



## QUAD OPERATIONAL AMPLIFIER

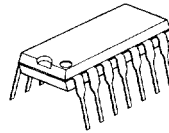
### ■ GENERAL DESCRIPTION

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.

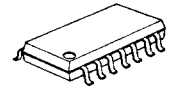
### ■ FEATURES

- 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

### ■ PACKAGE OUTLINE



NJM2060D

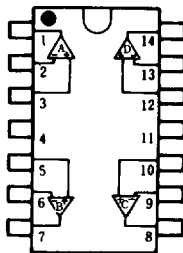


NJM2060M



NJM2060V

### ■ PIN CONFIGURATION

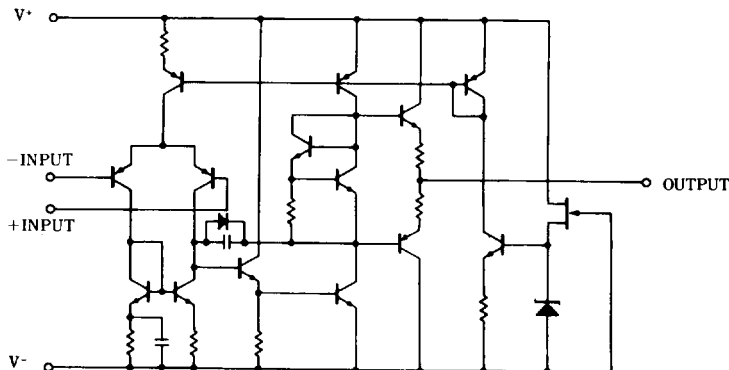


NJM2060D  
NJM2060M  
NJM2060V

#### PIN FUNCTION

- |             |              |
|-------------|--------------|
| 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°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup> /V <sup>-</sup>	±18	V
Differential Input Voltage	V <sub>ID</sub>	±30	V
Input Voltage	V <sub>I</sub>	±15 (note 1)	V
Power Dissipation	P <sub>D</sub>	(DIP14) 700	mW
		(DIM14) 700 (note 2)	mW
		(SSOP14) 300	mW
Operating Temperature Range	T <sub>opr</sub>	-20~+75	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

(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°C, V<sup>+</sup>=15V, V<sup>-</sup>= -15V)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> ≤ 10kΩ	—	0.5	6	mV
Input Offset Current	I <sub>IO</sub>		—	5	200	nA
Input Bias Current	I <sub>B</sub>		—	40	500	nA
Input Resistance	R <sub>IN</sub>		100	500	—	kΩ
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> ≥ 2kΩ, V <sub>O</sub> = ±10V	86	100	—	dB
Maximum Output Voltage Swing 1	V <sub>OM1</sub>	R <sub>L</sub> ≥ 2kΩ	±12	±14	—	V
Maximum Output Voltage Swing 2	V <sub>OM2</sub>	I <sub>O</sub> = 25mA	±10	±11.5	—	V
Input Common Mode Voltage Range	V <sub>ICM</sub>		±12	±14	—	V
Common Mode Rejection Ratio	CMR	R <sub>S</sub> ≤ 10kΩ	70	90	—	dB
Supply Voltage Rejection Ratio	SVR	R <sub>S</sub> ≤ 10kΩ	76	90	—	dB
Operating Current	I <sub>CC</sub>		—	9	14	mA
Slew Rate	SR		—	4	—	V/μs
Gain Bandwidth Product	GB		—	10	—	MHz
Equivalent Input Noise Voltage	V <sub>NI</sub>	RIAA R <sub>S</sub> = 2.2kΩ, 30kHz L.P.F.	—	1.2	—	μVrms

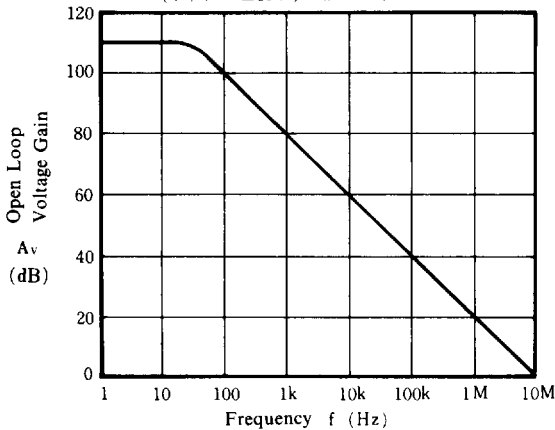
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■ TYPICAL CHARACTERISTICS

