

RF Amplifier for CD Players

Description

The CXA1610M is an IC developed for compact disc players. The IC incorporates an APC circuit, and amplifiers for 3-spot optical pick-up output, focus error, and tracking error. (Corresponds to voltage-converted optical pick-up outputs only.)

Features

- Low power consumption (70mW at $\pm 5V$)
- Built-in APC (automatic power control) circuit
- Enables both dual $\pm 5V$ power supply, and single +5V power supply

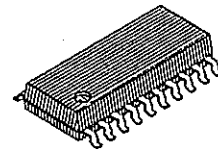
Application

Compact disc players

Structure

Bipolar silicon monolithic IC

20 pin SOP (Plastic)



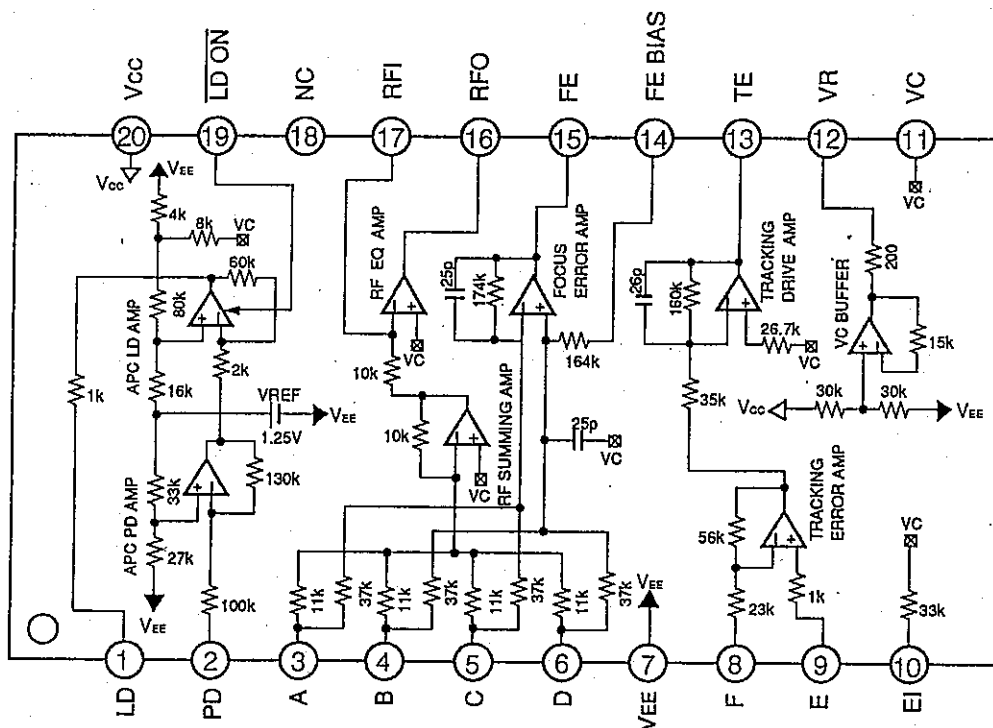
Absolute Maximum Ratings

• Supply voltage	V_{CC}	12	V
• Operating temperature	T_{opr}	-20 to +75	°C
• Storage temperature	T_{stg}	-65 to +150	°C
• Allowable power dissipation	P_D	600	mW

