Single Supply, Rail-to-Rail Output Dual Operational Amplifier

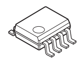
■ GENERAL DESCRIPTION

The NJM8202 is a Rail-to-Rail output single supply dual operational amplifier with a low noise of 10nV/√Hz (typ. at 1kHz) and high RF noise immunity.

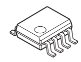
The high RF noise immunity can reduce malfunctions caused by RF noises from mobile phones and others.

It offers a single supply voltage operation from +2.5V to +14V, rail-to-rail output swing close to both rails and input voltage range from ground. It is suitable for various applications such as current sense amplifiers, sound processing, buffer amplifiers, filter circuits and others. The NJM8202 is available in small surface mounting packages of SOP8 (DMP8), SSOP8, SOP8 JEDEC 150mil, MSOP8 (VSP8) and MSOP8 (TVSP8).

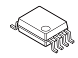
■ PACKAGE OUTLINE



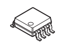
NJM8202M (DMP8)



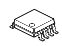
NJM8202E (SOP8)



NJM8202V (SSOP8)



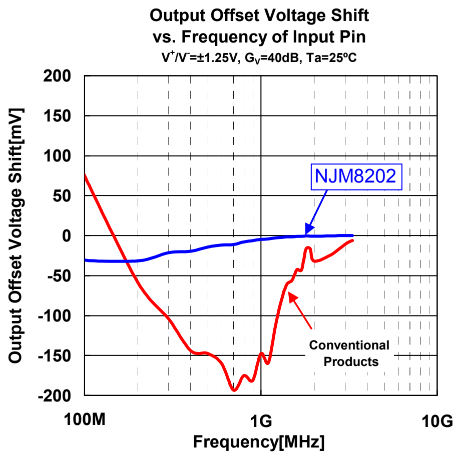
NJM8202R (MSOP8(VSP8))



NJM8202RB1 (MSOP8(TVSP8))

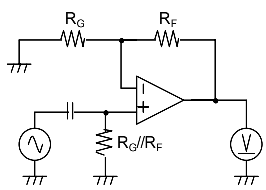
■ FEATURES

●RF Immunity	Enhance the RF immunity from mobile phones
●Rail-to-Rail Output	0.25V~4.75V min.(@V+=5V)
●Operating Temperature	-40ºC ~+85ºC
●Operation Voltage	+2.5V~+14V(±1.25~±7V)
●Slew Rate	3.5V/μs(typ.)
●GBW	10MHz(typ.)
●Low Noise	10nV/√Hz(typ.) @1kHz
●Input Offset Voltage	6.0mV(max.)
●Supply Current	5mA(max.)
●Package	DMP8, SSOP8, SOP8 JEDEC 150mil MSOP8 (VSP8) MEET JEDEC MO-187-DA MSOP8 (TVSP8) MEET JEDEC MO-187-DA / THIN TYPE



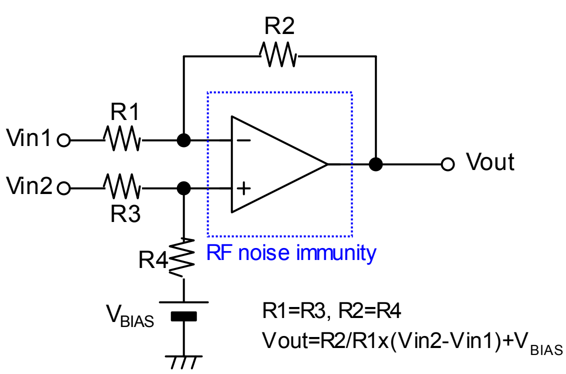
■ APPLICATIONS

- ●Note PC, PDA
- ●Mobile phone
- ●Audio signal processing
- ●Current detect
- ●Buffer, Active filter