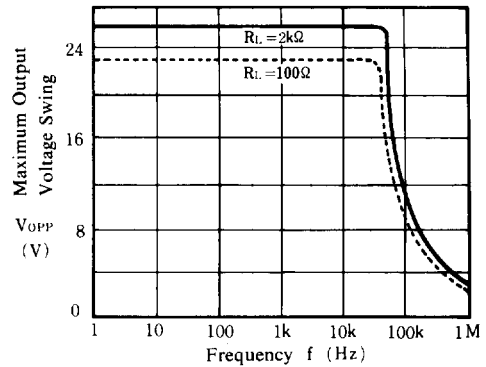
Open Loop Voltage Gain vs. Frequency

( $V^+/V^- = \pm 15V$ ,  $R_i = 2k\Omega$ ,  $T_a = 25^\circ C$ )



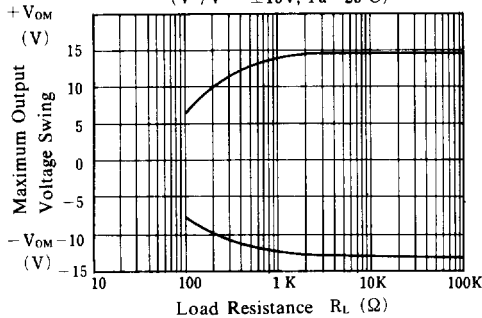
Maximum Output Voltage Swing vs. Frequency

( $V^+/V^- = \pm 15V$ ,  $T_a = 25^\circ C$ )



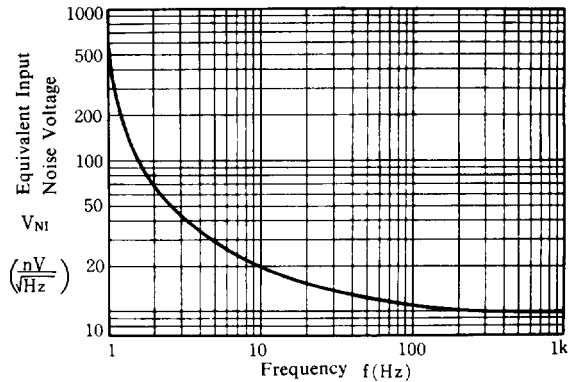
Maximum Output Voltage Swing vs. Load Resistance

( $V^+/V^- = \pm 15V$ ,  $T_a = 25^\circ C$ )



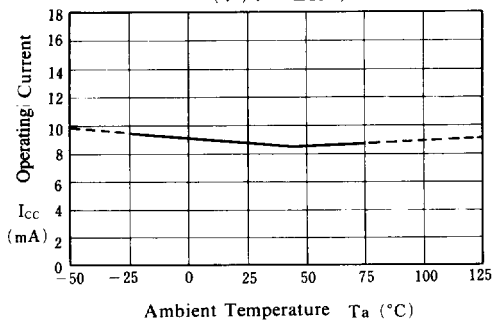
Equivalent Input Noise Voltage vs. Frequency

( $V^+/V^- = \pm 15V$ ,  $R_s = 50\Omega$ ,  $A_v = 60dB$ ,  $T_a = 25^\circ C$ )



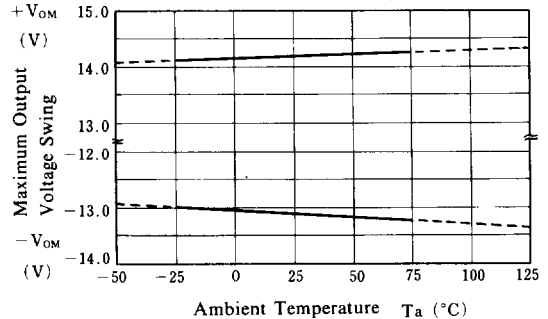
Operating Current vs. Temperature

( $V^+/V^- = \pm 15V$ )



Maximum Output Voltage Swing vs. Temperature

( $V^+/V^- = \pm 15V$ )

