High Quality Audio Dual Operational Amplifier

■GENERAL DESCRIPTION

The NJM8801 is a high quality audio dual operational Amplifier with bipolar technology, strikes a balance between “MUSES technology” and mass-production technique.

The original process tuning and the assembly technology, based on MUSES technology, make excellent sound and absorbing cost increases.

The characteristics like Low noise (4.5nV/√Hz), Wide Bandwidth (15MHz) and low distortion (0.0005%) suitable for audio preamplifiers, active filters, and line amplifiers.

NJM8801 packages are EMP8 and small SSOP8 with copper frame.

■PACKAGE OUTLINE

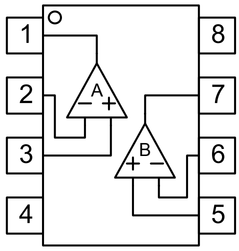
NJM8801E (EMP8) **NJM8801VA3 (SSOP8)**

■FEATURES

●Low Noise Voltage	4.5nV/√Hz typ.
	0.8uVrms typ. (RIAA)
●Low Distortion	0.0005% typ.
●Wide GB	15MHz typ.
●Slew Rate	5V/µs typ.
●Input Offset Voltage	0.3mV typ. 3mV max.
●Input Bias Current	100nA typ. 500nA max.
●Voltage Gain	110dB typ.
●Operating Voltage	±2V to ±18V
●Bipolar Technology	
●Package Outline	EMP8, SSOP8 (copper frame)

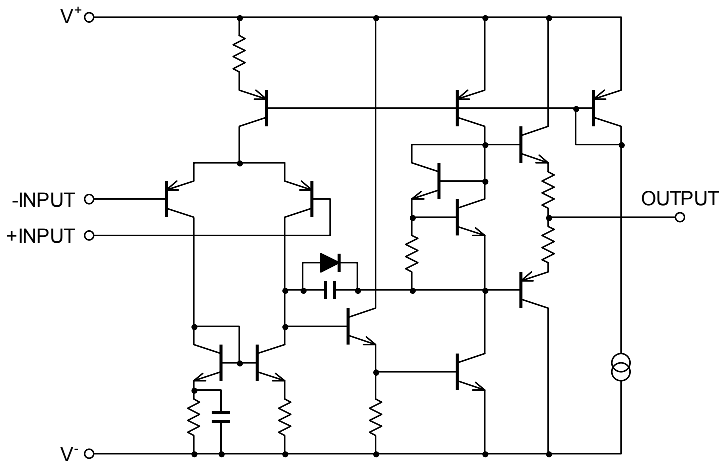
■ PIN CONFIGURATION

(Top View)



PIN FUNCTION
1. A OUTPUT
2. A -INPUT
3. A +INPUT
4. V-
5. B +INPUT
6. B -INPUT
7. B OUTPUT
8.V+

■EQUIVALENT CIRCUIT (1/2 Shown)



■ABSOLUTE MAXIMUM RATINGS (Ta=25ºC)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	±18	V
Common Mode Input Voltage Range	V_{ICM}	±15 (Note1)	V
Differential Input Voltage Range	V_{ID}	±30	V
Power Dissipation	P_D	EMP8: 500 (Note2) SSOP8: 460 (Note2)	mW
Operating Temperature Range	T_{OPR}	-40~+85	ºC
Storage Temperature Range	T_{STG}	-40~+125	ºC

(Note 1) For supply Voltages less than ±15V, the maximum input voltage is equal to the Supply Voltage.

(Note 2) Mounted on the EIA/JEDEC standard board (114.3×76.2×1.6mm, two layer, FR-4).

Please refer to the following Power Dissipation and Ambient Temperature.

