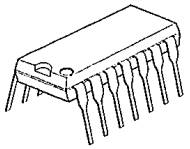
# QUAD OPERATIONAL AMPLIFIER

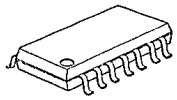
## ■ GENERAL DESCRIPTION

The NJM2060 integrated circuit is a high-gain, wide-bandwidth, quad operational amplifier capable of driving 20V peak-to-peak into 400Ω loads. The NJM2060 combines many of the features of the NJM2058 as well as providing the capability of wider bandwidth, and higher slew rate make the NJM2060 ideal for active filters, data and telecommunications, and many instrumentation applications. The availability of the NJM2060 in the surface mounted micro-package allows the NJM2060 to be used in critical applications requiring very high packing densities. Each amplifier of the NJM2060 has the same electrical characteristic of the NJM4560.

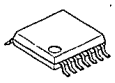
## ■ PACKAGE OUTLINE



NJM2060D



NJM2060M

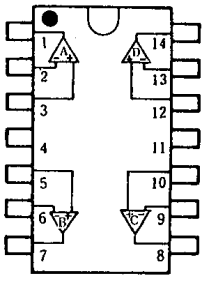


NJM2060V

## ■ FEATURES

- Operating Voltage (±4V～±18V)
- Low Noise Voltage (RIAA 1.2 μVrms typ.)
- Slew Rate (4V/μs typ.)
- Unity Gain Bandwidth (10MHz typ.)
- High Output Current (25mA)
- Package Outline DIP14, DMP14, SSOP14
- Bipolar Technology

## ■ PIN CONFIGURATION

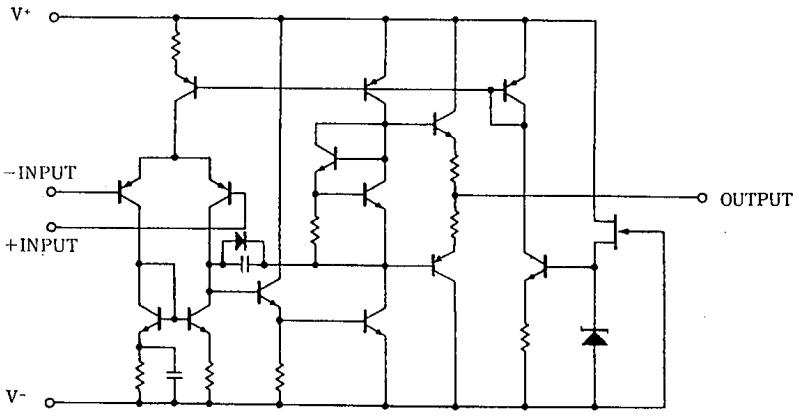



NJM2060D
NJM2060M
NJM2060V

PIN FUNCITON

| | | | |
|---|---|---|---|
| 1. | A OUTPUT | 8. | C OUTPUT |
| 2. | A−INPUT | 9. | C−INPUT |
| 3. | A+INPUT | 10. | C+INPUT |
| 4. | $V^+$ | 11. | $V^-$ |
| 5. | B+INPUT | 12. | D+INPUT |
| 6. | B−INPUT | 13. | D−INPUT |
| 7. | B OUTPUT | 14. | D OUTPUT |

## ■ EQUIVALENT CIRCUIT (1/4 Shown)



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

| PARAMETER | SYMBOL | RATINGS | | UNIT |
|---|---|---|---|---|
| Supply Voltage | $V^+/V^-$ | ±18 | | V |
| Differential Input Voltage | $V_{ID}$ | ±30 | | V |
| Input Voltage | $V_{IC}$ | ±15 | (note 1) | V |
| Power Dissipation | $P_D$ | (DIP14) 700 | | mW |
| | | (DIM14) 700 | (note 2) | mW |
| | | (SSOP14) 300 | | mW |
| Operating Temperature Range | $T_{opr}$ | −20~+75 | | ℃ |
| Storage Temperature Range | $T_{stg}$ | −40~+125 | | ℃ |

(note 1) For supply voltage less than ±15V. the absolute maximum input voltage is equal to the supply voltage.
(note 2) At on PC board

