



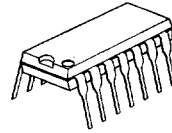
## SINGLE-SUPPLY QUAD OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

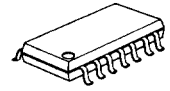
The NJM3403A is high performance ground sensing quad operational amplifier featuring the high slew rate and no cross-over distortion.

The NJM3403A is improved version of the NJM2902.

### ■ PACKAGE OUTLINE



NJM3403AD



NJM3403AM

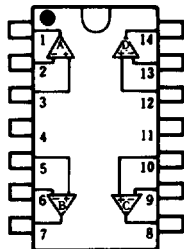


NJM3403AV

### ■ FEATURES

- Single Supply
- Operating Voltage (+4V ~ +36V)
- Low Operating Current (3mA typ.)
- Slew Rate (1.2V/μs typ.)
- Package Outline DIP14, DMP14, SSOP14
- Bipolar Technology

### ■ PIN CONFIGURATION

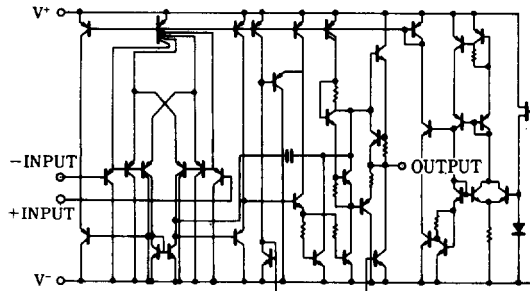


NJM3403AD  
NJM3403AM  
NJM3403AV

#### PIN FUNCTION

- |                   |                    |
|-------------------|--------------------|
| 1. A OUTPUT       | 8. C OUTPUT        |
| 2. A -INPUT       | 9. C -INPUT        |
| 3. A +INPUT       | 10. C +INPUT       |
| 4. V <sup>+</sup> | 11. V <sup>-</sup> |
| 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*(V*/V-)	36(or ±18)	V
Differential Input Voltage	V <sub>ID</sub>	36	V
Input Voltage	V <sub>I</sub>	-0.3~+36	V
Power Dissipation	P <sub>D</sub>	(DIP14) 500	mW
		(DMP14) 300	mW
		(SSOP14) 300	mW
Operating Temperature Range	T <sub>opr</sub>	-20~+75	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, V\*/V- = ±15V)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> =0Ω	—	2	5	mV
Input Offset Current	I <sub>IO</sub>		—	5	50	nA
Input Bias Current	I <sub>B</sub>		—	70	200	nA
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> >2kΩ	88	100	—	dB
Maximum Output Voltage Swing	V <sub>OM</sub>	R <sub>L</sub> =2kΩ	±13	±14	—	V
Input Common Mode Voltage Range	V <sub>ICM</sub>		-15 ~+13	—	—	V
Common Mode Rejection Ratio	CMR	DC	70	90	—	dB
Supply Voltage Rejection Ratio	SVR		80	94	—	dB
Output Source Current	I <sub>SOURCE</sub>	V <sub>IN</sub> <sup>+</sup> =1V, V <sub>IN</sub> <sup>-</sup> =0V	20	30	—	mA
Output Sink Current	I <sub>SINK</sub>	V <sub>IN</sub> <sup>+</sup> =0V, V <sub>IN</sub> <sup>-</sup> =1V	10	20	—	mA
Channel Separation	CS	f=1k~20kHz Input Referred	—	120	—	dB
Operating Current	I <sub>CC</sub>	R <sub>L</sub> =∞	—	3	5	mA
Slew Rate	SR		—	1.2	—	V/μS
Unity Gain Bandwidth	f <sub>T</sub>		—	1.2	—	MHz
Total Harmonic Distortion	THD	f=20kHz, V <sub>O</sub> =10V <sub>pp</sub>	—	1	—	%

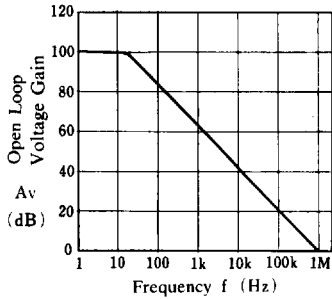
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## ■ TYPICAL CHARACTERISTICS

