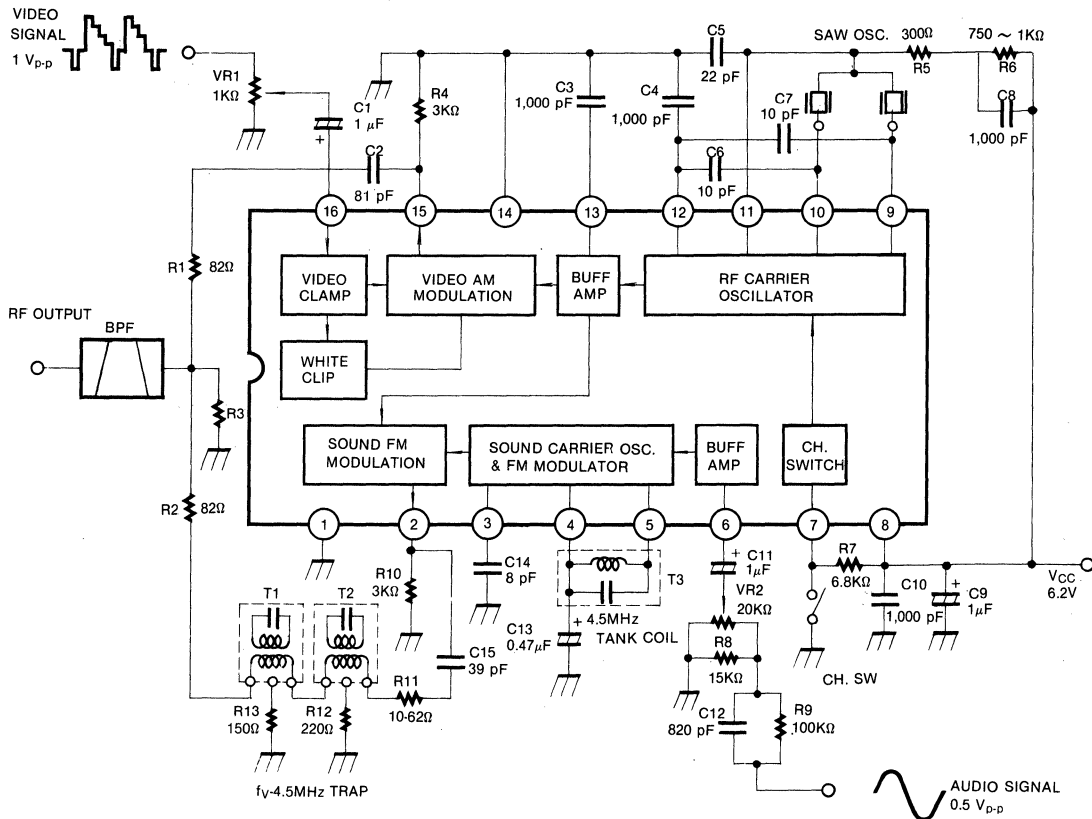
B. AC Characteristic



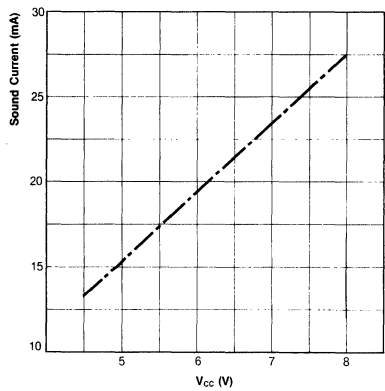
INTERNAL STRUCTURE WITH PIN



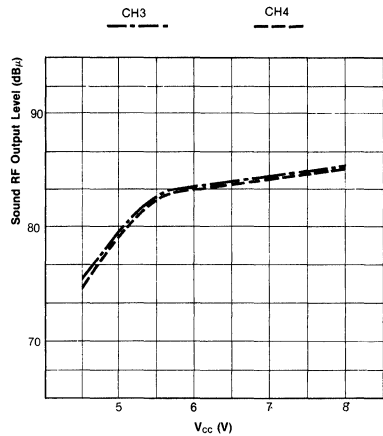
APPLICATION CIRCUIT



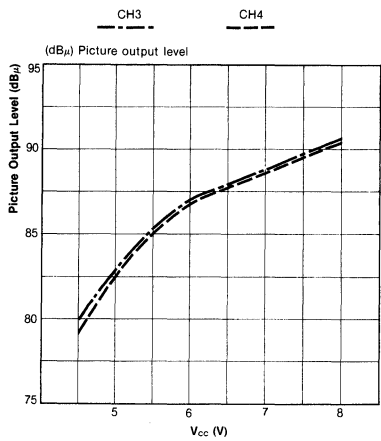
Supply Voltage & Supply Current



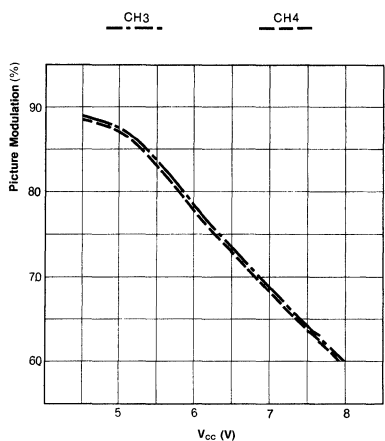
Supply Voltage & Sound RF Output Level



Supply Voltage & Picture Output Level



Supply Voltage & Picture Modulation



SWITCHLESS RECORDING/ PLAYBACK AMPLIFIER

The KA2983 is a monolithic integrated circuit designed to simplify VTR AUDIO signal circuitry. Logic control is used, so that by merely setting the recording/playback control pin voltage, the amplifier and signal paths are automatically switched between recording and playback and the muting functions are appropriately controlled.

FUNCTION

- Record/Playback preamplifier
- Recording amplifier
- Recording/Playback/Muting control circuit
- Analog switch
- Line amplifier
- ALC Circuit

FEATURES

- Contains all Recording/Playback amplifiers required for VTR AUDIO signal system.
- Capable of setting each mode of Recording/Playback/Muting by changing only the control pin voltage.
- Very small pop noise occurring at the time of mode selection.
- Easy to adjust recording level, playback sensitivity.
- Improvement in reliability due to electronic switch.

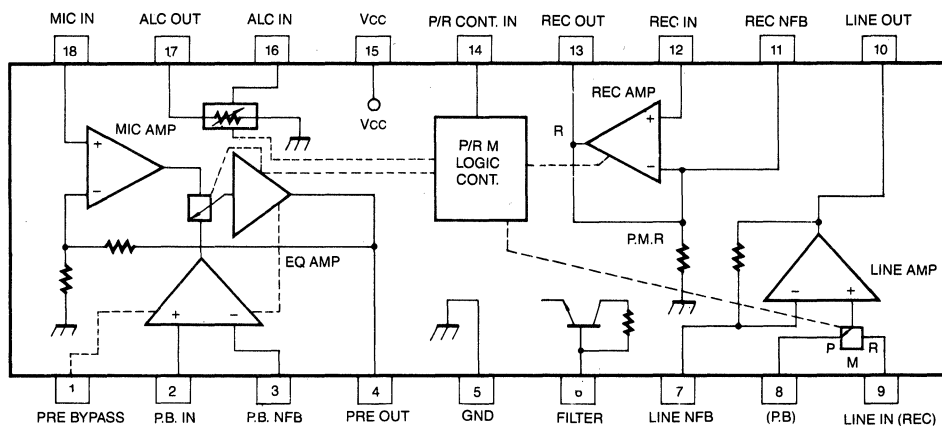
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2983	18 DIP	-10 ~ +75°C

APPLICATION

- 9 and 12V VTR audio system units.
- Logic-controlled tape recorders.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_d	700	mW
Operating Temperature	T_{opr}	$-10 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITION ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	9	V

ELECTRICAL CHARACTERISTICS($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$, $f = 1\text{KHz}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Current (PLAYBACK)	I_{CCP}	$V_{CC} = 9\text{V}$	5	8.5	13	mA
Supply Current (RECORD)	I_{CCR}	$V_{CC} = 9\text{V}$	6	10	15	mA

EQ AMPLIFIER

Voltage Gain	GVC	$V_O = 0\text{dBm}$		44		dB
Output Voltage	V_{OM}	THD = 3%		2.2		V
Total Harmonic Distortion	THD	$V_O = 0\text{dBm}$		0.1		%
Input Resistance	R_{IN}		40	55		$\text{K}\Omega$
Input Referred Noise Voltage	V_{NIN}	$R_g = 2.2\text{K}\Omega$ (DIN AUDIO)		1	1.8	μV

MIC AMPLIFIER

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Voltage Gain	GVC	$V_O = 0\text{dBm}$	35.5	37.5	39.5	dB
Output Voltage	V_{OM}	THD = 3%		2.2		V
Total Harmonic Distortion	THD	$V_O = 0\text{dBm}$		0.07		%
Input Resistance	R_{IN}		40	55		$\text{K}\Omega$
Input Referred Noise Voltage	V_{NIN}	$R_g = 2.2\text{K}$ (DIN AUDIO)		1	2	μV

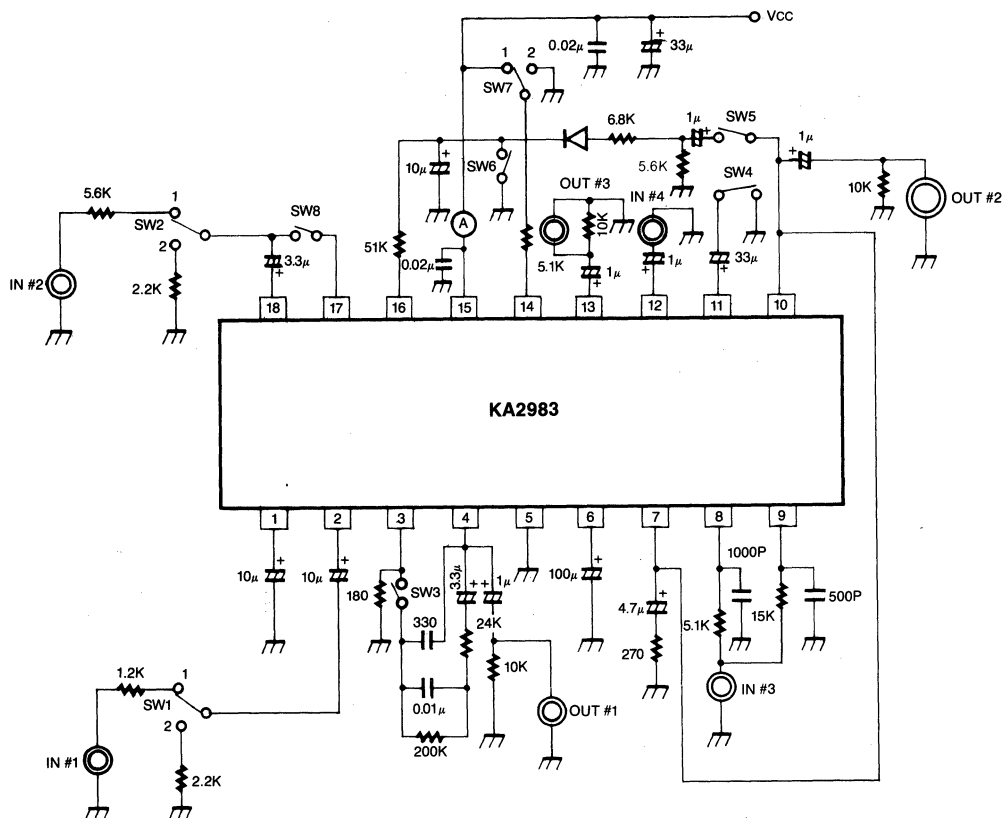
LINE AMPLIFIER

Voltage Gain	GVC	$V_O = 0\text{dBm}$		35 (PB)		dB
				30 (REC)		
Output Voltage	V_{OM}	THD = 3%	1.9	2.4		V
Total Harmonic Distortion	THD	$V_O = 0\text{dBm}$		0.3		%

REC AMPLIFIER

Voltage Gain (OPEN LOOP)	GVO	$V_O = 0\text{dBm}$	38	42		dB
Voltage Gain (CLOSED LOOP)	GVC	$V_O = 0\text{dBm}$	11.5	13	14.5	
Output Voltage	V_{OM}	THD = 3%	1.9	2.3		V
Total Harmonic Distortion	THD	$V_O = 0\text{dBm}$		0.2	0.6	%

TEST CIRCUIT



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	≤ 15	V
Power Dissipation	P_D	800 ($T_{OPR} = 65^\circ\text{C}$) 675 ($T_{OPR} = 75^\circ\text{C}$)	mW
Operating Temperature	T_{opr}	$-10 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$
Operating Supply Voltage	V_{opr}	9 ± 1	V

* Value at 65°C **Value at 75°C ELECTRICAL CHARACTERISTIC ($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Current	I_{CC}	Total REC Mode at Pins 8, 19, 21, and 27	—	70	90	mA
Zener Voltage	V_{19}	820 Ω Connected to 9V	—	7.2	—	V
REC ACC Dynamic Range	V_{ACC}	With Respect to Input of $0.15V_{p-p}$; Input Peak to Peak Voltage which Varies Output from -3dB to $+3\text{dB}$	15	150	450	mV_{p-p}
REC ACC Secondary Harmonics		Input Signal to Pin 4 = $0.15V_{p-p}$; 33K Connected to GND Via Pin 26; Output at Pin 1 Measured	—	-35	-30	dB
PB ACC Secondary Harmonics		Input Signal at Pin 4 = $0.15V_{p-p}$; Output at Pin 2 Measured	—	-43	-30	dB
REC Main Converter Carrier Leak Spurious		$f = 3.58\text{MHz}$	—	-30	-20	dB
		$f = 4.21\text{MHz}$	—	-28	-20	dB
PB Main Converter Conversion Gain		Input Signal to Pin 24 = 629KHz , $0.15V_{p-p}$; Input Signal to Pin 26 = 4.21MHz , $0.3V_{p-p}$	4.5	6.0	7.5	dB
PB Main Converter Carrier Leak Spurious		$f = 4.21\text{MHz}$	—	-32	-20	dB
		$f = 629\text{KHz}$	—	-34	-20	dB
Burst Emphasis	G_{KR}		5	6	7	dB
Burst Emphasis DC Offset Voltage			—	0	± 100	mV
Burst De-Emphasis	G_{KP}		—	4.7	—	dB
Burst De-Emphasis DC Offset Voltage			—	0	± 50	mV
Burst De-Emphasis AMP Gain		Chroma	9.5	11	12.5	dB

ELECTRICAL CHARACTERISTIC (continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Burst De-Emphasis Secondary Harmonics			—	-45	-30	dB
REC Killer Sensitivity			—	-46	-30	dB
PB Killer Sensitivity			—	-43	-30	dB
Subconverter Carrier Leak	C _L	629KHz Internally	—	-40	-30	dB
Subconverter Spurious		629KHz Internally; (4.21 + 0.629 × 3) MHz	—	-16	-13	dB
REC AFC Pull-In Range			75	—	—	KHz
VCO (160f _H) Control Sensitivity	β		80	140	200	Hz/mV
REC AFC Phase Detective Sensitivity	μRS		50	100	—	mV/deg
REC DC Loop Gain			9	14	—	KHz/deg
PB AFC Pull-In Range	f _{PR}		75	—	—	KHz
3.58MHz VCO Output Peak-To-Peak Voltage	V _{OSC}	Measured at Pin 16	—	0.36	—	V _{P-P}
REC APC Pull-In Range	f _{PR}		300	—	—	Hz
REC APC Phase Detective Sensitivity	μRP		13	18	21	mV/deg
REC APC Control Sensitivity	β		1.9	—	2.7	Hz/mV
Killer Threshold Voltage		Burst Level at Pin 4 Measured	—	8	—	mV
Injector Current		f _r = 160f _H ; Input Current of Pin 27 Measured	—	0.32	—	mV
ID Input Threshold Voltage		Threshold at Pin 1 Measured (PB Only)	—	1.1	2.0	V _{DC}

PIN FUNCTIONS

No.	Function	Comment
1	REC Color Output (REC) ID Input (PB)	
2	Buffer Amp Output (connected to 1HDL filter) (PB only)	DC 1V
3	ACC Det Filter Terminal	
4	ACC Amp Input	
5	Mono-Multi Constant Terminal 1/2H Pulse Killer Circuit	
6	1/2 H Pulse Killer Circuit Input (Sync. Pulse)	
7	GND	
8	I ² L Injector Terminal	DC 0.8V
9	Freq. Discrimination Filter Terminal	DC 5V
10	APC PD Filter Terminal at PB	DC 5V PB
11	AFC PD Filter Terminal at REC	DC 5V REC
12	3.58 MHz VCO Output	
13	3.58 MHz VCO Input	
14	3.58 MHz VCO Input	
15	4-Phase 40f _H Signal By-Pass	
16	3.58 MHz VCO Output	
17	APC PD Filter Terminal at REC	DC 5V
18	Sub Conv. Output	
19	Zener Voltage Terminal	DC 7.2V
20	PB Color Output (PBonly)	
21	V _{CC}	DC 9V
22	(REC) REC Color Signal Input (PB) Main Conv. Output (Connected to 3.58 MHz B.P.F.)	
23	Killer Det. Filter Terminal	DC 5V
24	Main Conv. Input (PB 629 KHz signal) (PB only)	
25	30 Hz Pulse Signal Input	
26	Main Conv. Input (Carrier for Freq. Conversion)	
27	160 f _H VCO Control Current Input	DC 5V
28	(PB) Burst De-emphasis Killer Amp Input	

ANALOG INTERFACE CIRCUIT FOR TELETEXT SYSTEM

The KA6101 is a silicon monolithic integrated circuit designed for R.G.B. and Y interface between teletext decoder and chroma processor.

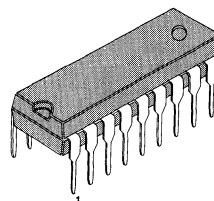
FUNCTIONS

- Y Signal/External Data Switching
- Color Control
- Contrast Control
- Brightness Control
- Clamp and Banking Circuit

FEATURES

- Wide band characteristics
- High data switching speed characteristics
($t_{dr}(\max) = 60\text{ns}$, $t_{df}(\max) = 55\text{ns}$)

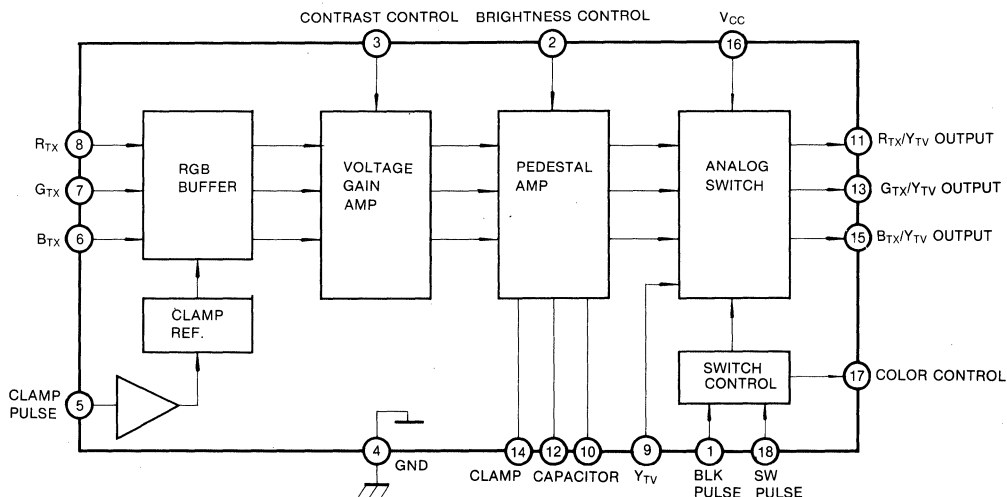
18 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA6101	18 DIP	$-20 \sim +70^{\circ}\text{C}$
KA6102		

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristics		Symbol	Value		Unit
Voltage	Supply Voltage	V _{CC}	13.2		V
	Circuit Voltage	V _{pin 1}	− 1	8	V
		V _{pin 2,3,9,17}	0	V _{pin 16}	V
		V _{pin 5}	− 1	6	V
		V _{pin 6,7,8}	0	4	V
Current	Supply Current	I ₁	75		mA
	Circuit Current	I _{pin 10, 12, 14}	− 1	1	mA
		I _{pin 11,13,15}	− 2	2	mA
		I _{pin 17}	− 1	30	mA
Power Dissipation (Ta = 60°C)		P _D	1000		mW
Temperature	Operating Temperature	T _{opr}	− 20 ~ + 70		°C
	Storage Temperature	T _{stg}	− 55 ~ + 150		°C

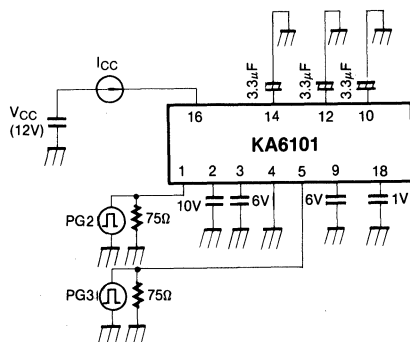
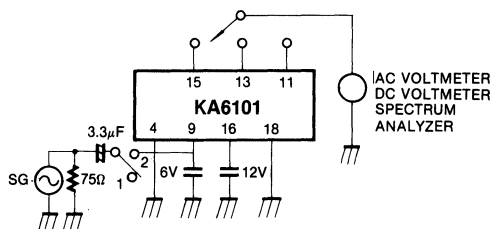
ELECTRICAL CHARACTERISTICS ($V_{CC} = 12\text{V}$, $T_a = 25^\circ\text{C}$)

Characteristics			Symbol	Test Conditions	Min	Typ	Max	Unit	Test Circuit
Supply Current			I_{tot}	$V_{CC} = 12\text{V}$	42	55	68	mA	1
RGB Signal	Voltage Gain (Max)		A_{V1}	RGB input pulse $1V_{p-p}$ contrast max 7.5V, min 4.5V, brightness 10V	5.0	5.5	6.0	times/ times	3
	Contrast Ratio	KA6101 KA6102	$A_{(max)}/A_{(min)}$		2.5	3.0	3.5		
					5.3	8.9	15.9		
	Frequency Bandwidth		f_{BW1}	$V_i = 200mV_{p-p}$, contrast 6V brightness 10V		28		MHz	3
	Brightness Control Sensitivity		ΔS_{BR}	RGB input pulse $1V_{p-p}$ contrast 6V brightness 10.9V, 9.9V	- 3.1	- 2.7	- 2.2	V/V	3
	Pedestal DC Level Difference		ΔE_{PT}	RGB input pulse $1V_{p-p}$ contrast 6V, brightness 10V			± 100	mV	3
	Rising Delay Time		t_{dr1}	RGB input pulse $1V_{p-p}$ contrast 5.4V brightness 10V		25	45	ns	3
	Rising Time		t_r			25	45	ns	3
	Falling Delay Time		t_{df1}			25	45	ns	3
	Falling Time		t_f			20	40	ns	3
	t_{dr1} , t_{df1} 3-Channel Time difference		Δt_{d1}				± 15	ns	3
Y Signal	Output DC Level Difference		ΔE_Y			0	± 100	mV	2
	Voltage Gain		A_{V2}	$f = 1\text{MHz}$, $1V_{p-p}$	0.9	1	1.1	times	2
	Frequency Band Width		f_{BW2}	$V_i = 1V_{p-p}$		37		MHz	2

ELECTRICAL CHARACTERISTICS (Continued)

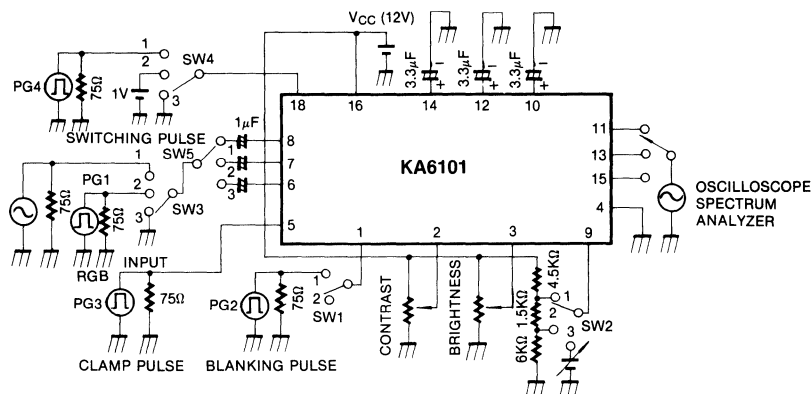
Characteristics		Symbol	Test Conditions	Min	Typ	Max	Unit	Test Circuit
RGB/Y Switching	Delay Rising Time	t_{dr2}	RGB input pulse 1V _{p-p} contrast 6V brightness 10.8V		40	60	ns	3
	Delay Falling Time	t_{df2}			35	55	ns	3
	t_{dr} , t_{df} , 3 Channel Time Difference	Δt_{d2}				± 15	ns	3
Cross Talk	RGB Channel	CT ₁	$f = 1\text{MHz}$, $V_i = 200\text{mV}_{p-p}$	35	40		dB	4
	RGB $\rightleftharpoons$ Y	CT ₂		50	60		dB	5
Clamp Pulse Minimum Supply Voltage		$V_{i(CL.P)}$	To see wave form for pulse width	1.5			V _{p-p}	3
Blanking Pulse Minimum Supply Voltage		$V_{i(BLK)}$		2.0			V _{p-p}	3
Switching Pulse Minimum Supply Voltage		$V_{i(SWP)}$		0.9			V _{p-p}	3
Y Signal Input Level		$E_{(Yin)}$		1.5		7.5	V	
RGB Signal Input Level		$E_{(TX-in)}$			1.0	1.2	V	

TEST CIRCUIT

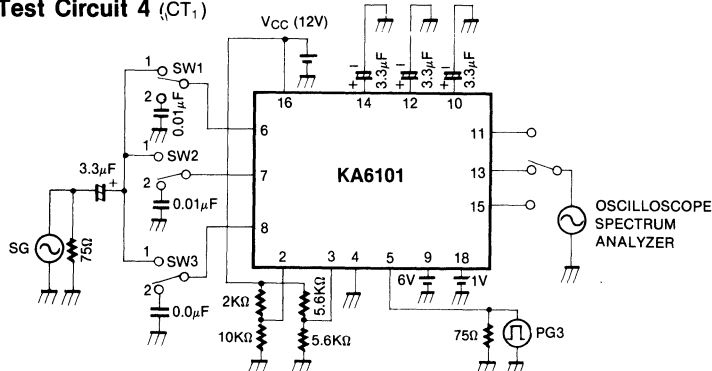
Test Circuit 1 (I_{CC})Test Circuit 2 (ΔE_Y , A_{V2} , f_{BW2})

LINEAR INTEGRATED CIRCUIT

Test Circuit 3 (A_{V1} , A_{max}/A_{min} , f_{BW1} , ΔS_{BR} , ΔE_{PT} , t_{dr1} , t_r , Δt_{d1} , t_{df1} , t_f , t_{dr2} , t_{df2} , Δt_{df2} , $V_{t(CLP)}$, $V_{t(BLK)}$, $V_{t(SWP)}$)



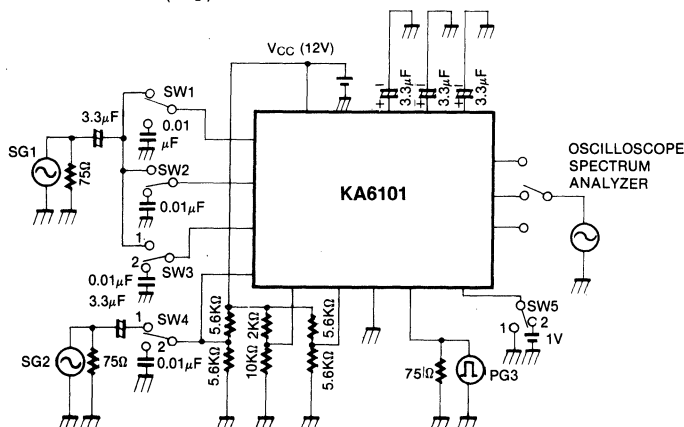
Test Circuit 4 (CT₁)



Switch Condition

SW1	SW2	SW3
1	2	2
2	1	2
2	2	1

Test Circuit 5 (CT₂)



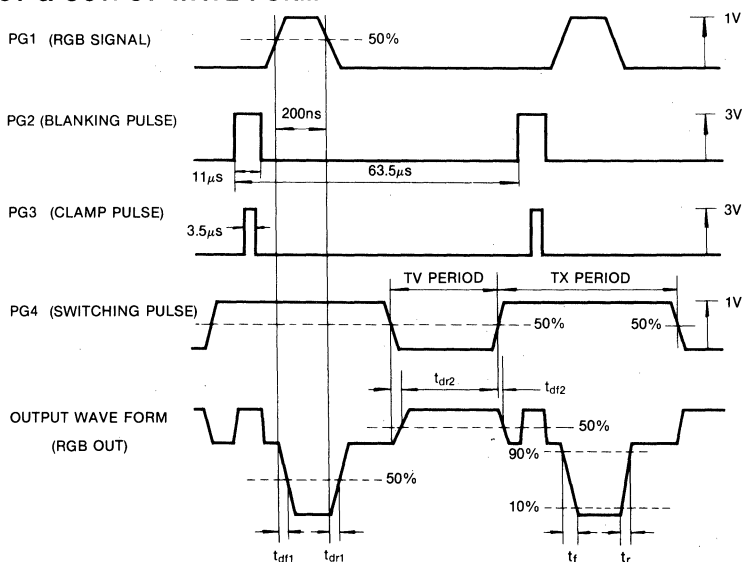
Switch Condition

SW1	SW2	SW3	SW4	SW5
2	2	2	1	2
1	2	2	2	1
2	1	2	2	1
2	2	1	2	1

SWITCH CONDITION

Test Item	SW1	SW2	SW3	SW4	SW5
RGB Signal Voltage Gain	2	2	2	2	1, 2, 3
RGB Signal Frequency Characteristic	2	2	1	2	1, 2, 3
RGB Signal Contrast Ratio	2	2	2	2	1, 2, 3
RGB Signal Brightness Control Sensitivity	2	2	2	2	1, 2, 3
RGB Signal Pedestal DC Level Difference	2	2	2	2	1, 2, 3
RGB Signal Delay Rising Time	2	2	2	2	1, 2, 3
RGB Signal Rising Time	2	2	2	2	1, 2, 3
RGB Signal Delay Falling Time	2	2	2	2	1, 2, 3
RGB Signal Falling Time	2	2	2	2	1, 2, 3
RGB Signal t_{dr1} , t_{df1} 3 Channel Time Difference	2	2	2	2	1, 2, 3
RGB/Y Switch Delay Rising Time	2	2	3	1	1, 2, 3
RGB/Y Switch Delay Falling Time	2	2	3	1	1, 2, 3
RGB/Y Switch t_{dr2} , t_{df2} 3 Channel Time Difference	2	2	3	1	1, 2, 3
Clamp Pulse Minimum Supply Voltage	2	2	2	2	1, 2, 3
Blanking Pulse Minimum Supply Voltage	1	1	3	2	1, 2, 3
Switching Pulse Minimum Supply Voltage	2	1	3	1	1, 2, 3

INPUT & OUTPUT WAVE FORM

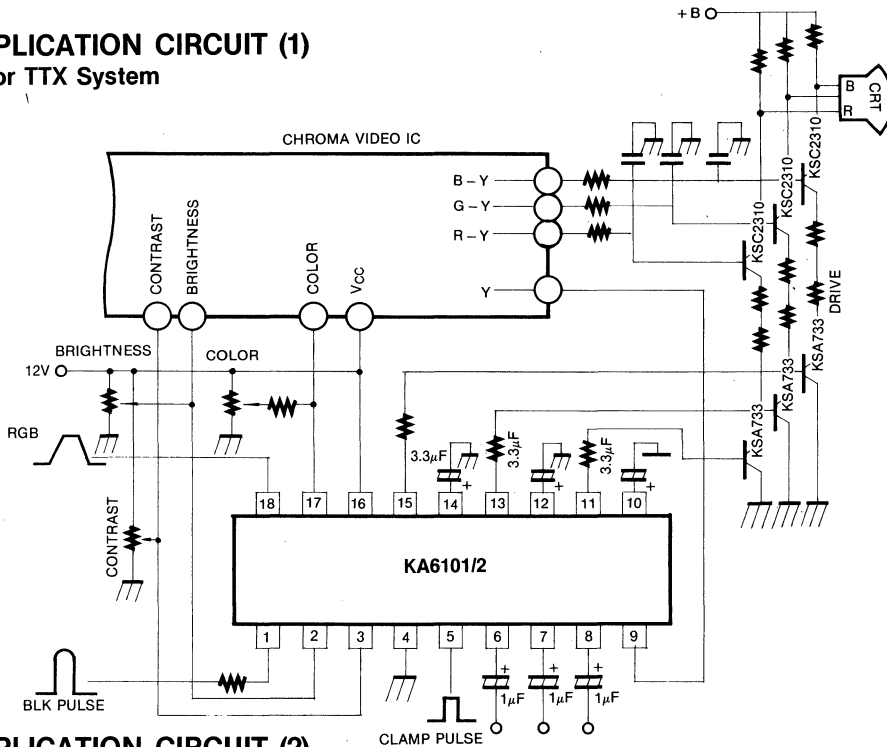


NOTE: 1. Rising time of PG1 – 4 must be lower than 5ns.

2. Waveforms of PG1, PG4 are shown in more detail by enlarging the time axis on the rising time and falling time.

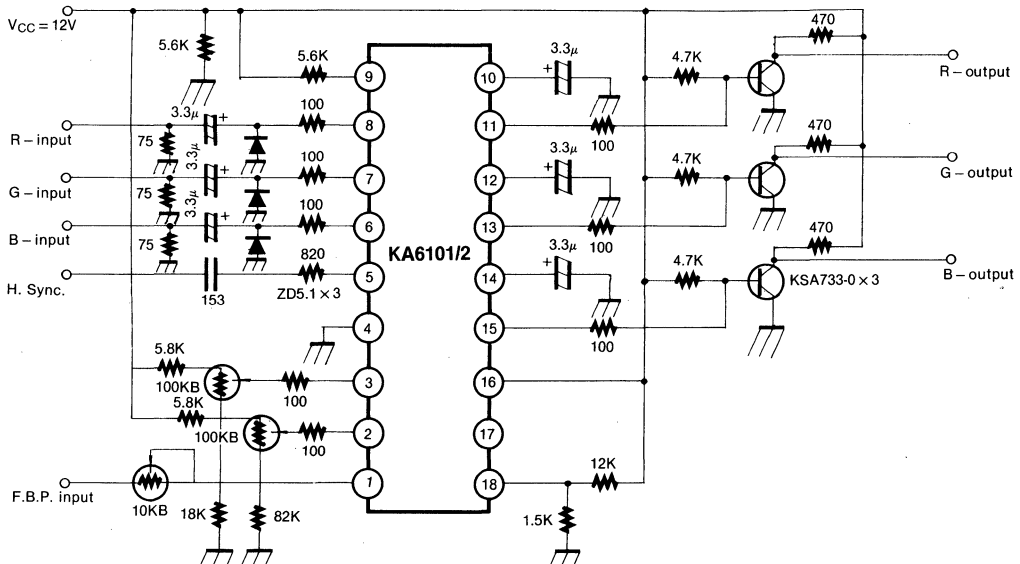
APPLICATION CIRCUIT (1)

- For TTX System



APPLICATION CIRCUIT (2)

- R/G/B Interface for Analog Type Monitor



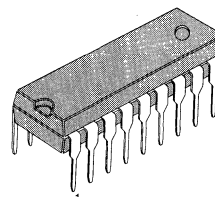
FLEXIBLE DISK READ AMPLIFIER

The KA6201 is a monolithic integrated circuit designed for read amplifier for flexible disk driver, and generate pulse wave-shaped output signals. The amplified analog signals from the magnetic head generate data pulses by differentiator, zero-voltage comparator and pulse waveform shaper block.

FEATURES

- Contained all the active circuit to accomplish the flexible disk read amplifier function in one chip.
- Direct connection with TTL IC.

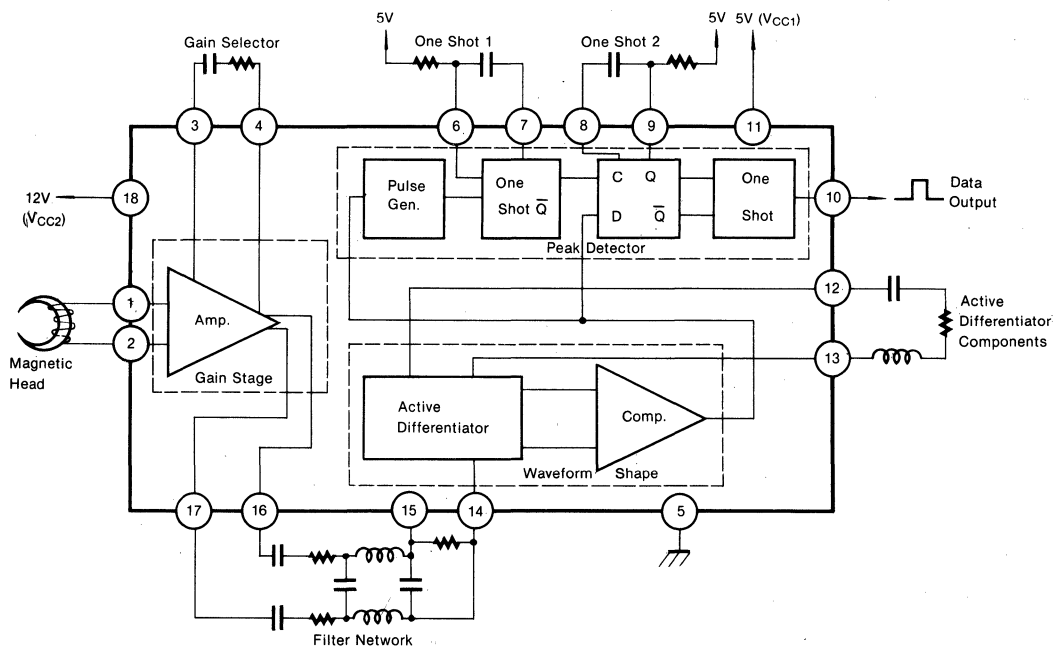
18 DIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA6201	18 DIP	0 ~ +70°C



ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage 1 (Pin 11)	V _{CC1}	7.0	V
Supply Voltage 2 (Pin 18)	V _{CC2}	16	V
Amp. Input Voltage (Pin 1, 2)	V _{IN}	-0.2 ~ +7.0	V
Data Output Voltage (Pin 10)	V _O	-0.2 ~ +7.0	V
Differential Amp. Input Voltage (Pin 1, 2)	V _{IN} (Diff.)	0 ~ +5.0	V
Operating Temperature	T _{opr}	0 ~ +70	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C

(Note) Meaning of the absolute maximum ratings is not equal to safety operating ratings.
Please use this device under the absolute maximum ratings range.

RECOMMENDED OPERATING CONDITIONS (Ta = 25°C)

Characteristic	Symbol	Min	Typ	Max	Unit
Power Supply Voltage Range	V _{CC1R}	4.75	5.0	5.25	V
	V _{CC2R}	10.0	12.0	14.0	
Ambient Temperature Range	T _A	0 +70			°C

ELECTRICAL CHARACTERISTICS

A. Amplifier Section (Ta = 25°C, V_{CC1} = 5.0V, V_{CC2} = 12.0V)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Circuit
Input Bias Current	I _{IB}	V _{CM} = 4V	—	1	9	μA	3
Common Mode Voltage Range	V _{ICM}		1.85	—	6.2	V	2
Output Distortion Ratio	THD	f = 1KHz, V _{CC1R} V _{CC2R} , V _{IN} = 25mV _{p-p}	—	1.5	5	%	2
Differential Voltage Gain	A _{VD}	f = 250KHz, V _{CC1R} V _{CC2R} , V _{IN} = 5mV _{rms}	39	42	43.5	dB	2
Differential Output Voltage	V _{OD}	V _{CC1R} , V _{CC2R}	3.0	4.2	—	V _{p-p}	2
Output Sink Current	I _{OS}		2.8	4.0	—	mA	5
Output Source Current	I _O		—	8.0	—	mA	4
Input Resistance	Y _{IN}		30	120	—	KΩ	6
Output Resistance	r _O		—	15	—	Ω	7
Common Mode Rejection Ratio	CMRR	f = 100KHz, V _{IN} = 200mV	50	—	—	dB	8

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Circuit
Power Supply Rejection Ratio V_{CC1}	PSRR ₁	$V_{CC2} = 12.0V$ $4.75V \leq V_{CC1} \leq 5.25V$	50	—	—	dB	9
Power Supply Rejection Ratio V_{CC2}	PSRR ₂	$V_{CC1} = 5.0V$ $10.0V \leq V_{CC2} \leq 14.0V$	60	—	—	dB	9
Differential Output Offset Voltage	V_{DD}		—	—	0.4	V	10
Common Mode Output Voltage	V_{CO}		—	3.1	—	V	10
Effective Differential Emitter Resistance (Pin 3, 4)	R_{EFF}		370	570	770	Ω	11

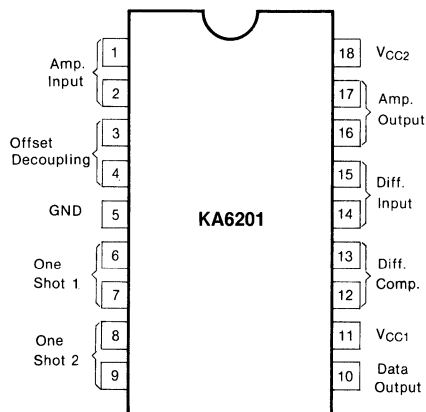
B. Peak Detector Section ($T_a = 25^\circ C$, $V_{CC1} = 5.0V$, $V_{CC2} = 12.0V$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit	Test Condition
Input Resistance	r_{ID}		—	30	—	K Ω	14
Output Resistance	r_{OD}		—	40	—	Ω	14
Sink Current (Pin 12, 13)	I_{OD}		1.0	1.5	—	mA	12
Peak Shift	P_S	$f = 250KHz$, $V_{IN} = 1.0V_{p-p}$	—	—	5	%	13

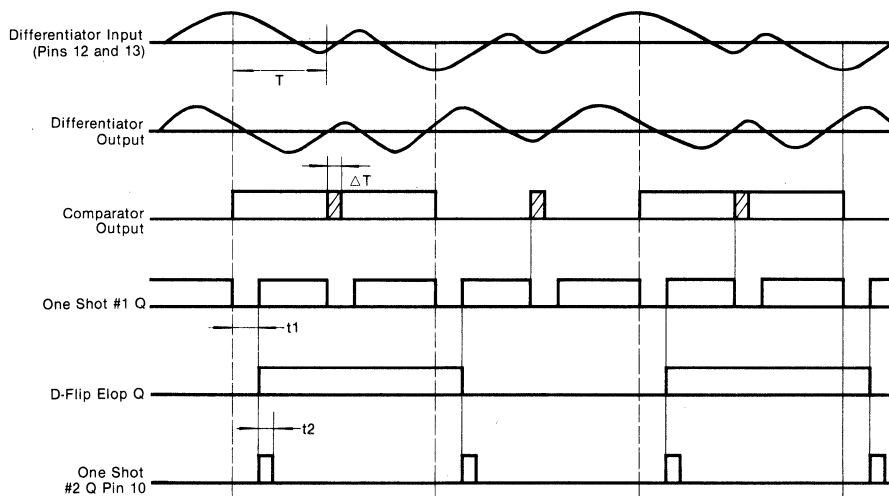
C. Waveform Shaper Section ($T_a = 25^\circ C$, $V_{CC1} = 5.0V$, $V_{CC2} = 12.0V$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit	Test Condition 1
Output Voltage (Pin 10)	High V_{OH}	$V_{CC1} = 4.75V$, $V_{CC2} = 12.0V$ $I_{OH} = 0.4mA$, $I_{OL} = 8mA$	2.7	—	—	V	15
	Low V_{OL}		—	—	0.5	V	16
Rising Time	t_{TLH}	$V_{CC1} = 4.75V$, $V_{CC2} = 12.0V$ $V_{OUT} = 0.5V \rightarrow 2.7V$	—	—	25	ns	17
Falling Time	t_{THL}	$V_{CC1} = 4.75V$, $V_{CC2} = 12.0V$ $V_{OUT} = 2.7V \rightarrow 0.5V$	—	—	25	ns	17
Timing Range #1	$t_{1A,B}$	$V_{CC1} = 4.75V$, $V_{CC2} = 12.0V$ $f = 125/250KHz$	600	—	2000	ns	17
Timing Accuracy #1	E_{I1}	$E_{T1} = 0.625 R_1 C_1 + 150$ $R_1 = 6.8K\Omega$, $C_1 = 200pF$	85	—	125	%	17
Timing Range #2	$t_{2A,B}$	$V_{CC1} = 4.75V$, $V_{CC2} = 12.0V$ $f = 125/250KHz$	150	—	1000	ns	17
Timing Accuracy #2	E_{I2}	$E_{I2} = 0.625 R_2 C_2$ $C_1 = 200pF$, $R_1 = 1.6K\Omega$	85	—	115	%	17
Power Supply Current	I_{CC1}	$V_{CC1} = 5.0V$	—	36	—	mA	1
	I_{CC2}	$V_{CC2} = 12.0V$	—	4.8	—		

PIN CONFIGURATION

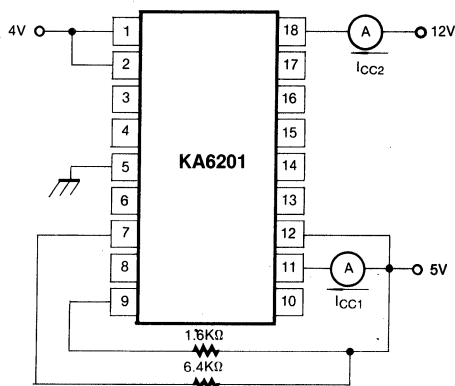


TIMING CHART

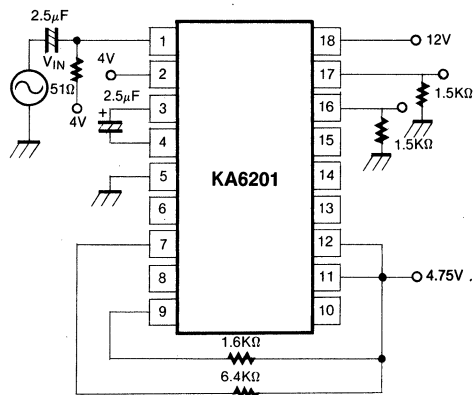


TEST CIRCUIT

1. Power Supply Current

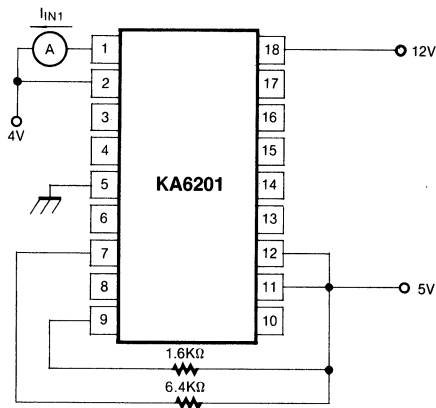


2. Voltage Gain, Band-width, Output Voltage Swing, Output Distortion Ratio



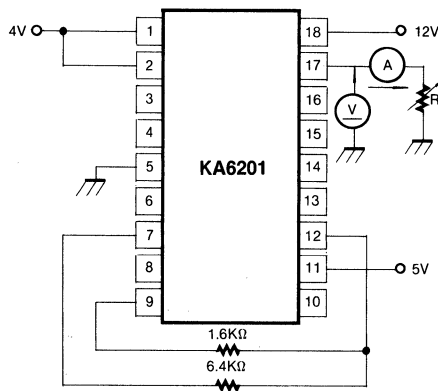
$$A_v = \frac{V_{O16} - V_{O17}}{V_{IN}}$$

3. Input Bias Current



Measure I_{IN2} in the same way.

4. Output Source Current

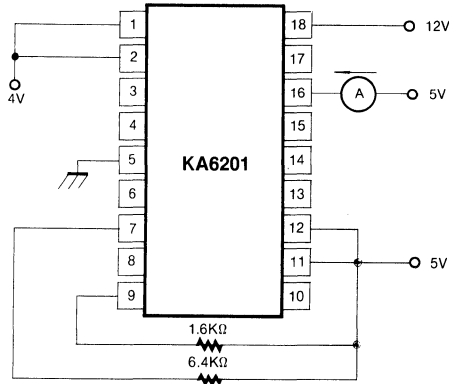


$$R_{CO}: V_{17}(\infty)$$

$$|V_{17}(\infty) - V_{17}(R)_1| \leq 0.1V$$

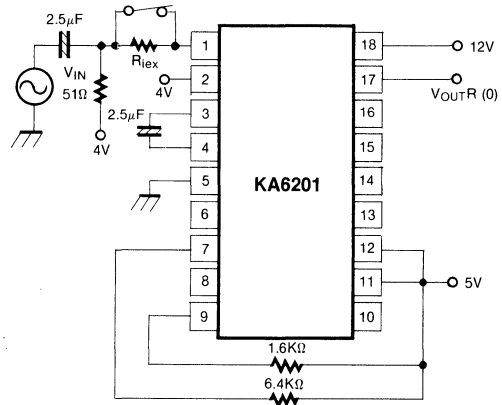
Measure Pin 16 in the same way.

5. Output Sink Current



Measure Pin 12 in the same way.

6. Input Resistance

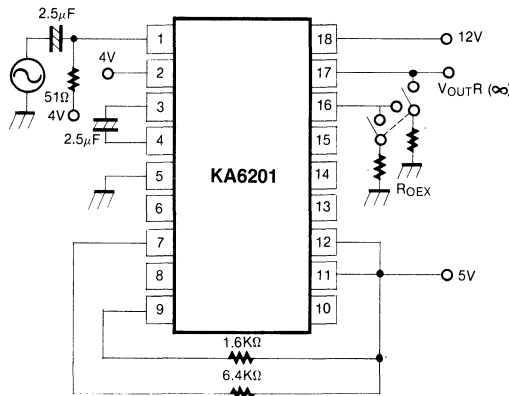


$$V_{IN} = \frac{V_{OUTR} \cdot R_{lex}}{V_{OUTO} - V_{OUTR}}$$

$$= \frac{R_{lex}}{\frac{V_{OUTO}}{V_{OUTR}} - 1}$$

$$R_{lex} = 100K\Omega$$

7. Output Resistance

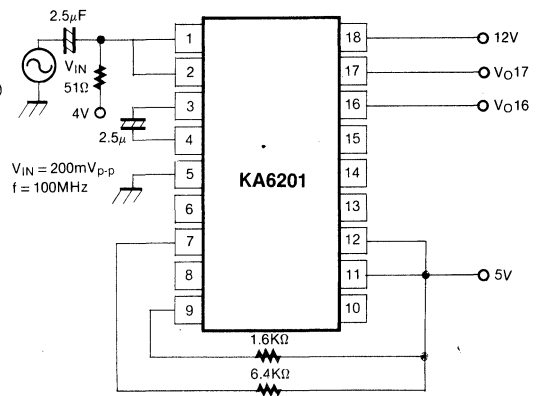


$$V_{OUT} = \frac{V_{OUT} - V_{OUTR}}{V_{OUTR}} R_{OEX}$$

$$= R_{OEX} (V_{OUT} / V_{OUTR} - 1)$$

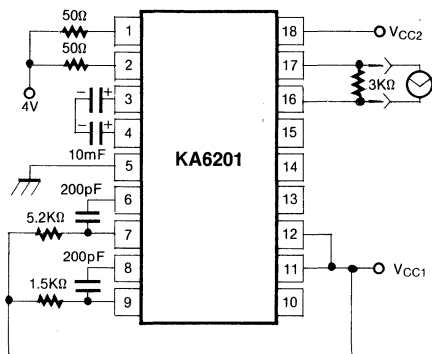
$$R_{OEX} = 500\Omega$$

8. Common Mode Rejection Ratio

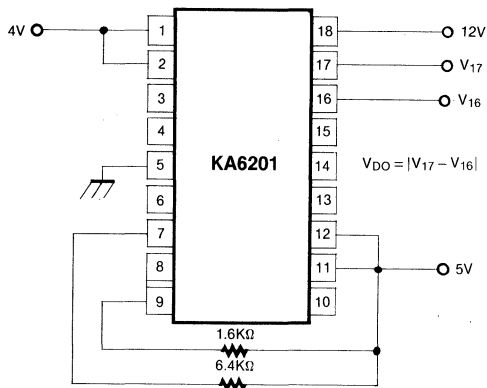


$$CMRR = 20 \log_{10} \frac{100V_{IN}}{V_{O16} - V_{O17}}$$

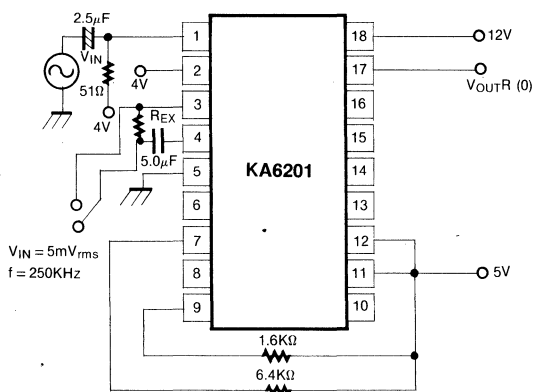
9. Power Supply Rejection Ratio



10. Differential Output Offset Voltage, Common Mode Output Voltage



11. Pre-Amplifier Section Effective Emitter Resistance (Pins 3 and 4)



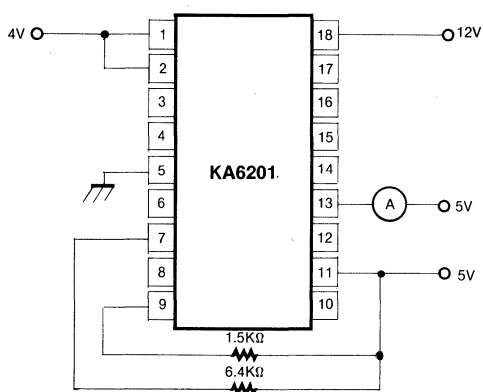
$$A_v = \frac{V_{OUT}}{V_{IN}}$$

$$re + R_e = \frac{R_{EX}}{\frac{A_{VO}}{A_{VR}} - 1}$$

$$= \frac{500}{\frac{V_{OUTO}}{V_{OUTR}} - 1}$$

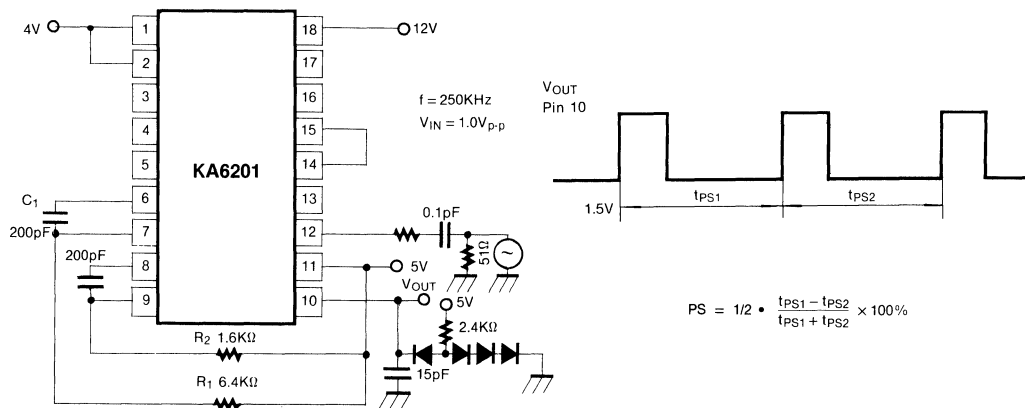
$$R_{EX} = 500\Omega$$

12. Differentiator Output Sink Current

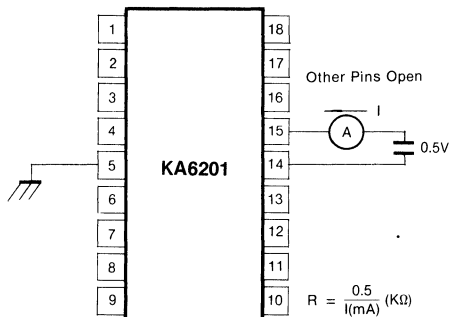


Measure Pin 12 in the same way.

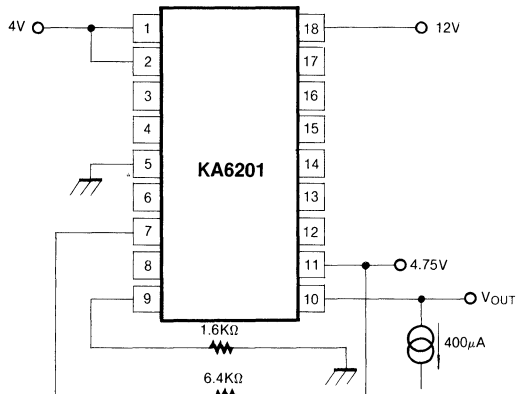
13. Peak Shift



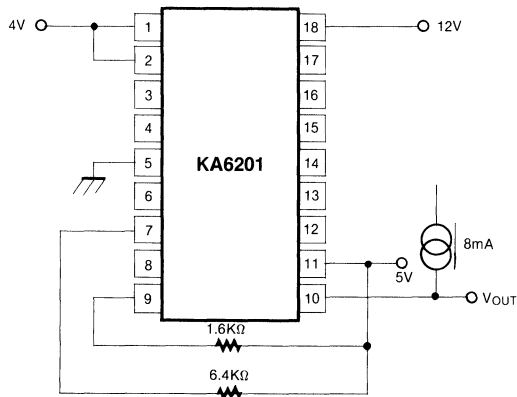
14. Input Resistance



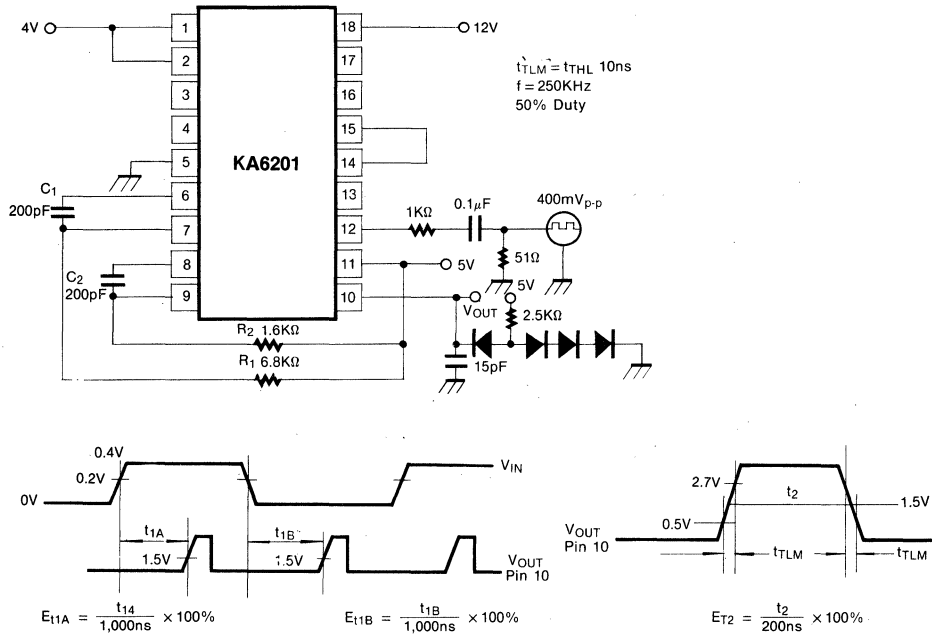
15. Output Voltage H (Pin 10)



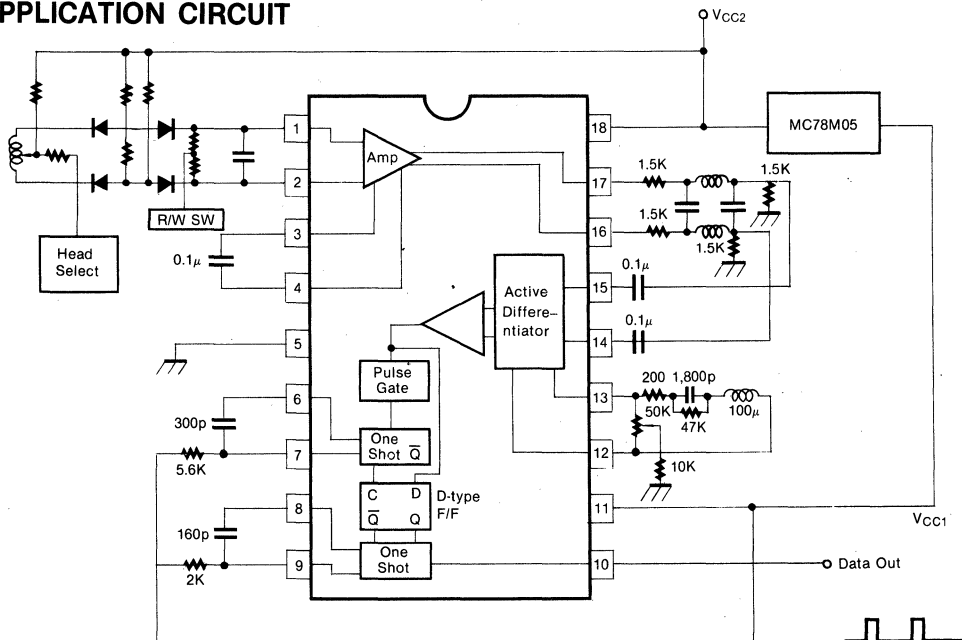
16. Output Voltage L (Pin 10)



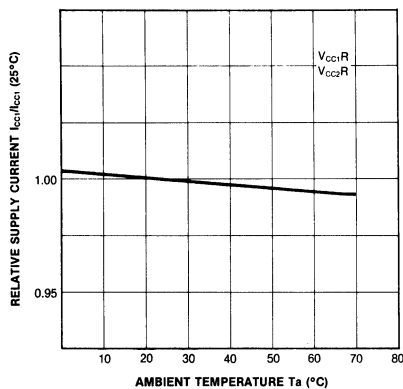
17. Timing Accuracy, Rising Time, Falling Time



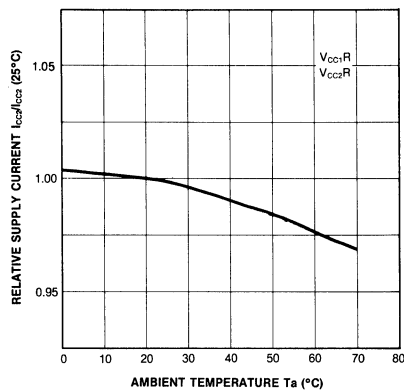
APPLICATION CIRCUIT



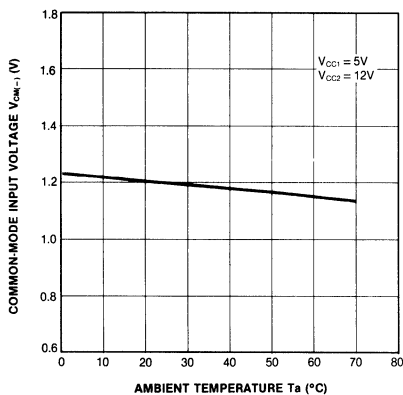
RELATIVE SUPPLY CURRENT vs.
AMBIENT TEMPERATURE (1)



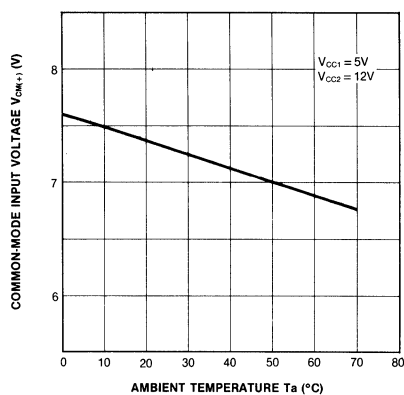
RELATIVE SUPPLY CURRENT vs.
AMBIENT TEMPERATURE (2)



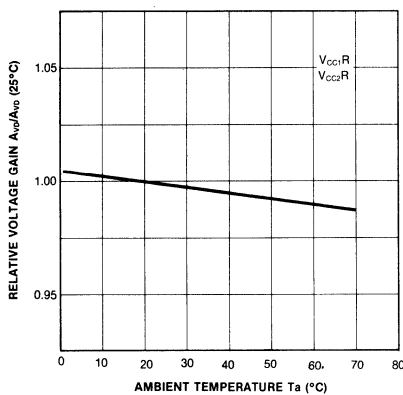
COMMON-MODE INPUT VOLTAGE vs.
AMBIENT TEMPERATURE



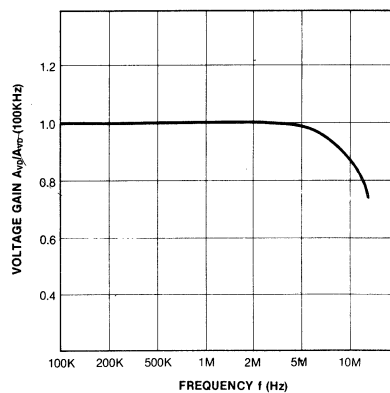
COMMON-MODE INPUT VOLTAGE vs.
AMBIENT TEMPERATURE



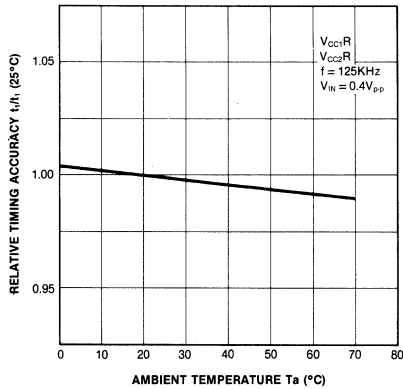
RELATIVE VOLTAGE GAIN vs.
AMBIENT TEMPERATURE



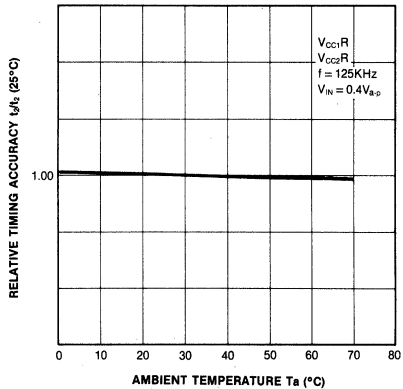
VOLTAGE GAIN vs. FREQUENCY



RELATIVE TIMING ACCURACY VS.
AMBIENT TEMPERATURE



RELATIVE TIMING ACCURACY VS.
AMBIENT TEMPERATURE



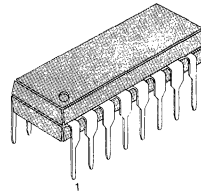
TWO PHASE STEPPING MOTOR DRIVER

The KA6202 is a monolithic power ICs. The maximum driving current and voltage are $0.33A \times 12V$ per bridge. Therefore, this value finds best use in the 2 bipolar stepping motor driving to head actuator of 3 to 5.25 inch FDD.

