

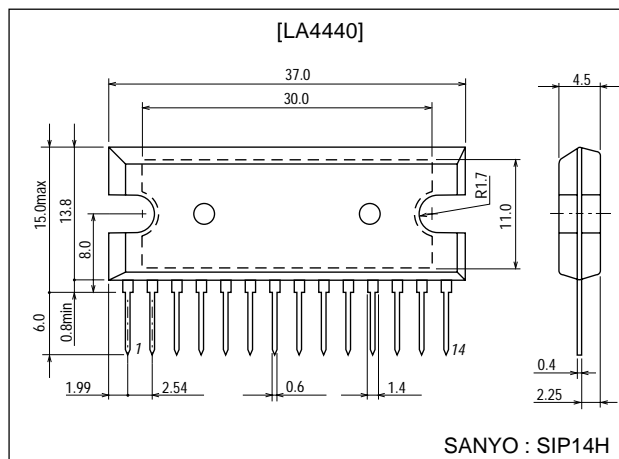
**LA4440****6W 2-Channel, Bridge 19W typ Power Amplifier****Features**

- Built-in 2 channels (dual) enabling use in stereo and bridge amplifier applications.
Dual : 6W×2 (typ.)
Bridge : 19W (typ.)
- Minimum number of external parts required.
- Small pop noise at the time of power supply ON/OFF and good starting balance.
- Good ripple rejection : 46dB (typ.)
- Good channel separation.
- Small residual noise ($R_g=0$).
- Low distortion over a wide range from low frequencies to high frequencies.
- Easy to design radiator fin.
- Built-in audio muting function.
- Built-in protectors.
 - a. Thermal protector
 - b. Overvoltage, surge voltage protector
 - c. Pin-to-pin short protector

Package Dimensions

unit:mm

3023A-SIP14H

**Specifications****Absolute Maximum Ratings** at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max1}}$	Quiescent ($t=30\text{s}$)	25	V
	$V_{CC \text{ max2}}$	Operating	18	V
Surge supply voltage	$V_{CC(\text{surge})}$	$t \leq 0.2\text{s}$	50	V
Allowable power dissipation	$P_d \text{ max}$	$T_c = 75^\circ\text{C}$, See $P_d \text{ max} - T_a$ characteristic	15	W
Thermal resistance	θ_{j-c}	Junction-to-case	3	$^\circ\text{C/W}$
Operating temperature	T_{opr}		-20 to +75	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +150	$^\circ\text{C}$

Recommended Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		13.2	V
Load resistance	R_L	Stereo	2 to 8	Ω
		Bridge	4 to 8	Ω

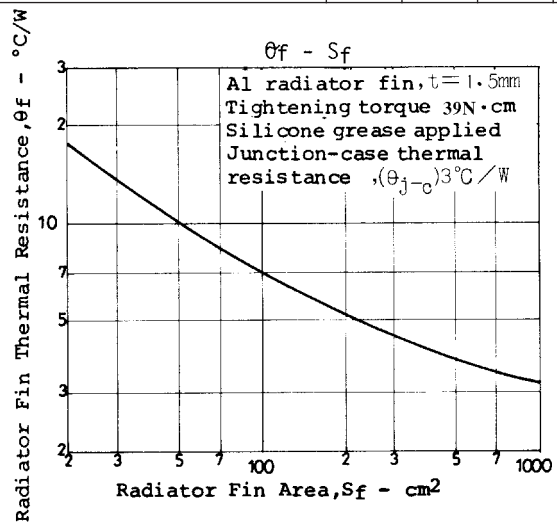
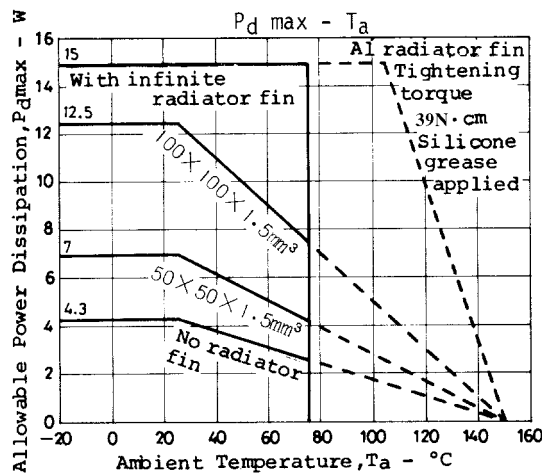
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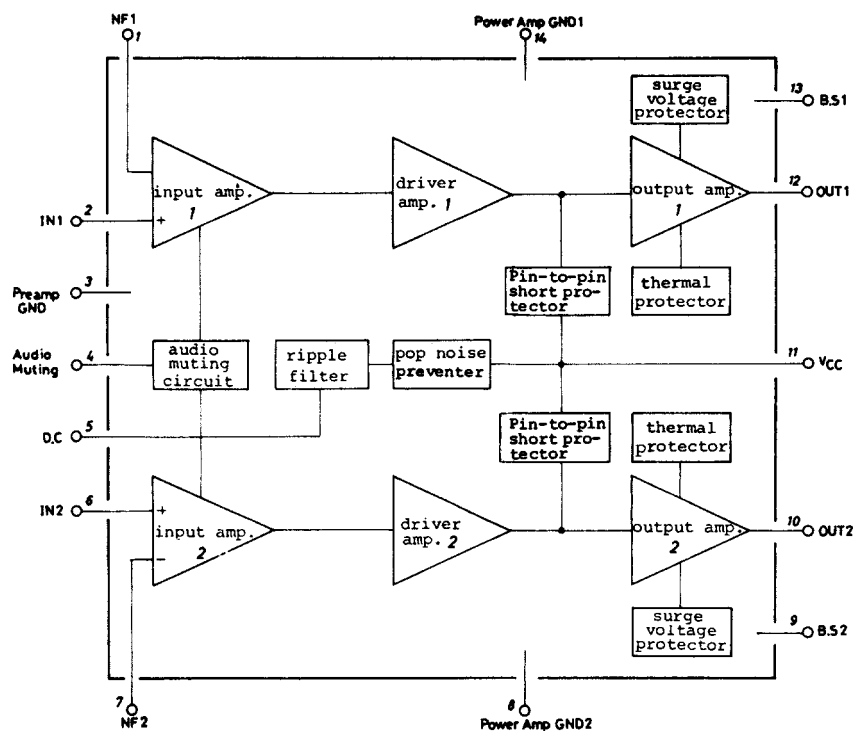
LA4440

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 13.2\text{V}$, $R_L = 4\Omega$, $f = 1\text{kHz}$, $R_g = 600\Omega$, with $100 \times 100 \times 1.5\text{mm}^3$ Al fin,
See specified Test Circuit.

