

Low Noise Low Supply Voltage Dual Operational Amplifier with Full Swing Input and Output

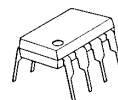
■ GENERAL DESCRIPTION

NJM2737 is a single supply dual operational amplifier with full swing input and output, operates from 1.8V.

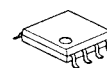
Noise characteristic is designed low as conventional low noise operational amplifiers, such as NJM5532 and NJM4580.

It is suitable for PC audio, portable audio and other low voltage single supplied audio applications.

■ PACKAGE OUTLINE



NJM2737D



NJM2737M



NJM2737V

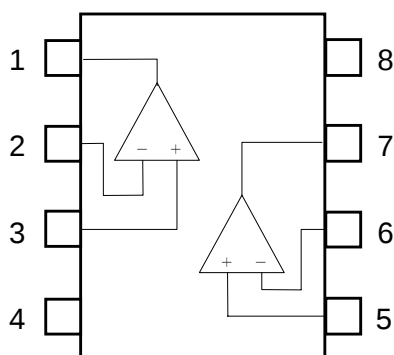


NJM2737RB1

■ FEATURES

- Operating Voltage 1.8 to 6.0V
- Low Input Voltage Noise 5nV/√Hz typ.
- Gain Band Width product 3.1MHz typ. at $V^+=5V, R_L=2k\Omega$
- Slew Rate 0.7V/μs typ. at $V^+=5V, R_L=2k\Omega$
- Offset Voltage 5mV max
- Input Full-Swing $V_{ICM}=0$ to 5.0V at $V^+=5V$
- Output Full-Swing $V_{OH} \geq 4.9V / V_{OL} \leq 0.15V$ at $V^+=5V, R_L=20k\Omega$
- Load Drivability $V_{OH} \geq 4.75V / V_{OL} \leq 0.25V$ at $V^+=5V, R_L=2k\Omega$
- Bipolar Technology
- Package Outline DIP8, DMP8, SSOP8, TVSP8

■ PIN CONFIGURATION



PIN CONFIGURATION

- 1. OUTPUT1
- 2. -INPUT1
- 3. +INPUT1
- 4. V^-
- 5. +INPUT2
- 6. -INPUT2
- 7. OUTPUT2
- 8. V^+

NJM2737

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)			
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	7.0	V
Differential Input Voltage	V_{ID}	± 1.0	V
Input Common Mode Voltage Range	V_{ICM}	0 to 7.0	V
Power Dissipation	P_D	500(DIP8) 300(DMP8) 250(SSOP8) 320(TVSP8)	mW
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-40 to +125	°C

(Note1)

If the supply voltage (V^+) is less than 7V, the input voltage must not over the V^+ level through 7V is limit specified.

■ RECOMMENDED OPERATING CONDITION

(Ta=25°C)			
PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+	1.8 to 6.0	V

■ ELECTRICAL CHARACTERISTICS

● DC CHARACTERISTICS

(V ⁺ =5V, Ta=25°C)						
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Current	I_{CC}	No Signal	-	1200	1600	μA
Input Offset Voltage	V_{IO}		-	1	5	mV
Input Bias Current	I_B		-	200	800	nA
Input Offset Current	I_{IO}		-	5	100	nA
Voltage Gain	A_V	$R_L=2k\Omega$	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: $2.5V \leq V_{CM} \leq 5.0V$, CMR-: $0 \leq V_{CM} \leq 2.5V$ (Note2)	55	70	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+/GND = \pm 2.0$ to $\pm 3.0V$	70	85	-	dB
Maximum Output Voltage1	V_{OH1}	$R_L=20k\Omega$	4.9	4.95	-	V
	V_{OL1}	$R_L=20k\Omega$	-	0.05	0.1	
Maximum Output Voltage 2	V_{OH2}	$R_L=2k\Omega$	4.75	4.85	-	V
	V_{OL2}	$R_L=2k\Omega$	-	0.15	0.25	
Input Common Mode Voltage Range	V_{ICM}	CMR>55dB	0	-	5	V

(Note2) CMR is represented by either CMR+ or CMR- which has lower value.

CMR+ is measured with $2.5V \leq V_{CM} \leq 5V$ and CMR- is measured with $0V \leq V_{CM} \leq 2.5V$.

