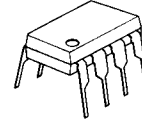


DUAL LOW VOLTAGE POWER AMPLIFIER

■ GENERAL DESCRIPTION

The NJM2073 is a monolithic integrated circuit in 8 lead dual-in-line package, which is designed for dual audio power amplifier in portable radio and handy cassette player.

■ PACKAGE OUTLINE



NJM2073D

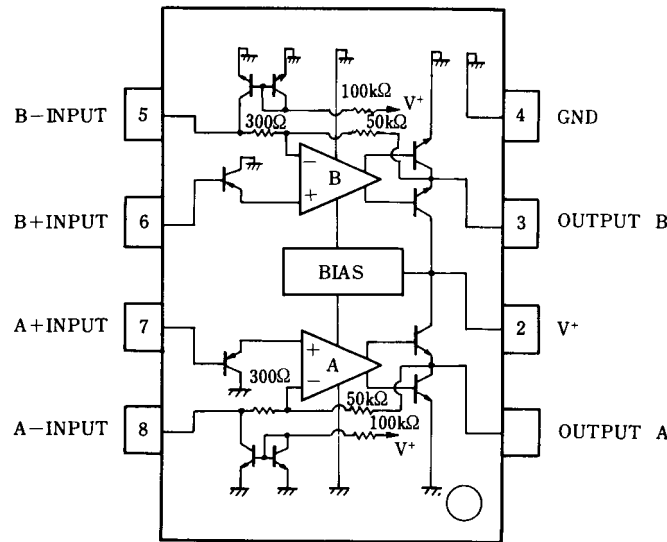


NJM2073M

■ FEATURES

- Operating Voltage (V⁺=1.8V~15V)
- Low Crossover Distortion
- Low Operating Current
- Bridge or Stereo Configuration
- No Turn-on Noise
- Package Outline DIP8,DMP8
- Bipolar Technology

■ PIN CONFIGURATION



NJM2073D
NJM2073M

NJM2073

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|-----------------------------|------------------|------------------------------|------|
| Supply Voltage | V ⁺ | 15 | V |
| Output Peak Current | I _{OP} | 1 | A |
| Power Dissipation | P _D | (DIP8) 700 (DMP8) 300 | mW |
| Input Voltage Range | V _{IN} | ± 0.4 | V |
| Operating Temperature Range | T _{opr} | -40~+85 | °C |
| Storage Temperature Range | T _{stg} | -40~+125 | °C |

■ ELECTRICAL CHARACTERISTICS D-Type

(1) BTL Configuration (Test Circuit Fig.1)

(V⁺=6V, Ta=25°C)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--|------------------|--|------|------|------|------|
| Operating Voltage | V ⁺ | | 1.8 | - | 15 | V |
| Operating Current | I _{CC} | R _L =∞ | - | 6 | 9 | mA |
| Output Offset Voltage (Between the Outputs) | ΔV _O | R _L =8Ω | - | 10 | 50 | mV |
| Input Bias Current | I _B | | - | 100 | - | nA |
| Output Power | P _O | THD=10%, f=1kHz | | | | |
| | P _O | V ⁺ =9V, R _L =16Ω (Note) | - | 2.0 | - | W |
| | P _O | V ⁺ =6V, R _L =8Ω (Note) | 0.9 | 1.2 | - | W |
| | P _O | V ⁺ =4.5V, R _L =8Ω | - | 0.6 | - | W |
| | P _O | V ⁺ =4.5V, R _L =4Ω (Note) | - | 0.8 | - | W |
| | P _O | V ⁺ =3V, R _L =4Ω | 200 | 300 | - | mW |
| | P _O | V ⁺ =2V, R _L =4Ω | - | 80 | - | mW |
| | | THD=1%, f=40Hz~15kHz | | | | |
| | P _O | V ⁺ =6V, R _L =8Ω | - | 1.0 | - | W |
| | P _O | V ⁺ =4.5V, R _L =4Ω | - | 0.6 | - | W |
| Total Harmonic Distortion | THD | P _O =0.5W, R _L =8Ω, f=1kHz | - | 0.2 | - | % |
| Close Loop Voltage Gain | A _V | f=1kHz | 41 | 44 | 47 | dB |
| Input Impedance | Z _{IN} | f=1kHz | 100 | - | - | kΩ |
| Equivalent Input Noise Voltage | V _{NI1} | R _S =10kΩ, A Curve | - | 2 | - | μV |
| | V _{NI2} | R _S =10kΩ, B=22Hz~22kHz | - | 2.5 | - | μV |
| Ripple Rejection | RR | f=100Hz | - | 40 | - | dB |
| Cutoff Frequency | f _H | A _V =-3dB from f=1kHz, R _L =8Ω, P _O =1W | - | 130 | - | kHz |