FEATURES

- 330mA Output Current Capability.
- Dual Bridge Included.
- With Power Save.
- Single-Input Direction Control.
- Low Output Saturation Voltage.
- Low Supply Current.
- Low Input Current.
- Compatible with TTL, LSTTL & 5V CMOS.

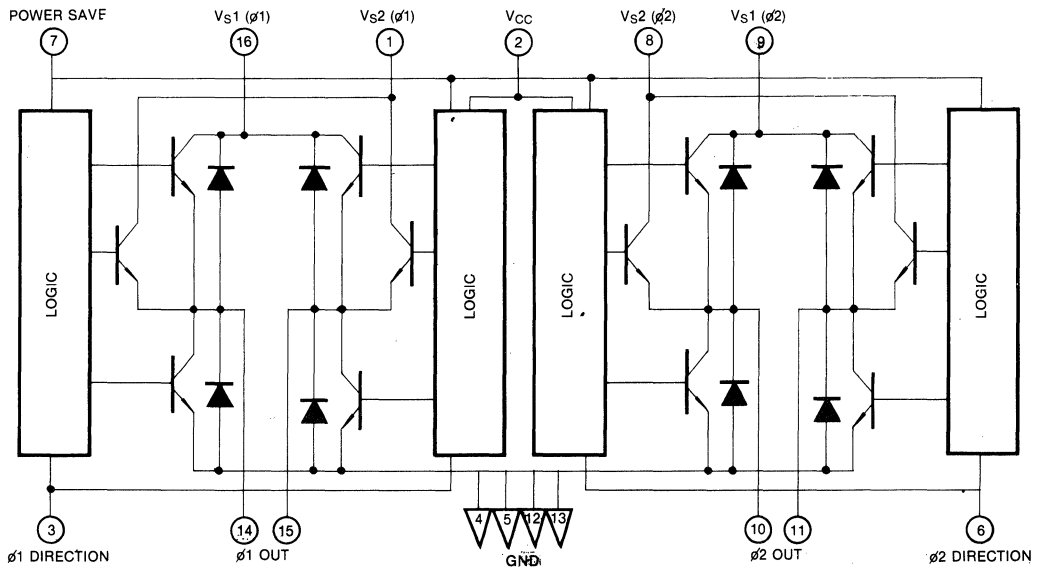
16 DIP



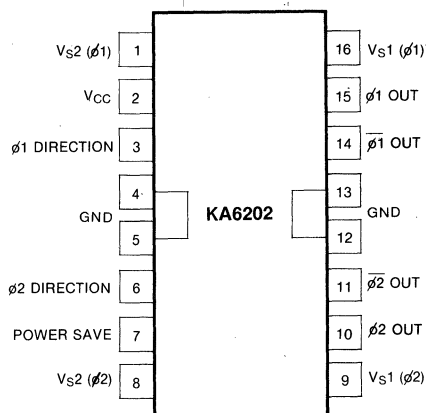
ORDERING INFORMATION

Device	Package	Operating Temperature
KA6202	16 DIP	- 20 ~ + 75 °C

BLOCK DIAGRAM



PIN CONFIGURATION

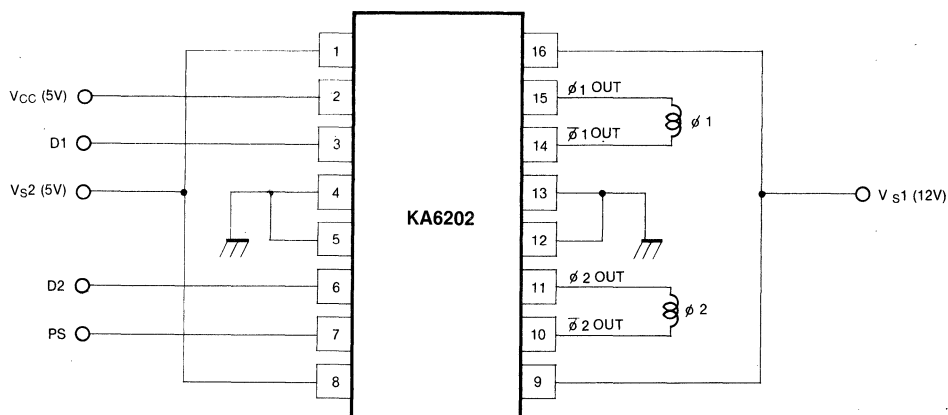
ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Logic Stage Supply Voltage	V_{CC}	7	V
Seeking Supply Voltage	V_{S1}	15	V
Holding Supply Voltage	V_{S2}	7	V
Seeking Current	I_{OS}	330	mA
Holding Current	I_{OH}	200	mA
Power Dissipation	P_D	2.0	W
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $V_{S2} = 5\text{V}$, $V_{S1} = 12\text{V}$)

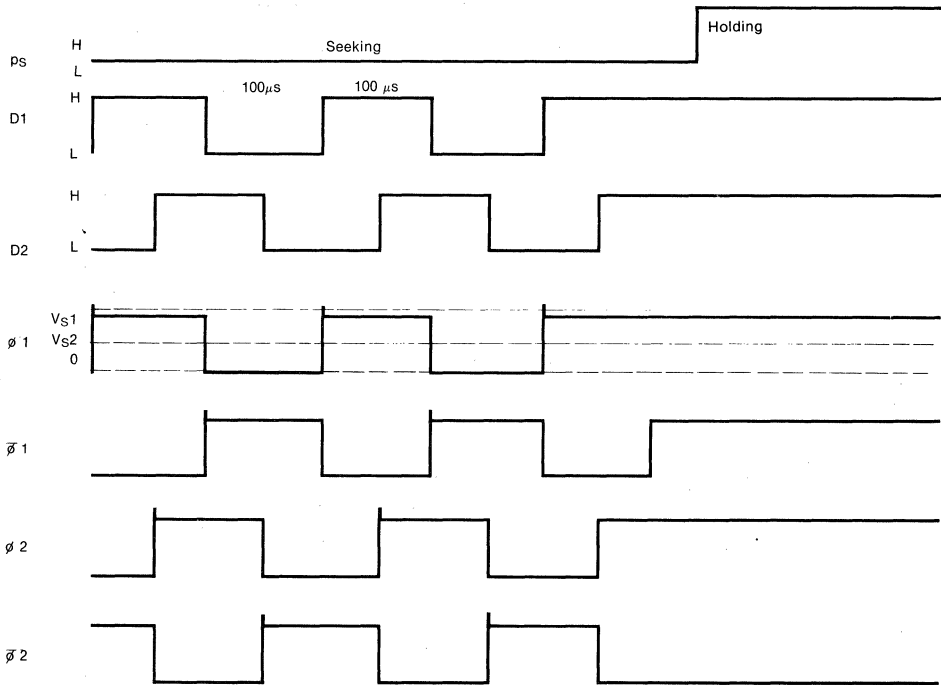
Characteristic	Symbol	Test Condition		Spec			Unit
				Min	Typ	Max	
Input Low Voltage	V _{IL}			—	—	0.8	V
Input High Voltage	V _{IH}			2.0	—	—	V
Input Low Current	I _{IL}	V _I = 0.8V		—	—	± 10	μA
Input High Current	I _{IH}	V _I = 2V		—	1.0	10	μA
		V _I = 5.5V		—	0.55	1.0	mA
Supply Current	I _{CC}	PS = 0.8V	V _{CC}	—	25	33	mA
			V _{S1}	—	10	20	mA
			V _{S2}	—	—	1.0	mA
		PS = 2V	V _{CC}	—	25	33	mA
			V _{S1}	—	3	5	mA
			V _{S2}	—	3	10	mA
Output TRS Breakdown Voltage	V(BR) _{CER}	I _C = 10mA		18	—	—	V
V _{O1} Saturation Voltage	V _{CE(sat)} 1	PS = 0.8V, I _O = 330mA		—	1.5	2.0	V
V _{O2} Saturation Voltage	V _{CE(sat)} 2	PS = 2.0V, I _O = 130mA		—	1.5	2.0	V
Clamp Diode Forward Voltage	V _F	IF = 330mA	Upper	—	5	—	V
			Lower	—	1.5	—	
Delay Time	tp _{LH}			—	1.0	5	μs
	tp _{HL}			—	1.0	5	

APPLICATION CIRCUIT & TIMING CHART



(2-Phase Bipolar Stepping Motor Drive Circuit)

TIMING CHART



TRUTH TABLE (For Each Bridge)

Power Save	Direction	ϕ - Out	$\bar{\phi}$ - Out
L	L	L	H +
L	H	H +	L
H	L	L	H -
H	H	H -	L

L : Low Voltage States

H + : High Voltage State: Seeking TRS On

H - : High Voltage State: Holding TRS On

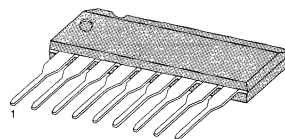
DETAIL ENHANCER

The KA8101 is a monolithic integrated circuit designed for sub-HQ in a VCR system. This device combined with KA2944 and KA2945 can emphasize the high frequency region more than that of pre-emphasis.

FEATURE

- Available for each SP, LP, EP mode of NTSC/PAL

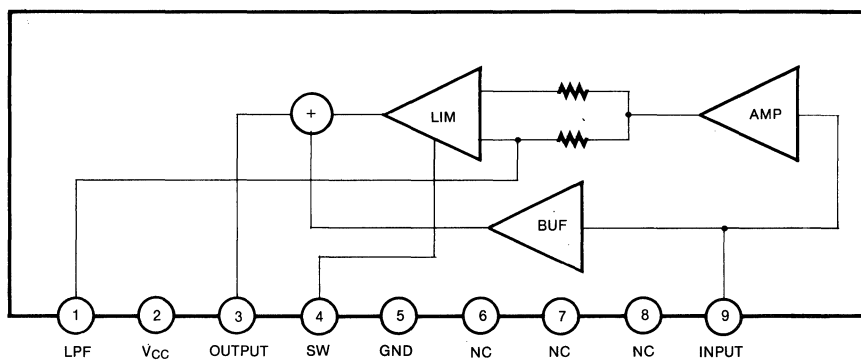
9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8101	9 SIP	-10 ~ +75°C

BLOCK DIAGRAM



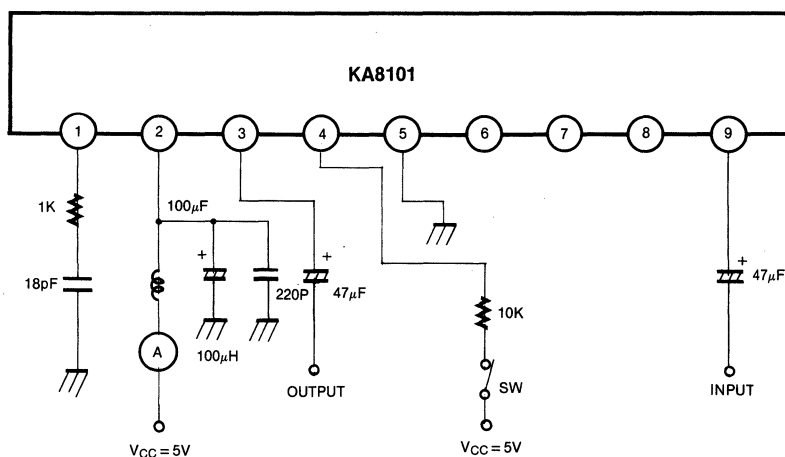
ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	7	V
Power Dissipation	P_D	150	mW
Operating Temperature	T_{opr}	-10 ~ +75	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

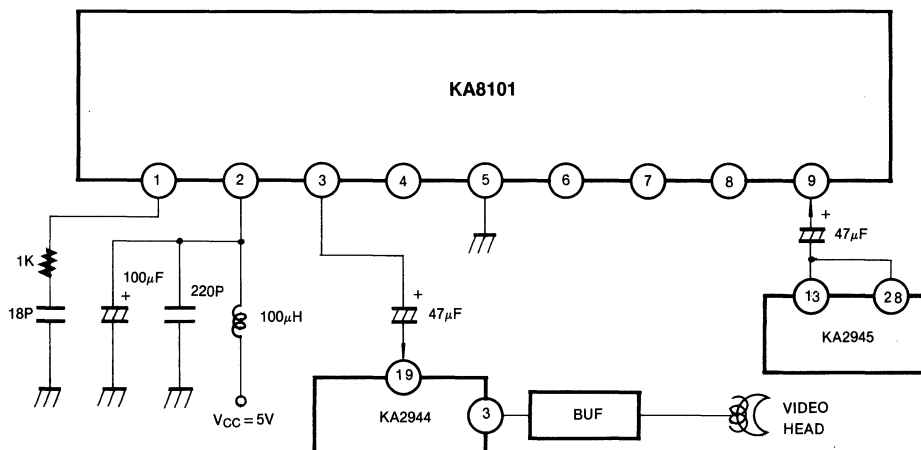
ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

Characteristic	Input Condition (mVpp)	Frequency (MHz)	Min	Typ	Max	Unit
Supply Current	No Signal	No Signal	3.4	4.5	5.8	mA
Main AMP Gain	250	0.1	-0.5	0	0.3	dB
	250	5	-1.0	0	0.3	
Enhance Characteristics 1	250	2	0.1	0.4	0.7	dB
Enhance Characteristics 2	78	2	1.2	1.7	2.2	
Enhance Characteristics 3	25	2	3.9	4.6	5.3	
Enhance Characteristics 4	7.8	2	5.4	6.4	8.4	

TEST CIRCUIT

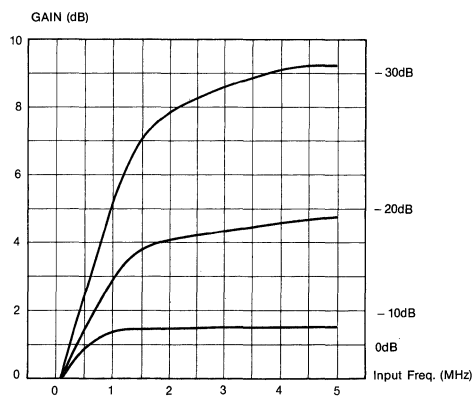


APPLICATION CIRCUIT



4

DETAIL ENHANCE CHARACTERISTICS



WRITE & READ AMPLIFIER

KA8102 is a monolithic integrated circuit designed for write & read amplifier in a VCR system.

FUNCTIONS**Record**

- EQ Amp
- Current Amp
- REC/PB SW TR

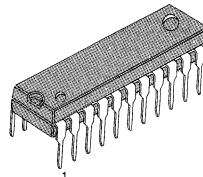
Playback

- Pre Amp
- Chrominance Amp
- Peaking Amp
- RF AGC Amp

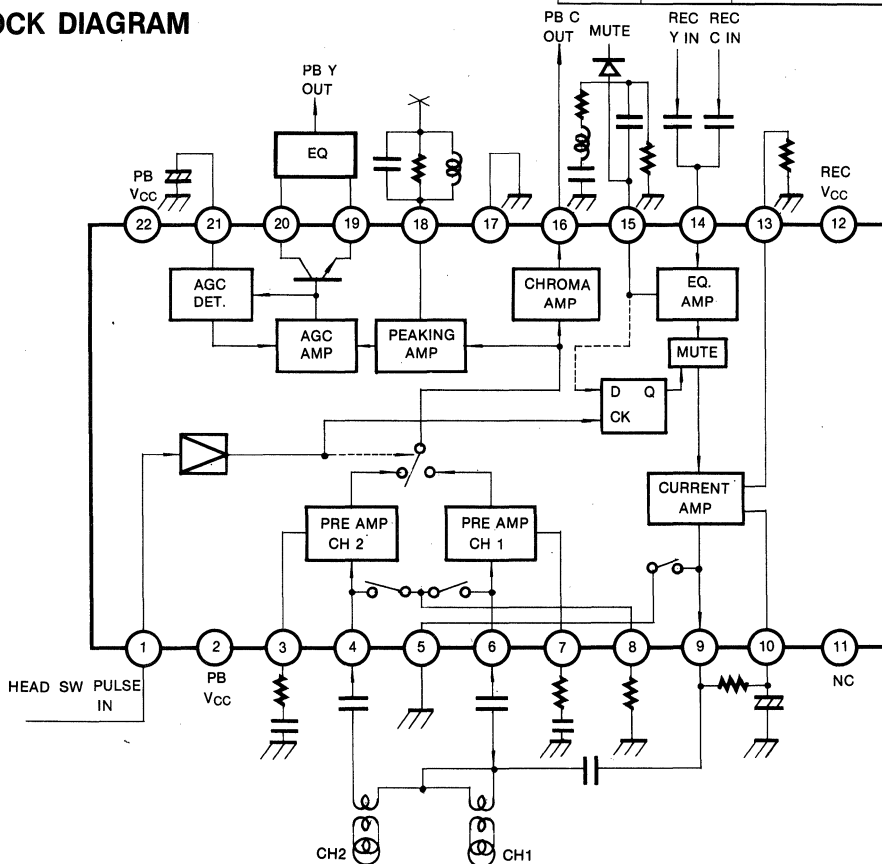
FEATURES

- Operating voltage: REC 9V/PB 5V
- REC amp & PB pre amp on a single chip
- REC amp input: Low impedance
- Includes REC muting control circuit
- Includes REC timing control circuit
- Combined with the KA8103, luminance processor and the KA8104, chrominance processor, the compact, video signal system is available.
- 22 Pin shrink dual in line package

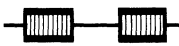
22 SDIP

**ORDERING INFORMATION**

Device	Package	Operating Temperature
KA8102	22 SDIP	-10 ~ +70°C

BLOCK DIAGRAM

PIN ASSIGNMENT

Pin No.	Function	Waveform	Outline			
1	Head Switching Pulse Input		Input terminal of head switching pulse.			
2	PB V _{cc}		Terminal of supply voltage in a PB mode.			
3	Pre Amp CH-2 By-Pass		By-pass terminal of CH-2.			
4	Pre Amp CH-2 Input		Input terminal of CH-2. PB signal through a capacitor is input.			
			Grounded through Pin 8 in REC mode.			
5	GND		GND for pre amp.			
6	Pre Amp CH-1 Input		Input terminal of CH-1. PB signal through a capacitor is input.			
			Grounded through Pin 8 in REC mode.			
7	Pre Amp CH-1 By-Pass		By-pass terminal of CH-1.			
8	Pre Amp Input SW GND		GND of pre amp input SW. Grounded by a resistor.			
9	REC Current Output		Output terminal of REC current. Drives output current to video heads via a capacitor.			
10	REC Amp Feed Back		DC feed back terminal to fix output DC level.			
11	NC		Non connection			
12	REC V _{cc}		Terminal of supply voltage in REC mode.			
13	REC Current Adjustment		Terminal for adjusting REC current. REC current is adjusted by the resistor on this terminal.			
14	REC Amp Input		Input terminal of REC signal. Input of low impedance.			
15	REC EQ Amp/ Muting Control		Input terminal of EQ amp. Connected with EQ circuit externally. Muting control			
			<table><tr><th>Mute</th><th>Voltage of Pin 15</th></tr><tr><td>on</td><td>Less than 2.0V</td></tr><tr><td>off</td><td>2.5V to V_{cc}</td></tr></table>	Mute	Voltage of Pin 15	on
Mute	Voltage of Pin 15					
on	Less than 2.0V					
off	2.5V to V _{cc}					
16	Chroma Output		Output terminal of chroma signal. Chroma signal is provided with PB FM luminance signal.			

PIN ASSIGNMENT (Continued)

Pin No.	Function	Waveform	Outline
17	GND		Main GND
18	Head Peaking		Head peaking terminal. Connected with peaking coil externally and V_{CC} in PB mode.
19	AGC Output		Emitter terminal of output TR.
20			Collector terminal of output TR.
21	AGC DET Output		AGC detector output terminal
22	PB V_{CC}		Terminal of supply voltage in PB mode. $V_{CC} = 4.5 \sim 5.5V$

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
REC Supply Voltage	$V_{CC(REC)}$	12.5	V
PB Supply Voltage	$V_{CC(PB)}$	7	V
Power Dissipation	P_d	500	mW
Operating Temperature	T_{opr}	$-10 \sim +75$	$^{\circ}C$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^{\circ}C$

ELECTRICAL CHARACTERISTICS ($T_a = 25^{\circ}C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
PB Supply Current	I_{CCP}	Pin 2/Pin 22	14.0	18.0	22.0	mA
REC Supply Current	I_{CCR}	Pin 12	27.0	34.0	41.0	mA
CH-1 Gain/CH-2 Gain	G_{P1}/G_{P2}	Pin 6/4 input: sine wave 0.3mV _{p-p} 4MHz Test Pin 16	66.0	71.0	76.0	dB
Differential Gain	G_P	$G_{P1} - G_{P2}$	-2.0	0	2.0	dB
CH-1/CH-2 DC Offset	V_{OS}	Pin 16 DC	-100	0	100	mV
Channel Select Voltage	V_{SW}	Pin 1 DC (CH-1 ON)			1.0	V
		Pin 1 DC (CH-1 ON)	1.6			
CH-1 2nd Harmonic Distortion	H_{D1}	Pin 6 input: Sine wave 0.3mV _{p-p} 4MHz Test Pin 16, 8/4MHz ratio	—	—	-40	dB
CH-2 2nd Harmonic Distortion	H_{D2}	Pin 4 input: Sine wave 0.3mV _{p-p} 4MHz Test Pin 16, 8/4MHz ratio	—	—	-40	dB

ELECTRICAL CHARACTERISTICS (Continued)

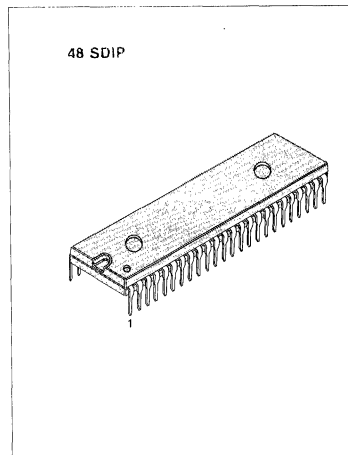
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Crosstalk 1 (CH-1 to CH-2)	CT ₁₂	Pin 6 input: Sine wave 0.3mV _{p-p} , 4MHz Pin 1 input: H Test Pin 16	—	—	−40	dB
Crosstalk 2 (CH-2 to CH-1)	CT ₂₁	Pin 4 input: Sine wave 0.3mV _{p-p} , 4MHz Pin 1 input: L Test Pin 16	—	—	−40	dB
FM AGC Output Voltage	V _{AGC}	Pin 6: sine wave 0.3mV _{p-p} , 4MHz	0.3	0.4	0.5	V _{p-p}
FM AGC Control Characteristics 1	V _{A1}	Sine wave 4MHz, 1.0mV _{p-p} /0.3mV _{p-p} , Test Pin 19	0	0.3	1.0	dB
FM AGC Control Characteristics 2	V _{A2}	Sine wave 4MHz, 1.0mV _{p-p} /0.3mV _{p-p} , Test Pin 19	−1.0	−0.3	0	dB
FM AGC Freq. Response	F _{AGC}	Pin 7 input: sine wave 0.1mV _{p-p} , 10MHz/4MHz Test Pin 21	−3.0	—	—	dB
FM AGC 2nd Harmonic Distortion	HD _{AGC}	Pin 6 input: sine wave 0.3mV _{p-p} , 4MHz Test Pin 19 8M/4MHz ratio	—	—	−40	dB
FM AGC DET Voltage	V _{AGCDET}	Pin 6 input: sine wave 0.1mV _{p-p} , 4MHz Test Pin 21	0.6	0.8	1.0	V
REC Amp Output Current	I _{REC}	Pin 14 input: sine wave 0.25V _{p-p} , 4MHz Test Pin 8	10	15	20	mA
REC 2nd Harmonic Distortion	HD _{REC}	Pin 14 input: sine wave 0.25V _{p-p} , 4MHz, Test Pin 8 8M/4MHz ratio	—	—	−40	dB
REC Cross Modulated Distortion	X _{MOD}	Pin 14 input: sine wave 0.25V _{p-p} , 4MHz & sine wave 50mV _{p-p} , 630KHz, Test Pin 8 630KHz/4MHz ratio	—	—	−40	dB
REC Freq. Response	F _{REC}	Pin 14 input: sine wave 0.25V _{p-p} , 10MHz/ 4MHz ratio, Test Pin 19	−0.3	—	—	dB
REC Mute Response	R _{MUTE}	Pin 14 input: sine wave 0.25V _{p-p} , 4MHz Pin 15: GND, Test Pin 8, DC level ratio in Pin 1 H/L	—	—	−50	dB

LUMINANCE PROCESSOR

The KA8103 is a monolithic integrated circuit designed for chrominance processor in a VCR system, which includes all function necessary for luminance processing.

FEATURES

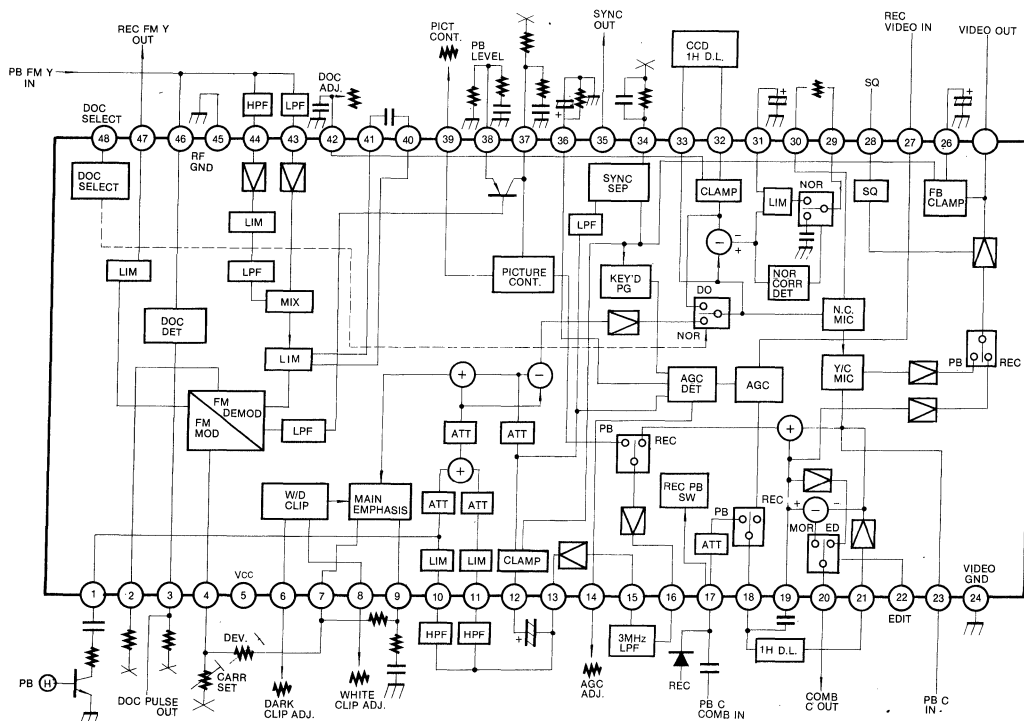
- Supply voltage: 5V (typ.)
- Luminance processing by single chip.
- Luminance-chrominance separator by comb filter.
- Detail enhancer
- Edit control
- Video DOC (CCD Delay Line)
- Picture control
- Combined with KA8102, write and read amplifier and KA8104, chrominance processor, compact video processing system is available.
- 48 Pin shrink dual line package.



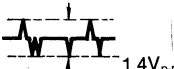
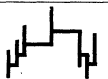
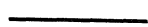
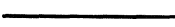
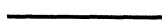
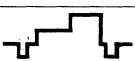
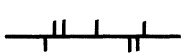
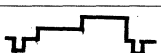
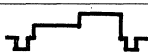
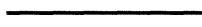
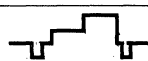
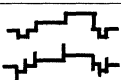
ORDERING INFORMATION

Device	Package	Operating Temperature
KA8103	48 SDIP	- 10 ~ + 70°C

BLOCK DIAGRAM



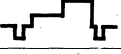
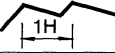
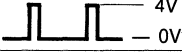
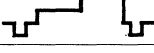
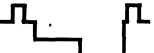
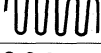
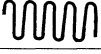
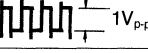
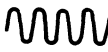
PIN FUNCTION (Continued)

Pin No.	Function	Waveform	Outline
1	PB NC LPF		Noise canceller LPF in PB mode.
2	FM DEMO Sens. Adjust		Pull up by recommended resistor for proper DEMO sensitivity.
3	Drop Out Pulse Output		Drop out pulse is provided corresponding to drop out by pull-up resistor.
4	FM MOD Input		FM modulator input terminal. Carrier frequency, deviation are adjusted by external volume.
5	V _{CC}		4.5~5.5V
6	Dark Chip Adjust		Clip level adjusting terminal. Adjustment is made with supplying DC voltage from external volume.
7	Main-Emphasis Output		Main emphasis amplifier output.
8	White Clip Adjust		Clip level adjusting terminal. Adjustment is made with supplying DC voltage from external volume.
9	Main-Emphasis Feed Back		Feed back terminal of emphasis amp.
10	Detail Enhancer (REC) Noise Canceller (PB)		Differential signal input terminal for detail enhancer in REC mode, and for noise canceller in PB mode. Differential input signal from HPF is mixed with main video signal via limiter.
11	NL Emphasis Mix Output		High frequency signal input for NL emphasis/deemphasis. The signal from pin 13 is fed via HPF and is mixed with main video signal.
12	Clamp Input		Clamp terminal of main video signal.
13	12dB Amp Output		Output terminal of 12dB amplifier.
14	EE Level Adjust		Adjustment is made with supplying DC voltage from external volume.
15	12dB Amp Input		Input terminal of 12dB amplifier. The output signal from LPF is input in both REC and PB mode.
16	REC/PB Y Output		Comb filter output in REC mode and main deemphasis output in PB mode. This terminal drives LPF directly.

PIN FUNCTION (Continued)

Pin No.	Function	Waveform	Outline
17	PB Chroma Input REC/PB Mode Switch		Chroma input terminal for cross-talk canceller in PB mode. In addition, REC/PB mode is switched by supplying DC voltage to this pin. REC mode is selected by the voltage more than 3.8V.
18	AGC Output		AGC AMP output terminal. In PB, chroma signal is output via pin 17. The output is input to pin 21 via 1H delay line to make comb filter.
19	EE Amp Input		The input terminal of EE AMP and comb filter. The output of pin 18 is input through capacitor.
20	Comb Chroma Output		Chroma output of comb filter. Input composite signal is provided in edit mode.
21	Delayed signal Input		Delayed signal input terminal for luminance/chroma separation and chroma cross talk canceller.
22	Edit Control		Edit mode selector. By setting this terminal high level, luminance/chroma separation stops in REC mode.
23	PB Chroma Input		Chroma signal input terminal for luminance/chroma mix circuit in PB mode.
24	Video GND		Ground terminal of video signal.
25	Video Output		Video output terminal.
26	Feedback Clamp Filter		Feedback clamp filter terminal which holds clamp level shift every horizontal pulse period.
27	REC Video Input		Composite video signal input in REC mode.
28	Squelch Control		By supplying high level, the output level of pin 25 is set at same level as sync. tip's. High level: 1.9~2.7V Low level: 0~1.1V
29	LNC Limiter Output		Limiter output terminal for line noise canceller. Differential signal between present and 1H delayed signal is output via limiter.
30	LNC Limiter Input		Non-correlated noise input for line-noise canceller. Attenuated signal is input.

PIN FUNCTION (Continued)

Pin No.	Function	Waveform	Outline
31	Limiter By-Pass Capacitor		By-pass capacitor terminal for LNC limiter.
32	Delayed Signal Input		1H delayed luminance signal input terminal to make LNC and video DOC. Video signal delayed by CCD is input after adjustment.
33	DOC SW Video Output		Luminance output terminal sent to CCD.
34	Sync. Sep. Filter		Filtering terminal for sync. separator pull-up by capacitor and resistor.
35	Sync. Sep. Output		Composite sync. output.
36	AGC DET Filter		AGC DET filter terminal.
37	Main De-emphasis 1		Collector terminal of internal transistor for main deemphasis.
38	Main De-emphasis 2		Emitter terminal of internal transistor for deemphasis. PB level is adjusted by a volume connected to this terminal.
39	Picture Control		PB picture control terminal. By supplying DC voltage, frequency response of high frequency is enhanced/depressed.
40	Limiting Capacitor		Limiting capacitor terminal.
41			
42	DOC Offset Adjust		Offset adjust terminal of video DOC.
43	Limiter Input 1		FM signal input terminal for LPF.
44	Limiter Input 2		FM signal input terminal for HPF.
45	RF GND		RF Ground
46	DOC Sens. Adjust		Drop out detecting level is adjusted by FM signal amplitude.
47	FM MOD Output		Output terminal of FM Modulator.
48	DOC Mode Selector		H level: DOC off L level: Video DOC

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	7	V
Power Dissipation	P_D	580	mW
Operating Temperature	T_{opr}	-10 ~ +75	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
REC Supply Current	I_{CCR}	Pin 17: H Test pin 5	42	53	70	mA
AGC Adjust	AGC	Pin 27 video input; $1V_{p-p}$ Adjust pin 14 DC level so as to provide $2V_{p-p}$ output at video output terminal.	3.0	3.5	40	V
AGC Control Characteristics 1	AGC_{+6}	Pin 27 video input: $2V_{p-p}$. Check output level at pin 25 ($2V_{p-p}$ output = 0dB).	-1.0	0.5	1.5	dB
AGC Control Characteristics 2	AGC_{-6}	Pin 27 video input: $0.5V_{p-p}$. Check output level at pin 25. ($2V_{p-p}$ output = 0dB)	-1.5	0.5	1.5	dB
AGC Control Characteristics 3	AGC_{-S}	Pin 27 video input: $0.85V_{p-p}$ (Video = $0.7V_{p-p}$, sync = $0.15V_{p-p}$). Check output level at pin 25 ($2V_{p-p}$ output = 0dB)	-1.5	-0.5	+2.0	dB
AGC Amp Gain	G_{AGC}	$V_{14} = 1.5V$ Pin 27 input: $0.1V_{p-p}$, 100KHz sine wave. Check output level at pin 18	0.5	2.5	4.5	dB
AGC Amp Frequency Response	F_{AGC}	$V_{14} = 1.5V$ Pin 27 input: $0.1V_{p-p}$, sine wave Test pin 18 output at 10MHz/1MHz	-3.0	-0.1	—	dB
EE-FB AMP Gain	G_{EE-FB}	AGC ON Pin 19 input: $0.25V_{p-p}$ video signal Test Pin 25 output	16	18	20	dB
Comb Filter Amp Gain	G_{COMBY}	Pin 19 input: $0.25V_{p-p}$, 100KHz sine wave Test pin 16 output	4.5	6.0	7.5	dB
Comb Filter Frequency Characteristics 1	F_{COMB}	Pin 19 input: $0.25V_{p-p}$, sine wave Test pin 16: 10MHz/1MHz	-3.0	-1.4	—	dB
Comb Filter Chroma Amp Gain	G_{COMBC}	Pin 21 input: $10mV_{p-p}$, 3.58MHz sine wave Pin 19 input: 0 Test pin 20 output	4.5	6.5	8.5	dB

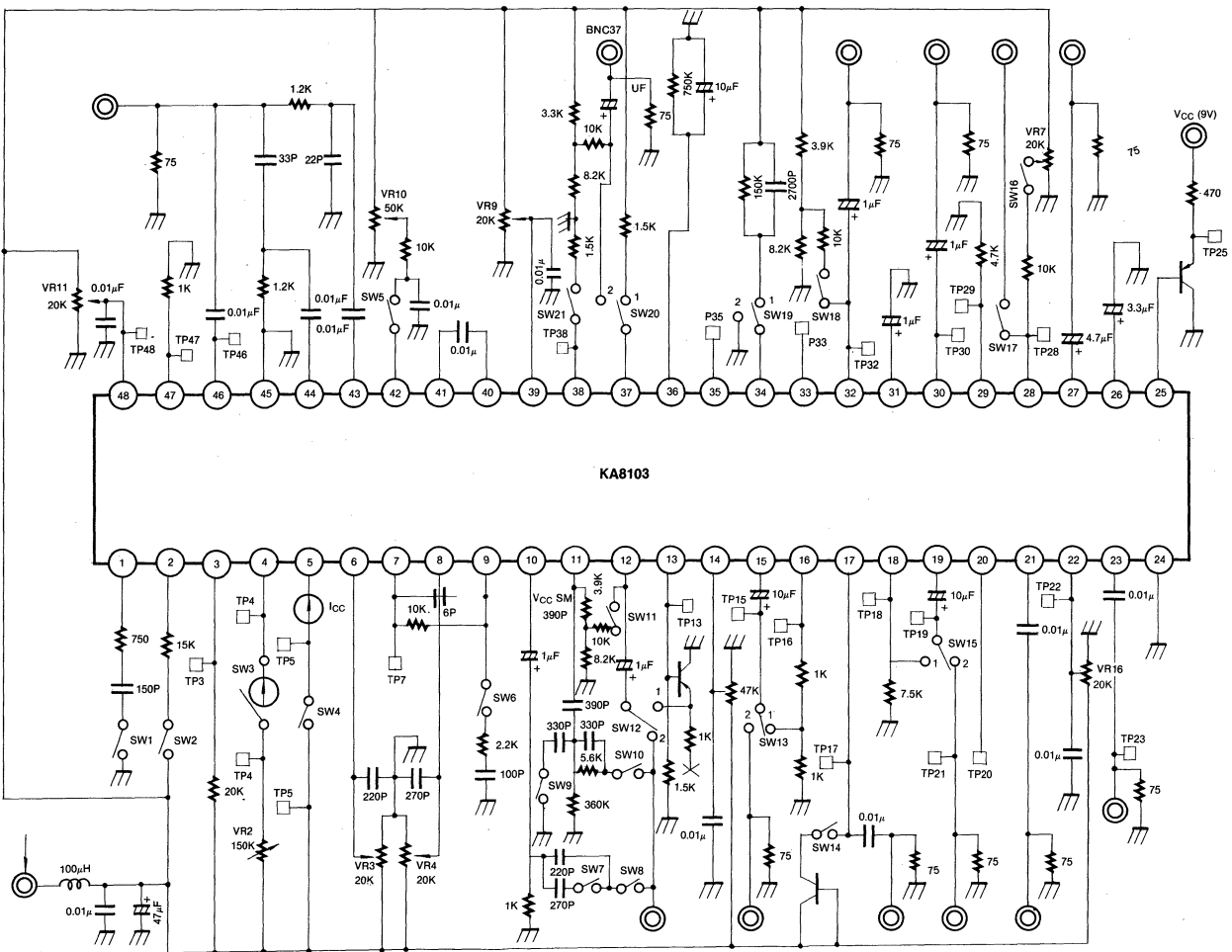
ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Comb Filter Chroma Frequency Response	F _{COMBC}	Pin 21 input: 10mV _{p-p} sine wave Pin 19 input: 0 Test pin 20 output: 10MHz/1MHz	−3.0	−0.5	—	dB
12dB Amp Gain	G ₁₅₋₁₃	Pin 15 input: 0.25V _{p-p} , 100KHz sine wave Test pin 13 output	10	12	14	dB
12dB Amp Frequency Characteristics	F ₁₅₋₁₃	Pin 15 input: 0.25V _{p-p} sine wave Pin 13 output: 10MHz/1MHz	−3.0	−0.1	—	dB
Main Emphasis Output Level	V _{ME}	Pin 27 input: 1V _{p-p} video signal (AGC _{ON}) Test pin 7 output	0.32	0.5	0.72	V _{p-p}
White Clip Adjust Level	V _{WC}	DC level at pin 8 when white clip adjusted on 200%.	1.6	2.7	3.8	V
Dark Clip Adjust Level	V _{DC}	DC level at pin 6 when white clip adjusted on 50%.	1.8	3.0	4.2	V
FM MOD Lineality	L _{MOD}	Pin 47: 3, 4, 5MHz Test the injection current at pin 4.	−5	0	+5	%
FM MOD Sensitivity	S _{MOD}	Pin 47: 3, 4, 5MHz Test the injection current at pin 4.	—	26	—	MHz/mA
FM MOD 2nd Harmonic Spurious	HD _{MOD}	Test 8MHz spurious level at pin 47. (4MHz level = 0dB)	—	−40	−30	dB
FM MOD Output Level	V _{MOD}	Test pin 47 output	0.7	1.0	1.3	V _{p-p}
REC/PB Switch Level	V _{R/P}	Pin 17 DC level in REC.	4.0	—	5.0	V _{p-p}
		Pin 17 DC level in PB.	Self-biased			
PB Supply Current	I _{CCP}	PB mode Test pin 5 current	51	64	86	mA
DOC SW Offset	ΔV _{DOC}	PB FM input: 4MHz, sine wave Test output DC offset at pin 33 (DOC/NOR). Pin 48: GND	−240	−80	0	mV
DOC Hysterisis	H _{DOC}	Differential level between DET and recovering level.	5.0	7.0	9.0	dB
DOC Sensitivity	S _{DOC}	Pin 46 input: 4MHz, sine wave Pin 3 output: H (open) Test input level at pin 46. (0dB = 0.4V _{p-p})	−24	−20	−16	dB

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
DOC Mode Switch Level	V_{DOC}	DOC off: pin 48 DC level	3.5	—	5.0	V
FM DEMO Sensitivity	S_{DEM}	Video DOC: pin 46 DC level Test pin 37 level	0 60	— 100	0.5 140	mV/MHz
FM DEMO Lineality	L_{DEM}	Test pin 37 level	-4	0	+4	%
FM DEMO Carrier Leakage	CL_{DEM}	Test 4MHz level at pin 38. (400mV _{p-p} = 0dB)	—	-35	-25	dB
LNC Limiter Gain	G_{LNC}	Pin 48: H Pin 32 input: 1MHz, 20mV _{p-p} sine wave Gain B/W pin 32 and 29.	20	25	30	dB
Y/C Mix Amp Gain	$G_{23/25}$	Pin 23 input: 3.58MHz, 250mV _{p-p} Test pin 25 output	10	12	14	dB
Edit Mode Switch Level	V_{ED}	Edit on: pin 22 DC level Edit off: pin 22 DC level	4.0 0	— —	5.0 3.0	V
Sync SEP Pulse Level	V_{SYNC}	Test output level at pin 35.	3.6	—	4.1	V
Sync SEP Pulse Width	W_{SYNC}	Test pulse width of 50% level at pin 35.	4.0	4.4	4.8	μS
Sync SEP Pulse Delay	TD_{SYNC}	Differential time between output pulse at pin 35 and video signal at pin 12.	0.4	0.7	1.0	μS
Sync SEP Threshold Level	TH_{SYNC}	Test pin 27 level	—	-12	-9	dB
Edit Switch NOR Gain	G_{NOR}	Pin 19 input: 0.25V _{p-p} video signal Pin 22: GND Test pin 20 output	-1.0	0	+1.0	dB
Edit Switch Edit Gain	G_{ED}	Pin 19 input: 0.25V _{p-p} video signal Pin 22: V _{CC} Test pin 20 output	4.0	5.5	7.0	dB
Squelch Control Voltage	V_{SQ}	SQ OFF, Pin 28 DC level SQ Sync ON, pin 28 DC level SQ Gray ON, pin 28 DC level	0 2.0 4.0	— — —	1.0 2.5 5.0	V
Cross-Talk Carrier Gain	$G_{17/18}$	Pin 17 input: 0.4V _{p-p} , sine wave 3.58MHz. Test pin 18 output	-8.0	-6.5	-5.0	dB
EE Output Control Level	EE_{CL}	Pin 27 input: 1V _{p-p} , video signal Pin 25 output: 2V _{p-p} Test pin 14 level	3.0	3.5	4.0	V

TEST CIRCUIT



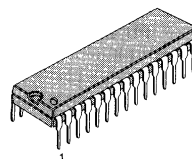
CHROMINANCE PROCESSOR

The KA8104 is a monolithic integrated circuit designed for chrominance processor in a VCR system, which includes all functions necessary for chrominance processing.

FEATURES

- Supply voltage: 5V (typ.)
- Corresponded to NTSC, PAL, Quasi SECAM mode
- 1X-tal only for PAL mode application
- Includes REC LPF
- Edit control
- PB chroma input level compensator
- f_{sc} multiplier (2 f_{sc})
- Field start inhibit
- High speed APC circuit
- APC reference control
- Operational type of subconverter for spurious reduction
- Combined with KA8102, write & read amplifier and KA8103, luminance processor, the compact video processing system is available.
- 30 pin shrink dual-in-line package.

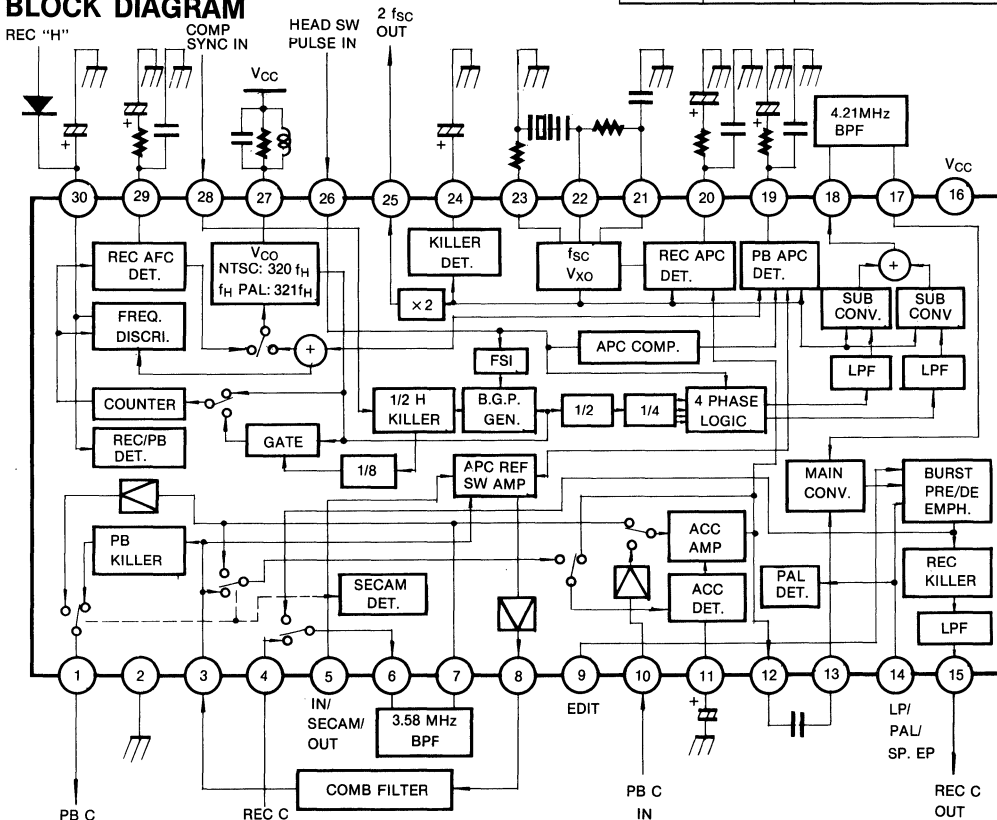
30 SDIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8104	30 SDIP	-10 ~ +70°C

BLOCK DIAGRAM



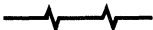
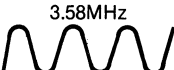
PIN ASSIGNMENT

Pin No.	Function	Waveform	Outline								
1	PB Chroma Output		PB chroma signal output								
2	GND		GND								
3	PB Killer Amp Input		PB killer amp input signal is cross-talk cancelled signal								
4	REC Chroma Input		REC chroma signal input								
5	APC REF. SW/ SECAM SETTING		Reference signal switching for PB APC DET & SECAM mode control <table data-bbox="762 781 1106 897"><tr><th>Pin 5 DC Level</th><th>Mode</th></tr><tr><td>3.6 ~ 5.0V</td><td>APC IN</td></tr><tr><td>1.7 ~ 3.2V</td><td>SECAM</td></tr><tr><td>0 ~ 1.3V</td><td>APC OUT</td></tr></table> *APC IN: Indicates APC REF signal is picked out before comb filter (Pin 8) APC OUT: Indicates after comb filter (Pin 3)	Pin 5 DC Level	Mode	3.6 ~ 5.0V	APC IN	1.7 ~ 3.2V	SECAM	0 ~ 1.3V	APC OUT
Pin 5 DC Level	Mode										
3.6 ~ 5.0V	APC IN										
1.7 ~ 3.2V	SECAM										
0 ~ 1.3V	APC OUT										
6	REC/PB SW Amp Output		Composite signal output at REC mode & converter output at PB mode. Drives 3.58MHz (4.43MHz) BFP.								
7	REC/PB 3.58MHz Chroma Input		ACC amp input at REC mode & comb filter driving amp input at PB mode. 3.58MHz (4.43MHz) BPF is necessary between Pin 6 and Pin 7.								
8	Comb Filter Amp Output		Chroma signal output at PB mode. Drives comb filter for cross-talk cancell. In case of using Y/C separate circuit as cross-talk canceller, connect to KA8103 Pin 17 through capacitor.								

PIN FUNCTION (Continued)

Pin No.	Function	Waveform	Outline								
9	Edit Control		Burst De-emphasis level control as edit mode function <table border="1"><thead><tr><th>Pin 9 DC Level</th><th>Burst De-empha. Level</th></tr></thead><tbody><tr><td>3.6 ~ 5.0V</td><td>- 6dB</td></tr><tr><td>1.7 ~ 3.2V</td><td>- 5.5dB</td></tr><tr><td>0 ~ 1.3V</td><td>- 5dB</td></tr></tbody></table>	Pin 9 DC Level	Burst De-empha. Level	3.6 ~ 5.0V	- 6dB	1.7 ~ 3.2V	- 5.5dB	0 ~ 1.3V	- 5dB
Pin 9 DC Level	Burst De-empha. Level										
3.6 ~ 5.0V	- 6dB										
1.7 ~ 3.2V	- 5.5dB										
0 ~ 1.3V	- 5dB										
10	PB Chroma Input		PB chroma signal ($40f_H$) is taken out from pre-amplifier output by LPF.								
11	ACC DET Filter		ACC loop filter. Grounded by a capacitor.								
12	ACC Amp Output		ACC amp output at REC/PB mode. 3.58MHz at REC mode, $40f_H$ (= 629KHz) at PB mode.								
13	Main Converter Input		Main converter input (at REC/PB mode). A capacitor is necessary between Pin 12 and Pin 13.								
14	SP, LP, EP Mode SW/PAL Setting		SP, LP, EP (NTSC) & PAL mode function control. <table border="1"><thead><tr><th>Pin 14 DC Level</th><th>Mode</th></tr></thead><tbody><tr><td>3.6 ~ 5.0V</td><td>NTSC LP</td></tr><tr><td>1.7 ~ 3.2V</td><td>PAL</td></tr><tr><td>0 ~ 1.3V</td><td>NTSC SP/ED</td></tr></tbody></table>	Pin 14 DC Level	Mode	3.6 ~ 5.0V	NTSC LP	1.7 ~ 3.2V	PAL	0 ~ 1.3V	NTSC SP/ED
Pin 14 DC Level	Mode										
3.6 ~ 5.0V	NTSC LP										
1.7 ~ 3.2V	PAL										
0 ~ 1.3V	NTSC SP/ED										
15	REC Chroma Output		REC chroma signal (converted to low freq.) output. This signal is obtained through LPF (cut-off freq. = 1.7MHz).								
16	V _{CC}		V _{CC} = 4.5 ~ 5.5V								
17	Main Converter Carrier Input	4.21MHz 	Conversion carrier input for main converter function. 4.21MHz (5.06MHz) BPF is necessary between Pin 17 and Pin 18.								
18	Sub-converter Output		Low spurious characteristics by employing an operational type of sub converter.								

PIN FUNCTION (Continued)

Pin No.	Function	Waveform	Outline												
19	PB APC DET Filter		PB APC loop filter												
20	REC APC DET Filter		REC APC loop filter. In need of accurater V_{XO} free-running frequency at PB mode, adjust DC level through resistor.												
21	f_{sc} V_{XO} Input 2		V_{XO} feed back input. Delayed phase signal input (90° from Pin 22)												
22	f_{sc} V_{XO} Input 1		V_{XO} feed back input.												
23	f_{sc} V_{XO} Output		V_{XO} Output												
24	Killer DET Filter		Color killer DET loop filter.												
25	2 f_{sc} Output														
26	Head Switching Pulse Input		Head switching pulse input for chroma phase rotation <table border="1" data-bbox="739 833 1142 937"> <thead> <tr> <th>Pin 26 DC Level</th><th>NTSC</th><th>PAL</th><th>SECAM</th></tr> </thead> <tbody> <tr> <td>H</td><td>+ 90</td><td>STOP</td><td>STOP</td></tr> <tr> <td>L</td><td>- 90</td><td>- 90</td><td>STOP</td></tr> </tbody> </table>	Pin 26 DC Level	NTSC	PAL	SECAM	H	+ 90	STOP	STOP	L	- 90	- 90	STOP
Pin 26 DC Level	NTSC	PAL	SECAM												
H	+ 90	STOP	STOP												
L	- 90	- 90	STOP												
27	320 f_H V_{CO} Filter		By using specified TANK COIL, non-adjustment of 320 f_H V_{CO} is possible.												
28	Composite Sync Pulse Input		Input level L: GND ~ 1.5V H: 3.5 ~ V_{CC}												
29	REC AFC DET Filter		REC AFC loop filter												
30	PB Discri Filter REC/PB SW Setting		PB AFC loop (freq. discri.) filter. At REC mode, set up level to high mode.												

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	7	V
Power Dissipation	P_D	590	mW
Operating Temperature	T_{opr}	- 10 ~ + 75	°C
Storage Temperature	T_{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
REC Supply Current	I _{CCR}	At Pin 30: H (REC mode) Measure Pin 16 input current. No signal input.	41.0	54.0	77.0	mA
PB Supply Current	I _{CCP}	At PB mode Measure Pin 16 input current. No signal input.	42.0	55.0	79.0	mA
REC Chroma Signal Output Amplitude	V _{OR}	Supply a 3.58MHz chroma signal (burst = 140mV _{p-p}) to Pin 4. Measure an output burst level at Pin 15. (burst emphasis: on)	0.35	0.47	0.60	V _{p-p}
REC ACC Covering Range + 6dB	ACC _{R+6}	Burst = 280mV _{p-p} at Pin 4 Measure an output burst level at Pin 15 (0dB = V _{OR})	-0.5	0	+1.0	dB
REC ACC Covering Range - 15dB	ACC _{R-15}	Burst = 25mV _{p-p} at Pin 4 Measure an output burst level at Pin 15 (0dB = V _{OR})	-1.0	-0.2	0.5	dB
PB Chroma Signal Output Amplitude	V _{OP}	Supply a 629KHz chroma signal (burst = 100mV _{p-p}) to Pin 10. Measure an output burst level at Pin 1. (burst De-empha: on)	0.3	0.4	0.5	V _{p-p}
PB ACC Covering Range + 6dB	ACC _{P+6}	Burst = 200mV _{p-p} at Pin 10. Measure an output burst level at Pin 1. (0dB = V _{OP})	-0.5	0	+1.0	dB
PB ACC Covering Range - 15dB	ACC _{P-15}	Burst = 18mV _{p-p} at Pin 10. Measure an output burst level at Pin 1. (0dB = V _{OP})	-1.0	-0.2	0.5	dB
Burst Emphasis Quantity	Q _{BE}	Supply a sine wave (3.58MHz, 140mV _{p-p}) to Pin 4. Measure a differential level. ratio between burst gate period & chroma period at Pin 15.	5.0	6.0	7.5	dB
Burst Emphasis DC Offset	Q _{SBE}	Measure a differential DC voltage level between burst gate period & chroma period at Pin 15.	-60	0	60	mV
Burst De-emphasis Quantity (- 6dB)	Q _{BD}	Supply a sine wave (629KHz, 100mV _{p-p}) to Pin 10. Measure a differential level ratio between burst gate period & chroma period at Pin 1. (Pin 9: H)	-7.0	-6.0	-5.0	dB

ELECTRICAL CHARACTERISTICS (Continued)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Burst De-emphasis Quantity Variation (–6– –5.5dB)	BD ₁	Same as above. (Pin 9: H – M)	0.1	0.5	0.9	dB
Burst De-emphasis Quantity Variation (–5.5– –5dB)	BD ₂	Same as above. (Pin 9: M – L)	0.1	0.5	0.9	dB
Burst De-emphasis DC Offset	OS _{BD}	Measure a differential DC voltage level between burst gate period & chroma period at Pin 9.	–50	0	50	mV
REC Chroma Output Carrier Leakage 1	CL _{R1}	Supply a sine wave (3.58MHz, 400mV _{p-p}) to Pin 13, (4.21MHz, 400mV _{p-p}) to Pin 17. Measure a differential level ratio between 629KHz component level & 3.58MHz component level at Pin 15.	—	–59	–40	dB
REC Chroma Output Carrier Leakage 2	CL _{R2}	Same as above condition. Measure a differential level ratio between 629KHz & 4.21MHz components level at Pin 15.	—	–62	–40	dB
PB Main Converter Carrier Leakage 1	CL _{P1}	Supply a sine wave (629KHz, 200mV _{p-p}) to Pin 13, (4.21MHz, 400mV _{p-p}) to Pin 17. Measure a differential level ratio between 3.58MHz & 629KHz components level at Pin 15.	—	–40	–30	dB
PB Main Converter Carrier Leakage 2	CL _{P2}	Same as above condition. Measure a differential level ratio between 3.58MHz & 4.21MHz components level at Pin 15.	—	–40	–30	dB
REC Video Amplifier Gain	G _R	Supply a sine wave (3.58MHz, 140mV _{p-p}) to Pin 4. Measure a differential level ratio between Pin 4 & Pin 6.	–1.0	0	1.0	dB
Comb Filter Input Amplifier Gain	G _{COMB}	Supply a sine wave (629KHz, 200mV _{p-p}) to Pin 13, (4.21MHz, 400mV _{p-p}) to Pin 17. Measure a differential level ratio between Pin 8 & Pin 7.	5.0	6.0	7.0	dB

ELECTRICAL CHARACTERISTICS (Continued)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
PB Killer Gain	G_{PK}	Same as above condition. Measure a differential level ratio between Pin 1 & Pin 3.	5.0	6.0	7.0	dB
SECAM Output Amplifier Gain	G_{SECAM}	Same as above condition. Measure a differential level ratio between Pin 1 & Pin 7.	10.0	12.5	15.0	dB
REC LPF Cut-off Frequency	f_C	Supply a variable frequency sine wave (400mV _{p-p}) to Pin 13. Measure a cut-off frequency at Pin 15.	1.0	1.4	2.2	MHz
REC Killer Cross-talk Level	C_{TRK}	Supply a 3.58MHz chroma signal (burst = 140mV _{p-p}) to Pin 4. Measure a differential level ratio of 629KHz component at Pin 15. (killer sw: ON/OFF)	—	—	-35	dB
PB Killer Cross-talk Level	C_{TPK}	Supply a 629KHz chroma signal (burst = 100mV _{p-p}) to Pin 10. Measure a differential level ratio of 3.58MHz component at Pin 1. (killer sw: ON/OFF)	—	—	-35	dB
REC Killer Threshold Level	T_{HRK}	Supply a 3.58MHz chroma signal to Pin 4. (0dB = 140mV _{p-p}) Measure a maximum burst level suppressed by color killer.	—	—	-30	dB
Sub Converter Carrier Leakage 1	CL_{SCL}	Supply a 3.58MHz chroma signal (burst = 140mV _{p-p}) to Pin 4. Measure a differential level ratio between 4.21MHz & 3.58MHz components level at Pin 18.	—	-47	-30	dB
Sub Converter Carrier Leakage 2	CL_{SC2}	Same as above condition. Measure a differential level ratio between 4.21MHz & 629KHz components level at Pin 18.	—	-45	-30	dB
Sub Converter Spurious 1	S_{SC1}	Same as above condition. Measure a differential level ratio between 4.21MHz & 2.95MHz components level at Pin 18.	—	—	-20	dB
Sub Converter Spurious 2	S_{SC2}	Same as above condition. Measure a differential level ratio between 4.21MHz & 5.47MHz components level at Pin 18.	—	—	-30	dB

ELECTRICAL CHARACTERISTICS (Continued)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Sub Converter Output Amplitude	V_{SC}	Same as above condition. Measure an output amplitude level at Pin 18.	1.5	1.9	2.3	V_{p-p}
320 f_H V_{CO} Sensitivity	S_{VCO}	Supply a variable DC voltage level to pin 29. Measure an output frequency at Pin 18.	—	300	—	Hz/mV
REC APC Phase Detect Sensitivity	S_{RP}	Supply a 3.58MHz variable phase sine wave to Pin 4. Measure a DC voltage level at Pin 20.	3.5	10	—	mV/deg
PB APC Phase Detect Sensitivity	S_{PP}	Supply a 3.58MHz variable phase sine wave to Pin 3. Measure a DC voltage level at Pin 19.	2	6	—	mV/deg
f_{SC} V_{XO} Sensitivity	S_{VXO}	Measure an output frequency at Pin 23 in case of changing a DC voltage level of Pin 20.	—	9	—	Hz/mV
f_{SC} V_{XO} Output Amplitude	V_X	Measure an output amplitude at Pin 23	0.7	1.0	1.3	V_{p-p}
f_{SC} Free Run Control Voltage	V_{CFSC}	Pin 23: 3.579545MHz Measure Pin 20 DC level at PB mode.	2.2	2.75	3.3	V

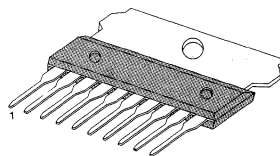
MOTOR DRIVER FOR VTR

The KA8301 is a monolithic integrated circuit designed to perform bi-directional DC motor driving, braking and speed control for VTR. The speed control can be achieved by adjusting the external voltage of motor speed control pin.

FEATURES

- Stable braking characteristics by built-in braking function.
- Built-in element to absorb dash current derived from changing motor direction and braking motor driving.
- Built-in external motor speed control pin.
- Stable driving direction change.
- CMOS logic level compatible input level.