■RECOMMENDED OPERATING CONDITION (Ta=25ºC)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+/V^-		±2	-	±18	V

■ELECTRIC CHARACTERISTICS

●DC CHARACTERISTICS (V^+/V^-=±15V, Vcm=0V, Ta=25ºC, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{CC}	R_L=∞, No Signal	-	6	9	mA
Input Offset Voltage	V_{IO}	Rs≤10kΩ (Note3)	-	0.3	3	mV
Input Bias Current	I_B		-	100	500	nA
Input Offset Current	I_{IO}	(Note3)	-	5	200	nA
Voltage Gain	A_V	R_L≥2kΩ, Vo=±10V, Rs≤10kΩ	90	110	-	dB
Common Mode Rejection Ratio	CMR	V_{CM}=±12V, Rs≤10kΩ	80	110	-	dB
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±9.0 to ±18V, Rs≤10kΩ	80	110	-	dB
Maximum Output Voltage	V_{OM}	R_L≥2kΩ	±12	±13.5	-	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥80dB	±12	±13.5	-	V

(Note3) Written by the absolute rate.

●AC CHARACTERISTICS (V^+/V^-=±15V, Vcm=0V, Ta=25ºC unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R_L≥2kΩ	-	5	-	V/us
Gain Bandwidth Product	GB	f=10kHz	-	15	-	MHz
Equivalent Input Noise Voltage	E_N	R_S=100Ω , f=1KHz	-	4.5	-	nV/√Hz
Equivalent Input Noise Voltage	V_{NI}	RIAA, R_S=2.2kΩ, 30kHz, LPF, NJM8801VA3	-	0.8	-	µVrms
Equivalent Input Noise Voltage	V_{NI}	RIAA, R_S=2.2kΩ, 30kHz, LPF, NJM8801E	-	0.8	1.4	µVrms
Total Harmonic Distortion	THD	f=1kHz ,A_V=+10, Vo=5Vrms, R_L=2kΩ	-	0.0005	-	%
Channel Separation	CS	f=1kHz , A_V=-100, R_S=1kΩ, R_L=2kΩ		130	-	dB

■Application Notes

●Package Power, Power Dissipation and Output Power

IC is heated by own operation and possibly gets damage when the junction power exceeds the acceptable value called Power Dissipation P_D. The dependence P_D on ambient temperature is shown in Fig 1. The plots are depended on following two points. The first is P_D on ambient temperature 25ºC, which is the maximum power dissipation. The second is 0W, which means that the IC cannot radiate any more. Conforming the maximum junction temperature Tjmax to the storage temperature Tstg derives this point. Fig.1 is drawn by connecting those points and conforming the P_D lower than 25ºC to it on 25ºC. The P_D is shown following formula as a function of the ambient temperature between those points.

$$\text{Dissipation Power} \quad P_D = \frac{Tjmax - Ta}{\theta ja} \text{ [W] (Ta=25ºC to Ta=150ºC)}$$

Where, θja is heat thermal resistance which depends on parameters such as package material, frame material and so on. Therefore, P_D is different in each package.

While, the actual measurement of dissipation power on IC is obtained using following equation.

(Actual Dissipation Power) = (Supply Voltage V_{DD}) X (Supply Current I_{DD}) – (Output Power Po)

This IC should be operated in lower than P_D of the actual dissipation power.

To sustain the steady state operation, take account of the Dissipation Power and thermal design.