● AC CHARACTERISTICS

(V ⁺ =5V, Ta=25°C)						
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	f_T	$R_L=2k\Omega$	-	3.1	-	MHz
Phase Margin	Φ_M	$R_L=2k\Omega$	-	85	-	Deg
Equivalent Input Noise Voltage	V_N	$f=1kHz$	-	5	-	nV/ √Hz

● TRANSIENT CHARACTERISTICS

(V⁺=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	SR	R _L =2kΩ	-	0.7	-	V/μs

● DC CHARACTERISTICS

(V⁺=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Current	I _{CC}	No Signal	-	1000	1500	μA
Input Offset Voltage	V _{IO}		-	1	5	mV
Input Bias Current	I _B		-	200	800	nA
Input Offset Current	I _{IO}		-	5	100	nA
Voltage Gain	A _V	R _L =2kΩ	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 1.5V ≤ V _{CM} ≤ 3.0V, CMR-: 0 ≤ V _{CM} ≤ 1.5V (Note3)	48	63	-	dB
Supply Voltage Rejection Ratio	SVR	V ⁺ /GND = ±1.2 to ±2.0V	68	83	-	dB
Maximum Output Voltage1	V _{OH1}	R _L =20kΩ	2.9	2.95	-	V
	V _{OL1}	R _L =20kΩ	-	0.05	0.1	
Maximum Output Voltage 2	V _{OH2}	R _L =2kΩ	2.75	2.85	-	V
	V _{OL2}	R _L =2kΩ	-	0.15	0.25	
Input Common Mode Voltage Range	V _{ICM}	CMR>48dB	0	-	3	V

(Note3) CMR is represented by either CMR+ or CMR- which has lower value.

CMR+ is measured with 1.5V ≤ V_{CM} ≤ 3V and CMR- is measured with 0V ≤ V_{CM} ≤ 1.5V.

● AC CHARACTERISTICS

(V⁺=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	f _T	R _L =2kΩ	-	2.6	-	MHz
Phase Margin	Φ _M	R _L =2kΩ	-	85	-	Deg
Equivalent Input Noise Voltage	V _N	f=1kHz	-	5	-	nV/ √Hz

● TRANSIENT CHARACTERISTICS

(V⁺=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	SR	R _L =2kΩ	-	0.6	-	V/μs

● DC CHARACTERISTICS

($V^+=1.8V$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Current	I_{CC}	No Signal	-	1000	1500	μA
Input Offset Voltage	V_{IO}		-	1	5	mV
Input Bias Current	I_B		-	200	800	nA
Input Offset Current	I_{IO}		-	5	100	nA
Voltage Gain	A_V	$R_L=2k\Omega$	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: $0.9V \leq V_{CM} \leq 1.8V$, CMR-: $0 \leq V_{CM} \leq 0.9V$ (Note4)	40	55	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+/GND = \pm 0.9$ to $\pm 1.2V$	65	80	-	dB
Maximum Output Voltage1	V_{OH1}	$R_L=20k\Omega$	1.7	1.75	-	V
	V_{OL1}	$R_L=20k\Omega$	-	0.1	0.15	
Maximum Output Voltage 2	V_{OH2}	$R_L=2k\Omega$	1.6	1.65	-	V
	V_{OL2}	$R_L=2k\Omega$	-	0.15	0.25	
Input Common Mode Voltage Range	V_{ICM}	CMR>40dB	0	-	1.8	V

(Note4) CMR is represented by either CMR+ or CMR- which has lower value.

CMR+ is measured with $0.9V \leq V_{CM} \leq 1.8V$ and CMR- is measured with $0V \leq V_{CM} \leq 0.9V$.

● AC CHARACTERISTICS

($V^+=1.8V$, $T_a=25^\circ C$)

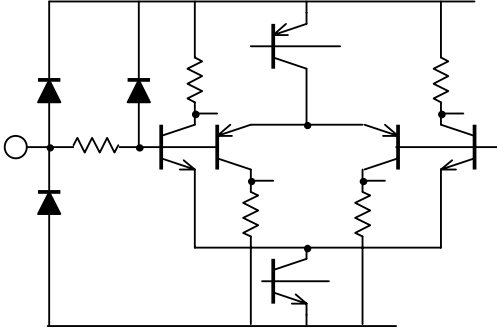
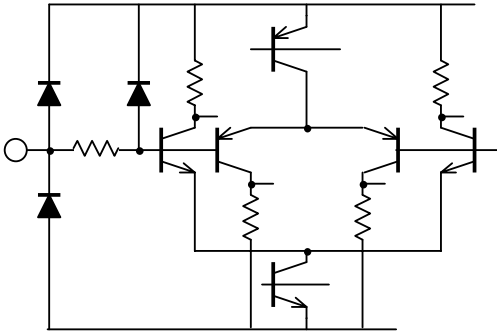
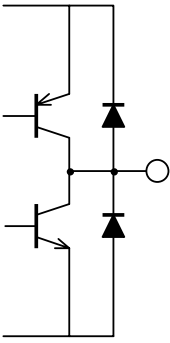
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	f_T	$R_L=2k\Omega$	-	2.3	-	MHz
Phase Margin	Φ_M	$R_L=2k\Omega$	-	85	-	Deg
Equivalent Input Noise Voltage	V_N	$f=1kHz$	-	5	-	nV/ $\sqrt{Hz}$

