

## SINGLE SUPPLY DUAL OPERATIONAL AMPLIFIER

### ■ GENERAL DESCRIPTION

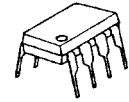
The NJM13404 is single-supply dual operational amplifier, which can operate from 2V supply. The features are low offset voltage, low bias current, high slew-rate, and free crossover distortion through the AB class output stage.

The package lineup is DIP, DMP and others compact, so that the NJM13404 is suitable for audio for low voltage operation and any other kind of signal amplifier.

### ■ FEATURES

- Operating Voltage ( +2V~+14V )
- Slew Rate ( 1.2V/μs typ. )
- Operating Current ( 2.0mA typ. )
- Bipolar Technology
- Package Outline DIP8,DMP8,EMP8,SSOP8  
VSP8,SIP8

### ■ PACKAGE OUTLINE



NJM13404D



NJM13404M



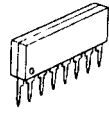
NJM13404E



NJM13404V

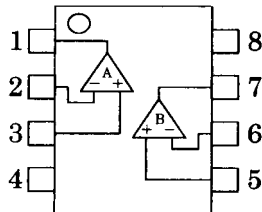


NJM13404R

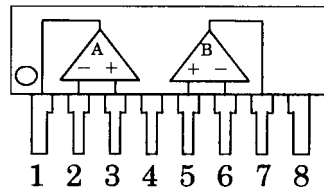


NJM13404L

### ■ PIN CONFIGURATION



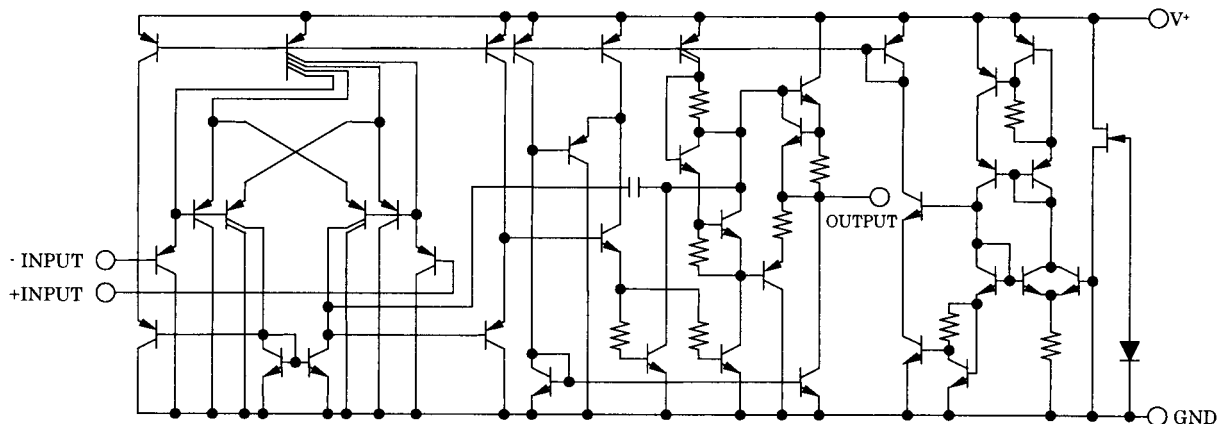
NJM13404D/13404M  
NJM13404E/13404V/13404R



NJM13404L

- PIN FUNCTION**  
 1.A OUTPUT  
 2.A -INPUT  
 3.A +INPUT  
 4.GND  
 5.B +INPUT  
 6.B -INPUT  
 7.B OUTPUT  
 8.V<sup>+</sup>