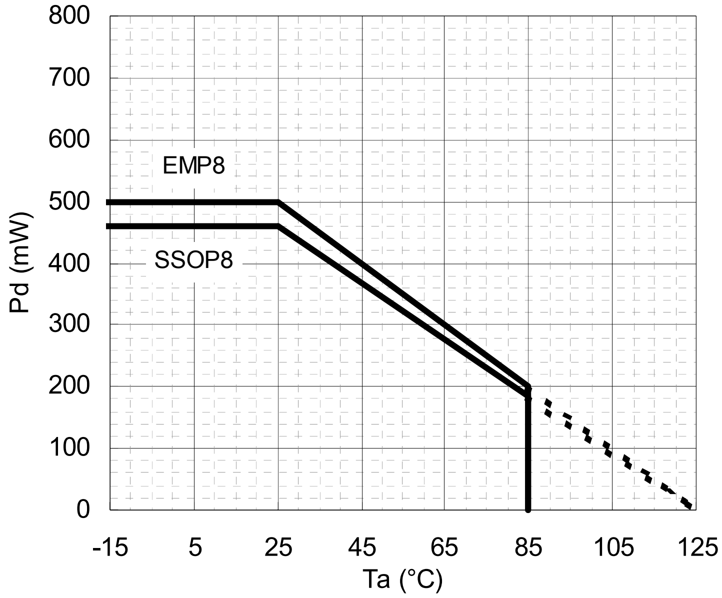
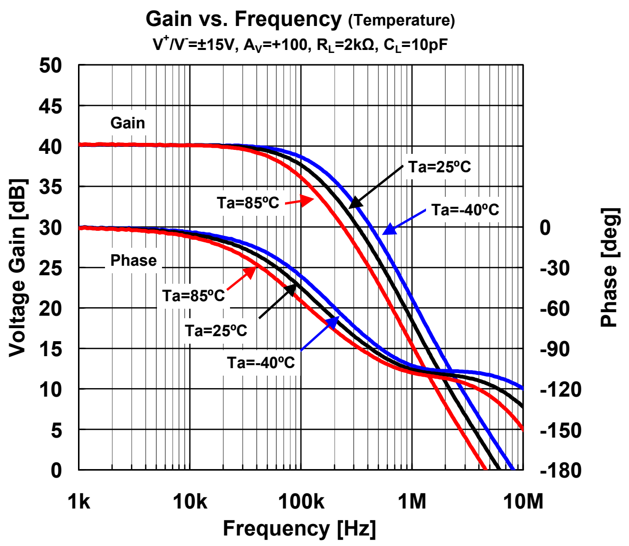
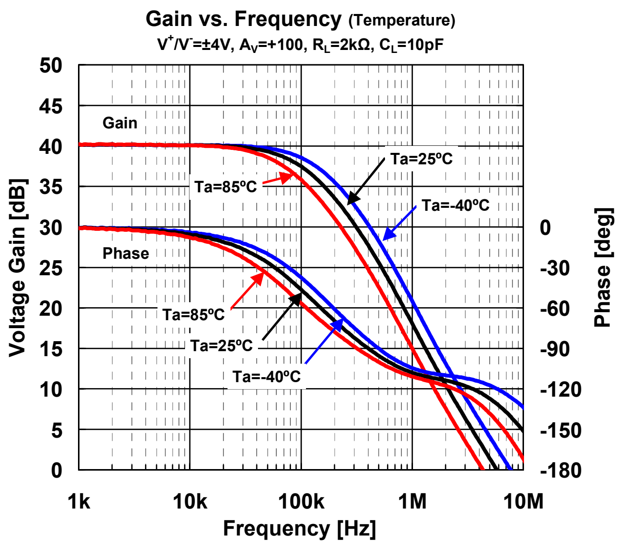
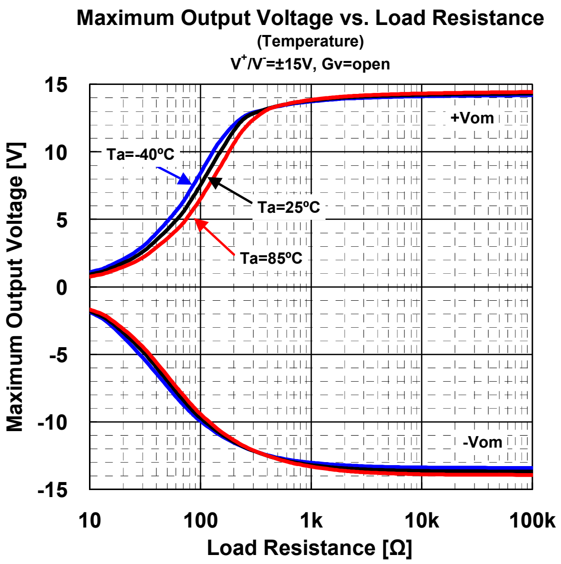