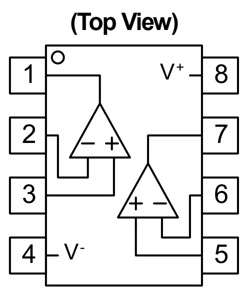
Test Circuit

■ TYPICAL APPLICATION



Differential Amplifier

■ PIN CONFIGURATION



Pin Function

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

■ ABUSOLUTE MAXIMUM RATINGS (Ta=25˚C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+	15	V
Common Mode Input Voltage Range	V_{ICM}	0~15 (Note1)	V
Differential Input Voltage Range	V_{ID}	±15 (Note1)	V
Power Dissipation (Note3)	P_D	380 [DMP8], 530 [DMP8](Note2) 300 [EMP8], 690 [EMP8] (Note2) 250[SSOP8], 460[SSOP8] (Note2) 320[MSOP8 (VSP8)], 595[MSOP8 (VSP8)] (Note2) 320[MSOP8 (TVSP8)], 580[MSOP8 (TVSP8)] (Note2)	mW
Operating Temperature Range	Topr	-40~+85	ºC
Storage Temperature Range	Tstg	-50~+150	ºC

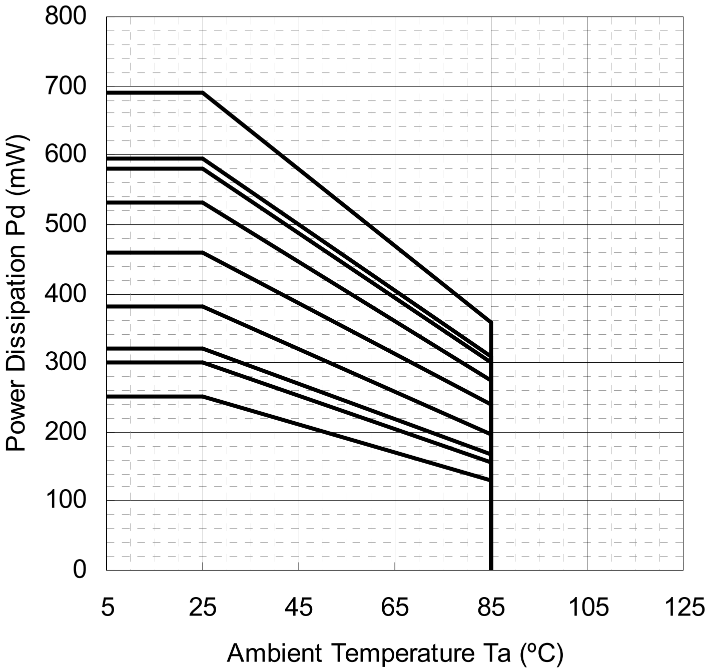
(Note1) For supply voltage less than 15V, the absolute maximum input voltage is equal to supply voltage.

(Note2) On the PCB "EIA/JEDEC (114.3×76.2×1.57mm, 2 layers, FR-4)"

(Note3) See Figure1 "Power Dissipation Derating Curve" when ambient temperature is over 25ºC.

Figure1

Power Dissipation Derating Curve



Pkg.	⊿Pd (mW/℃)	Pd (25℃)	Pd (85℃)
DMP8	-3.04	380	198
EMP8	-2.40	300	156
SSOP8	-2.00	250	130
MSOP8 (TVSP8)	-2.56	320	166
MSOP8 (VSP8)	-2.56	320	166
DMP8(2 Layer)	-4.24	530	276
EMP8(2 Layer)	-5.52	690	359
SSOP8(2 Layer)	-3.68	460	239
MSOP8 (TVSP8)(2 Layer)	-4.64	580	302
MSOP8 (VSP8)(2 Layer)	-4.76	595	309

■ RECOMMENDED OPERATING VOLTAGE (Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+		2.5	-	14	V