### ■ EQUIVALENT CIRCUIT ( 1/2 Shown )



# NJM13404

## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V^+$	15	V
Differential Input Voltage	$V_{ID}$	14	V
Input Voltage	$V_{IC}$	-0.3~+14	V
Power Dissipation	$P_D$	( DIP8 ) 500 ( DMP8 ) 300 ( EMP8 ) 300 ( SSOP8 ) 250 ( VSP8 ) 320 ( SIP8 ) 800	mW
Operating Temperature Range	$T_{opr}$	-40~+85	°C
Storage Temperature Range	$T_{stg}$	-40~+125	°C

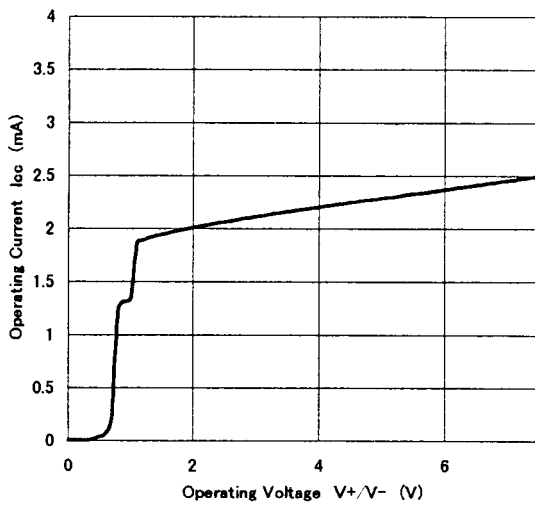
## ■ ELECTRICAL CHARACTERISTICS

(  $V^+=5V, Ta=25°C$  )

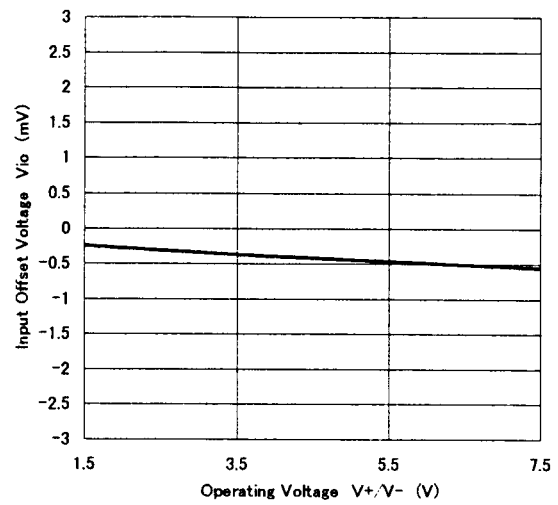
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	$V_{opr}$		2	-	14	V
Input Offset Voltage	$V_{IO}$	$R_S=0\Omega$	-	0.5	4	mV
Input Offset Current	$I_{IO}$		-	5	50	nA
Input Bias Current	$I_B$		-	25	150	nA
Large Signal Voltage Gain	$A_V$	$R_L \geq 2k\Omega$	88	100	-	dB
Maximum Output Voltage Swing	$V_{OM}$	$R_L=2k\Omega$	4.0	4.2	-	V
Input Common Mode Voltage Range	$V_{ICM}$		0~3.5	-	-	V
Common Mode Rejection Ratio	CMR		70	90	-	dB
Supply Voltage Rejection Ratio	SVR		80	94	-	dB
Output Source Current	$I_{SOURCE}$	$V_{IN}^+=1V, V_{IN}^-=0V$	20	35	-	mA
Output Sink Current	$I_{SINK}$	$V_{IN}^+=0V, V_{IN}^-=1V$	10	30	-	mA
Operating Current	$I_{CC}$	$R_L=\infty$	-	2.0	3.5	mA
Slew Rate	SR	$V^+/V^-=\pm 2.5V, R_L=2k\Omega,$ $A_V=0dB, f=1kHz$	-	1.2	-	V/ $\mu s$
Unity Gain Bandwidth	$f_T$	$R_L=2k\Omega$	-	2.0	-	MHz
Total Harmonic Distortion	THD	$R_L=2k\Omega, A_V=40dB,$ $f=20kHz, V_O=1V_{rms}$	-	0.2	-	%