● TRANSIENT CHARACTERISTICS

($V^+=1.8V$, $T_a=25^\circ C$)

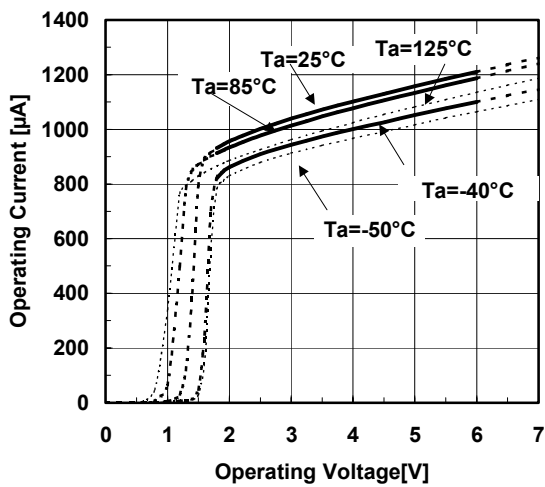
PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	SR	$R_L=2k\Omega$	-	0.5	-	V/ μs

■ TERMINAL CHARACTERISTICS

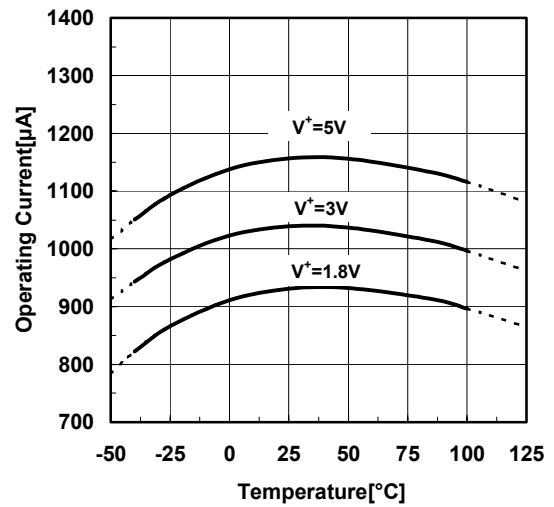
No.	Symbol	Equivalent Circuit	Typ.DC Voltage(V)	Function
3,5	+INPUT			non-inverting input
2,6	-INPUT			inverting input
1,7	VOUT			output