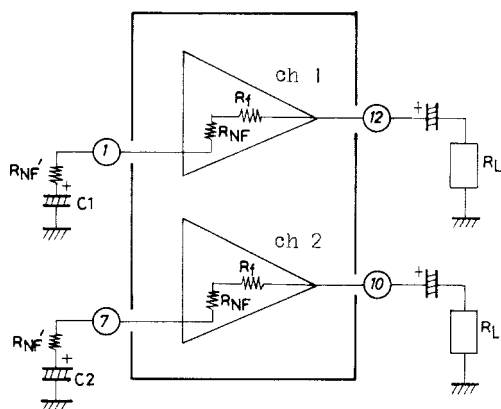
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CCO}			100	200	mA
Voltage gain	VG		49.5	51.5	53.5	dB
Output power	P_O	THD=10%, Stereo	5.0	6.0		W
		THD=10%, Bridge		19		W
Total harmonic distortion	THD	$P_O = 1\text{W}$		0.1	1.0	%
Input resistance	r_i			30k		Ω
Output noise voltage	V_{NO}	$R_g = 0$		0.6	1.0	mV
		$R_g = 10\text{k}\Omega$		1.0	2.0	mV
Ripple rejection ratio	R_r	$V_R = 200\text{mV}$, $f_R = 100\text{Hz}$, $R_g = 0$		46		dB
Channel separation	Ch sep	$V_O = 0\text{dBm}$, $R_g = 10\text{k}\Omega$	45	55		dB
Muting attenuation	ATT	$V_O = 0\text{dBm}$, $V_M = 9\text{V}$		40		dB
Gain difference between channels	ΔVG				2	dB



Equivalent Circuit Block Diagram



Voltage Gain Adjust at Stereo Mode



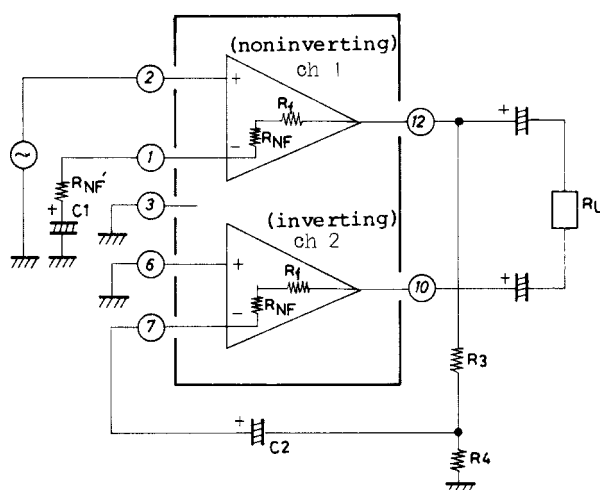
$R_{NF}=50\Omega$ (typ), $R_f=20k\Omega$ (typ)
At $R_{NF}'=0$ (recommended VG)

$$VG=20\log \frac{VG}{R_{NF}} \text{ (dB)}$$

In case of using R_{NF}'

$$VG=20\log \frac{R_f}{R_{NF}+R_{NF}'} \text{ (dB)}$$

Voltage Gain Adjust at Bridge Amplifier Mode (No. 1)



The bridge amplifier configuration is as shown left, in which ch1 and ch2 operate as noninverting amplifier and inverting amplifier respectively.

The output of the noninverting amplifier divided by resistors R3, R4 is applied, as input, to the inverting amplifier.

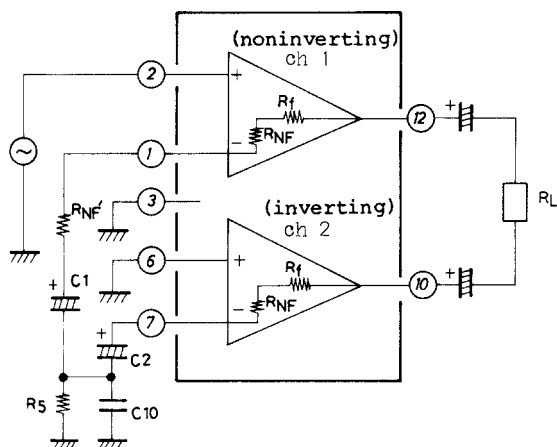
Since attenuation (R_4/R_3) of the non-inverting amplifier output and amplification factor (R_f/R_4+R_{NF}) of the inverting amplifier are fixed to be the same, signals of the same level and 180° out of phase with each other can be obtained at output pins (12) and (10). The total voltage gain is apparently higher than that of the noninverting amplifier by 6dB and is approximately calculated by the following formula.

$$VG=20\log \frac{R_f}{R_{NF}} + 6\text{dB}$$

In case of reducing the voltage gain, R_{NF}' is connected to the noninverting amplifier side only and the following formula is used.

$$VG=20\log \frac{R_f}{R_{NF}+R_{NF}'} + 6\text{dB}$$

Voltage Gain Adjust at Bridge Amplifier Mode (No. 2)

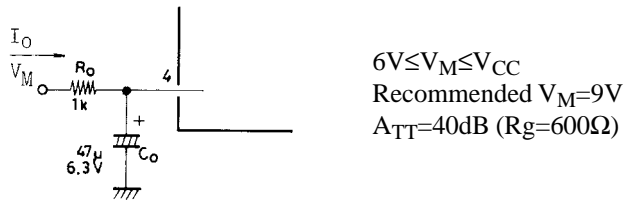


$$VG=20\log \frac{R_f}{\frac{R_{NF}+R_{NF}'}{2}} \text{ (dB)}$$

where $(R_{NF}+R_{NF}') \ll R_5$

From this formula, it is seen that connecting R_{NF}' causes the voltage gain to be reduced at the modes of both stereo amplifier and bridge amplifier.

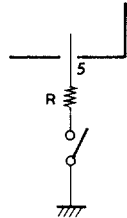
(g) In case of applying audio muting in each application circuit, the following circuit is used.



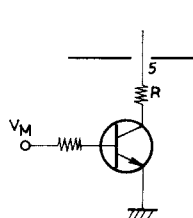
Flow-in current I_O is calculated by the following formula.

$$I_O = \frac{V_M - V_{BE}}{R_O}$$

In case of increasing the muting attenuation, resistor $5.6k\Omega$ is connected in series with the input, and then the attenuation is made to be 55dB. Be careful that connecting an input capacitor causes pop noise to be increased at the time of application of AC muting. Increased R_O , C_O make it possible to reduce the noise. In case of completely cutting off power IC, pin (5) is grounded, and then DC control is available and the attenuation is made to be ∞ .