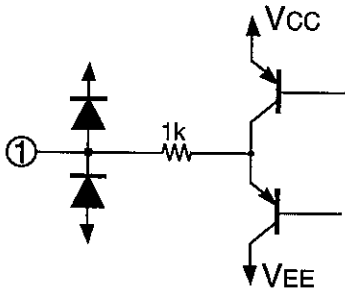
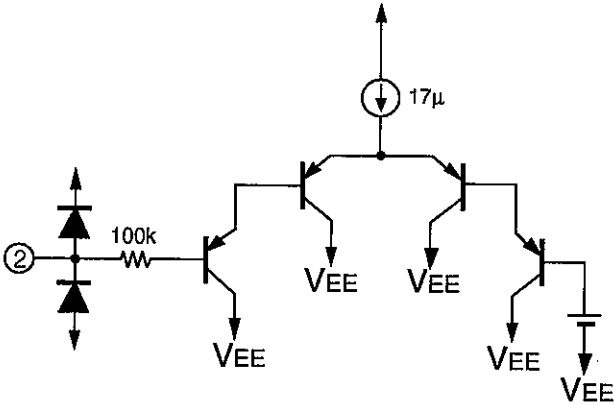
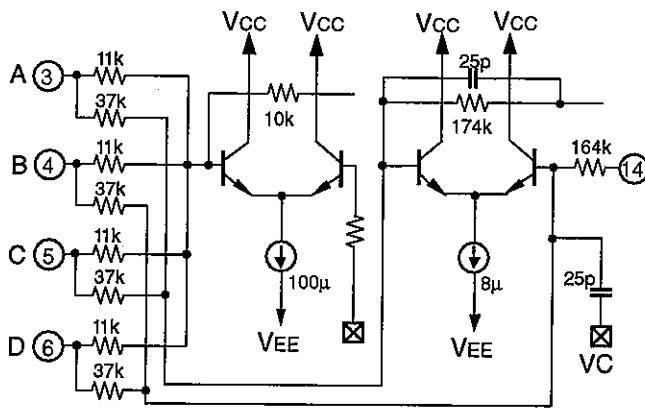
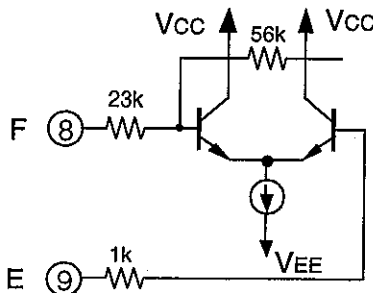
Operating Conditions

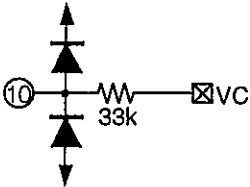
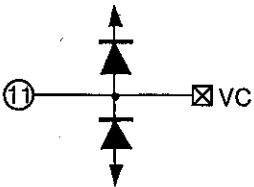
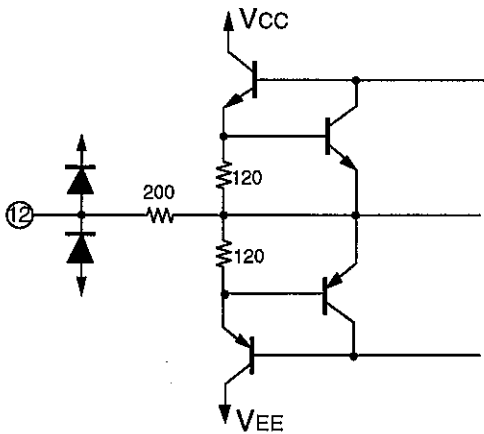
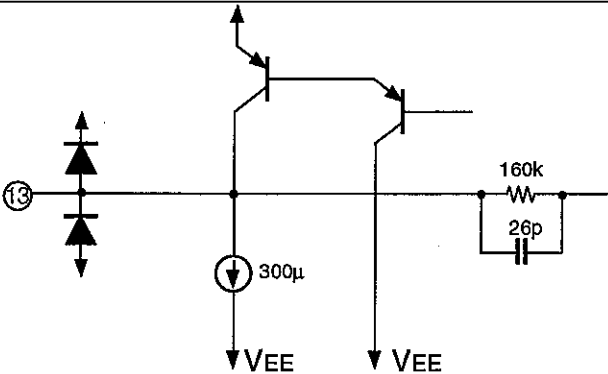
• Supply voltage	$V_{CC}-V_{EE}$	3.6 to 11.0	V
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Block Diagram and Pin Configuration (Top View)



Pin Description

Pin No	Symbol	I/O	Equivalent circuit	Description
1	LD	O		APC amplifier output
2	PD	I		APC amplifier input
3 4 5 6 14	A B C D FE BIAS	I I I I I		Pins 3, 4, 5 and 6 are inputs for the RF amplifier and FE amplifier. Pin 14 is for focus bias adjustment.
7	VEE	I		VEE
8 9	F E	I I		Tracking error amplifier input.