■ TYPICAL CHARACTERISTICS

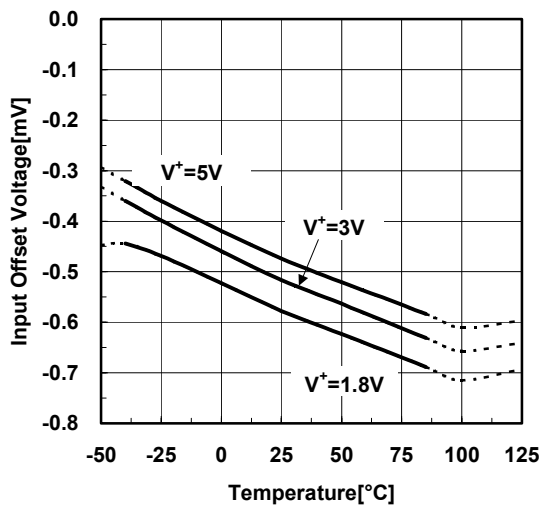
Operating Current vs. Operating Voltage



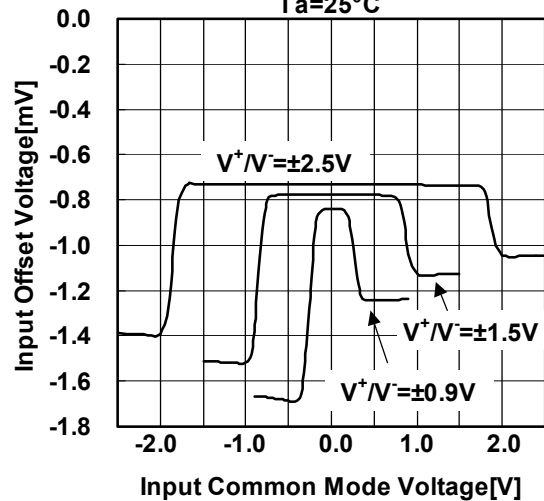
Operating Current vs. Temperature



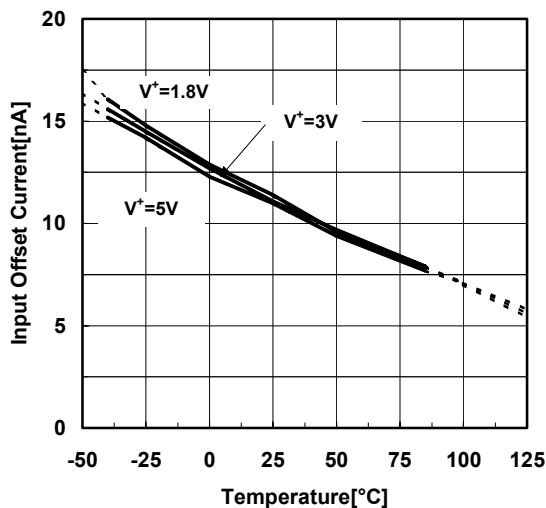
Input Offset Voltage vs. Temperature



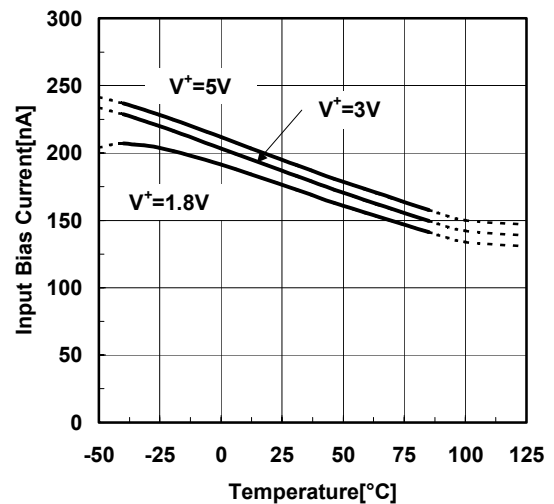
Input Offset Voltage
vs. Input Common Mode Voltage
Ta = 25°C