General-purpose switch



Transistor switch

Stereo : $20\Omega \leq R \leq 100\Omega$
 Bridge No.1 : $20\Omega \leq R \leq 100\Omega$
 Bridge No. 2 : $0\Omega \leq R \leq 50\Omega$

Pin Voltage (unit : V)

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Function pin	CH1 NF	CH1 NF	Pre GND	AC Audio Muting	DC	CH2 IN	CH2 NF	CH2 Power GND	CH2 BS	CH2 OUT	V_{CC}	CH1 OUT	CH1 BS	CH1 Power GND
Pin Voltage at quiescent mode	1.4	0.03	0	0	13.0	0.03	1.4	0	11.9	6.8	13.2	6.8	11.9	0

Proper Cares in Using IC

· Maximum ratings

If the IC is used in the vicinity of the maximum ratings, even a slight variation in conditions may cause the maximum ratings to be exceeded, thereby leading to breakdown. Allow an ample margin of variation for supply voltage, etc. and use the IC in the range where the maximum ratings are not exceeded.

· Printed circuit board

When making the board, refer to the sample printed circuit pattern and be careful that no feedback loop is formed between input and output.

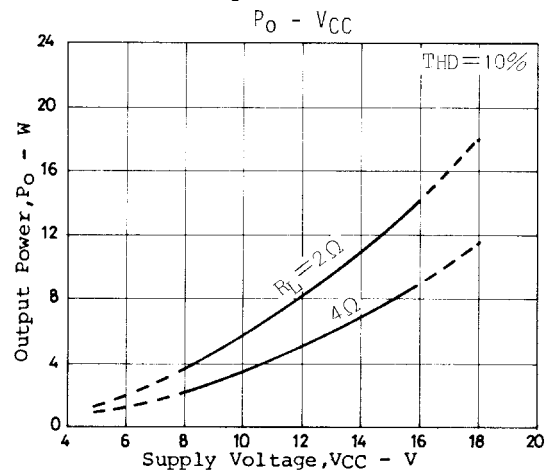
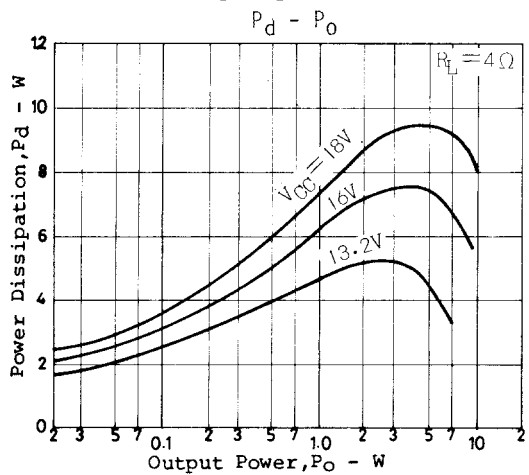
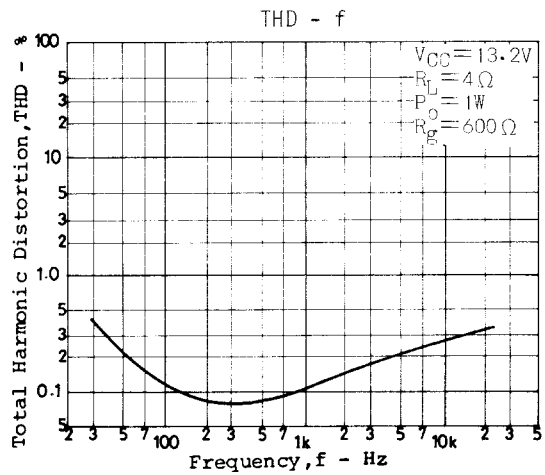
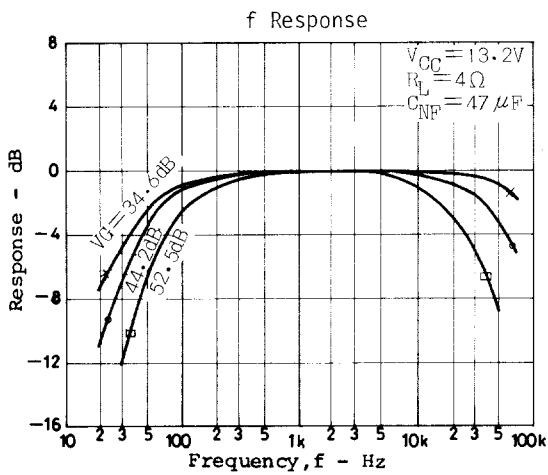
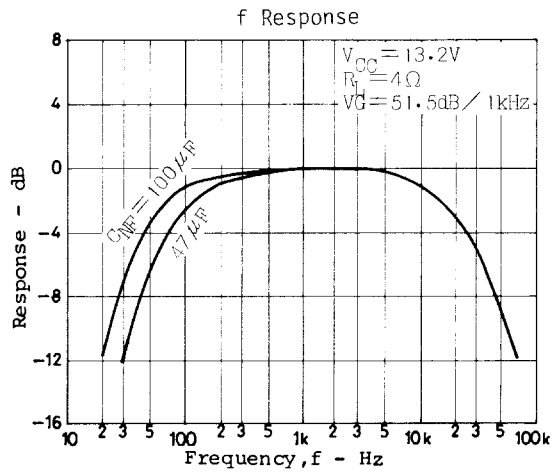
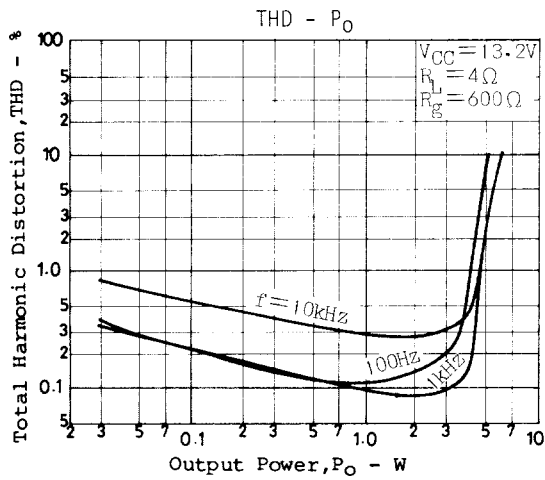
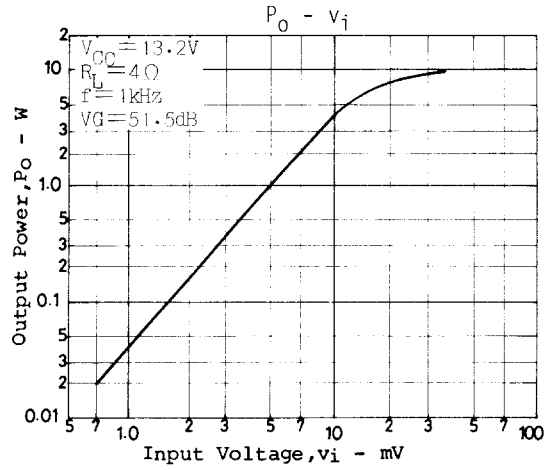
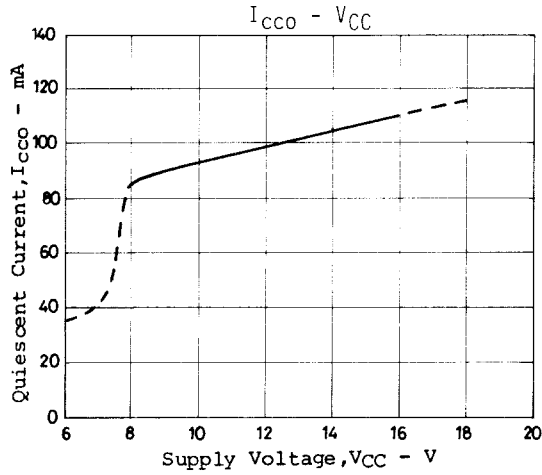
· Oscillation preventing capacitor