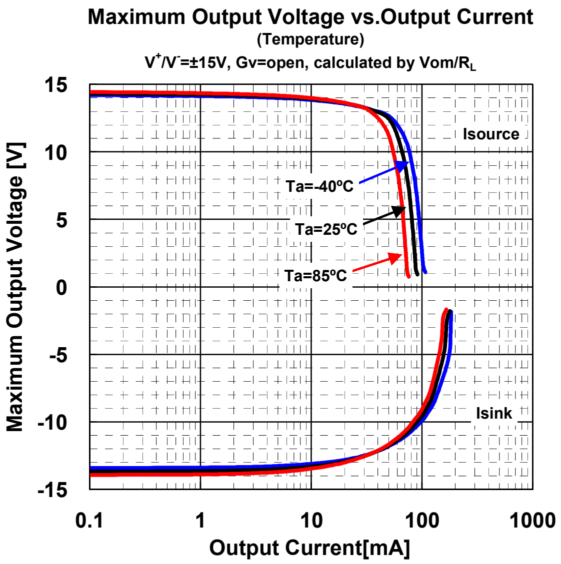
Fig.1 Power Dissipations vs. Ambient Temperature

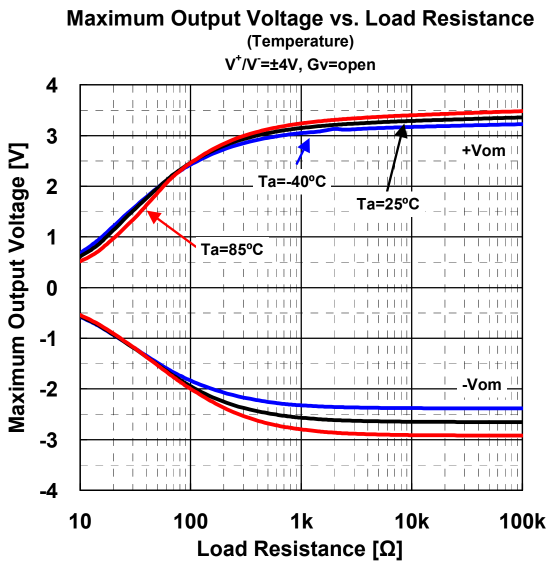
TYPICAL CHARACTERISTICS

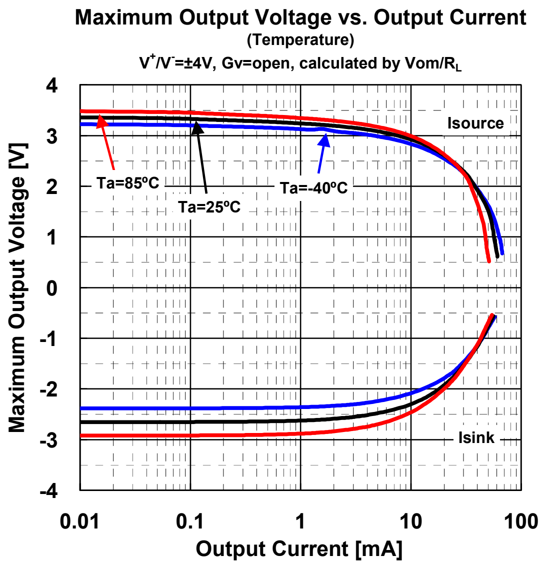








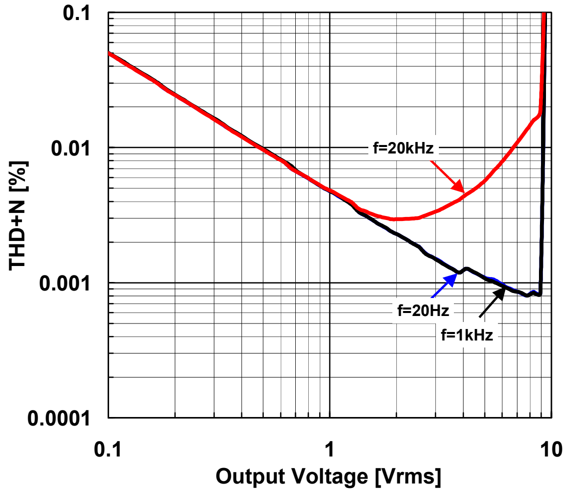




■ TYPICAL CHARACTERISTICS

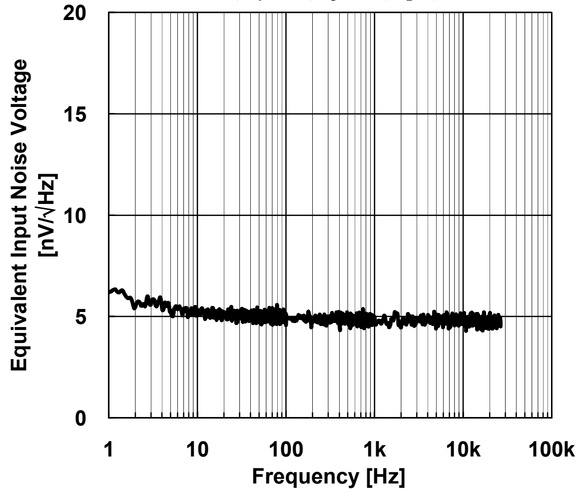