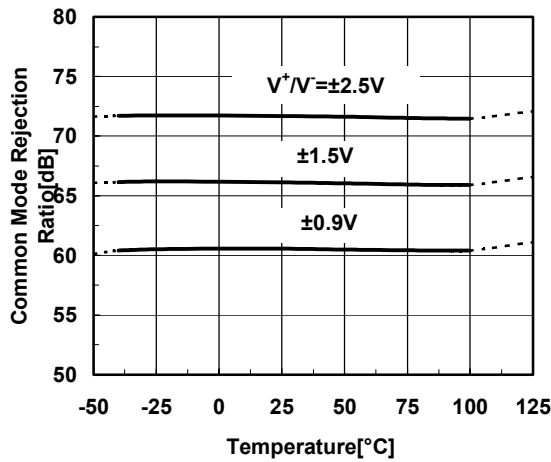
Input Offset Current vs. Temperature



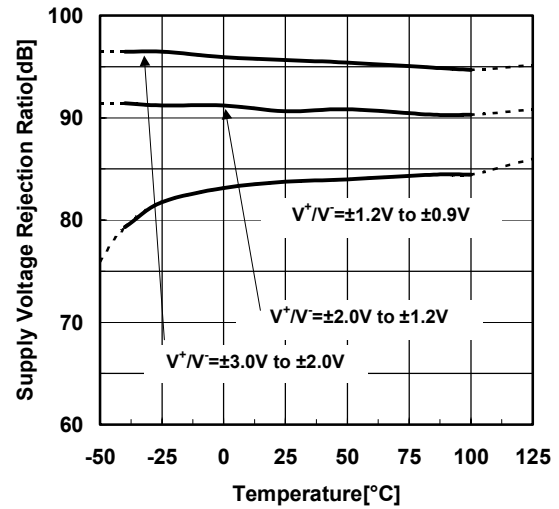
Input Bias Current vs. Temperature



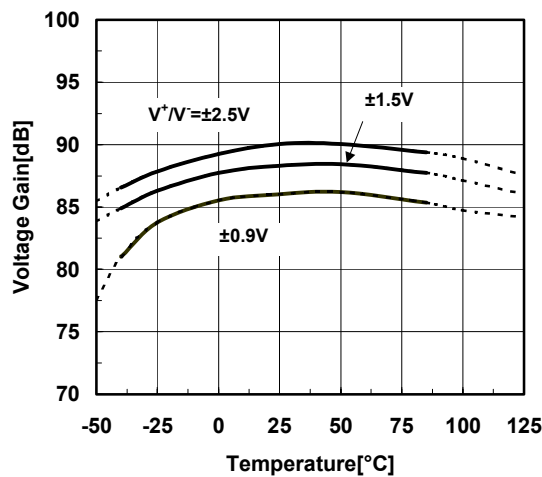
Common Mode Rejection Ratio
vs. Temperature
 $V_{IC}=V^+, 0, V^-$



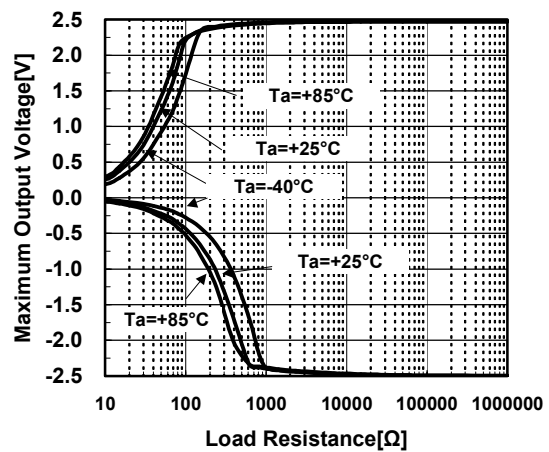
Supply Voltage Rejection Ratio vs.
Temperature



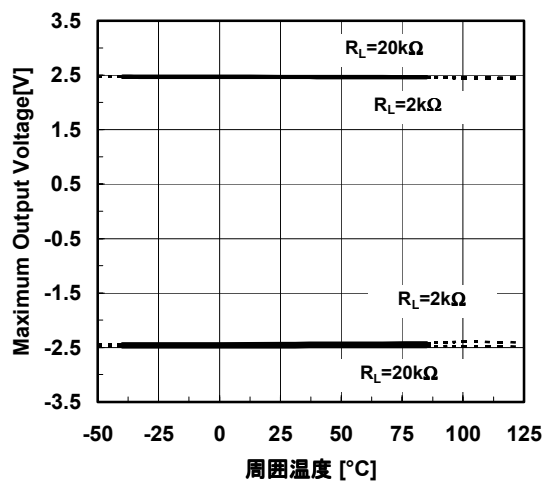
Voltage Gain vs. Temperature
 $R_L=2k\Omega$



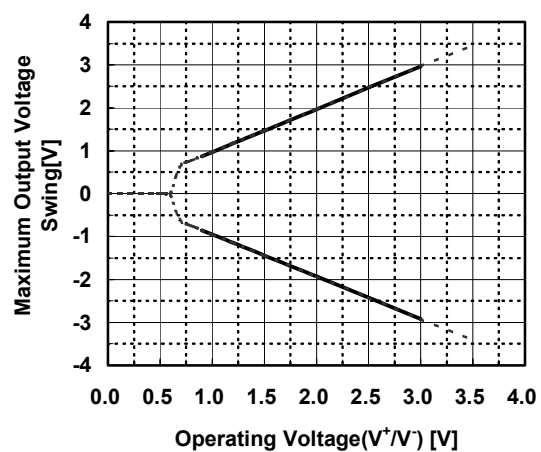
Maximum Output Voltage
vs. Load Resistance
 $V^+/V^-=2.5V$, OPEN LOOP



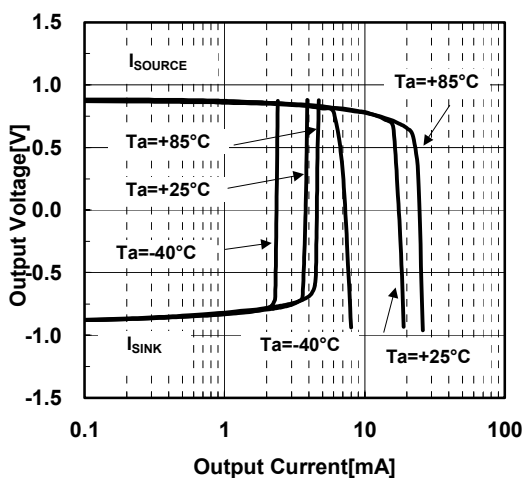
Maximum Output Voltage vs. Temperature
 $V^+/V^-=2.5V$, OPEN LOOP