■ ELECTRICAL CARACTERISTICS

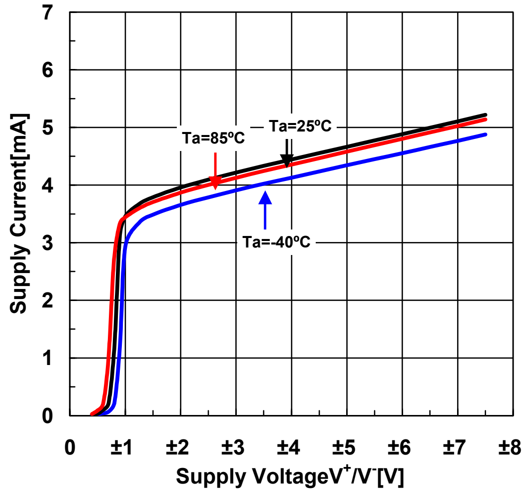
● ELECTRICAL CARACTERISTICS (V^+=5V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	R_L=∞, V_{IN}=2.5V , No Signal	-	4	5	mA
Input Offset Voltage	V_{IO}		-	1	6	mV
Input Bias Current	I_B		-	100	350	nA
Input Offset Current	I_{IO}		-	5	100	nA
Voltage Gain	Av	R_L≥10kΩ to 2.5V, Vo=0.5V~4.5V	65	85	-	dB
Common Mode Rejection Ratio	CMR	0V≤V_{CM}≤4V	60	75	-	dB
Supply Voltage Rejection Ratio	SVR	V^+=2.5V to 14V	60	80	-	dB
Maximum Output Voltage1	V_{OH1}	R_L≥5kΩ to 2.5V	4.75	4.9	-	V
	V_{OL1}	R_L≥5kΩ to 2.5V	-	0.1	0.25	V
Maximum Output Voltage2	V_{OH2}	R_L≥5kΩ to GND	4.75	4.9	-	V
	V_{OL2}	R_L≥5kΩ to GND	-	-	0.25	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥60dB	0	-	4	V
Gain Bandwidth Product	GB	f=1MHz	-	10	-	MHz
Phase Margin	Φ_M	R_L=10kΩ, C_L=10pF	-	50	-	deg
Equivalent Input Noise Voltage	V_{NI}	f=1kHz , V_{CM}=2.5V	-	10	-	nV/√Hz
Total Harmonic Distortion	THD	f=1kHz , A_V=+2, R_L=10kΩ to 2.5V, Vo=1.5Vrms	-	0.001	-	%
Channel Separation	CS	f=1kHz, R_L=10kΩ to 2.5V, Vo=1.5Vrms	-	120	-	dB
Slew Rate	SR	(Note4), A_V=1, V_{IN}=2Vpp R_L=10kΩ to 2.5V, C_L=10pF to 2.5V	-	3.5	-	V/µs

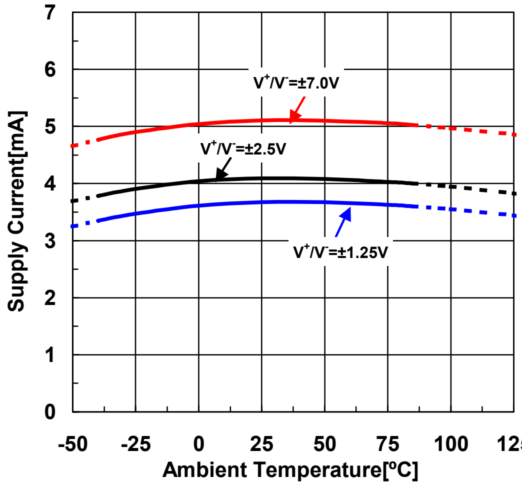
(Note4) Number specified is the slower of the positive and negative slew rates.

■ TYPICAL CHARACTERISTICS

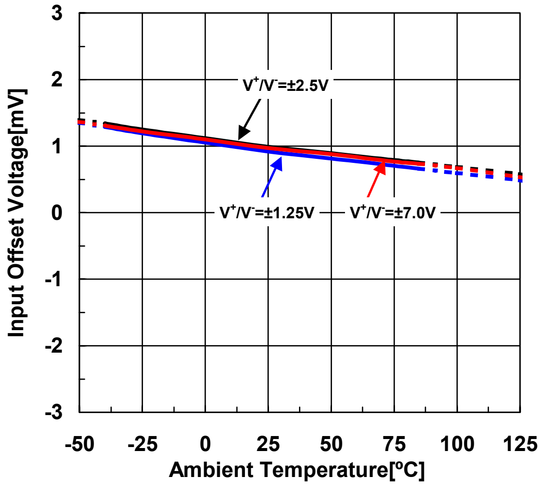
Supply Current vs. Supply Voltage
(Temperature)
G_V=0dB