THD+N vs. Output Voltage

V^+/V^-=±15V, A_V=+10, R_L=2kΩ, Ta=25ºC



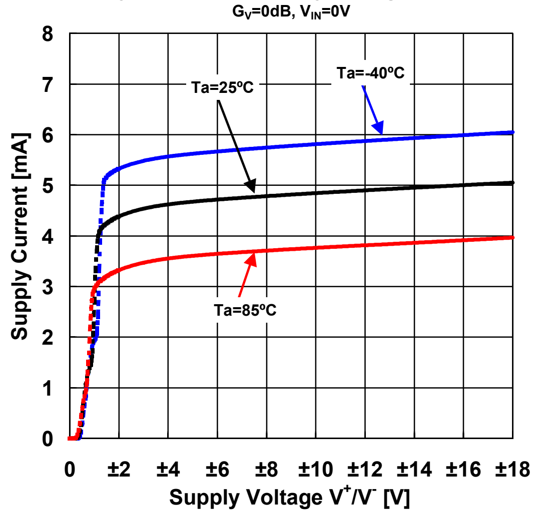
Voltage Noise vs. Frequency

V^+/V^-=±15V, A_V=+100, R_S=100Ω, R_L=∞, Ta=25ºC



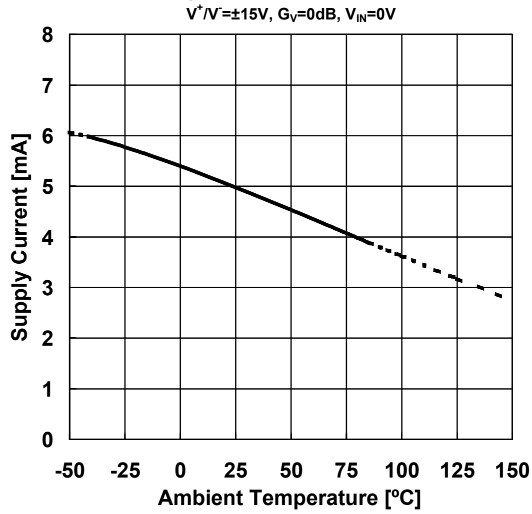
Supply Current vs. Supply Voltage (Temperature)