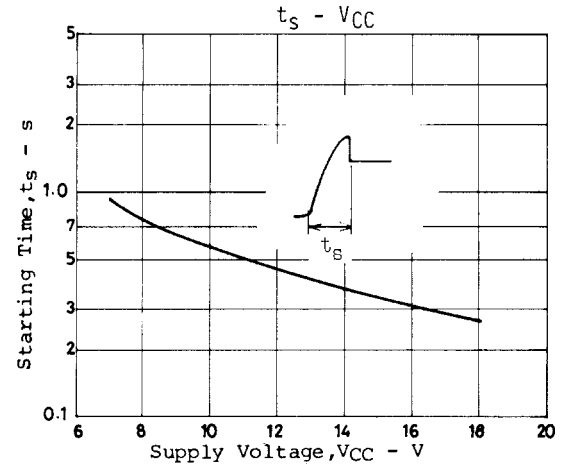
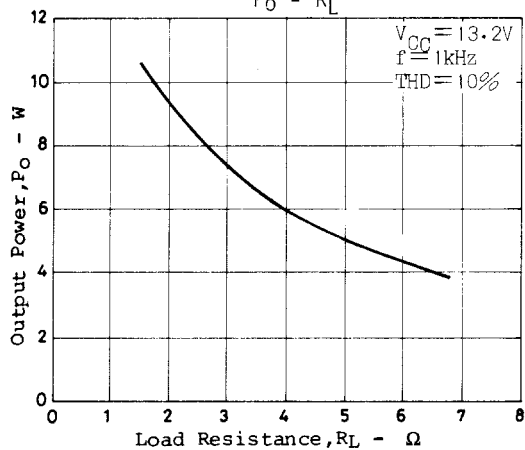
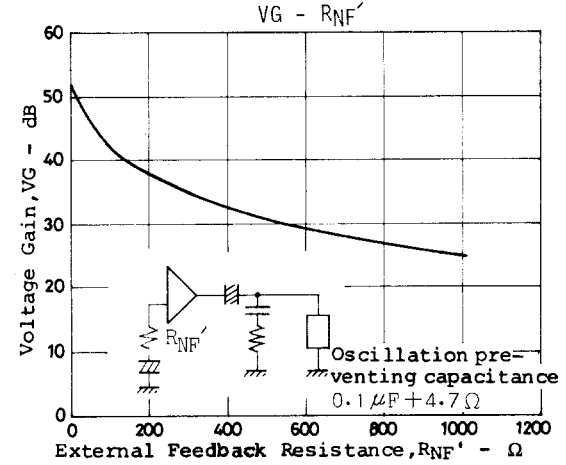
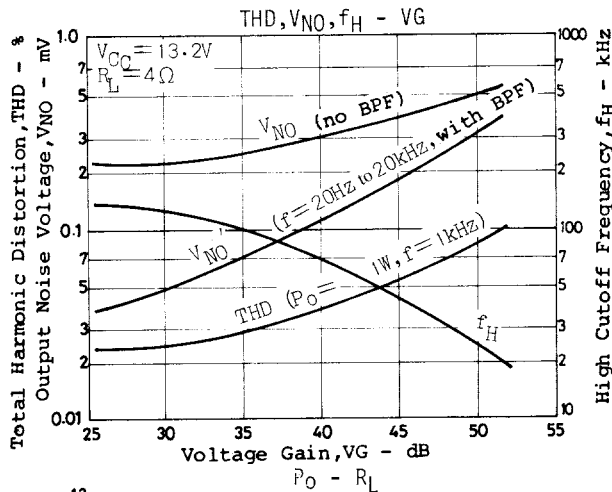
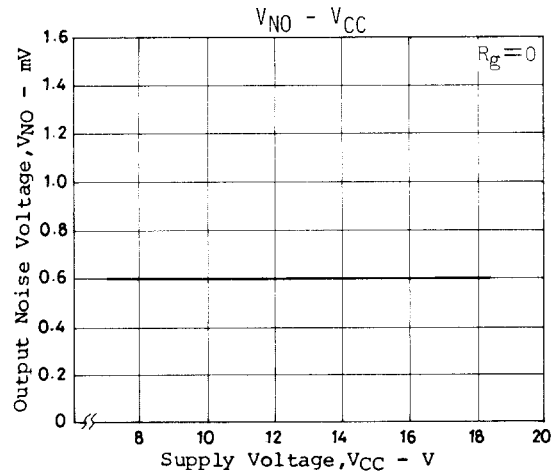
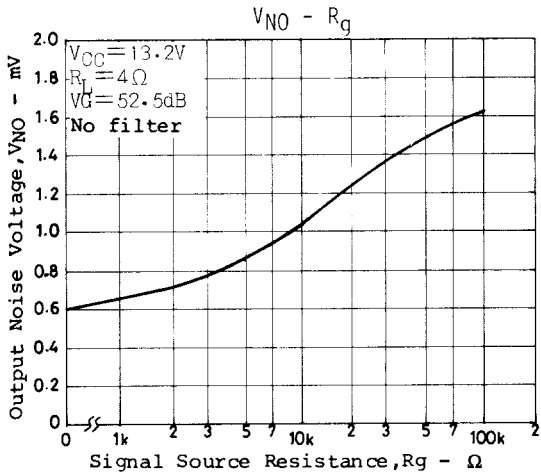
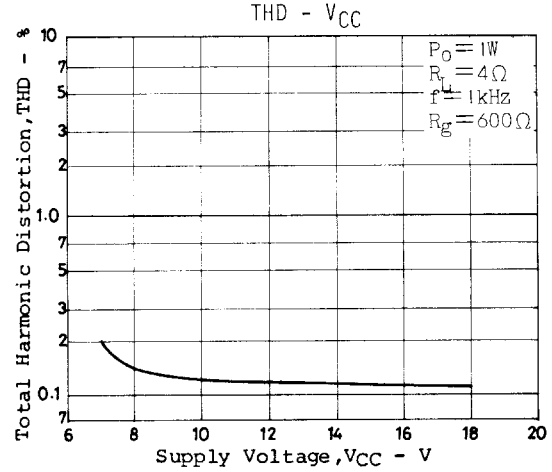
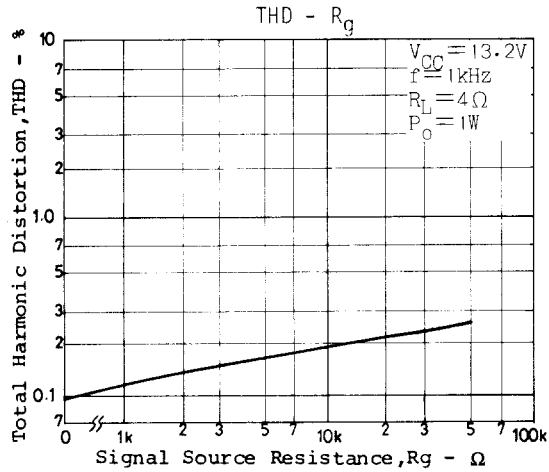
Normally, a polyester film capacitor is used for $0.1\mu F + 4.7\Omega$. The capacitance value can be reduced to $0.047\mu F$ depending on the stability of the board.