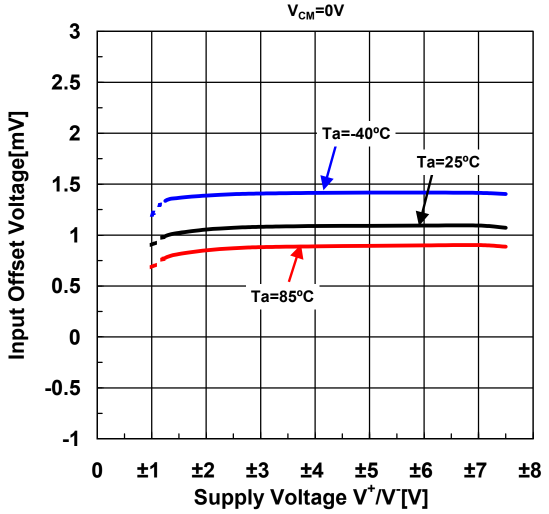
Supply Current vs. Temperature
(Supply Voltage)
G_V=0dB



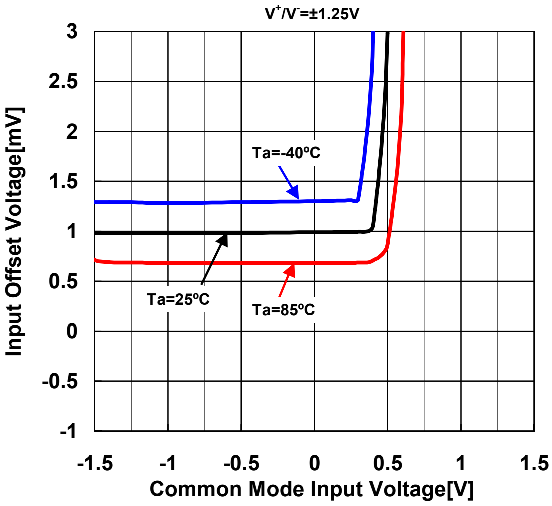
Input Offset Voltage vs. Temperature (Supply Voltage)
V_{CM}=0V



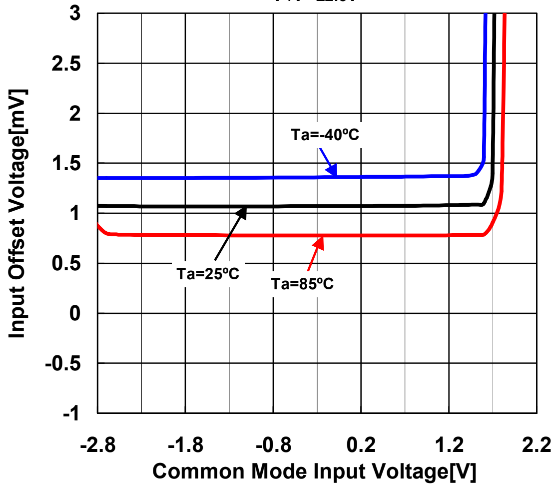
Input Offset Voltage vs. Supply Voltage (Temperature)
V_{CM}=0V