G_V=0dB, V_{IN}=0V



Supply Current vs. Temperature

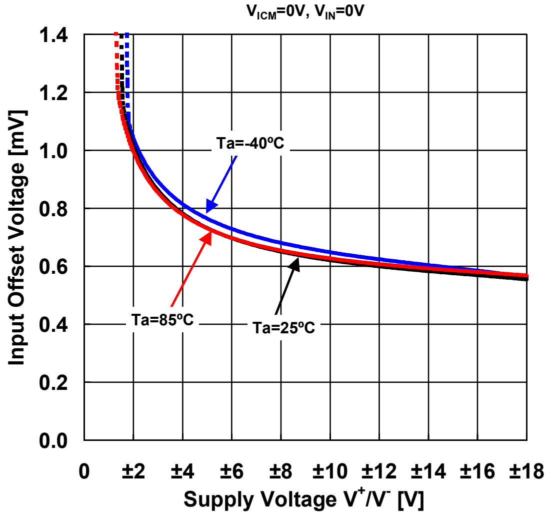
V^+/V^-=±15V, G_V=0dB, V_{IN}=0V



Input Offset Voltage vs. Supply Voltage

(Temperature)

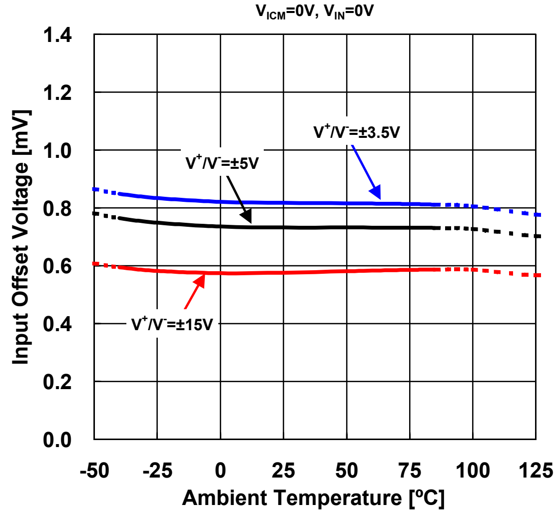
V_{ICM}=0V, V_{IN}=0V



Input Offset Voltage vs. Temperature

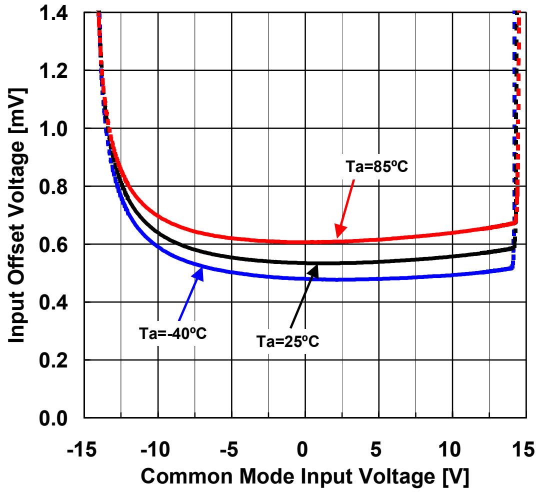
(Supply Voltage)