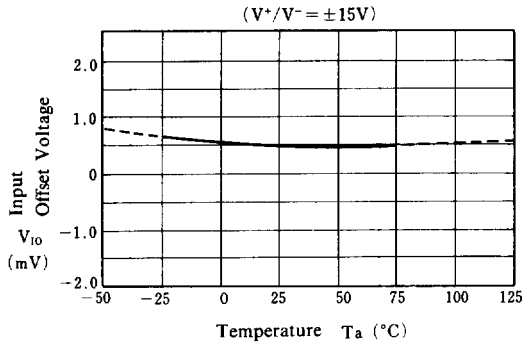


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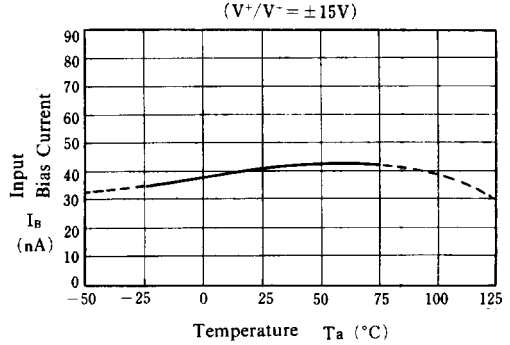


## ■ TYPICAL CHARACTERISTICS

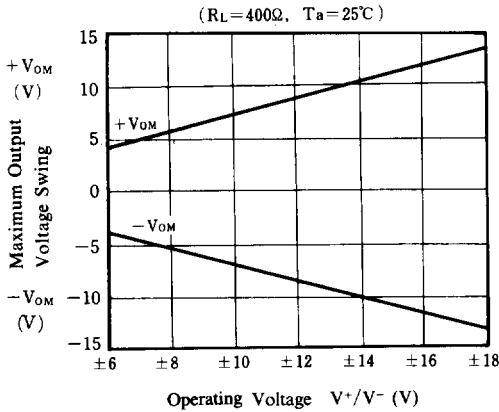
**Input Offset Voltage vs. Temperature**



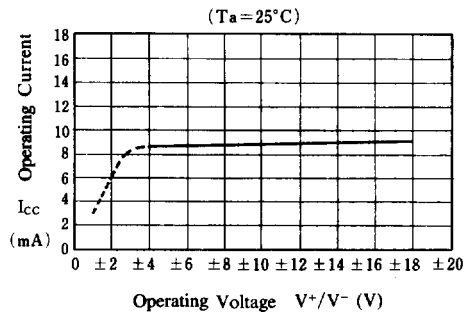
**Input Bias Current vs. Temperature**



**Maximum Output Voltage Swing vs. Operating Voltage**



**Operating Current vs. Operating Voltage**

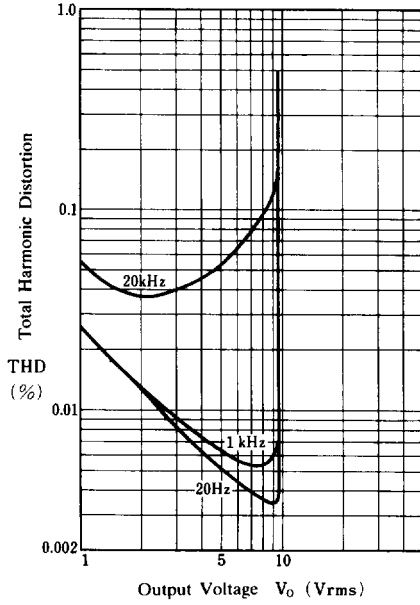




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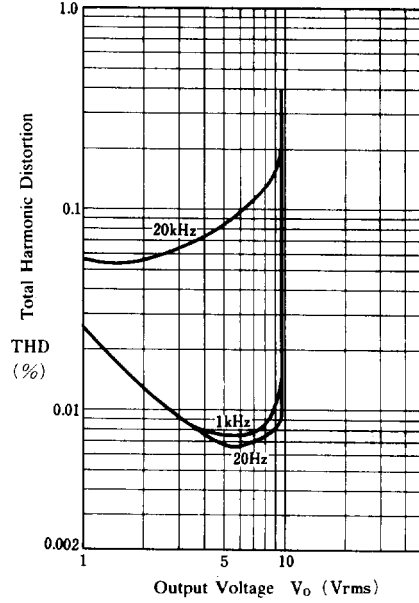
**Total Harmonic Distortion**

( $V^+/V^- = \pm 15V$ , Gain=40dB,  $R_L = 10k\Omega$ ,  
 $T_a = 25^\circ C$ )



**Total Harmonic Distortion**

( $V^+/V^- = \pm 15V$ , Gain=40dB,  $R_L = 2k\Omega$ ,  
 $T_a = 25^\circ C$ )



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