## ■ TYPICAL CHARACTERISTICS

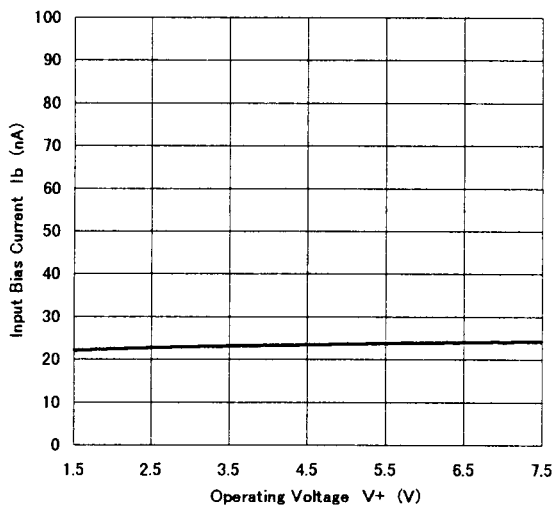
NJM13404 Operating Current vs. Operating Voltage



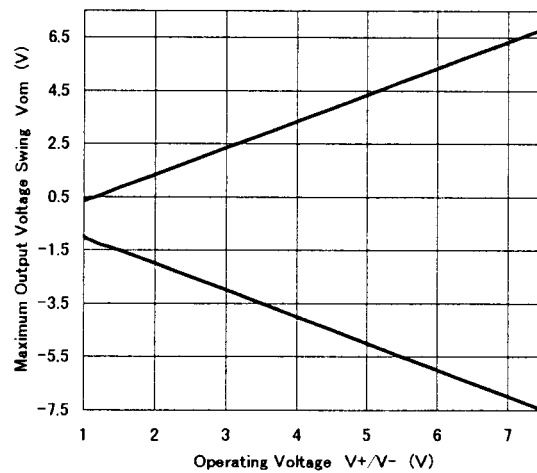
NJM13404 Input Offset Voltage vs. Operating Voltage



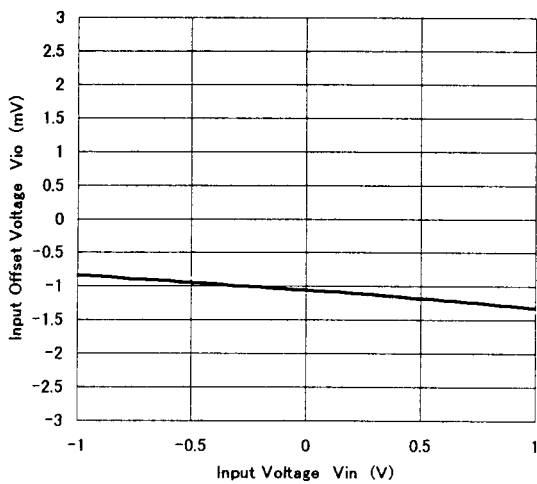
NJM13404 Input Bias Current vs. Operating Voltage



NJM13404 Maximum Output Voltage Swing vs. Operating Voltage



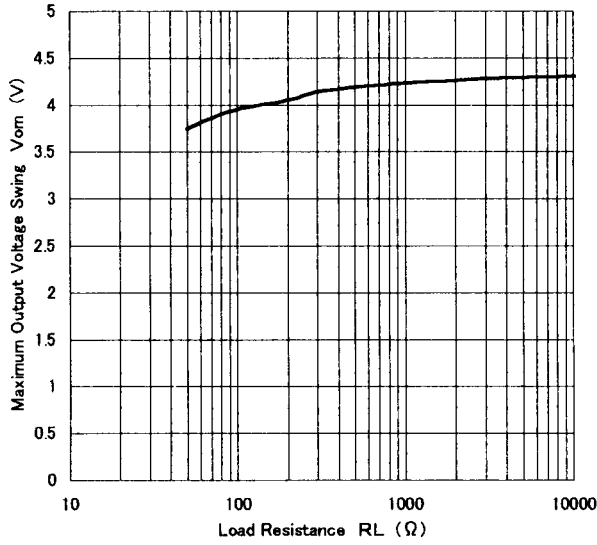
NJM13404 Input Common Mode Input Voltage Range