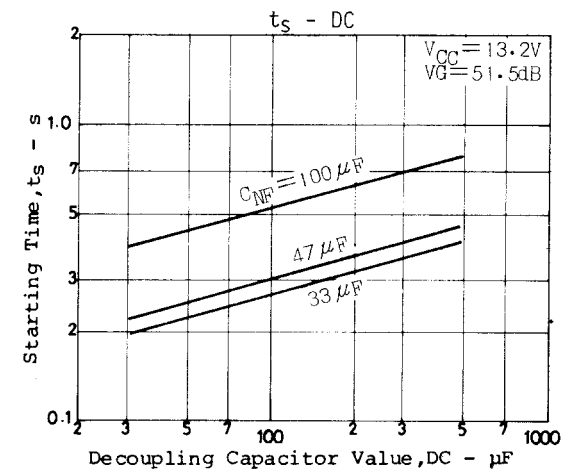
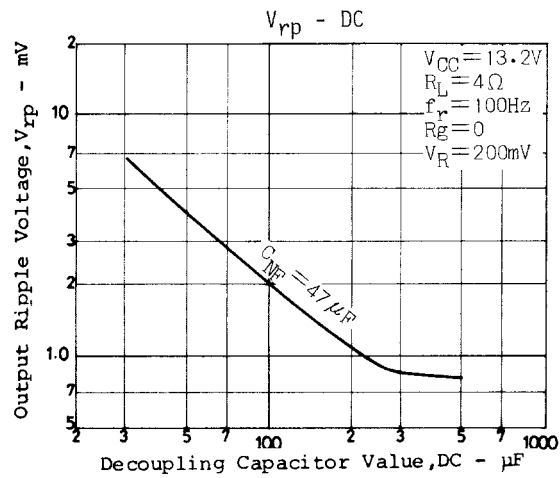
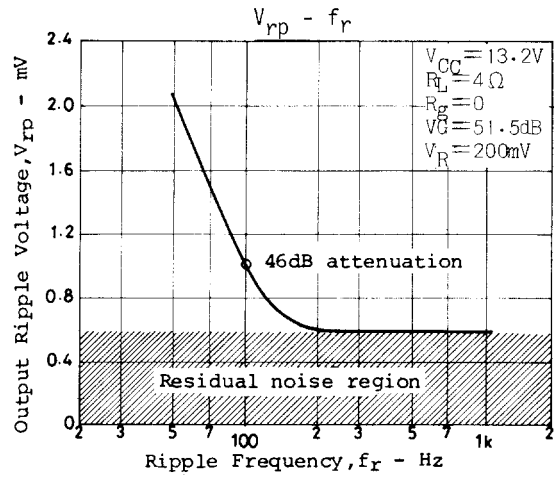
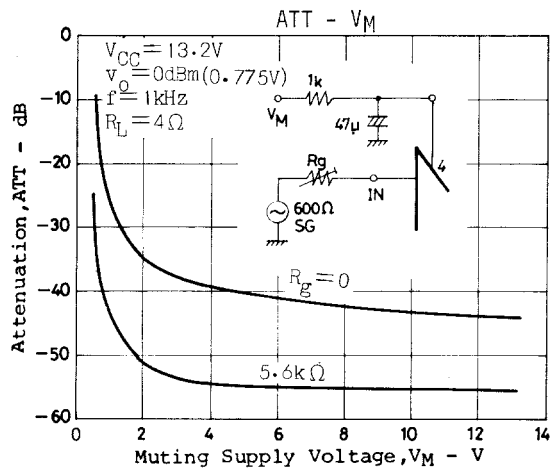
· Others

Connect the radiator fin of the package to GND.