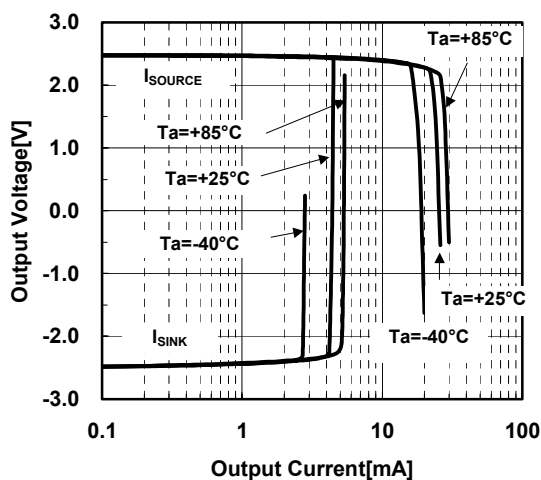
Maximum Output Voltage Swing vs.
Operating Voltage
OPEN LOOP, $R_L=2k\Omega$, $T_a=25^\circ C$



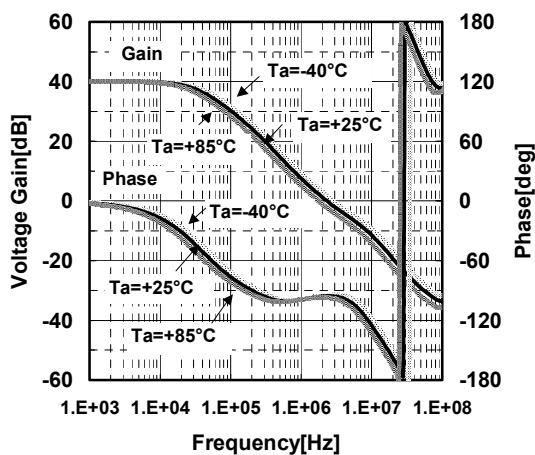
Output Voltage vs. Output Current
 $V^+/V^- = 0.9V$, OPEN LOOP



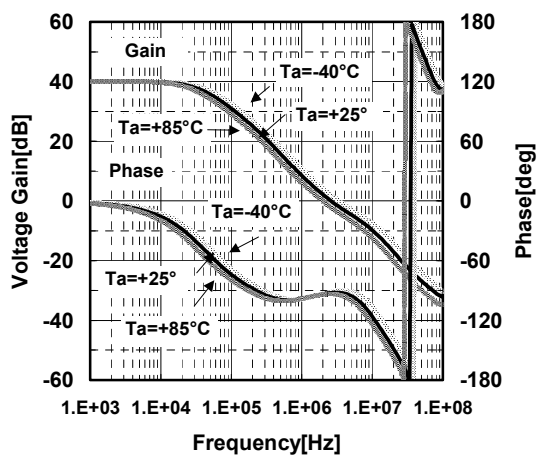
Output Voltage vs. Output Current
 $V^+/V^- = 2.5V$, OPEN LOOP



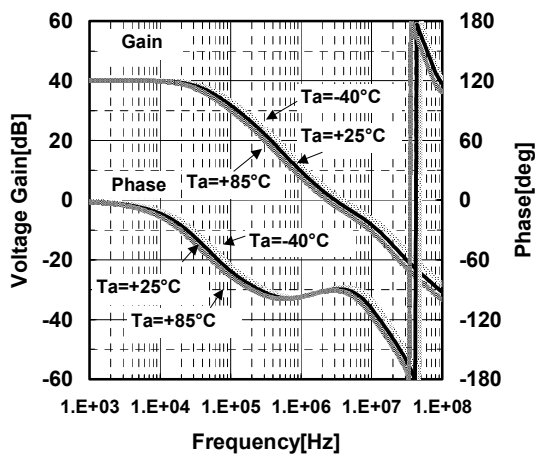
Voltage Gain, Phase vs. Frequency
 $V^+/V^- = 0.9V$, $GV = 40dB$
 $R_F = 20\Omega$, $R_G = 2k\Omega$, $CL = 0pF$