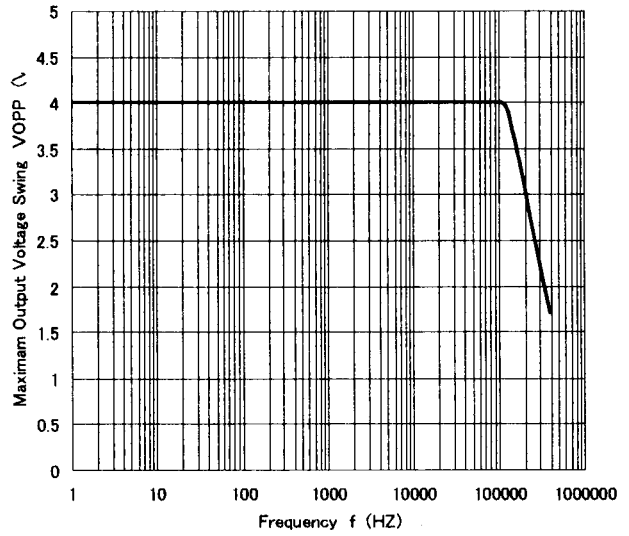
# NJM13404

## ■ TYPICAL CHARACTERISTICS

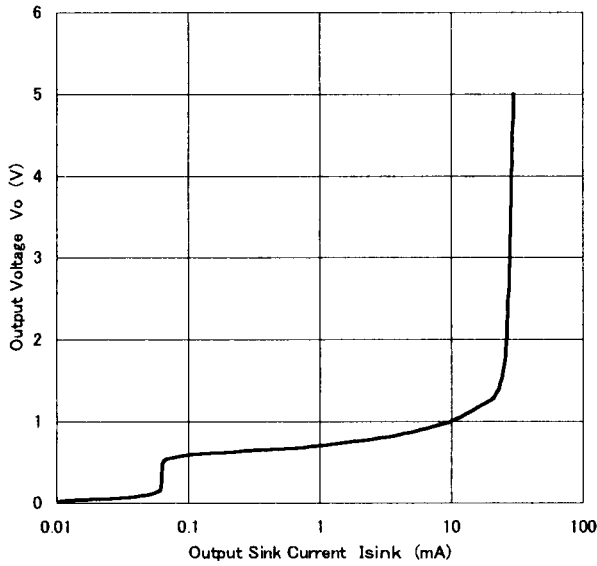
NJM13404 Maximum Output Voltage Swing v.s Load Resistance



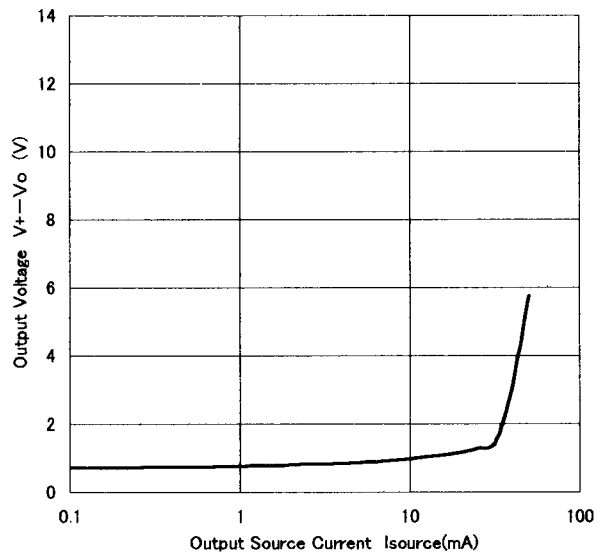
NJM13404 Maximum Output Voltage Swing v.s Frequency