(Note) At on PC Board

(2) Stereo Configuration (Test Circuit Fig.2)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|--------------|--|------|------|---------|------------|
| Operating Voltage | V^+ | | 1.8 | - | 15 | V |
| Output Voltage | V_O | | - | 2.7 | - | V |
| Operating Current | I_{CC} | $R_L = \infty$ | - | 6 | 9 | mA |
| Input Bias Current | I_B | | - | 100 | - | nA |
| Output Power (Each Channel) | | THD=10%,f=1kHz | | | | |
| | P_O | $V^+=6V, R_L=4\Omega$ (Note) | 0.5 | 0.65 | - | W |
| | P_O | $V^+=4.5V, R_L=4\Omega$ | - | 0.32 | - | W |
| | P_O | $V^+=3V, R_L=4\Omega$ | - | 120 | - | mW |
| | P_O | $V^+=2V, R_L=4\Omega$ | - | 30 | - | mW |
| | | THD=1%,f=1kHz | | | | |
| | P_O | $V^+=6V, R_L=4\Omega$ | - | 500 | - | mW |
| | P_O | $V^+=4.5V, R_L=4\Omega$ | - | 250 | - | mW |
| Total Harmonic Distortion | THD | $P_O=0.4W, R_L=4\Omega, f=1kHz$ | - | 0.25 | - | % |
| Voltage Gain | A_V | f=1kHz | 41 | 44 | 47 | dB |
| Channel Balance | ΔA_V | | - | - | ± 1 | dB |
| Input Impedance | Z_{IN} | f=1kHz | 100 | - | - | k Ω |
| Equivalent Input Noise Voltage | V_{NI1} | $R_S=10k\Omega, A$ Curve | - | 2.5 | - | μV |
| | V_{NI2} | $R_S=10k\Omega, B=22Hz\sim 22kHz$ | - | 3 | - | μV |
| Ripple Rejection | RR | f=100Hz, $C_X=100\mu F$ | 24 | 30 | - | dB |
| Cutoff Frequency | f_H | $A_V=-3dB$ from f=1kHz, $R_L=8\Omega, P_O=250mW$ | - | 200 | - | kHz |

(Note) At on PC Board

■ ELECTRICAL CHARACTERISTICS M-Type

(1) BTL Configuration (Test Circuit Fig.1)

($V^+=6V, T_a=25^\circ C$)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--|--------------|--|------|------|------|------------|
| Operating Voltage | V^+ | | 1.8 | - | 15 | V |
| Operating Current | I_{CC} | $R_L = \infty$ | - | 6 | 9 | mA |
| Output Offset Voltage (Between the Outputs) | ΔV_O | $R_L=8\Omega$ | - | 10 | 50 | mV |
| Input Bias Current | I_B | | - | 100 | - | nA |
| Output Power | | THD=10%,f=1kHz | | | | |
| | P_O | $V^+=6V, R_L=16\Omega$ (Note) | - | 0.8 | - | W |
| | P_O | $V^+=4V, R_L=8\Omega$ (Note) | 350 | 460 | - | mW |
| | P_O | $V^+=3V, R_L=4\Omega$ (Note) | 200 | 300 | - | mW |
| | P_O | $V^+=2V, R_L=4\Omega$ | - | 80 | - | mW |
| | | THD=1%,f=40Hz~15kHz | | | | |
| | P_O | $V^+=4V, R_L=8\Omega$ | - | 380 | - | mW |
| Total Harmonic Distortion | THD | $V^+=4V, R_L=8\Omega, P_O=200mW, f=1kHz$ | - | 0.2 | - | % |
| Close Loop Voltage Gain | A_V | f=1kHz | 41 | 44 | 47 | dB |
| Input Impedance | Z_{IN} | f=1kHz | 100 | - | - | k Ω |
| Equivalent Input Noise Voltage | V_{NI1} | $R_S=10k\Omega, A$ Curve | - | 2 | - | μV |
| | V_{NI2} | $R_S=10k\Omega, B=22Hz\sim 22kHz$ | - | 2.5 | - | μV |
| Ripple Rejection | RR | f=100Hz | - | 40 | - | dB |
| Cutoff Frequency | f_H | $A_V=-3dB$ from f=1kHz, $R_L=16\Omega, P_O=0.5W$ | - | 130 | - | kHz |