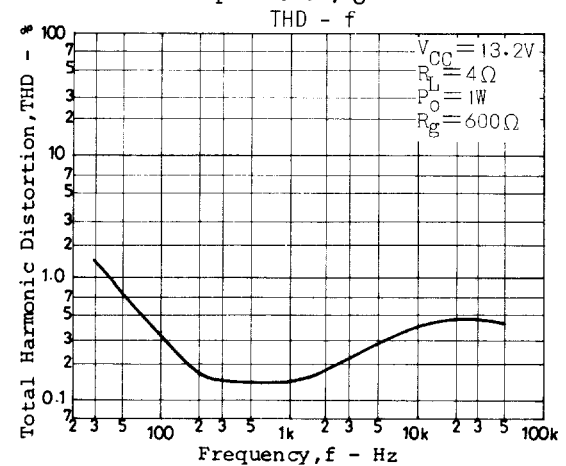
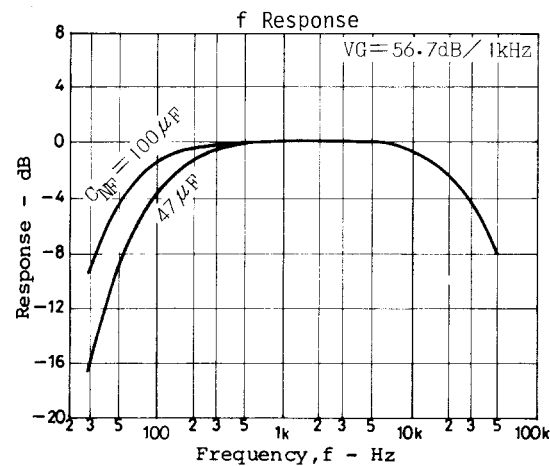
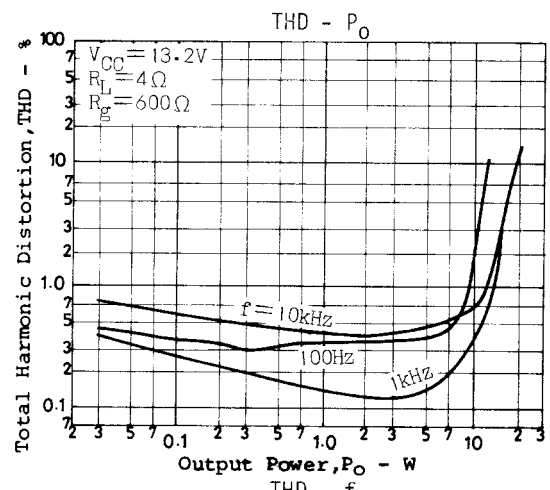
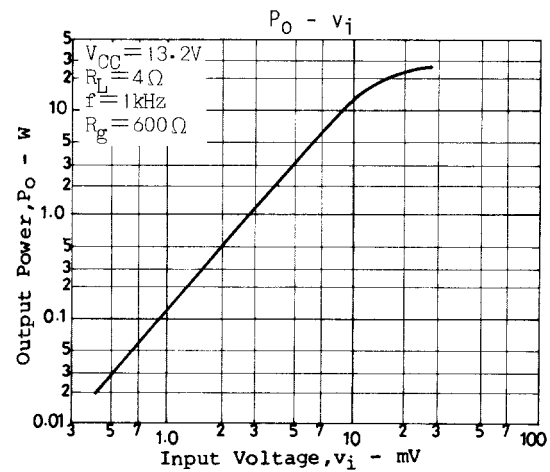
Characteristics at stereo amplifier mode

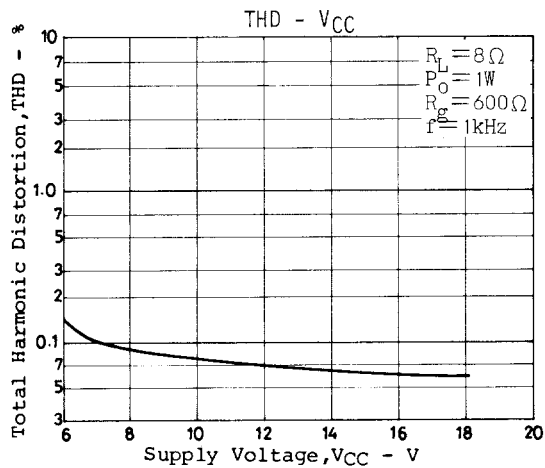
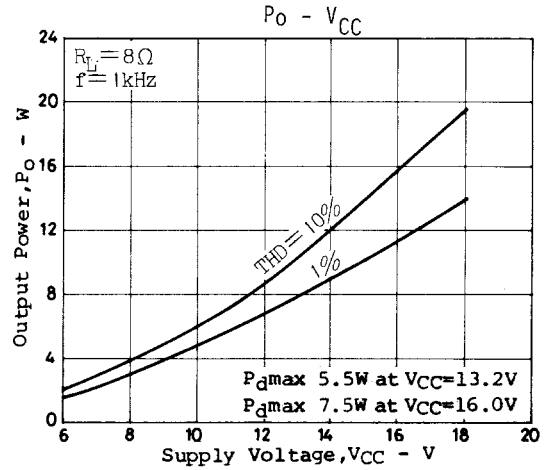
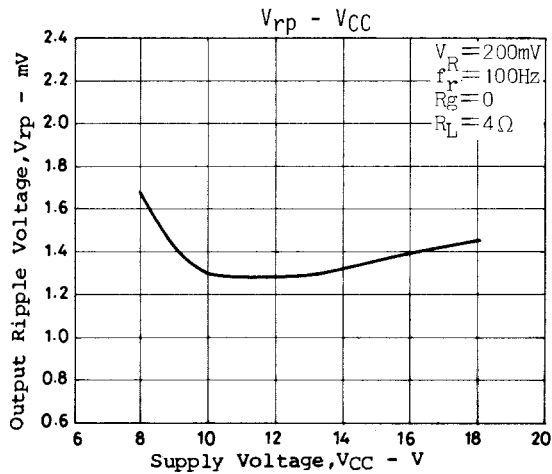
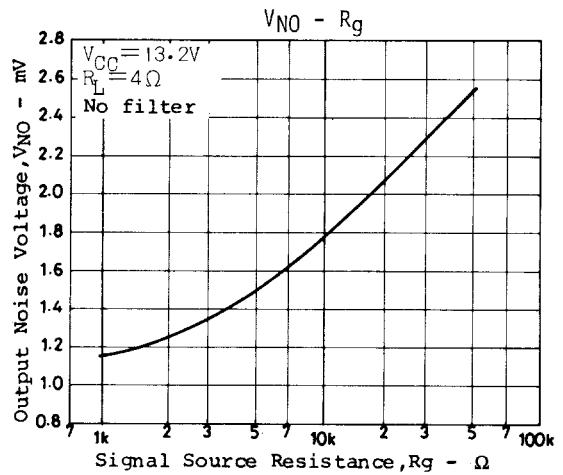
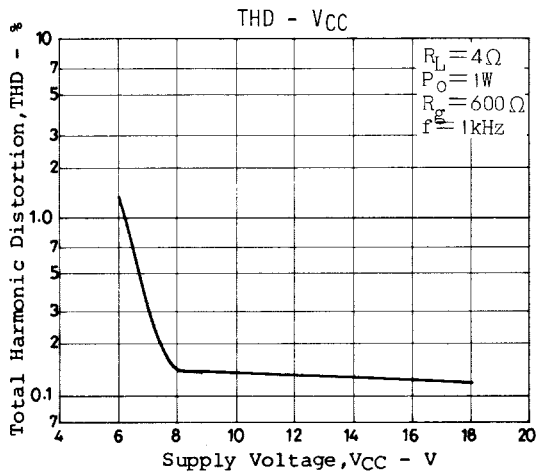
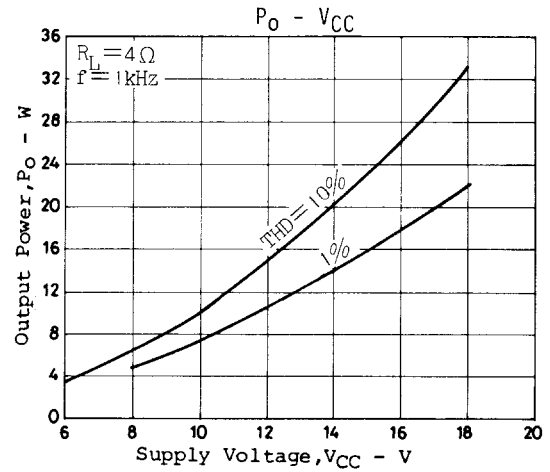
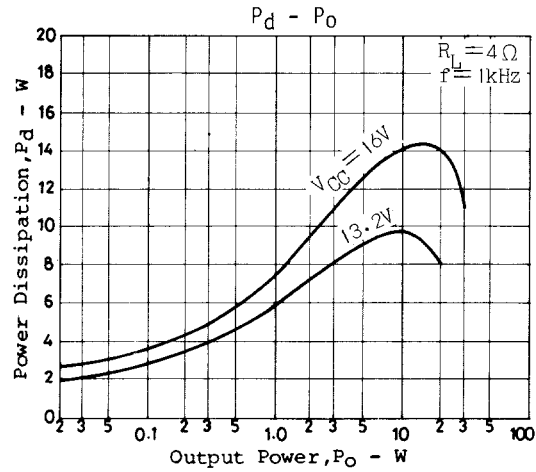