NJM13404 Output Voltage v.s Output Sink Current

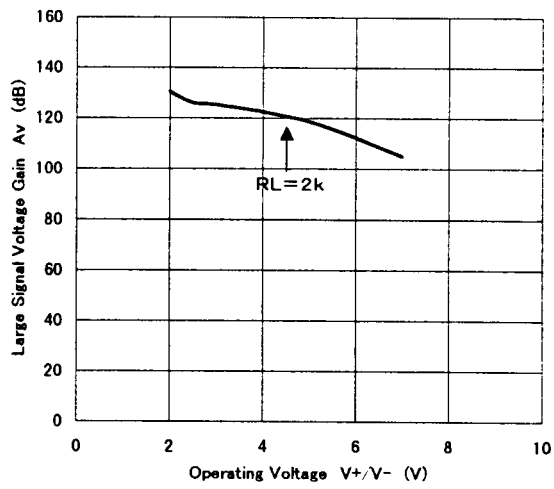


NJM13404 Output Voltage v.s Output Source Current

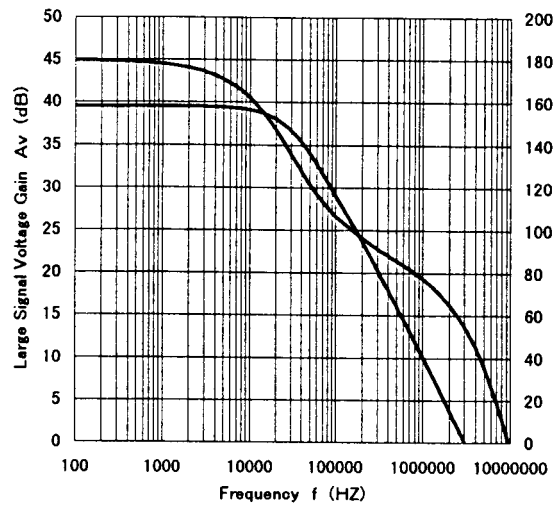


## ■ TYPICAL CHARACTERISTICS

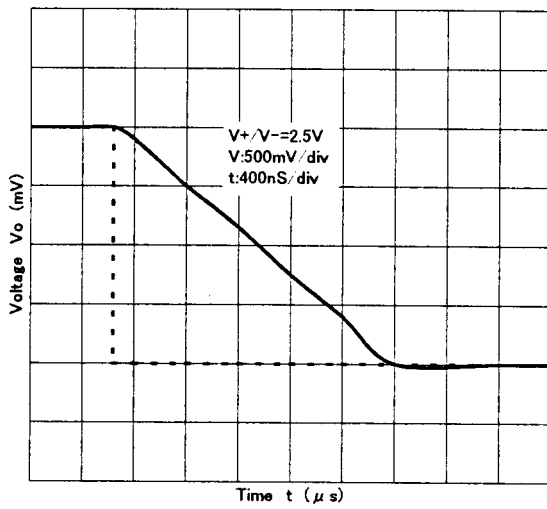
NJM13404 Large Signal Voltage Gain vs. Operating Voltage



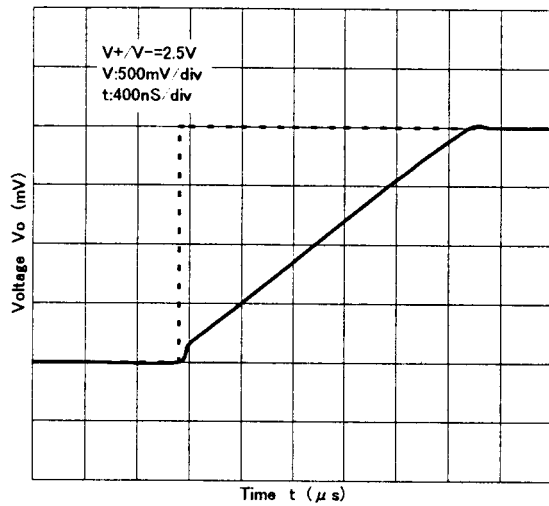
NJM13404 Large Signal Voltage Gain vs. Frequency