(Note) At on PC Board

NJM2073

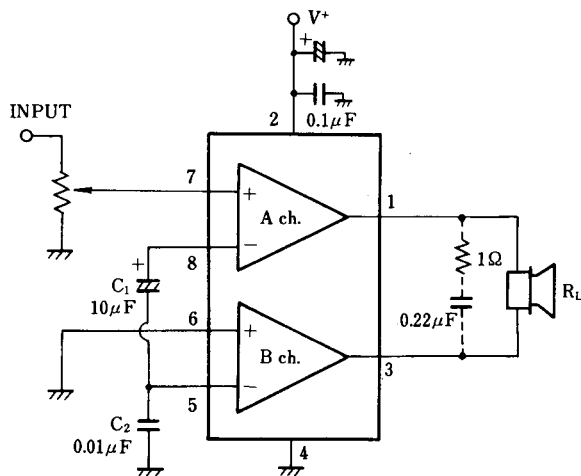
(2) Stereo Configuration (Test Circuit Fig.2)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|--------------|---|------|------|---------|------------|
| Operating Voltage | V^+ | | 1.8 | - | 15 | V |
| Output Voltage | V_o | | - | 2.7 | - | V |
| Operating Current | I_{CC} | $R_L = \infty$ | - | 6 | 9 | mA |
| Input Bias Current | I_B | | - | 100 | - | nA |
| Output Power (Each Channel) | P_o | THD=10%, f=1kHz | | | | |
| | P_o | $V^+ = 6V, R_L = 16\Omega$ | - | 240 | - | mW |
| | P_o | $V^+ = 5V, R_L = 8\Omega$ (Note) | - | 270 | - | mW |
| | P_o | $V^+ = 4V, R_L = 4\Omega$ (Note) | 180 | 250 | - | mW |
| | P_o | $V^+ = 3V, R_L = 4\Omega$ | - | 120 | - | mW |
| | P_o | $V^+ = 2V, R_L = 4\Omega$ | - | 30 | - | mW |
| Total Harmonic Distortion | THD | THD=1%, f=1kHz | - | 0.25 | - | % |
| | | $V^+ = 4V, R_L = 4\Omega$ | - | 180 | - | mW |
| | | $V^+ = 4V, R_L = 4\Omega, P_o = 150mW, f = 1kHz$ | - | 0.25 | - | % |
| Voltage Gain | A_v | f=1kHz | 41 | 44 | 47 | dB |
| Channel Balance | ΔA_v | | - | - | ± 1 | dB |
| Input Impedance | Z_{IN} | f=1kHz | 100 | - | - | k Ω |
| Equivalent Input Noise Voltage | V_{NI1} | $R_S = 10k\Omega, A$ Curve | - | 2.5 | - | μV |
| | V_{NI2} | $R_S = 10k\Omega, B = 22Hz \sim 22kHz$ | - | 3 | - | μV |
| Ripple Rejection | RR | f=100Hz, $C_x = 100\mu F$ | 24 | 30 | - | dB |
| Cutoff Frequency | f_H | $A_v = -3dB$ from f=1kHz, $R_L = 16\Omega, P_o = 125mW$ | - | 200 | - | kHz |

(Note) At on PC Board

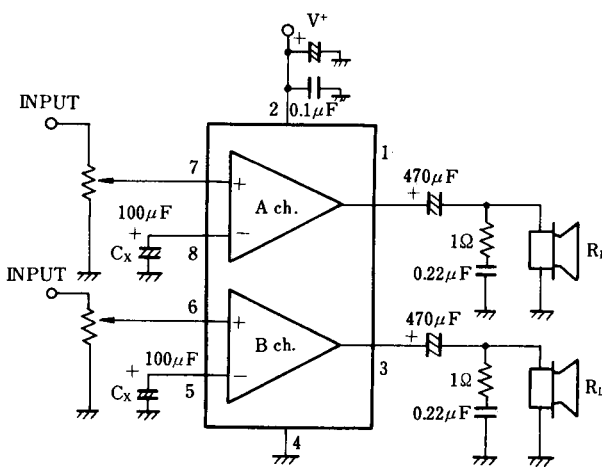
■ TYPICAL APPLICATION & TEST CIRCUIT

Fig.1 BTL Configuration



note: pin No. to D,M-Type

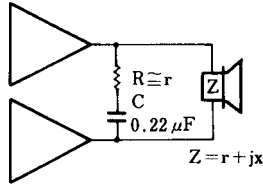
Fig.2 Stereo Configuration



■ PARASTIC OSCILLATION PREVENTING CIRCUIT

Put $1\Omega + 0.22\mu\text{F}$ on parallel to load, if the load is speaker. Recommend putting $0.1\mu\text{F}$ and more than $100\mu\text{F}$ capacitors with good high frequency characteristics in to near ground and supply voltage pins.

In BTL operation of less than 2V supply voltage, parastic oscillation may be occurred with $R=1\Omega$. And so recommended R to be the same value of pure resistance(r) when it is lower than 3V.



■ MUTING CIRCUIT

When Mute ON, OUTPUT level saturates to GND side.

Fig.3 BTL Configuration

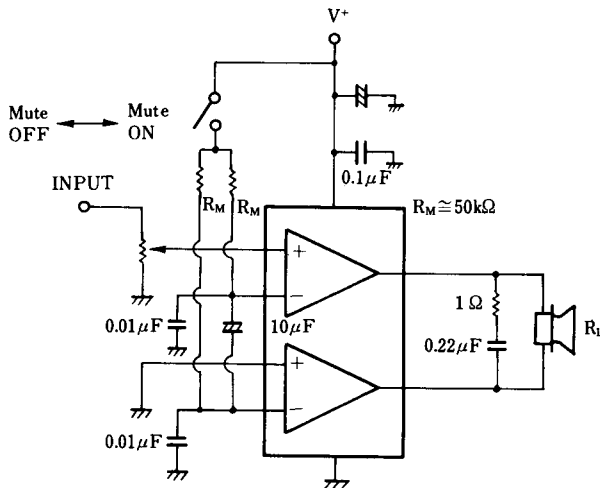
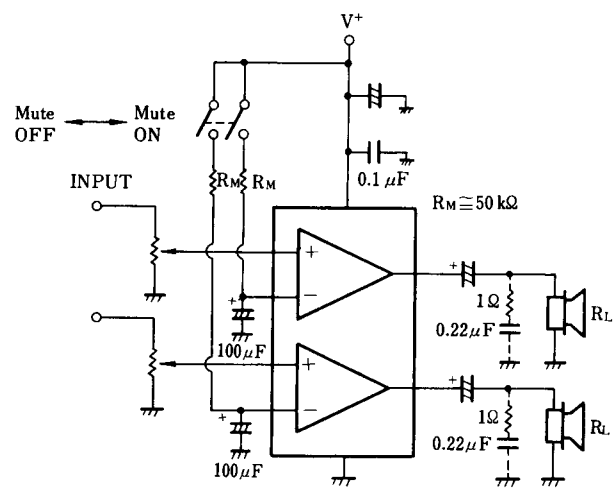