Pin No	Symbol	I/O	Equivalent circuit	Description
10	EI			<p>33kΩ resistance is between VC and this pin.</p> <p>Use by connecting with TE adjustment volume.</p>
11	VC	I		<p>Center voltage input for VC</p> <p>Connect to GND when using dual ± 5 V power supply; connect to VR pin when using single +5V power supply.</p>
12	VR	O		<p>DC voltage output for $(V_{CC}+V_{EE})/2$</p>
13	TE	O		<p>Tracking error amplifier output.</p> <p>Outputs F-E signals.</p>

Pin No	Symbol	I/O	Equivalent circuit	Description
15	FE	O		Focus error amplifier output
16	RFO	O		RF amplifier output
17	RFI			RF amplifier inversed input. Gain of RF amplifier is determined by the resistance connected between this pin and RFO pin.
18	NC			No connected
19	LD ON			Switch for APC amplifier ON/OFF ON at GND, OFF at Vcc
20	Vcc			Vcc

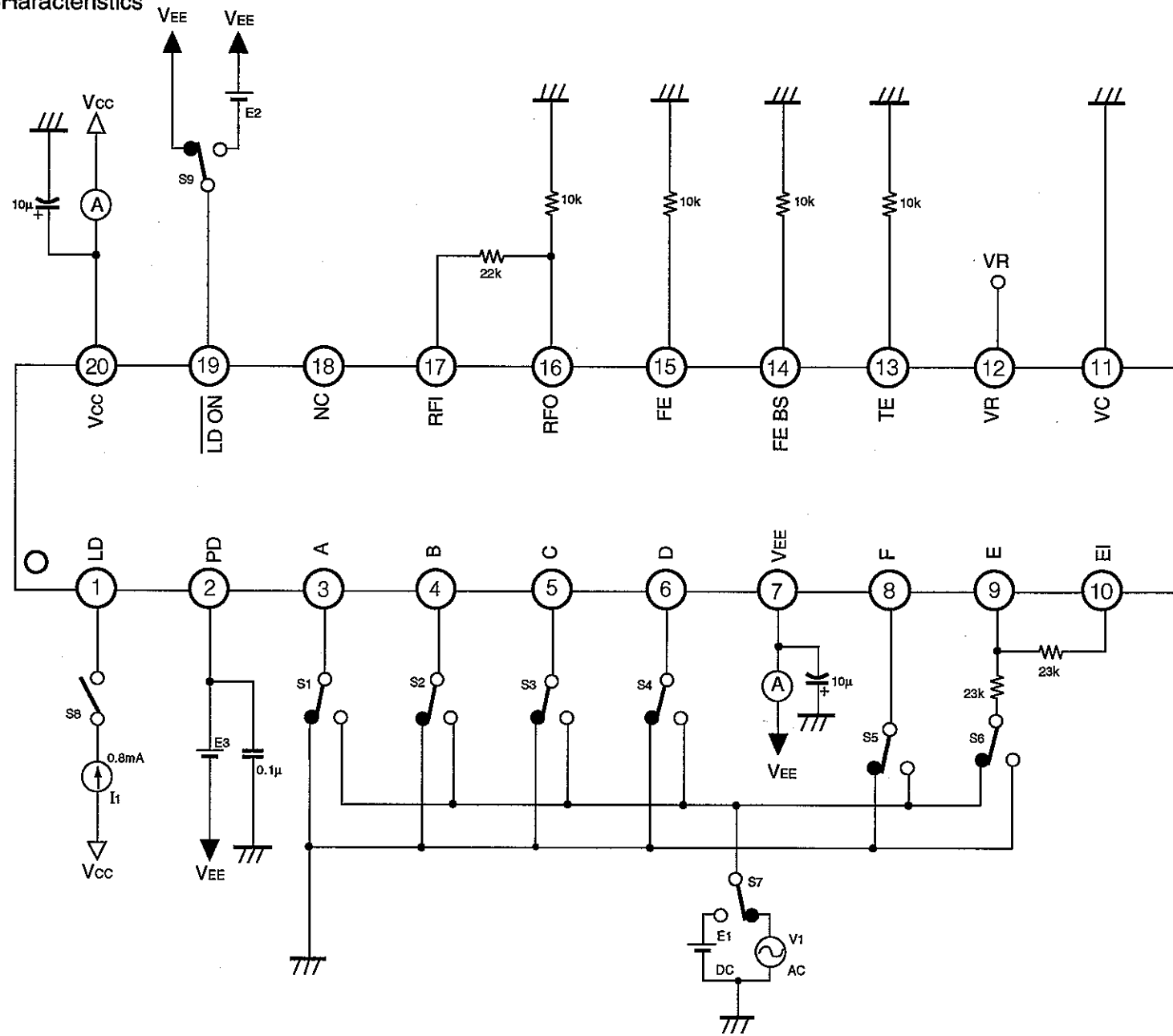
Electrical Characteristics

±2.5V power supply (V_{CC}=2.5V, V_{EE}=-2.5V, V_C=GND)

Test No.	Test item	Symbol	SW conditions*									Bias conditions			Test pin	Description of I/O waveform and test method		Min.	Typ.	Max.	Unit
			1	2	3	4	5	6	7	8	9	E1	E2	E3							
1	Current consumption	I _{CC}												20			—	7.0	11.0	mA	
2		I _{EE}												7			−11.0	−7.0	—	mA	
3	RF amplifier	Offset voltage 1	V16-1											16	Input GND		−20.0	—	20.0	mV	
5		Voltage gain	V16-2	○	○	○	○							16	Input 1 kHz, 150 mVp-p		15.1	18.1	21.1	dB	
6		Max. output amplitude“H”	V16-3	○	○	○	○		○			+400mV		16			1.3	—	—	V	
7		Max. output amplitude“L”	V16-4	○	○	○	○		○			−400mV		16			—	—	−0.3	V	