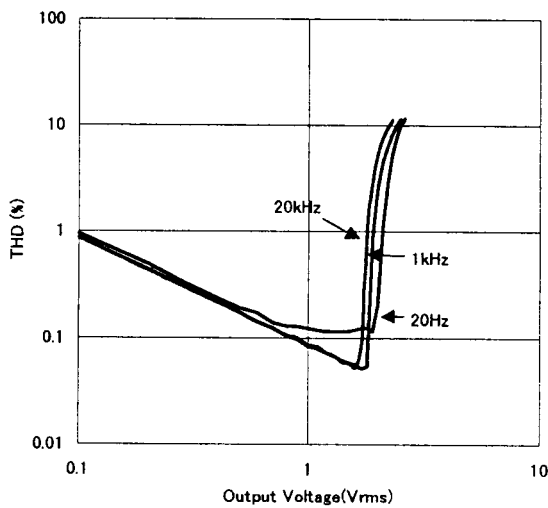
NJM13404 Slew Rate(Fall)



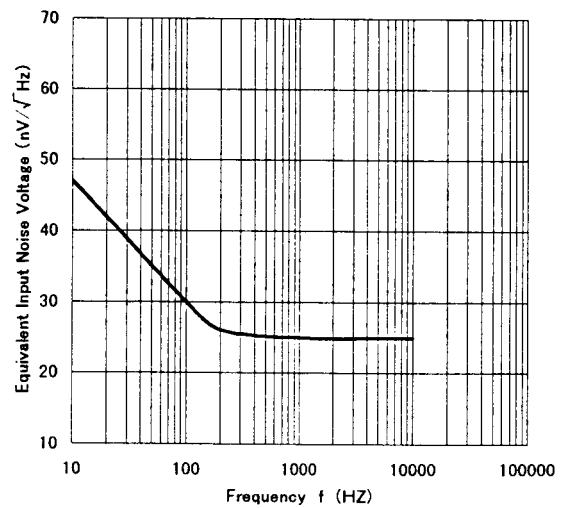
NJM13404 Slew Rate(Rise)



NJM13404 THD v.s Output Voltage



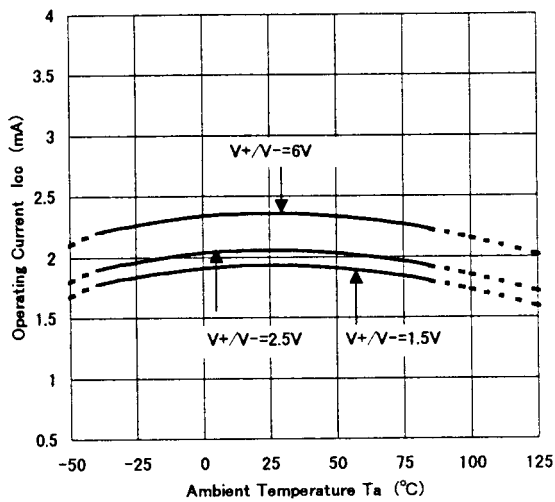
NJM13404 Equivalent Input Noise Voltage v.s Frequency