## ■ ELECTRICAL CHARACTERISTICS

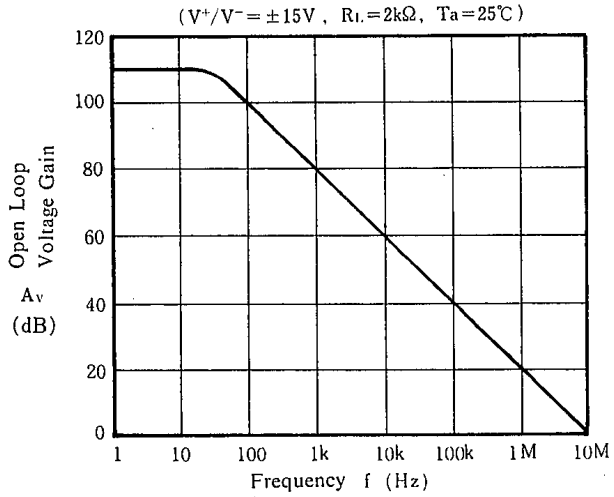
(Ta =25℃, $V^+$=15V, $V^-$=−15V)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $R_S$≦10kΩ | — | 0.5 | 6 | mV |
| Input Offset Current | $I_{IO}$ | | — | 5 | 200 | nA |
| Input Bias Current | $I_B$ | | — | 40 | 500 | nA |
| Input Resistance | $R_{IN}$ | | 100 | 500 | — | kΩ |
| Large Signal Voltage Gain | $A_V$ | $R_L$≧2kΩ, $V_O$=±10V | 86 | 100 | — | dB |
| Maximum Output Voltage Swing 1 | $V_{OM1}$ | $R_L$≧2kΩ | ±12 | ±14 | — | V |
| Maximum Output Voltage Swing 2 | $V_{OM2}$ | $I_O$=25mA | ±10 | ±11.5 | — | V |
| Input Common Mode Voltage Range | $V_{ICM}$ | | ±12 | ±14 | — | V |
| Common Mode Rejection Ratio | CMR | $R_S$≦10kΩ | 70 | 90 | — | dB |
| Supply Voltage Rejection Ratio | SVR | $R_S$≦10kΩ | 76 | 90 | — | dB |
| Operating Current | $I_{CC}$ | | — | 9 | 14 | mA |
| Slew Rate | SR | | — | 4 | — | V/μs |
| Gain Bandwidth Product | GB | | — | 10 | — | MHz |
| Equivalent Input Noise Voltage | $V_{NI}$ | RIAA $R_S$ =2.2kΩ, 30kHz L.P.F. | — | 1.2 | — | μVrms |

## ■ TYPICAL CHARACTERISTICS

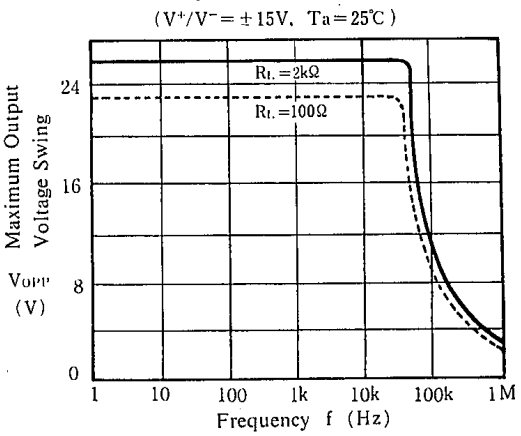
### Open Loop Voltage Gain vs. Frequency

($V^+/V^-=\pm15V$, $R_L=2k\Omega$, $Ta=25°C$)



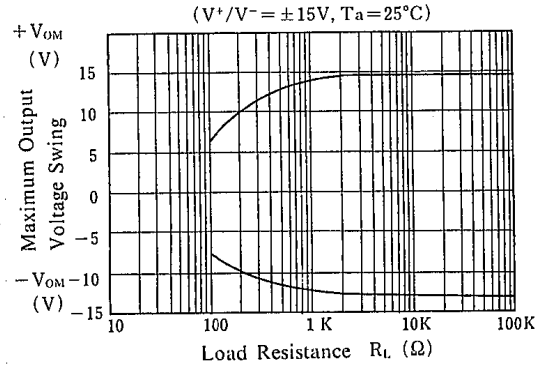

### Maximum Output Voltage Swing vs. Frequency

($V^+/V^-=\pm15V$, $Ta=25°C$)