8	FE amplifier	Offset voltage	V15-1											15	Input GND	Output DC test	−30.0	0	30.0	mV	
9		Voltage gain 1	V15-2	○		○								15	Input 1 kHz, 300 mVp-p	Output AC test	16.5	19.5	22.5	dB	
10		Voltage gain 2	V15-3		○		○							15	Input 1 kHz, 300 mVp-p	Output AC test	16.5	19.5	22.5	dB	
11		Voltage gain difference	V15-4											15	V15-4 = V15-2 − V15-3		−3.0	0	3.0	dB	
12		Max. output amplitude“L”	V15-5	○		○			○			+300mV		15		Output DC test		—	−1.9	V	
13		Max. output amplitude“H”	V15-6	○		○			○			+300mV		15		Output DC test	1.9	—		V	
14	TE amplifier	Offset voltage 1	V13-1											13	Input GND	Output DC test	−30	0	30	mV	
15		Voltage gain 1	V13-2					○						13	Input 1 kHz, 100 mVp-p	Output AC test	17.9	20.9	23.9	dB	
16		Voltage gain 2	V13-3						○					13	Input 1 kHz, 100 mVp-p	Output AC test	17.9	20.9	23.9	dB	
17		Voltage gain difference	V13-4											13			−3.0	0	3.0	dB	
18		Max. output amplitude“H”	V13-5					○	○			+240mVdc		13		Output DC test	1.9	—	—	V	
19		Max. output amplitude“L”	V13-6						○	○		+240mVdc		13		Output DC test	—	—	−1.9	V	
20	APC	Output voltage 1	V1-1							○		0.5V	+69mV	1		Output DC test	—	−1.6	−0.3	V	
21		Output voltage 2	V1-2							○		0.5V	+123mV	1		Output DC test	−1.5	−0.2	1.1	V	
22		Output voltage 3	V1-3							○		0.5V	+177mV	1		Output DC test	0.6	1.9	—	V	
23		Output voltage 4	V1-4							○		4.5V	+0mV	1	LD OFF	Output DC test	2.1	2.4	—	V	
24		Output voltage 5	V1-5							○	○		0.5V	+0mV	1	I1 = 0.8 mA	Output DC test	—	—	0	V
25	Center amplifier	Output voltage 1	V12-1											12			−100	—	+100	mV	