10 SIP H/S



ORDERING INFORMATION

BLOCK DIAGRAM

Device	Package	Operating Temperature
KA8301	10 SIP H/S	- 25 ~ + 75°C

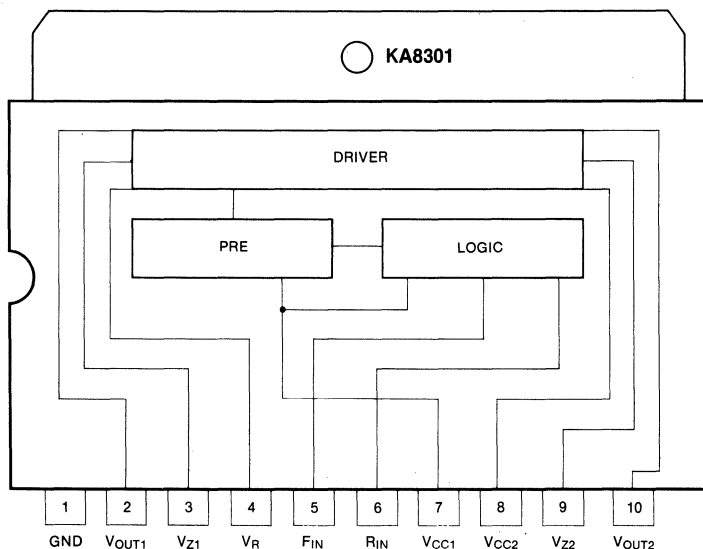


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Allowable Power Dissipation	P_D	2.2	W
Operating Temperature	T_{opr}	-25 ~ +75	°C
Storage Temperature	T_{stg}	-55 ~ +125	°C
Output Current	I_{OUT}	1.6*	A
Input Voltage	V_{IN}	-0.3 ~ V_{CC}	V

* Duty 1/100, pulse width 500 μ s

RECOMMENDED OPERATING CONDITIONS (Ta = 25°C)

Characteristics	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	8	12	16	V

ELECTRICAL CHARACTERISTICS ($V_{CC} = 12V$, Ta = 25°C)

Characteristics	Symbol	Min	Typ	Max	Unit	Condition
Quiescent Current	I_{CCQ}	3	5.5	10	mA	Pin 5, 6: GND, $R_L = \infty$
Minimum Input on Current 1	I_{IN1}	—	10	50	μ A	$R_L = \infty$, Pin 5: I_{IN1} , Pin 6: L
Minimum Input on Current 2	I_{IN2}	—	10	50	μ A	$R_L = \infty$, Pin 5: L, Pin 6: I_{IN2}
Input Threshold Voltage 1	V_{INTH1}	0.7	1.3	2.0	V	$R_L = \infty$, Pin 5: V_{INTH1} , Pin 6: L
Input Threshold Voltage 2	V_{INTH2}	0.7	1.3	2.0	V	$R_L = \infty$, Pin 5: L, Pin 6: V_{INTH2}
Output Leakage Current 1	I_{OL1}	—	—	1	mA	$R_L = \infty$, Pin 5, 6: GND
Output Leakage Current 2	I_{OL2}	—	—	1	mA	$R_L = \infty$, Pin 5, 6: GND
Zener Current 1	I_{Z1}	—	0.85	1.5	mA	Pin 5: H, Pin 6: L, $R_L = \infty$
Zener Current 2	I_{Z2}	—	0.85	1.5	mA	Pin 5: L, Pin 6: H, $R_L = \infty$
Output Voltage 1	V_{O1}	6.6	7.2		V	Pin 5: H, Pin 6: L, $R_L = 60\text{ohm}$
Output Voltage 2	V_{O2}	6.6	7.1		V	Pin 5: L, Pin 6: H, $R_L = 60\text{ohm}$
Saturation Voltage Pin 10-1	V_{CE10-1}	—	0.83	1.5	V	$I_{SINK} = 100\text{mA}$ Pin 5: H, Pin 6: L, $R_L, R_C = \infty$
Saturation Voltage Pin 2-1	V_{CE2-1}	—	0.83	1.5	V	$I_{SINK} = 100\text{mA}$ Pin 5: L, Pin 6: H, $R_L, R_C = \infty$
Saturation Voltage Pin 8-2	V_{CE8-2}	—	0.83	1.5	V	$I_{SOURCE} = 100\text{mA}$ Pin 5: H, Pin 6: L, $R_L, R_C = \infty$
Saturation Voltage Pin 8-10	V_{CE8-10}	—	0.83	1.5	V	$I_{SOURCE} = 100\text{mA}$ Pin 5: L, Pin 6: H, $R_L, R_C = \infty$

TEST CIRCUIT

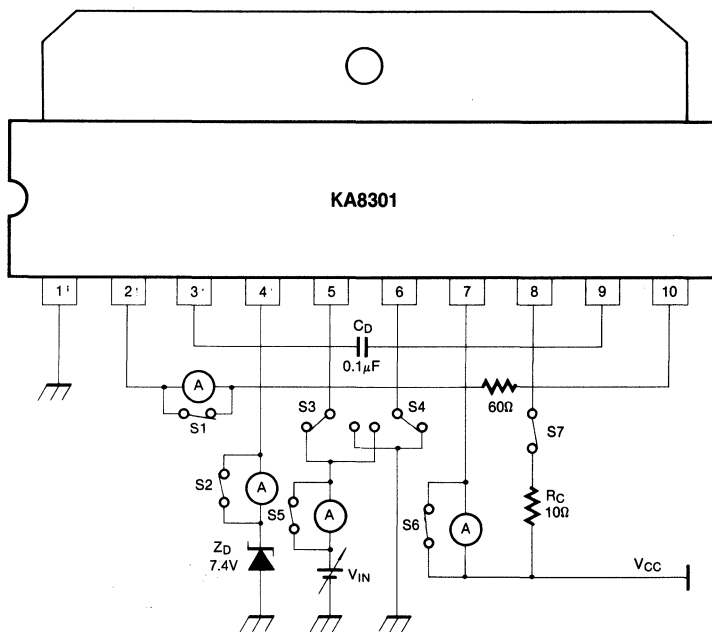


Fig. 2

LOGIC TRUTH TABLE

F_{IN} (Pin 5)	R_{IN} (Pin 6)	V_{O1} (Pin 2)	V_{O2} (Pin 10)	Note
L	L	L	L	Braking
L	H	L	H	Reverse
H	L	H	L	Forward
H	H	L	L	Braking

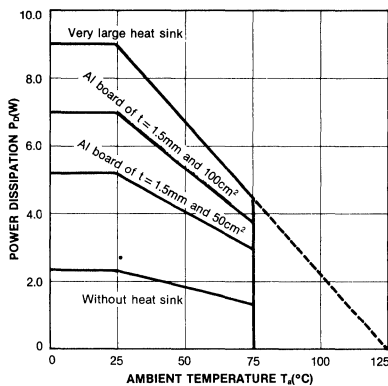
* Input Level 'H' > 2.0V

Input Level 'L' < 0.7V

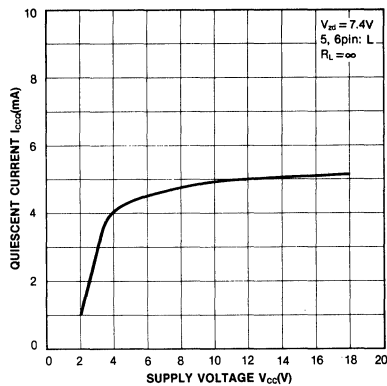
APPLICATIONS

- VTR loading motor driver
- VTR reel motor driver
- VTR capstan motor driver
- Bi-directional DC motor driver

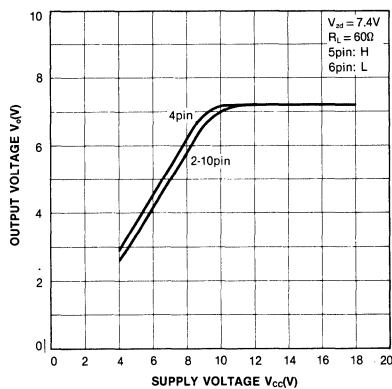
POWER REDUCTION CURVE



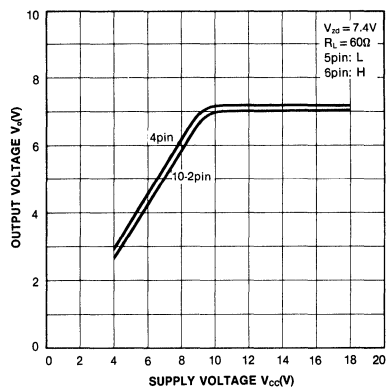
QUIESCENT CURRENT VS. SUPPLY VOLTAGE



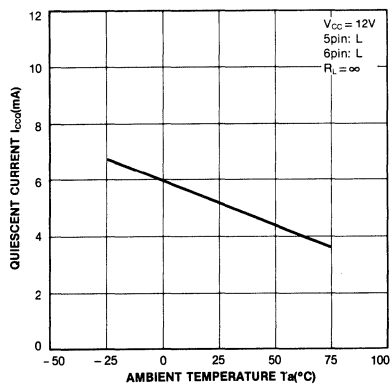
MAXIMUM OUTPUT VOLTAGE VS. SUPPLY VOLTAGE



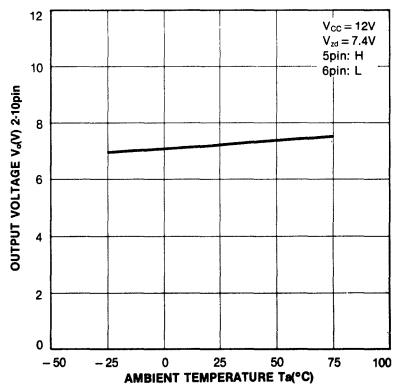
MAXIMUM OUTPUT VOLTAGE VS. SUPPLY VOLTAGE



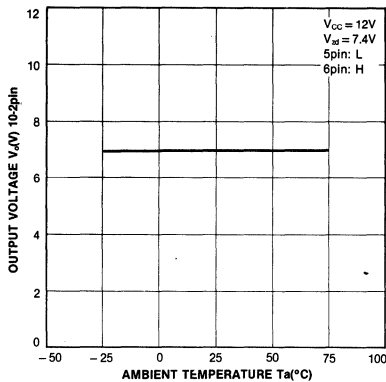
QUIESCENT CURRENT VS. AMBIENT TEMPERATURE



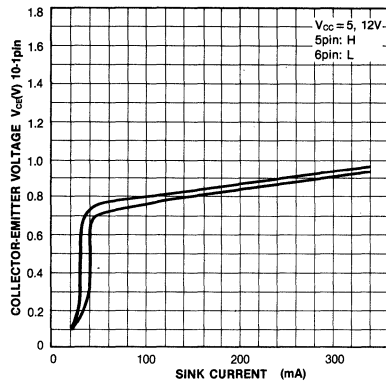
OUTPUT VOLTAGE VS. AMBIENT TEMPERATURE



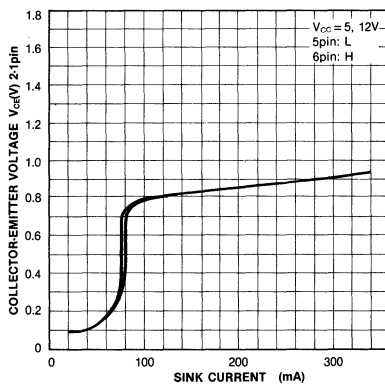
OUTPUT VOLTAGE
VS. AMBIENT TEMPERATURE



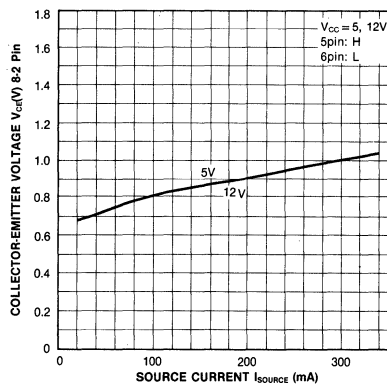
OUTPUT SATURATION VOLTAGE
VS. SINK CURRENT



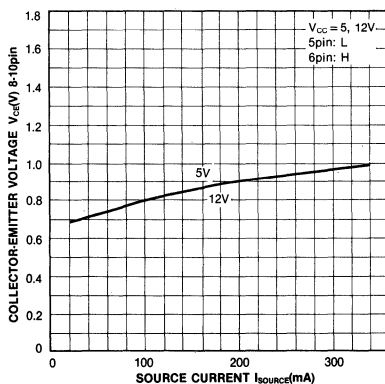
OUTPUT SATURATION VOLTAGE
VS. SINK CURRENT



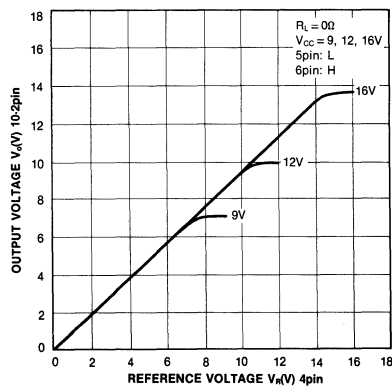
OUTPUT SATURATION VOLTAGE
VS. SOURCE CURRENT



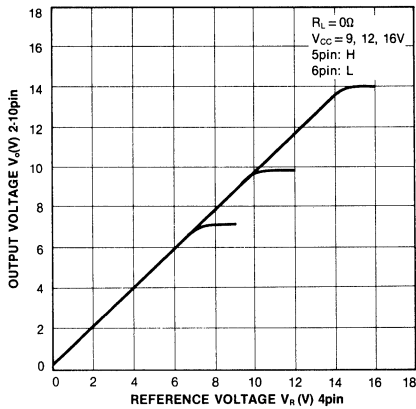
OUTPUT SATURATION VOLTAGE
VS. SOURCE CURRENT



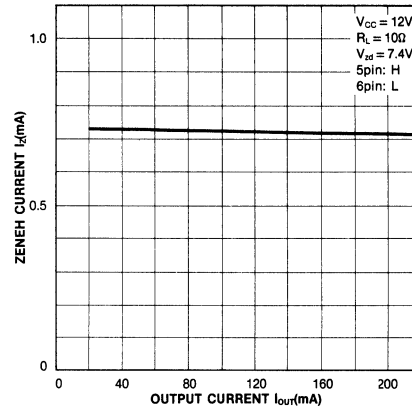
OUTPUT VOLTAGE
VS. REFERENCE VOLTAGE



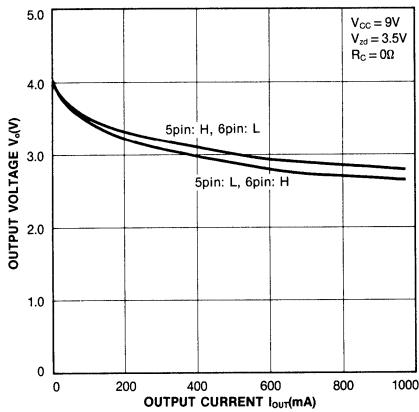
OUTPUT VOLTAGE VS. REFERENCE VOLTAGE



ZENER CURRENT VS. OUTPUT CURRENT



OUTPUT VOLTAGE VS. OUTPUT CURRENT



SERVO CONTROL AMP

The KA8302/8312 is a monolithic integrated circuit designed for servo control amp in a VCR system.

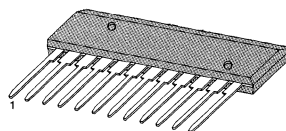
FUNCTIONS

- Capstan FG Signal Amp
- Control Signal Amp
- Two Times Frequency of Capstan FG Signal (KA8302)

FEATURES

- CTL schmitt width: $\pm 150\text{mV}$ (Typ)
- FG schmitt width: $\pm 95\text{mV}$ (Typ)
- Large output current: 4mA (Max)
- Wide supply voltage range: 5 ~ 10V

12 SIPS

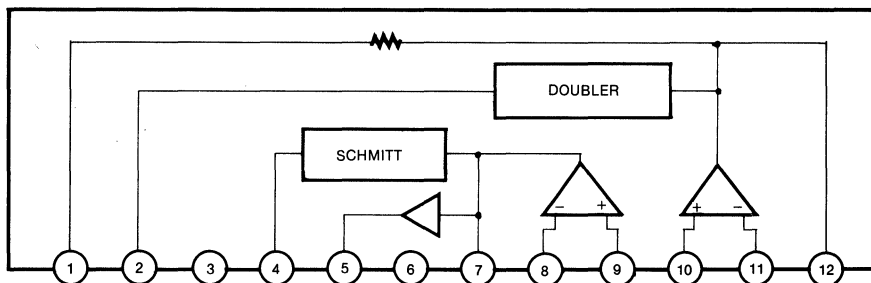


ORDERING INFORMATION

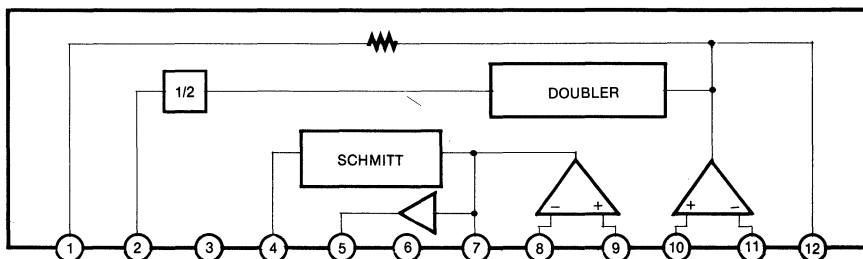
Device	Package	Operating Temperature
KA8302	12 SIPS	-25 ~ +75°C
KA8312	12 SIPS	-25 ~ +75°C

BLOCK DIAGRAM

KA8302



KA8312



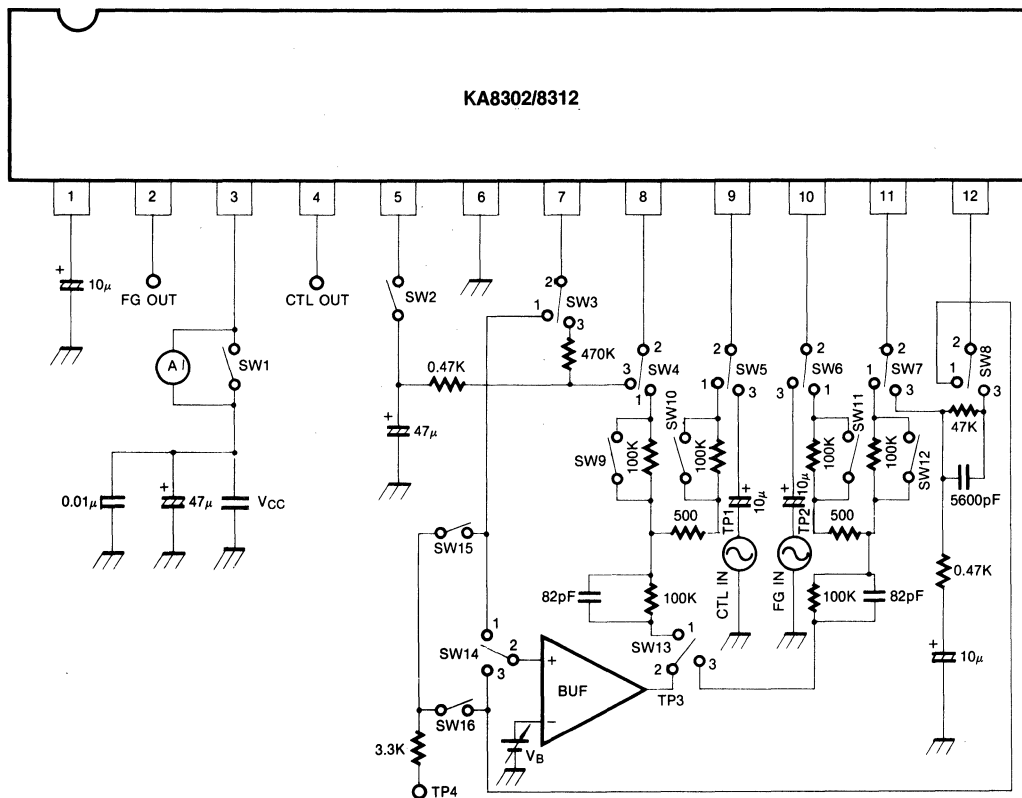
ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	10	V
Power Dissipation	P _D	100	mW
Operating Temperature	T _{opr}	-25 ~ +75	°C
Storage Temperature	T _{stg}	-55 ~ +150	°C

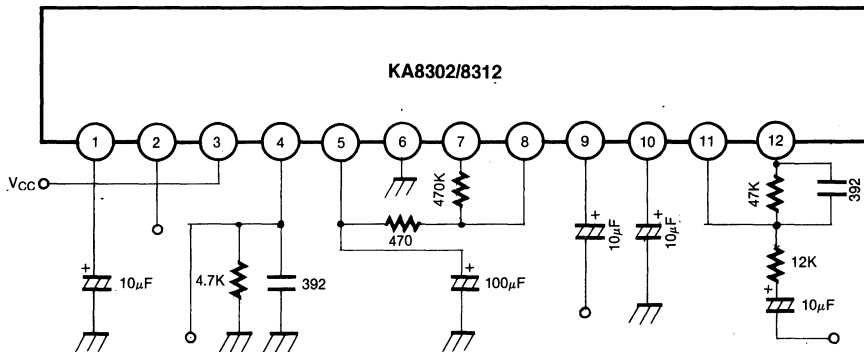
ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 5V)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Voltage	V _{CC}		4.5	5.0	5.5	V
Supply Current	I _{CC}		1.4	2.7	4.0	mA
8 Pin Input Bias Current	I _{IN8}		—	15	150	nA
CTL Input Offset Current	I _{OFF1}		-30	±0	+30	nA
9 Pin Bias Voltage	V ₉		1.935	1.980	2.025	V
CTL Input Offset Voltage	V _{OFF1}		-10	±0	+10	mV
CTL Open Loop Gain	G _{V1}		80	100	—	dB
CTL AMP Output Voltage	V _{OH1}		2.4	3.6	—	V
	V _{OL1}		—	0.3	1.0	V
CTL AMP Output Current	I _{SO1}		-0.2	-1	-1.8	mA
	I _{SINK1}		+0.2	+1.1	+2.0	mA
CTL Schmitt Width	V _{SCH1}		±130	±150	±170	mV
CTL Output Voltage	V _{OH2}	I _{OH} = 1mA	3.7	—	—	V
	V _{OL2}	I _{OL} = -0.5mA	—	—	0.8	V
5 Pin Output Current	I _{O5}		±0.001	—	±1.2	μA
11 Pin Input Bias Current	I _{IN11}		—	15	150	nA
FG Input Offset Current	I _{OFF2}		-30	±0	+30	nA
10 Pin Bias Voltage	V _{P10}		2.40	2.50	2.60	V
FG Input Offset Voltage	V _{OFF2}		-10	±0	+10	mV
FG Open Loop Gain	G _{V2}		80	100	—	dB
FG AMP Output Voltage	V _{OH3}		3.6	4.2	—	V
	V _{OL3}		—	0.7	1.5	V
FG Schmitt Width	V _{SCH2}		±60	±95	±130	mV
FG Output Voltage	V _{OH4}	I _{OH} = 1mA	3.7	—	—	V
	V _{OL4}	I _{OL} = -0.5nA	—	—	0.8	V
FG AMP Output Current	I _{SO2}		-0.2	-1.1	-1.9	mA
	I _{SINK2}		0.1	0.2	0.8	mA

TEST CIRCUIT



APPLICATION CIRCUIT



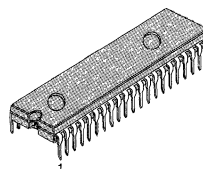
VTR DIGITAL SERVO CONTROLLER

The KA8303 is designed to provide all functions required to compose a VTR digital servo-control system. The KA8303 includes not only drum and capstan motor control, but also multi-speed play back functions.

FEATURES

- Digital servo-control function of drum and capstan motor
- A few quantizing error
- Fix tracking on self-recording and play back
- Head switching pulse output for audio FM
- Pseudo V generation meet clean-still and clean-slow
- Provided automatic switching of capstan mix amplifier and of loop gain
- Provided 3 kinds of search-speed play back (± 3 , $\pm N1$, $\pm N2$), f_H automatic correction and reversal play back (X-1 search)
- Automatic mode distinction
- Possible to meet all sorts of drums FG/PG system
2PG + FG, 1PG + FG, 2PG
- A few external parts
- Provided digital V-SYNC SEP.
- Provided SP, LP, EPX location adjustment
- Provided editor function
- Possible to meet any kind of FG (Frequency Generation) frequency by changing mask ROM.

42 SDIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8303	42 SDIP	- 10 ~ + 75°C

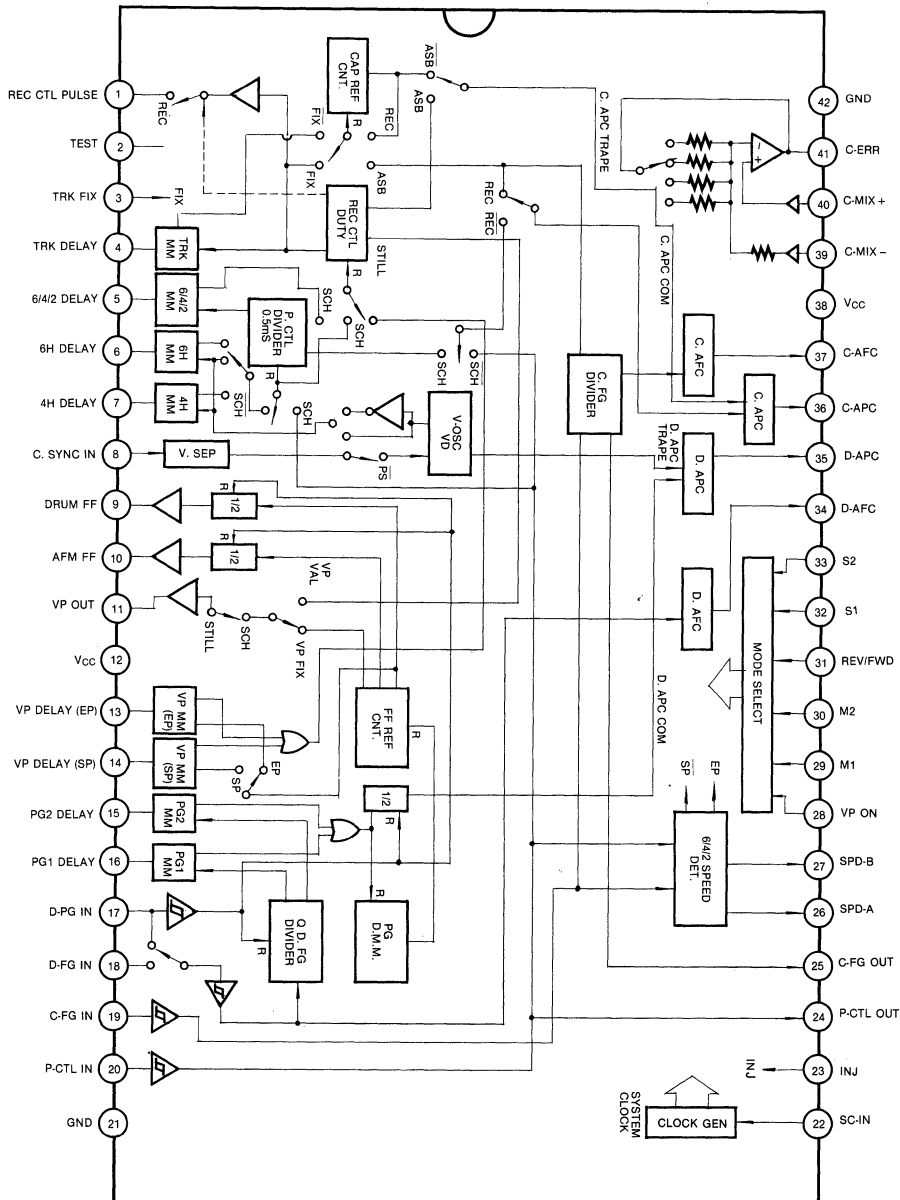
MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply Voltage	V_{CC}	6	V
Supply Voltage	$V_{DD(23)*}$	6	V
Input Voltage	V_{IN}	$GND \sim V_{CC}$	V
Power Dissipation	P_D	1200	mW
Operating Temperature	T_{opr}	- 10 ~ + 75	°C
Storage Temperature	T_{stg}	- 55 ~ + 150	°C

*Impressed voltage for 23 terminal

(Note) Dertated linearly above Ta = 25°C in the proportion of 4mW/°C

BLOCK DIAGRAM



PIN ASSIGNMENT

Pin No.	Symbol	Function
1	REC CTL PULSE	Control pulse output, Possible to select 2 kinds of duty.
2	TEST	Test terminal, Connect to GND expect the case of test.
3	TRK FIX	Open when self-recording and play back.(Tracking Volume Center) Pull-up to V_{CC} by $5K\Omega$ when using tracking volume. (c.f. Mode Chart)
4	TRK DELAY	Tracking adjustment.
5	6/4/2 DELAY	2H, 4H, 6H, X-adjustment.
6, 7	6H DELAY, 4H DELAY	6H, 4H, X-adjustment.
8	C. SYNC IN	Composite sync signal input.
9	DRUM FF	Head switching pulse output.
10	A FM FF	FM Audio head switching pulse output.
11	VP OUT	Pserdo V output.
12	V_{CC}	Power supply, Impress $V_{CC} = 5V$
13, 14	VP DELAY	Pserdo V insert location adjustment for EP and SP.
15, 16	PG2 DELAY, PG1 DELAY	PG1, PG2 mounting location adjustment.
17	D-PG IN	Drum PG Input.
18	D-FG IN	Drum FG Input.
19	C-FG IN	Capstan FG Input.
20	P-CTL IN	Track signal input for play back control.
21	GND	GND
22	SC-IN	Subcarrier input.
23	INJ	Injector (Supply of CMOS) Connect with V_{CC}
24	P-CTL OUT	Track signal output for play back control.
25	C-FG OUT	Capstan FG output.
26, 27	SPD-A, SPD-B	SP, LP, EP Designation input, Decision output.
28	VP ON	c.f. Mode chart
29, 30	M1, M2	Mode designation signal input.
31	REV/FWD	Forward/Reverse designation signal.
32, 33	S1, S2	Cue revue speed designation signal input.
34, 35	D-AFC, D-APC	AFC, APC, PWM output for Drum.
36, 37	C-APC, C-AFC	AFC, APC, PWM output for Capstan.
38	V_{CC}	Power supply, $V_{CC} = 5V$ Impressed.
39, 40	C-MIX $\ominus$ C-MIX $\oplus$	Capstan Mix Amp Input
41	C-ERR	Capstan Mix Amp Output
42	GND	GND

ELECTRICAL CHARACTERISTICS ($V_{CC} = 5V$, $V_{DD} = 5V$, $T_a = 25^\circ C$)

Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage		V _{CC}		4.5	5.0	5.5	V
		V _{DD}	R _{PU1} = 100Ω, V _{DD} = V _{CC}	4.5	5.0	5.5	
Supply Current		I _{CC}	No-load play back	2	5	10	mA
		I _{DD}	R _{PU1} = 100Ω, V _{DD} = V _{CC}	1	4	10	
V _{DD} Pull-up Resistor		R _{PU1}		—	100	—	Ω
REC CTL PULSE	Output Voltage	V _{R_{COH}}	I _{SO} = 3mA	3.5	—	—	V
		V _{R_{COL}}	I _{SI} = 3mA	—	—	0.5	
TRK FIX	Input Voltage	V _{TRIH}		3.8	—	V _{CC}	V
		V _{TRIH}		2.3	—	2.9	
		V _{TRIL}		0	—	1.0	
	Input Current	I _{TRIH}		0	—	250	μA
		I _{TRIL}		− 250	—	0	
	Bias Voltage	V _{TRB}		2.3	2.6	2.9	V
TRK DELAY 6/4/2 DELAY 6H DELAY 4H DELAY	Threshold Voltage	V _{1DTH}		2.25	2.45	2.65	V
		V _{2DTH}					
		V _{6DTH}					
		V _{4DTH}					
	Output L Voltage	V _{HHOL}	I _{SI} = 0.2mA	—	—	0.4	V
C-SYNC	Input Voltage	V _{CSIH}		3.0	—	V _{CC}	V
		V _{CSIL}		0	—	1.0	
	Input Current	I _{CSIH}	5V	—	—	20	μA
		I _{CSIL}	0V	− 1.0	—	—	
DRUM FF	Output Voltage	V _{DFOH}	I _{SO} = 1mA	3.5	—	—	V
		V _{DFOL}	I _{SI} = 0.5mA	—	—	0.7	
AFM FF	Output Voltage	V _{AFOH}	I _{SO} = 0.7mA	3.5	—	—	V
		V _{AFOL}	I _{SI} = 0.5mA	—	—	0.7	
VP-OUT	Output Voltage	V _{VPOH}	I _{SO} = 0.5mA	3.5	—	—	V
		V _{VPOL}		—	—	—	

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
VP DELAY (EP) VP DELAY (SP) PG2 DELAY PG1 DELAY	V _{EPTH}		2.3	2.5	2.7	V
	V _{SPTH}					
	V _{P2TH}					
	V _{P1TH}					
	Output L Voltage	V _{HHOL} I _{SI} = 0.2mA	—	—	0.4	
D-PG	Schmitt Width 1	ΔV _{DP1}	—	—	—	mV
	Schmitt Width 2	ΔV _{DP2}	± 100	± 150	± 200	
	Bias Voltage	V _{DPB}	—	2.25	—	V
	Input Impedance	R _{DPI}	17	25	32	KΩ
D-FG	Schmitt Width	ΔV _{DF}	± 50	± 100	± 150	mV
	Bias Voltage	V _{DFB}	—	2.25	—	V
	Input Impedance	R _{DPI}	17	25	32	KΩ
C-FG IM	Input Voltage	V _{CFIH}	3.0	—	V _{CC}	V
		V _{CFIL}	0	—	1.0	
	Input Current	I _{CFIH} 5V	—	—	20	μA
		I _{CFIL} 0V	— 1.0	—	—	
P-CTL IN	Input Voltage	V _{PCIH}	3.0	—	V _{CC}	V
		V _{PCIL}	0	—	1.0	
	Input Current	I _{PCIH} 5V	—	—	20	μA
		I _{PCIL} 0V	— 1.0	—	—	
SC-IN	Input Voltage	V _{SCI}	—	—	120	mV _{p-p}
	Bias Voltage	V _{SCB}	—	0.7	—	V
	Input Impedance	R _{SCI}	—	4.3	—	KΩ
P-CTL OUT	Internal Pull-Up Resistor	R _{PCO}	14	20	26	KΩ
	Low Level Output Voltage	V _{PCOL} I _{SI} = 0.5mA	—	—	0.5	V
C-FG OUT	Internal Pull-Up Resistor	R _{CFO}	14	20	26	KΩ
	Low Level Output Voltage	V _{CFOL} I _{SI} = 0.5mA	—	—	1.3	V
	Hono-Halti Threshold Voltage	V _{CFTH}	2.4	2.5	2.6	V

ELECTRICAL CHARACTERISTICS (Continued)

Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
SPD-A SPD-B	Input Voltage	V_{ABIH}		3.0	—	V_{CC}	V
		V_{IABL}		0	—	2.0	
	Output Current	I_{ABIH}	3V Impress		600		μA
		I_{ABIL}	2V Impress		520		
V_{PON}	Input Voltage	V_{VPIH}		3.8	—	V_{CC}	V
		V_{VPIM}		2.0	—	3.0	
		V_{VPIL}		0	—	1.0	
	Input Current	I_{VPIH}	5V Impress	—	—	50	μA
		I_{VPIM}	2.5V Impress	—	—	20	
		I_{VPIL}	0V Impress	-1.0	—	1.0	
M1, M2 REV/FWD S1, S2	Input Voltage	V_{2I1H}		3.0	—	V_{CC}	V
		V_{2I1L}		0	—	1.0	
	Input Current	I_{2I1H}	5V Impress	—	—	20	μA
		I_{2I1L}	0V Impress	-300	—	-100	
D-AFC D-APC C-AFC C-APC	Output Voltage	V_{HPWM}	Unload	4.9	—	V_{CC}	V
		V_{LPWM}	$I_{SI} = 0.5mA$	—	—	0.4	
	Internal Pull-up Resistor	R_{PWM}		2.8	4.0	5.2	$K\Omega$
C-MIX – C-MIX +	Input Bias Current	I_{MIB}	39, 40 Pin 2.5V Impress	—	—	100	mA
	MIX – Limitter Voltage	V_{MIH-}	$I_{IH} = 10\mu A$	3.5	3.7	3.9	V
		V_{MIL-}	$I_{IL} = -10\mu A$	0.8	1.0	1.2	
	MIX + Limitter Voltage	V_{MIH+}	$I_{IH} = 10\mu A$	3.1	3.3	3.5	V
		V_{MIL+}	$I_{IL} = -10\mu A$	1.2	1.4	1.6	
	Input Offset Voltage	V_{MIOF}		-20	—	20	mV
C-ERR	Output Voltage	V_{HOH}	$I_{SO} = 0.1mA$	3.5	—	—	V
		V_{HOL}	$I_{SO} = 0.1mA$	—	—	0.5	
	Gain Precision	ΔG_M	At all mode	-2	—	2	dB

**MODE CHART FOR DISIGNATE
"TAPE SPEED"**

TERMINAL NAME		MODE
SPD-A	SPD-B	
H	H	SP
H	L	SP
L	H	LP
L	L	EP

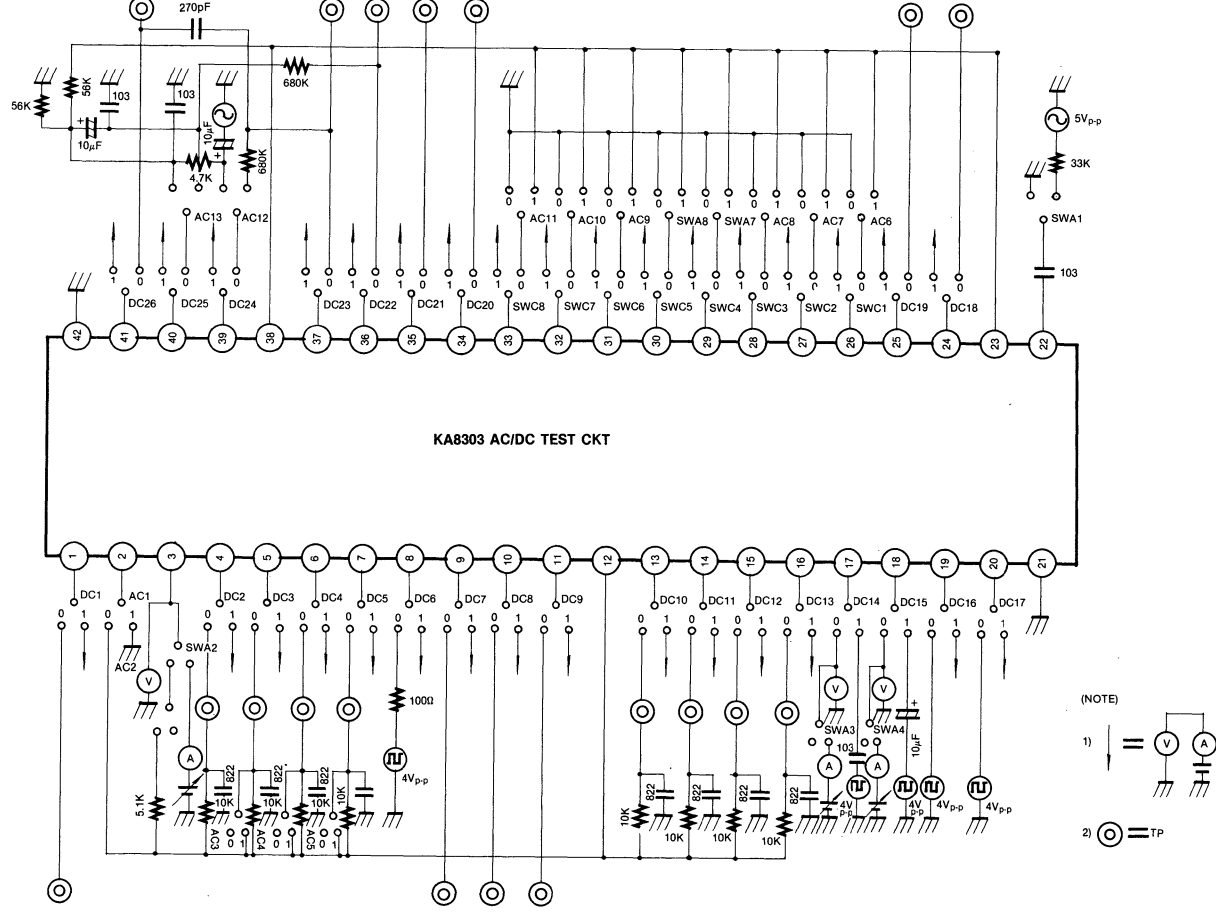
**TRUE CHART FOR DECIDE
"TAPE SPEED"**

TAPE SPEED	TERMINAL NAME	
	SPD-A	SPD-B
SP	H	L
LP	L	H
EP	L	L

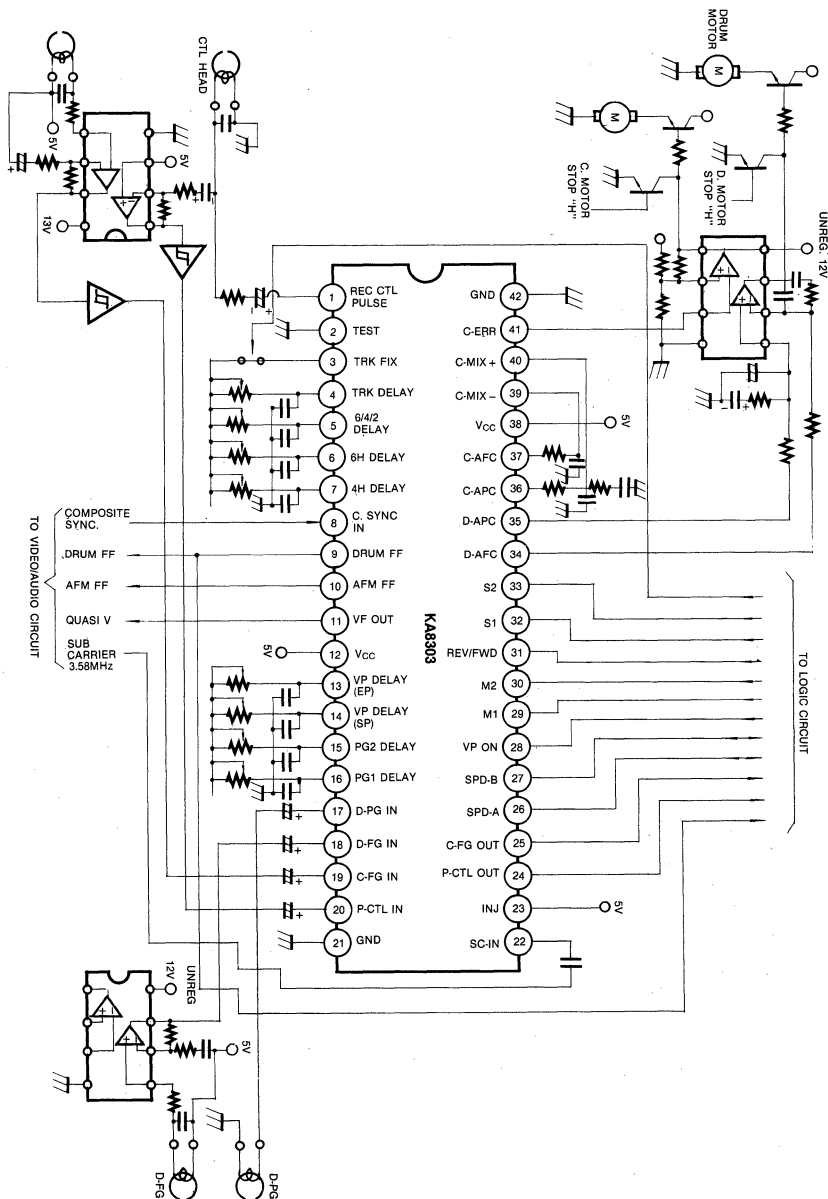
MODE CHART

MODE		M1	M2	VPOH	SPEED		TRK FIX	REV/FWD
					S1	S2		
REC	REC CTL DUTY 60%	H	H	L	L	L	—	L
	REC CTL DUTY 27.5%	H	H	H	L	L	—	L
ASB	ASB	H	L	L	L	L	—	L
	BACK SPACE	H	L	L	L	L	—	H
INST	INST	L	H	L	L	L	—	L
	BACK SPACE	L	H	L	L	L	—	H
PB	NORMAL PB (TRK VARIABLE/FIXED)	L	L	L	L	L	H/M	H
	STILL (ONE SIDE VP VARIABLE)	L	L	H	L	L	H/M	H
	INTERMITTENT FORWARD (BOTH SIDE VP VARIABLE)	L	L	H	L	L	L	H
	1/N SLOW (BOTH SIDE VP VARIABLE)	L	L	H	L	L	L	H/L
	X 1 SEARCH (BOTH SIDE FIXED VP OUTPUT)	L	L	L	L	L	L	L
	X 3 SEARCH (TRK VARIABLE/FIXED)	L	L	H	H	L	H/M	L
	X N1 SEARCH (TRK VARIABLE/FIXED)	L	L	H	L	H	H/M	L
	X N2 SEARCH (TRK VARIABLE/FIXED)	L	L	H	H	H	H/M	L
	X -1 SEARCH (TRK VARIABLE/FIXED)	L	L	H	L	L	H/M	H
	X -3 SEARCH (TRK VARIABLE/FIXED)	L	L	H	H	L	H/M	H
	X -N1 SEARCH (TRK VARIABLE/FIXED)	L	L	H	L	H	H/M	H
	X -N2 SEARCH (TRK VARIABLE/FIXED)	L	L	H	H	H	H/M	H

TEST CIRCUIT



APPLICATIONA CIRCUIT



2-PHASE DD MOTOR DRIVER

The KA8304 is a monolithic integrated circuit for 2-phase full wave linear DD motor driving. It consists of a hall amplifier, a control circuit, a rotation direction switching circuit for hall device feeding.

The signal generator from the hall device is directly by the hall amplifier and then transmitted to the output port to drive a motor (linear driving method). Since the hall amplified gain can be controlled by the external control current, a servo circuit can be constructed by feed-backing the motor rotation count information which is detected by FG and then F-I converted.

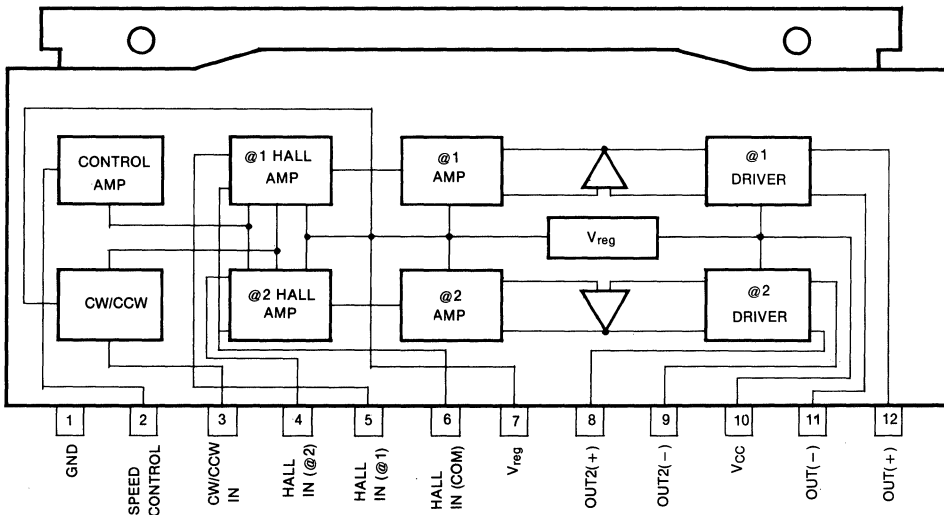
FEATURES

- Linear driving producing low switching noise
- Incorporates rotation direction switching function
- With regulated power supply for hall device feeding
- High power dissipation
- High output current-control current ratio (420 Typ)
- Low current consumption ($I_Q = 2.5\text{mA}$ Typ)

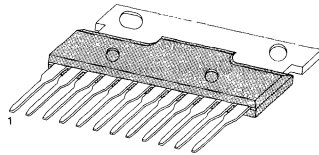
APPLICATIONS

- VTRs, Video disk players
- Compact disc players
- Tape recorders, record players

BLOCK DIAGRAM



12 SIP H/S



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8304	12 SIP H/S	- 20 ~ + 75°C
KA8304W	20 ZIP H/S	

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Power Dissipation	P_d	3.0	W
Maximum Output Current	I_{OM}	1.2	A
Regulated Voltage	$I_{reg} \text{ (max)}$	45	mA
Maximum Output Current			
Operating Temperature Range	T_{opr}	-20 ~ +75	°C
Storage Temperature	T_{stg}	-55 ~ +125	°C

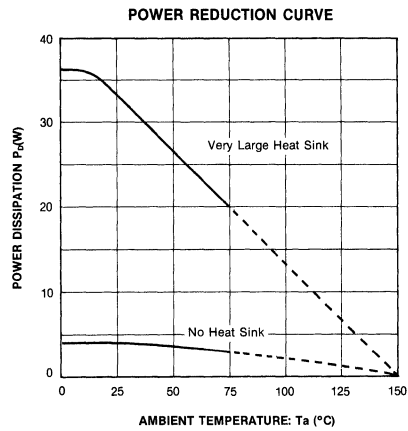
* Refer to the power reduction curve for operation above $T_a = 25^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	9.0	12.0	18.0	V

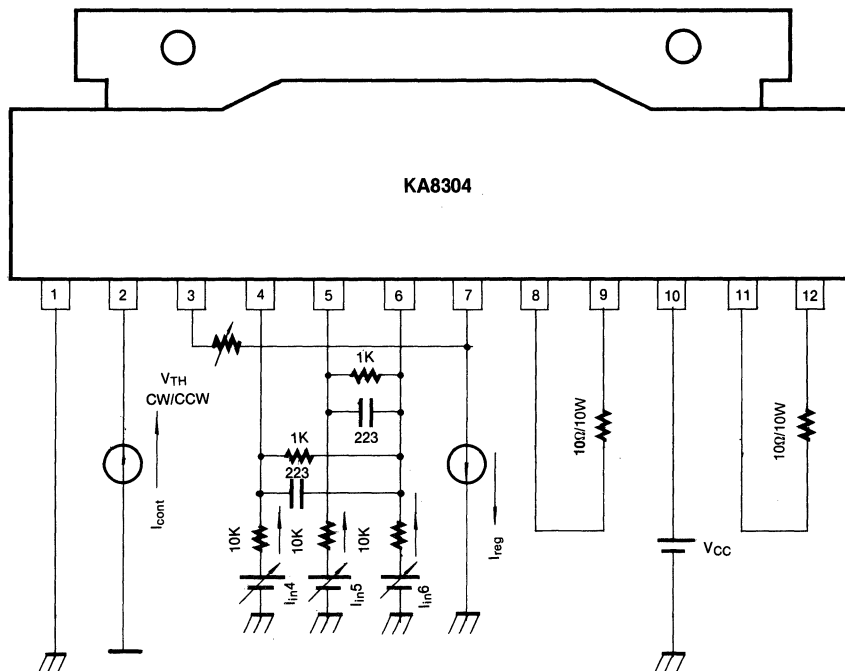
ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 12.0\text{V}$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Current	I_o	$I_{cont} = 0\text{A}$	—	2.5	5.0	mA
Regulated Voltage Output 1	V_{reg1}	$I_{reg} = 10\text{mA}$	6.2	7.0	7.8	V
Regulated Voltage Output 2	V_{reg2}	$I_{reg} = 30\text{mA}$	6.1	6.9	7.8	V
Rotation Direction Switch Threshold	V_{TH} CW/CCW		V_{reg} -4.5	V_{reg} -1.3	V_{reg} -0.5	V
Pin 3 Output Current	I_{out3}	$V_3 = 0\text{V}$	300	650	1000	μA
Pin 4 Input Bias Current	I_{in4}	$I_{cont} = 100\mu\text{A}$	—	0.25	2.0	μA
Pin 5 Input Bias Current	I_{in5}	$I_{cont} = 100\mu\text{A}$	—	0.25	2.0	μA
Pin 6 Input Bias Current	I_{in6}	$I_{cont} = 100\mu\text{A}$	—	0.5	4.0	μA
Motor Driving Voltage	V_o	$I_{cont} = 400\mu\text{A}$ $I_{out} = 800\text{mA}$	8.3	—	—	V
Pin 2 Current-Output Current Ratio (1)	I_{out}/I_{cont}	$I_{cont} = 100\mu\text{A}$ $V_6-V_5(V_4) = +100\text{mV}$	3500	4200	5500	—
Pin 2 Current-Output Current Ratio (2)	I_{out}/I_{cont}	$I_{out} = 40\mu\text{A}$ $V_6-V_5(V_4) = +100\text{mV}$	3500	4200	5500	—
ϕ_1, ϕ_2 Ratio	—	$I_{cont} = 100\mu\text{A}$ $V_6-V_5(V_4) = +100\text{mV}$	0.8	1.0	1.2	—
Regulated Voltage Temperature Characteristics	ΔTV_{reg}	$I_{reg} = 10\text{mA}$ $T_a = -20 \quad +75^\circ\text{C}$	—	400	—	ppm

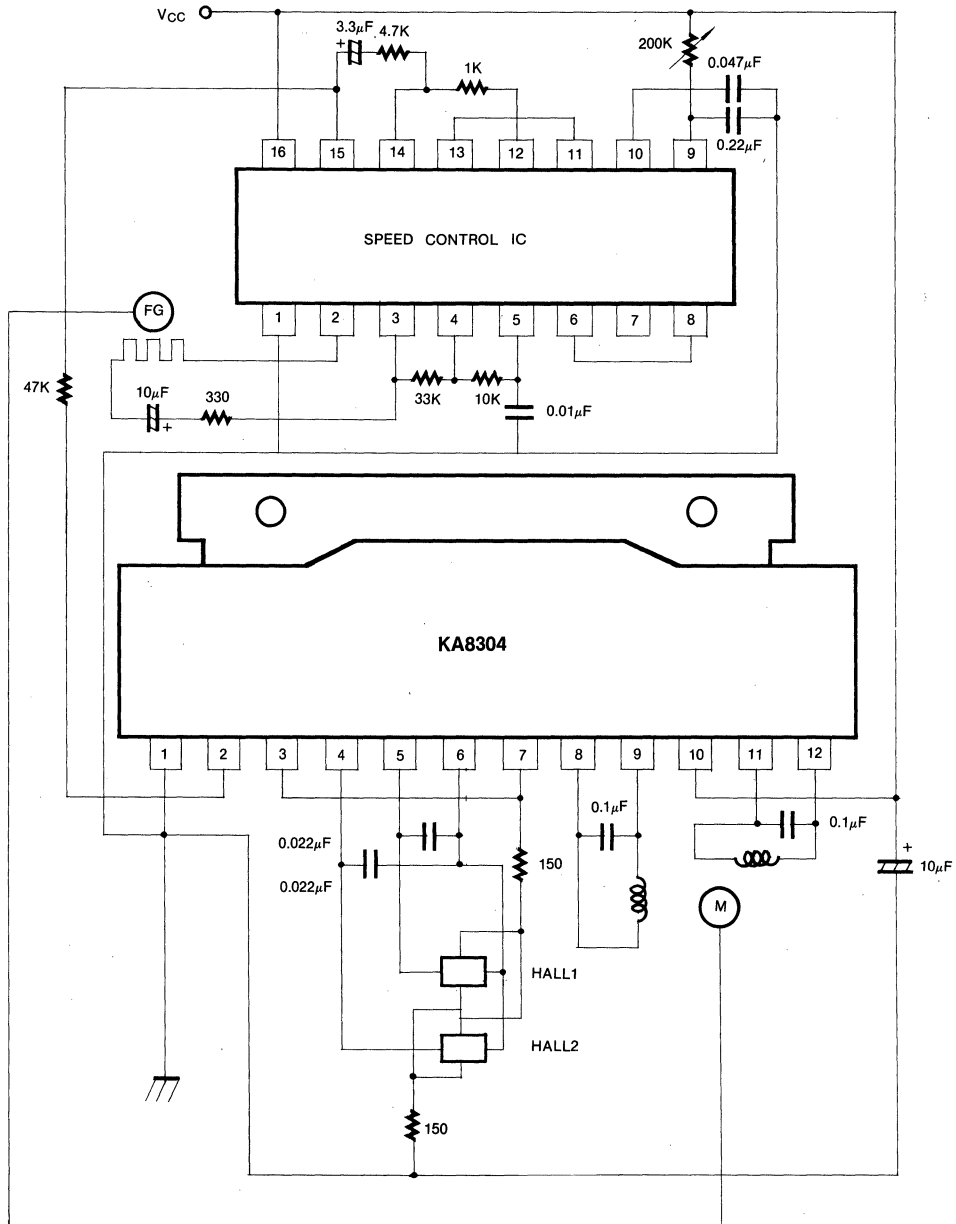


4

TEST CIRCUIT



APPLICATION CIRCUIT



OPERATION DESCRIPTION

1. The signal generated from a hall device is amplified by a hall amplifier which gain can be varied by PIN 2 input current (speed control input). The signal passes through the rotation direction switching circuit and is supplied to the driver circuit. Since the gain of the driver circuit is constant, output current is determined by the hall input voltage level and PIN 2 input current. Therefore, the motor rotation can be held constant by detecting it with FG, F-I converting this FG output, and feedbacking to PIN 2. (Fig. 5)

This is, (1) Motor rotation reduces

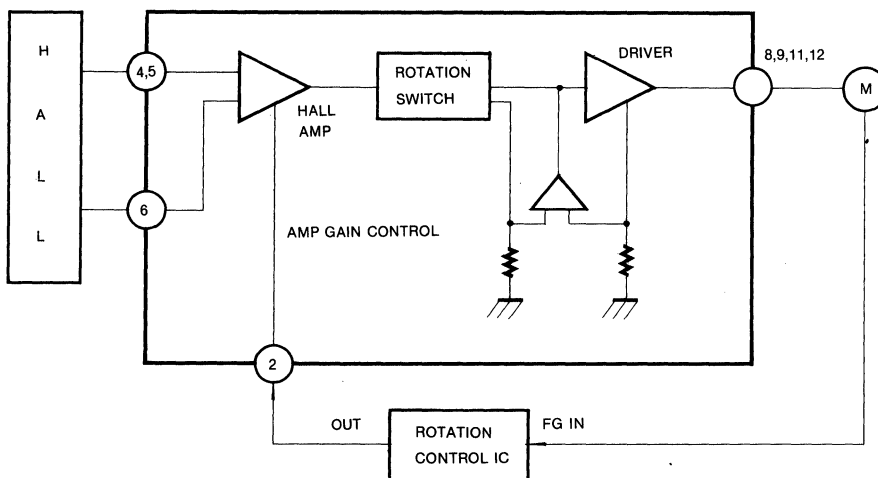
(2) PIN 2 input current (control input) increases (at rotation control IC)

(3) Hall amplifier gain increases

(4) Output current increases

(5) Motor rotation increases, then the motor rotation becomes constant.

2. Concerning about the output current flow, if PIN 4 voltage is high relative to PIN 6, an output current resulted from the voltage difference flows from PIN 8 to PIN 9. In case PIN 6 voltage is higher than PIN 4 conversely, output current flows from PIN 9 to PIN 8. If PIN 5 voltage is higher than PIN 6, an output current resulted from the voltage difference flows from PIN 12 to PIN 11. In case PIN 6 voltage is higher than PIN 5 conversely, output current flows from PIN 11 to PIN 12. (Fig. 6)
3. Practical output waveform is illustrated in Fig. 7. While output is switching from positive to negative, the status becomes OPEN (This is due to the existence of the amplifier offset). During this period, since the impedance at the IC side becomes high, output current is determined by external parameters. In general, the load is inductive and a capacitor is connected to the external port to prevent backlash voltage generation.



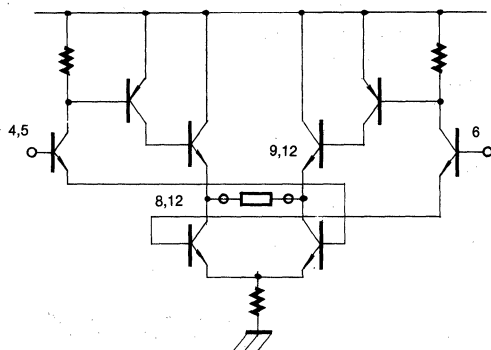


Fig. 6

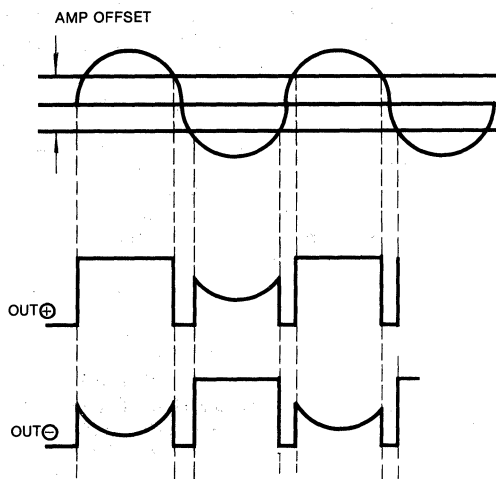


Fig. 7

PRECAUTIONS FOR USE

1. HALL INPUT

For hall input, a signal above 50mV_{p-p} should be added between PIN 6-PIN 4 and PIN 6-PIN 5. The input range of the DC level is from 2V to ($V_{reg} - 1.5V$). There is no problem if the input is around $V_{reg}/2$. Since the input impedance of the hall input is above 1Mohm, a hall device of any type can be connected.

A hall device with lower DC offset is recommended because the KA8304 directly amplifies the DC offset of hall device output by its linear driving. (Fig. 8)

2. INPUT IMPEDANCE (INPUT CIRCUIT)

1) PIN 2 (Speed Control Input)

2V_i + 500ohm resistance is directly inserted. There is no current limitation except 500ohm resistance (Fig. 8)

2) PIN 3 (CW/CCW Input)

R1 (10kohm) has $\pm 30\%$ deviation (Fig. 9)

3) PIN 4, 5, 6 (Hall Input)

The output port is the base of a NPN transistor 1/70 (max) of the control current flows to the port. (b This current with 1/70 - 1/400 deviation is not affected by the voltage) However, because of the differential operation of PIN 4-PIN 6 and PIN 5-PIN 6, current flows even during the transistor off period. Since PIN 6 is COM, twice as much current of PIN 4 or PIN 5 flows to PIN 6 (Fig. 8)

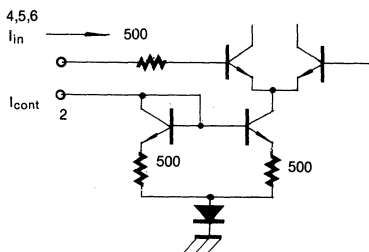


Fig. 8

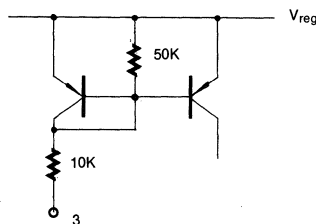


Fig. 9

ELECTRICAL CHARACTERISTIC CURVE

Fig. 10 QUIESCENT CURRENT vs. SUPPLY VOLTAGE

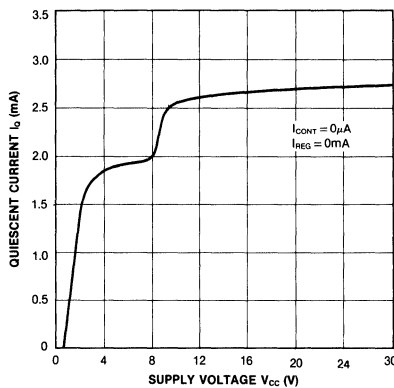


Fig. 11 CIRCUIT CURRENT vs. SUPPLY CURRENT

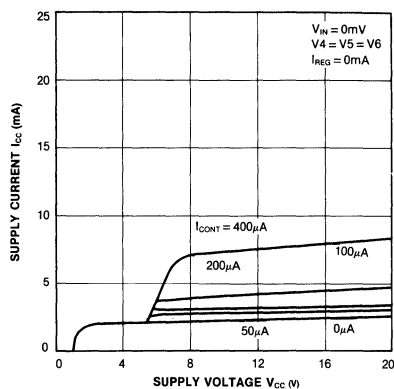


Fig. 12 REGULATED VOLTAGE vs. SUPPLY VOLTAGE

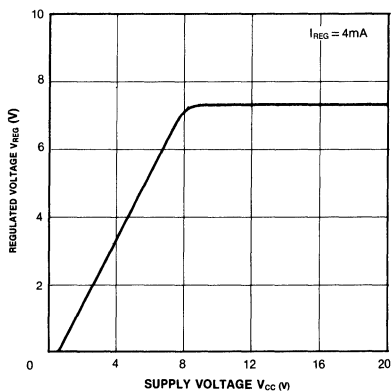


Fig. 13 REGULATED VOLTAGE vs. LOAD CURRENT

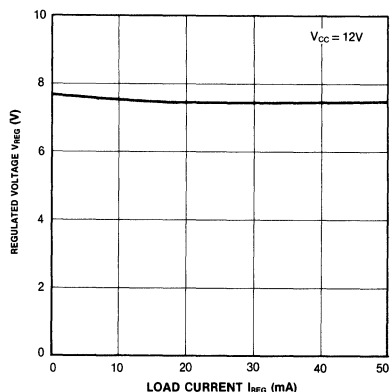


Fig. 14 OUTPUT CURRENT vs. INPUT VOLTAGE

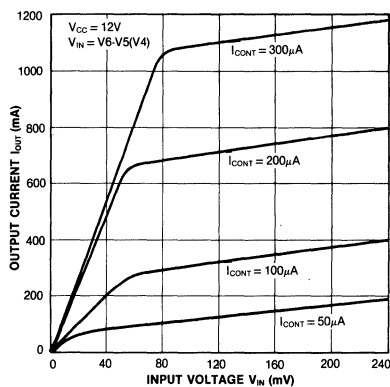


Fig. 15 OUTPUT CURRENT vs. CONTROL CURRENT

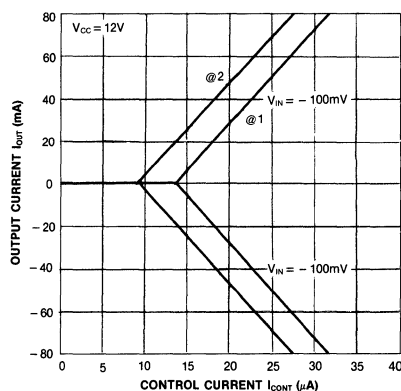


Fig. 16 OUTPUT LOW LEVEL vs. OUTPUT CURRENT

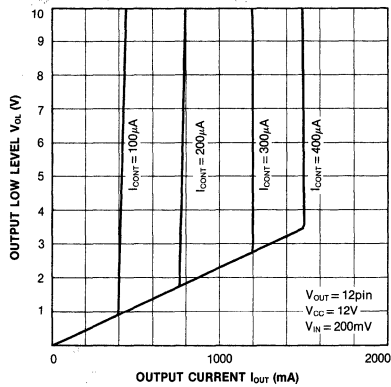
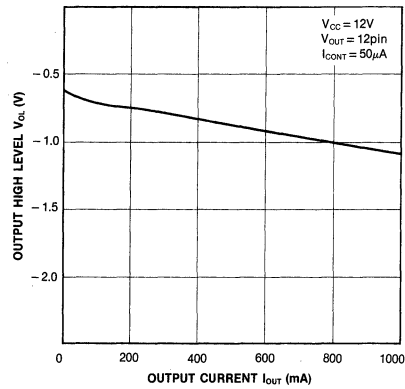


Fig. 17 OUTPUT HIGH LEVEL vs. OUTPUT CURRENT



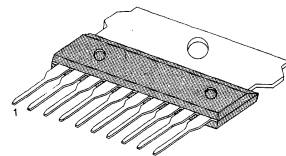
DUAL BRIDGE DRIVER

KA8306 is dual bridge driver designed for cassette and tape loading motor drives in a VCR system.