V_{ICM}=0V, V_{IN}=0V

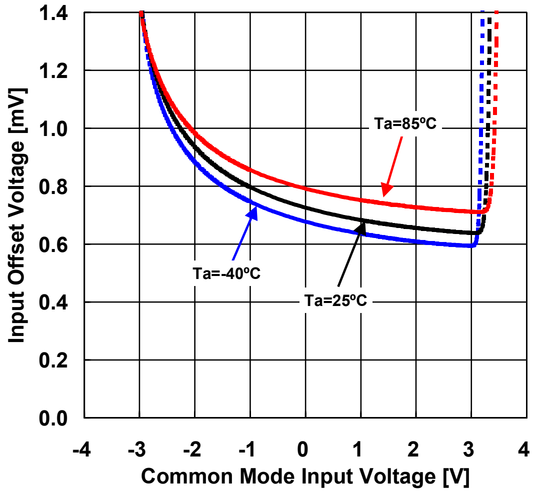


■ TYPICAL CHARACTERISTICS

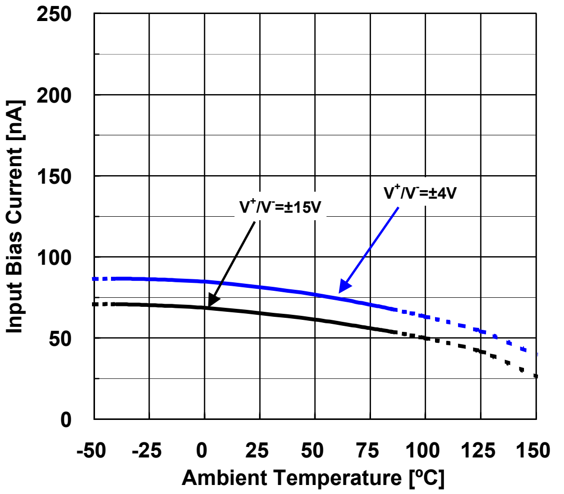
Input Offset Voltage vs. Common Mode Input Voltage
(Temperature)
$V^+/V^-=\pm15V$



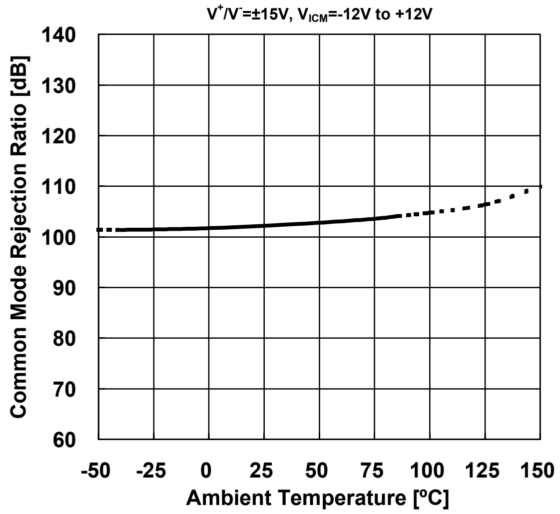
Input Offset Voltage vs. Common Mode Input Voltage
(Temperature)
$V^+/V^-=\pm4V$



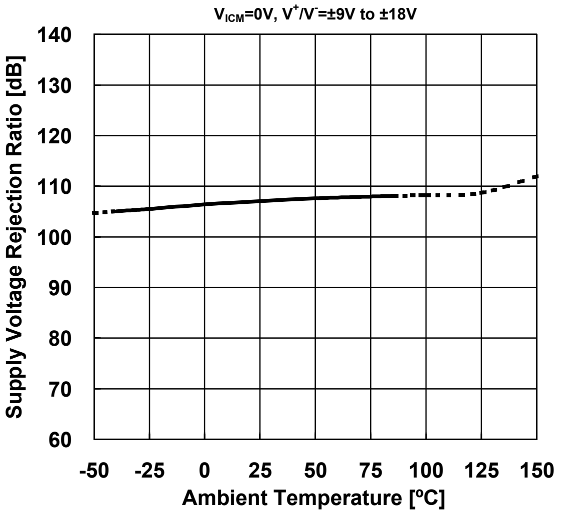
Input Bias Current vs. Temperature (Supply Voltage)
$V_{ICM}=0V$