*○ represents ON condition.

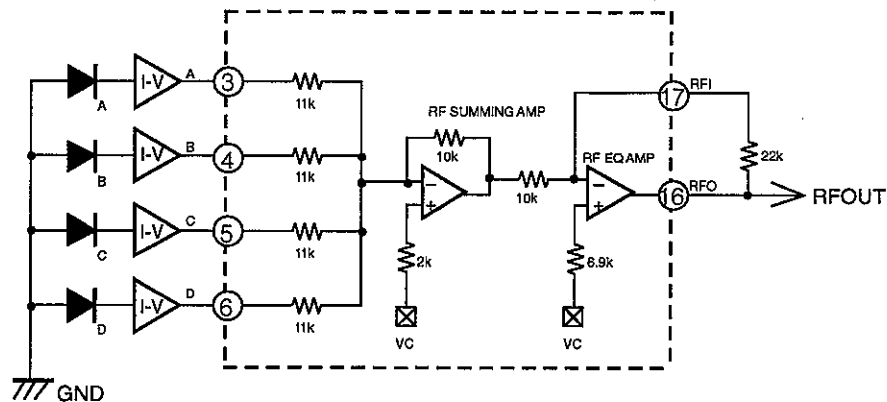
Electrical CHaracteristics Test Circuit



Description of Functions

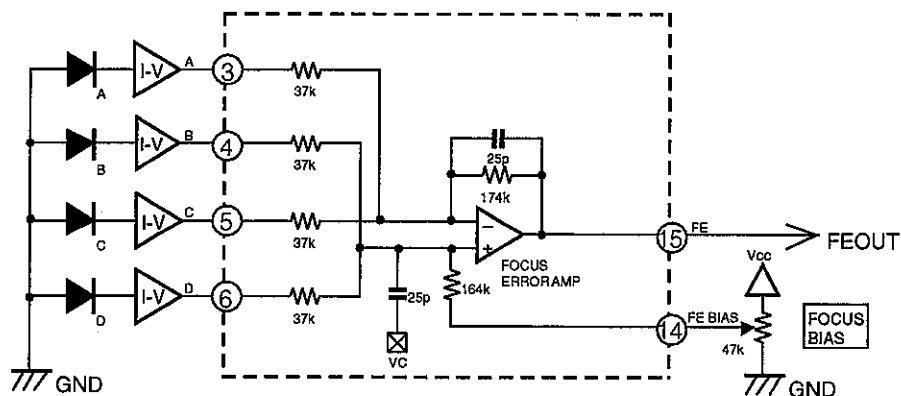
RF amplifier

Signal currents from photodiodes A, B, C, and D are I-V converted and input to Pins 3, 4, 5, and 6. These signals are added to by the RF summing amplifier, equalized by the RF equalizing amplifier, and then output to Pin 16. When equalizing RF signals, insert an equalizing circuit between Pins 16 to 17.



Focus error amplifier

The operation of $(B+D)-(A+C)$ is performed and output to Pin 15. Pin 14 is for the bias adjustment of the focus error signals.