FEATURE

- 4 modes available (CW/CCW/STOP/BRAKE)
- Output current up to 1.0A (AVE) and 1.5A (PEAK)
- Wide range of operating voltage
 - $V_{CC\text{ opr}} = 4.5 \sim 18V$
 - $V_S\text{ opr} = 0 \sim 18V$
 - $V_{ref\text{ opr}} = 0 \sim 18V$
- Build in thermal shutdown, over current protector and punch through current restriction circuit.
- Hysteresis for all inputs.

10 SIP H/S



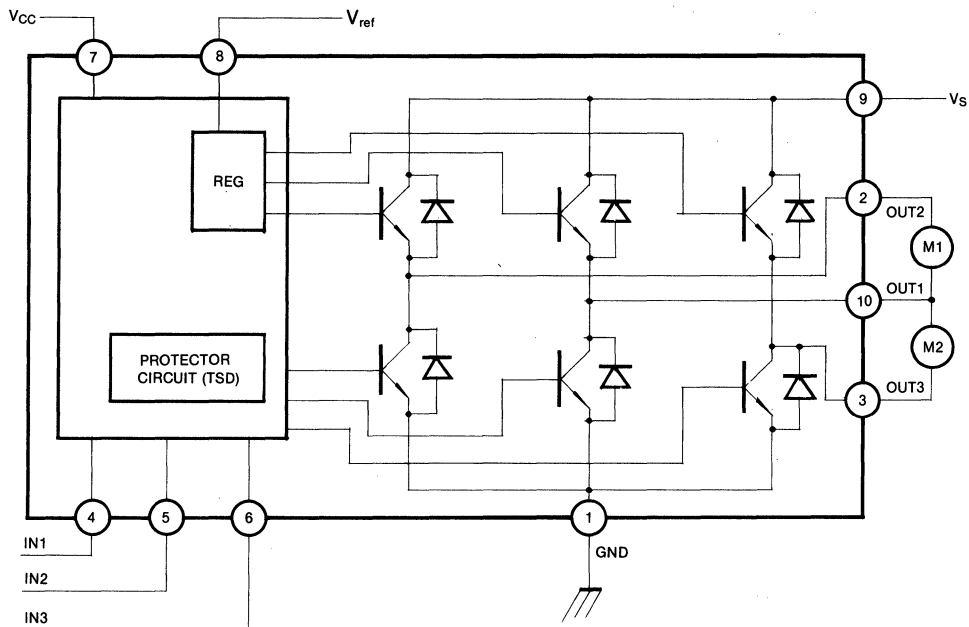
ORDERING INFORMATION

Device	Package	Operating Temperature
KA8306	10 SIP H/S	$-30 \sim +75^{\circ}\text{C}$

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^{\circ}\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	25	V
Motor Drive Voltage	V_S	25	V
Reference Voltage	V_{ref}	25	V
Output Current	I_o (peak)	1.5	A
	I_o (AVE)	1.0	A
Power Dissipation	P_d	7.0	W
Operating Temperature	T_{opr}	$-30 \sim +75$	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +150$	$^{\circ}\text{C}$

BLOCK DIAGRAM



INPUT*			OUTPUT			MODE	
IN1	IN2	IN3	OUT1	OUT2	OUT3	M1	M2
0	0	1/0	L	L	L	BRAKE	BRAKE
1	0	0	H	L	**	CW/CCW	STOP
1	0	1	L	H	**	CCW/CW	STOP
0	1	0	H	**	L	STOP	CW/CCW
0	1	1	L	**	H	STOP	CCW/CW
1	1	1/0	L	L	L	BRAKE	BRAKE

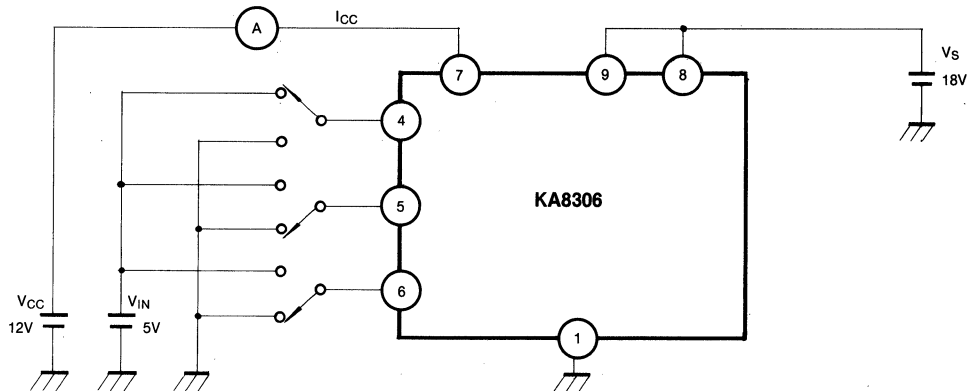
*: Inputs are all high active type.

**: High impedance

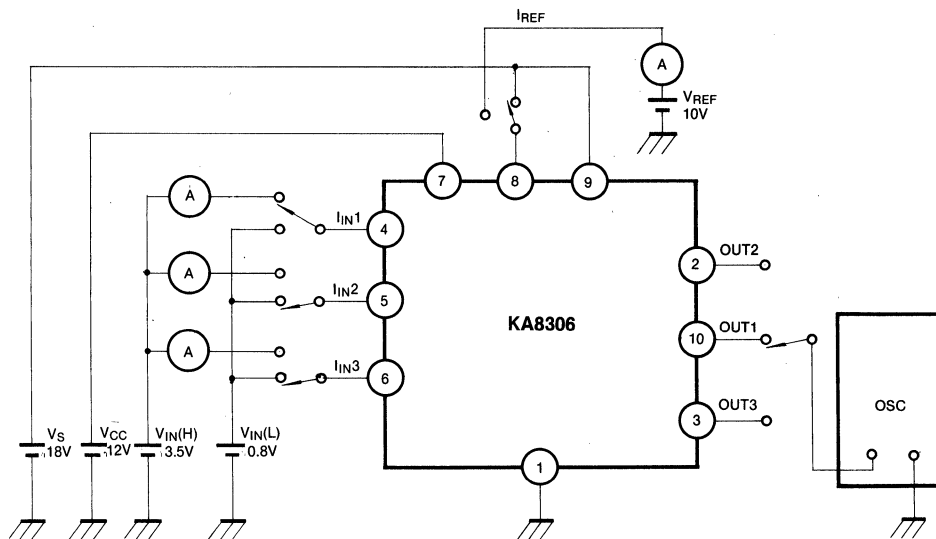
ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 18\text{V}$, $V_S = 18\text{V}$)

Characteristic		Symbol	Test Circuit	Test Conditions	Min	Typ	Max	Unit
Supply Current		I_{CC1}	1	Output Off CW/CCW Mode	—	17	30	mA
		I_{CC2}	1	Output Off, Stop Mode	—	13	25	mA
Input Operating Voltage	H	V_{in-H}	2	$T_J = 25^\circ\text{C}$	3.5	—	5.5	V
	L	V_{in-L}	2	$T_J = 25^\circ\text{C}$	0	—	0.8	V
Input Current		I_{in}	2	$V_{in} = 3.5\text{V}$, Sink Mode	—	5	20	μA
Input Hysteresis Voltage		V_{hys}	2		—	0.7	—	V
Saturation Voltage	Upper	V_{sat-1U}	3	$V_{ref} = V_S$, $I_O = 0.2\text{A}$	—	1.2	1.5	V
	Lower	V_{sat-1L}	3	$V_{ref} = V_S$, $I_O = 0.2\text{A}$	—	1.1	1.4	V
	Upper	V_{sat-2U}	3	$V_{ref} = V_S$, $I_O = 1.0\text{A}$	—	2.7	3.1	V
	Lower	V_{sat-2L}	3	$V_{ref} = V_S$, $I_O = 1.0\text{A}$	—	2.5	3.0	V
Output Voltage		V_O-1	3	$V_{ref} = 10\text{V}$, $I_O = 0.5\text{A}$ Output Measure	10.3	10.7	11.5	V
		V_O-2	3	$V_{ref} = 10\text{V}$, $I_O = 0.5\text{A}$ Output Measure	10.1	10.5	11.3	V
Leakage Current	Upper	I_{L-U}		$V_S = 25\text{V}$	—	0	50	μA
	Lower	I_{L-L}		$V_S = 25\text{V}$	—	0	50	μA
Diode Forward Voltage	Upper	V_F-U	4	$I_F = 1.0\text{A}$	—	2.2	—	V
	Lower	V_F-L	4	$I_F = 1.0\text{A}$	—	1.4	—	V
Reference Current		I_{ref}	2	$V_{ref} = 10\text{V}$, Source Mode	—	20	30	μA

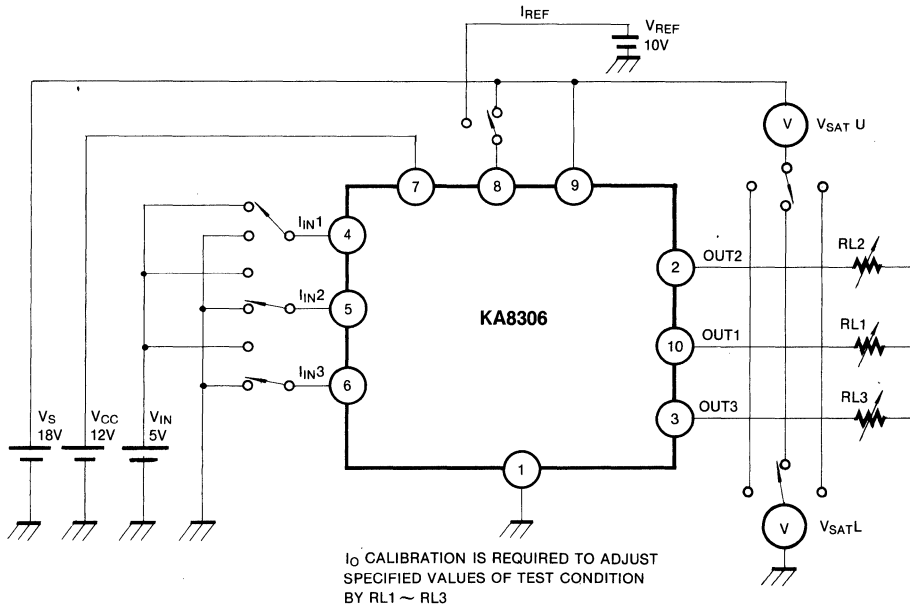
TEST CIRCUIT 1



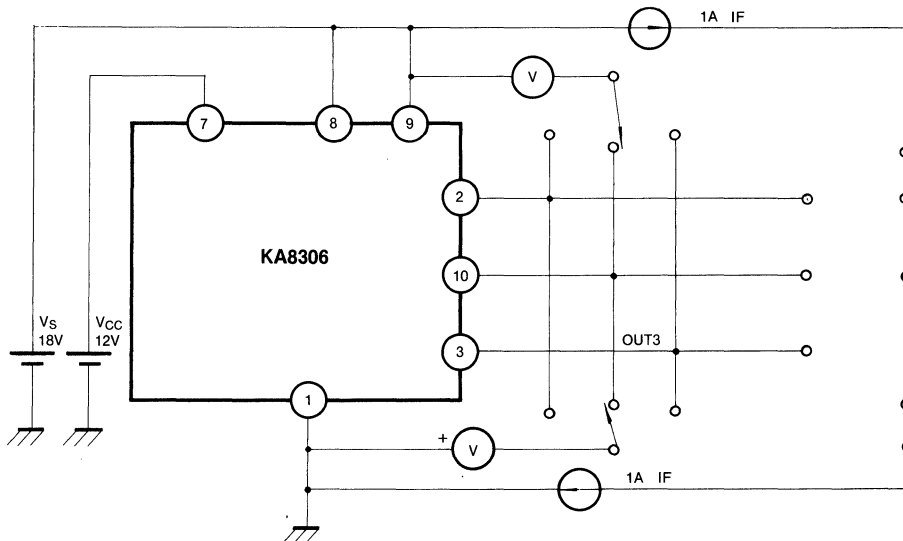
TEST CIRCUIT 2



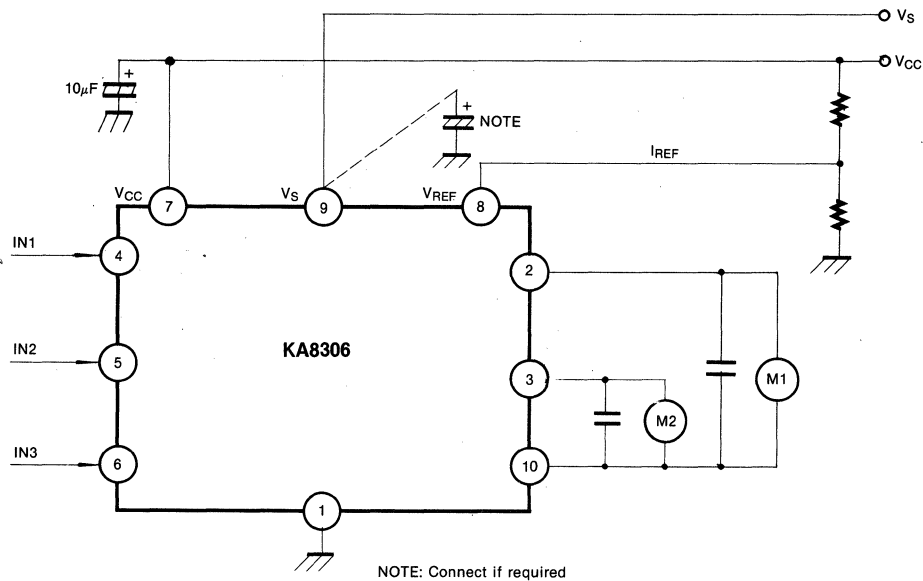
TEST CIRCUIT 3



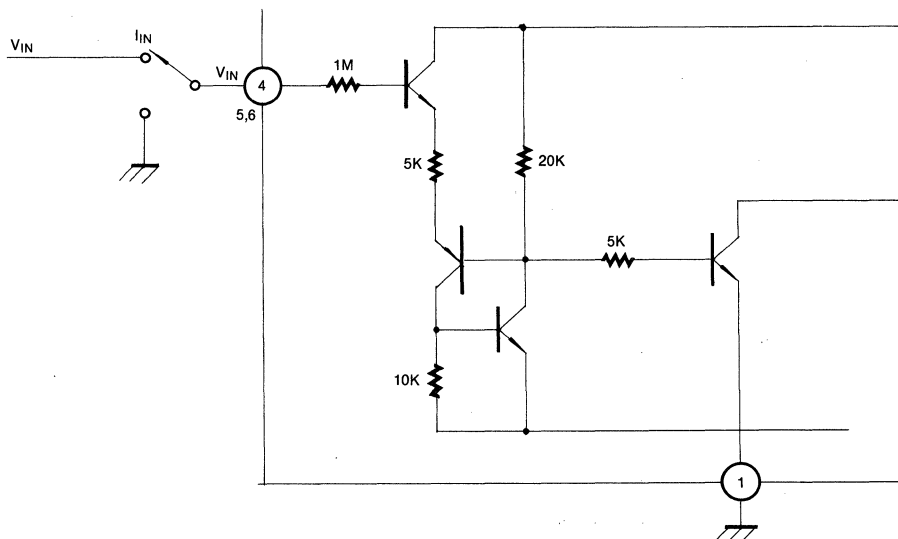
TEST CIRCUIT 4



APPLICATION CIRCUIT

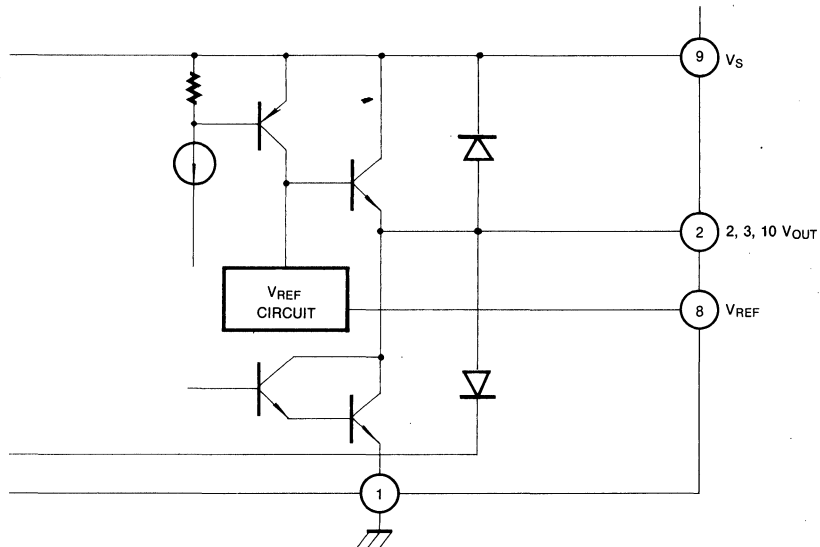


INPUT CIRCUIT



INPUT TERMINALS OF 4,5 AND 6 PIN ARE ALL HIGH ACTIVE TYPE AND HAVE A HYSTERESIS OF 0.7V TYPE. 5 μ A TYPE OF SOURCE MODE INPUT CURRENT IS REQUIRED.

OUTPUT CIRCUIT

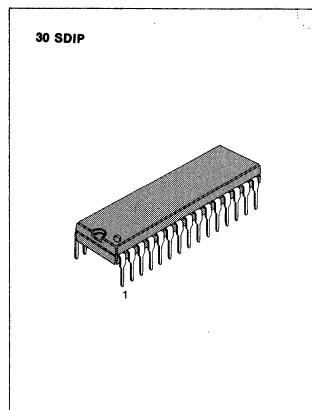


OUTPUT VOLTAGE IS CONTROLLED BY V_{REF} VOLTAGE. RELATIONSHIP BETWEEN V_{OUT} AND V_{REF} IS $V_{OUT} = V_{BE}(=0.7) + V_{REF}$
 V_{REF} TERMINAL REQUIRED TO CONNECT TO V_S TERMINAL FOR STABLE OPERATION IN CASE OF NO REQUIREMENT OF V_{OUT} CONTROL.

The KA8308 is a large scale integrated circuit in a 30-lead shrink dual in-line plastic package designed for use digital servo controller for VTR.

This device have mainly function of a drum motor and capstan motor speed and phase control at the play back or record mode which correspond to multi-head set through selection pin.

- Mode (SP, LP, EP) selection by serial data
- Containing gain compensation circuit by digital method in the capstan part
- Containing f_H -compensation circuit in the drum part
- Head switching pulse generation for FM audio
- Pseudo vertical sync pulse generation correspond to clean still and slow
- Unrecording zone detector
- Containing sync-separator block
- X-point compensation



Device	Package	Operating Temperature
KA8308	30 SDIP	- 15 ~ + 75°C

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{DD}	7	V
Power Dissipation	P _d	500	mW
Operating Temperature	T _{opr}	-15 ~ +70	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C
Pin Input Voltage	V _{IN}	V _{SS} - 0.3 ~ V _{DD} + 0.3	V

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{DD} = 5V)

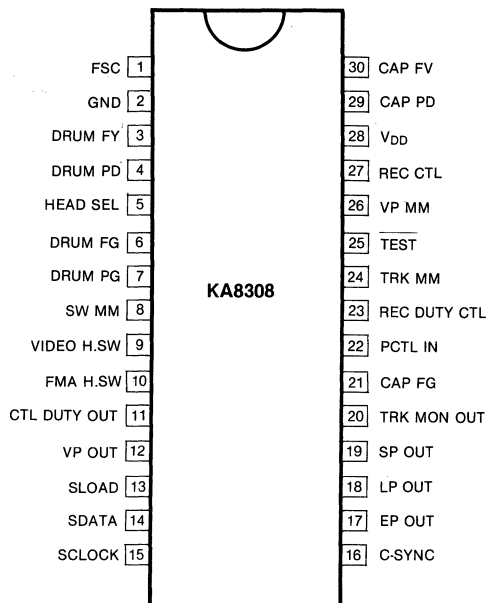
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V _{DD}	I _L = 1.0mA	4.5	5.0	5.5	V
Supply Current	I _{DD}		4	6.35	16	mA
FV, PV High Output Voltage	V _{FVH}		4.5	4.88	—	V
FV, PV Low Output Voltage	V _{FVL}	I _L = 5.0mA	—	0.043	0.5	V
REC CTL High Output Voltage	V _{RECH}		4.5	4.88	—	V
REC CTL Low Output Voltage	V _{RECL}		—	0.04	0.5	V
Output High Voltage	V _H	I _L = 1.0mA	4.5	4.88	—	V
Output Low Voltage	V _L		—	0.04	0.5	V
F _{SC} Input Level	V _{fsc IN}	AC coupling	—	—	2.0	V _{p-p}
F _{SC} Minimum Input Level	V _{fsc MIN}		—	188	300	mV _{p-p}
F _{SC} Input Current	I _{fsc IN}	V _{IN} = 5V, 0V	—	19	50	μ
Hysteresis Input Current	I _{hys IN}	V _{IN} = 0V, Monitor	5	40	80	μA
Hysteresis Input Threshold	V _{hys IN}		1.5	—	3.5	V
Tristate Input High Threshold	V _{th H}		3.0	3.7	4.5	V
Tristate Input low Threshold	V _{th L}		0.5	1.2	2.0	V
MM Comparator Level	V _{th MM}		2.0	2.5	3.0	V
MM Off Leakage Current	I _{L MIN}		—	0	1	μA
REC CTL Off Leakage Current	I _{LCTL}		—	0	1	μA
FG, PG, CTL Input Threshold	V _{th}		1.5	—	3.5	V
FG, PG, CTL Input Current	I _{IN}		—	—	5	μA

*Calculation Mono-Multi time constant (τ_M) ms

$$\tau_M = C \times R \times \ln \frac{V_{DD}}{V_{DD} - V_{th MM}} \quad (C = 0.15\mu F, R = 150K\Omega)$$

	Min	Typ	Max	Unit
V _{th MM}	2.0	2.5	3.0	V
τ _M	11.5	15.6	20.5	ms

PIN ASSIGNMENT



PIN DESCRIPTION

Pin No.	Symbol	I/O	Function
1	FSC	I	System clock input
2	GND	I	Ground
3	DRUM FV	O	Drum FV PWM output
4	DRUM PD	O	Drum PD PWM output
5	HEAD SEL	I	Head selection of DGAP1, DGAP2 and 2 Head
6	DRUM FG	I	Drum FG signal input
7	DRUM PG	I	Drum PG signal input
8	SW MM	O	Mono-Multi switch for PG control
9	VIDEO H.SW	O	Video head and switching pulse output
10	FMA H.SW	O	Audio head switching pulse output
11	CTL DUTY OUT	O	PCTL duty detecting output
12	VP OUT	O	Pseudo V-lock pulse output

PIN DESCRIPTION

Pin No.	Symbol	I/O	Function
13	SLOAD	I	Serial data load signal
14	SDATA	I	Serial data input
15	SCLOCK	I	Serial data clock
16	C-SYNC	I	Composite sync signal input
17	EP OUT	O	EP mode detecting output
18	LP OUT	O	LP mode detecting output
19	SP OUT	O	SP mode detecting output
20	TRK MONITOR	O	Tracking monitor
21	C-FG	I	Capstan FG signal input
22	PCTL	I	PCTL signal input
23	REC DUTY	I	REC control pulse duty assignment
24	TRK MM	O	Tracking control
25	TEST	I	Test pin
26	VP MM	O	V-lock pulse position control
27	REC CTL	O	REC control pulse output
28	V _{DD}	I	V _{DD}
29	CAPSTAN PD	O	Capstan PD PWM output
30	CAPSTAN FV	O	Capstan FV PWM output

SERIAL DATA MODE CONDITION

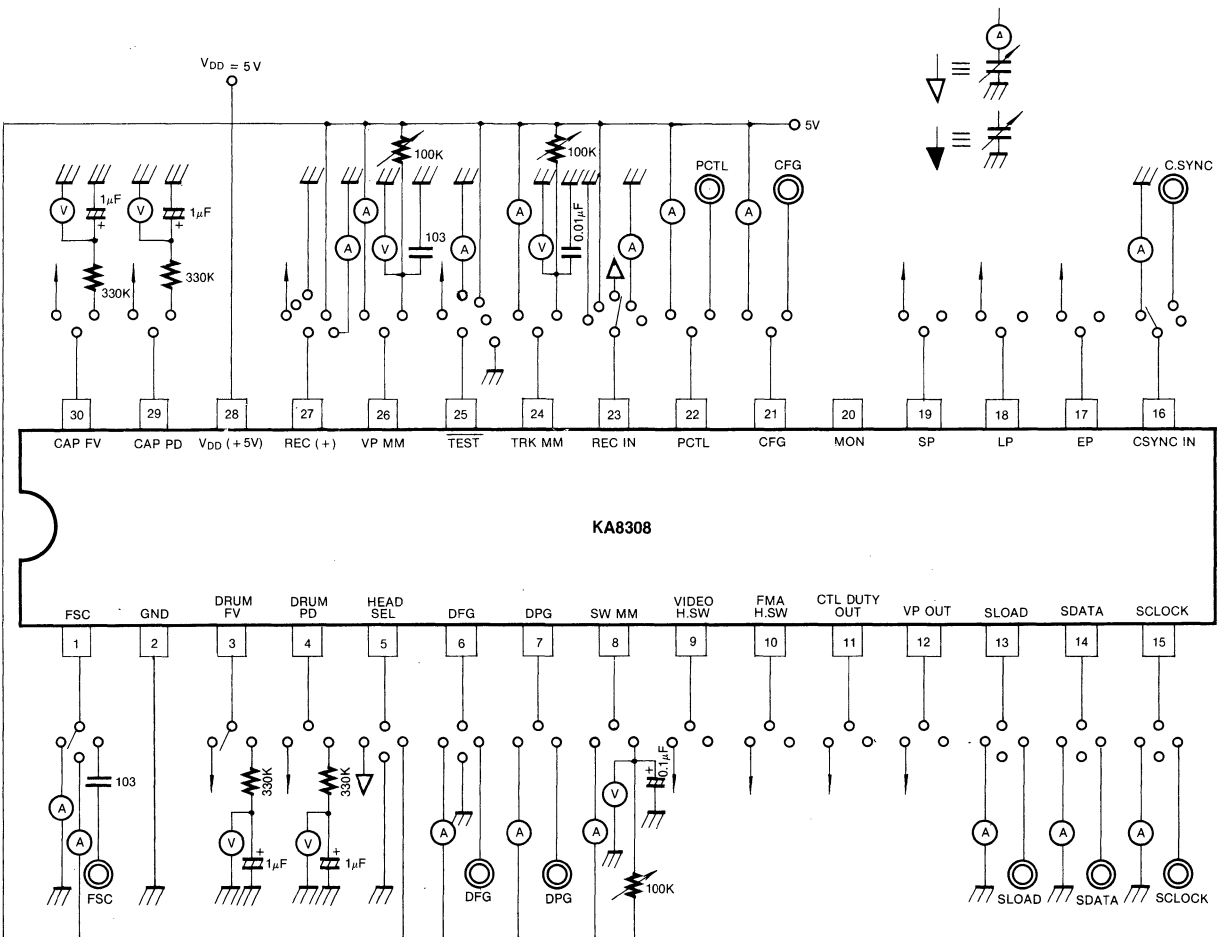
MODE	D0	D1	D2	D3	D4	D5	D6	D7	MODE DISTINCTION
REC	0	0	0	0	0	0	0	0	Don't assign mode distinction depending on D8, D9.
ASB	0	1	0	0	0	0	0	0	
INST	1	0	0	0	0	0	0	0	
PB	1	1	0	0	0	0	0	0	Distinction or holding
REV	1	1	1	0	0	0	0	0	
SLOW	1	1	0	0	0	1	0	0	
× 1.5	1	1	0	0	1	0	0	0	Holding
× 2	1	1	0	0	1	1	0	0	
SER1	1	1	0	1	0	0	0	0	
SER1*REV	1	1	1	1	0	0	0	0	
SER2	1	1	0	1	0	0	0	1	
SER2*REV	1	1	1	1	0	0	0	1	
SER3	1	1	0	1	0	0	1	0	
SER3*REV	1	1	1	1	0	0	1	0	
SER4	1	1	0	1	0	0	1	1	
SER4*REV	1	1	1	1	0	0	1	1	
FF1	1	1	×	1	1	0	0	0	
FF2	1	1	×	1	1	0	0	1	
FF3	1	1	×	1	1	0	1	0	
FF4	1	1	×	1	1	0	1	1	
ASB*SER1*REV	0	1	1	1	0	0	0	0	
ASB*SER2*REV	0	1	1	1	0	0	0	1	
ASB*SER3*REV	0	1	1	1	0	0	1	0	Don't assign mode distinction depending on D8, D9.
ASB*SER4*REV	0	1	1	1	0	0	1	1	
ASB*REV	0	1	1	0	0	0	0	0	

Note 1) Capstan is SP mode at FF.

Note 2) "X" means don't care.

MODE	D8	D9
SP	1	0
LP	0	1
EP	0	0
HOLDING	1	1

TEST CIRCUIT



[illegible]

SWITCHLESS RECORDING/ PLAY BACK AMPLIFIER

The KA8401 is a monolithic integrated circuit in a 16-lead zigzag in-line plastic package (shrink type). It consists of playback equalizer amplifier, recording/play back switch, line amplifier, ALC circuit with detector, recording amplifier and logic control circuit can control REC/EE and PB/EE line muting independently.

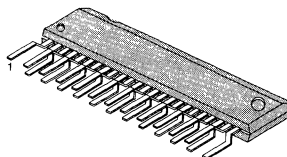
FUNCTIONS

- Play Back EQ Amp.
- Recording/Play Back S/W.
- Line Amp. & ALC Circuit with Detector.
- Recording Amp. & Logic Control Circuit.

FEATURES

- High level ALC V_R utilization provides a good S/N ratio & distortion factor
- The ALC level can be set according to the external resistance
- Extremely low POP noise during supply ON/OFF switching
- Extremely low shock noise during control system switching
- Few external parts required
- Wide operating supply voltage (4.5 ~ 12V)

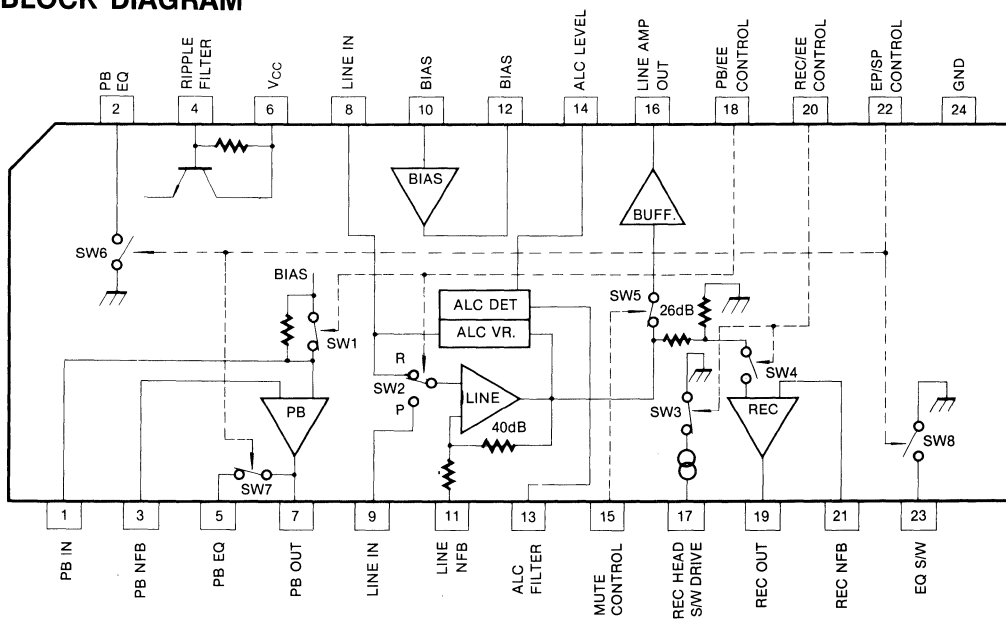
24 ZIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8401	24 ZIP	- 10 ~ + 65°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Value	Unit
Maximum Supply Voltage	V_{CC}	13	V
Power Dissipation	P_D	400*	mW
Operating Temperature	T_{opr}	$-10 \sim +65$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$

Note: Derated above $T_a = 25^\circ\text{C}$ in the proportion of 4mW/ $^\circ\text{C}$

ELECTRICAL CHARACTERISTIC

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $f = 1\text{KHz}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Current	I_{CC1}	No Signal SP mode	—	5.0	9.2	mA
Supply Current	I_{CC2}	No Signal SP moode	—	8.0	14.1	mA

(Line Amp)

Recording Input Gain	G_{VEE}	$V_{IN} = -25\text{dBV}$, ALC OFF	15.0	16.7	18.4	dB
Total Harmonic Distortion	THD_{EE}	$V_{IN} = -25\text{dBV}$, ALC OFF	—	0.06	0.2	%
Residual Noise	V_{NOL}	$R_G = 5.6\text{K}\Omega$	—	-76	-68	dBV
Input Impedance	Z_{INP}	P.B input	—	30	—	$\text{K}\Omega$
Input Impedance	Z_{INR}	REC input	—	30	—	$\text{K}\Omega$
Maximum Output Level	V_{OML}	$THD = 1\%$	0.75	1.1	—	V_{rms}
ALC Level	V_{OA}	$V_{IN} = -15\text{dBV}$, ALC ON	0.47	0.58	0.71	V_{rms}
ALC Total Harmonic Distortion	THD_A	$V_{IN} = -15\text{dBV}$, ALC ON	—	0.06	0.2	%
ALC Distortion for Large Input	ΔTHD_A	$V_{IN} = +10\text{dBV}$, ALC ON	—	0.15	0.3	%

(REC AMP)

Overall Recording Gain	G_{VR}	$V_{IN} = -25\text{dBV}$, ALC OFF	16.3	18.0	19.7	dB
Open Loop Recording Gain	G_{VOR}	$V_{IN} = -65\text{dBV}$, ALC OFF	72	79	—	dB
Total Harmonic Distortion	THD_R	$V_{IN} = -25\text{dBV}$, ALC OFF	—	0.06	0.2	%
Maximum Recording Output	V_{OMR}	$THD = 1\%$	0.85	1.2	—	V_{rms}

(PB EQ AMP)

Open Loop Playback Gain	G_{VOPB}	$V_{IN} = -40\text{dBV}$	64	71	—	dB
Total Harmonic Distortion	THD_{PB}	$V_{IN} = -10\text{dBV}$	—	0.02	0.15	%
PB EQ Input Noise	V_{NIPB}	$R_G = 620\Omega$	—	-122	-114	dBV
Input Impedance	Z_{INPB}		—	120	—	$\text{K}\Omega$
PB Overall Gain	G_{VP}	$V_{IN} = -25\text{dBV}$	74.3	78.5	82.7	dB

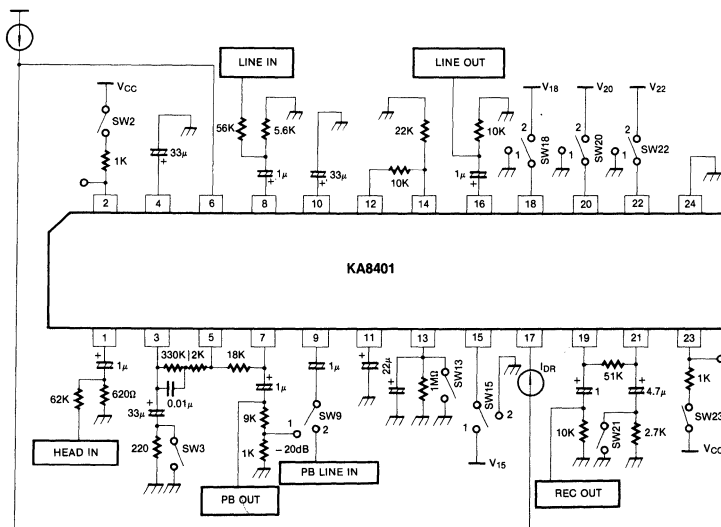
(PB/EE S/W MODE)

EE Mode Sustain Voltage	V_{18L}		0	—	0.8	V
PB Mode Sustain Voltage	V_{18H}		3.6	—	V_{CC}	V
Head S/W Impedance	Z_{SW1}		—	5	15	Ω

ELECTRICAL CHARACTERISTIC (Continued)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
(MUTE/MUTE S/W Mode)						
MUTE Mode Sustain Voltage	V _{15L}		0	—	1.5	V
MUTE Mode Sustain Voltage	V _{15H}		3.6	—	V _{CC}	V
MUTE Level	V _{MU}		—	– 100	– 60	dBV
(REC/EE S/W Mode)						
EE Mode Sustain Voltage	V _{20L}		0	—	1.7	V
REC Mode Sustain Voltage	V _{20H}		3.6	—	V _{CC}	V
Drive Sink Current	I _{SW17}		80	200	—	μA
(EQ S/W Mode)						
SP Mode Sustain Voltage	V _{22L}		0	—	1.0	V
EP Mode Sustain Voltage	V _{22H}		3.6	—	V _{CC}	V
SW2 Impedance	Z _{SW2}		—	6	30	Ω
SW5 Impedance	Z _{SW5}		—	12	60	Ω
SW23 Impedance	Z _{SW23}		—	6	30	Ω
(AFR S/W Mode)						
PB Mode Sustain Voltage	V _{20L}		0	—	0.5	V
REC Mode Sustain Voltage	V _{20H}		3.6	—	V _{CC}	V

TEST CIRCUIT



CONTROL MODE TABLE

Mode	Control				SW								ALC
	REC/EE	PB/EE	MUTE	EP/SP	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	
EE	L	L	L	—	ON	R	ON	OFF	ON	—	—	—	ON
EE MUTE	L	L	H	—	ON	R	ON	OFF	OFF	—	—	—	ON
REC	H	L	L	—	ON	R	OFF	ON	ON	—	—	—	ON
REC MUTE	H	L	H	—	ON	R	OFF	ON	OFF	—	—	—	ON
PB	L	H	L	—	OFF	P	ON	OFF	ON	—	—	—	OFF
PB MUTE	L	H	H	—	OFF	P	ON	OFF	OFF	—	—	—	OFF
AFR	H	H	L	—	ON	R	OFF	ON	ON	—	—	—	ON
AFR MUTE	H	H	H	—	ON	R	OFF	ON	OFF	—	—	—	ON
EP	—	—	—	H	—	—	—	—	—	ON	OFF	ON	—
SP	—	—	—	L	—	—	—	—	—	OFF	ON	OFF	—

CONTROL MODE FUNCTION

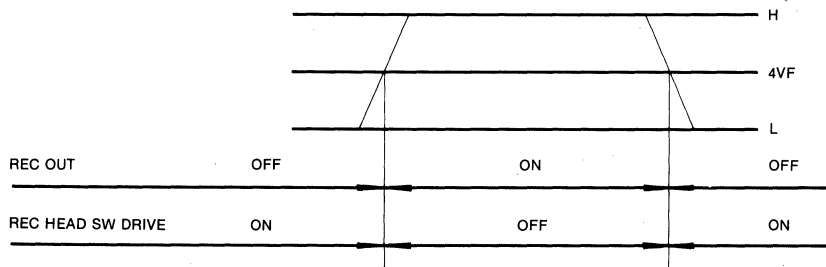
Mode	Function
PB/EE Control	PB: High EE: Low REC/EE input selection from line amp input ALC ON/OFF PB head switch ON/OFF
REC/EE Control	REC: High EE: Low REC amp output ON/OFF REC head switch ON/OFF (This mode is prior to PB/EE control mode and is able to correspond AFR mode)
MUTE Control	MUTE ON: High MUTE OFF: Low Line amp switch ON/OFF (ALC loop, this mode is able to control REC amp independantly)
EQ SW Control	EP: High SP: Low Each EQ switch/switch ON/OFF

4

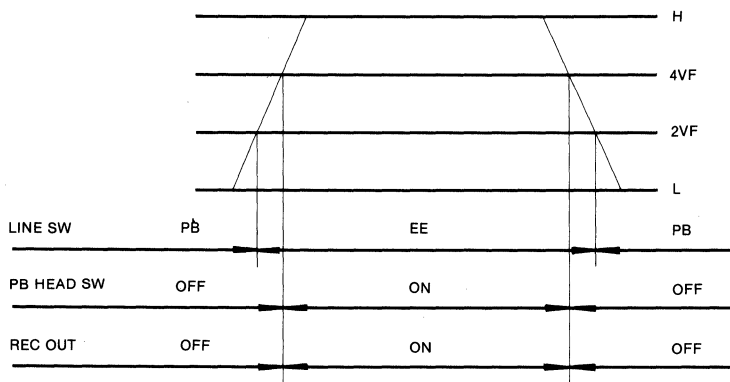


-
- Timing diagram for the PB output of the 74VHC125. The diagram shows four input signals: LINE SW, PB HEAD SW, and two unlabeled inputs (H, 4VF, 2VF, L). The output PB is shown as a square wave. The output is high when both LINE SW and PB HEAD SW are high, and low when either is low. The output is also high when the unlabeled inputs are high, and low when either is low.

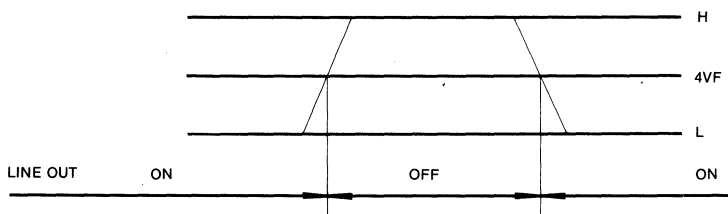
2. REC/EE Control: 20 Pin (PB/EE: "L")



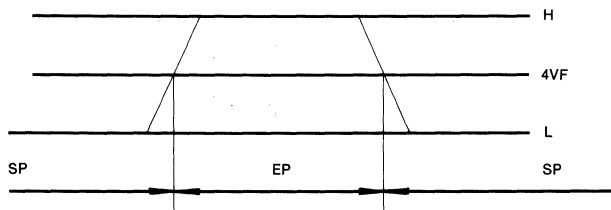
3. AFR/PB Control: 20 Pin (PB/EE: "H")



4. MUTE Control



5. EP/SP Control

NOTE: VF $\pm$ 6.8V

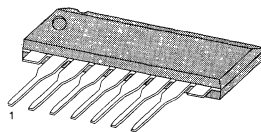
2-INPUT SWITCH

The KA8402 is a monolithic integrated circuit designed for 2-input switch in a VCR system.

FEATURES

- Suitable for video & audio signal
- Low current operation (4.8mA typ.)

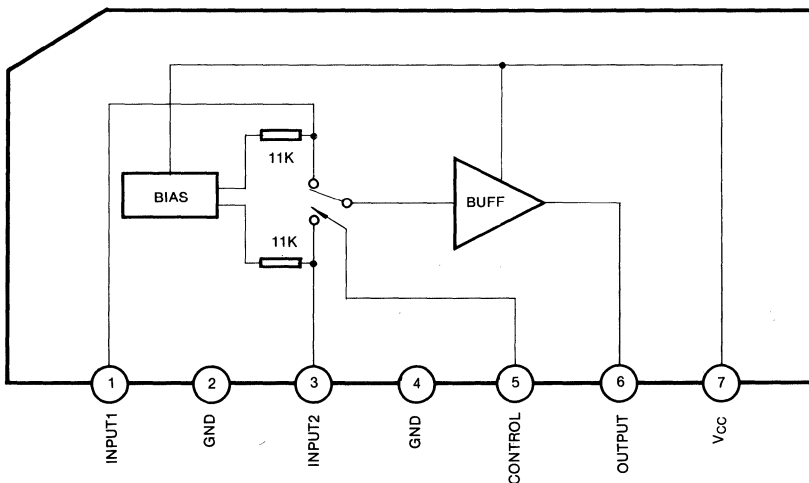
7 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8402	7 SIP	- 10 ~ + 80°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
Supply Voltage	V_{CC}	14	V
Signal Level At Input Pin	E_{IN}	5	V_{p-p}
Input Voltage At Control Pin	V_{IN}	$-0.3 \sim V_{CC} + 0.3$	V
Power Dissipation	P_D	400	mW
Operating Temperature	T_{opr}	$-10 \sim +80$	$^{\circ}C$
Storage Temperature	T_{stg}	$-50 \sim +125$	$^{\circ}C$

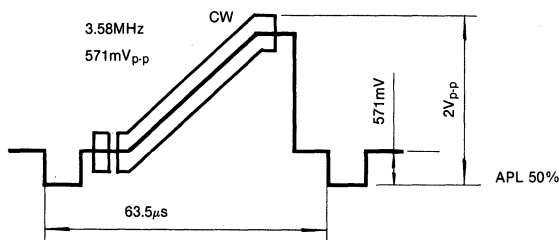
ELECTRICAL CHARACTERISTICS ($V_{CC} = 9V$, $T_a = 25^{\circ}C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}		8.0	9.0	10.0	V
Total Current	I_{CC}	$S1 = S2 = S3 = 2$	3.8	4.8	6.2	mA
Frequency Response	GF_1	$V_i = 2.5V_{p-p}$ $V_o(20Hz)/V_o(100KHz)$	-0.5	0	± 0.5	dB
	GF_2	$V_i = 2.0V_{p-p}$ $V_o(5MHz)/V_o(100KHz)$				
Insertion Loss	GL	$V_i = 2.5V_{p-p}, 100KHz, V_o/V_i$	-0.5	0	+0.5	dB
Distortion	THD	$V_i = 2.5V_{p-p}, 1KHz$	0	0.2	0.5	%
Differential Gain	DG	$V_i = \text{Input Waveform 1}$	—	0.5	—	%
Differential Phase	DP	$V_i = \text{Input Waveform 1}$	—	0.5	—	deg
Output Offset Voltage	V_{off}	Note 1)	-15	0	+15	mA
Cross-Talk	V_{CR}	$S1 = S3 = 1, S2 = 2$ & $S1 = S3 = 2, S2 = 1$ $V_i = 2.0V_{p-p}, 4.43MHz, V_o/V_i$	—	-70	-60	dB
SW Control Voltage	V_{con}	Note 2)	1.7	2.2	2.7	V
Input Impedance	R_i			15		Kohm
Output Impedance	R_o			10		ohm

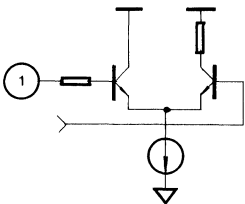
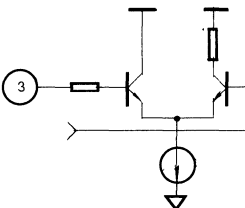
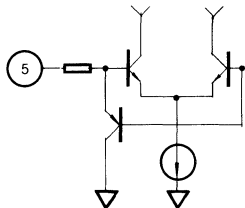
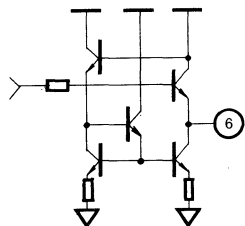
Note 1) In $S1 = S2 = 2, S3 = 1 \rightarrow 3$, read the difference of output DC voltage

2) Quaranteed switching level (Active & Nonactive)

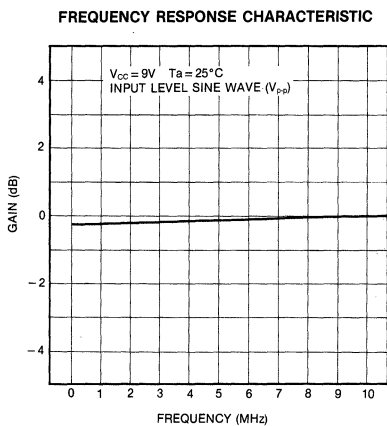
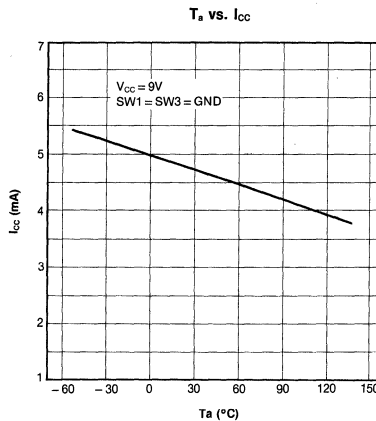
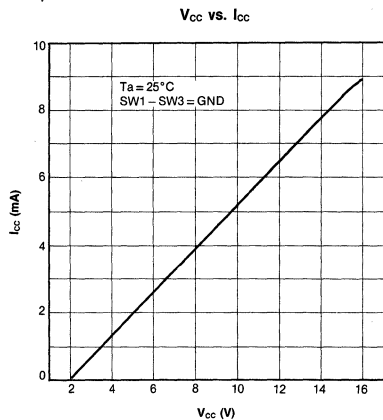
INPUT WAVEFORM 1



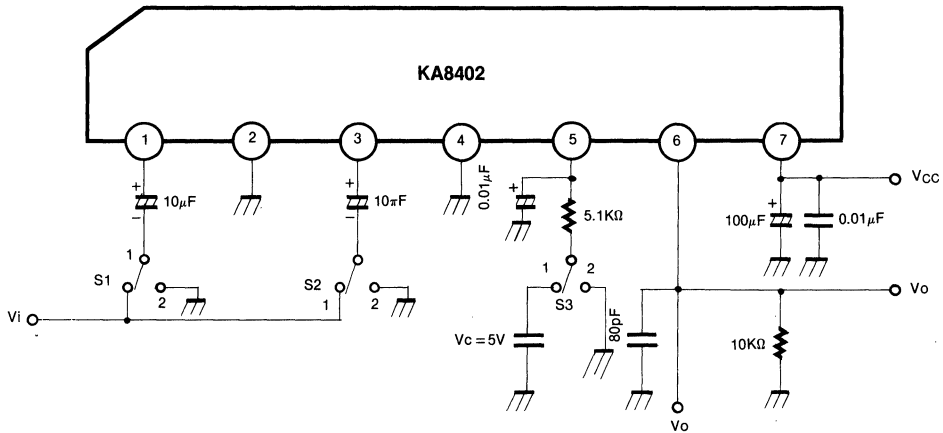
PIN ASSIGNMENT

Pin No.	Function	DC Voltage	Output Circuit
1	Input 1	6.14V	
2	GND	—	
3	Input 2	6.15V	
4	GND	—	
5	Control Input	0V: Input 1 5V: Input 2	
6	Output	5.34V	
7	V _{CC}	9.0V	

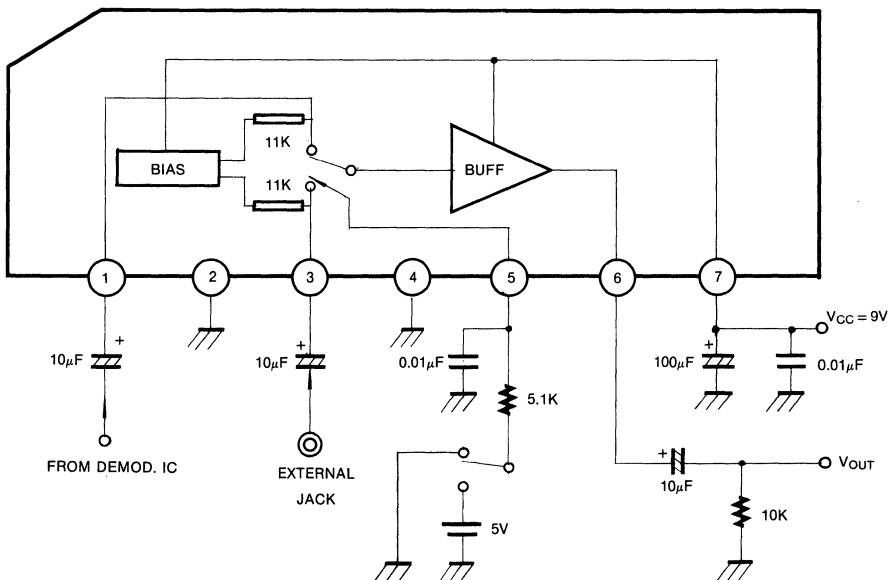
CHARACTERISTICS GRAPH



TEST CIRCUIT



APPLICATION CIRCUIT



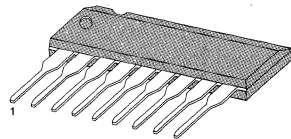
3-INPUT SWITCH

The KA8403 is a monolithic integrated circuit designed for 3-input switch in a VCR system.

FEATURES

- Suitable for video & audio signal
- Low current operation
- With muting terminal

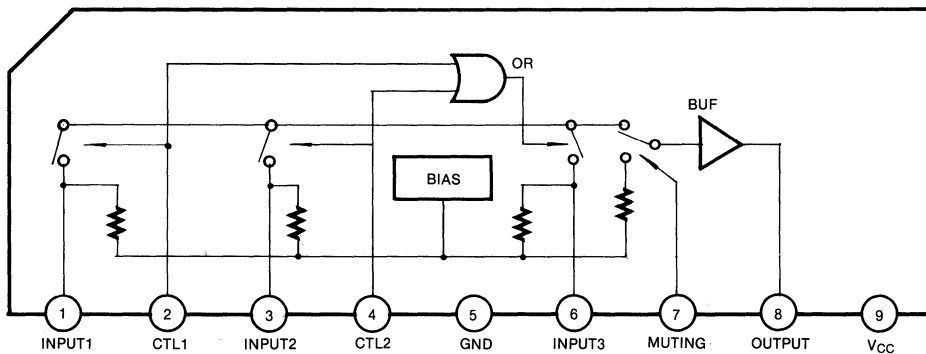
9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA8403	9 SIP	-10 ~ +70°C

BLOCK DIAGRAM



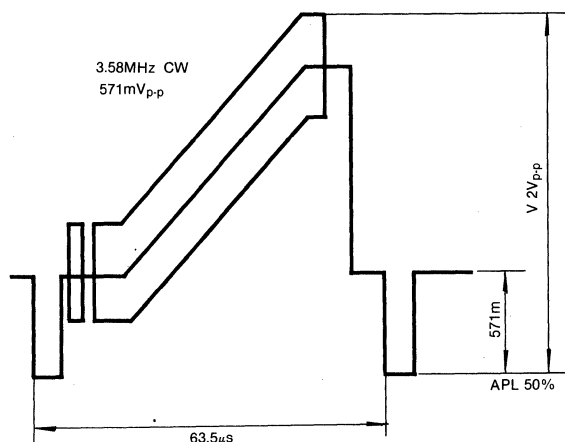
ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
Supply Voltage	V_{CC}	14	V
Signal Level At Input Pin	E_{IN}	5	V_{p-p}
Input Voltage At Control Pin	V_{IN}	$-0.3 \sim V_{CC} + 0.3$	V
Power Dissipation	P_D	500	mW
Operating Temperature	T_{opr}	$-10 \sim +80$	$^{\circ}C$
Storage Temperature	T_{stg}	$-50 \sim +125$	$^{\circ}C$

ELECTRICAL CHARACTERISTICS ($V_{CC} = 9V$, $T_a = 25^{\circ}C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}		8.0	9.0	10.0	V
Total Current	I_{CC}	SW1 – SW6 = 2	3.4	5.5	7.8	mA
Frequency Response	G_{F1}	$V_i = 2.5V_{p-p}$ $V_o(20Hz)/V_o(100KHz)$	-0.5	0	+0.5	dB
	G_{F2}	$V_i = 2.0V_{p-p}$ $V_o(5MHz)/V_o(100KHz)$				
Insertion Loss	G_L	$V_i = 2.5V_{p-p}$, 100KHz V_o/V_i	-0.5	-0.3	0	dB
Distortion	THD	$V_i = 2.5V_{p-p}$, 1KHz	0	0.2	0.5	%
Differential Gain	DG	$V_i = \text{Input Waveform}$	—	0.5	—	%
Differential Phase	DP	$V_i = \text{Input Waveform}$	—	0.5	—	deg
Output Offset Voltage	V_{OS}		-30	0	+30	mV
Cross Talk	C_{R1}	$V_i = 2.0V_{p-p}$, V_o/V_i 4.43MHz	—	-70	-60	dB
	C_{R2}	$V_i = 2.0V_{p-p}$, V_o/V_i 4.43MHz	—	-70	-50	dB
SW Control Voltage	V_{CON}	2.5V _{p-p} , 100KHz	2.4	2.9	3.4	V
	V_{MUT}	2.5V _{p-p} , 100KHz	2.1	2.6	3.1	V
Muting Capacity	C_{TM}	—	—	-50	-40	dB
Video Output Level	V_{OUT}	$V_i = 2.0V_{p-p}$	1.89	1.93	2.00	V_{p-p}

INPUT WAVEFORM

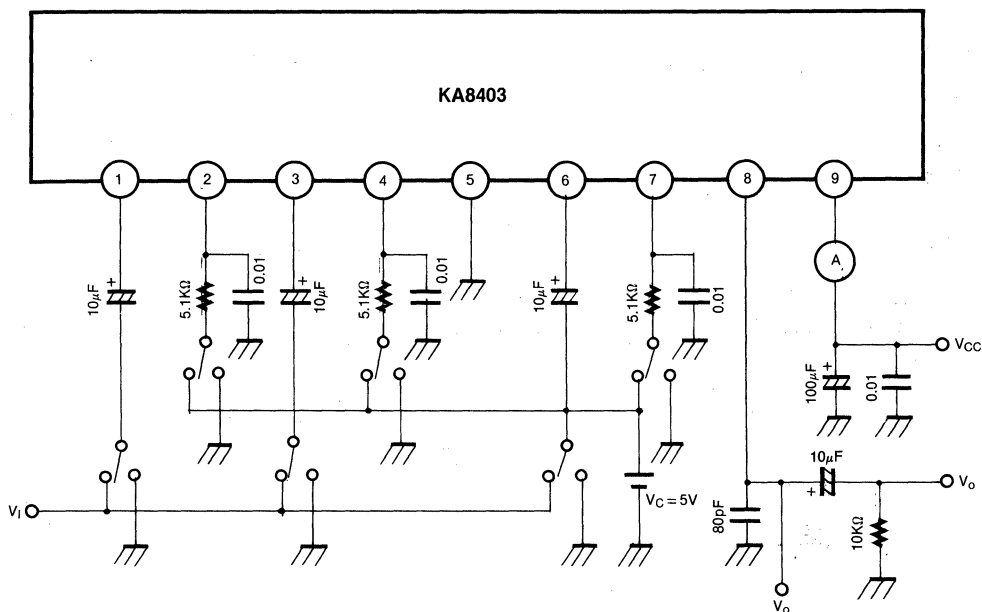


TRUTH TABLE

Control-1	Control-2	Muting	Output
H	L	L	Input-1
L	H	L	Input-2
L	L	L	Input-3
H	H	L	Undefined
*	*	H	None

- * Don't care

TEST CIRCUIT



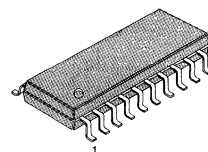
REMOTE CONTROL TRANSMITTER

The KS5410 is CMOS integrated circuit for infrared remote control transmitter function which is available for TV, VTR, VDP, CDP, AV controller etc. The KS5410 is designed to be decoded by 4 bit MPU and to prevent operation false code.

FEATURES

- Low voltage operation: $V_{DD} = 2.0$ to $4.0V$
- Low power consumption: $I_{DD} < 1\mu A$ at stand by mode
- Containing ceramic oscillation circuit
- 32 key function code
- 8 bit custom code (256 custom codes selected by Mask option)
- Function of double key
- High efficiency transmission: IR LED on duty 1.8%
- Indicator output

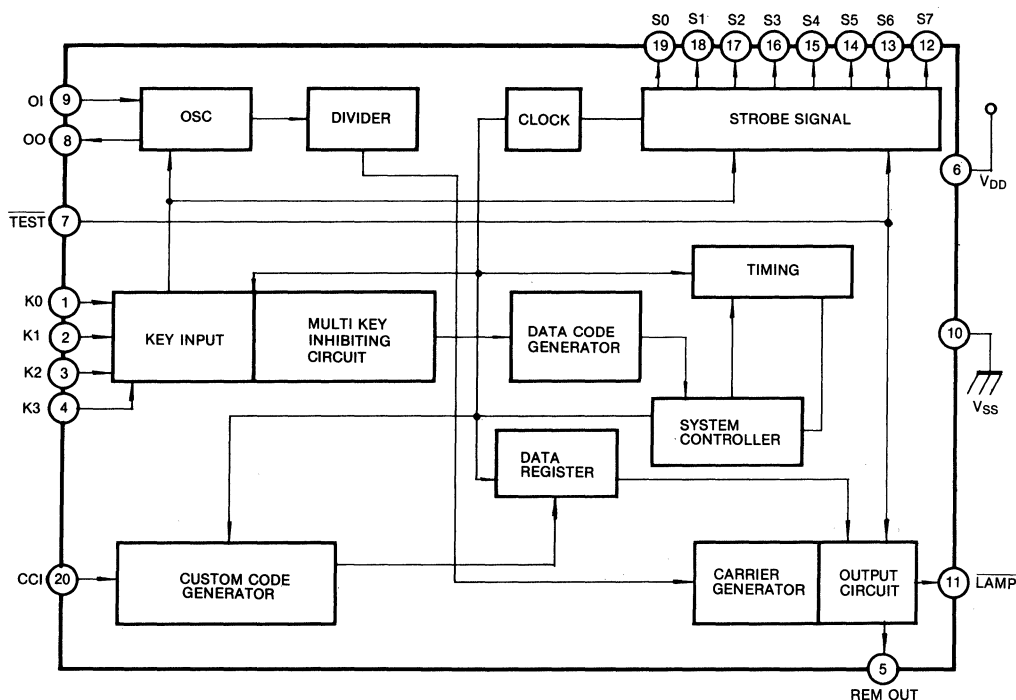
20 SOP



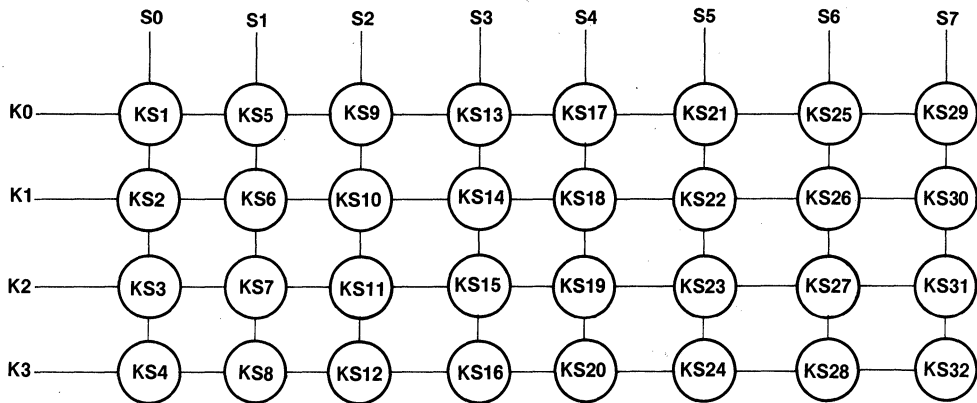
ORDERING INFORMATION

Device	Package	Operating Temperature
KS5410	20 SOP	-20 ~ +75°C

BLOCK DIAGRAM



KEY MATRIX



ABSOLUTE MAXIMUM RATING (Ta = 25°C)

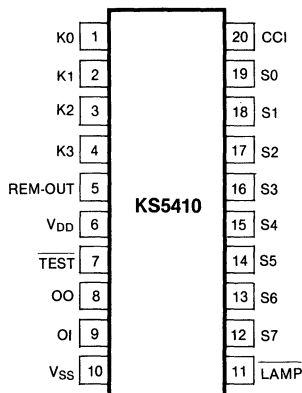
Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.3 ~ 5.0	V
Input Voltage	V_{IN}	$V_{SS} - 0.3 \sim V_{DD} + 0.3$	V
Output Current	I_{OUT}	-20	mA
Power Dissipation	P_D	300	mW
Operating Temperature	T_{opr}	-20 ~ +75°C	°C
Storage Temperature	T_{stg}	-40 ~ +125°C	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{DD} = 3.0V)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	All Function	2.0	3.0	4.0	V
Supply Current	I_{DD}	$f_{osc} = 455\text{KHz}$	—	—	1	mA
Static Current	I_{DS}	$f_{osc} = \text{stop}$	—	—	1	μA
Oscillation Frequency	f_{osc}		400	455	500	KHz
Input	High Voltage	$V_{IH} (K_i)$	0.7 V_{DD}	—	V_{DD}	V
	Low Voltage	$V_{IL} (K_i)$	0	—	0.3 V_{DD}	V
Pull Down Register	$R (K_i)$		100	200	400	KΩ
Output	High Current	$I_{OH} (REM)$ $V_{OH} (REM) = 1.5V$	-10	—	—	mA
	Low Current	$I_{OL} (LAMP)$ $V_{OL} (LAMP) = 1.5V$	5	—	—	mA

PIN DIAGRAM

1. Pin Connection



2. Pin Function

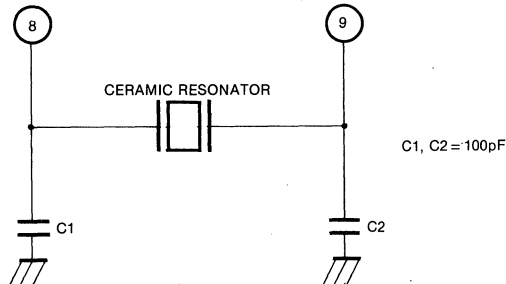
Pin	Symbol	Function
1	K0	Key input 0
2	K1	Key input 1
3	K2	Key input 2
4	K3	Key input 3
5	REM	Remote output
6	V _{DD}	Power supply
7	$\overline{\text{TEST}}$	Test terminal
8	OO	Oscillator output
9	OI	Oscillator input
10	V _{SS}	Ground

Pin	Symbol	Function
11	$\overline{\text{LAMP}}$	Lamp output (indicator for transmission)
12	S7	Strobe output 7
13	S6	Strobe output 6
14	S5	Strobe output 5
15	S4	Strobe output 4
16	S3	Strobe output 3
17	S2	Strobe output 2
18	S1	Strobe output 1
19	S0	Strobe output 0
20	CCI	Selected custom code

FUNCTION DESCRIPTION

1. Oscillation Circuit

The oscillation circuit is only activated by a key input. Ceramic resonator connected with OO, OI is normally operate at 455KHz oscillation frequency.