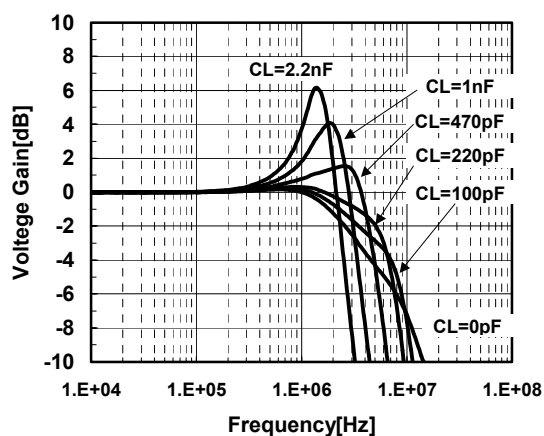
Voltage Gain, Phase vs. Frequency
 $V^+/V^- = 1.5V$, $GV = 40dB$
 $R_F = 20\Omega$, $R_G = 2k\Omega$, $CL = 0pF$



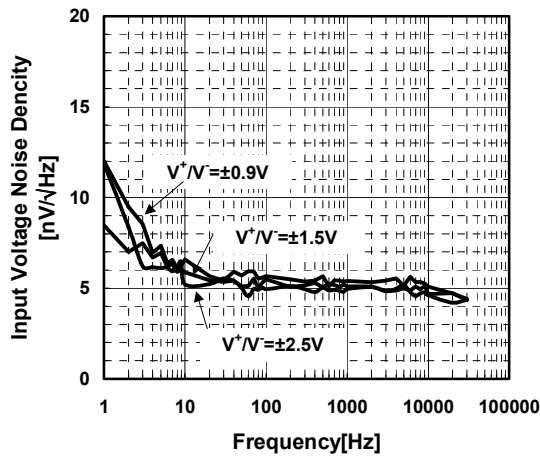
Voltage Gain, Phase vs. Frequency
 $V^+/V^- = 2.5V$, $GV = 40dB$
 $R_F = 20\Omega$, $R_G = 2k\Omega$, $CL = 0pF$



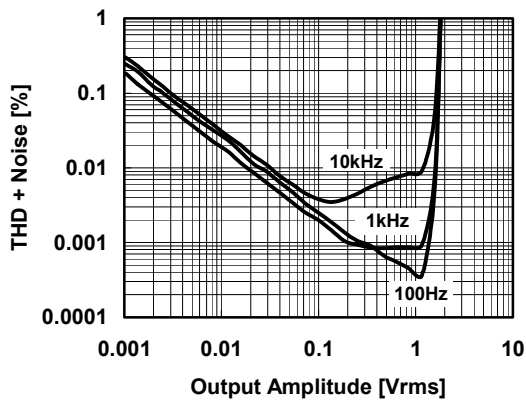
Peak Gain of Voltage Follower
 $V^+/V^- = 2.5V$, $GV = 0dB$
 $R_S = 50\Omega$, $R_L = 2k\Omega$, $T_a = +25^\circ C$



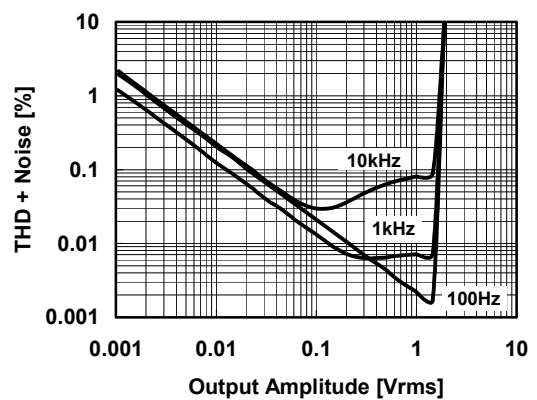
Input Voltage Noise Density vs. Frequency
 $G_V=40\text{dB}$, $R_s=50\Omega$, $R_G=20\Omega$,
 $R_F=2\text{k}\Omega$, $C_L=0\text{pF}$, $T_a=25^\circ\text{C}$



