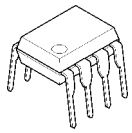
# ULTRA LOW NOISE DUAL OPERATIONAL AMPLIFIER

## ■ GENERAL DESCRIPTION

The NJM2122 is an ultra low noise dual operational amplifier.

The features of ultra low noise, low operating voltage, and low saturation voltage are suitable for microphone amplifier of digital audio items such as portable MD,DAT,and others.

## ■ PACKAGE OUTLINE



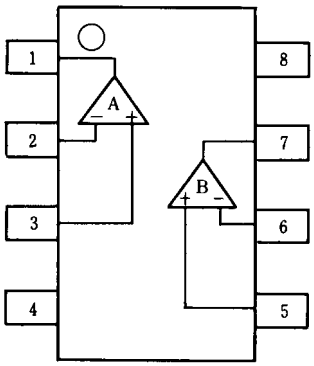
NJM2122D

NJM2122M

## ■ FEATURES

- Operating Voltage ( ±2.0V~±7.0V )
- Ultra Low Noise Voltage ( 1.5nV/√Hz typ.@ f=1kHz )
- Low Saturation Output Voltage ( 0.3V typ. )
- Bipolar Technology
- Package Outline DIP8,DMP8

## ■ PIN CONFIGURATION

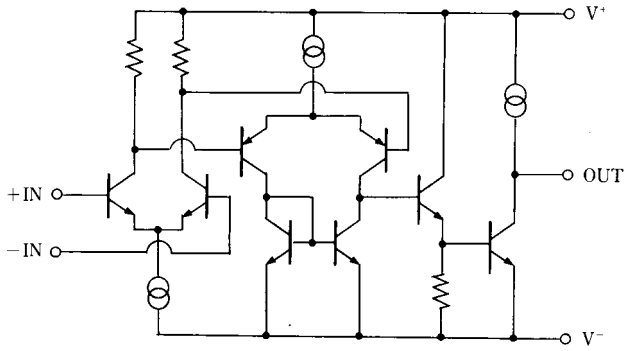



NJM2122D
NJM2122M

**PIN FUNCTION**

1. A OUTPUT
2. A –INPUT
3. A +INPUT
4. $V^-$
5. B +INPUT
6. B –INPUT
7. B OUTPUT
8. $V^+$

## ■ EQUIVALENT CIRCUIT ( 1/2 Shown )



## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25˚C )

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V^+/V^-$ | ± 10 | V |
| Differential Input Voltage | $V_{ID}$ | ± 0.5 | V |
| Input Voltage | $V_{IC}$ | ± 10 ( note ) | V |
| Power Dissipation | $P_D$ | ( DIP8 ) 500<br>( DMP8 ) 300 | mW |
| Operating Temperature Range | $T_{opr}$ | -20~+75 | ˚C |
| Storage Temperature Range | $T_{stg}$ | -40~+125 | ˚C |

( note ) When the supply voltage is less than ±10V,the absolute maximum input voltage is equal to the supply voltage.

## ■ ELECTRICAL CHARACTERISTICS

( $V^+$=5V,Ta=25˚C )

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Operating Voltage 1 | Vope1 | DIP Package | ± 2.0 | - | ± 10.0 | V |
| Operating Voltage 2 | Vope2 | DMP Package | ± 2.0 | - | ± 7.0 | V |
| Operating Current | $I_{CC}$ | $V_{IN}$=0V,$R_L$=∞Ω | - | 7.0 | 9.5 | mA |
| Input Offset Voltage | $V_{IO}$ | $R_S$=500Ω | - | 1.0 | 6.0 | mV |
| Input Offset Current | $I_{IO}$ | | - | 0.45 | 1.50 | μA |
| Input Bias Current | $I_B$ | | - | 3.6 | 8.0 | μA |
| Large Signal Voltage Gain | $A_V$ | $R_L$≥10kΩ | 80 | 100 | - | dB |
| Input Common Mode Voltage Range | $V_{ICM}$ | | ± 0.7 | ± 1.0 | - | V |
| Common Mode Rejection Ratio | CMR | | 60 | 74 | - | dB |
| Supply Voltage Rejection Ratio | SVR | | 60 | 80 | - | dB |
| Maximum Output Voltage | $V_{OM}$ | $R_L$≥2.5kΩ | ± 2.0 | ± 2.2 | - | V |
| Slew Rate | SR | $G_V$=20dB,$V_{IN}$=± 0.1V | - | 2.4 | - | V/μs |
| Gain Bandwidth Product | GB | | - | 12 | - | MHz |
| Equivalent Input Noise Voltage 1 | $e_{n1}$ | $R_S$=10Ω,f=1kHz | - | 1.5 | - | nV√Hz |
| Equivalent Input Noise Voltage 2 | $e_{n2}$ | *Figure1 | - | 0.56 | 0.75 | μVrms |
| Channel Separation | CS | f=1kHz | - | 90 | - | dB |
| Total Harmonic Distortion | THD | $V_O$=1Vrms,f=1kHz<br>$G_V$=20dB,$R_L$=2.5kΩ | - | 0.003 | - | % |