2. Key Input & Output Circuit

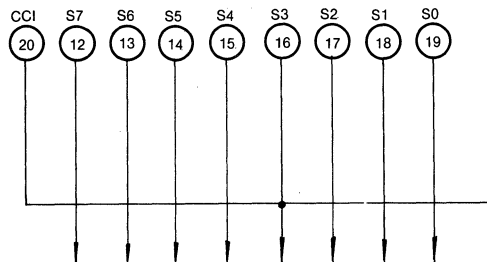
Pull down registers are connected key input pins. The 32 commands are available with input key K0-K3 and strobe output S0-S7. Simultaneous pressing of several keys activates the multiple input inhibiting circuit, thus preventing transmission.

- pressing of two keys—no transmission
- two key inputs with the interval of less than 36ms—no transmission
- priority of two inputs separating more than 36ms is given on the first-pressed—first-served.
- first input key is ON less than 36ms—transmission the second key input. One transmission is given if the key is kept pressed during this 36ms. And to prevent on chattering don't read the data during 9ms.
(When custom code is "I" above 5 bit, key is pressed during 36ms + 18ms)

3. Custom Code Latch Circuit

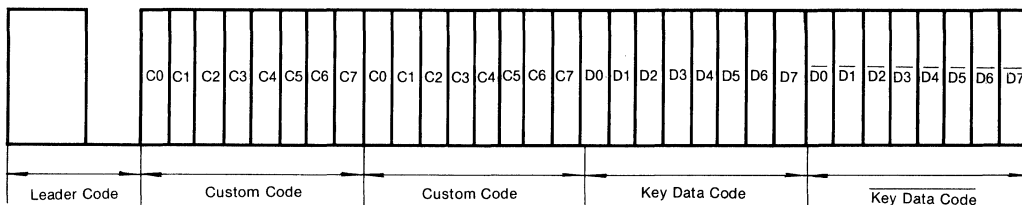
Custom code pin (CCI) is connected with one of key output pins makes 8 custom codes. Custom code consists of 8 bit and low 3 bit is latched timing of strobe signal, high 5 bit is made decision mask option. (High 5 bit of KS5140 sets "O"). Therefore, custom code is 8 bit, and makes 256 custom codes.

Strobe Signal (Connect with CCI)	Custom Code (Low 3 bit)
S0	0 0 0
S1	0 0 1
S2	0 1 0
S3	0 1 1
S4	1 0 0
S5	1 0 1
S6	1 1 0
S7	1 1 1



*CCI pin is connected with one of S0-S7.

4. Remote Output (REM)

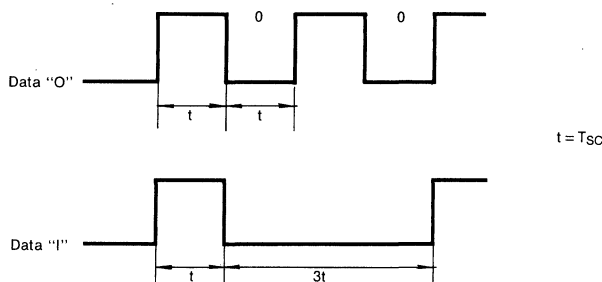


The transmission output consists of the leader code, 8 bit custom code and the same 8 bit custom code, another 8 bit key data code and the complementary code of key data code and data totalling 32 bits.

The leader pulse code consists of 8 T_{sc} High and 8 T_{sc} Low signal. This enables effective usage of time relations between reception detection and other processings when the receiver is micro-computerized.

The succeeding codes are PPM (pulse position modulation) which depends on the time between pulses.

Each code consists of 2 custom code, data code and complementary data code are simultaneously transmitted. This transmission is low failure rate operation.



When the same key remains, the second transmission only transmits leader code and complementary the first custom code $\overline{C0}$ for saving of the infrared LED power drain.

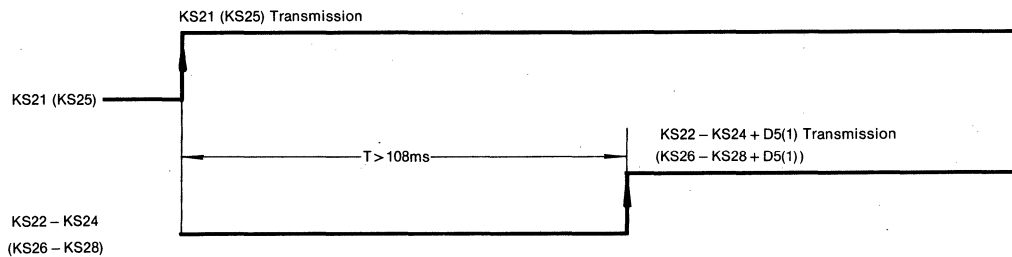
In this case the leader code transmission duty is predominant and the average power drain of the LED is about 1.8% of peak. In case of 455KHz oscillation the signal is modulated by 1/12 duty 37.9KHz.

5. Double Key Operation

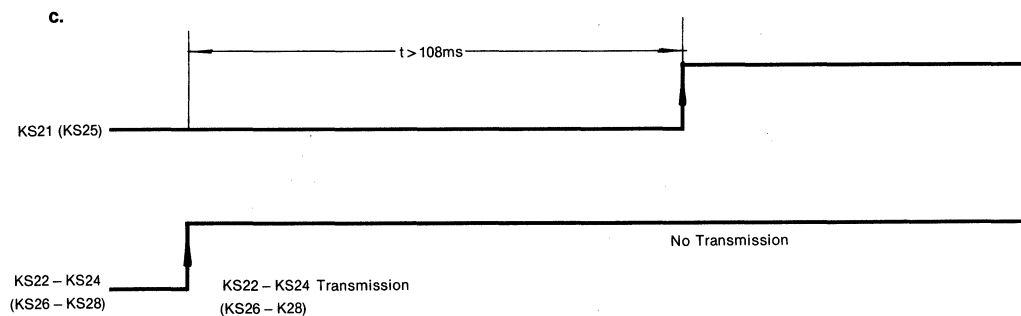
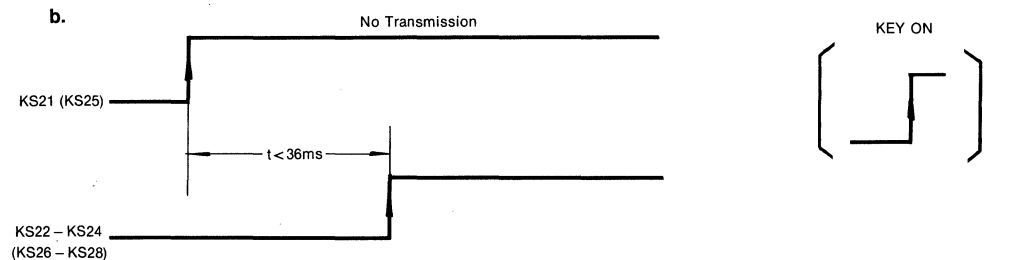
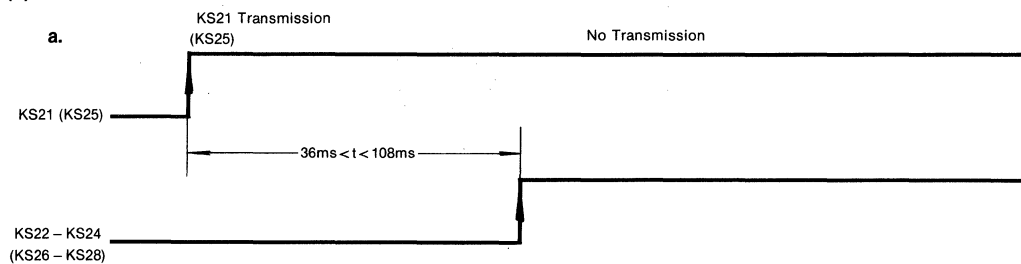
Double key input activates the multiple input inhibiting circuit except KS21 to KS28. When a pair key inputs, KS21 + KS22, KS21 + KS23, KS21 + KS24, KS25 + KS26, KS25 + KS27, KS25 + KS28, give "1" to D5 and operate double key transmission. But this function is assured only when one of the KS22 to KS24 (KS26 to KS28) is pressed 108 ms (when one of three MSB bits of custom code is "1"; 126ms) at the minimum after KS21 (KS25).

The inhibiting function circuit assures the prevention of malfunction except this condition.

(1) OPERATION



(2) NO OPERATION



KEY DATA CODE

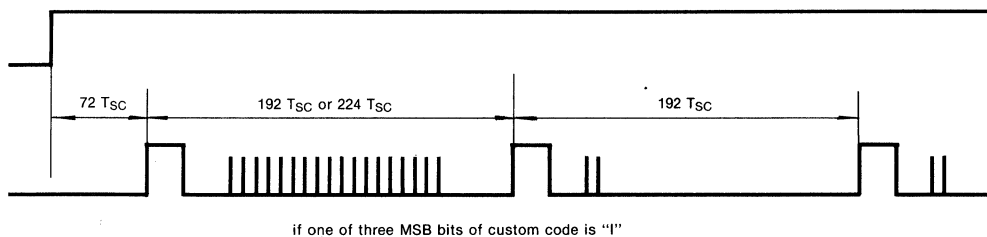
Key	Connection					Key Data Code								Notes
	K0	K1	K2	K3	S	D0	D1	D2	D3	D4	D5	D6	D7	
KS1	*				S0	0	0	0	0	0	0	0	0	
KS2		*				1	0	0	0	0	0	0	0	
KS3			*			0	1	0	0	0	0	0	0	
KS4				*		1	1	0	0	0	0	0	0	
KS5	*				S1	0	0	1	0	0	0	0	0	
KS6		*				1	0	1	0	0	0	0	0	
KS7			*			0	1	1	0	0	0	0	0	
KS8				*		1	1	1	0	0	0	0	0	
KS9	*				S2	0	0	0	1	0	0	0	0	
KS10		*				1	0	0	1	0	0	0	0	
KS11			*			0	1	0	1	0	0	0	0	
KS12				*		1	1	0	1	0	0	0	0	
KS13	*				S3	0	0	1	1	0	0	0	0	
KS14		*				1	0	1	1	0	0	0	0	
KS15			*			0	1	1	1	0	0	0	0	
KS16				*		1	1	1	1	0	0	0	0	
KS17	*				S4	0	0	0	0	1	0	0	0	
KS18		*				1	0	0	0	1	0	0	0	
KS19			*			0	1	0	0	1	0	0	0	
KS20				*		1	1	0	0	1	0	0	0	
KS21	*				S5	0	0	1	0	1	0	0	0	
KS22		*				1	0	1	0	1	0	0	0	
KS23			*			0	1	1	0	1	0	0	0	
KS24				*		1	1	1	0	1	0	0	0	
KS25	*				S6	0	0	0	1	1	0	0	0	
KS26		*				1	0	0	1	1	0	0	0	
KS27			*			0	1	0	1	1	0	0	0	
KS28				*		1	1	0	1	1	0	0	0	
KS29	*				S7	0	0	1	1	1	0	0	0	
KS30		*				1	0	1	1	1	0	0	0	
KS31			*			0	1	1	1	1	0	0	0	
KS32				*		1	1	1	1	1	0	0	0	

DOUBLE KEY OPERATION CODE

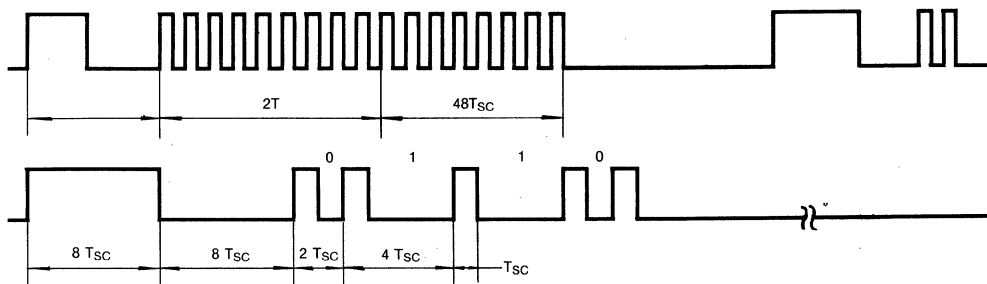
Key		D0	D1	D2	D3	D4	D5	D6	D7
KS21	KS22	1	0	1	0	1	1	0	0
	KS23	0	1	1	0	1	1	0	0
	KS24	1	1	1	0	1	1	0	0
KS25	KS26	1	0	0	1	1	1	0	0
	KS27	0	1	0	1	1	1	0	0
	KS28	1	1	0	1	1	1	0	0

REMOTE OUTPUT WAVEFORMS

KEY ON



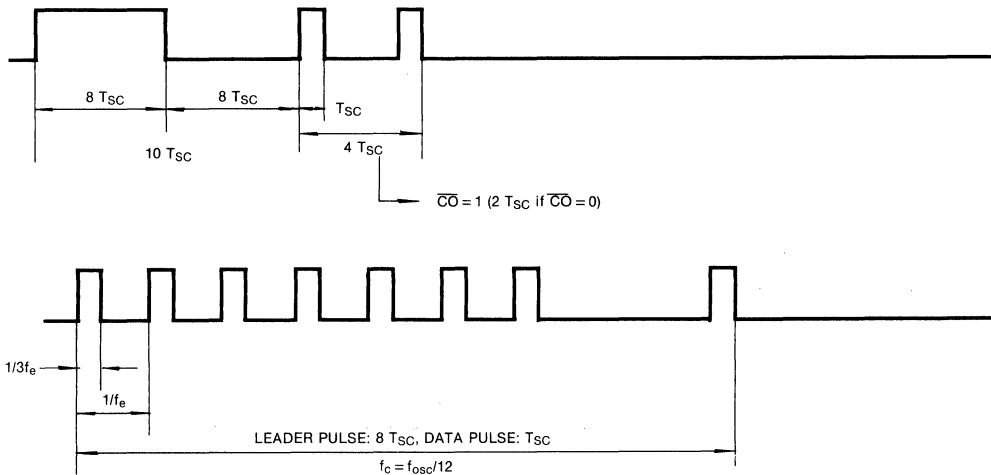
DATA TRANSMISSION WAVEFORMS



T_{sc} : $256/f_{osc}$; system clock

T: output time of custom code $224 T_{sc}$ if $T > 26 T_{sc}$

CONTINUOUS TRANSMISSION WAVEFORMS



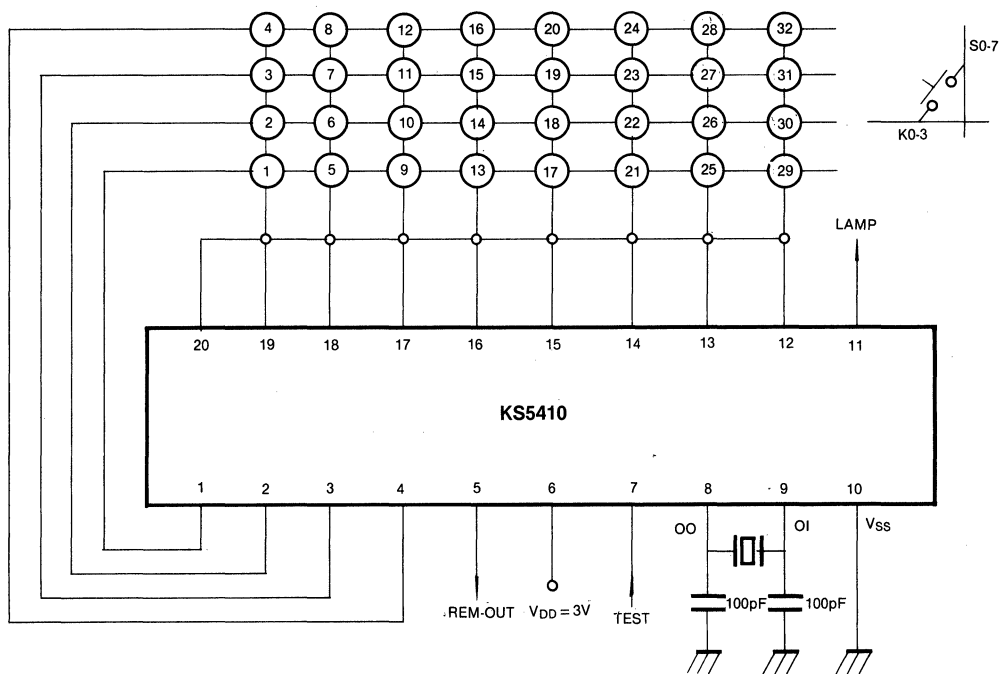
In 455KHz oscillation the signal is modulated by 1/3 duty 37.9KHz.

(Note)

When the receiver is designed, rule in the following.

- Determine the key data code and the complementary key data code is decoded by receiver.
- Determine the custom code and the repeated custom code is decoded by receiver.

APPLICATION NOTE



REMOTE CONTROL TRANSMITTER

The KS5803 is a CMOS LSI for infrared remote control transmitter function which is available for C/TV, VTR and TOY etc.

Originally the KS5803 is designed to have 20 pin but practically is divided two types.

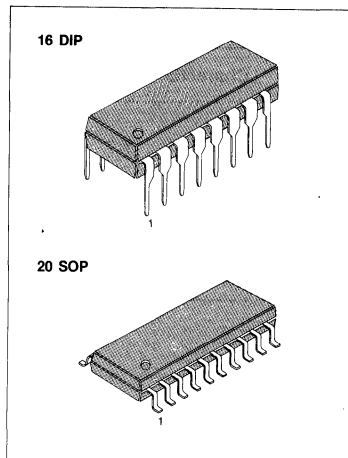
One type (KS5803A) has 16 pins to transmit 736 commands. The other (KS5803B) has 20 pins to transmit 8960 commands.

These commands is made to a P.P.M system of 16 bit code, which transmit the code twice (invert in the second time) to prevent operation false code.

The KS5803 is designed to be received with 4 bit CPU (DTS).

FEATURES

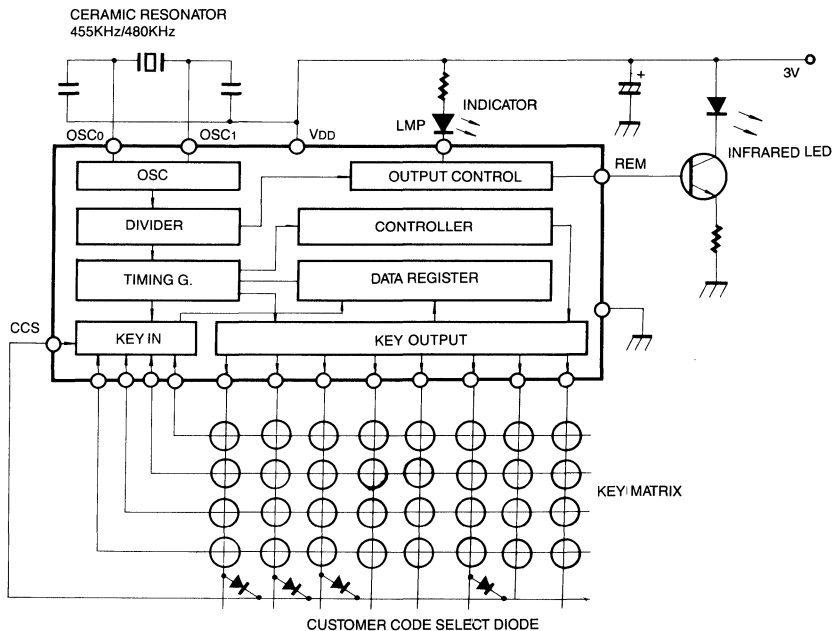
- Low voltage operation: $V_{DD} = 2.0$ to $3.3V$
- Low power consumption (CMOS): $I_{DD} < 1\mu A$ at standby mode
- 32 function KEY and 3 dual action KEY (KS5803A is 20 function KEY)
- 256 custom codes selected by external diode (KS5803A is 32 custom codes)
- 16 bit pulse position modulated code
- High efficiency transmission: IR LED ON Duty 3%
- Indicator output
- Package KS5803A: 16 PIN DIP
- Package KS5803B: 20 PIN SOP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA5803A	16 DIP	- 20 ~ + 70°C
KS5803B	20 SOP	

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	4.0	V
Input Voltage	V_{IN}	$-3.0 \sim V_{DD}$	V
Output Current	I_{OH} (REM, LMP)	- 15.0	mA
Power Dissipation	P_D	250	mW
Operating Temperature	T_{opt}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-65 \sim +75$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS

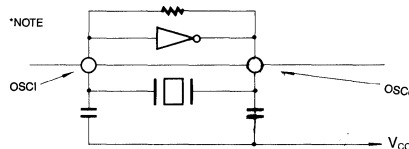
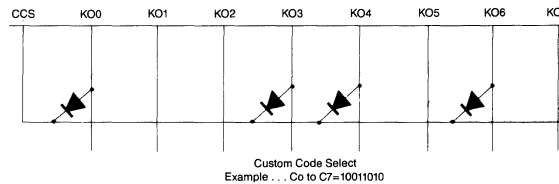
Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	2.0	3.0	3.3	V
Oscillation Frequency	f_{osc}	400	455	500	kHz
Lamp Output Current	I_{OL} (LMP)		1		mA

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{DD} = 3.0\text{V}$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Current	I_{DD} (DP)	$f_{osc} = 455\text{KHz}$		0.1	1.0	mA
Supply Current	I_{DD} (ST)	$f_{osc} = \text{STOP}$			1	μA
Input High Voltage	V_{IH} (KI)		$0.7 V_{CC}$		V_{CC}	V
Input Low Voltage	V_{IL} (KI)		0		$0.3 V_{CC}$	V
Input Pull Down Resistor	R (KI)		150	300	600	$\text{K}\Omega$
Output Current	I_{OH} (REM)	V_{OH} (REM) = 1.5V	- 5			mA
Output Low Voltage	V_{OL} (LMP)	$I_{OL} = 1.0\text{mA}$			0.3	V

PIN FUNCTION

PIN (KS5803B)	PIN (KS5803A)	FUNCTION	
1	1	KI0	Key Input 0
2	2	KI1	Key Input 1
3	3	KI2	Key Input 2
4	4	KI3	Key Input 3
5	5	REM	Remote Output
6	6	V _{DD}	Positive Supply . . . 2.0 to 3.3V
7	—	TEST	TEST Terminal . . . Normally Open
8	7	*OSC0	Oscillator Output
9	8	*OSC1	Oscillator Input
		(*NOTE)	
10	9	V _{SS}	Ground
11	10	LMP	Lamp Output . . . Indicator for Transmission
12	—	Ko7	Key Output 7
13	11	Ko6	Key Output 6
14	12	Ko5	Key Output 5
15	13	Ko4	Key Output 4
16	—	Ko3	Key Output 3
17	14	Ko2	Key Output 2
18	—	Ko1	Key Output 1
19	15	Ko0	Key Output 0
20	16	CCS	Custom Code Select input
		Custom Code is selected by diode	
		Connection to Key Output Ko0 to Ko7	
		This terminal is usually pull up to	
		V _{CC} by internal Resistor.	



OPERATION OF DUAL ACTION KEY

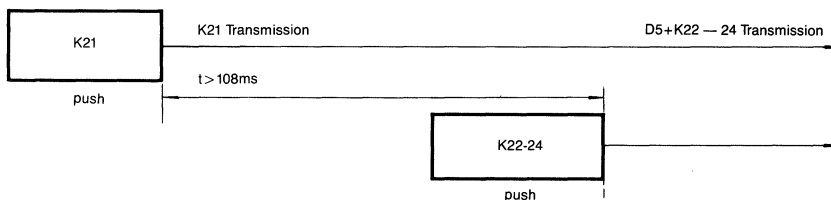
Keys (K21 to K24) are used for preventing failure caused by mistakes.

Example: Cassette Tape Recorder K21 . . . REC KEY

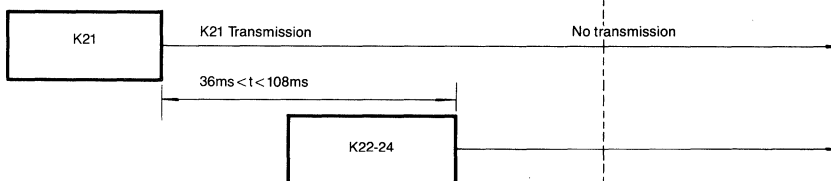
K22 . . . PLAY KEY

KEY	D0	D1	D2	D3	D4	D5	D6	D7
K21 + K22	1	0	1	0	1	1	0	0
K21 + K23	0	1	1	0	1	1	0	0
K21 + K24	1	1	1	0	1	1	0	0

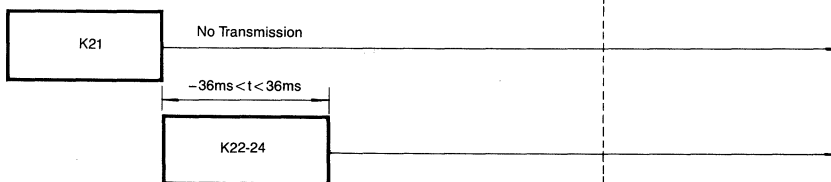
(a) Operation



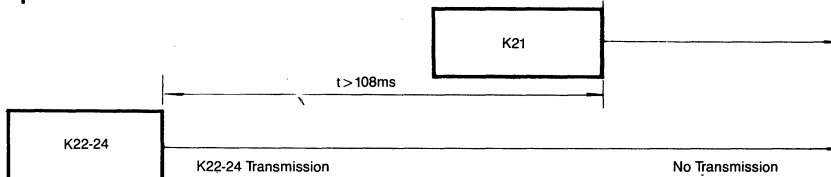
(b) No operation



(c) No operation



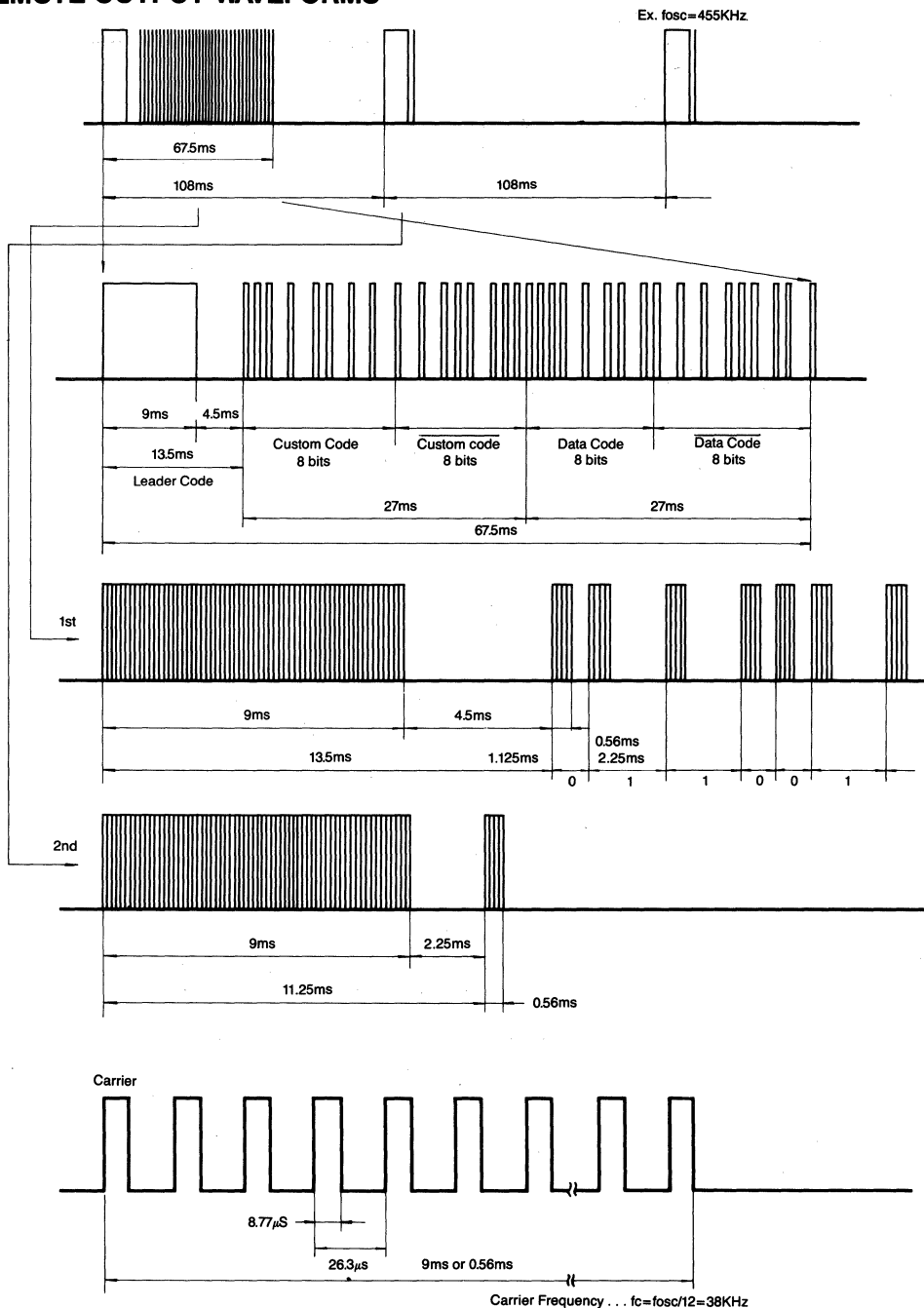
(d) No operation



KEY DATA CODE

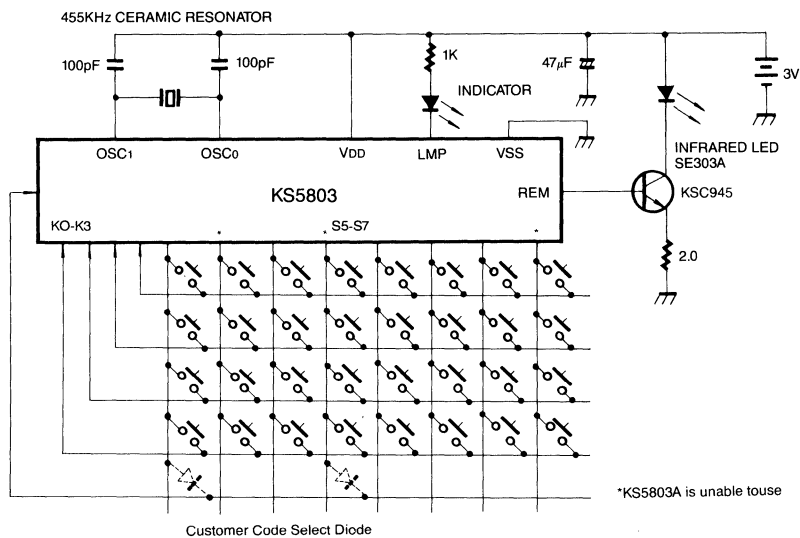
Key	Connection					Data Code								Notes
	KI ₀	KI ₁	KI ₂	KI ₃	K ₀	D0	D1	D2	D3	D4	D5	D6	D7	
K 1	*				K ₀₀	0	0	0	0	0	0	0	0	KS5803A is unable to use
K 2		*				1	0	0	0	0	0	0	0	
K 3			*			0	1	0	0	0	0	0	0	
K 4				*		1	1	0	0	0	0	0	0	
K 5	*				K ₀₁	0	0	1	0	0	0	0	0	KS5803A is unable to use
K 6		*				1	0	1	0	0	0	0	0	
K 7			*			0	1	1	0	0	0	0	0	
K 8				*		1	1	1	0	0	0	0	0	
K 9	*				K ₀₂	0	0	0	1	0	0	0	0	KS5803A is unable to use
K10		*				1	0	0	1	0	0	0	0	
K11			*			0	1	0	1	0	0	0	0	
K12				*		1	1	0	1	0	0	0	0	
K13	*				K ₀₃	0	0	1	1	0	0	0	0	KS5803A is unable to use
K14		*				1	0	1	1	0	0	0	0	
K15			*			0	1	1	1	0	0	0	0	
K16				*		1	1	1	1	0	0	0	0	
K17	*				K ₀₄	0	0	0	0	1	0	0	0	KS5803A is unable to use
K18		*				1	0	0	0	1	0	0	0	
K19			*			0	1	0	0	1	0	0	0	
K20				*		1	1	0	0	1	0	0	0	
K21	*				K ₀₅	0	0	1	0	1	0	0	0	KS5803A is unable to use
K22		*				1	0	1	0	1	0	0	0	
K23			*			0	1	1	0	1	0	0	0	
K24				*		1	1	1	0	1	0	0	0	
K25	*				K ₀₂	0	0	0	1	1	0	0	0	KS5803A is unable to use
K26		*				1	0	0	1	1	0	0	0	
K27			*			0	1	0	1	1	0	0	0	
K28				*		1	1	0	1	1	0	0	0	
K29	*				K ₀₇	0	0	1	1	1	0	0	0	KS5803A is unable to use
K30		*				1	0	1	1	1	0	0	0	
K31			*			0	1	1	1	1	0	0	0	
K32				*		1	1	1	1	1	0	0	0	

REMOTE OUTPUT WAVEFORMS

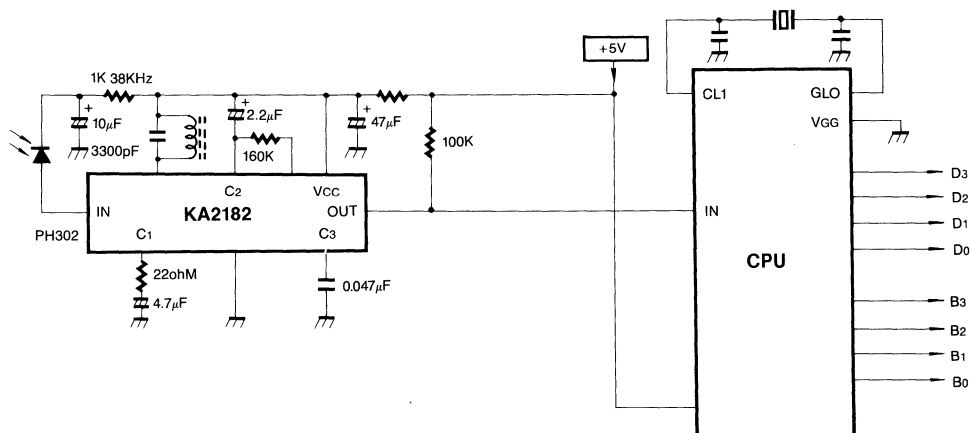


TYPICAL APPLICATION CIRCUIT

Transmitter



Receiver



NOTES

TOY RADIO CONTROL ACTUATORS 5

TOY Application

Device	Function	Package	Page
KA2303	Toy Radio Control Actuator	9 SIP	809
KA2304	Toy Radio Control Actuator	9 SIP	812
KA2305A	Toy Radio Control Actuator (Rx)	12 SIP-SH	814
KA2306A	Toy Radio Control Actuator (Rx)	14 DIP	818
KA2309	Toy Radio Control Actuator (Rx)	16 DIP	822
KA2310	Toy Radio Control Actuator (Tx)	9 SIP	829
KA2311	Toy Radio Control Actuator (Rx)	16 DIP	832
KA2312	Toy Radio Control Actuator (Tx)	9 SIP	837
KA2303	Application Note		840
KA2309	Application Note		847
KA2311	Application Note		857
KA2312	Application Note		868

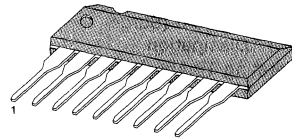
TOY RADIO CONTROL ACTUATOR

The KA2303 is a monolithic integrated circuit having 3 functions (Forward, stop, Backward) designed for radio controlled toy car and other equipment.

FEATURES

- Includes Amplifier, Detector, Comparator, Latch, Voltage Regulator, Actuator.
- Wide operating supply voltage range (2.5V ~ 10V)
- Very low quiescent circuit current (Stop: $I_{CC} = 5\text{mA}$)
- Capable of driving small DC motors in both directions.
- Minimum number of external parts required.

9 SIP



BLOCK DIAGRAM

ORDERING INFORMATION

Device	Package	Operating Temperature
KA2303	9 SIP	- 20 ~ + 70°C

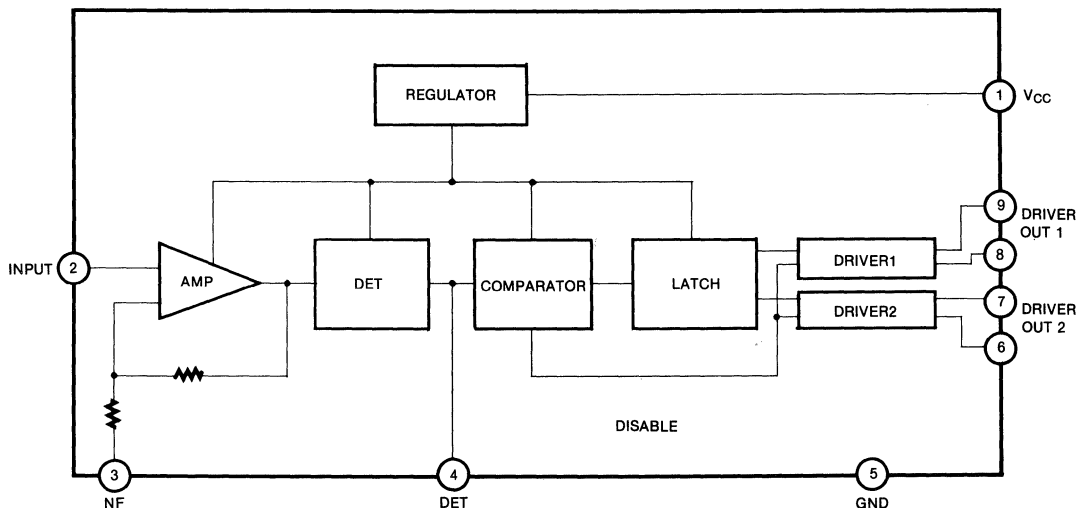


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	11	V
Output Current (Continuous)	I_o (cont)	0.7	A
Output Current (Surge)	I_o (surge)	1.2	A
Power Dissipation	P_d	500	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Circuit Current	I_{CC1}	Without Load, $V_i = 0$		40	50	mA
	I_{CC2}	Stop, $V_i = 10\text{mV}$		5		mA
Input Impedance	R_i			10		$\text{K}\Omega$
Output Saturation Voltage	V_{SAT}	$I_o = 400\text{mA}$, Pin 7, Pin 8		0.25	0.45	V
Output Sink Current	I_{SINK}	$V_i = 0$, Pin 6, Pin 9		10		mA
Sensitivity	V_i (sen)	$f = 1\text{KHz}$	3.5	6	9	mV
Comparator Hysteresis	HY		4	8	14	dB

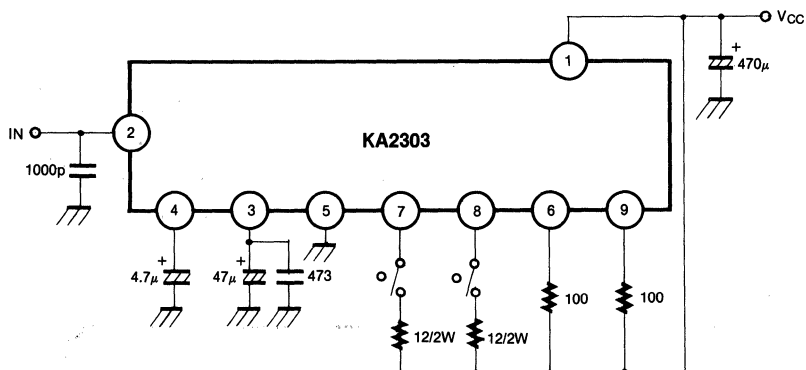
TEST CIRCUIT

Fig. 2

TYPICAL APPLICATION CIRCUIT

1. Low Voltage Application Circuit

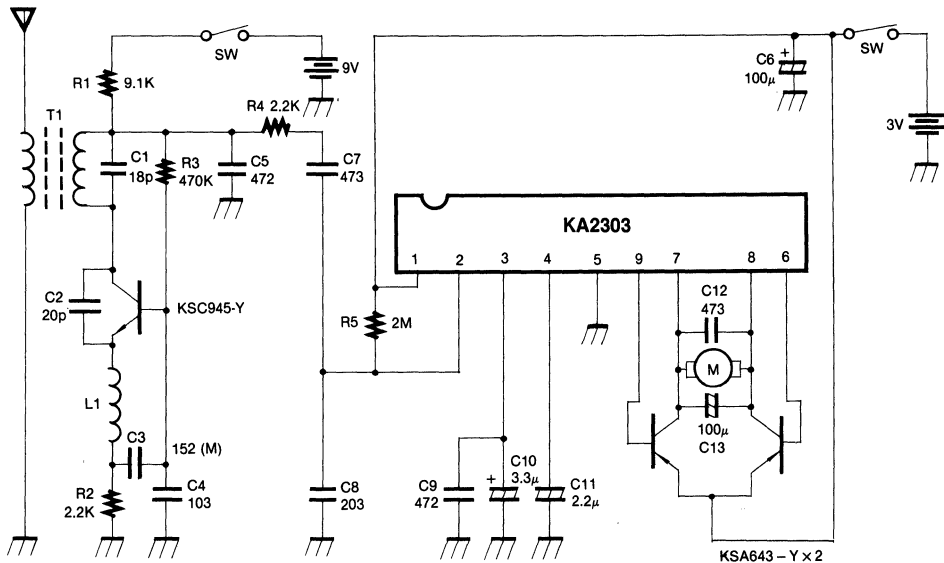


Fig. 3

2. High Voltage Application Circuit

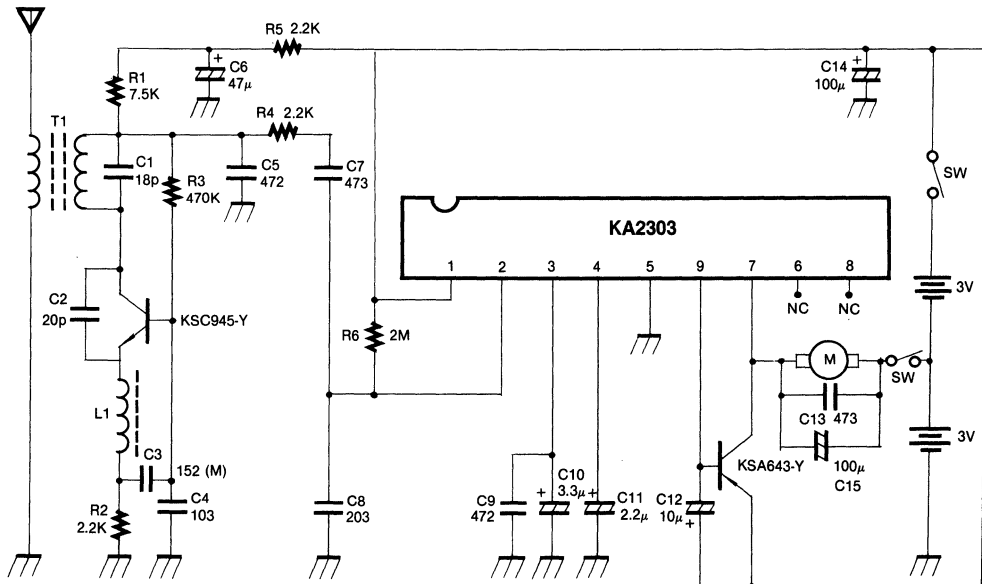


Fig. 4

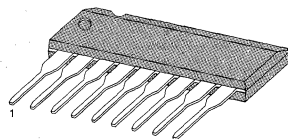
TOY RADIO CONTROL ACTUATOR

The KA2304 is a monolithic integrated circuit designed for remote controlled 2 function (Forward, Backward) actuators. It is suitable for radio controlled toy car and other equipment.

FEATURES

- Include
Amplifier, Detector, Comparator, Latch, Voltage Regulator, Actuator
- Wide operating supply voltage range ($V_{CC}=2.5V \sim 10V$)
- Minimum number of external parts required.

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2304	9 SIP	$-20 \sim +70^{\circ}\text{C}$

BLOCK DIAGRAM

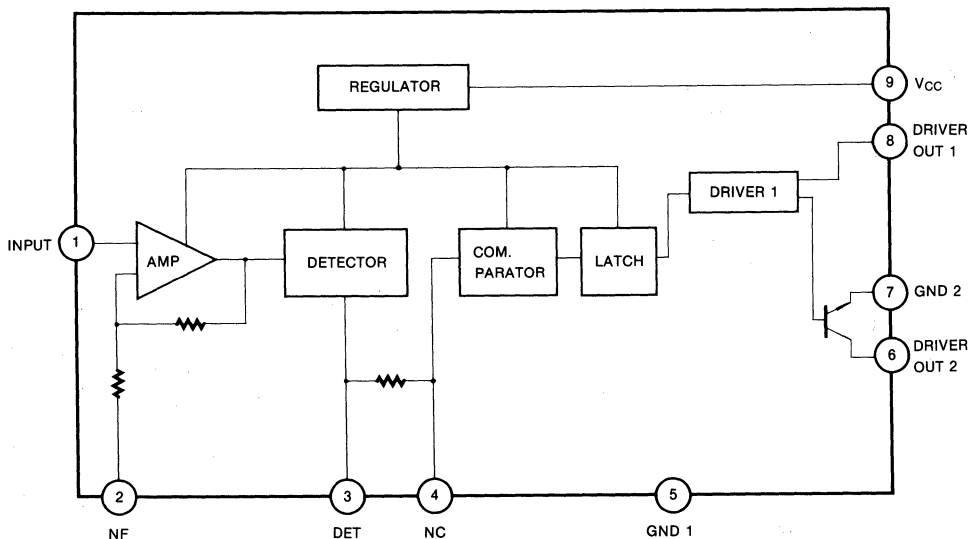


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V _{CC}	11	V
Power Dissipation	P _d	500	mW
Operating Temperature	T _{opr}	- 20 ~ + 70	°C
Storage Temperature	T _{stg}	- 40 ~ + 150	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 5V)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Voltage	V _{CC}		2.5	5	10	V
Circuit Current	I _{CC}	V _{CC} = 5V	10	20	40	mA
Input Impedance	Z _i	V _{CC} = 5V		10		KΩ
Output Sink Current	I _{SINK}	Pin 8 is actuated	6	15	20	mA
Output Saturation Voltage	V _{SAT}	Pin 6 is actuated		0.25	0.45	V
Sensitivity	V _i (sen)	Output is actuated	2	4	6	mV
Comparator Hysteresis	HY		5	8	11	dB

TYPICAL APPLICATION CIRCUIT

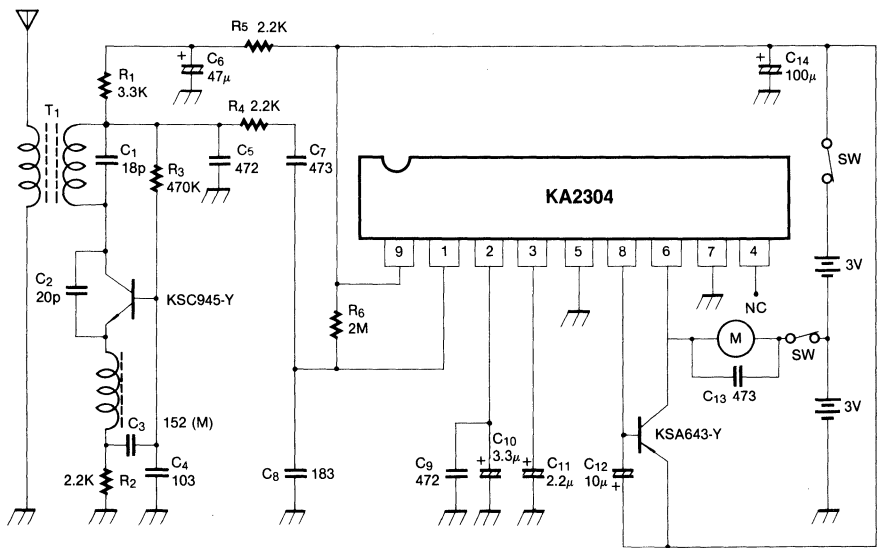


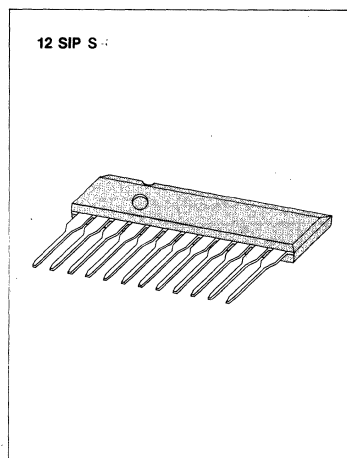
Fig. 2

TOY RADIO CONTROL ACTUATOR (RX)

The KA2305A is a monolithic integrated circuit having 3 Function designed for receiving radio controlled toy car and other equipments.

FEATURES

- Includes regulator for super regeneration circuit.
- Simple 3 function on nonsequential mode : forward, backward, stop
- Wide operating supply voltage range:
 $V_{CC} = 3V \sim 18V$
- Low quiescent circuit current ($I_{CC} = 10.5mA$: Typ)
- Low operating supply voltage ($V_{CC} = 3V$)
- Minimum number of external parts required



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2305A	12 SIP-SH	- 20 ~ + 75°C

BLOCK DIAGRAM

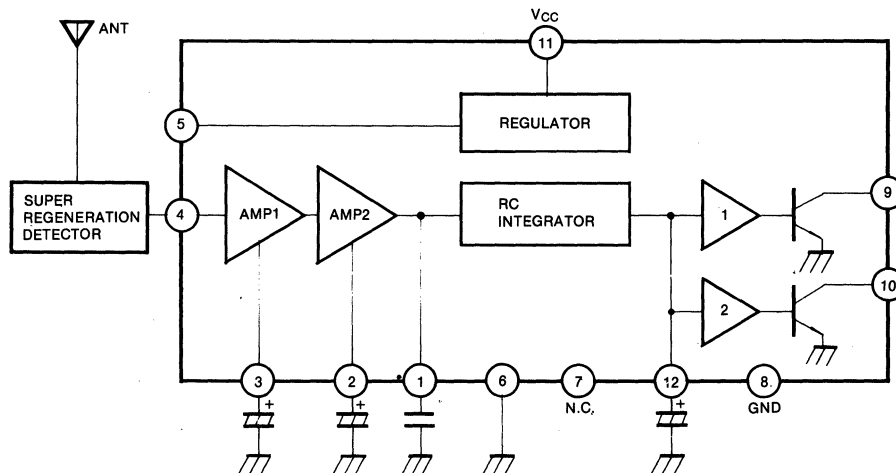


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Drive Voltage	V_d	20	V
Drive Current	I_d	40	mA
Regulator Output Current	I_{reg}	15	mA
Power Dissipation	P_d	625	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Circuit Current	I_{CC}	$V_{CC} = 6\text{V}$, $V_i = 0$		10.5	13.5	mA
Saturation Voltage	$V_g(\text{sat})$	$D_t = 25\%$, $I_g = 30\text{mA}$		0.9	1.2	V
	$V_{10}(\text{sat})$	$D_t = 75\%$, $I_{10} = 30\text{mA}$				
Regulator Output Voltage	V_{reg}	$V_{CC} = 6\text{V}$	2.3	2.5	2.7	V
Low Operating Voltage	V_{CCL}	$V_{reg} = 2.3\text{V}$			3	V
High Operating Voltage	V_{CCH}	$V_{reg} = 2.3\text{V}(\text{min}) \sim 2.7\text{V}(\text{max})$	20			V
Sensitivity ($V_i = \text{square wave}$)	$V_g(\text{sen})$	$D_t = 25\%$		2	4	mV _{p-p}
	$V_{10}(\text{sen})$	$D_t = 75\%$				
Voltage Gain	A_v	$V_i = 0.8\text{mV}_{\text{rms}}$, $f = 1\text{KHz}$	55	58	61	dB

TEST CIRCUIT

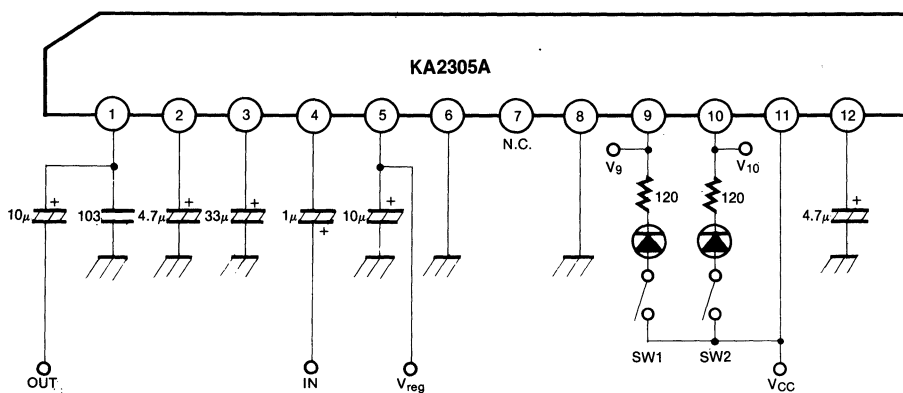


Fig. 2

TRANSMITTER APPLICATION CIRCUIT FOR KA2305A

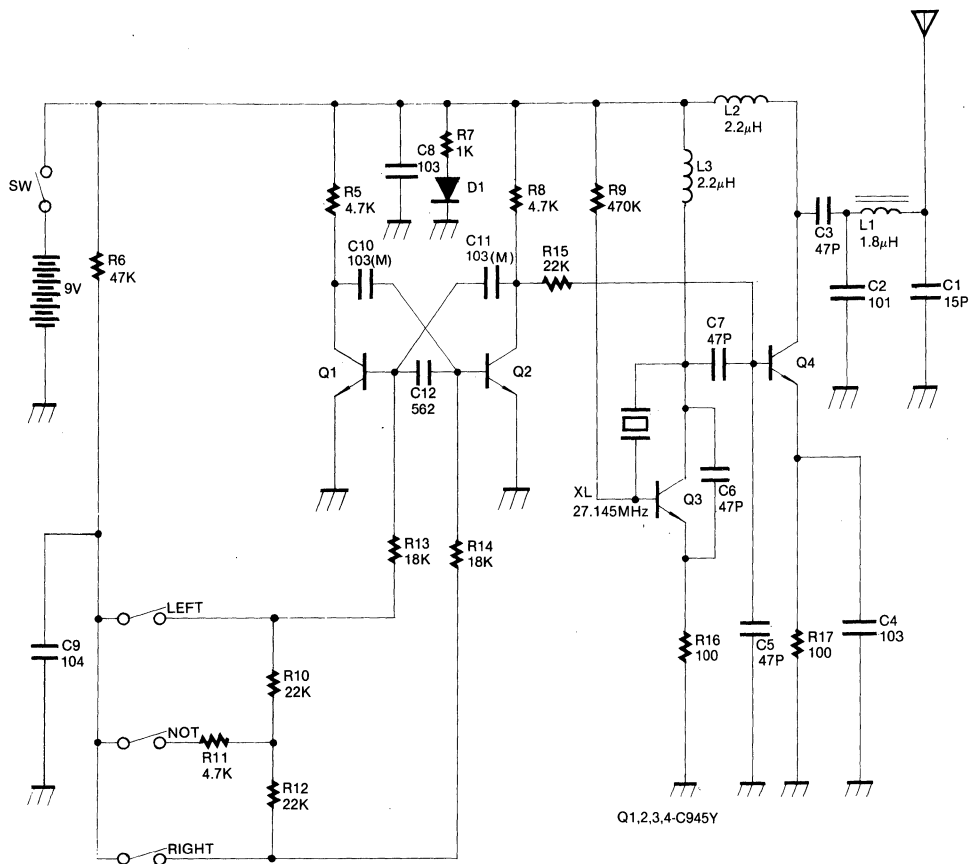


Fig. 4

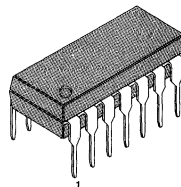
TOY RADIO CONTROL ACTUATOR (RX)

The KA2306A is a monolithic integrated circuit having 3 Function designed for receiving radio controlled toy car and other equipments.

FEATURES

- Includes regulator for super regeneration circuit.
- Simple 3 function : forward, backward, stop
- Wide operating supply voltage range:
 $V_{CC} = 3V \sim 18V$
- Low quiescent circuit current ($I_{CC} = 10.5mA$: Typ)
- Low operating supply voltage ($V_{CC} = 3V$)
- Minimum number of external parts required
- Internal TURBO circuit

14 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2306A	14 DIP	$-20 \sim +75^{\circ}C$

BLOCK DIAGRAM

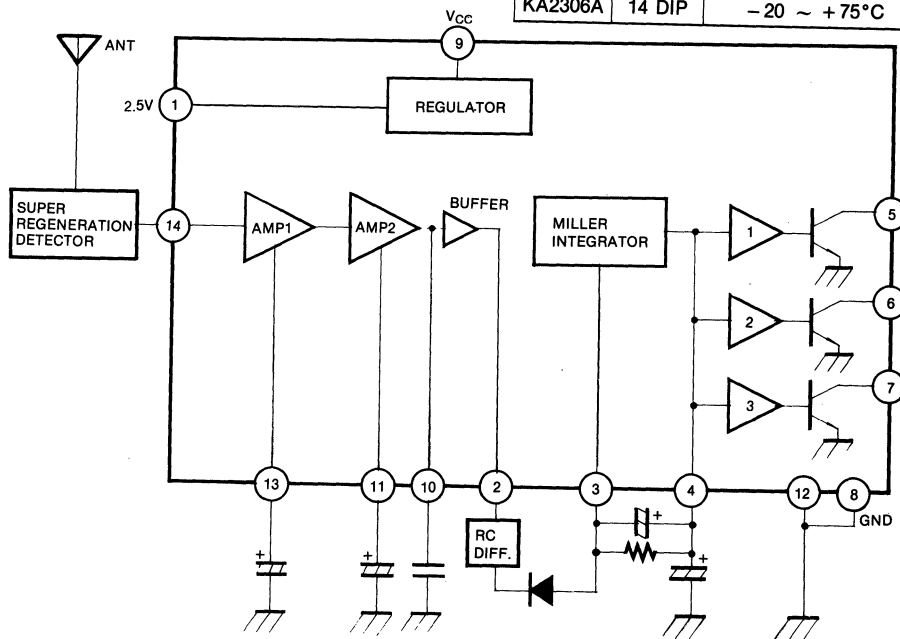


Fig. 1

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Drive Voltage	V_d	20	V
Drive Current	I_d	40	mA
Regulator Output Current	I_{reg}	15	mA
Power Dissipation	P_d	625	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Circuit Current	I_{CC}	$V_{CC} = 6\text{V}$, $V_i = 0$		10.5	13.5	mA
Saturation Voltage	$V_5(\text{sat})$	$V_4 = 0.8\text{V}$, $I_5 = 30\text{mA}$		0.9	1.2	V
	$V_6(\text{sat})$	$V_4 = 2.0\text{V}$, $I_6 = 30\text{mA}$				
	$V_7(\text{sat})$	$V_4 = 1.5\text{V}$, $I_7 = 30\text{mA}$				
Regulator Output Voltage	V_{reg}	$V_{CC} = 6\text{V}$	2.3	2.5	2.7	V
Low Operating Voltage	V_{CCL}	$V_{reg} = 2.3\text{V}$			3	V
High Operating Voltage	V_{CCH}	$V_{reg} = 2.3\text{V}(\text{min}) \sim 2.7\text{V}(\text{max})$	20			V
Sensitivity ($V_i = \text{square wave}$)	$V_5(\text{sen})$	$V_{CC} = 6\text{V}$, $f = 300\text{Hz}$		2	4	mV _{p-p}
	$V_6(\text{sen})$	$V_{CC} = 6\text{V}$, $f = 900\text{Hz}$				
	$V_7(\text{sen})$	$V_{CC} = 6\text{V}$, $f = 600\text{Hz}$				
Voltage Gain	A_v	$V_i = 0.8\text{mV}_{\text{rms}}$, $f = 1\text{KHz}$	55	58	61	dB

TEST CIRCUIT

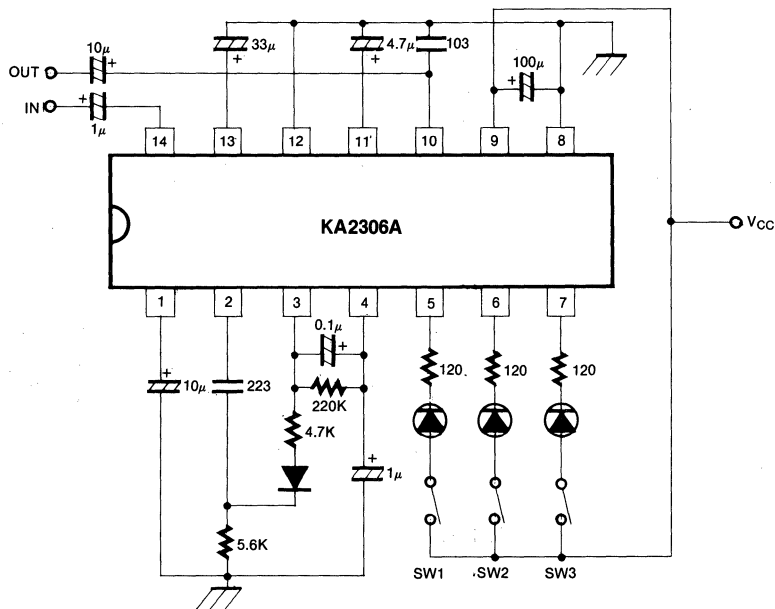
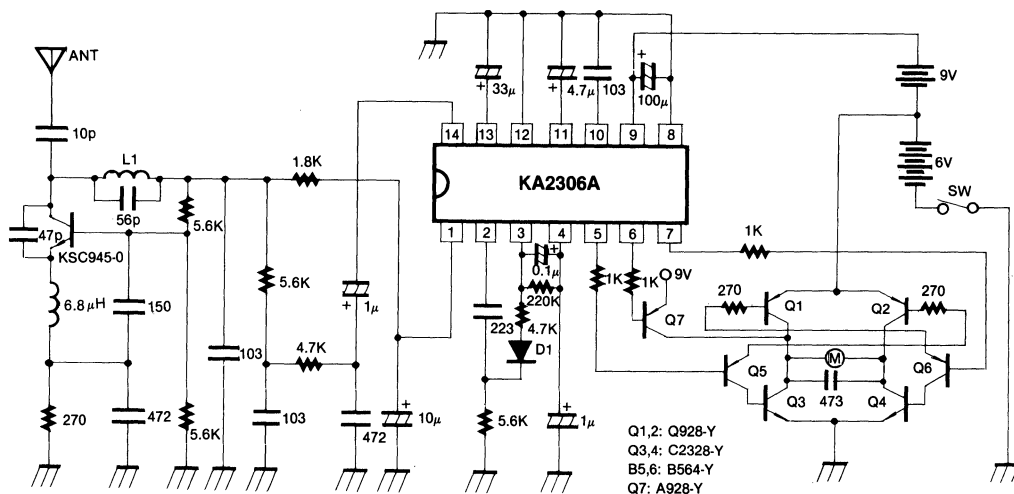


Fig. 2

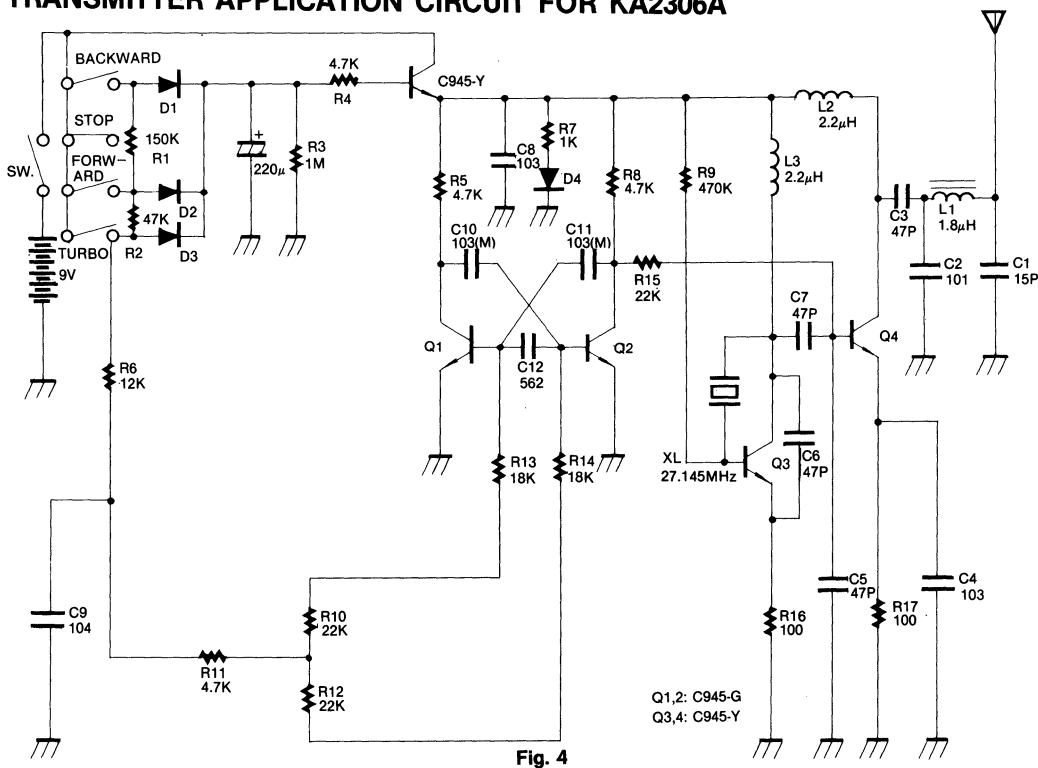
PIN DESCRIPTION

Pin No.	Symbol	Function
1	V_{reg}	Output of REGULATOR ($V_{reg} = 2.5V$)
2	BU	Output of BUFFER
3	INT-I	Input of Miller Integrator
4	INT-O	Output of Miller Integrator
5	OUTPUT1	Output of BACKWARD
6	OUTPUT2	Output of TURBO
7	OUTPUT3	Output of FORWARD
8	GND	GND
9	V_{cc}	V_{cc}
10	AMP-O	Output of the 2'nd AMP.
11	BY-2	BY-PASS of the 2'nd AMP.
12	GND	GND
13	BY-1	BY-PASS of the 1'st AMP.
14	INPUT	Signal INPUT

APPLICATION CIRCUIT



TRANSMITTER APPLICATION CIRCUIT FOR KA2306A



TOY RADIO CONTROL ACTUATOR (RX)

The KA2309 is monolithic integrated circuit having 7 Function designed for receiving radio controlled toy car and other equipments.