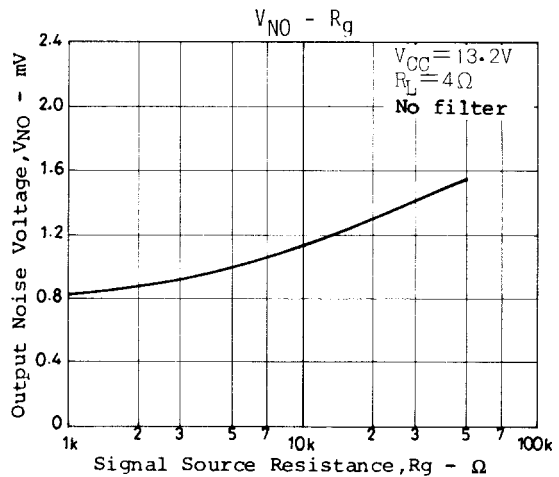
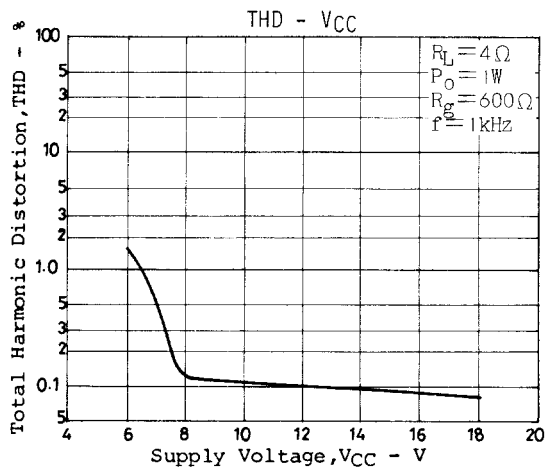
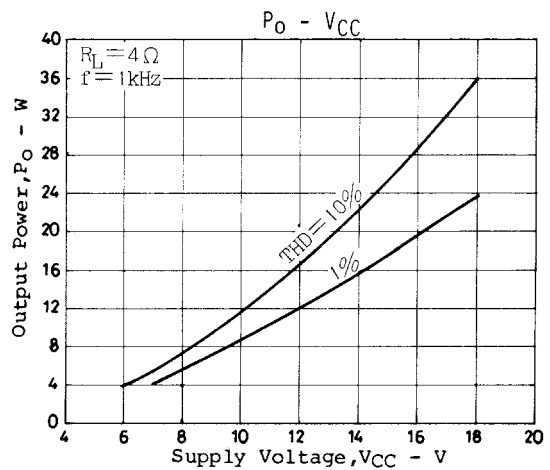
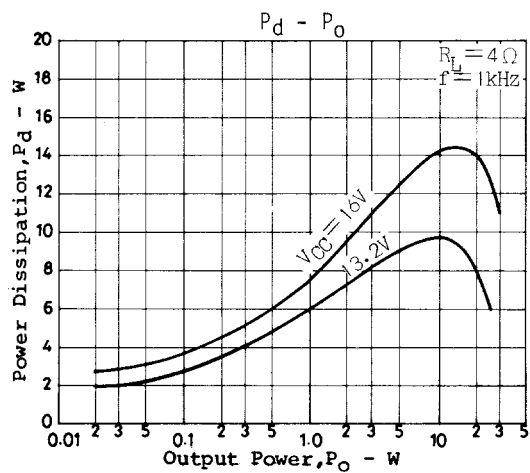
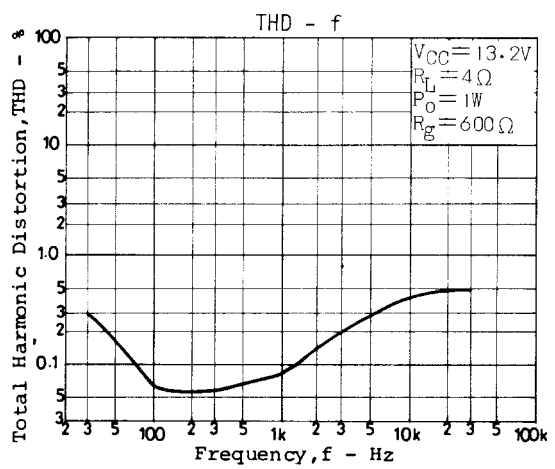
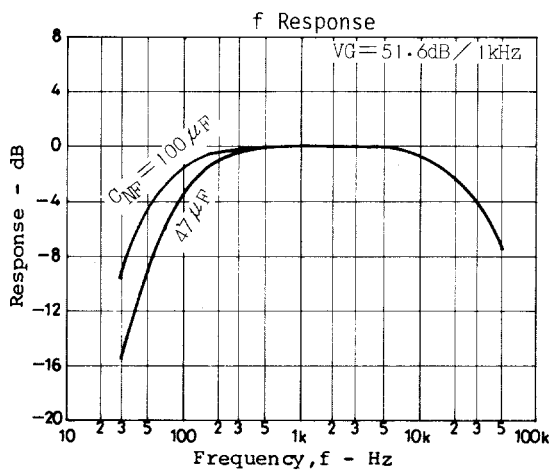
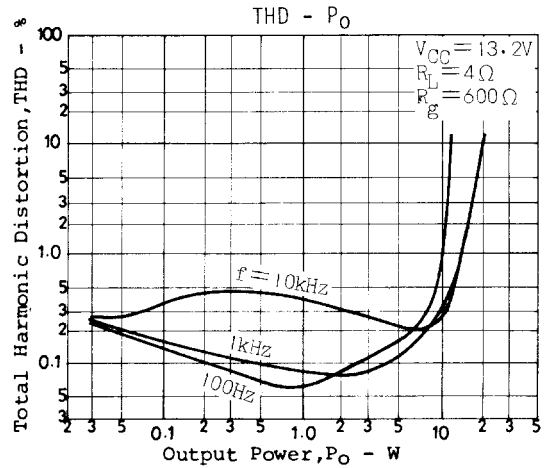
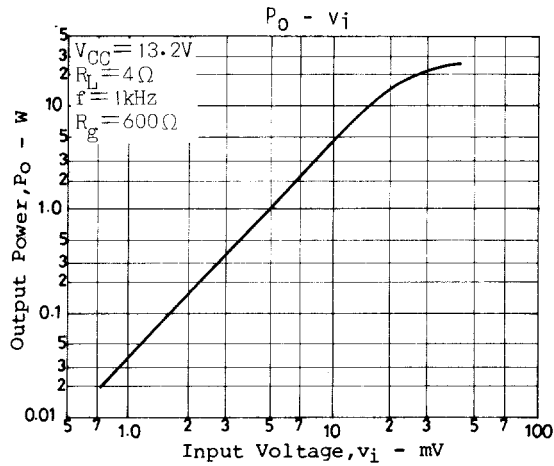