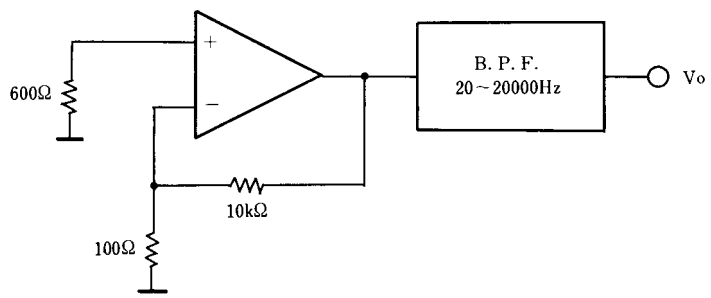
( note ) Between 30 to 50dB voltage gain is recommended.

In case of voltage gain less than 30dB,phase compensation by external circuit is required.

The voltage follower circuit must not be used.

DMP package should be used in operating voltage less than ±7V,because of the $P_D$ limitation.

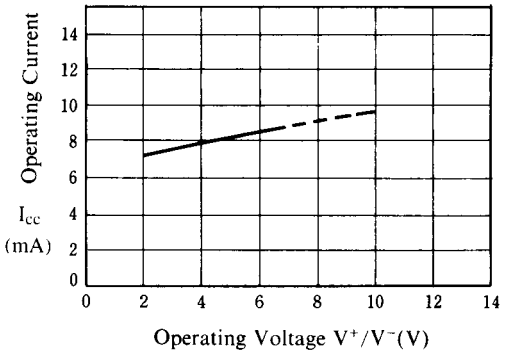
Figure1



## ■ TYPICAL CHARACTERISTICS

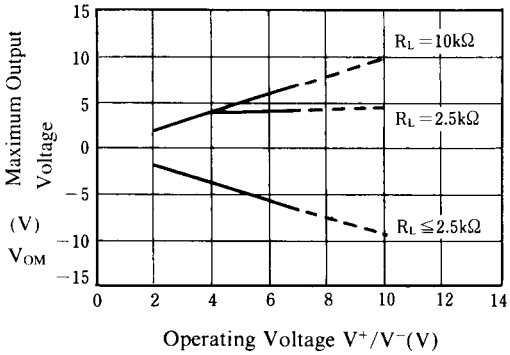
### Operating Current vs. Operating Voltage

(Ta=25℃)



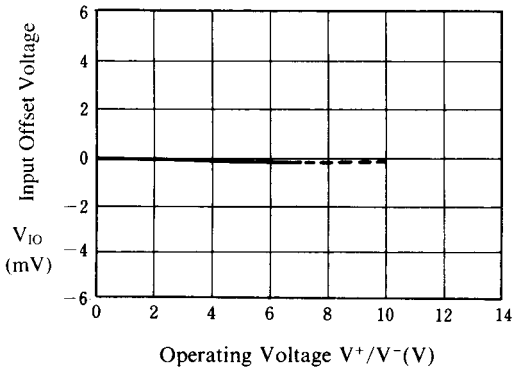

### Maximum Output Voltage vs. Operating Voltage

(Ta=25℃)



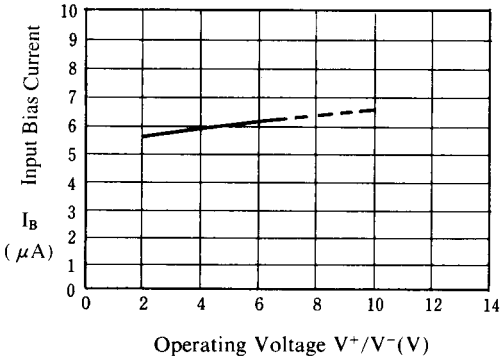

### Input Offset Voltage vs. Operating Voltage

(Ta=25℃)