Input Offset Voltage
vs. Common Mode Input Voltage
(Temperature)
V+/V-=±1.25V

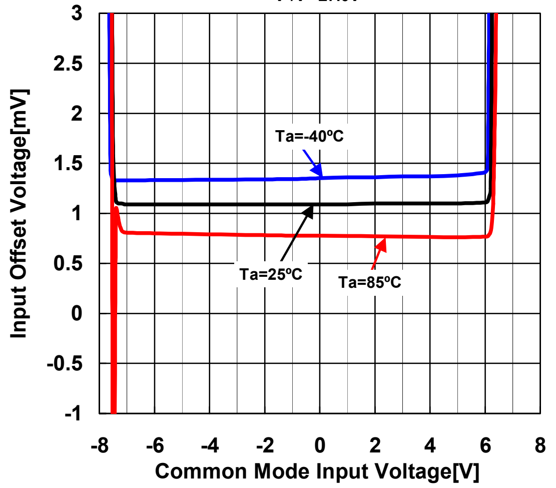


Input Offset Voltage
vs. Common Mode Input Voltage
(Temperature)
V+/V-=±2.5V

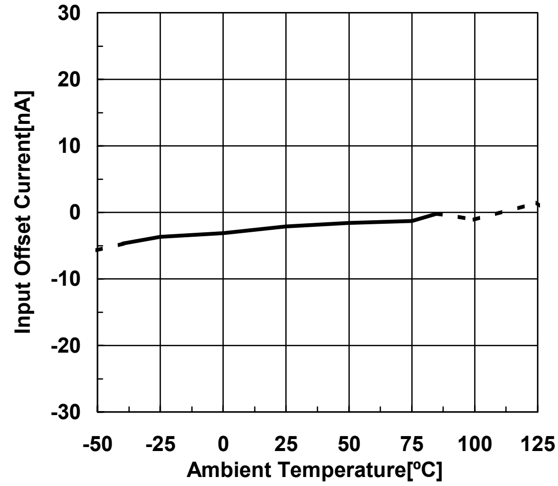


■ TYPICAL CHARACTERISTICS

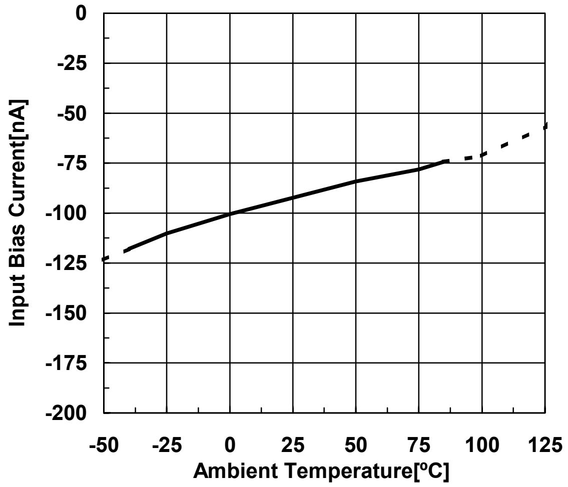
Input Offset Voltage
vs. Common Mode Input Voltage
(Temperature)
$V^+/V^-=\pm7.0V$



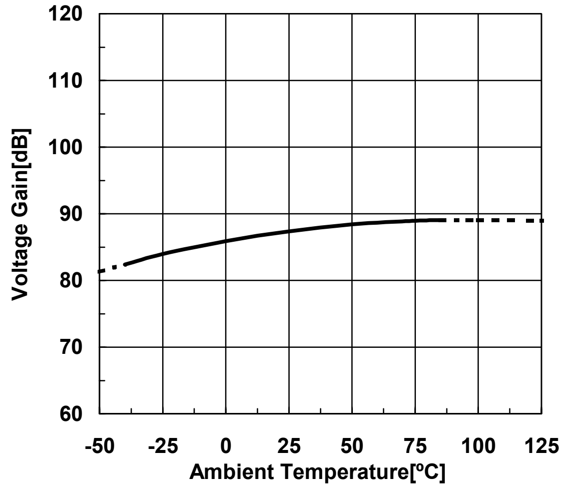
Input Offset Current vs. Temperature
$V^+/V^-=\pm2.5V$



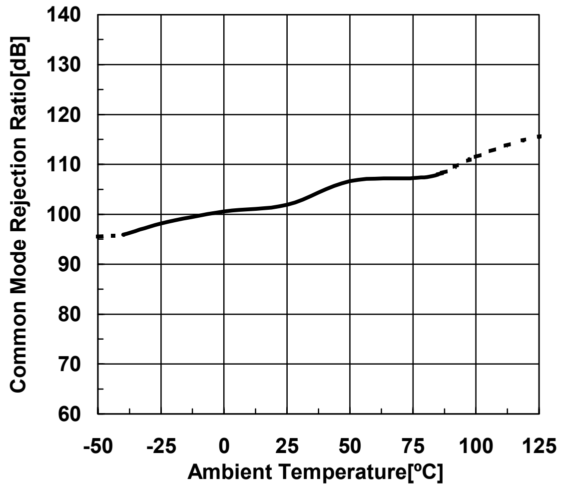
Input Bias Current vs. Temperature
$V^+/V^-=\pm2.5V$