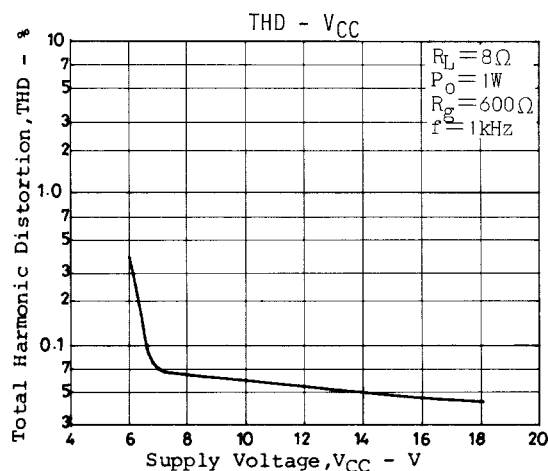
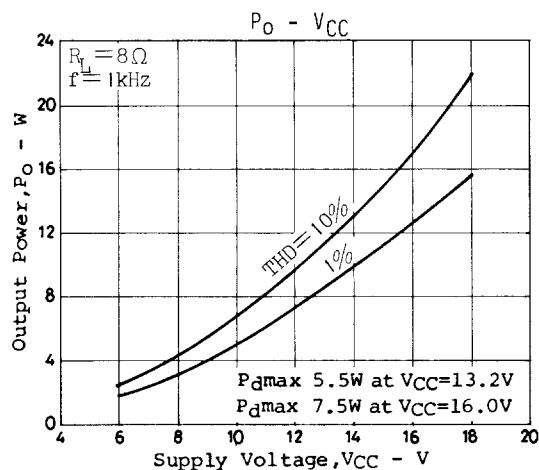
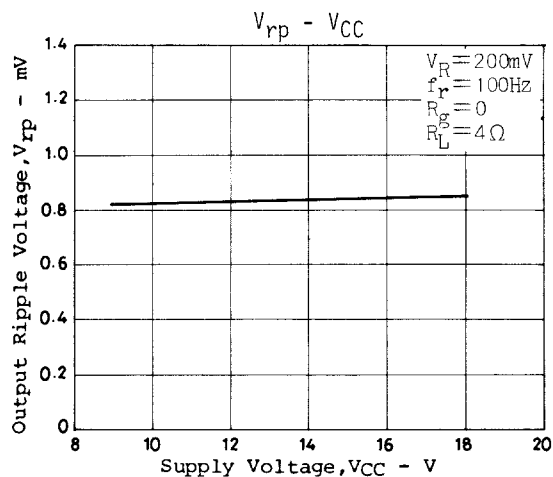
Characteristics at bridge amplifier mode No. 1





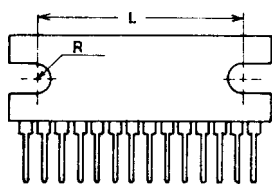
Characteristics at bridge amplifier mode No. 2





Proper Cares in Mounging Radiator Fin

1. The mounting torque is in the range of 39 to 59N · cm.
2. The distance between screw holes of the radiator fin must coincide with the distance between screw holes of the IC.
With case outline dimensions L and R referred to, the screws must be tightened with the distance between them as close to each other as possible.



3. The screw to be used must have a head equivalent to the one of truss machine screw or binder machine screw defined by JIS. Washers must be also used to protect the IC case.
4. No foreign matter such as cutting particles shall exist between heat sink and radiator fin. When applying grease on the junction surface, it must be applied uniformly on the whole surface.
5. IC lead pins are soldered to the printed circuit board after the radiator fin is mounted on the IC.

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