In order to obtain a suitable radio control system of toy, KA2309 (Receiver IC) should be used in combination with a KA2310 (Transmitter IC).

FEATURES

- Includes regulator, Amp. RC integrator, miller integrator
- Wide operating supply voltage range:
 $V_{CC} = 3V \sim 18V$
- Low quiescent circuit current ($I_{CC} = 10.5mA$: Typ)
- Low operating supply voltage ($V_{CC} = 3V$)
- Minimum number of external parts required
(Includes TURBO circuit)

BLOCK DIAGRAM

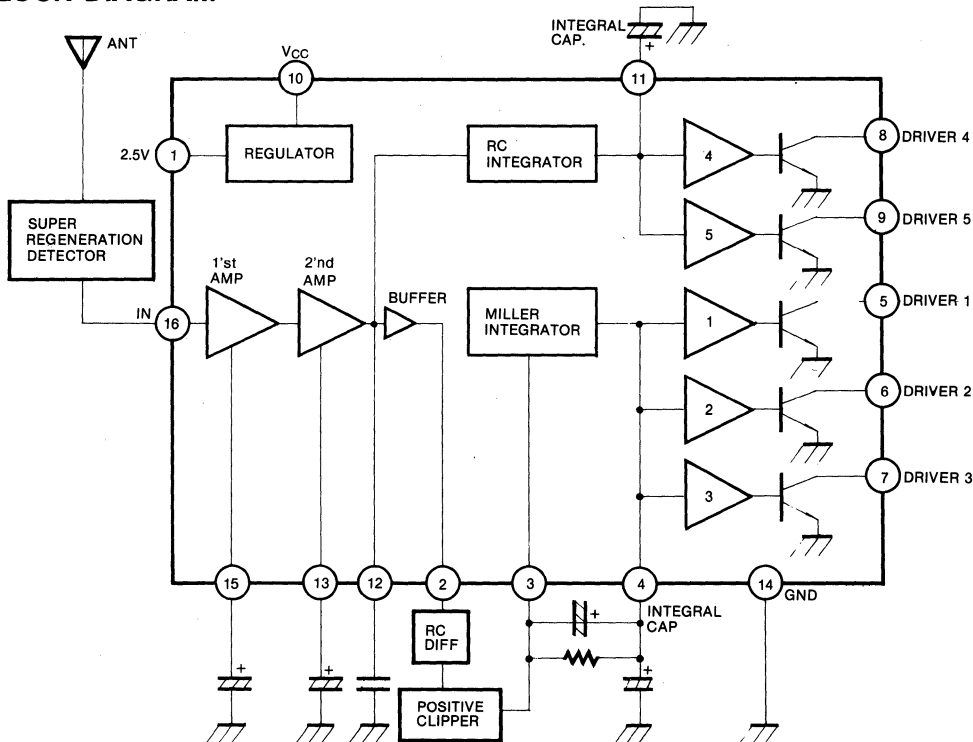
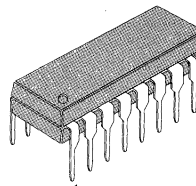


Fig. 1

16 DIP



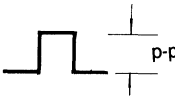
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2309	16 DIP	-20 ~ +75°C

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	20	V
Drive Voltage	V_d	20	V
Drive Current	I_d	40	mA
Regulator Output Current	I_{reg}	15	mA
Power Dissipation	P_d	625	mW
Operating Temperature	T_{opr}	$-20 \sim +75$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Circuit Current	I_{CC}	$V_{CC} = 6\text{V}$, $V_i = 0$		10.5	13.5	mA
Saturation Voltage ($V_i = 10\text{mV}_{p-p}$, $I_s = 30\text{mA}$) 	$V_5(\text{sat})$	$f = 300\text{Hz}$, $D_t = 50\%$		0.9	1.2	V
	$V_6(\text{sat})$	$f = 900\text{Hz}$, $D_t = 50\%$				
	$V_7(\text{sat})$	$f = 600\text{Hz}$, $D_t = 50\%$				
	$V_8(\text{sat})$	$f = 300\text{Hz}$, $D_t = 25\%$				
	$V_9(\text{sat})$	$f = 900\text{Hz}$, $D_t = 75\%$				
Regulator Output Voltage	V_{reg}	$V_{CC} = 6\text{V}$	2.3	2.5	2.7	V
Low Voltage Operating	V_{CCL}	$V_{reg} = 2.3\text{V}$			3	V
High Voltage Operating	V_{CCH}	$V_{reg} = 2.3\text{V}(\text{min}) \sim 2.7\text{V}(\text{max})$	20			V
Sensitivity ($V_i = \text{square wave}$)	$V_5(\text{sen})$	$V_{CC} = 6\text{V}$, $f = 300\text{Hz}$		2	4	mV_{p-p}
	$V_6(\text{sen})$	$V_{CC} = 6\text{V}$, $f = 900\text{Hz}$				
	$V_7(\text{sen})$	$V_{CC} = 6\text{V}$, $f = 600\text{Hz}$				
Voltage Gain	A_v	$V_i = 0.8\text{mV}_{rms}$, $f = 1\text{KHz}$	55	58	61	dB

TEST CIRCUIT

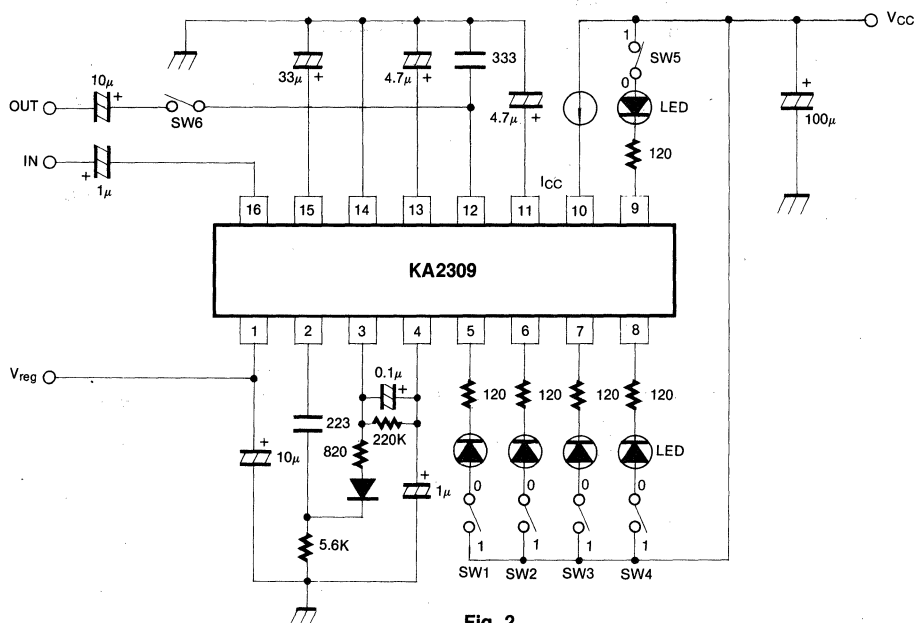


Fig. 2

PIN DESCRIPTION

Pin No.	Symbol	Function
1	V_{reg}	Regulator Output ($V_{reg} = 2.5V$)
2	BU	Buffer Output
3	INT-I	Miller Integrator Input
4	INT-O	Miller Integrator Output
5	D1	Backward Output ($I_{sink} = 30mA$)
6	D2	Turbo Output ($I_{sink} = 30mA$)
7	D3	Forward Output ($I_{sink} = 30mA$)
8	D4	Left Turn Output, DUTY 25% ($I_{sink} = 30mA$)
9	D5	Right Turn Output, DUTY 75% ($I_{sink} = 30mA$)
10	V_{CC}	V_{CC}
11	INT-O	Integrator Output
12	OUT2	The 2'nd AMP Output
13	BY2	The 2'nd AMP By-Pass
14	GND	GND
15	BY1	The 1'st AMP By-Pass
16	IN	Super Regenerator Signal Input

APPLICATION CIRCUIT

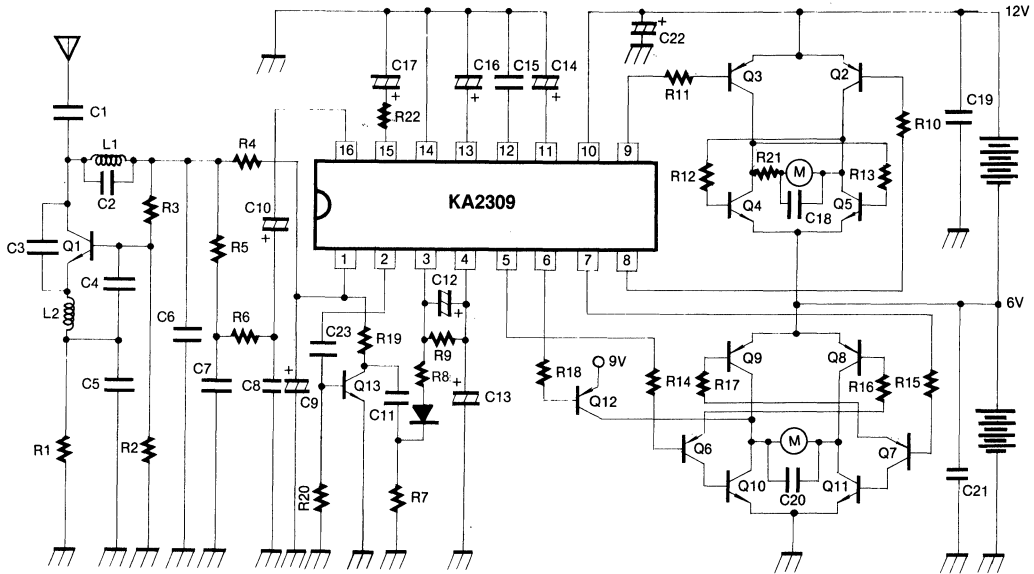


Fig. 3

PARTS LIST & VALUE

Resistors (Unit: Ω)	Capacitors	Transistors	Coil
R1 = 390 R2 = 4.7K R3 = 5.6K R4 = 1.8K R5 = 5.6K R6 = 4.7K R7 = 5.6K R8 = 3.3K R9 = 150K R10 = 1K R11 = 1K R12 = 270 R13 = 270 R14 = 1K R15 = 1K R16 = 270 R17 = 270 R18 = 100 R19 = 1.5K R20 = 5.6K R21 = 4.7 (0.5 Watt) R22 = 470	C1 = 10pF C2 = 56pF/4pF C3 = 47pF C4 = 150pF C5 = 0.0047 μ F C6 = 0.01 μ F C7 = 0.01 μ F C8 = 0.0047 μ F C9 = 10 μ F C10 = 4.7 μ F C11 = 0.022 μ F C12 = 0.1 μ F C13 = 1 μ F C14 = 4.7 μ F C15 = 0.01 μ F C16 = 4.7 μ F C17 = 33 μ F C18 = 0.056 μ F C19 = 0.047 μ F C20 = 0.1 μ F C21 = 0.047 μ F C22 = 100 μ F C23 = 0.022 μ F	Q1 = C838 - O/Y Q2 = B564 - O/Y/G Q3 = B564 - O/Y/G Q4 = D471 - O/Y/G Q5 = D471 - O/Y/G Q6 = B564 - O/Y/G Q7 = B564 - O/Y/G Q8 = B772 - O/Y/G Q9 = B772 - O/Y/G Q10 = D882 - O/Y/G Q11 = D882 - O/Y/G Q12 = B772 - O/Y/G Q13 = C945 - O/Y/G *C2 27MHz: 56pF 49MHz: 4pF	L1 = tank coil L2 = 3.3 μ H Diodes IN4148 Motors DC motor

TIME BASE

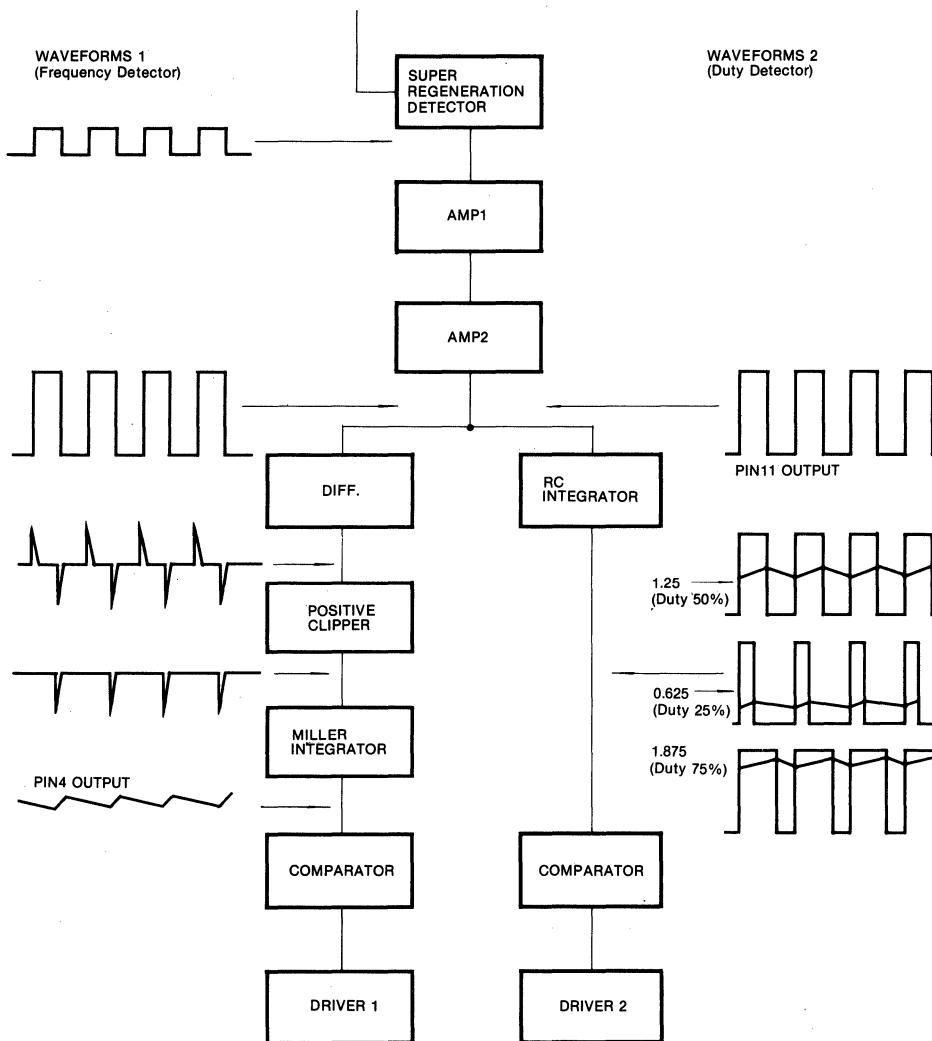


Fig. 4

MODULATION FREQUENCY (TX) & PIN4 DC LEVEL (RX)

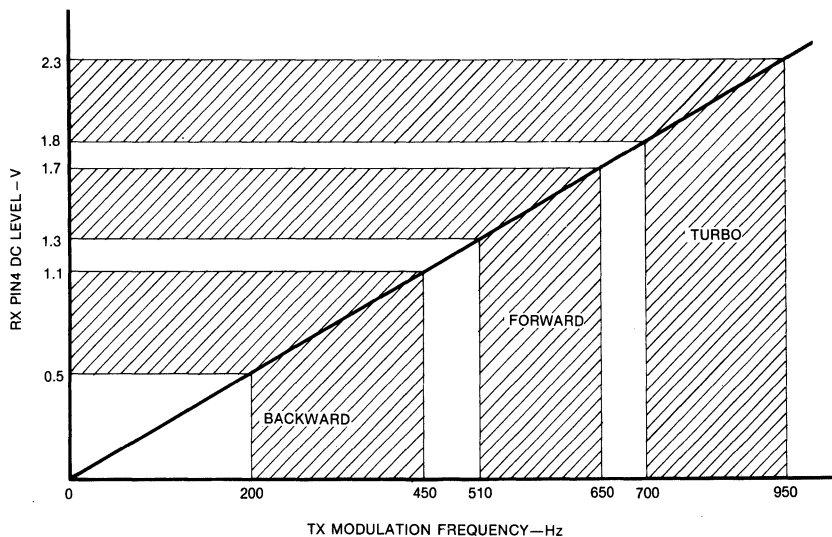


Fig. 5

7 FUNCTION TRANSMITTER APPLICATION CIRCUIT (KA2310)

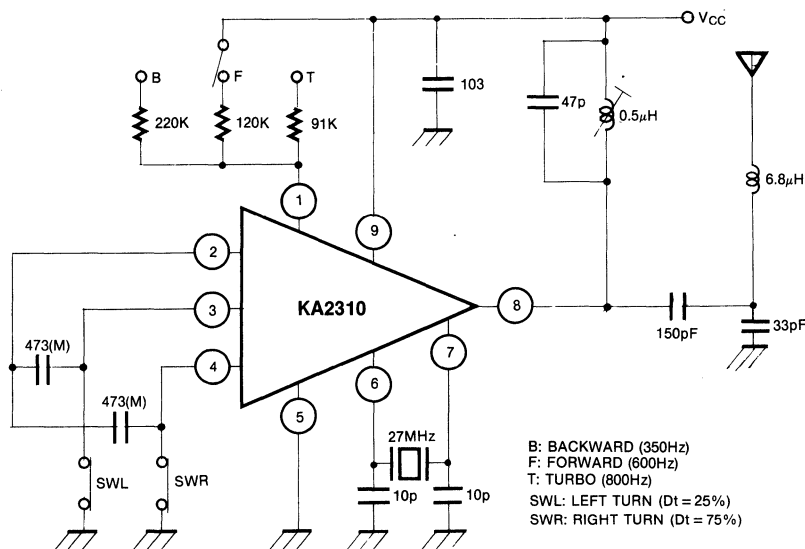
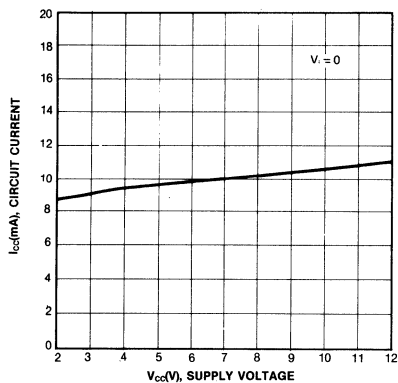
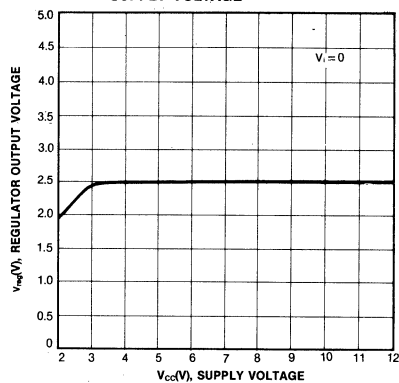


Fig. 6

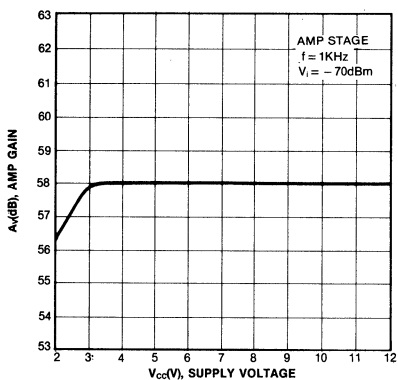
CIRCUIT CURRENT-SUPPLY VOLTAGE



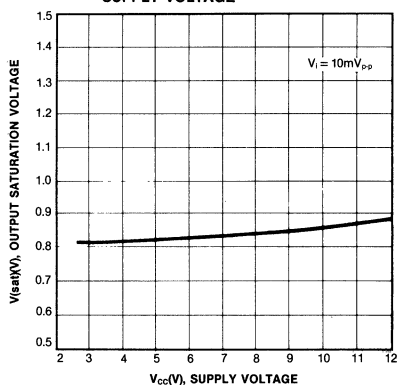
REGULATOR OUTPUT VOLTAGE-SUPPLY VOLTAGE



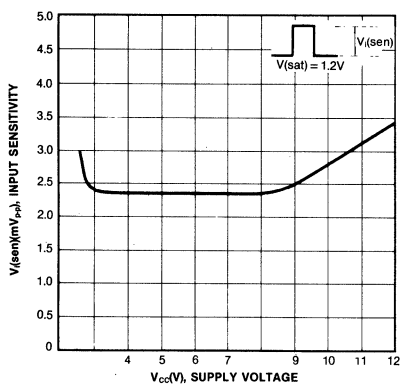
AMP GAIN-SUPPLY VOLTAGE



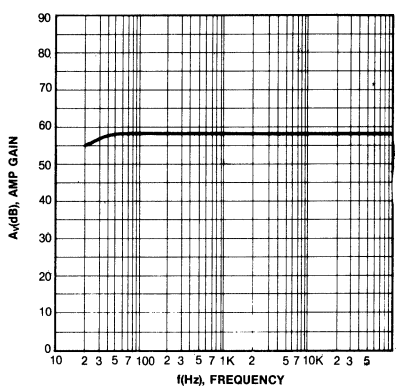
OUTPUT SATURATION VOLTAGE-SUPPLY VOLTAGE



INPUT SENSITIVITY-SUPPLY VOLTAGE



AMP GAIN-FREQUENCY



TOY RADIO CONTROL ACTUATOR (TX)

The KA2310 is monolithic integrated circuit having 7 Function designed for transmitting radio controlled toy car and other equipments.
In order to obtain a suitable radio control system of toy, KA2310 (Transmitter IC) should be used in combination with a KA2309 (Receiver IC).

FEATURES

- Includes Auto power switch, Pulse generator, Modulator, High frequency amplifier, Pulse width controller, Transmitting signal oscillator.
- Wide operating supply voltage range:
 $V_{CC} = 6V \sim 12V$
- Minimum number of external parts required
- Low current dissipation

BLOCK DIAGRAM

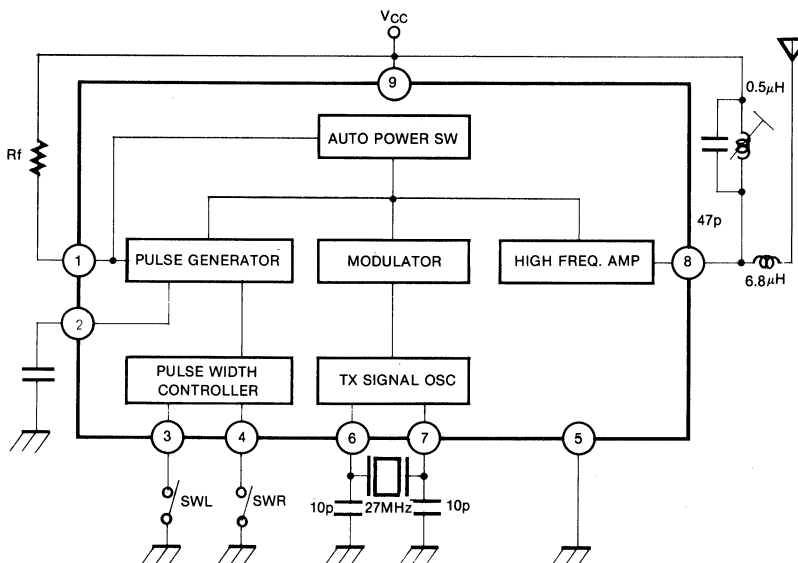
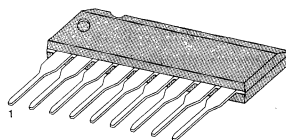


Fig. 1

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2310	9 SIP	-20 ~ +70°C

PIN DESCRIPTION

Pin No.	Symbol	Function
1	PS	Auto Power switch function and modulating signal oscillation. Backward, Turbo, Forward input (DUTY 50%)
2	FM	Modulating signal oscillation.
3	DL	Translation pulse width of modulating signal. Left turn input (DUTY 25%)
4	DR	Translation pulse width of modulating signal. Right turn input (DUTY 75%)
5	GND	GND
6	FC1	Transmitting signal oscillation.
7	FC2	Transmitting signal oscillation.
8	V _O	The output signal of modulating and transmitting.
9	V _{CC}	V _{CC} (6-12V)

APPLICATION CIRCUIT

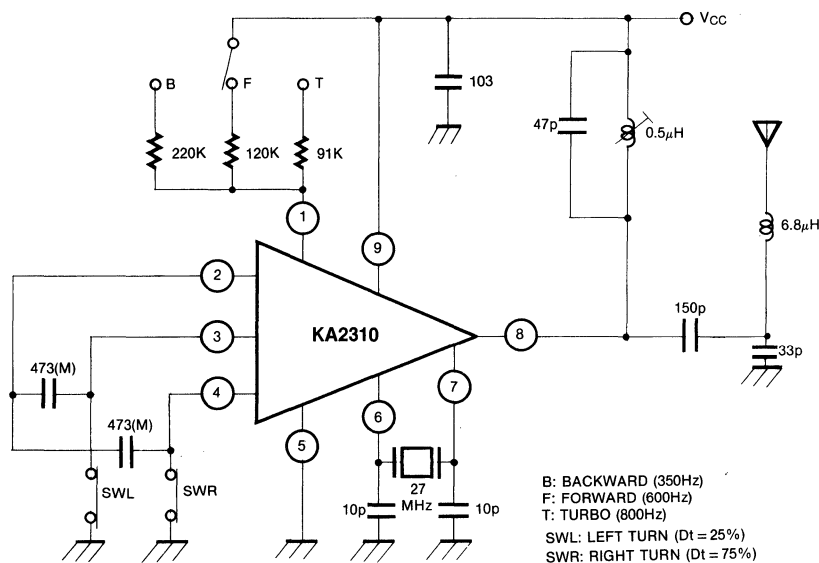


Fig. 3

TOY RADIO CONTROL ACTUATOR (RX)

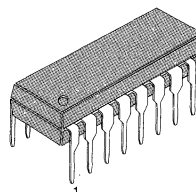
The KA2311 is monolithic integrated circuit having full Function designed for receiving radio controlled toy car and other equipments.

In order to obtain a suitable radio control system of toy, KA2311 (Receiver IC) should be used in combination with a KA2312 (Transmitter IC).

FEATURES

- It is possible to turn left or right on stop state.
- Includes Regulator, Amp, Duty Integrator, Miller Integrator
- Wide operating supply voltage range:
 $V_{CC} = 3V \sim 18V$
- Low operating supply voltage ($V_{CC} = 3V$)
- Minimum number of external parts required (Includes TURBO circuit)

16 DIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2311	16 DIP	$-20 \sim +75^{\circ}\text{C}$

BLOCK DIAGRAM

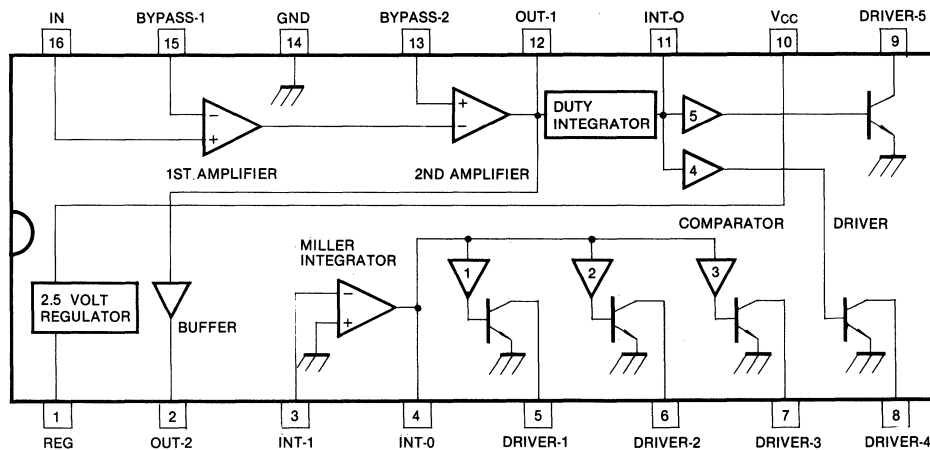
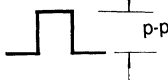


Fig. 1

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristic	Symbol	Condition	Value	Unit
Supply Voltage	V _{CC}	V _i = 2.3V ~ 2.7V	20	V
Drive Voltage	V _d	I _{LK} = 100μA	20	V
Drive Current	I _d	V _{sat} = 1.2V	150	mA
Regulator Output Current	I _{reg}	V _i = 2.3V	20	mA
Power Dissipation	P _d		625	mW
Operating Temperature	T _{opr}		- 20 ~ + 75	°C
Storage Temperature	T _{stg}		- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C, V_{CC} = 6V)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Circuit Current	I _{CC}	V _{CC} = 6V, V _i = 0		15	20	mA
Leakage Current	I _{LK}	V _{CC} = 6V, V _i = 0		0	100	μA
Saturation Current (V _i = 10mV _{p-p} , V _{sat} = 1.2V) 	I _s (sat)	f = 300Hz, V _s (sat) = 1.2V	100	150		mA
	I _e (sat)	f = 900Hz, V _e (sat) = 1.2V				
	I ₇ (sat)	f = 600Hz, V ₇ (sat) = 1.2V				
	I ₈ (sat)	f = 900Hz, V ₈ (sat) = 1.2V				
	I ₉ (sat)	f = 300Hz, V ₉ (sat) = 1.2V				
Regulator Output Voltage	V _{reg}	V _{CC} = 6V	2.3	2.5	2.7	V
Low Voltage Operating	V _{CCL}	V _{reg} = 2.3V			3	V
High Voltage Operating	V _{CCH}	V _{reg} = 2.3(min) ~ 2.7V(max)	20			V
Sensitivity (V _i = square wave)	V _s (sen)	V _{CC} = 6V, f = 300Hz		2	4	mV _{p-p}
	V ₈ (sen)	V _{CC} = 6V, f = 900Hz				
	V ₇ (sen)	V _{CC} = 6V, f = 600Hz				
Voltage Gain	A _V	V _i = 0.3mV _{rms} , f = 1KHz	60	65	70	dB

TEST CIRCUIT

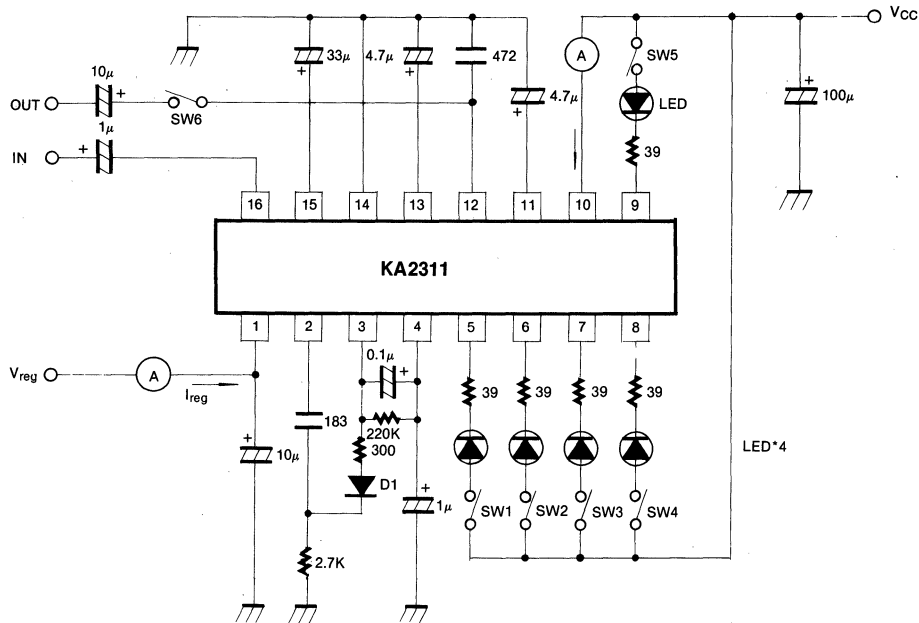


Fig. 2

PIN DESCRIPTION

Pin No.	Symbol	Function
1	V _{reg}	Regulator Output (V _{reg} = 2.5V)
2	BU	Buffer Output
3	INT-I	Miller Integrator Input
4	INT-O	Miller Integrator Output
5	D1	Backward Output (I _{sink} = 30mA)
6	D2	Turbo Output (I _{sink} = 30mA)
7	D3	Forward Output (I _{sink} = 30mA)
8	D4	Left Turn Output, DUTY 25% (I _{sink} = 30mA)
9	D5	Right Turn Output, DUTY 75% (I _{sink} = 30mA)
10	V _{CC}	V _{CC}
11	INT-O	Integrator Output
12	OUT2	The 2 nd AMP Output
13	BY2	The 2 nd AMP By-Pass
14	GND	GND
15	BY1	The 1 st AMP By-Pass
16	IN	Super Regenerator Signal Input

APPLICATION CIRCUIT

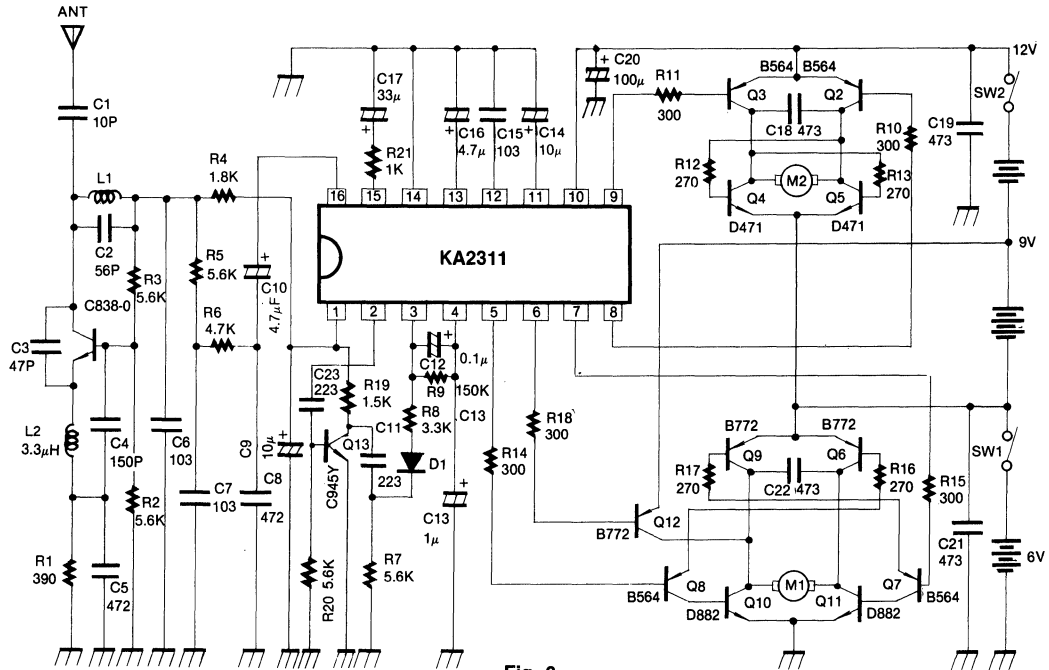


Fig. 3

TRANSMITTER APPLICATION CIRCUIT FOR KA2311

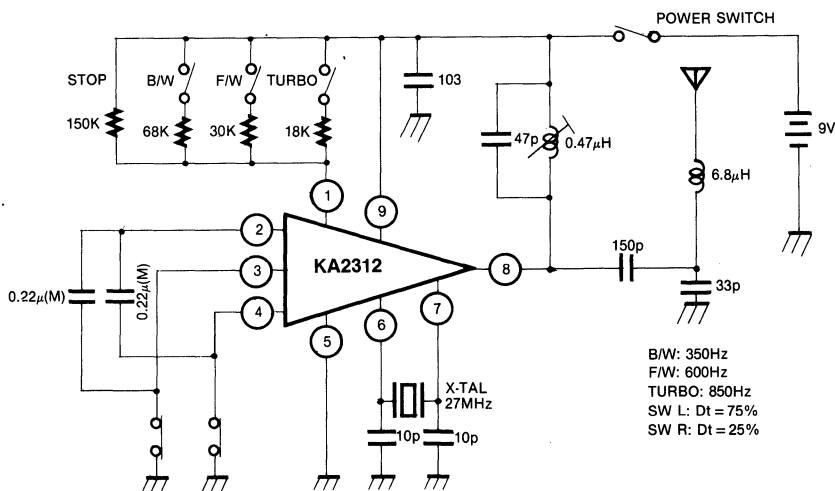


Fig. 4

TIME BASE

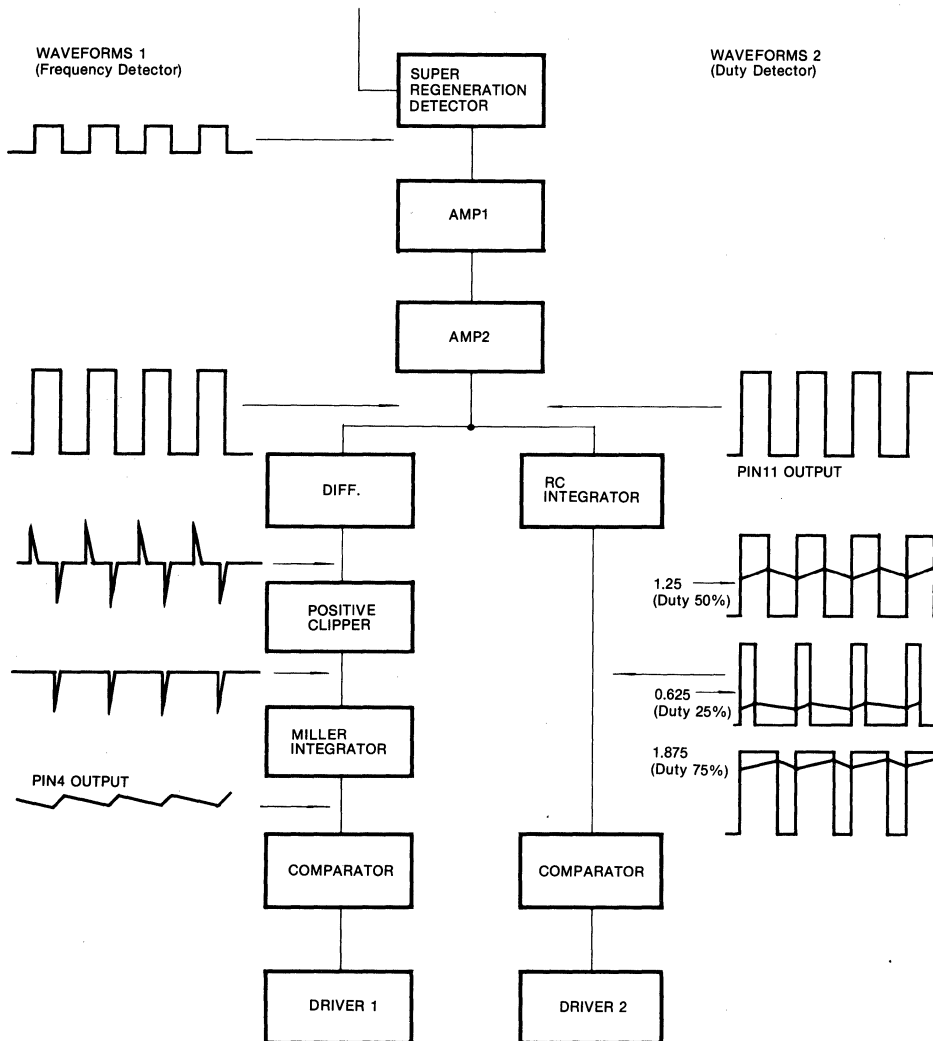


Fig. 4

TOY RADIO CONTROL ACTUATOR (TX)

The KA2312 is monolithic integrated circuit having full Function designed for transmitting radio controlled toy car and other equipments.

In order to obtain a suitable radio control system of toy, KA2312 (Transmitter IC) should be used in combination with a KA2311 (Receiver IC).

FEATURES

- Includes Pulse generator, Modulator, High frequency amplifier, Pulse width controller, Transmitting signal oscillator.
- Wide operating supply voltage range:
 $V_{CC} = 6V \sim 12V$
- Minimum number of external parts required
- It is possible for user to select modulating frequency

BLOCK DIAGRAM

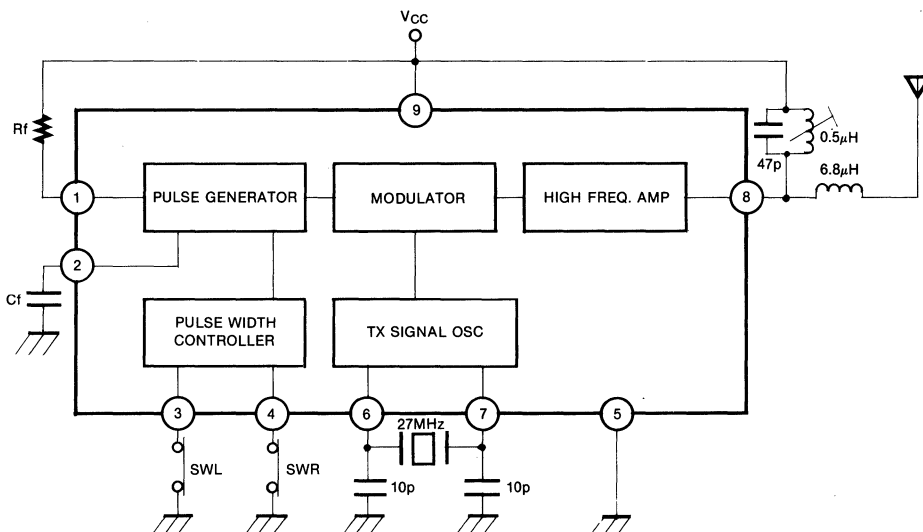
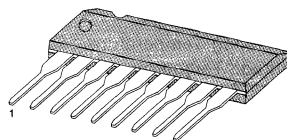


Fig. 1

9 SIP



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2312	9 SIP	$-20 \sim +70^{\circ}\text{C}$

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	12	V
Supply Voltage (PIN 8)	V_8	18	V
Acceptable Load (PIN 8)	R_L	300	Ω
Power Dissipation	P_d	600	mW
Operating Temperature	T_{opr}	$-20 \sim +70$	$^\circ\text{C}$
Storage Temperature	T_{stg}	$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 9\text{V}$)

Characteristic	Symbol	Test Condition				Test Point	Min	Typ	Max	Unit
		SW1	SW2	SWL	SWR					
Circuit Current	$I_{CC(1)}$	OFF	B	ON	ON	A1	15	20	25	mA
	$I_{CC(2)}$	ON	B	ON	OFF	A1	13	18	23	mA
	$I_{CC(3)}$	ON	B	OFF	ON	A1	7	12	17	mA
	$I_{CC(4)}$	ON	B	ON	ON	A1	11	16	21	mA
Output Sink Current	I_s	ON	A	ON	ON	A2	2	5	8	mA
Modulation Frequency	$f_m(1)$	ON	A	ON	OFF	F/M		2		KHz
	$f_m(2)$	ON	A	ON	ON	F/M		4		KHz
Duty Cycle	$Dt(1)$	ON	A	ON	OFF	F/M	70	75	80	%
	$Dt(2)$	ON	A	OFF	ON	F/M	20	25	30	%
	$Dt(3)$	ON	A	ON	ON	F/M	45	50	55	%
Oscillator Frequency	f_{osc}	ON	B	ON	ON	H/F		27		MHz
Transmitting Power	$P_o(1)$	ON	B	$f_c = 27\text{MHz}$		H/F	15	20		mW
	$P_o(2)$	ON	B	$f_c = 40\text{MHz}$		H/F		17		mW

TEST CIRCUIT

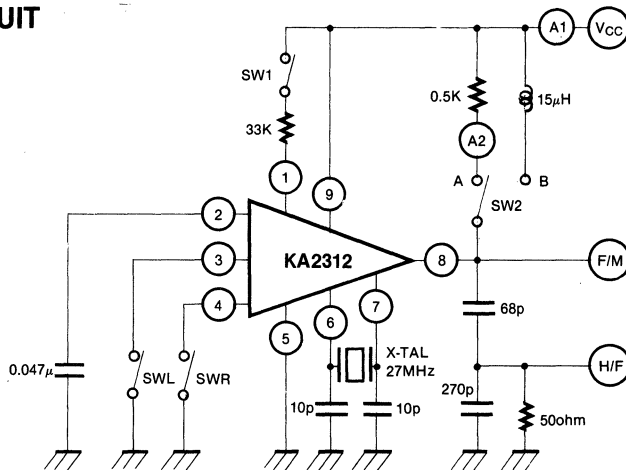


Fig. 2

PIN DESCRIPTION

Pin No.	Symbol	Function
1	FM1	Modulating signal oscillation. Backward, Turbo, Forward input (DUTY 50%)
2	FM2	Modulating signal oscillation.
3	DL	Translation pulse width of modulating signal. Left turn input (DUTY 75%)
4	DR	Translation pulse width of modulating signal. Right turn input (DUTY 25%)
5	GND	GND
6	FC1	Transmitting signal oscillation.
7	FC2	Transmitting signal oscillation.
8	V _o	The output signal of modulating and transmitting.
9	V _{cc}	V _{cc} (6-12V)

APPLICATION CIRCUIT Fig. 3 KA2312

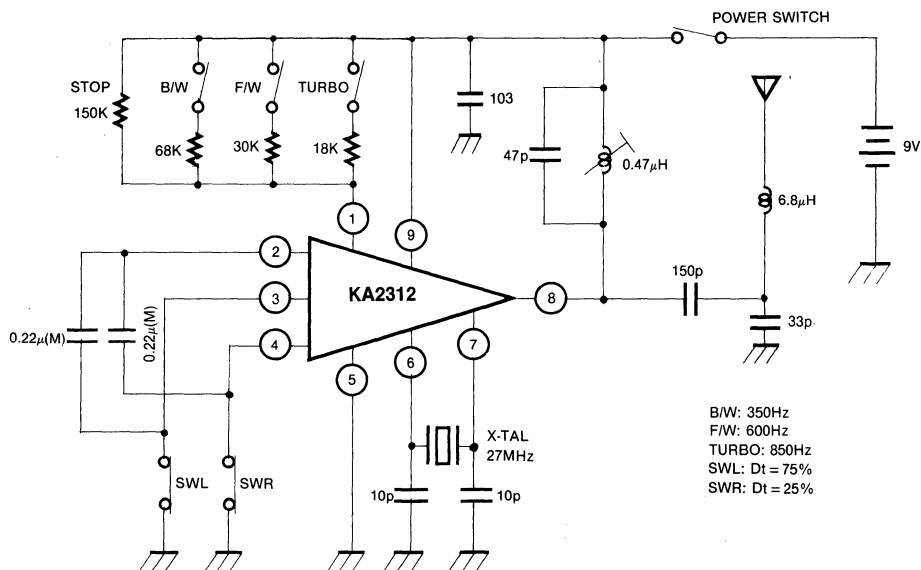


Fig. 3

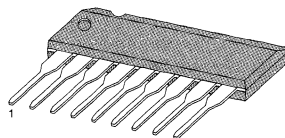
KA2303 APPLICATION NOTE

1. INTRODUCTION

The KA2303 is an integrated circuit intend to drive remote controlled toy car. By obtaining the 27MHz (or 49MHz) non-modulated signal from wireless transmitter through super regenerative detection circuit, the I.C. is designed to control the 3 function (forward, stop, backward) of the DC motor.

The circuit consists of amplifier, detector, comparator, latch, driver, and regulator. Reduced components surrounding the circuit enable an easy circuit designed.

9 SIP



2. BLOCK DIAGRAM AND OPERATIONAL OF EACH BLOCK

1) A SIMPLIFIED BLOCK DIAGRAM AND OPERATIONAL DESCRIPTION

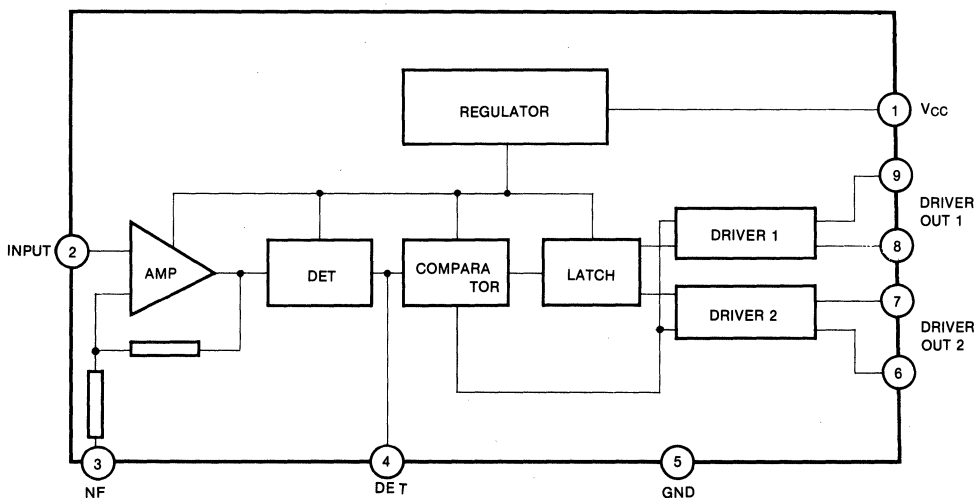


Fig. 1

- A) AMPLIFIER : As an AC amplifier, it only amplifies noise signal within audio frequency range.
- B) DETECTOR : With capacitor connected to pin 4 a peak detector is formed. The low frequency noise signal amplified in the previous block is converted into DC.
- C) COMPARATOR : A schmitter trigger circuit with hysteresis characteristic.
- D) LATCH : Through switching operation, it generates the signal to determine the direction of the motor.
- E) DRIVER 1, 2 : With output from direction control circuit, the driver 1 & 2 control the direction of the motor. The motor is connected to pin 6 – pin 9.
- F) REGULATOR : As a constant voltage supplier circuit, it stabilizes the operation of the device against the ripple and noise generated when the motor is set.

KA2303 APPLICATION NOTE

2) DETAILED BLOCK DIAGRAM AND OPERATION DESCRIPTION

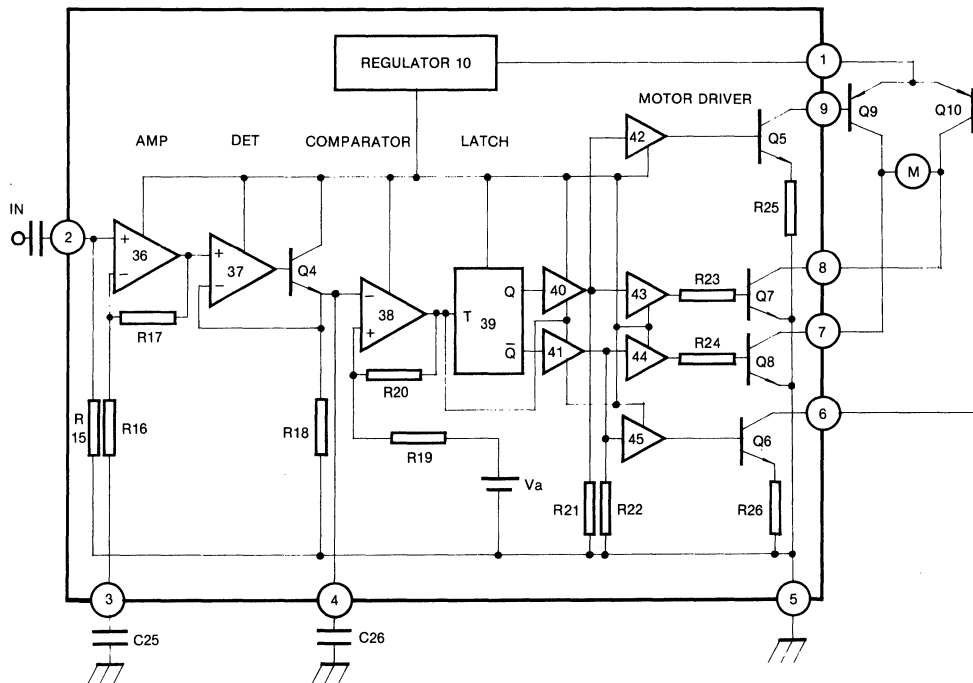


Fig. 2

A) AMPLIFIER

- Consists of operational amplifier (36), resistors (R25, R16 and R17), and a capacitor C25.
- Input signal is fed to non-inverting terminal (+) of operational amplifier.
- Since pin 3 couples with capacitor C25, DC output is kept "0" in spite of offset voltage of operational amplifier.
- Amplification rate of alternative voltage should be $(R17/R16) + 1$.

B) DETECTOR

- Consists of operational amplifier (37), transistor Q4, resistor R18 and capacitor C26.
- The output voltage of amplifier stage is supplied to non-inverting terminal (+) of operational amplifier, while the terminal voltage of capacitor C26 is fed to the inverting terminal (-).
- When input voltage of the non-inverting terminal is bigger than that of the inverting terminal, transistor Q4 is turned on and the output voltage of the operational amplifier is charged to capacitor C26.
- If condition of input voltage is reverse to c), transistor Q4 is turned off while the voltage charged at capacitor C26 is discharged through resistor R18.
- As a result, low frequency peak voltage fed to non-inverting terminal of the operational amplifier is detected at this stage.

KA2303 APPLICATION NOTE

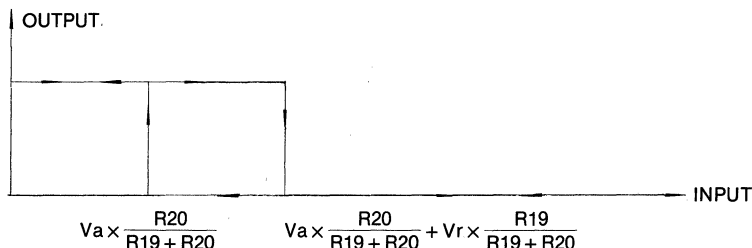
C) COMPARATOR

- a) Consists of operational amplifier (38), resistors (R19 and R20) and reference voltage (Va).
- b) When comparator output is high (Vr), the input voltage becomes:

$$V_a \times \frac{R_{20}}{R_{19} + R_{20}}$$

- c) If comparator output is low, the input voltage is:

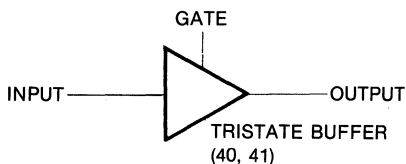
$$V_a \times \frac{R_{20}}{R_{19} + R_{20}} + V_r \times \frac{R_{19}}{R_{19} + R_{20}}$$



- d) The hysteresis characteristic prevents any misoperation caused by noise from the motor, ripple from detector, or the fluctuation of the input signal.

D) LATCH (DIRECTION CONTROL CIRCUIT)

- a) Consists of T flip-flop (39) and transistor buffer (40 & 41)
- b) The T flip-flop has its logic output Q converted when the output from the comparator is elevated from low (0) to high (1).
- c) When the comparator output is lowered from high (1) to low (0), the T flip-flop maintains up edge operation to keep output Q constant.
- d) The output Q' of T flip-flop is generated as non-inverted logic output.
- e) The output from the comparator becomes the gate signal of tristate buffer (40 & 41).
- f) When gate signal is "1" (high), the input of tristate buffer is delivered to the output.
- g) If gate signal is "0" (low), the output from tristate buffer becomes "0."



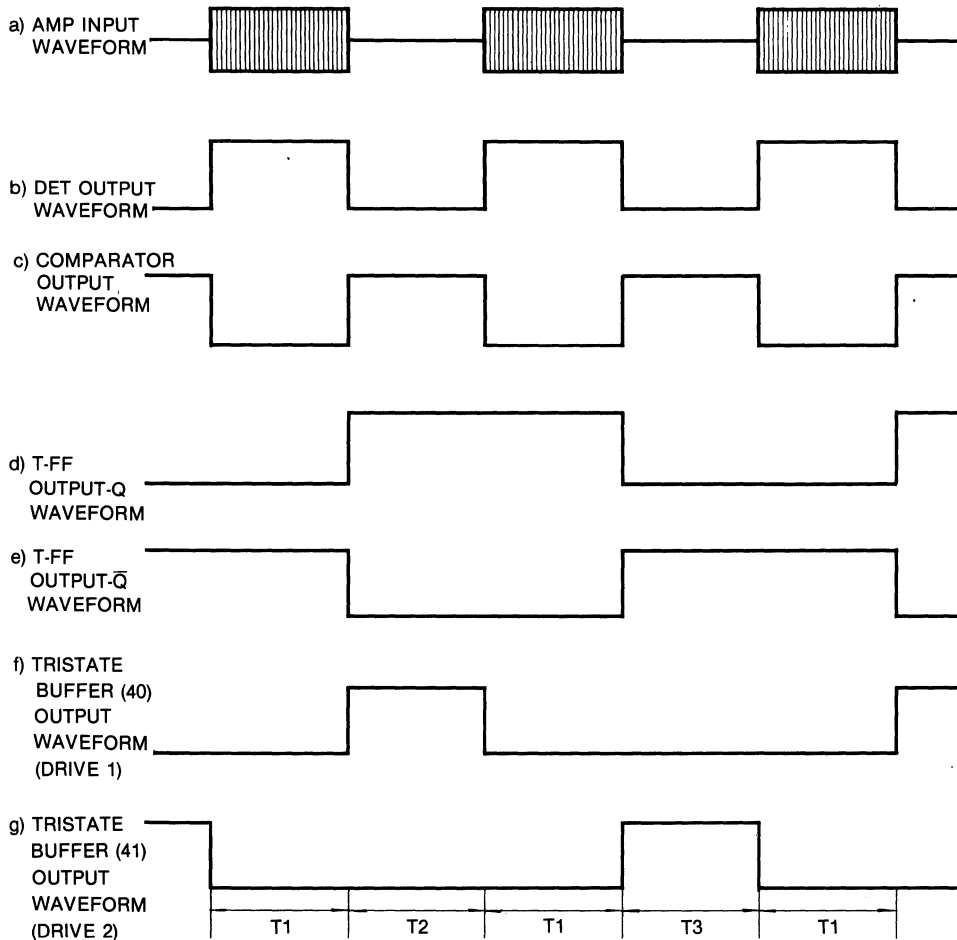
GATE	INPUT	OUTPUT
L (0)	L (0)	L (0)
L (0)	H (1)	L (0)
H (1)	L (0)	L (0)
H (1)	H (1)	H (1)

E) MOTOR DRIVER CIRCUIT

- a) Consists of buffer (42, 43, 44 & 45), resistors (R21, R22, R23, R24, R25 & R26) and transistors (Q5, Q6, Q7 & Q8).
- b) The buffer has a role of driving transistors.
- c) Transistor Q7 and Q8 are saturated by resistor R23 and R24 when input of the buffer is "1."
- d) By resistor R25 and R26, transistor Q5 and Q6 operate as constant current supplier.
- e) Pin 1, 6, 7, 8 & 9 of the motor driver circuit are connected to the motor circuit consisting of transistor Q9 and Q10, motor (M) and voltage (V) supplier.
- f) When driver 1 input is "1" and driver 2 input is "0", transistor Q5 and Q7 are turned on while Q6 and Q8 are turned off. As a result, motor driver current flows through transistor Q9, motor (M) and transistor (Q7). ("Forward")
- g) When both inputs of driver 1 & 2 are in opposite condition to f), transistor Q5 and Q7 are turned off whereas Q6 and Q8 are on. Therefore, motor driver current flows through transistor Q10, motor (M) and Q8. The motor is driven "backward".
- h) When the input of T flip-flop is "0", output of tristate buffer 40 and 41 also becomes "0." Since transistors from Q5 to Q8 are turned off, the motor stops functioning.

3) DYNAMIC WAVEFORM OF EACH BLOCK.

A) DYNAMIC WAVEFORMS



B) OPERATION OF DYNAMIC WAVEFORMS

- For waveform (f) and (g), input signals of motor driver circuit become "0" during period T1. So transistors from Q5 to Q8 are turned off and the motor stops its operation.
- In period T2, motor driver 1 input becomes high whereas that of motor driver 2 is low. So transistors Q5 and Q7 are activated while Q6 and Q8 are turned off. As a result, the motor is driven forward.
- In period T3, motor driver 1 has low input while high input is provided to motor driver 2. So transistors Q5 and Q7 are turned off while Q6 and Q8 are turned on. The direction of the motor is "backward."

KA2303 APPLICATION NOTE

3. APPLICATION CIRCUIT AND THEIR OPERATIONS

1) APPLICATION CIRCUIT 1

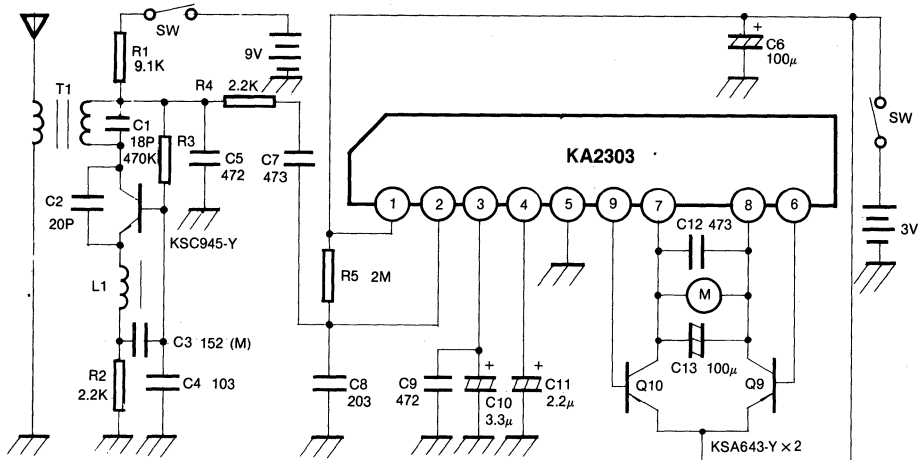


Fig. 3

2) APPLICATION CIRCUIT 2

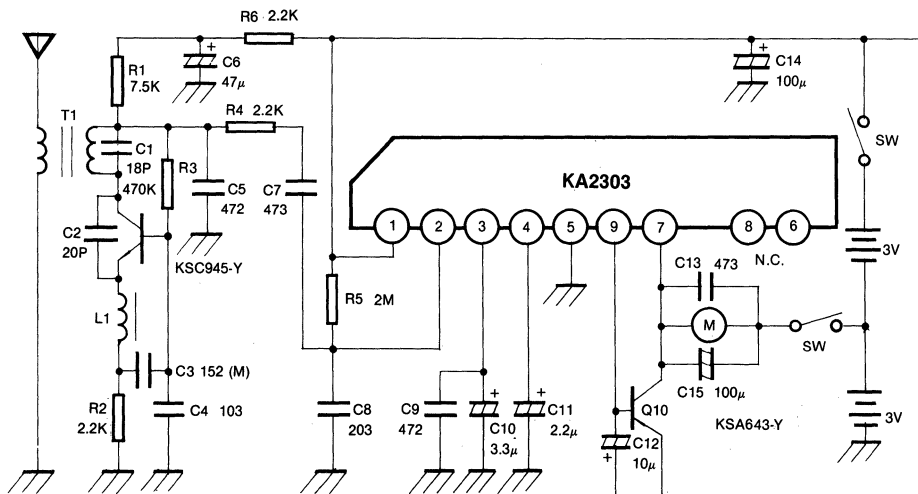


Fig. 4

KA2303 APPLICATION NOTE

3) OPERATIONAL DESCRIPTION (Please refer to above block diagrams)

- A) WHEN NO SIGNAL IS TRANSMITTED ("Stop" motion of the motor).
- a) Noise signal within audio frequency range is obtained at the antenna.
 - b) Quenching signal is generated by transistor Q1, capacitor C2 and coil L1 of the super regeneration receiver circuit. (Quenching frequency of 100KHz to 500KHz).
 - c) Quenching signal and noise signal are mixed before entering pin 2 through L.P.F. (R4 and C5).
 - d) In the amplifier stage, an AC amplifier, only noise signal is amplified to be delivered to detector stage. The amplification rate should be about 43dB.
 - e) The peak voltage of low frequency noise signal fed to non-inverting terminal (+) of operational amplifier is detected at the detector stage. Here the noise component of AC voltage is converted into DC voltage so the size of DC voltage is determined by the amount of noise input. The amplification rate is about 24.6dB.
 - f) Detected peak voltage should be "1" (High condition: the voltage detected should be above 0.7V) and it is input to inverting terminal (-) of operational amplifier in the comparator stage.
 - g) The high signal fed to inverting terminal (-) of the comparator is generated as low output to be delivered to the latch.
 - h) Since low (0) input is provided to the T flip-flop of the latch stage, the original output from T flip-flop remains unchanged. Both gate signal of tristate buffer and the output of latch stage are low.
 - i) As low input is fed to the motor driver stage, transistors from Q5 to Q8 are turned off so the motor stops its function.
- B) WHEN SIGNAL IS TRANSMITTED FROM THE TRANSMITTER (Forward/Backward)
- a) Non-modulated high frequency signal (in the KA2303: 27-49MHz) resonated by the coil (T1) of super generation receiver circuit and by capacitor C1 is obtained at the antenna.
 - b) The non-modulated high frequency signal organized at the antenna and the quenching signal are fed to L.P.F. of R4 and C5.
 - c) The only signal passing through L.P.F. is the quenching signal and it is impressed on pin 2.
 - d) Only noise signal can be amplified at the amplifier stage. However only signal provided to the stage is quenching signal, so no noise can be generated.
 - e) Without any noise signal input, the detector stage has low (0) output. (To be low, the detector voltage should be less than 0.3V).
 - f) With low input, the inverting terminal of the comparator generates high output which will enters latch stage.
 - g) The T flip-flop of the latch stage has high input which will be inverted into a previous one. Since gate signal of the tristate buffer is high, the output of T flip-flop is delivered to the tristate buffer output.