Fig.4 Stereo Configuration



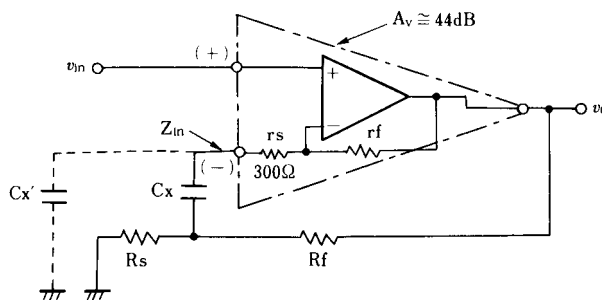
■ VOLTAGE GAIN REDUCTION APPLICATION EXAMPLE

(1) Outline of way to further Reduction

NJM2073 by taking in assumption, as one of OP-AMP (Gain 44dB, minus input impedance about 300Ω), to feedback from output to minus input helps to get reduction of stabilized Voltage Gain. Fig.5 indicates the model example.

Here is the point to be noticed that, in order to get the appropriate output Bias Voltage, it is important to keep the minus input floating as DC condition, (inserting C_X), and also that when extended too much reduction of Gain might cause Oscillation due to high band phase margin. The reduction of voltage gain is limited at around 26dB (20 times), and when oscillation, it is necessary to attach the oscillation stopper. Please examine the C_X value accordingly to the application requirement.

Fig.5 Model of Voltage Gain Reduction



$$A_v = \frac{v_o}{v_{in}} \cong \frac{R_s + R_f}{R_s + \frac{R_s + R_f}{A_v} + \frac{R_s \times R_f}{A_v \times Z_{in}}}$$

NJM2073

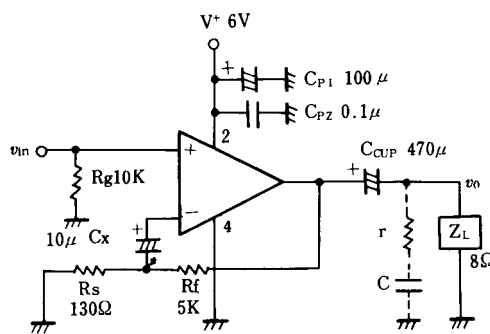
(2) The Application Example of Voltage Gain Reduction. (STEREO)

Fig.6 indicates the application example and Table1 indicates the recommendable value of parts to be attached externally.

Table1,Applying purpose and Recommended Value of Externally parts to be attached.

| EXTERNAL PARTS | APPLICATION PURPOSE | RECOMMENDED VALUE | REMARKS |
|----------------|--|---|---|
| R_g | Plus input to be grounded by fixed DC | Under about 100k Ω | Catch the noise when much higher. |
| R_s | AV shall be decided with R_f | - | |
| R_f | AV shall be decided with R_s | About 5k Ω | The co-temperature of AV becomes higher in case when R_s is higher resistance.The current from output pin to GND becomes higher,in case when R_s is lower resistance.(The current sinks in vain.) |
| C_x | Minus input to be grounded by fixed DC | - | Low-band Cut off frequency (fL) is to be decided. The rise time becomes longer in case that C_x is big. |
| C_{CUP} | Output DC Decoupling | When $R_L=8\Omega$,More than 220 μ F | fL shall be decided by C_{CUP} and Z_L . |
| C_{P1} | Stabilization of V^+ | More than about C_{CUP} | Inserting near around V^+ pin and GND pin. |
| C_{P2} | Prevention of Oscillation | More than 0.1 μ F | |
| r | Prevention of Oscillation | About R_L | Inserting near around V^+ pin and GND pin. |
| C | Prevention of Oscillation | 0.22 μ F | To be examined by about the resistor volume of the speaker load. |

Fig.6 STEREO Application Example.