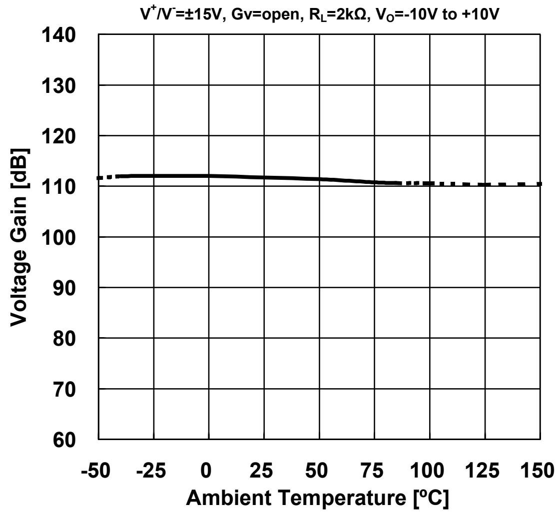
CMR vs. Temperature
$V^+/V^-=\pm15V$, $V_{ICM}=-12V$ to $+12V$



SVR vs. Temperature
$V_{ICM}=0V$, $V^+/V^-=\pm9V$ to $\pm18V$

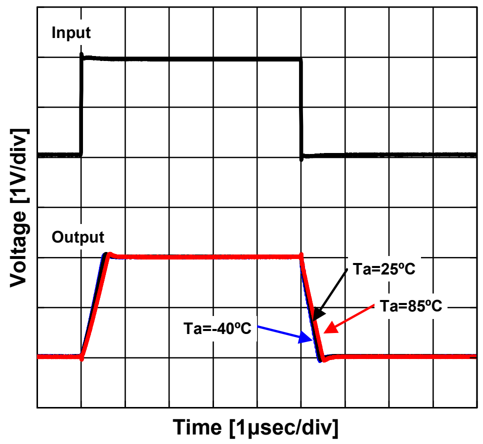


Open Loop Gain vs. Temperature
$V^+/V^-=\pm15V$, Gv=open, $R_L=2k\Omega$, $V_O=-10V$ to $+10V$

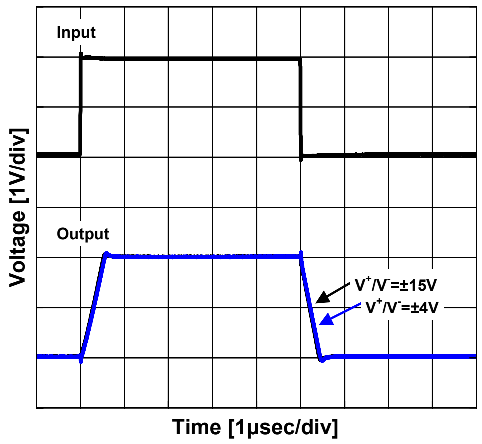


■ TYPICAL CHARACTERISTICS

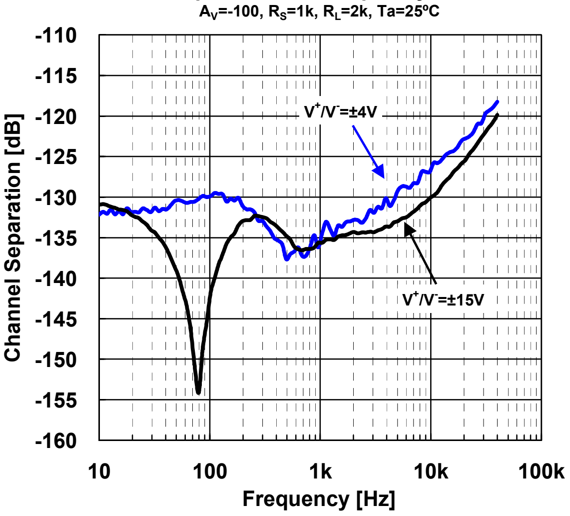
Pulse Response (Temperature)
V^+/V^-=±15V, Gv=0dB, C_L=10pF, R_L=2kΩ



Pulse Response (Supply Voltage)
Gv=0dB, R_L=2kΩ, Ta=25ºC



Channel Separation vs. Frequency (Supply Voltage)
A_V=-100, R_S=1k, R_L=2k, Ta=25ºC



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