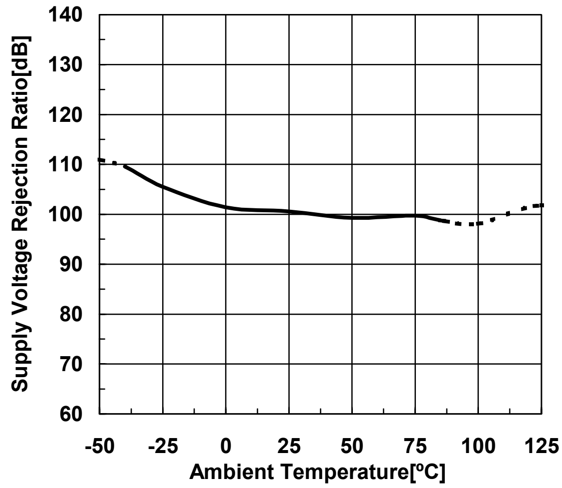
Voltage Gain vs. Temperature
$V^+/V^-=\pm2.5V$, $R_L=10k\Omega$



Common Mode Rejection Ratio vs. Temperature
$V^+/V^-=\pm2.5V$

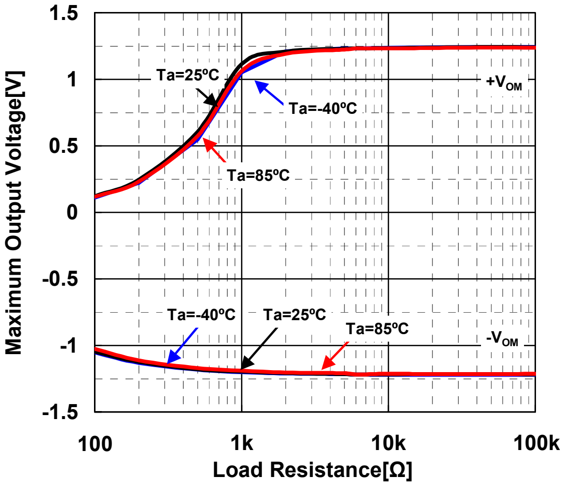


Supply Voltage Rejection Ratio vs. Temperature
$V^+/V^-=\pm2.5V$

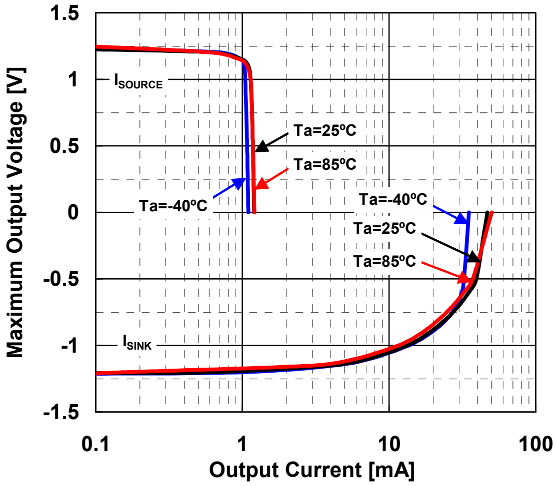


■ TYPICAL CHARACTERISTICS

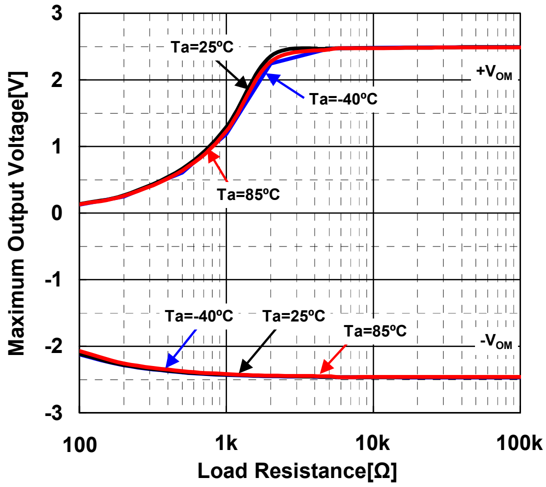
Maximum Output Voltage vs. Load Resistance
(Temperature)
V^+/V^-=±1.25V, G_V=open