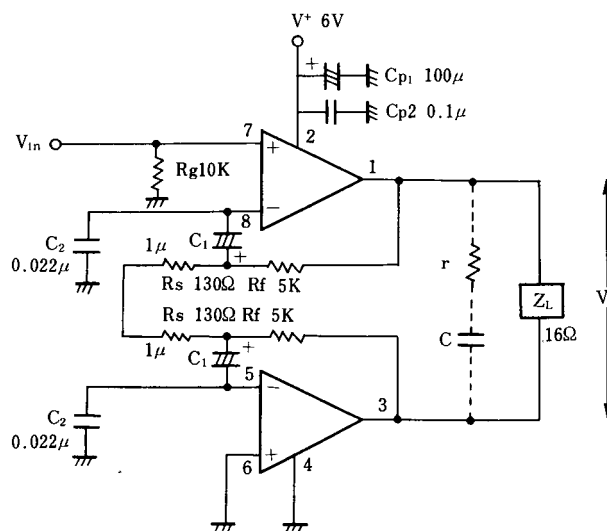
● Application for Voltage Gain Reduction (BTL)

Fig.7 indicates the application example, Table2 shows recommended value of externally attaching parts.

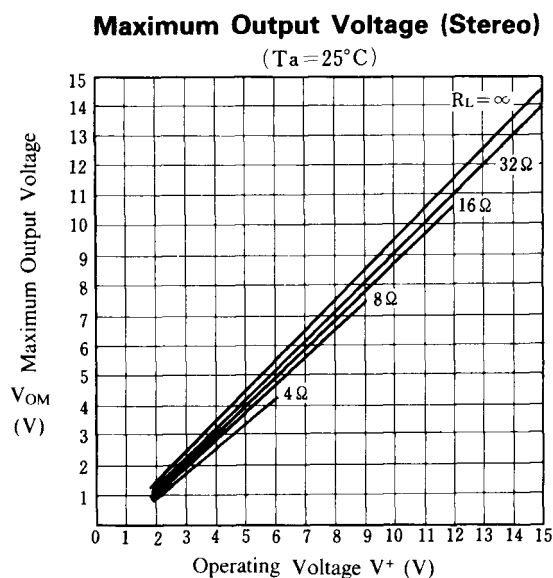
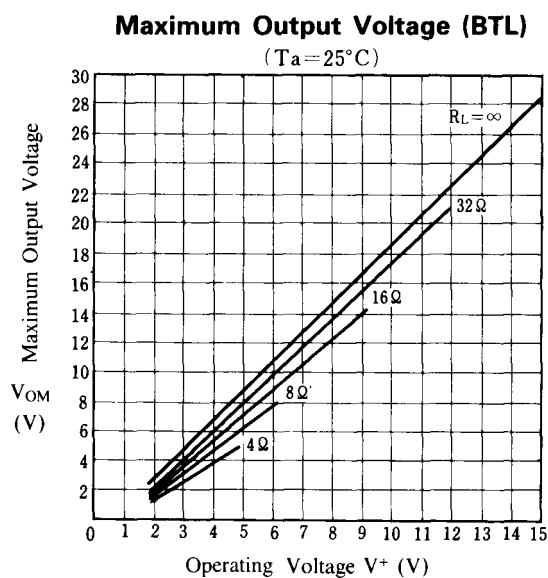
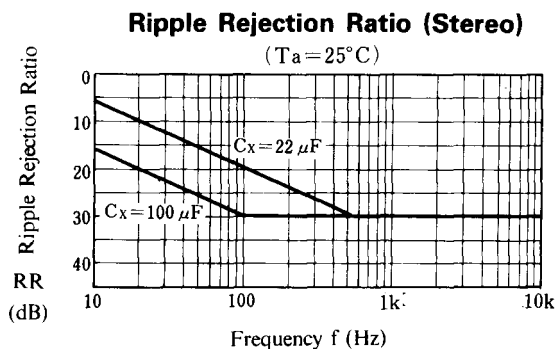
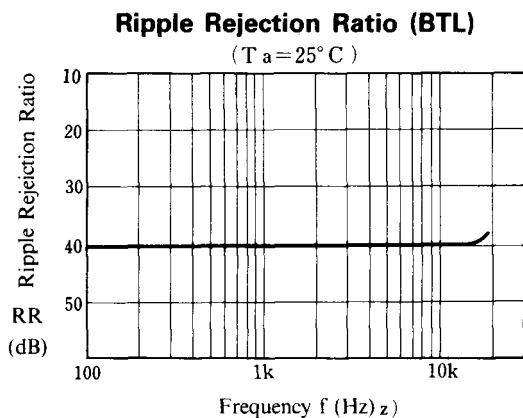
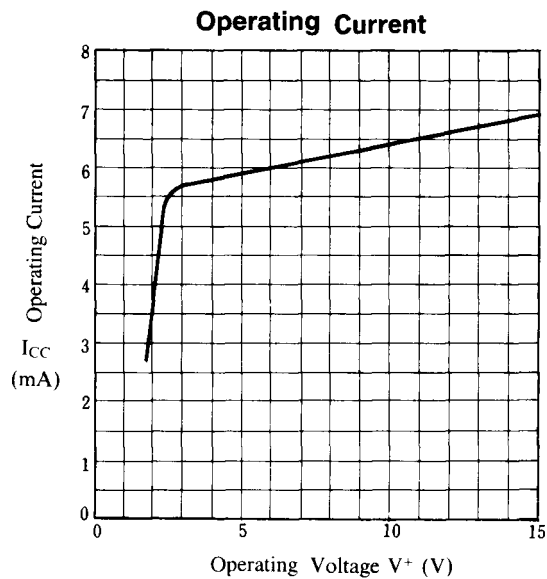
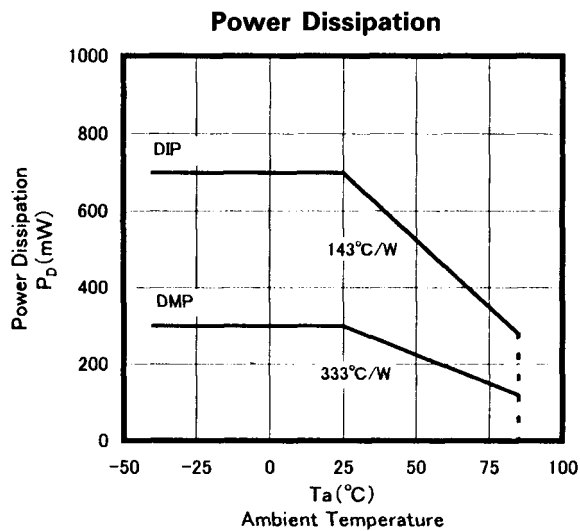
Table2 Applying purpose and Recommended Value of External Part