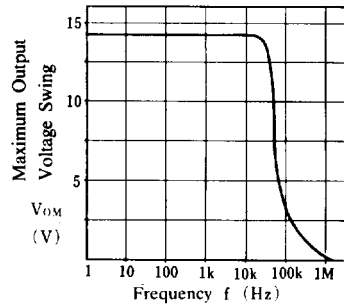
### Open Loop Voltage Gain vs. Frequency

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



### Maximum Output Voltage Swing vs. Frequency

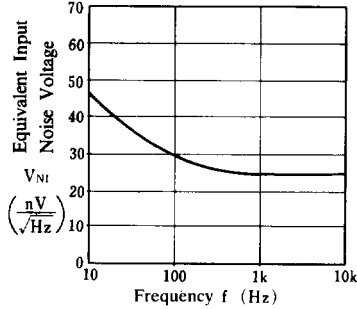
( $V^+/V^- = \pm 15V$ ,  $R_L = 2k\Omega$ ,  $T_a = 25^\circ C$ )



4

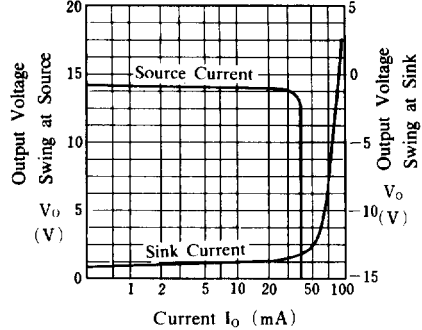
### Equivalent Input Noise Voltage vs. Frequency

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



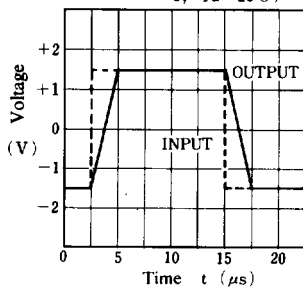
### Output Source Current vs. Output Voltage Swing

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



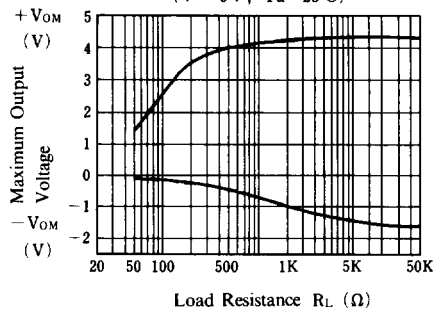
### Square Wave Respos

( $V^+/V^- = \pm 15V$ ,  $R_L = 2k\Omega$ ,  $A_v = 1$ ,  $T_a = 25^\circ C$ )



### Maximum Output Voltage vs. Load Resistance

( $V^+ = 5V$ ,  $T_a = 25^\circ C$ )