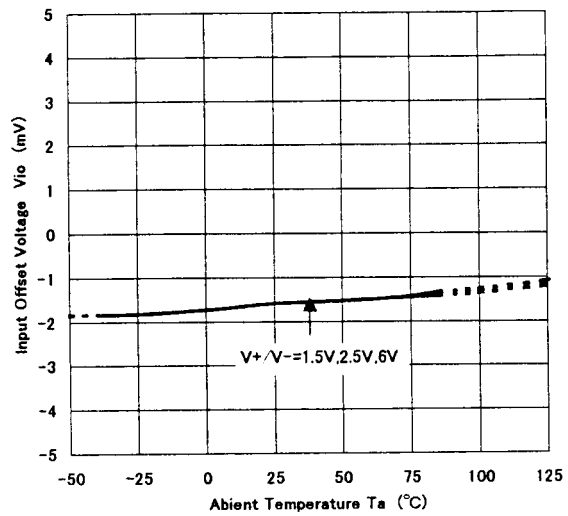
# NJM13404

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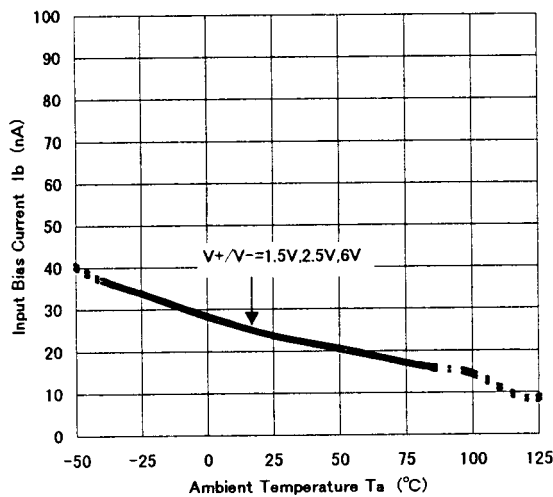
NJM13404 Operating Current vs. Temperature



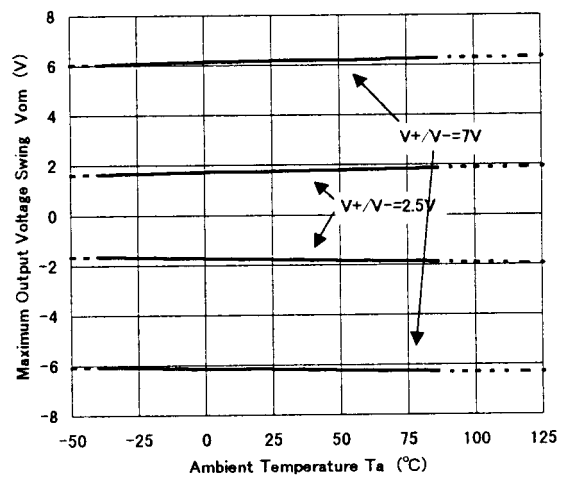
NJM13404 Input Offset Voltage vs. Temperature



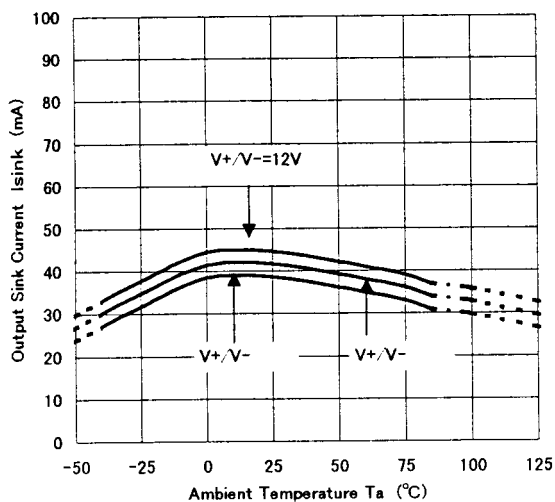
NJM13404 Input Bias Current vs. Temperature