| EXTERNAL PARTS | APPLICATION PURPOSE | RECOMMENDED VALUE | REMARKS |
|----------------|--|-----------------------------|---|
| R_g | DC condition ground of plus input | Below about 10k Ω | Making noise when higher. |
| R_s | AV shall be decided with R_f | - | |
| R_f | AV shall be decided with R_s | About 5k Ω | Temperature feature to be increased accordingly as in higher AV value. When lower, to be trended of Oscillation. |
| C_1 | Releasing minus input in to DC condition | - | Setting up low band Cut-off frequency (fL). More higher, the rise time become longer. |
| C_2 | Preventing Oscillation | About 0.02 μ F | The more higher in value, the high band THD, due to phase slipping to be deteriorated. When lower, to be trended of oscillation. |
| C_{P1} | Stability of V^+ Preventing Oscillation | More than about 100 μ F | Inserting near around at V^+ and the GND pin. |
| C_{P2} | Preventing Oscillation | More than 0.1 μ F | Inserting near around at V^+ and the GND pin. |
| r | Preventing Oscillation | About R_L | To be examined at around pure resistor Value of speaker load. |
| C | Preventing Oscillation | 0.22 μ F | |

Fig.7 BTL Application



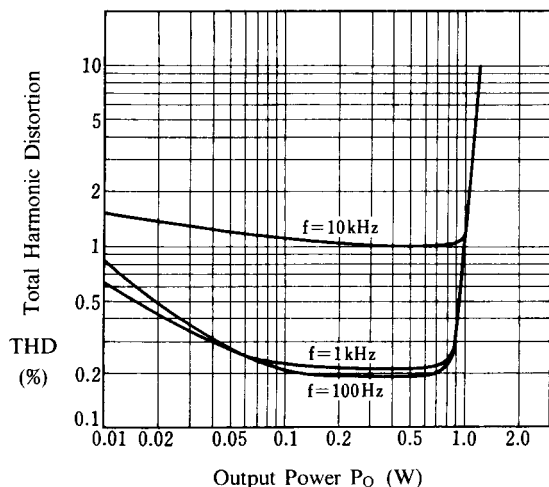
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS

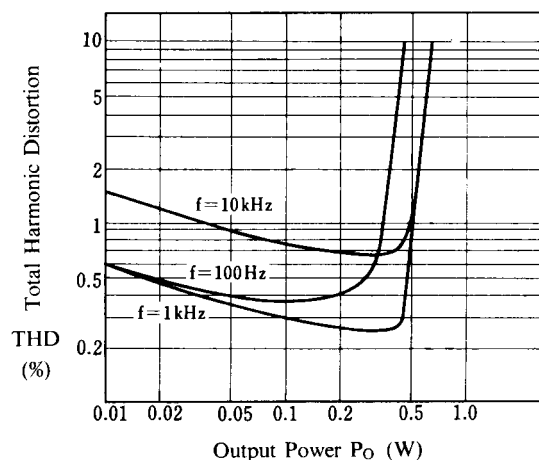
Total Harmonic Distortion (BTL)

($V^+ = 6V$, $R_L = 8\Omega$)



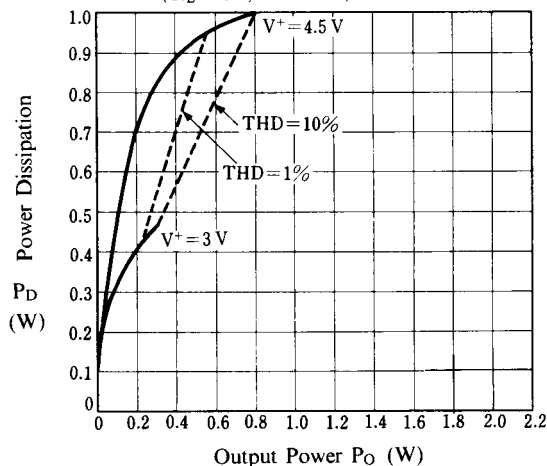
Total Harmonic Distortion (Stereo)