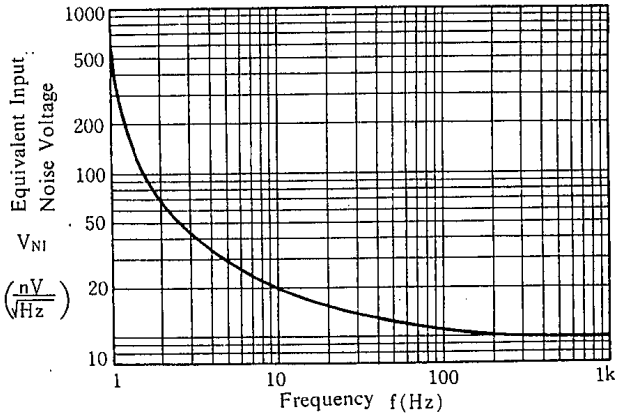

### Maximum Output Voltage Swing vs. Lood Resistance

($V^+/V^-=\pm15V$, $Ta=25°C$)



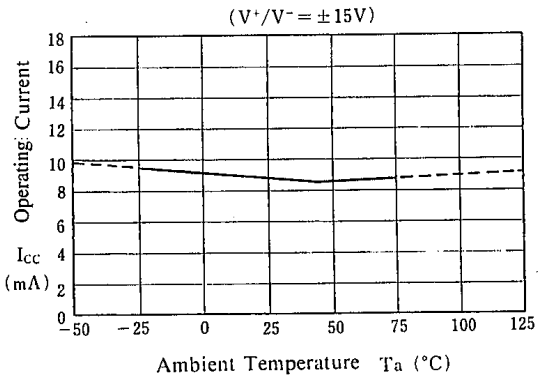

### Equivalent Input Noise Voltage vs. Frequency

($V^+/V^-=\pm15V$, $R_S=50\Omega$, $A_V=60dB$, $Ta=25°C$)



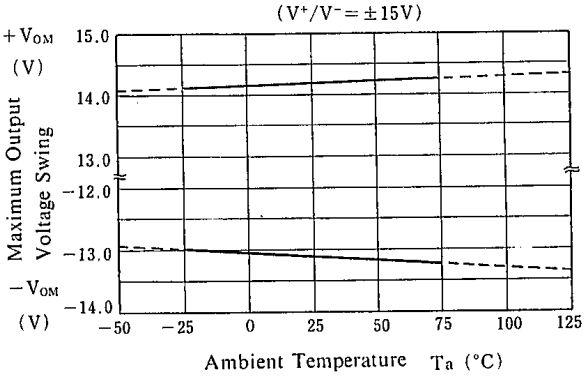

### Operating Current vs. Temperature

($V^+/V^-=\pm15V$)



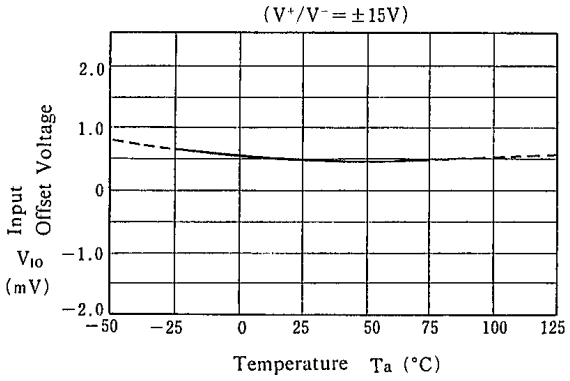

### Maximum Output Voltage Swing vs. Temperature

($V^+/V^-=\pm15V$)