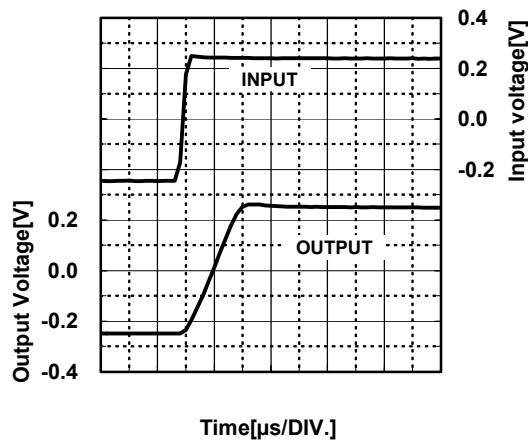
**TOTAL HARMONIC DISTORTION + NOISE
vs OUTPUT AMPLITUDE
(Voltage Follower)**
NJM2737, $V^+/V^- = 2.5\text{V}$, $G_V=0\text{dB}$
 $R_L=2\text{k}\Omega$, $T_a=25^\circ\text{C}$



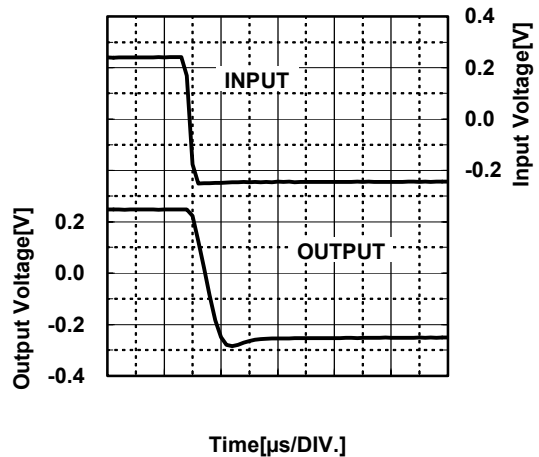
**TOTAL HARMONIC DISTORTION + NOISE
vs OUTPUT AMPLITUDE
($\times 10$ Amplifier)**
NJM2737, $V^+/V^- = 2.5\text{V}$, $G_V=20\text{dB}$
 $R_L=2\text{k}\Omega$, $T_a=25^\circ\text{C}$



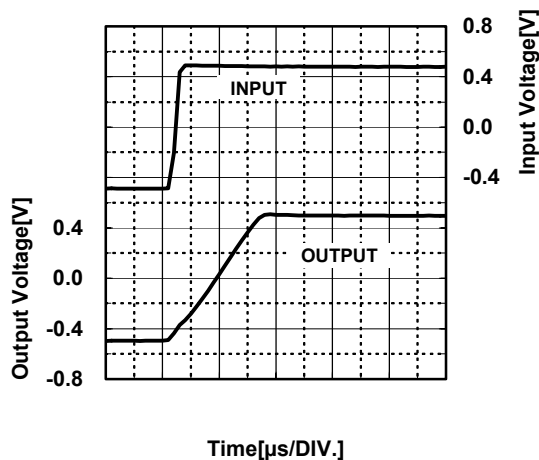
Positive Transient Response
 $V^*/V=0.9V, GV=0dB, f=10kHz, V_{IN}=0.5V_{PP}$
 $R_S=50\Omega, R_L=2k\Omega, C_L=0pF, T_a=+25^\circ C$



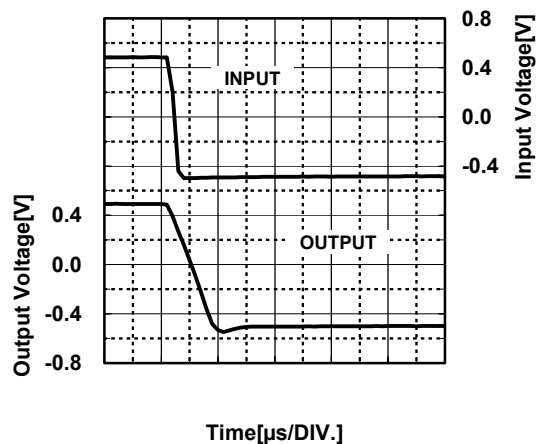
Negative Transient Response
 $V^*/V=0.9V, GV=0dB, f=10kHz, V_{IN}=0.5V_{PP}$
 $R_S=50\Omega, R_L=2k\Omega, C_L=0pF, T_a=+25^\circ C$



Positive Transient Response
 $V^*/V=1.5V, GV=0dB, f=10kHz, V_{IN}=1V_{PP}$
 $R_S=50\Omega, R_L=2k\Omega, C_L=0pF, T_a=+25^\circ C$



Negative Transient Response
 $V^*/V=1.5V, GV=0dB, f=10kHz, V_{IN}=1V_{PP}$
 $R_S=50\Omega, R_L=2k\Omega, C_L=0pF, T_a=+25^\circ C$



[CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.