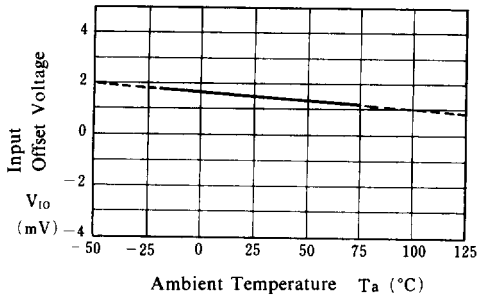




■ TYPICAL CHARACTERISTICS

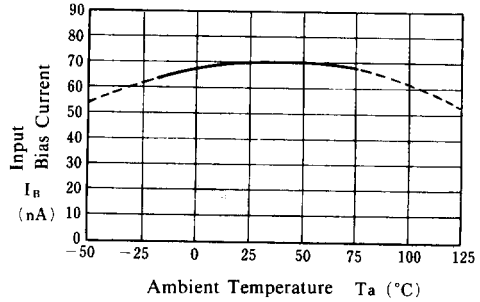
Input offset Voltage vs. Temperature

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



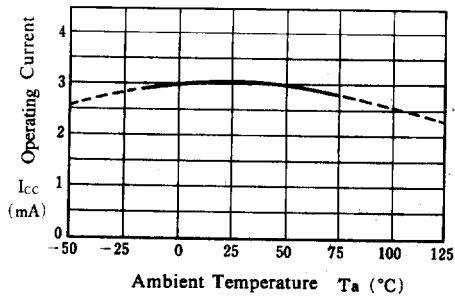
Input Bias Current vs. Temperature

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



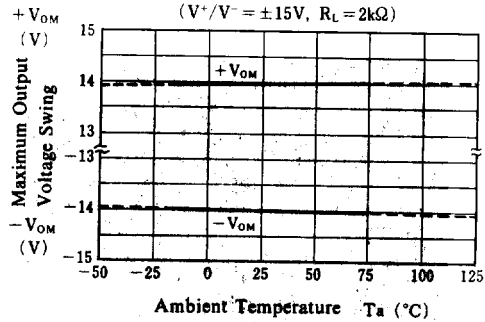
Operating Current vs. Temperature

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



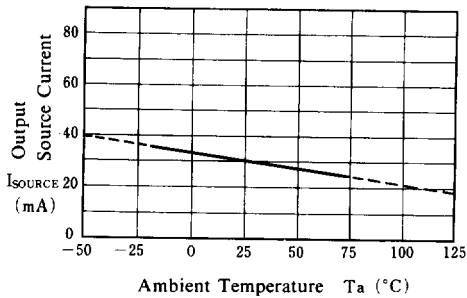
Maximum Output Voltage Swing vs. Temperature

( $V^+/V^- = \pm 15V, R_L = 2k\Omega$ )



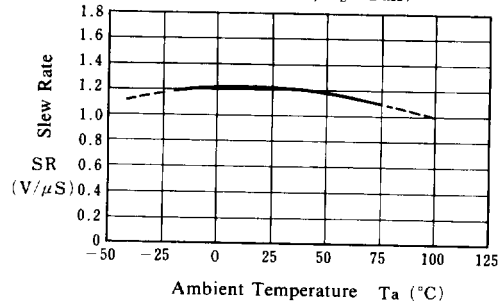
Output Source Current vs. Temperature

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



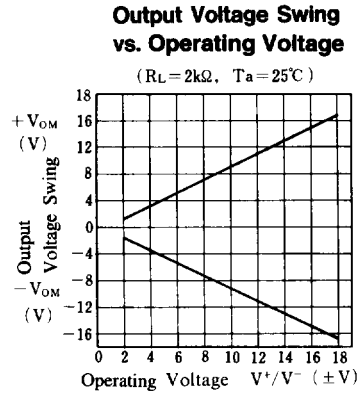
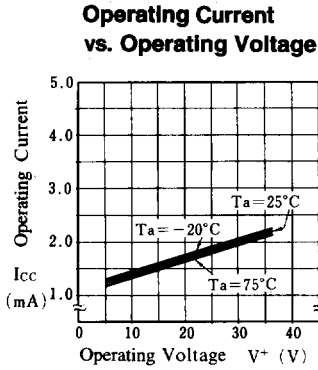
Slew Rate vs. Temperature

( $V^+/V^- = \pm 15V, R_L = 2k\Omega$ )



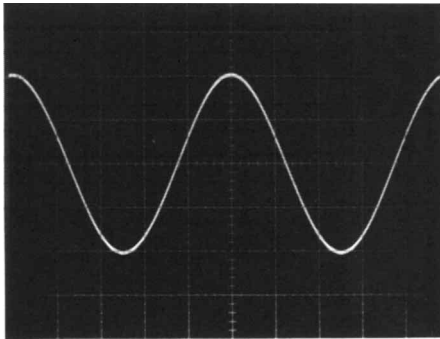


## ■ TYPICAL CHARACTERISTICS

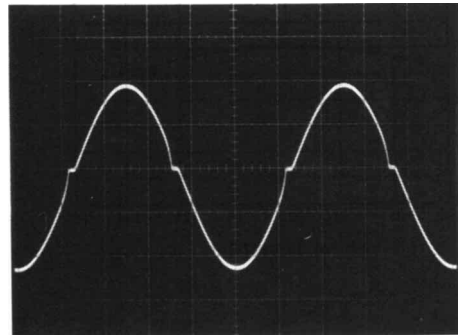


## ■ Crossover Distortion

Photos (1) and (2) show the output waveforms of NJM3403A and operational amplifier having crossover distortion. The NJM3403A eliminates the crossover distortion through the A, B class output stage as shown in the photo. NJM3403A IC has realized a wide band and a high slew rate in addition to the low distortion.



(1) NJM3403A Output Waveform



(2) Crossover Distortion Example

$f = 1\text{kHz}$ ,  $R_L = 2k\Omega$ , Vertical Axis:  $2\text{V/div}$