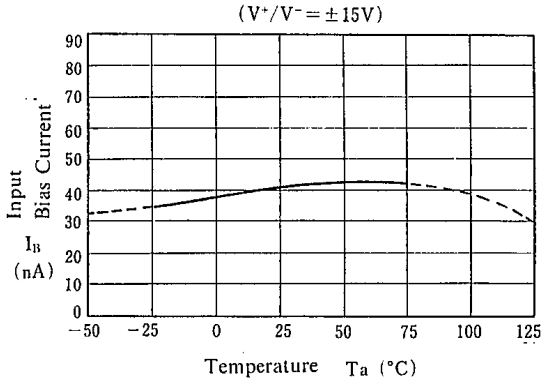


## ■ TYPICAL CHARACTERISTICS

### Input Offset Voltage vs. Temperature

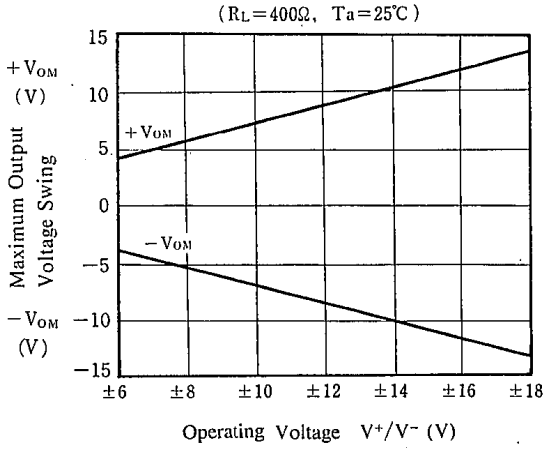



### Input Bias Current vs. Temperature

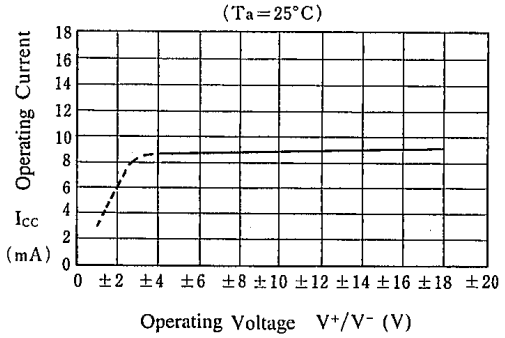



4

### Maximum Output Voltage Swing vs. Operating Voltage



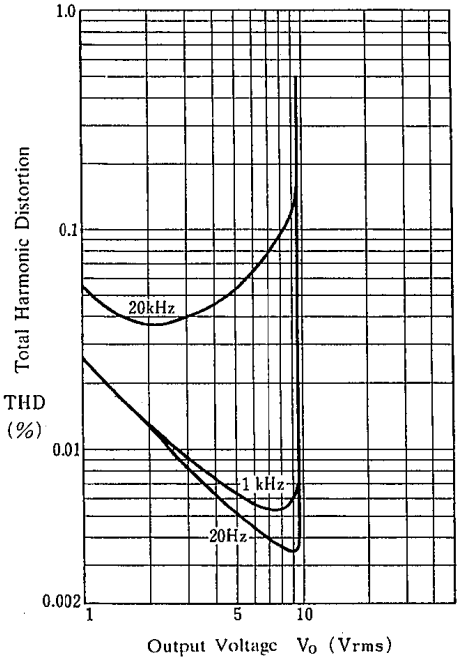

### Operating Current vs. Operating Voltage



## ■ TYPICAL CHARACTERISTICS

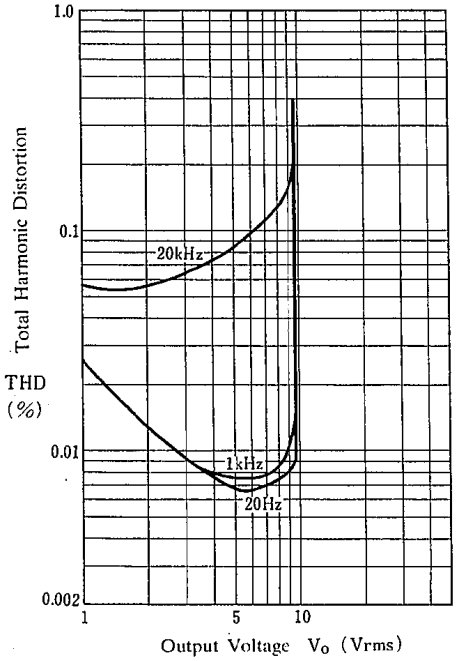
**Total Harmonic Distortion**

($V^+/V^-=\pm15V$, Gain=40dB, $R_L=10k\Omega$, Ta=25°C)




**Total Harmonic Distortion**

($V^+/V^-=\pm15V$, Gain=40dB, $R_L=2k\Omega$, Ta=25°C)




4

MEMO