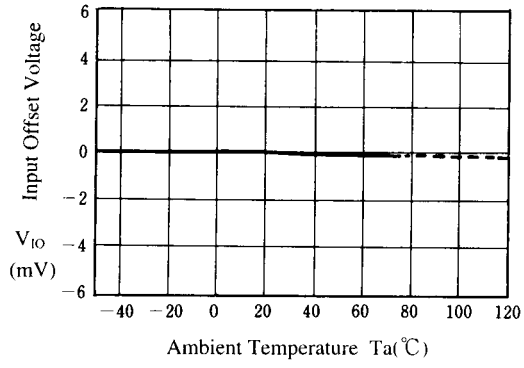

### Input Bias Current vs. Operating Voltage

(Ta=25℃)



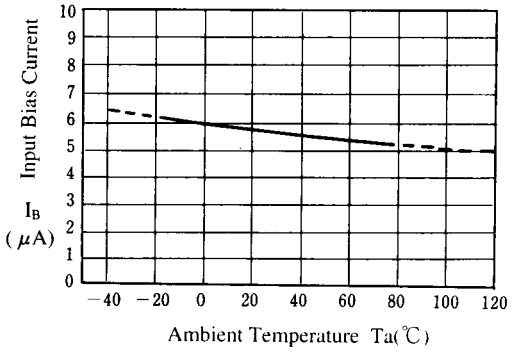

### Input Offset Voltage vs. Temperature

($V^+/V^-$ = ±2.5V)




### Input Bias Current vs. Temperature

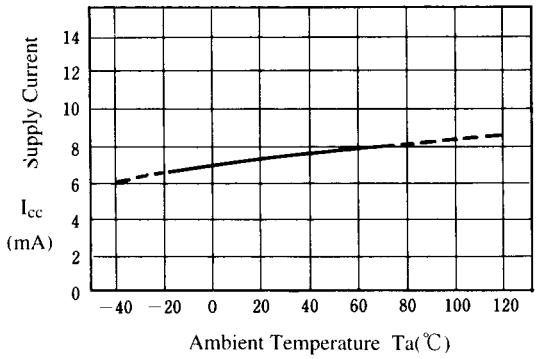
($V^+/V^-$ = ±2.5V)



## ■ TYPICAL CHARACTERISTICS

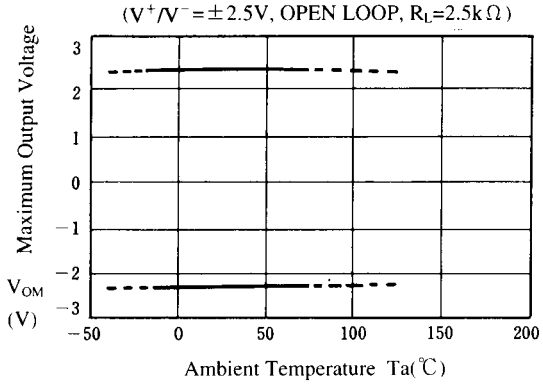
**Operating Current vs. Temperature**

($V^+/V^-=\pm2.5V$)



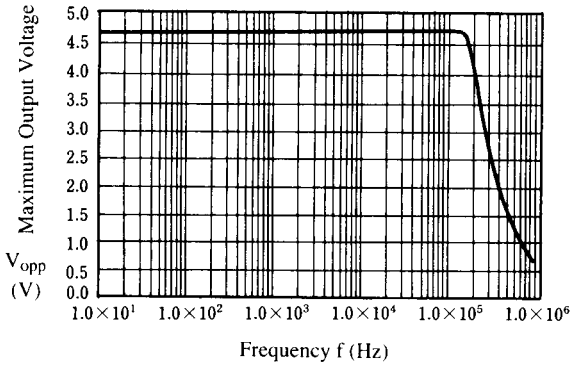

**Maximum Output Voltage vs. Temperature**

($V^+/V^-=\pm2.5V$, OPEN LOOP, $R_L=2.5k\Omega$)



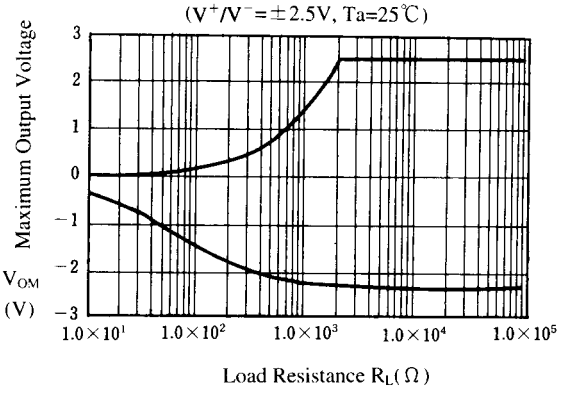

**Maximum Output Voltage vs. Frequency**

($V^+/V^-=\pm2.5V$, $R_L=2.5k\Omega$, Ta=25℃)