($V^+ = 6V$, $R_L = 4\Omega$)



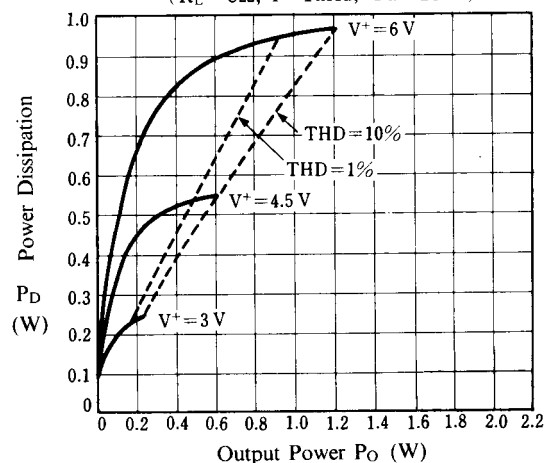
Power Dissipation vs. Output Power (BTL)

($R_L = 4\Omega$, $f = 1kHz$, $T_a = 25^\circ C$)



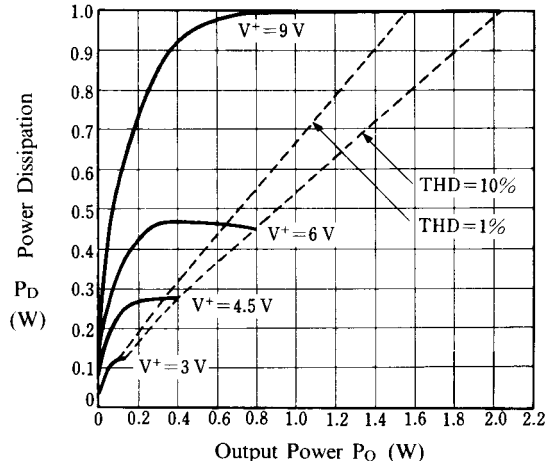
Power Dissipation vs. Output Power (BTL)

($R_L = 8\Omega$, $f = 1kHz$, $T_a = 25^\circ C$)



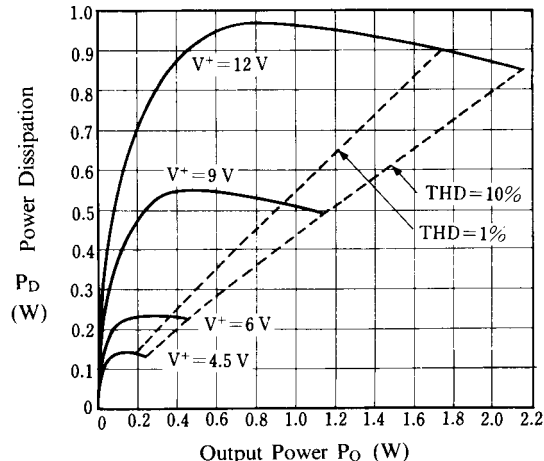
Power Dissipation vs. Output Power (BTL)

($R_L = 16\Omega$, $f = 1kHz$, $T_a = 25^\circ C$)