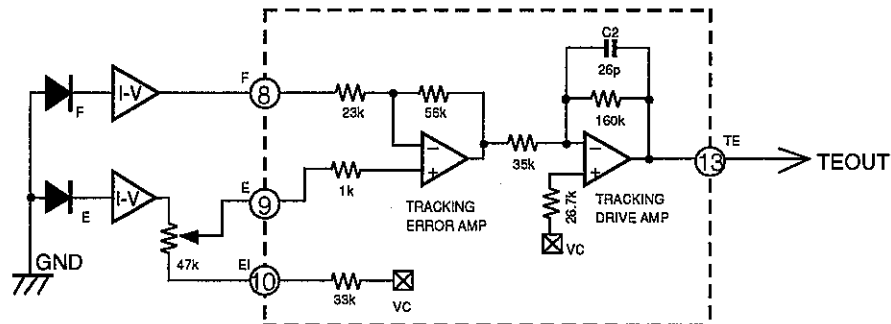


Tracking error amplifier

The signal current of photodiode F is I-V converted and applied to Pin 8. The signal current of photodiode E is I-V converted, and then gain-adjusted by the volume, and input to Pin 9. These signals are operated and amplified by the tracking error amplifier and the tracking drive amplifier to become (F-E) signals, and are output to Pin 13.

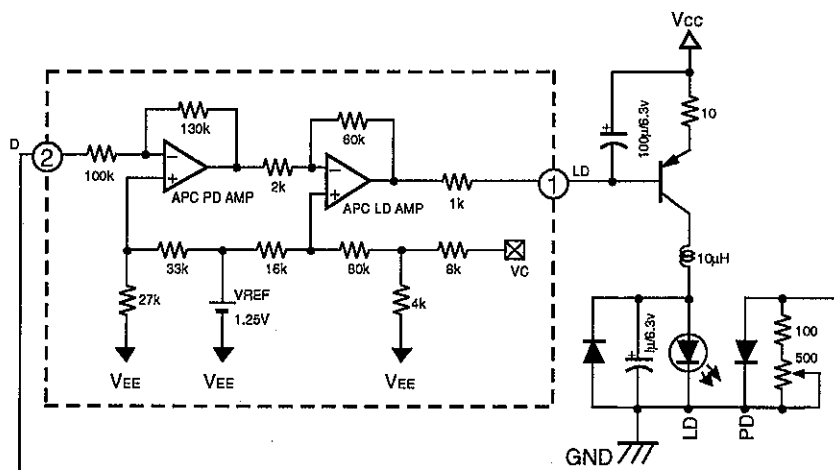
Also, because the 33 k Ω resistor between Pin 10 and VC is the IC's internal resistance, the absolute error is approximately $\pm 20\%$, and temperature characteristic is about $-1 \times 10^{-3}/^{\circ}\text{C}$.

Caution is necessary when using this resistor under harsh temperature conditions.



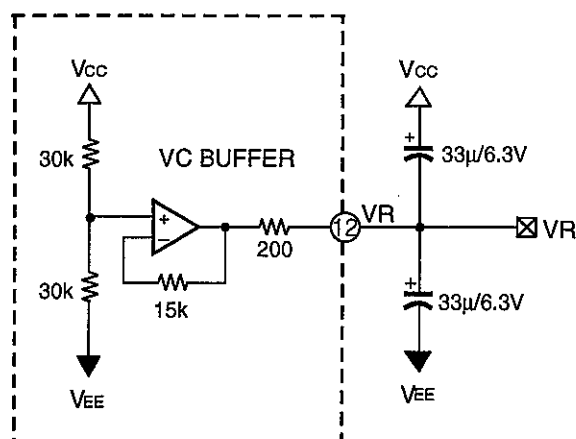
APC circuit

When the laser diode is under constant current drive, optical output will have large, negative temperature characteristics. Thus, in order to stabilize the optical output, a monitor photodiode must be used to control the current. The figure below is the APC circuit. APC is turned ON by grounding LD ON pin; OFF by connecting to Vcc.



Center voltage generation circuit

Center voltage is supplied when the CXA1610M is used on single power supply. Maximum current is approximately $\pm 3\text{mA}$. Output impedance is approximately 200Ω .