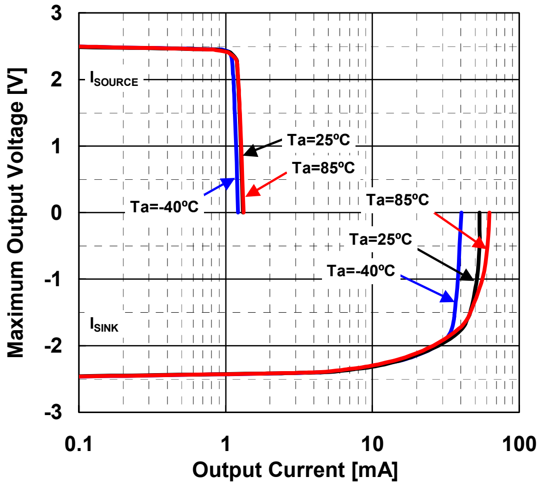
Maximum Output Voltage vs. Output Current
(Temperature)
V^+/V^-=±1.25V, Gv=open



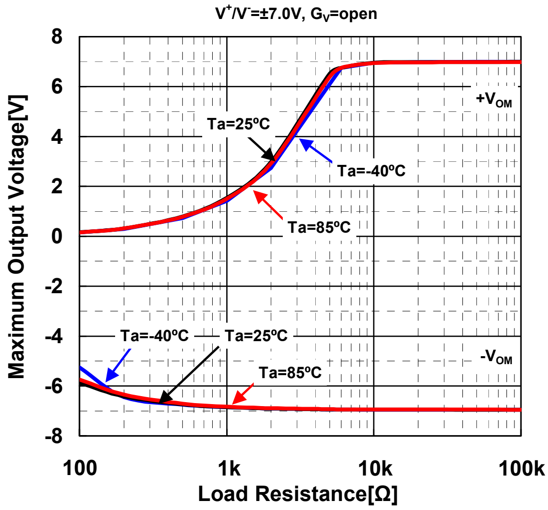
Maximum Output Voltage vs. Load Resistance
(Temperature)
V^+/V^-=±2.5V, Gv=open



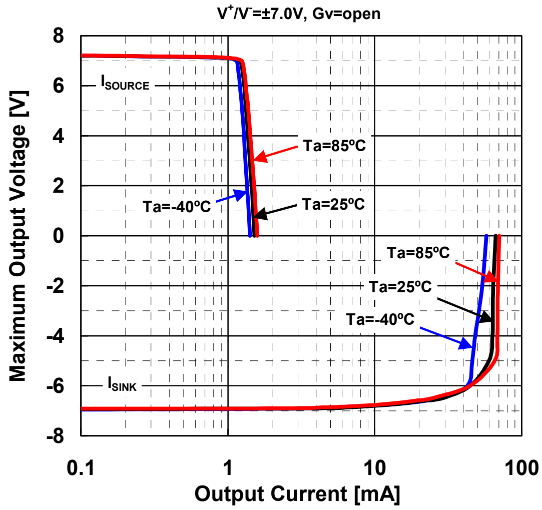
Maximum Output Voltage vs. Output Current
(Temperature)
V^+/V^-=±2.5V, G_V=open