Tn	Qn + 1
0	$\overline{Qn}$
1	$\overline{Qn}$

Here Tn: Input of T-FF

Qn: Previous output is maintained

Qn: Inversion of previous output

Qn + 1: Present output condition

- h) When T flip-flop output is high (1), transistor Q5 and Q7 are turned on while Q6 and Q8 are turned off. So the operational current flows through transistor Q9, motor (M) and transistor Q8.
- i) With low output (Q) of T flip-flop, transistor Q5 and Q7 are turned off while Q6 and Q8 are turned on. So the operational current flows through transistor Q10, motor (M) and transistor Q8. Consequently, the motor is driven backwards.

KA2303 APPLICATION NOTE

4) EXTERNAL COMPONENTS

A) R5: INPUT RESISTOR

Misoperation (When the motor maintains only one direction) caused by low input noise is prevented by R5. If its value is small, sensitivity of the receiver drops whereas excessive value blunts the prevention of a misoperation. Therefore value of 2M Ω is recommended.

B) C8: INPUT BYPASS CAPACITOR

If the capacitor value is reduced, the sensitivity of the receiver is also reduced. However, a large value may result a misoperation. So an appropriate value of 0.02 μ F is recommended.

C) C9, C10: FEEDBACK CAPACITOR

They control the forward/backward converting time of the motor. When their values are small, the motor either stops or misoperates when encountered with an obstacle. Also their voltage are low (V_{CC} = less than 2.5V). On the other hand, a large value delays the forward/backward converting time. In addition, if weak signal is obtained due to remote transmission, a misoperation is expected.

Therefore 0.0047 μ F for C9 and 2.2 μ F – 3.3 μ F for C10 are recommend.

D) C11: PEAK DETECTOR CAPACITOR

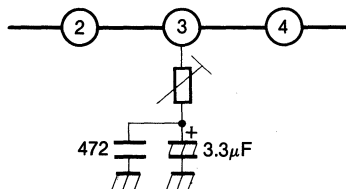
A misoperation is expected if weak signal is provided. On the other hand, a large value stabilizes DC voltage of pin 4 but it delays forward/backward time of the motor. Also when it encounters with an obstacle and voltage is low, the motor can be misoperated. Satisfying result can be achieved with a value within the range of 2.2 μ F to 3.3 μ F.

5) PROPER CARES IN USING THE I.C.

A) Since the KA2303 is operated by the noise within audio frequency range, it is sensitive to the noise. If it does not match properly with super regeneration receiver circuit, misoperation of the motor can be expected. Therefore, care is required when designing a set.

B) Input noise voltage can be easily modulated by DC voltage difference of pin 4. That is, an easy design of a set is provided if the DC voltage of pin 4: 0.7V – 1.0V when the motor stops, and less than 0.3V when motor is driven either backward or forward. Therefore, whether input noise is present in the device determines the conversion of the motor. Also motor can be activated by directly feeding DC voltage to pin 4.

C) By inserting a proper DC resistor between pin 3 terminal and feedback capacitor, the amplifier gain is controlled to obtain a desirable sensitivity of the receiver.



D) In order to apply the device in a low voltage (3V) circuit, super regeneration receiver circuit and power supply should be used separately.

If they share same power source, the motor may be misoperated.

*.super regeneration receiver circuit: V_{CC} = 9V, KA2303: V_{CC} = 3V.

E) If your circuit design contrasts with our recommendation, characteristics deviation should be reviewed.

KA2309 APPLICATION NOTE

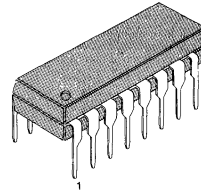
1. INTRODUCTION

The KA2309 is an integrated circuit designed for 7 function R/C toy car. This I.C. consists of a regulator, an amplifier, a frequency detector, a duty detector, a comparator and two stages of drivers.

The device operates on low voltage (3V) due to its structure requiring only minimum number of external parts and having 2.5V as regulator output. It is also free from any misoperation expected when power is switched ON/OFF. Built-in Turbo function is also available.

For a best performance, the device is recommended to be used with a transmitter I.C. KA2310.

16 DIP



2. BLOCK DIAGRAM & OPERATIONAL DESCRIPTION

2-1. BLOCK DIAGRAM

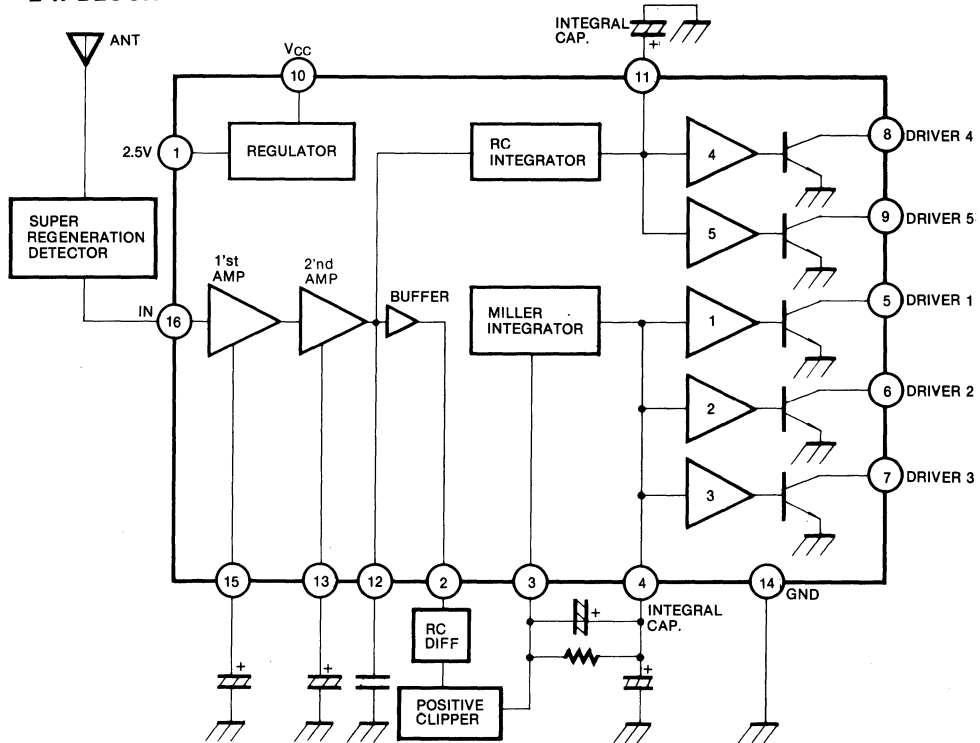
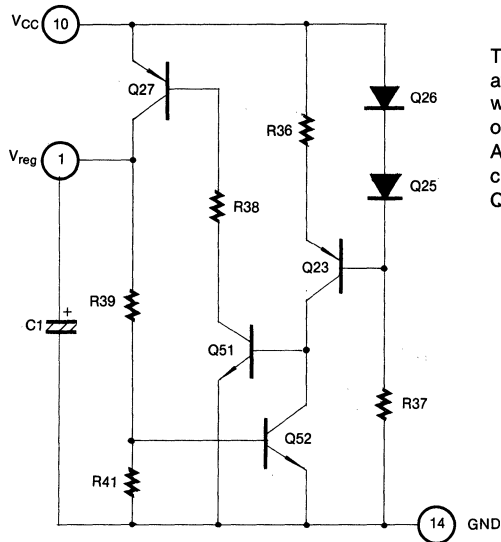


Fig. 1

KA2309 APPLICATION NOTE

2-2. OPERATIONAL DESCRIPTION

1) Regulator



The circuit is used as current biasing for super regeneration detector and other circuits. Constant 2.5V is always maintained in the circuit against changes in power or load, therefore stable characteristic is guaranteed. As a negative feedback, Q51-Q27-Q52 loop maintains continuous control action after being initiated by Q26-Q25-Q23.

Fig. 2

2) Amplifier

By amplifying the signal divided at the super regeneration detector, the signal can be separated into noise and functional signal at the detector.

Equivalent circuit of the 1st Amp

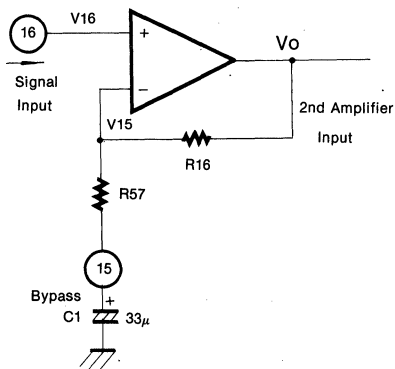


Fig. 3

$$Av1 \approx 20 \log \left(1 + \frac{R16}{R57} \right) \approx 29.5\text{dB}$$

$$Av = Av1 + Av2 = 58\text{dB}$$

Equivalent circuit of the 2nd Amp

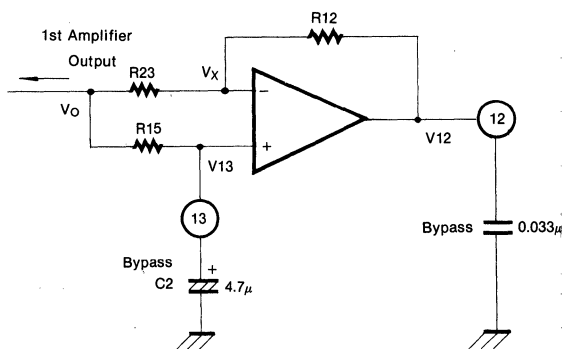


Fig. 4

$$Av2 \approx 20 \log \left(\frac{R12}{R23} \right) \approx 28.5\text{dB}$$

KA2309 APPLICATION NOTE

Frequency Characteristic

(i) Low frequency characteristic is determined by R57, R15, and external C1 and C2.

$$f_{L(1)} = \frac{1}{2\pi \cdot R57 \cdot C1} \text{ (Hz)}$$

$$f_{L(2)} = \frac{1}{2\pi \cdot R15 \cdot C2} \text{ (Hz)}$$

For example, when lowest frequency of the signal to be amplified is 50Hz, C1 becomes larger than 17.7μF { 1/(2π × 50 × 180) }.

(ii) High frequency is determined by the frequency characteristic of the amplifier. The 3dB cutoff frequency is,

$$f_{H(1)} = \frac{G.B}{2\pi \cdot Av1} \text{ (Hz)}$$

$$f_{H(2)} = \frac{G.B}{2\pi \cdot Av2} \text{ (Hz)}$$

*G.B = Avo·Wc Avo: open loop gain
Wc: -3dB corner frequency

3) Miller Integrator (Frequency Detector)

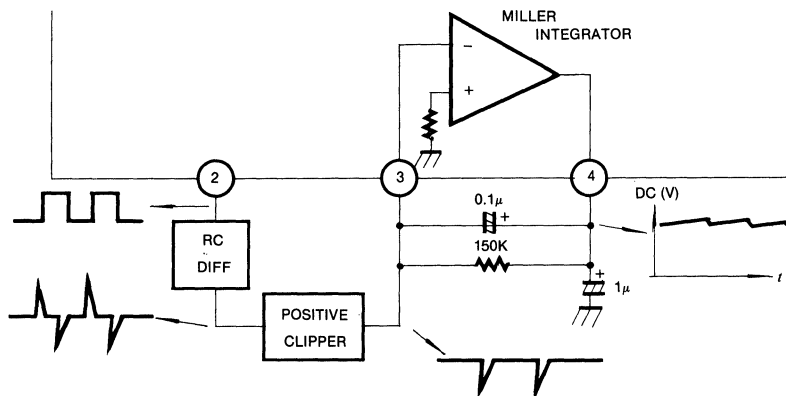


Fig. 5

The Miller Integrator converts functional signal into DC level. After Pin 2 square wave is differentiated to pass through positive clipper, only negative spikes remain. Therefore no matter what duty is, negative spike is generated with certain interval.

If functional signal (square wave) is not available, DC level of Pin 3 becomes more than zero and that of Pin 4 is kept nearly Ground. When the negative spike with certain interval is impressed on Pin 3, negative spike proportional to frequency is generated at Pin 4 to drive subsequential drive stage.

KA2309 APPLICATION NOTE

Since the integrator has high gain due to its structure, output voltage can easily drift from '0' level. In order to prevent such a drift, large resistor like R9 is connected between output and inverting input. The integrator at low frequency is not affected by the DC gain that is cut down by R9. If input frequency is too low that capacitance impedance becomes higher than R9, the integrator becomes disabled even though capacitor is not affected. Therefore, C12 should be $X_{C12} \ll R9$. Generally Xc12 is set at R9/10.

$$\frac{1}{2\pi f_L C12} = \frac{R9}{10}$$

$$f_L = \frac{10}{2\pi C12 R9}$$

4) RC Integrator (Duty Detector)

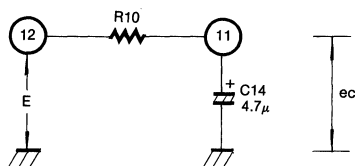


Fig. 6

Certain level of DC in respect to duty is generated by RC integrator. Output waveform of RC serial circuit relies on the relationship between time constant (CR) and pulse width (PW). This circuit, a $CR \parallel (10 \times PW)$, obtains output from both ends of the capacitor.

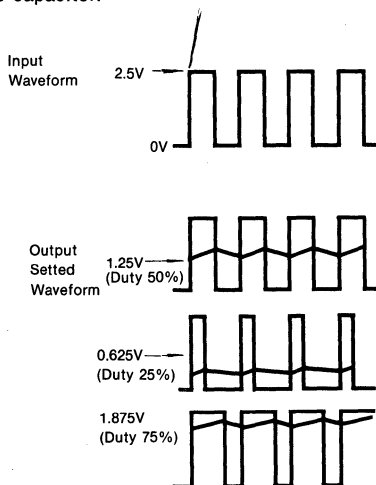


Fig. 7

KA2309 APPLICATION NOTE

5) Driver Stage

(1) Driver 1

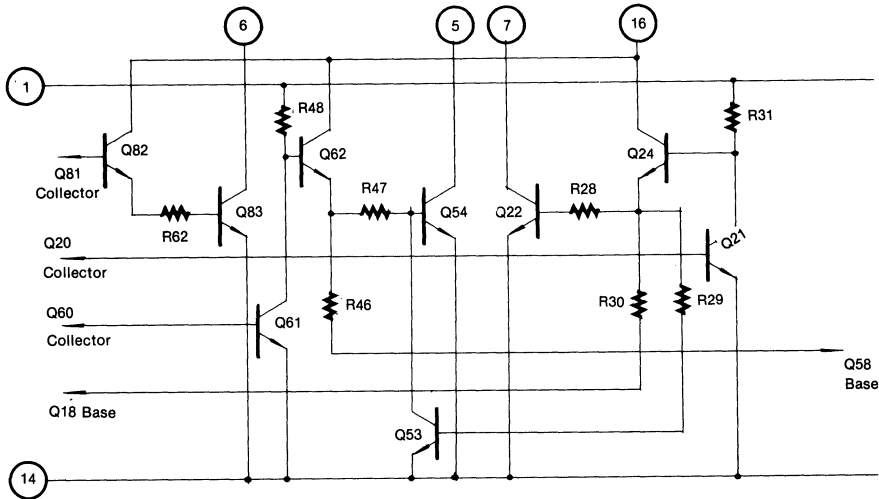


Fig. 8

- i) When Pin 4 DC level is 0.5-1.3V: Q61 is turned off Q62, Q54 and Q58 are turned on. So Pin 5 DC level becomes low.
- ii) When the DC level is 1.3-1.85V: Q21 is turned off. Q24, Q22, Q53, Q18 and Q58 are turned on. Q53 is turned on, Q54 becomes turned off and Pin 7 voltage becomes low.
- iii) When the DC level is above 1.85V: Q81 is turned off. Q82 and Q83 are turned on. Then Pin 6 and Pin 7 can not be operated at the same time, but Pin 7 operation is not disturbed owing to external application circuit. Q58 holds the operation of Driver 2 while Driver 1 is inhibited. In order words, Driver 2 is active only when operation of Driver 1 is determined.

(2) Driver 2

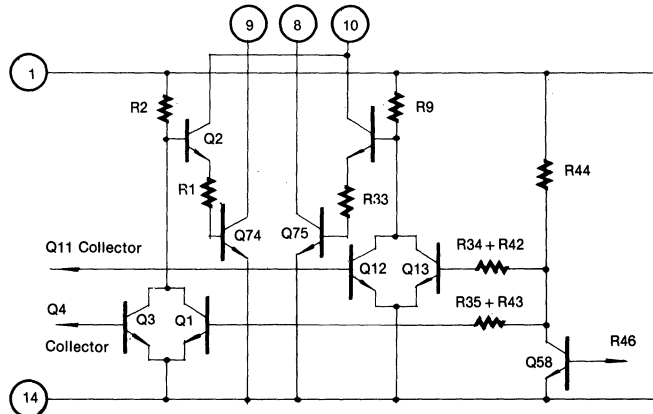


Fig. 9

Q1 and Q13 are turned off if Q58 connected with R46 is active. With 1.0 – 1.4V of Pin 11 voltage, Pin 8 and Pin 9 become high. However, Pin 11 voltage higher than $V_d(1.4V)$ turns off Q3 while Q2 and Q74 are turned on. On the other hand, Pin 11 voltage lower than $V_E(1.0V)$ turns off Q12 and turns on Q14 and Q75. As a result Pin 8 voltage becomes low.

When current sinking is 30mA, output terminal 5, 6, 7, 8 and 9 of both drivers is designed to be less than 1.2V respectively.



age of the KA230
) and the oscillat

Component and function
and positive clipping

by RC differentiation
of Q13 and the

1. DC level propo
e, R9 is connecte
re operation of th

between function fr

KA2309 APPLICATION NOTE

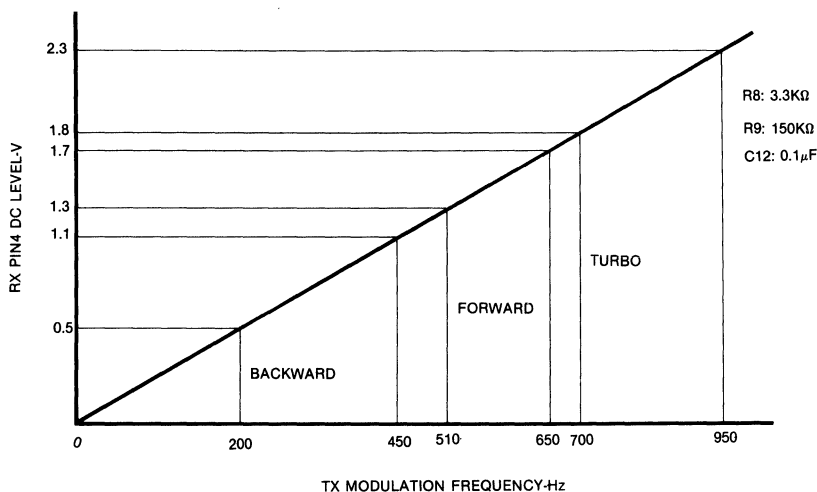


Fig. 11

Operation of each driver stage is determined by DC level of Pin 4.

- When the level is less than 0.5V (zero signal: Tx off): The driver stages stop functioning. Accordingly, transistors of the external driver stage are turned off. Therefore the Reel Motor STOPS.
- When the level is 0.5V-1.1V: Driver 1 is turned on (Pin 5 is low) while external driver transistors Q6, Q8, Q10 are turned on. Therefore the Reel Motor turns BACKWARD.
- When the level is 1.3-1.7V: Driver 3 is turned on (Pin 7 is low) and external driver transistors Q7, Q9, Q11 are turned on. Therefore the Reel Motor turns FORWARD.
- When the level is above 1.8V. Driver 2 is turned on (Pin 6 is low) and active Driver 3 turns on driver transistors Q7, Q9, Q12, Q11 on. Therefore the Reel Motor repeats Forward of Turbo function.

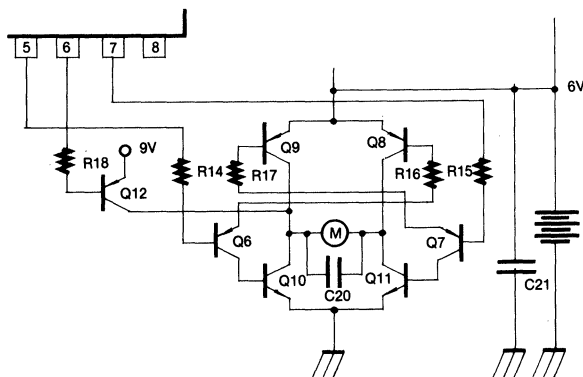


Fig. 12

KA2309 APPLICATION NOTE

The amplified functional signal fed to RC integrator is converted into DC level proportional to duty.

- Duty = 50%: DC level of Pin 11 becomes approximately 1.25V. So driver 4 & 5 are disabled. Accordingly external steering motor driver TR is turned off. Therefore the Steering Motor STOPS.
- Duty = 25%: Driver 4 is active if DC level of Pin 11 is approximately 0.625V (Pin 8 is low). Then external driver TRs Q2 and Q4 are turned on. Therefore the steering motor turns LEFT.
- Duty = 75%: Driver 5 is active when DC level of Pin 11 is approximately 1.875V (Pin 9 is low). TRQ3 and Q5 are turned on. Therefore the steering motor turns RIGHT.

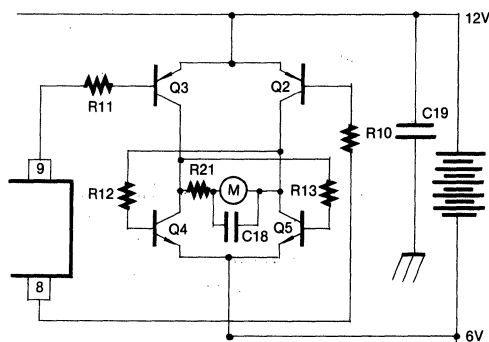


Fig. 13

4. REMARK

1) Adjustment of Receiver Sensitivity

Pin 12 square wave of the amplifier output terminal should adjust L1 and C2 resonance circuit of super regeneration receiver to an optimum point where waveform is free from noise.

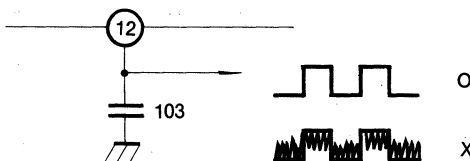


Fig. 14

KA2309 APPLICATION NOTE

2) Operational Mode (Forward, Backward, Turbo) Check

Pin 4 DC level and pin voltage of each driver stage need to be checked.

Function	Pin 4 VTG (DC)	Driver Pin (H→L)
Stop	0.5V↓	Pin 5, 6, 7: High
Backward	0.5 ~ 1.1V	Pin 5
Forward	1.3 ~ 1.7V	Pin 7
Turbo	1.8V↑	Pin 6

3) Left-Turn and Right Turn

Pin 12 DC level and pin voltage of each driver stage need to be checked.

Function	Pin 12 VTG (DC)	Driver Pin (H→L)
Stop	1.0 ~ 1.4V	Pin 8, 9: High
Left Turn	1.0V↓ (Typ: 0.625V)	Pin 8
Right Turn	1.4V↑ (Typ: 1.875V)	Pin 9

4) Motor Noise Causing a Misoperation can be Eliminated as Below

Steering Motor

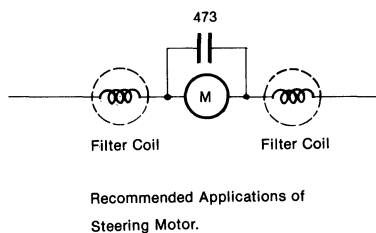


Fig. 15

Reel Motor

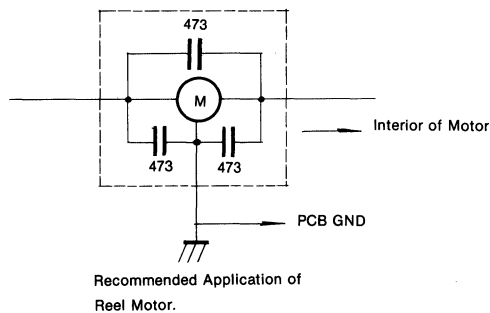


Fig. 16

KA2309 APPLICATION NOTE

- 5) When the device is applied with transmitter I.C. KA2310: Tx modulation frequency should be adjusted to center frequency of each operation mode (forward, backward, turbo) after checking the range of each functional frequency.

Function	KA2309 (RX)		KA2310 (TX) Modulation Frequency
	Frequency (Hz)	Pin 4 VTG (V)	
Backward	200 ~ 450	0.5 ~ 1.1	320Hz
Forward	510 ~ 650	1.3 ~ 1.7	580Hz
Turbo	700 ~ 950	1.8 ~ 2.3	820Hz

* Frequency range against KA2309 Pin 4 voltage changes in respect to surrounding time constant (R8, R9, C12). Therefore modulation frequency of Tx should be adjusted properly.

- 6) Each base resistor value of the steering motor driver stage and the reel motor driver stage should be set according to the type of the motor and operation voltage. If the values are too small, driver TR may be distracted by being overloaded. If it is large, performance of the driver inhibited.
- 7) If external driver TRs are not used properly according to voltage, current and the capacity of the motor, especially when they exceed Absolute Maximum Rating, driver TR can be distorded.

Recommended Driver TR

TR	I_c (max)	1A	2A	3A
PNP		B564A	A928A	B772
NPN		D471A	C2328A	D882

KA2311 APPLICATION NOTE

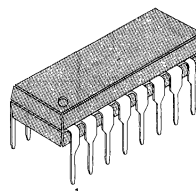
1. INTRODUCTION

The KA2311 is an integrated circuit designed for full function R/C toy car. This I.C. consists of a regulator, an amplifier, a frequency detector, a duty detector, a comparator and two stages of drivers.

The device operates on low voltage (3V) due to its structure requiring only minimum number of external parts and having 2.5V as regulator output. It is also free from any misoperation expected when power is switched ON/OFF. Built-in Turbo function is also available.

For a best performance, the device is recommended to be used with a transmitter I.C. KA2312.

16 DIP



2. BLOCK DIAGRAM & OPERATIONAL DESCRIPTION

2-1 BLOCK DIAGRAM

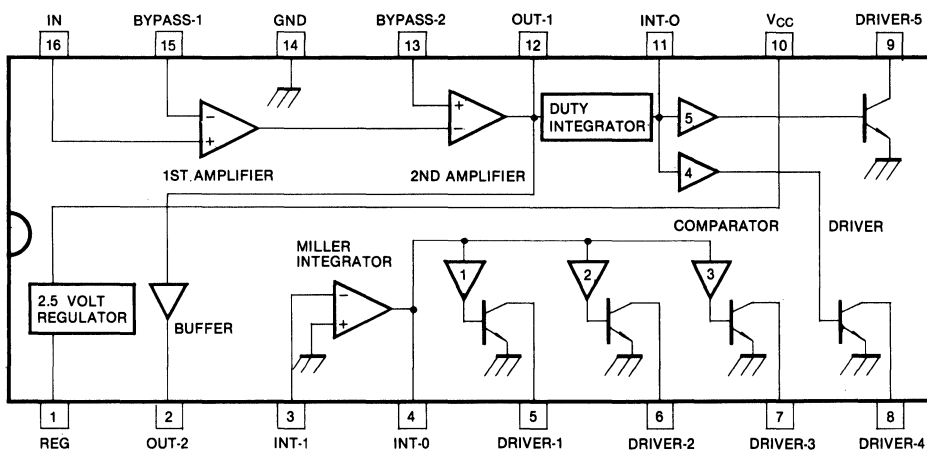
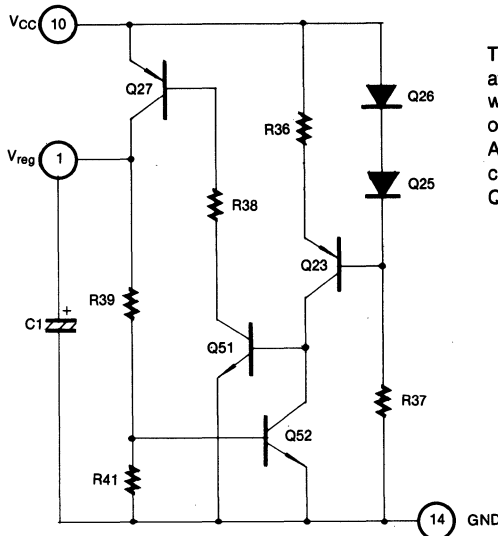


Fig. 1

KA2311 APPLICATION NOTE

2-2 OPERATIONAL DESCRIPTION

1) Regulator



The circuit is used as current biasing for super regeneration detector and other circuits. Constant 2.5V is always maintained in the circuit against changes in power or load, therefore stable characteristic is guaranteed. As a negative feedback, Q51-Q27-Q52 loop maintains continuous control action after being initiated by Q26-Q25-Q23.

Fig. 2

2) Amplifier

By amplifying the signal divided at the super regeneration detector, the signal can be separated into noise and functional signal at the detector.

Equivalent circuit of the 1st Amp

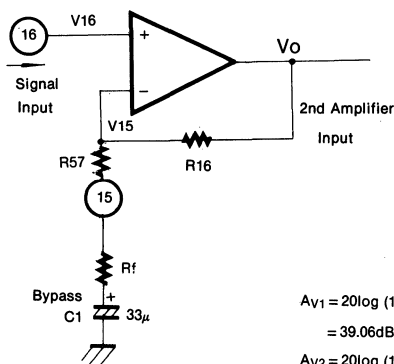


Fig. 3

Equivalent circuit of the 2nd Amp

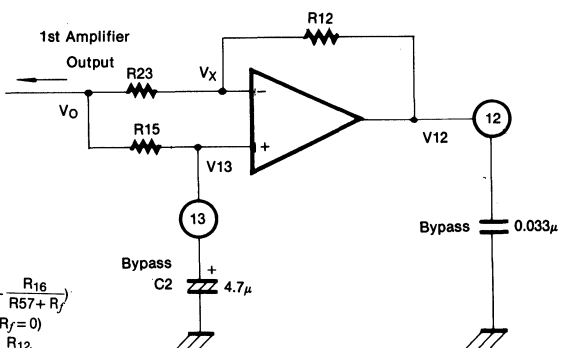


Fig. 4

$$A_{V1} = 20 \log \left(1 + \frac{R_{16}}{R_{57} + R_f} \right) = 39.06 \text{ dB} \quad (R_f = 0)$$

$$A_{V2} = 20 \log \left(1 + \frac{R_{12}}{R_{23}} \right) = 27.6 \text{ dB}$$

$$A_v = 20 \log |A_{V1}| + 20 \log |A_{V2}| = 39.06 + 27.6 = 66.66 \text{ dB}$$

KA2311 APPLICATION

Since the integrator has high gain, output can easily drift to '0' level. In order to prevent such a drift, large resistor R_{10} is connected between output and input. The integrator at low frequency is not affected by the R_{10} cut down R_{in} and R_{out} frequency is not affected. Therefore, impedance becomes higher than R_{in} becomes R_{out} through C_{12} should be $X_{C12} \ll R_{9}$. Generally $R_{9} \gg R_{10}$.

$$\frac{1}{2\pi f_c C_{12}} = \frac{R_9}{10}$$

$$f_c = \frac{10}{2\pi C_{12} R_9}$$

4) RC Integrator (Duty Dr

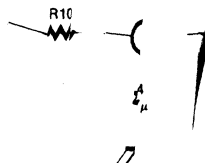


Fig. 6

Certain level of DC in respects generated by RC integrator waveform of RC serial circuit relies on the relationship between tiltant (CR) and pulse width (P circuit, a CR // (10 x PW), obtains output from both ends of the ca

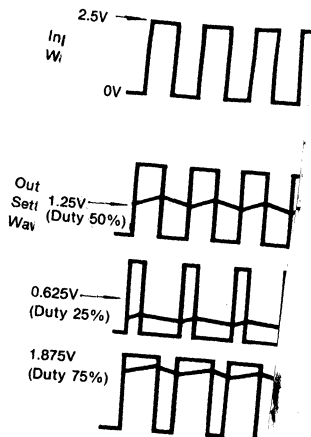


Fig. 7

KA2311 APPLICATION NOTE

Frequency Characteristic

(i) Low frequency characteristic is determined by R57, R15, and external C1 and C2.

$$f_L(1) = \frac{1}{2\pi \cdot R57 \cdot C1} \text{ (Hz)}$$

$$f_L(2) = \frac{1}{2\pi \cdot R15 \cdot C2} \text{ (Hz)}$$

For example, when lowest frequency of the signal to be amplified is 50Hz, C1 becomes larger than $17.7\mu\text{F}$ $\{1/(2\pi \times 50 \times 180)\}$.

(ii) High frequency is determined by the frequency characteristic of the amplifier. The 3dB cutoff frequency is,

$$f_H(1) = \frac{G.B}{2\pi \cdot Av1} \text{ (Hz)}$$

$$f_H(2) = \frac{G.B}{2\pi \cdot Av2} \text{ (Hz)}$$

*G.B = Avo·Wc Avo: open loop gain
Wc: -3dB corner frequency

3) Miller Integrator (Frequency Detector)

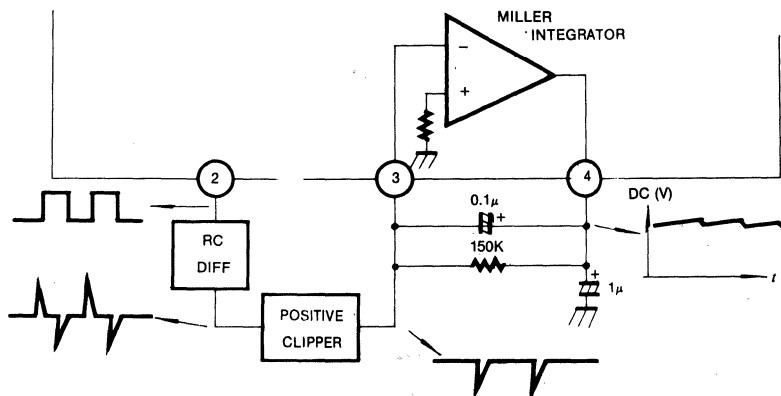


Fig. 5

The Miller Integrator converts functional signal into DC level. After Pin 2 square wave is differentiated to pass through positive clipper, only negative spikes remain. Therefore no matter what duty is, negative spike is generated with certain interval.

If functional signal (square wave) is not available, DC level of Pin 3 becomes more than zero and that of Pin 4 is kept nearly Ground. When the negative spike with certain interval is impressed on Pin 3, negative spike proportional to frequency is generated at Pin 4 to drive subsequential drive stage.

KA2311 APPLICATION NOTE

Since the integrator has high gain due to its structure, output voltage can easily drift from '0' level. In order to prevent such a drift, large resistor like R9 is connected between output and inverting input. The integrator at low frequency is not affected by the DC gain that is cut down by R9. If input frequency is too low that capacitance impedance becomes higher than R9, the integrator becomes disabled even though capacitor is not affected. Therefore, C12 should be $X_{c12} \ll R9$. Generally Xc12 is set at R9/10.

$$\frac{1}{2\pi f_L C12} = \frac{R9}{10}$$

$$f_L = \frac{10}{2\pi C12 R9}$$

4) RC Integrator (Duty Detector)

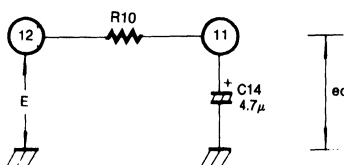


Fig. 6

Certain level of DC in respect to duty is generated by RC integrator. Output waveform of RC serial circuit relies on the relationship between time constant (CR) and pulse width (PW). This circuit, a CR // (10 × PW), obtains output from both ends of the capacitor.

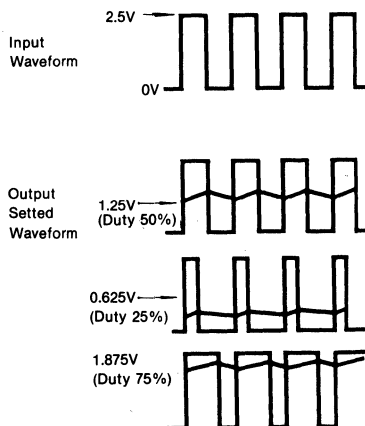


Fig. 7

KA2311 APPLICATION NOTE

5) Driver Stage

(1) Driver 1

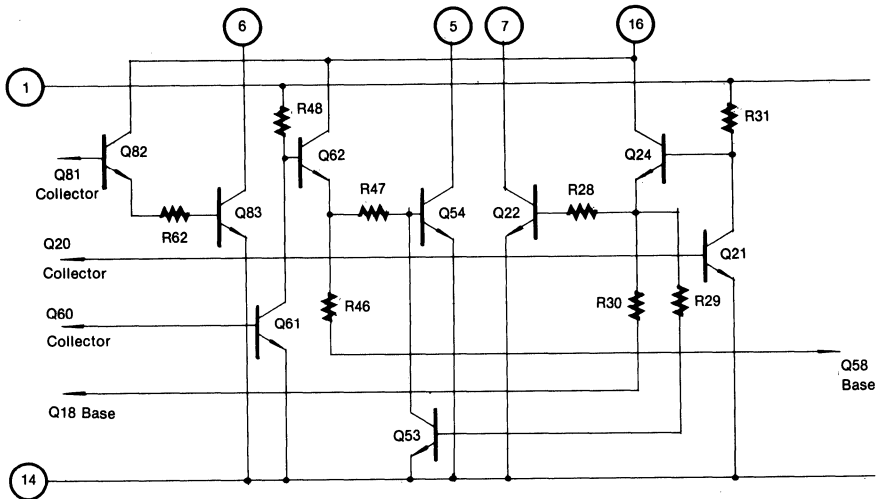


Fig. 8

- i) When Pin 4 DC level is 0.5-1.3V: Q61 is turned off Q62, Q54 and Q58 are turned on. So Pin 5 DC level becomes low.
- ii) When the DC level is 1.3-1.85V: Q21 is turned off. Q24, Q22, Q53, Q18 and Q58 are turned on. Q53 is turned on, Q54 becomes turned off and Pin 7 voltage becomes low.
- iii) When the DC level is above 1.85V: Q81 is turned off. Q82 and Q83 are turned on. Then Pin 6 and Pin 7 can not be operated at the same time, but Pin 7 operation is not disturbed owing to external application circuit. Q58 holds the operation of Driver 2 while Driver 1 is inhibited. In order words, Driver 2 is active only when operation of Driver 1 is determined.

(2) Driver 2

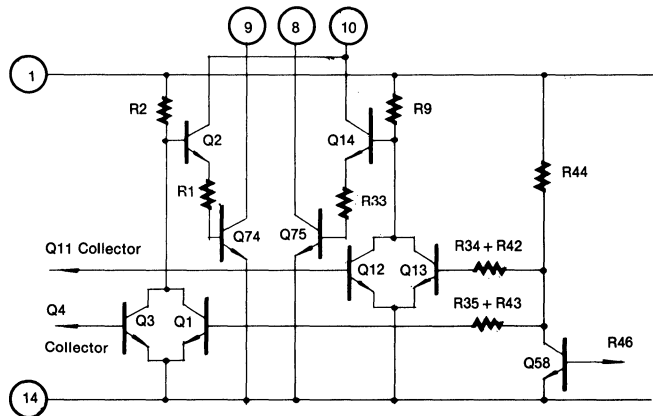


Fig. 9

Q1 and Q13 are turned off if Q58 connected with R46 is active. With 1.0 – 1.4V of Pin 11 voltage, Pin 8 and Pin 9 become high. However, Pin 11 voltage higher than $V_E(1.4V)$ turns off Q3 while Q2 and Q74 are turned on. On the other hand, Pin 11 voltage lower than $V_E(1.0V)$ turns off Q12 and turns on Q14 and Q75. As a result Pin 8 voltage becomes low.

When current sinking is 30mA, output terminal 5, 6, 7, 8 and 9 of both drivers is designed to be less than 1.2V respectively.

KA2311 APPLICATION NOTE

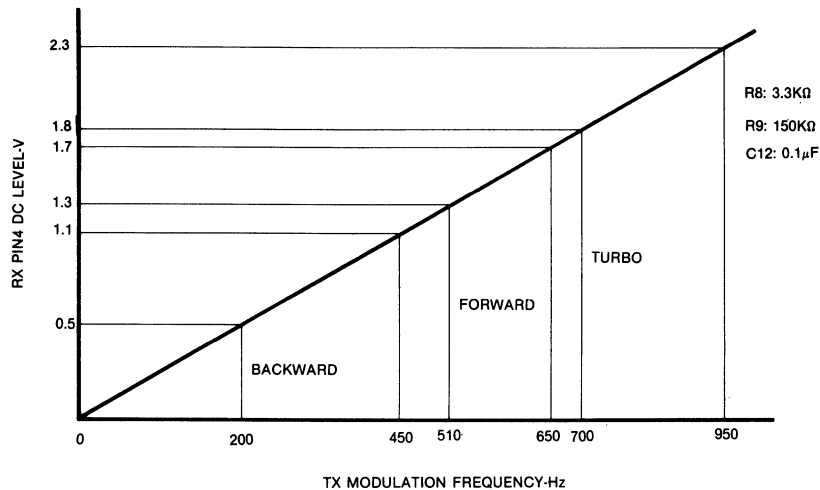


Fig. 11

Operation of each driver stage is determined by DC level of Pin 4.

- When the level is less than 0.5V (zero signal: Tx off): The driver stages stop functioning. Accordingly, transistors of the external driver stage are turned off. Therefore the Reel Motor STOPS.
- When the level is 0.5V-1.1V: Driver 1 is turned on (Pin 5 is low) while external driver transistors Q6, Q8, Q10 are turned on. Therefore the Reel Motor turns BACKWARD.
- When the level is 1.1V-1.7V: Driver 3 is turned on (Pin 7 is low) and external driver transistors Q7, Q9, Q11 are turned on. Therefore the Reel Motor turns FORWARD.
- When the level is above 1.8V. Driver 2 is turned on (Pin 6 is low) and active Driver 3 turns on driver transistors Q7, Q9, Q12, Q11 on. Therefore the Reel Motor repeats Forward or Turbo function.

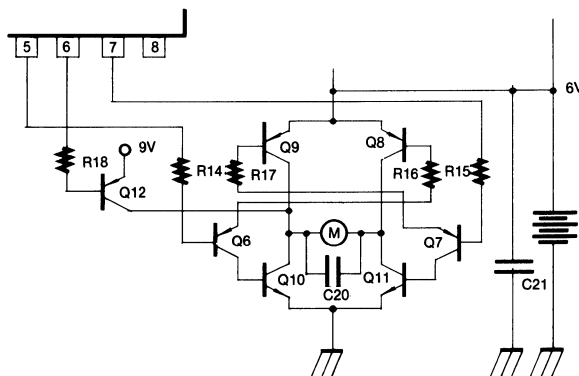


Fig. 12

KA2311 APPLICATION NOTE

The amplified functional signal fed to RC integrator is converted into DC level proportional to duty.

- Duty = 50%: DC level of Pin 11 becomes approximately 1.25V. So driver 4 & 5 are disabled. Accordingly external steering motor driver TR is turned off. Therefore the Steering Motor STOPS.
- Duty = 25%: Driver 4 is active if DC level of Pin 11 is approximately 0.625V (Pin 8 is low). Then external driver TRs Q2 and Q4 are turned on. Therefore the steering motor turns LEFT.
- Duty = 75%: Driver 5 is active when DC level of Pin 11 is approximately 1.875V (Pin 9 is low). TRQ3 and Q5 are turned on. Therefore the steering motor turns RIGHT.

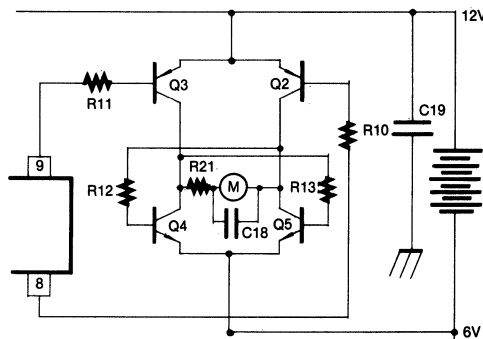


Fig. 13

4. REMARK

1) Adjustment of Receiver Sensitivity

Pin 12 square wave of the amplifier output terminal should adjust L1 and C2 resonance circuit of super regeneration receiver to an optimum point where waveform is free from noise.



Fig. 14

KA2311 APPLICATION NOTE

2) Operational Mode (Forward, Backward, Turbo) Check

Pin 4 DC level and pin voltage of each driver stage need to be checked.

Function	Pin 4 VTG (DC)	Driver Pin (H→L)
Stop	0.5V↓	Pin 5, 6, 7: High
Backward	0.5 ~ 1.1V	Pin 5
Forward	1.3 ~ 1.7V	Pin 7
Turbo	1.8V↑	Pin 6

3) Left-Turn and Right Turn

Pin 12 DC level and pin voltage of each driver stage need to be checked.

Function	Pin 12 VTG (DC)	Driver Pin (H→L)
Stop	1.0 ~ 1.4V	Pin 8, 9: High
Left Turn	1.0V↓ (Typ: 0.625V)	Pin 8
Right Turn	1.4V↑ (Typ: 1.875V)	Pin 9

4) Motor Noise Causing a Misoperation can be Eliminated as Below

Steering Motor

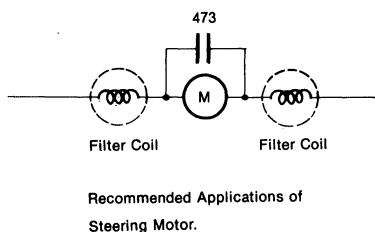


Fig. 15

Reel Motor

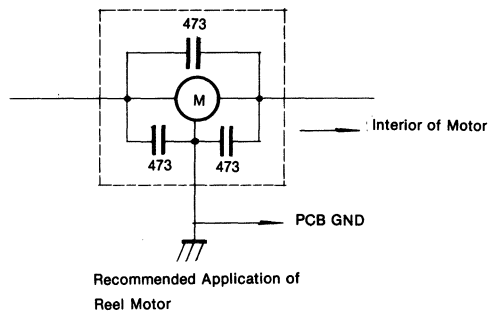


Fig. 16

KA2311 APPLICATION NOTE

- 5) When the device is applied with transmitter I.C. KA2312 Tx modulation frequency should be adjusted to center frequency of each operation mode (forward, backward, turbo) after checking the range of each functional frequency.

Function	KA2311 (RX)		KA2312 (TX) Modulation Frequency
	Frequency (Hz)	Pin 4 VTG (V)	
Backward	200 ~ 450	0.5 ~ 1.1	320Hz
Forward	510 ~ 650	1.3 ~ 1.7	580Hz
Turbo	700 ~ 950	1.8 ~ 2.3	820Hz

* Frequency range against KA2311 Pin 4 voltage changes in respect to surrounding time constant (R8, R9, C12). Therefore modulation frequency of Tx should be adjusted properly.

- 6) Each base resistor value of the steering motor driver stage and the reel motor driver stage should be set according to the type of the motor and operation voltage. If the values are too small, driver TR may be distracted by being overloaded. If it is large, performance of the driver inhibited.

If external driver TRs are not used properly according to voltage, current and the capacity of the motor, especially when they exceed Absolute Maximum Rating, driver TR can be distoryed.

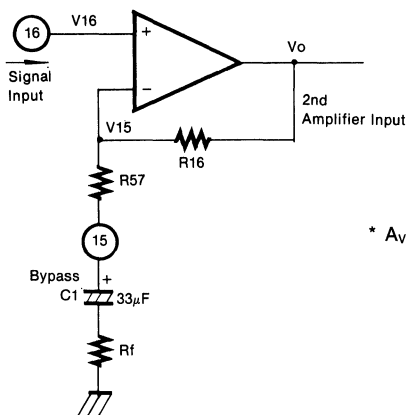
7) Recommended Driver TR

TR \ I_c (max)	1A	2A	3A
PNP	B564A	A928A	B772
NPN	D471A	C2328A	D882

KA2311 APPLICATION NOTE

8) AMP GAIN

Equivalent circuit of the 1st Amp



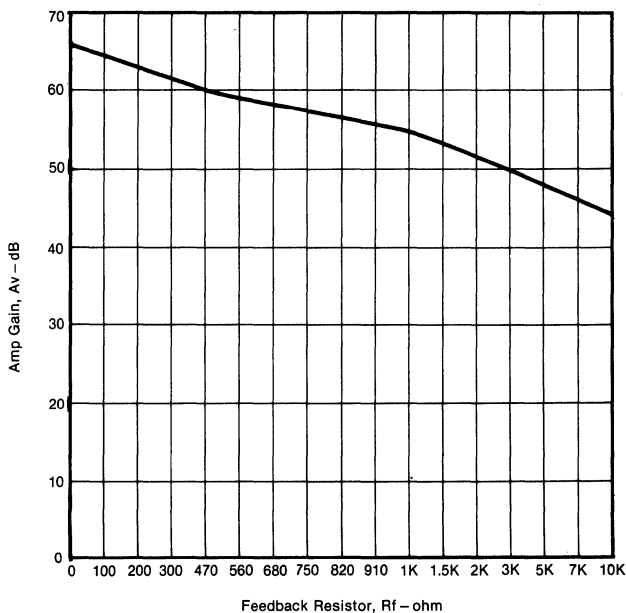
The gain of amp stage can be controlled with insertion of a external resistor in tandem.

Because the amp stage of the KA2311 is high and the value of reference voltage is low, it is necessary that the gain should be adjusted with insertion of a feedback resistor in order to get a stable operation characteristics. (Without using R_f resistor, malfunction would appear. Accordingly R_f must be used with the value of 1Kohm recommended.)

$$* A_v = 20 \log \left(1 + \frac{R_{16}}{R_{57} + R_f} \right)$$

The graph of Amp Gain according to the value of feedback resistors is as follows;

($A_v - R_f$)



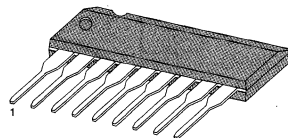
KA2312 APPLICATION NOTE

1. INTRODUCTION

The KA2312 is an integrated circuit designed for transmitter of full function R/C toy car which consists of a pulse generator, pulse width controller, modulator, TX signal osc, and high frequency amp.

The KA2312 TX IC is used as one kit with the KA2311 RX IC. The main application is a TX set of full function R/C toy car or some other kinds of TX for R/C toy car.

9 SIP



2. BLOCK DIAGRAM & OPERATIONAL DESCRIPTION

2-1 BLOCK DIAGRAM

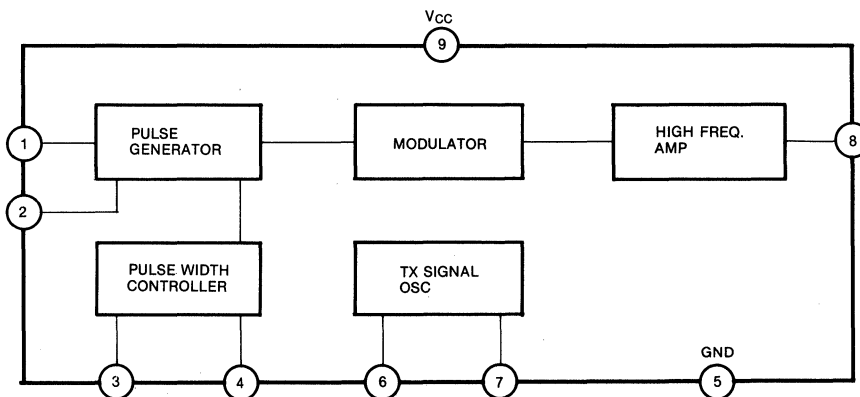


Fig. 1

KA2312 APPLICATION NOTE

2-2. OPERATIONAL DESCRIPTION

1) PULSE GENERATOR

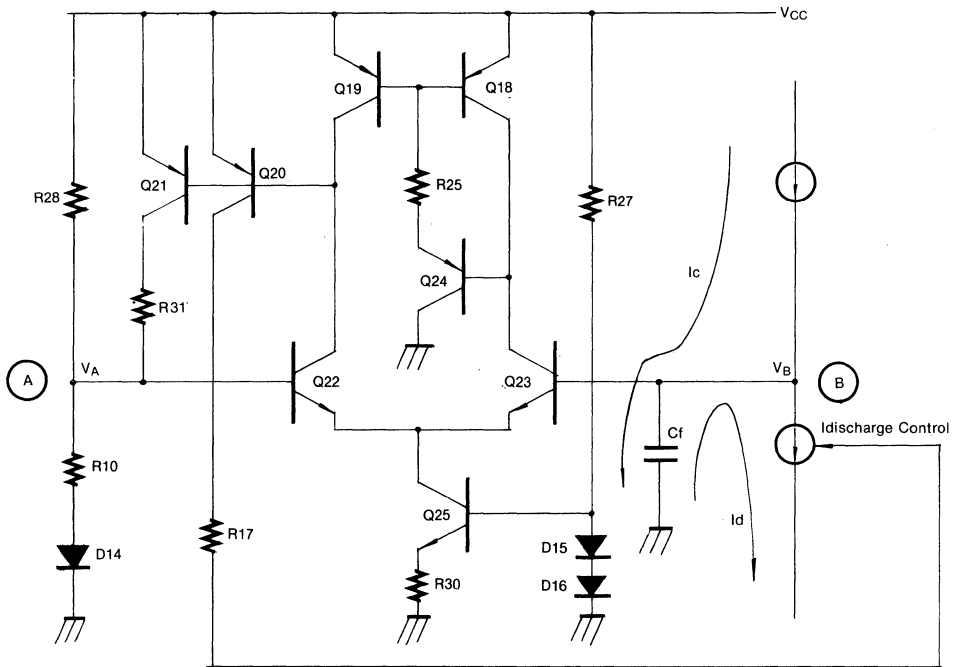
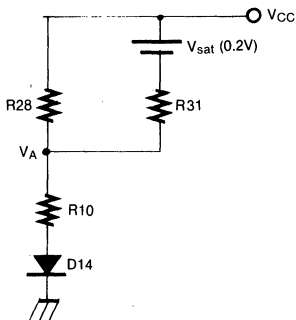


Fig. 2

The capacitor C_f charges or discharges according to the state of node A and B.

1. Charge

When V_A is larger than V_B , Q22 turns ON and Q23 turns OFF, and at this moment Q21 is saturated ($V_{sat} = 0.2V$).



To calculate the voltage value of node A, V_A is as follows:

$$V_A = V_{d14} + \frac{R10}{R10 + R28/R31} \times (V_{CC} - 0.7) \\ = 0.7 + 5.01 = 5.71V$$

Where $V_{sat} = 0.2V$ is neglected.

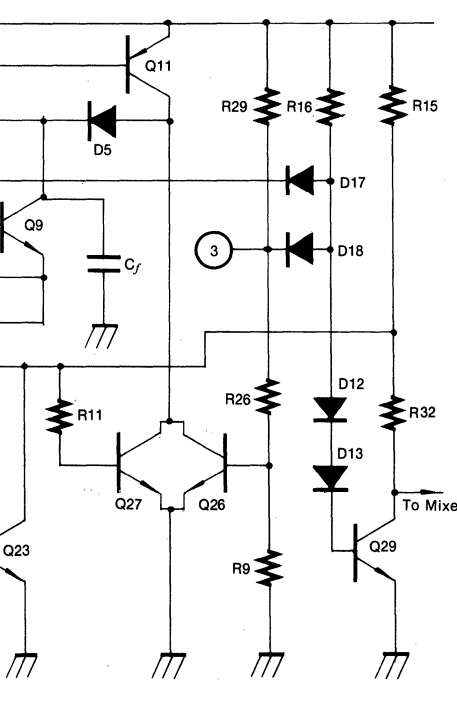
At this time, Q20 makes the discharge control terminal turn off and the charge.

FF according as the charge voltage of capacitor 1

FF according as the charge voltage of capacitor is control terminal ON, at last currents charged on the

than 3.49V, then Q22 turns ON and Q23 OFF. There

urrent mirror in which the collector current of Q3 is



KA2312 APPLICATION NOTE

Collector currents of current mirror of Q2, Q4, Q10, Q11 in the above circuit are as follows:

$I_c(Q2): I_{ref}$
 $I_c(Q4): 2 I_{ref}$
 $I_c(Q10): I_{ref}$
 $I_c(Q11): 2 I_{ref}$

1. DUTY 50% (Charge:Discharge = 50:50)

Condition: Pin 3 = GND
Pin 4 = GND

1. Charge Current

In case of Q20 ON, Vx become high state.

When pin 3, pin 4 is connected to the GND, Q5 and Q26 turns OFF.

The high state of Vx makes Q6, Q28 become in saturation and then Q28 is saturated and Q7, Q27, OFF.

Therefore the charge current of Cf at node B is as follows:

$$I_{charge} = I_c(Q10) + I_c(Q11) = I_{ref} + 2 I_{ref} = 3 I_{ref}$$

at this time, $I_c(Q4)$ flow through Q6, but $I_c(Q10)$ can not flow because Q7 is OFF

2. Discharge Current.

When Q20 turns OFF because of voltage increase above 5.71V.

Vx falls low state, and when Vx low, then Q6 and Q28 OFF.

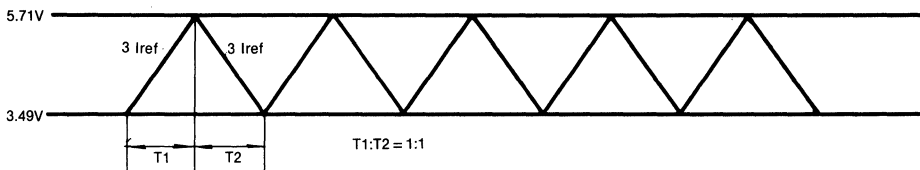
When Q28 turns OFF, Q7 and Q27 ON.

At this moment, the discharge current is as follows:

$$I_{discharge} = I_c(Q4) + I_c(Q10) = 2 I_{ref} + I_c(Q10) = 3 I_{ref}$$

Therefore, it is obvious that charge current equals discharge current.

$$I_{charge} = I_{discharge} \text{ (Duty 50\%)}$$



2. DUTY 25% (Charge:Discharge = 75:25)

Condition: Pin 3 = Open
Pin 4 = GND

1. Charge Current

*Q20 ON: Vx High

*Q26 turns ON in pin 3 open state and $I_c(Q11)$ flows through Q26.

$$I_{charge} = I_c(Q4) + I_c(Q10) = I_{ref}$$

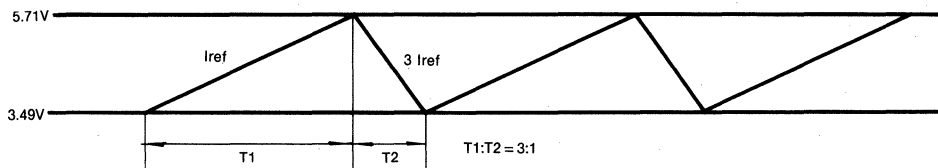
2. Discharge Current

*Q20 OFF: Vx Low

$$I_{discharge} = I_c(Q4) + I_c(Q10) = 2 I_{ref} + I_{ref} - 3 I_{ref} = I_{ref}$$

$$\therefore I_{charge} = I_{discharge} \text{ (Duty 25\%)}$$

KA2312 APPLICATION NOTE



3. DUTY 75% (Charge:Discharge = 25:75)

Condition: Pin 3 = GND
Pin 4 = Open

1. Charge Current

*Q20 ON: V_x High

*Q5 turns ON in pin 4 open state and I_c (Q4) flows through Q5.

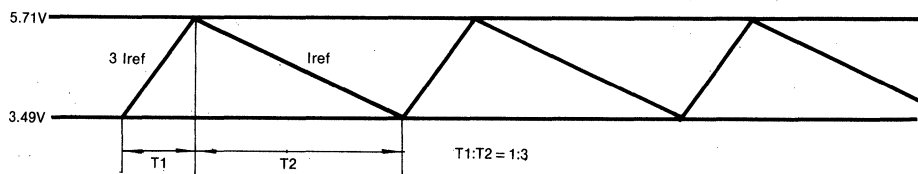
* $I_{charge} = I_c(Q10) + I_c(Q11) = I_{ref} + 2 I_{ref} = 3 I_{ref}$

2. Discharge Current

*Q20 OFF: V_x Low

* $I_{discharge} = I_c(Q10) = I_{ref}$

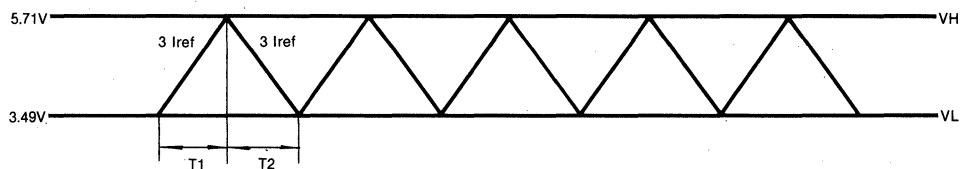
∴ $I_{charge} = 3 I_{discharge}$ (Duty 75%)



4. Pulse Generator Frequency

Condition: V_{CC} = 9V, R_f = 33K Ω , C_f = 0.047 μ F

1. Duty 50%



KA2312 APPLICATION NOTE

$$Q = CV, Q = IT$$

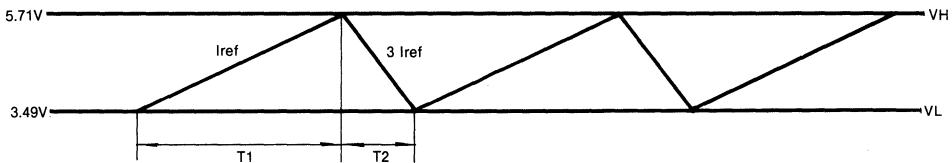
$$\therefore T = \frac{CV}{I}$$

$$\therefore T_1 = \frac{(V_H - V_L)}{3 I_{ref}} C = \frac{(5.71 - 3.49)}{3 \times 285 \mu A} 0.047 \mu F = 1.22 \times 10^{-4} \text{ Sec}$$

$$T_2 = \frac{(V_H - V_L)}{3 I_{ref}} C = \frac{(5.71 - 3.49)}{3 \times 285 \mu A} 0.047 \mu F = 1.22 \times 10^{-4} \text{ Sec}$$

$$\therefore f = \frac{1}{T} = \frac{1}{T_1 + T_2} = \frac{1}{2.44 \times 10^{-4}} = 4.098 \text{ KHz}$$

2. Duty 25%



$$T_1 = \frac{(5.71 - 3.49)}{285 \mu A} 0.047 \mu F = 3.661 \times 10^{-4} \text{ Sec}$$

$$T_2 = \frac{(5.71 - 3.49)}{3 \times 285 \mu A} 0.047 \mu F = 1.22 \times 10^{-4} \text{ Sec}$$

$$\therefore f = \frac{1}{T} = \frac{1}{T_1 + T_2} = \frac{1}{(3.661 + 1.22) \times 10^{-4}} = 2.049 \text{ KHz}$$

KA2312 APPLICATION NOTE

3. Duty 75%

$$f = \frac{1}{T} = \frac{1}{T_1 + T_2} = \frac{1}{(1.22 + 3.661) \times 10^{-4}} = 2.049 \text{ KHz}$$

In the case of Duty = 50%, the frequency double compared with that of 25%, 75%. Therefore one more capacitor must be connected in parallel to use properly in a application circuit.

If so, the frequency of Duty=50% equals that of 25% or 75%.

3) RF OSCILLATOR AND RF AMP

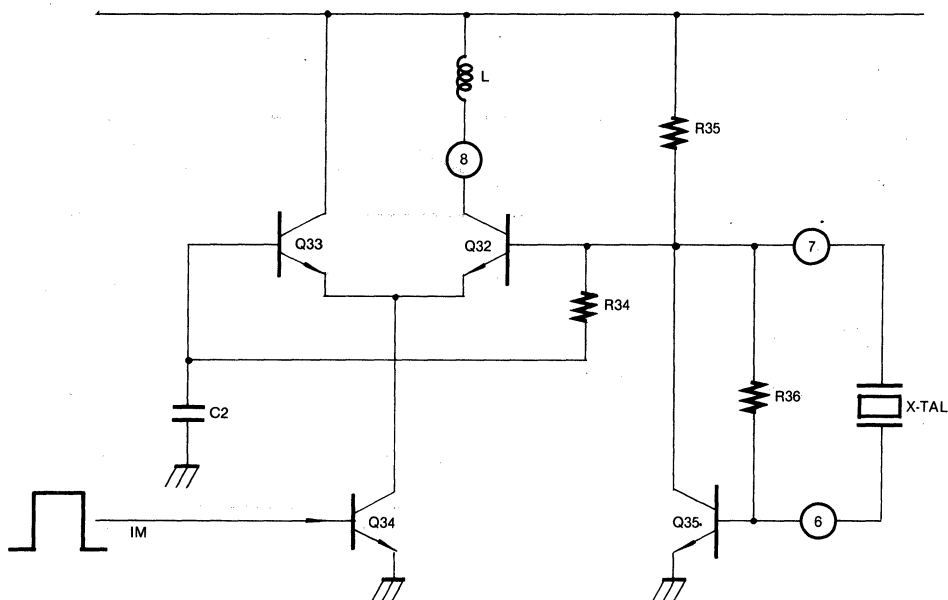


Fig. 4

'RF oscillator circuit is constituted easily by Q35, R35, R36.

27MHz high frequency is amplified by Q33 and the amplified high frequency is outputted through pin 8 when 27MHz X-TAL is external connected across pin 6 and pin 7.

Collector current through Q33 is controlled by Q34.

While IM flows into the base of Q34 by the signal made by pulse generator, RF signal oscillated from X-TAL is amplified and outputted through pin 8. On the contrary when IM doesn't flow, Q34 turns OFF, therefore RF signal is not outputted owing to Q33 OFF also.