Notes on Operation

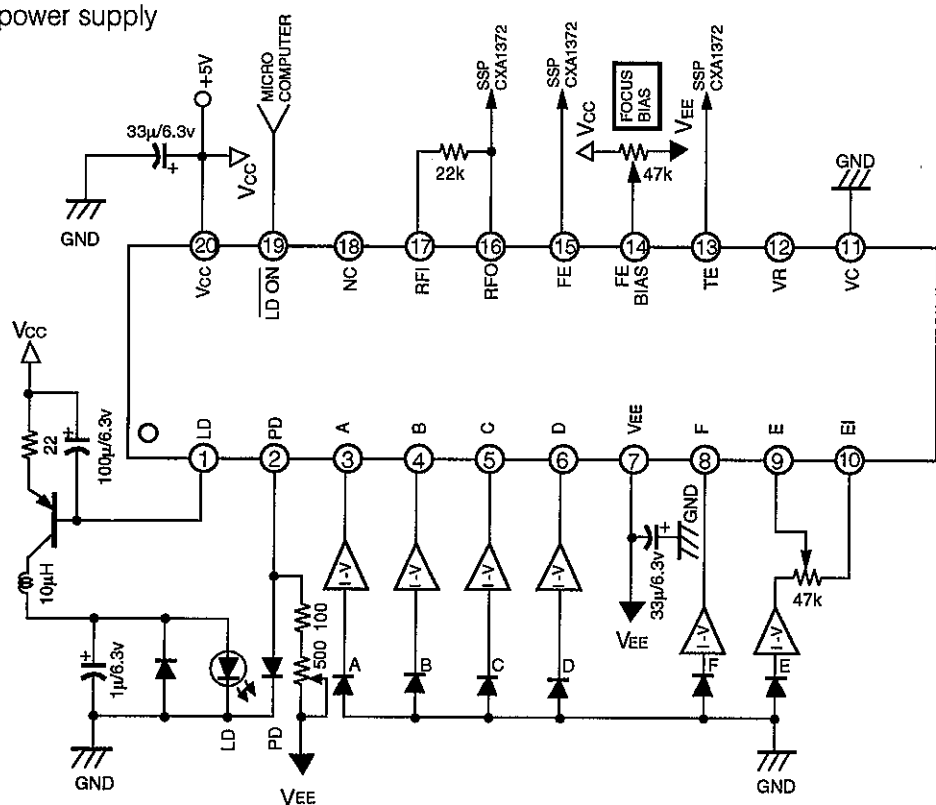
1. Power supply

The CXA1610M can be used on both \pm dual power supply and single power supply. Connections of power supplies on each case are shown in the following table.

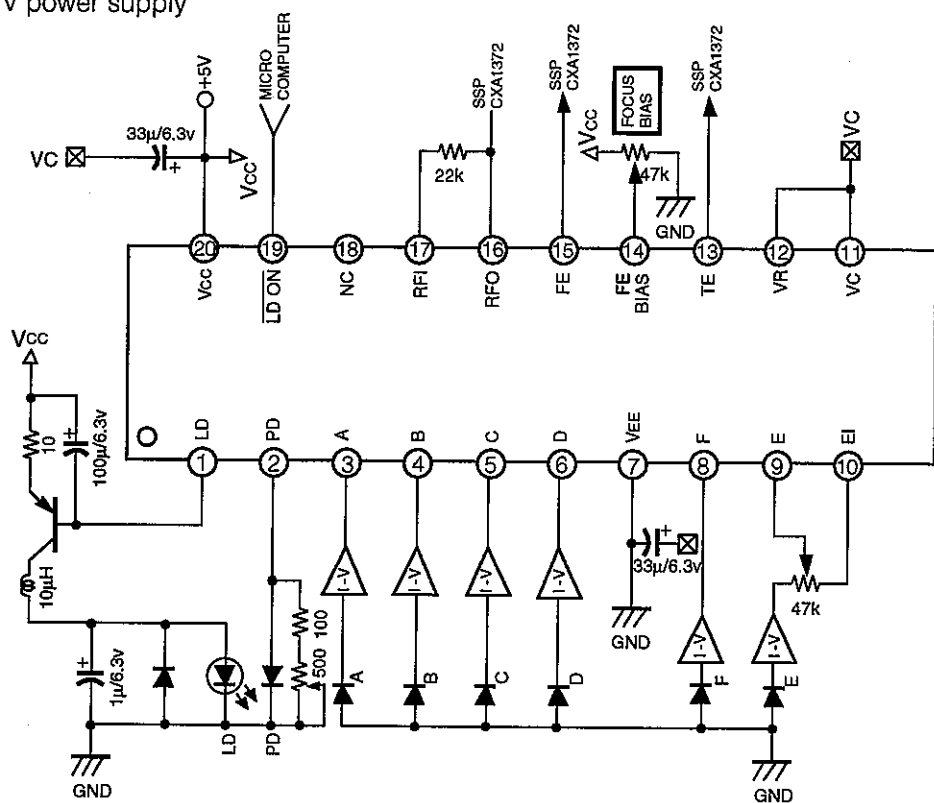
	Vcc	VEE	VR	VC
\pm Dual power supply	+Power supply	−Power supply	OPEN	GND
Single power supply	Power supply	GND	VC	VR