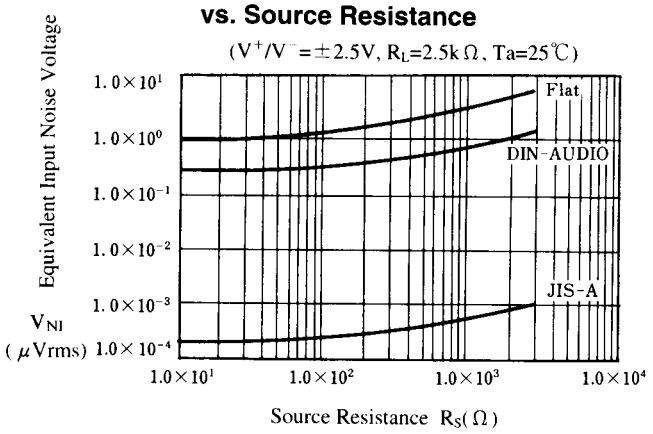

**Maximum Output Voltage vs. Load Resistance**

($V^+/V^-=\pm2.5V$, Ta=25℃)



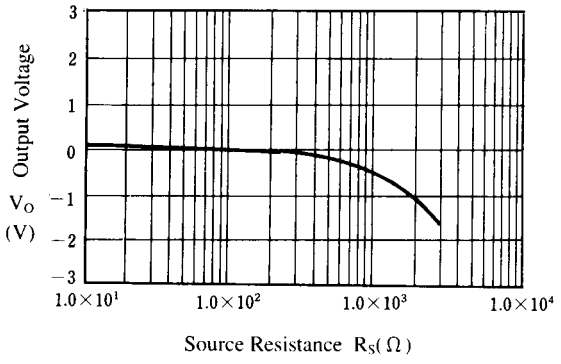

**Equivalent Input Noise Voltage vs. Source Resistance**

($V^+/V^-=\pm2.5V$, $R_L=2.5k\Omega$, Ta=25℃)




**Output Voltage vs. Source Resistance**

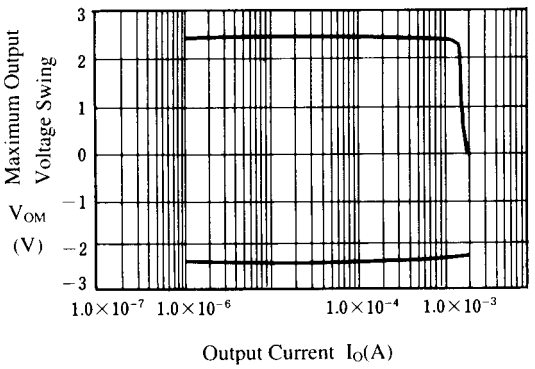
($V^+/V^-=\pm2.5V$, $R_L=2.5k\Omega$, Ta=25℃)



## ■ TYPICAL CHARACTERISTICS

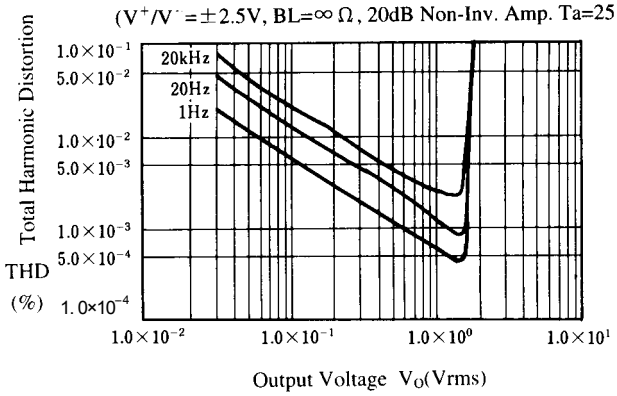
**Maximum Output Voltage Swing vs. Output Current**

($V^+/V^-$=±2.5V, Ta=25℃)




**Total Harmonic Distortion vs. Output Voltage**

($V^+/V^-$=±2.5V, BL=∞Ω, 20dB Non-Inv. Amp. Ta=25℃)




**Equivalent Input Noise Voltage vs. Frequency**

($V^+/V^-$=±2.5V, $R_S$=10Ω, Av=60dB, Ta=25℃)