KA2312 APPLICATION NOTE

4) WAVEFORM OF INDIVIDUAL BLOCK

Condition: $V_{CC} = 9V$, Pin 3 = Open, Pin 4 = GND (Duty = 25%)

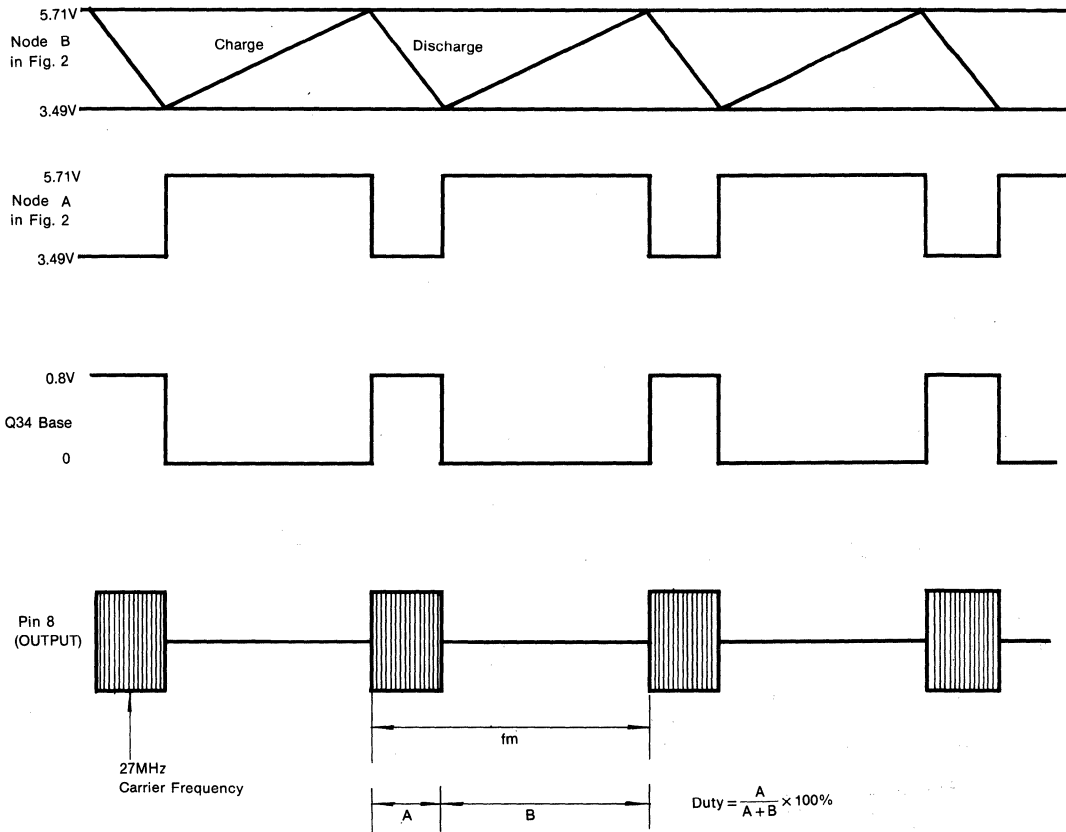


Fig. 5

27MHz signal is outputted when the capacitor connected between pin 2 and GND discharges.

KA2312 APPLICATION NOTE

3. APPLICATION CIRCUIT AND DESCRIPTION

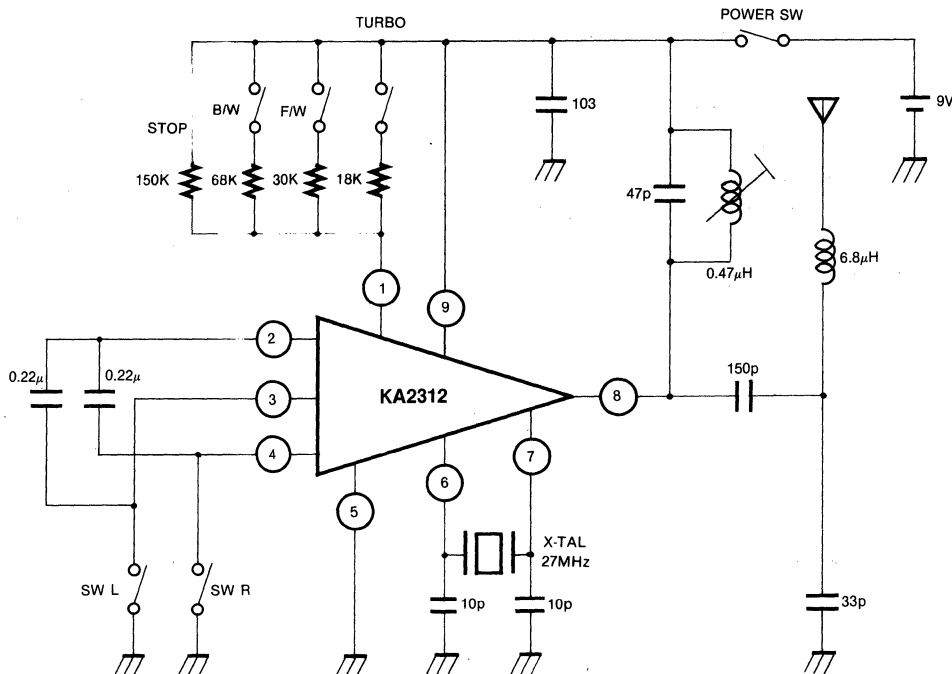
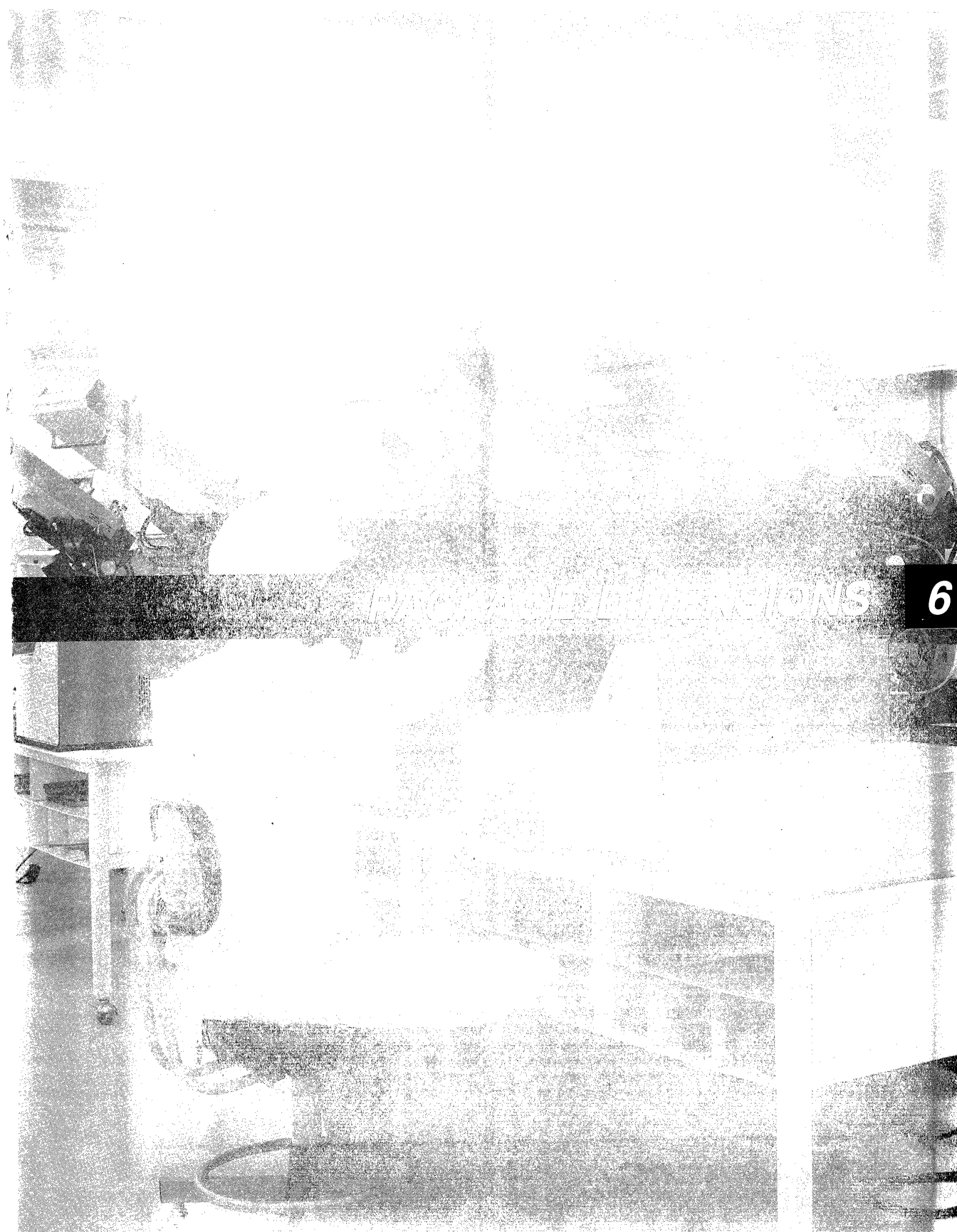


Fig. 6

Modulation frequency is determined by both external resistor of pin 1 and capacitor of pin 2. Therefore the modulation frequency according to their functions depends on the resistor of pin 1. Duty percent is determined by pin 3, pin 4 and when both pin 3, pin 4 are GND, Duty percent is 50%. When pin 3 open and pin 4 GND, Duty 25%. When pin 3 GND and pin 4 open, then Duty percent becomes 75%. In the case of both pin 3, pin 4 GND, the modulation frequency appears double value compared with that of Duty 25% or 75%. In order to obtain the same value of frequency, for this reason, the external same capacitor must be connected in parallel to the pin 2. X-TAL, which has the equal value of the desired RF signal, must be connected between pin 6 and pin 7. When 27MHz X-TAL is used, 10pF capacitor should be connected between both pins and GND, but when 49MHz X-TAL, 10pF capacitor may be connected between pin 6 and GND. Through these preparations, when the desired signal is made completely then outputted through pin 8. Output level of pin 8 can be optimized by controlling the tank coil between pin 8 and V_{CC} .

4. ATTENTION FOR PROPER USAGE

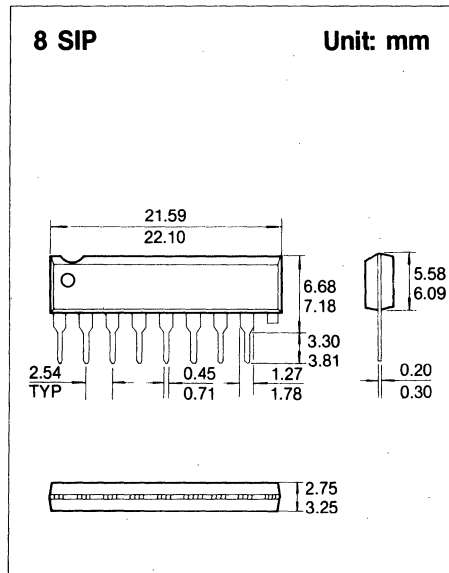
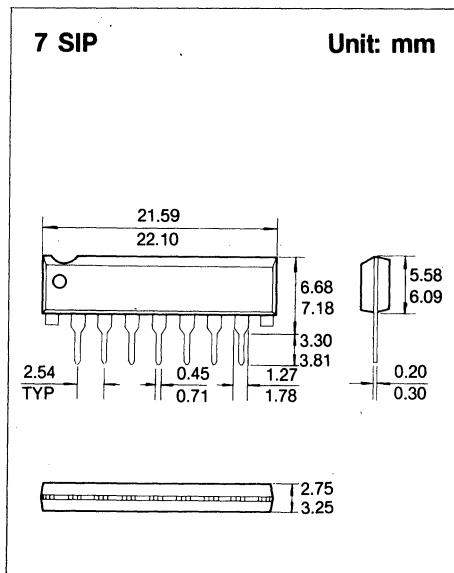
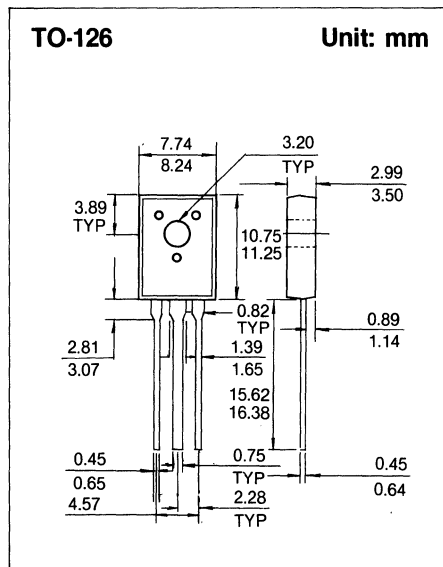
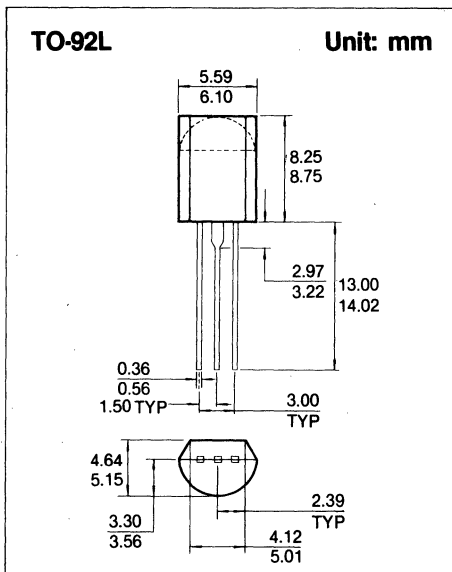
- 1) It is desirable that the lowest error capacitor connected to pin 2 should be used in order to get the stable modulation frequency characteristics. (below $\pm 2\%$ recommended)
Mylar capacitor is better than electrolytic capacitor in characteristics. If a high error capacitor is used, the deviation of modulation frequency appears severe according to the individual device.
- 2) In case that the transmitted signal was over the occupied bandwidth (20KHz/Max) of FCC standard, the modulation frequency should be lowered and used.
- 3) In the event of mismatching impedance between the external transmitter ANT and output circuit, duty cycle may be changed. At this event, it is necessary that the choke coil, which is connected to the TX ANT in tandem, should be changed to another one.
(27MHz – 6.8 μ H, 49MHz – 2.2 μ H recommended).



PACKAGE DIVERSIONS

6

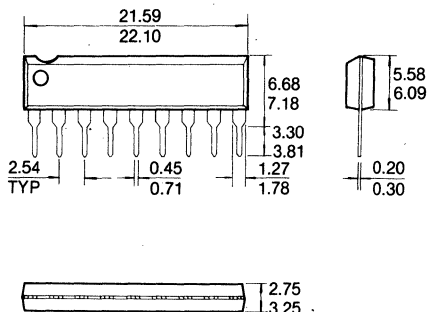
PACKAGE DIMENSIONS



PACKAGE DIMENSIONS

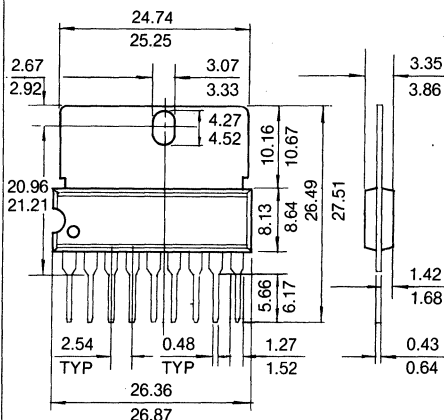
9 SIP

Unit: mm



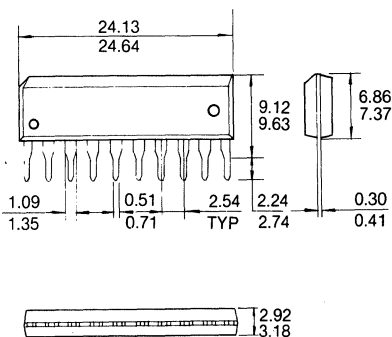
9 SIP H/S

Unit: mm



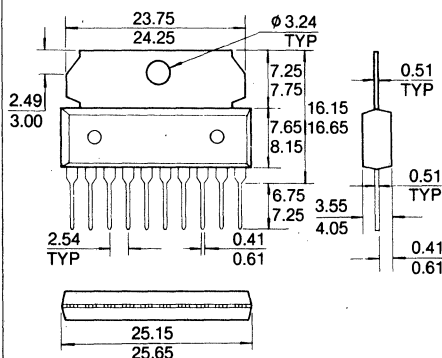
10 SIP

Unit: mm



10 SIP H/S

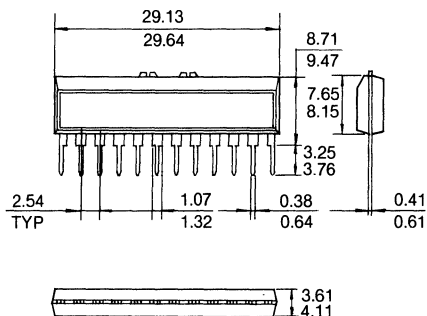
Unit: mm



PACKAGE DIMENSIONS

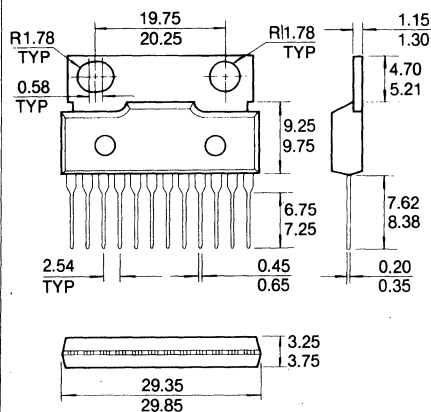
12 SIP

Unit: mm



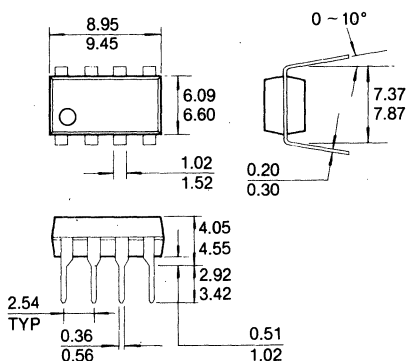
12 SIP H/S

Unit: mm



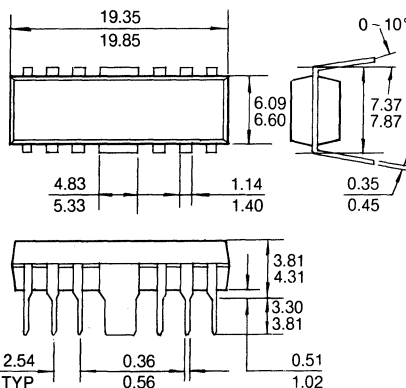
8 DIP

Unit: mm



12 DIP/F

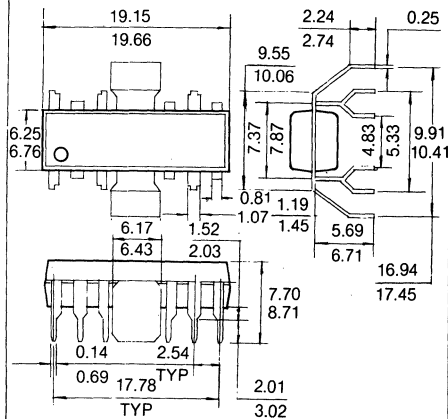
Unit: mm



PACKAGE DIMENSIONS

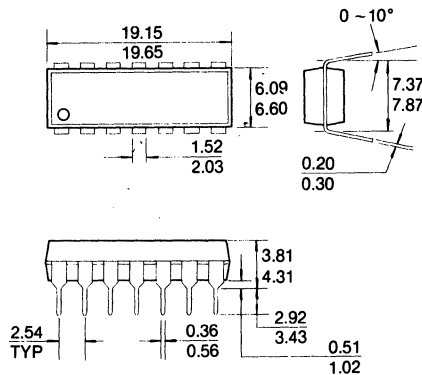
12 ZDIP/F

Unit: mm



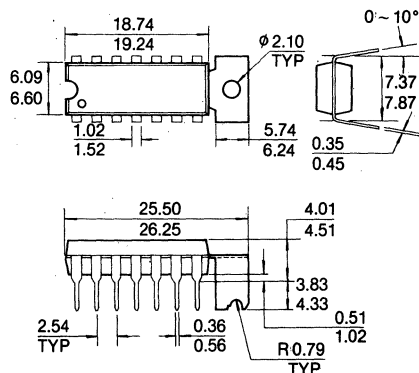
14 DIP

Unit: mm



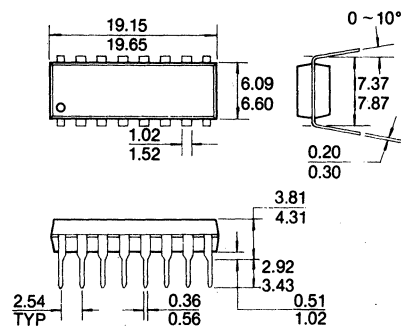
14 DIP H/S

Unit: mm



16 DIP

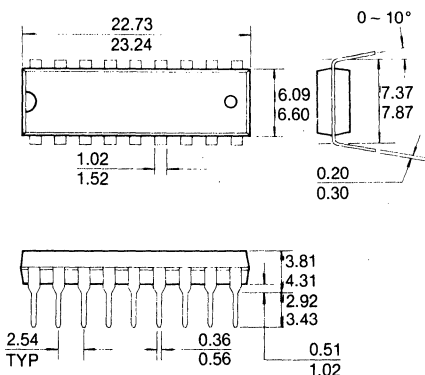
Unit: mm



PACKAGE DIMENSIONS

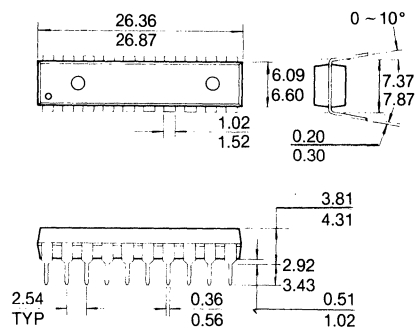
18 DIP

Unit: mm



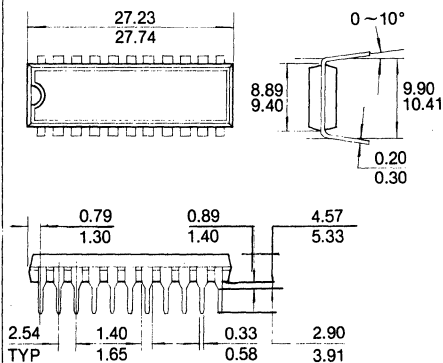
20 DIP

Unit: mm



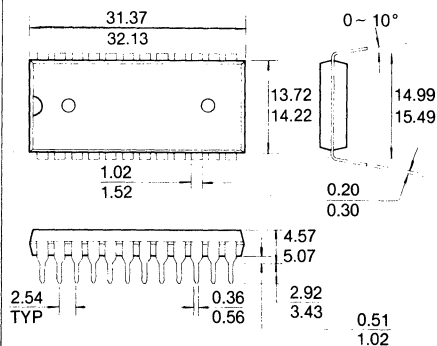
22 DIP (400)

Unit: mm

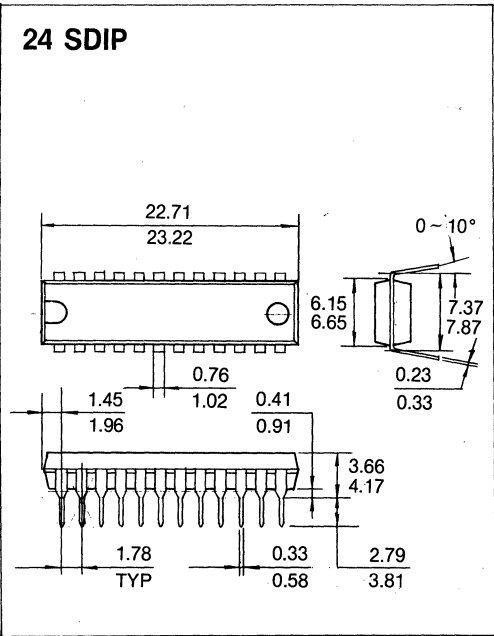
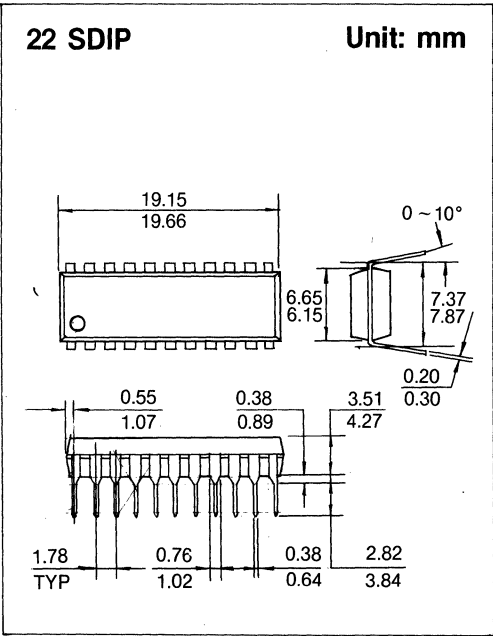
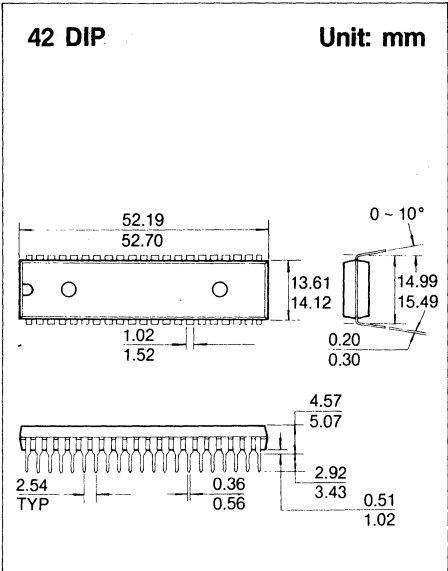
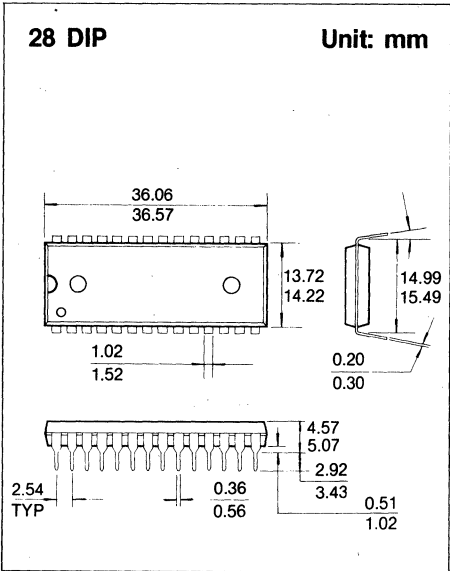


24 DIP

Unit: mm



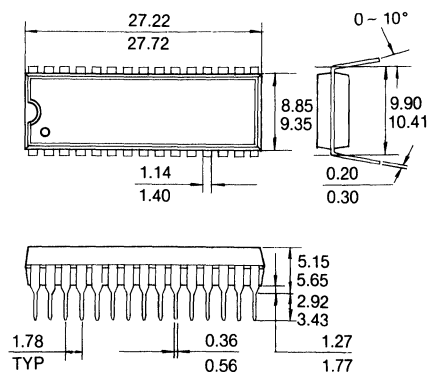
PACKAGE DIMENSIONS



PACKAGE DIMENSIONS

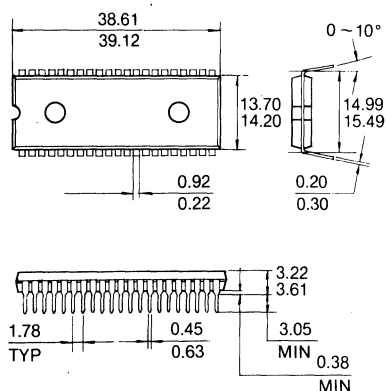
30 SDIP

Unit: mm



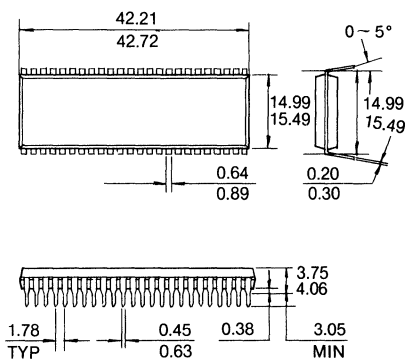
42 SDIP

Unit: mm



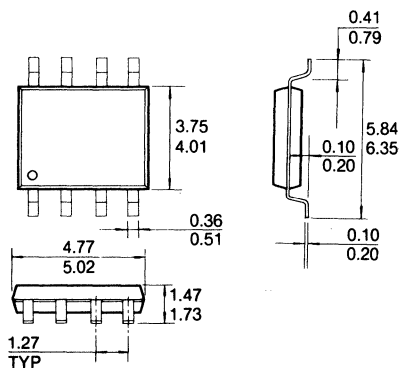
48 SDIP

Unit: mm



8 SOP

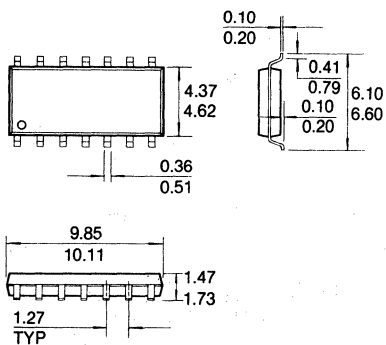
Unit: mm



PACKAGE DIMENSIONS

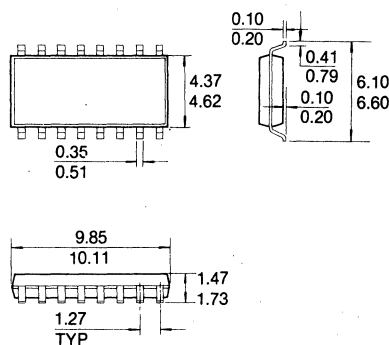
14 SOP

Unit: mm



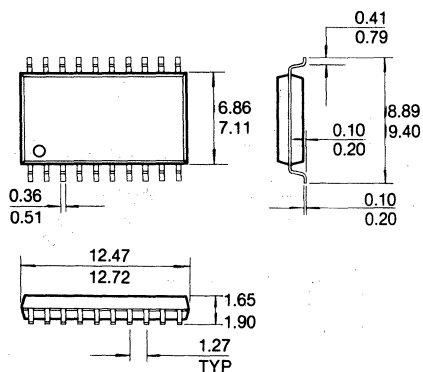
16 SOP

Unit: mm



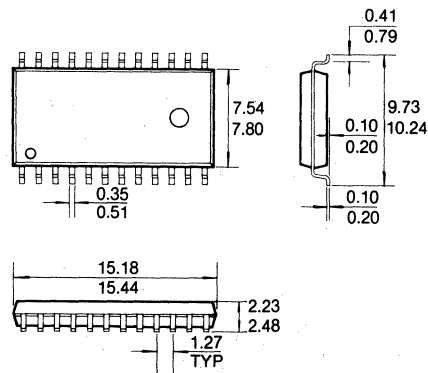
20 SOP

Unit: mm

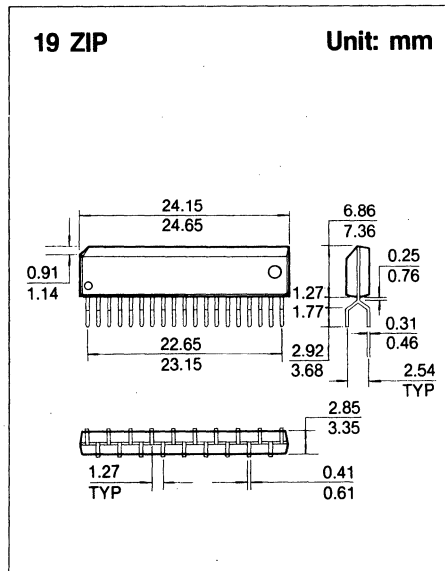
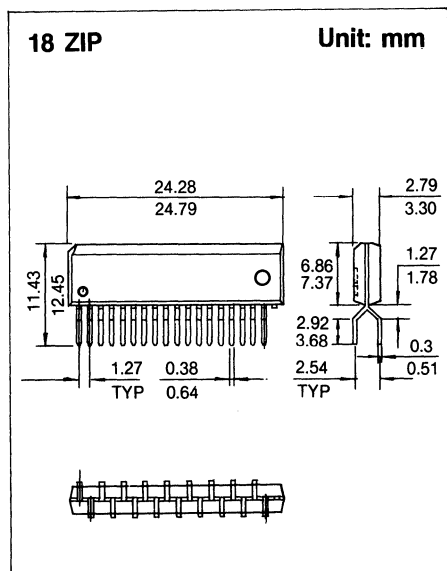
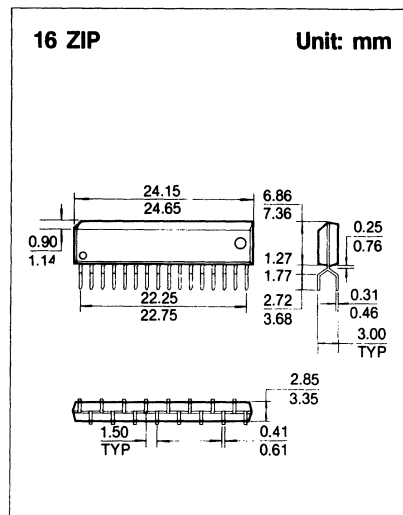
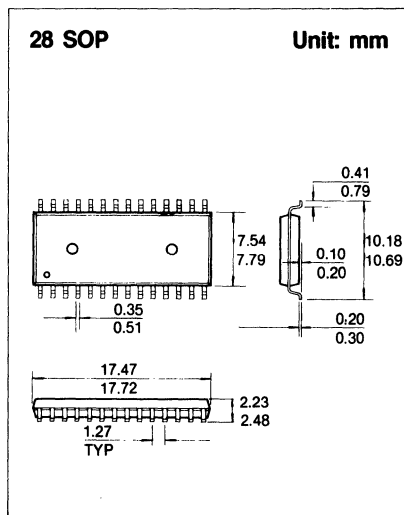


24 SOP

Unit: mm



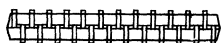
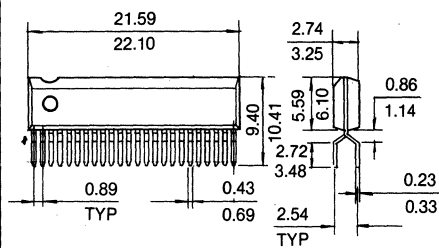
PACKAGE DIMENSIONS



PACKAGE DIMENSIONS

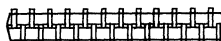
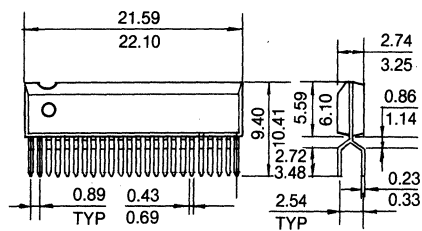
24 SZIP

Unit: mm



24 ZIP

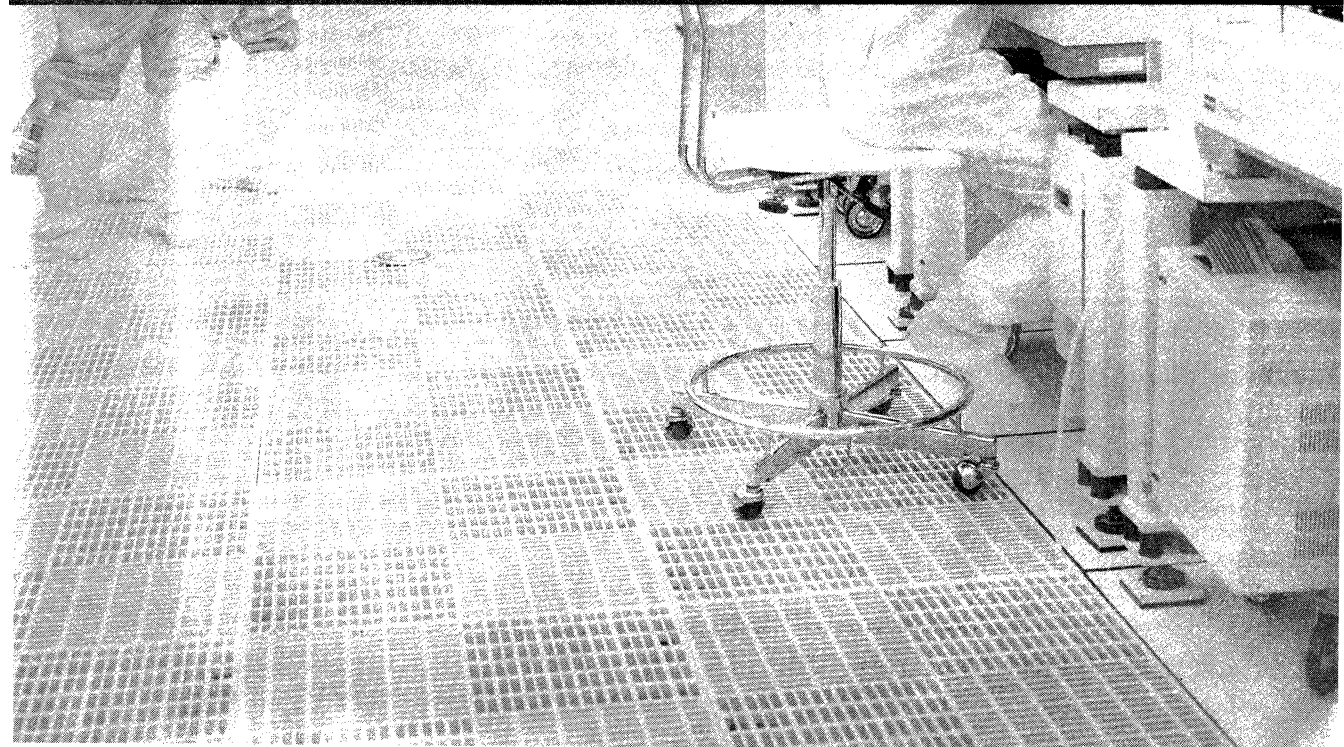
Unit: mm





**SALES OFFICES and MANUFACTURER'S
REPRESENTATIVES**

7



SAMSUNG SEMICONDUCTOR SALES OFFICES - U.S.A.

CALIFORNIA	ILLINOIS	MASSACHUSETTS	TEXAS
22837 Ventura Blvd. Suite 305 Woodland Hills, CA 91367 (818) 346-6416 FAX: (818) 346-6621	2700 Augustine Drive Suite 198 Santa Clara, CA 95054 (408) 727-7433 FAX: (408) 727-5071	901 Warrenville Road Suite 120 Lisle, IL 60532-1359 (312) 852-2011 FAX: (312) 852-3096	20 Burlington Mall Road Suite 205 Burlington, MA 01803 (617) 273-4888 FAX: (617) 273-9363
			15851 Dallas Parkway Suite 745 Dallas, TX 75248-3307 (214) 239-0754 FAX: (214) 392-4624

SAMSUNG SEMICONDUCTOR REPRESENTATIVES

U.S.A. and CANADA

ARIZONA

HAAS & ASSOC. INC. TEL: (602) 998-7195
77441 East Butherus Drive FAX: (602) 998-7869
Suite 300
Scottsdale, AZ 85260

CALIFORNIA

QUEST REP INC. TEL: (619) 565-8797
9444 Farnham St. FAX: (619) 565-8990
Suite 107
San Diego, CA 92123

SYNPAC TEL: (408) 988-6988
3945 Freedom Circle FAX: (408) 988-5041
Suite 650
Santa Clara, CA 95054

WESTAR REP COMPANY TEL: (714) 832-3325
2472 Chambers Road FAX: (714) 832-7894
Suite 100
Tustin, CA 92680

WESTAR REP COMPANY TEL: (213) 539-2156
25202 Crenshaw Blvd. FAX: (213) 539-2564
Suite 217
Torrance, CA 90505

CANADA

TERRIER ELEC. TEL: (416) 622-7558
145 The West Mall FAX: (416) 626-1035
Etobicoke, Ontario, Canada
M9C 1C2

TERRIER ELEC. TEL: (604) 433-0159
3700 Gilmore Way, 106A FAX: (604) 430-0144
Burnaby, B.C., Canada
V5G 4M1

TERRIER ELEC. TEL: (514) 695-4421
6600 Transcanadienne FAX: (514) 695-3295
Suite 750-17
Pointe Claire, Quebec, Canada
H9R 452

COLORADO

CANDAL INC. TEL: (303) 935-7128
7500 West Mississippi Ave. FAX: (303) 935-7310
Suite A-2
Lakewood, CO 80226

CONNECTICUT

PHOENIX SALES TEL: (203) 496-7709
257 Main Street FAX: (203) 496-0912
Torrington, CT 06790

FLORIDA

MEC TEL: (305) 426-8944
700 W. Hillsboro Blvd. FAX: (305) 426-8799
Bldg. 4, Suite 204
Deerfield Beach, FL 33441

MEC TEL: (407) 332-7158
511 Carriage Road FAX: (407) 773-1100
Indian Harbour Beach, FL 32937

MEC TEL: (407) 799-0820
830 North Atlantic Blvd. FAX: (407) 799-0923
Suite B401
Cocoa Beach, FL 32931

MEC TEL: (813) 522-3433
1001 45th, N.E. FAX: (813) 522-3993
St. Petersburg, FL 33703

ILLINOIS

IRI TEL: (312) 967-8430
8430 Gross Point Road FAX: (312) 967-5903
Skokie, IL 60076

INDIANA

STB & ASSOC. INC. TEL: (317) 844-9227
3003 E. 96th St. FAX: (317) 844-1904
Suite 102
Indianapolis, IN 46240

MARYLAND

ADVANCED TECH SALES TEL: (301) 789-9360
809 Hammonds Ferry Rd. FAX: (301) 789-9364
Suite D
Linthicum, MD 21090

MASSACHUSETTS

NEW TECH SOLUTIONS, INC. TEL: (617) 229-8888
111 South Bedford Street FAX: (617) 229-1614
Suite 102
Burlington, MA 01803

MICHIGAN

JENSEN C.B. TEL: (313) 643-0506
2145 Crooks Rd. FAX: (313) 643-4735
Troy, MI 48084

MINNESOTA

IRI
1120 East 80th Street TEL: (612) 854-1120
Bloomington, MN 55420 FAX: (612) 854-8312

NEW JERSEY

NECCO TEL: (201) 461-2789
2460 Lemoine Avenue FAX: (201) 461-3857
Ft. Lee, NJ 07024

NEW MEXICO

S.W. SALES, INC. TEL: (505) 899-9005
7137 Settlement Way, N.W.
Albuquerque, NM 87120

NEW YORK

T-SQUARE TEL: (315) 463-8592
6443 Ridings Road FAX: (315) 463-0355
Syracuse, NY 13206

T-SQUARE TEL: (716) 924-9101
7353 Victor-Pittsford Road FAX: (716) 924-4946
Victor, NY 14564

NORTH CAROLINA

GODWIN & ASSOC. TEL: (919) 878-8000
1100 Logger Ct. FAX: (919) 878-3923
Suite B 102
Raleigh, NC 27609

GODWIN & ASSOCIATES TEL: (704) 549-8500
2812 Oak Leigh Drive FAX: (704) 549-9792
Charlotte, NC 28213

OHIO

BAILEY, J.N. & ASSOC. TEL: (513) 687-1325
129 W. Main Street FAX: (513) 687-2930
New Lebanon, OH 45345

BAILEY, J.N. & ASSOC. TEL: (614) 262-7274
2679 Indianola Avenue FAX: (614) 262-0384
Columbus, OH 43202

BAILEY, J.N. & ASSOC. TEL: (216) 273-3798
1667 Devonshire Drive FAX: (216) 225-1461
Brunswick, OH 44212

OREGON

EARL & BROWN CO. TEL: (503) 643-5500
9735 S.W. Sunshine Ct. FAX: (503) 644-9230
Suite 500
Beaverton, OR 97005

PENNSYLVANIA

RIVCO JANUARY INC. TEL: (215) 631-1414
RJ1 Building FAX: (215) 631-1640
78 South Trooper Road
Norristown, PA 19403

PUERTO RICO

DIGIT-TECH
P.O. Box 1945 TEL: (809) 892-4260
Calle Cruz #2 FAX: (809) 892-3366
Bajos, San German 00753

TEXAS

S.W. SALES INC. TEL: (915) 594-8259
2267 Trawood, Bldg. E3 FAX: (915) 592-0288
El Paso, TX 79935

VIELOCK ASSOC. TEL: (214) 881-1940
720 E. Park Blvd. FAX: (214) 423-8556
Suite 102
Plano, TX 75074

VIELOCK ASSOC. TEL: (512) 345-8498
9600 Great Hills Trail FAX: (512) 346-4037
Suite 150-W
Austin, TX 78759

UTAH

ANDERSON & ASSOC. TEL: (801) 292-8991
270 South Main, #108 FAX: (801) 298-1503
Bountiful, UT 84010

VIRGINIA

ADVANCED TECHNOLOGY SALES, INC.
406 Grinnell Drive TEL: (804) 320-8756
Richmond, VA 23236
FAX: (804) 320-8761

WASHINGTON

EARL & BROWN CO. TEL: (206) 885-5064
2447-A 152nd Ave. N.E. FAX: (206) 885-2262
Redmond, WA 98052

WISCONSIN

IRI TEL: (414) 259-0965
631 Mayfair FAX: (414) 259-0326
Milwaukee, WI 53226

SAMSUNG SEMICONDUCTOR SALES OFFICES-EUROPE

SAMSUNG SEMICONDUCTOR EUROPE GmbH Mergenthaler Allee 38-40 D6236 Eschborn (West Germany) Tel: 06196/9009-0 Fax: 0196/9009-89	PARIS Centre d'Affaires La Boursidiere RN 186, Bat. Bourgogne, BP 202 F-92357 Le Plessis-Robinson (France) Tel: 1/40 94 07 00 Fax: 1/40 94 02 16	MILANO Viale G. Matteotti, 26 I-20095 Cusano Milanino (Italy) Tel: 2/61 32 888 Fax: 2/61 92 279	MÜNCHEN Carl-Zeiss-Ring 4, D-8045 Ismaning (West Germany) Tel: 089/96 48 30 + 089/96 48 38 Fax:
--	--	---	--

SAMSUNG SEMICONDUCTOR REPRESENTATIVES

EUROPE

AUSTRIA

SATRON HANDELSGES. MBH

Hoffmeistergasse 8-10/1/5 A-1120 Wien
TEL: 0043-222-87 30 20
FAX: 0043-222-83 35 83
TLX: 047-753 11 85 1

BELGIUM

C & S ELECTRONICS NV

Héembeekstraat 111 D1100
TEL: 0032-2-7 25 09 00
FAX: 0032-2-7 25 08 13
TLX: 046-25820

DENMARK

MER-EL

Ved Klædebo 18 DK-2907 Horsholm
TEL: 0046-157 100
FAX: 045-257 22 99
TLX: 37360 MEDEL DK

FINLAND

INSTRUMENTARIUM ELEKTRONIIKKA

P.O. Box 64, Vitikkä 1 SF-02631-ESPOO Helsinki
TEL: 00358-0-5 28 43 20
FAX: 00308-0-502 10 73
TLX: 057-12 44 26

FRANCE

ASIA MOS (OMNITECH ELCCTRONIQUE)

Ratiment Evolic 1 165, Boulevard De Vaimy F-92705 Colombes
TEL: 0033-1-47 60 12 47
FAX: 0033-1-47 60 15 82
TLX: 042-61 38 90

SONEL-ROHE (SCAIB)

6, Rue Le Corbusier Silic 424 F-94583 Rungis Cedex
TEL: 0033-1-46 86 81 70
FAX: 0033-1-45 60 55 49
TLX: 042-20 69 52

GERMANY (WEST)

SILCOM ELECTRONICS VERTRIEBS GmbH

Neusser Str. 336-338 D-4050 Monchengladbach
TEL: (49)-0-2161-6 07 52
FAX: (49)-0-2161-65 16 38
TLX: 85 21 89

TERMOTROL GmbH

Pilotystr. 4 D-8000 Munchen 22
TEL: (49)-0-89-23 0 52 52
FAX: (49)-0-89-23 0352 98
TLX: 17898453

ING. THEO HENSKE GmbH

Laatzener Str. 19 Postfach 72 12 26 D 3000 Hannover 72
TEL: (49)-0-511-86 50 75
FAX: (49)-0-511-87 60 04
TLX: 92 35 09

ASTRONIC GmbH

Grunwalder Weg 30 D-8024 Deisenhofen
TEL: (49)-0-89-61 30 303
FAX: (49)-0-89-61 31 66 8
TLX: 5 21 61 87

MSC-MICROCOMPUTERS SYSTEMS COMPONENTS VERTRIEBS GmbH

Industriestraße 16 Postfach 1380 D-7513 Stutensee 3
TEL: (49)-0-7249-70 75
FAX: (49)-0-7249-79 93
TLX: 17 72 49 11

SAMSUNG SEMICONDUCTOR REPRESENTATIVES

MICRONETICS GmbH

Wail Dur Stadter Str. 45
D-7253 Renningen 1

TEL: (49)-0-7159-60 19
FAX: (49)-0-7 159 51 19
TLX: 72 47 08

ITALY

DIS. EL. SPA

Via Aia Di Stura 71/18
I-10148 Torino

TEL: 0039-1-12201522/25
FAX: 0039-1-12 16 59 15
TLX: 043-21 51 18

MOXEL S.R.L.

Via C. Frova, 34
I-2092 Cinisello Balsamo

TEL: 0039-2-61 29 05 21
FAX: 0039-2-6 17 25 82
TLX: 043-35 20 45

NETHERLANDS

MALCHUS BV HANDEIMIJ.

Fokkerstraat 511-513
Postbus 48
NL-3125 BD Schiedam

TEL: 0031-10-4 27 77 77
FAX: 0031-10-4 15 48 67
TLX: 044-2 15 98

NORWAY

SEMI DEVICES A/S

Asenveien 1
N-1400 Ski

TEL: 0047-9-87 65 60

PORTUGAL

NIPOSOM-J. NABAIS LTD.

R. Casimiro Freire 9A
P-1900 Lisboa

TEL: 00351-1-89-66 10
FAX: 00351-80 95 17
TLX: 0404-1 40 28

SPAIN

SEMITRONIC S.A.

C/Maria Lombillo, 14
E 28077 Madrid

TEL: 0034-1-320 21 60 61
FAX: 0034-1-320 21 98

SEMICONDUCTORES S.A.

Ronda General Mitre
240 Bjs
E-08006 Barcelona

TEL: 0034-3-2 17 23 40
FAX: 0034-3-2 17 65 98
TLX: 052-9 77 87

SWEDEN

MIKO KOMPLEMENT AB

Segersby Vagen 3
P.O. Box 2001
S-14502 Norsborg

TEL: 0046-753-89 08 0
FAX: 0046-753-75 34 0
TLX: 054-150 23

SWITZERLAND

PANATEL AG

Grundstr. 20
CH-6343 Rotkreuz

TEL: 0041-42 64 30 30
FAX: 0041-42 64 30 35
TLX: 045-86 87 63

UNITED KINGDOM

KORD DISTRIBUTION LTD.

Watchmoor Road, Camberley
Surrey GU153AQ.

TEL: 0276 685741
TLX: 859919 KORDIS G.

BYTECH LTD.

2 The Western Centre,
Western Road,
Bracknell Berkshire
RG121RW

TEL: Sales 0344 482211
Account/Admin 0344
424222
TLX: 848215

ITT MULTI COMPONENTS

346 Edinburgh Avenue
Slough SL1 4TU

TEL: 0753 824212
FAX: 0753 824160
TLX: 849804

NELTRONIC LIMITED

John F. Kennedy Road,
Naas Road, Oublin 12,
Ireland

TEL: (01) 503560
FAX: (01) 552789
TLX: 93556 NELT EI

SAMSUNG SEMICONDUCTOR REPRESENTATIVES

ASIA

HONG KONG

AV. CONCEPT LTD.

Rm. 802-804, Tower A, TEL: 3-629325
Hungghom Comm. Centre, FAX: 3-7643108
37-39 Ma Tau Wai Road TLX: 52362 ADVCC HX
Hungghom, Kln, H.K.

PROTECH COMPONENTS LTD.

Flat 3, 10/F., Wing Shing Ind. TEL: 3-3522181
Bldg., 26Ng Fong Street, San FAX: 3-3523759
Po Kong, Kowloon, Hong TLX: 38396 PTLD HX
Kong

TAIWAN

YOSUN INDUSTRIAL COPR.

Min-Sheng Commercial Bldg., TEL: 011-886-2-501-
10F No. 481 Min-Sheng East 0770~9
Rd., Taipei, Taiwan, R.O.C. FAX: 001-886-2-503-1278
TLX: 26777 YOSUNIND

KENTOP ELECTRONCIS CO., LTD.

3/F, Nbr 22., Sec-2, Chung TEL: 001-886-2-832-
Cheng Rd., Shin-Lin, Taipei, 5800/5802
Taiwan, R.O.C. FAX: 001-886-2-832-5521

KINREX CORP

2nd. Fl., 514-3 TEL: 001-886-2-700-4686
Tun Hwa S.Rd., ~9
Taipei, Taiwan, R.O.C. FAX: 001-886-2-704-2482
TLX: 20402 KINREX

JAPAN

ADO ELECTRONIC INDUSTRIAL CO., LTD.

7th Fl., Sasage Bldg., 4-6 TEL: 03-257-1618
Sotokanda 2-Chome Chiyoda- FAX: 03-257-1579
ku, Tokyo 101, Japan

INTERCOMPO INC.

Ihi Bldg., 1-6-7, Shibuya, TEL: 03-406-5612
Shibuya-ku, Tokyo 150 Japan FAX: 04-409-4834

CHEMI-CON INTERNATIONAL COPR.

Mitauya Toranomom Bldg., TEL: 03-508-2841
22-14, Toranomom 1 Chome FAX: 03-504-0566
Minato-ku, Tokyo 105, Japan

TOMEN ELECTRONICS COPR.

1-1, Uchisaiwai-cho 2 TEL: 03-506-3473
Chome Chiyoda-ku, Tokyo, FAX: 03-506-3497
100

DIA SEMICON SYSTEMS INC.

Wacore 64 1-37-8, TEL: 03-487-0386
Sangenjaya, Setagaya-ku, FAX: 03-487-8088
Tokyo 154 Japan

RIKEI CORP.

Nichimen Bldg., 2-2-2, TEL: 06-201-2081
Nakanoshima, Kita-ku, Osaka FAX: 06-222-1185
530 Japan

SINGAPORE

GEMINI ELECTRONICS PTE LTD.

100, Upper Cross Street TEL: 65-5351777
#09-08 OG Bldg. Singapore FAX: 65-5350348
0105 TLX: RS 42819

INDIA

COMPONENTS AND SYSTEMS MARKETING ASSOCIATES (INDIA) PVT. LTD.

100, Dadasaheb Phalke TEL: 4114585
Road, Dadar, Bombay 400 FAX: 4112546
014 TLX: 001-4605 PDT IN

TURKEY

ELEKTRO SAN. VE TIC. KOLL. STI.

Hasanpasa, Ahmet Rasim Sok TEL: 337-2245
No. 16 Kadiköy istanbul- FAX: 336-8814
Turkey TLX: 29569 elts tr

THAILAND

VUTIPONG TRADING LTD., PART.

51-53 Pahurat Rd. (Banmoh) TEL: 221-9699 3641
Bangkok 10200 THAILAND 223-4608
FAX: 224-0861
TLX: 87470 Vutipong TH

SAMSUNG SEMICONDUCTOR REPRESENTATIVES

KOREA

NAEWAE ELECTRIC CO., LTD.

#751-33, Daelim-dong
Youngdeungpo-ku,
Seoul, Korea
Cable: "ELECONAEWAE"
Seoul

TEL: 646-9101-9
FAX: 844-3001
C.P.O. Box 1409
Sewoon Store: 277-0767
Pusan Branch:
(051) 808-7425
Youngsan: 701-7341-5

SAMSUNG LIGHT-ELECTRONICS CO., LTD.

4th Fl. Room 2-3, Electronics TEL: 718-0045,
Main Bldg., #16-9, 718-9531-5
Hankangro-3ka, Yongsan-ku, FAX: 718-9536
Seoul, Korea

NEW CASTLE SEMICONDUCTOR CO., LTD.

4th Fl. Room 10-11, Elec- TEL: 718-8531-4
tronics Main Bldg., #16-9, FAX: 718-8535
Hankangro-3ka, Yongsan-ku,
Seoul, Korea

HANKOOK SEMICON- DUCTOR

#1054-9, Namhyung-dong, TEL: 588-2981-4
Kwanak-ku, Seoul, Korea FAX: 588-2980

SEG YUNG INTERISE CORP.

#21-301, Suninbldg, 16-1, TEL: 701-6811-6,
Hankangro-2ka, Yongsan-ku, 701-6781-4
Seoul, Korea FAX: 701-6785

SAMSUNG SEMICONDUCTOR DISTRIBUTORS

ALABAMA

HAMMOND (205) 830-4764
4411-B Evangel Circle, N.W.
Huntsville, AL 35816

ARIZONA

ADDED VALUE (602) 951-9788
7741 East Gray Road
Suite #9
Scottsdale, AZ 85260

CYPRESS/RPS (602) 966-2256
2164 E. Broadway Road #310-8
Tempe, AZ 85282

CALIFORNIA

ADDED VALUE (209) 734-8861
3320 East Mineral King
Unit D
Visalia, CA 93291

ADDED VALUE (714) 259-8258
1582 Parkway Loop
Unit G
Tustin, CA 92680

ADDED VALUE (619) 558-8890
6397 Nancy Ridge Road
San Diego, CA 92121

ADDED VALUE (818) 889-2861
31194 La Baya Drive, #100
Westlake Village, CA 91362

ALL AMERICAN (800) 669-8300
369 Van Ness Way #701
Torrance, CA 90501

BELL MICRO PRODUCTS (714) 963-0667
18350 Mt. Langley
Fountain Valley, CA 92708

BELL MICRO PRODUCTS (408) 434-1150
550 Sycamore Drive
Milpitas, CA 95035

CYPRESS/RPS (714) 521-5230
6230 Descanso Avenue
Buena Park, CA 90620

CYPRESS/RPS (619) 535-0011
10054 Mesa Ridge Ct
Suite118
San Diego, CA 92121

CYPRESS/RPS (408) 980-8400
2175 Martin Avenue
Santa Clara, Ca 95050

CYPRESS/RPS (818) 710-7780
21550 Oxnard, #420
Woodland Hills, CA 91367

JACO (805) 495-9998

2260 Townsgate Road
Westlake Village, CA 91361

JACO (408) 432-9290
2880 ZANKER ROAD
SUITE 202
SAN JOSE, CA 95134

JACO (714) 837-8966
23-441 South Pointe Drive
Laguna Hills,, CA 92653

MICRO GENESIS (408) 727-5050
2880 Lakeside Drive
Santa Clara, CA 95054

CANADA

ELECTRONIC WHOLESALERS (514) 769-8861
1935 Avenue De L'Eglise
Montreal, Quebec, Canada
H4E 1H2

PETERSON, C.M (519) 434-3204
220 Adelaide Street North
London, Ontario, Canada
N6B 3H4

SAYNOR VARAH (416) 445-2340
99 Scarsdale Road
Don Mills, Ontario, Canada
M3B 2R4

SAYNOR VARAH (604) 273-2911
1-13511 Crestwood Place
Richmond, B.C., Canada
V6V 2G5

WESTBURNE IND. ENT., LTD. (416) 635-2950
300 Steeprock Drive
Downsview, Ontario, Canada
M3J 2W9

COLORADO

ADDED VALUE (303) 422-1701
4090 Youngfield
Wheat Ridge, CO 80033

CYPRESS/RPS (303) 792-5829
12503 E. Euclid Drive
Englewood, CO 80111

CONNECTICUT

ALMO ELECTRONICS (203) 288-6556
31 Village Lane
Wallingford, CT 06492

JACO (203) 235-1422
384 Pratt Street
Meriden, CT 06450

SAMSUNG SEMICONDUCTOR DISTRIBUTORS

(Continued)

JV (203) 469-2321
690 Main Street
East Haven, CT 06512

FLORIDA

ALL AMERICAN (305) 621-8282
16251 N.W. 54th Avenue
Miami, FL 33014

HAMMOND (407) 973-7103
6600 N.W. 21st Avenue
Fort Lauderdale, FL 33309

HAMMOND (407) 849-6060
1230 W. Central Blvd
Orlando, FL 32802

MICRO GENESIS (407) 869-9989
2170 W. State Road 434 #324
Longwood, FL 32779

GEORGIA

HAMMOND (404) 449-1996
5680 Oakbrook Parkway
#160
Norcross, GA 30093

QUALITY COMPONENTS (404) 449-9508
6145 Northbelt Parkway
Suite B
Norcross, GA 30071

ILLINOIS

GOOLD (312) 860-7171
101 Leland Court
Bensenville, IL 60106

QPS (312) 884-6620
101 Commerce Dr. #A
Schaumburg, IL 60173

INDIANA

ALTEX (317) 848-1323
12744 N. Meridian
Carmel, IN 46032

CHELSEA INDUSTRIES (317) 253-9065
8465 Keystone Crossing, #115
Indianapolis, IN 46240

MARYLAND

ALL AMERICAN (301) 251-1205
1136 Taft Street
Rockville, MD 20853

ALMO ELECTRONICS (301) 953-2566
8309B Sherwick Court
Jessup, MD 20794

GENERAL RADIO SUPPLY (301) 995-6744
6935L Oakland Mills Road
Columbia, MD 21045

JACO (301) 995-6620
Rivers Center
10270 Old Columbia Road
Columbia, MD 21046

MASSACHUSETTS

ALMO ELECTRONICS (617) 821-1450
60 Shawmut Avenue
Canton, MA 02021

GERBER (617) 329-2400
128 Carnegie Row
Norwood, MA 02062

JACO (617) 273-1860
222 Andover Street
Wilmington, MA 01887

MICHIGAN

CALDER (616) 698-7400
4245 Brockton Drive
Grand Rapids, MI 49508

CHELSEA INDUSTRIES (313) 525-1155
34443 Schoolcraft
Livonia, MI 48150

MINNESOTA

ALL AMERICAN (612) 944-2151
11409 Valley View Road
Eden Prairie, MN 55344

CYPRESS/RPS (612) 934-2104
7650 Executive Drive
Eden Prairie, MN 55344

VOYAGER (612) 571-7766
5201 East River Road
Fridley, MN 55421

MISSOURI

CHELSEA INDUSTRIES (314) 997-7709
2555 Metro Blvd
Maryland Heights, MO 63043

NEW JERSEY

ALMO ELECTRONICS (201) 613-0200
12 Connerty Court
East Brunswick, NJ 08816

GENERAL RADIO SUPPLY (609) 964-8560
600 Penn St. @ Bridge Plaza
Camden, NJ 08102

JACO (201) 942-4000
Ottilio Office Complex
555 Preakness Avenue
Totowa, NJ 07512



Electronics

Semiconductor Business

HEAD OFFICE:

8/10FL. SAMSUNG MAIN BLDG.
250, 2-KA, TAEPYUNG-RO,
CHUNG-KU, SEOUL, KOREA
C.P.O. BOX 8233

TELEX: KORSST K27970
TEL: (SEOUL) 751-2114
FAX: 753-0967

BUCHEON PLANT:

82-3, DODANG-DONG,
BUCHEON, KYUNGKI-DO, KOREA
C.P.O. BOX 5779 SEOUL 100

TELEX: KORSEM K28390
TEL: (SEOUL) 741-0066, 662-0066
FAX: 741-4273

KIHEUNG PLANT:

SAN #24 NONGSUH-RI, KIHEUNG-MYUN
YONGIN-GUN, KYUNGKI-DO, KOREA
C.P.O. BOX 37 SUWON

TELEX: KORSST K23813
TEL: (SEOUL) 741-0620/7
FAX: 741-0628

GUMI BRANCH:

259, GONDAN-DONG, GUMI,
KYUNGSANGBUK-DO, KOREA

TELEX: SSTGUMI K54371
TEL: (GUMI) 2-2570
FAX: (GUMI) 52-7942

SAMSUNG SEMICONDUCTOR INC.:

3725 NORTH FIRST STREET
SANJOSE, CA 95134-1708, USA

TEL: (408) 434-5400
TELEX: 339544
FAX: (408) 434-5650

HONG KONG BRANCH:

24FL. TOWER 1 ADMIRALTY CENTER
18 HARCOURT ROAD HONG KONG

TEL: 5-8626900
TELEX: 80303 SSTC HX
FAX: 5-8661343

TAIWAN OFFICE:

RM B. 4FL, NO 581
TUN-HWA S. RD, TAPIEI, TAIWAN

TEL: (2) 706-6025/7
FAX: (2) 706-6028

SAMSUNG ELECTRONICS JAPAN CO., LTD.

6F. SUDAMACHI BERDE BLDG.
2-3, KANDA-SUDAMACHI
CHIYODA-KU, TOKYO 101, JAPAN

TELEX: 2225206 SECJPN J
TEL: (03) 258-9506
FAX: (03) 258-9695

SAMSUNG SEMICONDUCTOR EUROPE GMBH:

MERGENTHALER ALLEE 38-40
D-6236 ESCHBORN, W/G

TEL: 0-6196-90090
FAX: 0-6196-900989
TELEX: 4072678 SSED

SAMSUNG (U.K.) LTD.:

SAMSUNG HOUSE 3 RIVERBANK WAY
GREAT WEST ROAD BRENTFORD
MIDDLESEX TW8 9RE

TEL: 862-9312 (EXT) 304
862-9323 (EXT) 292
FAX: 862-0096, 862-0097
TELEX: 25823

PRINTED IN KOREA
SEPTEMBER 1989