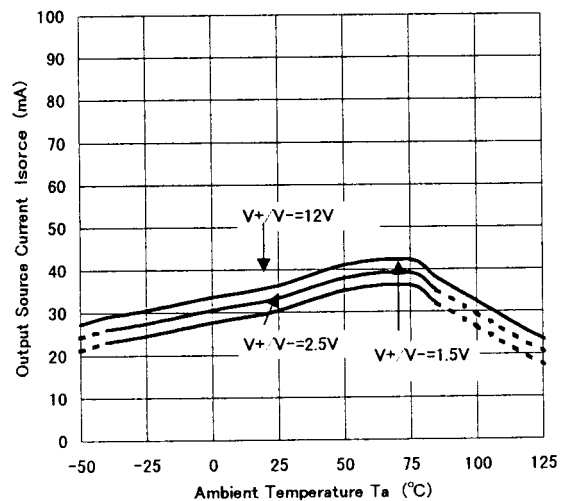
NJM13404 Maximum Output Voltage Swing vs. Temperature



NJM13404 Output Sink Current vs. Temperature

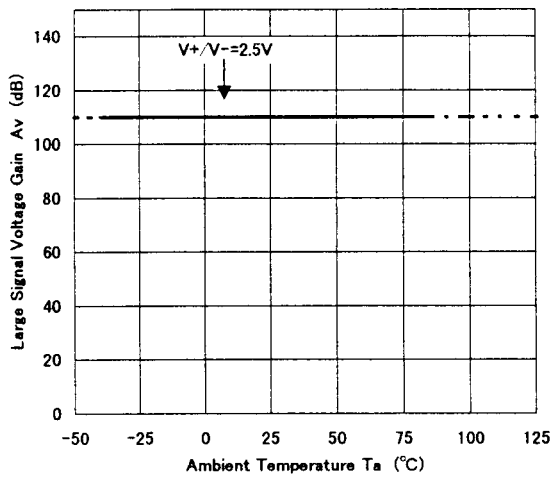


NJM13404 Output Source Current vs. Temperature

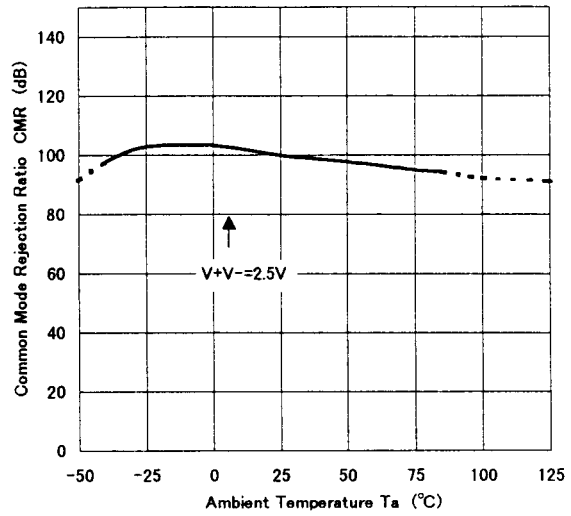


## ■ TYPICAL CHARACTERISTICS

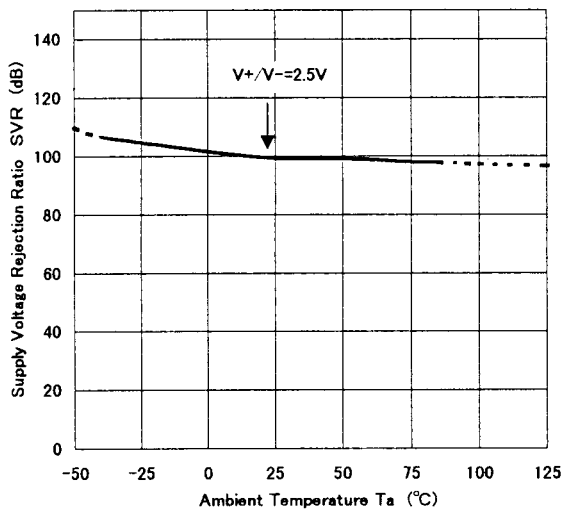
NJM13404 Large Signal Voltage Gain vs. Temperature



NJM13404 Common Mode Rejection Ratio vs. Temperature



NJM13404 Supply Voltage Rejection Ratio vs. Temperature





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