Application Circuit

•For dual ± 5 V power supply



•For single +5 V power supply

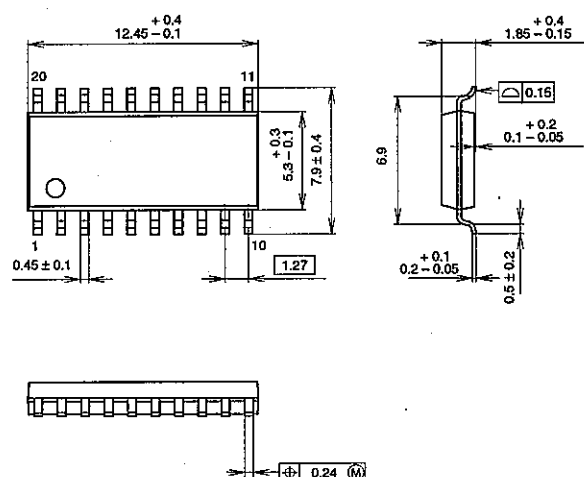


Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party and other right due to same.

Package Outline

Unit: mm

20PIN SOP (PLASTIC)

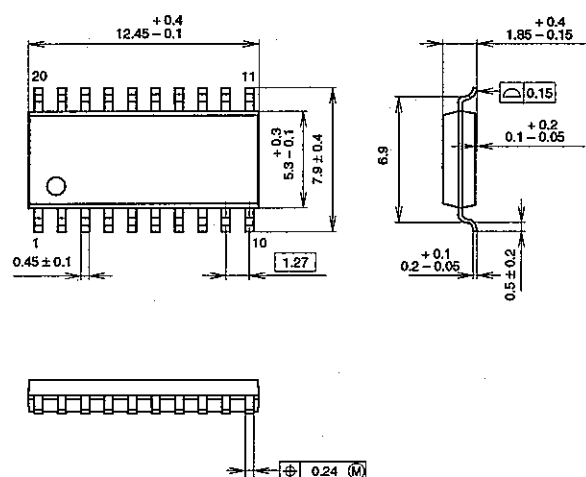


PACKAGE STRUCTURE

SONY CODE	SOP-20P-L01
EIAJ CODE	SOP020-P-0300
JEDEC CODE	

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	COPPER ALLOY
PACKAGE MASS	0.3g

20PIN SOP (PLASTIC)



PACKAGE STRUCTURE

SONY CODE	SOP-20P-L01
EIAJ CODE	SOP020-P-0300
JEDEC CODE	

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	COPPER ALLOY
PACKAGE MASS	0.3g

LEAD PLATING SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	COPPER ALLOY
SOLDER COMPOSITION	Sn-Bi-BI:1-4wt%
PLATING THICKNESS	5-18μm