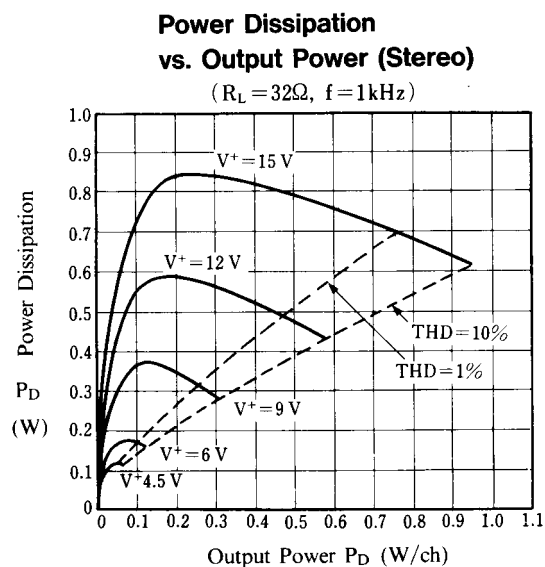
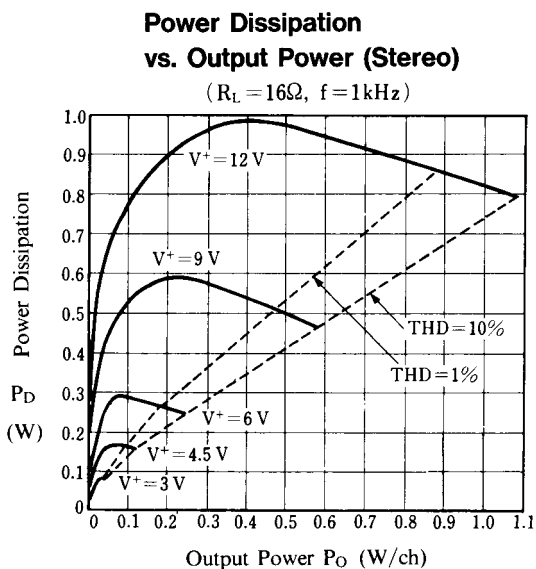
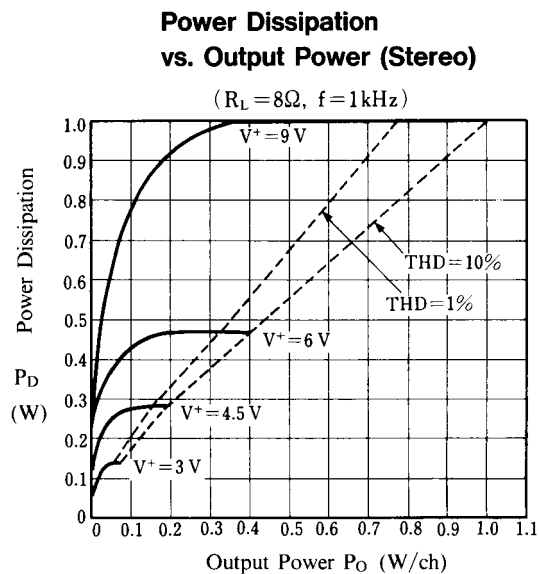
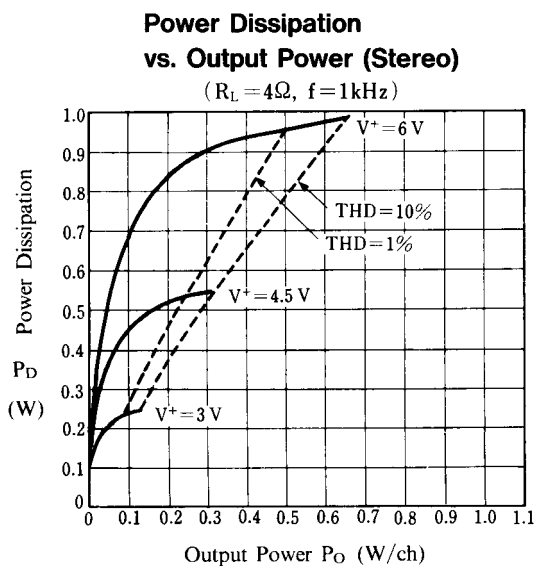


Power Dissipation vs. Output Power (BTL)

($R_L = 32\Omega$, $f = 1kHz$)

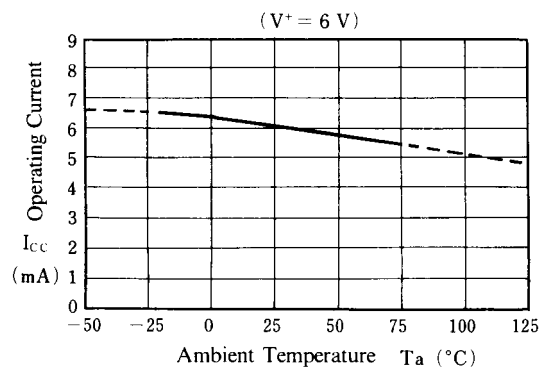


■ TYPICAL CHARACTERISTICS

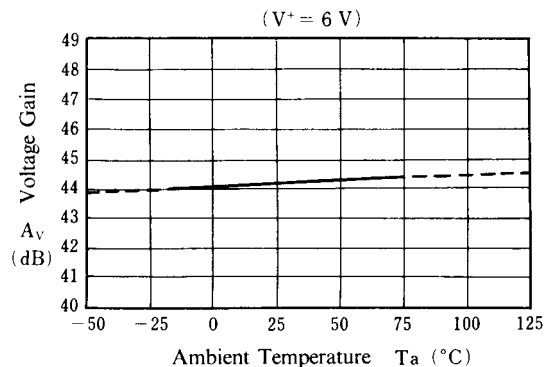


■ TYPICAL CHARACTERISTICS

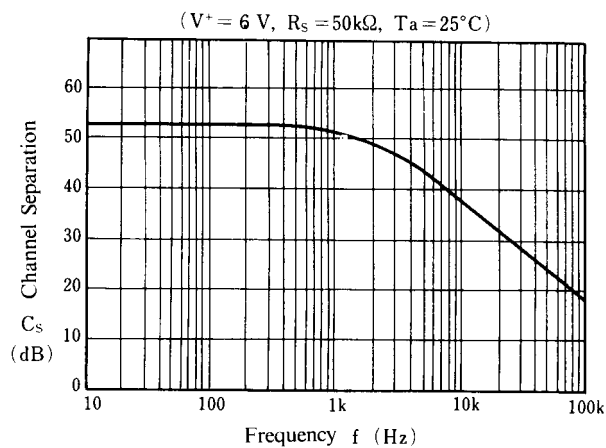
Operating Current vs. Temperature



Voltage Gain vs. Temperature



Channel Separation vs. Frequency



[CAUTION]

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Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
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Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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