Maximum Output Voltage vs. Load Resistance
(Temperature)
V^+/V^-=±7.0V, G_V=open

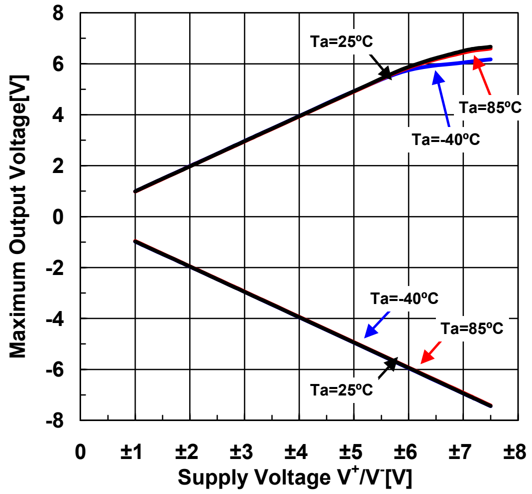


Maximum Output Voltage vs. Output Current
(Temperature)
V^+/V^-=±7.0V, Gv=open

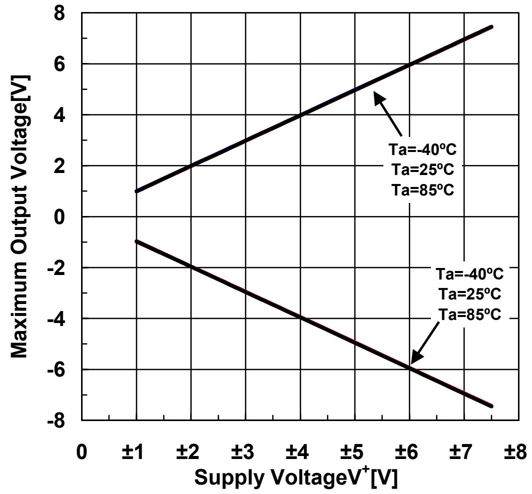


■ TYPICAL CHARACTERISTICS

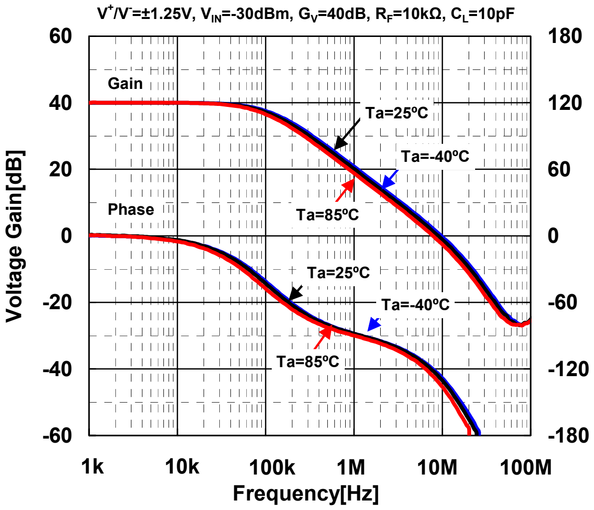
Maximum Output Voltage vs. Supply Voltage
(Temperature)
Gv=open, R_L=5kΩ



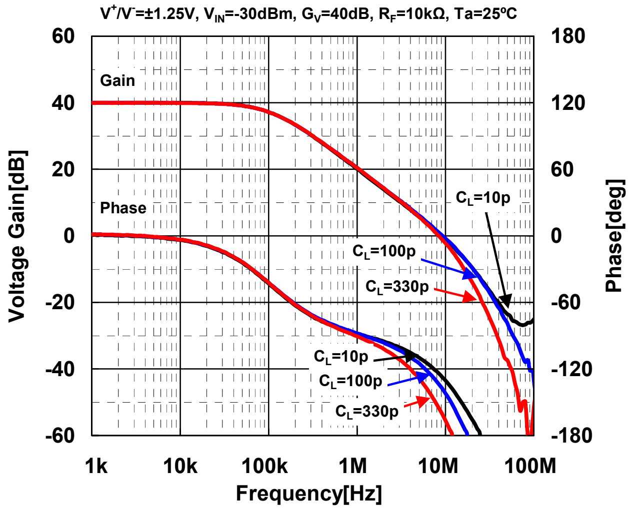
Maximum Output Voltage vs. Supply Voltage
(Temperature)
Gv=open, R_L=10kΩ



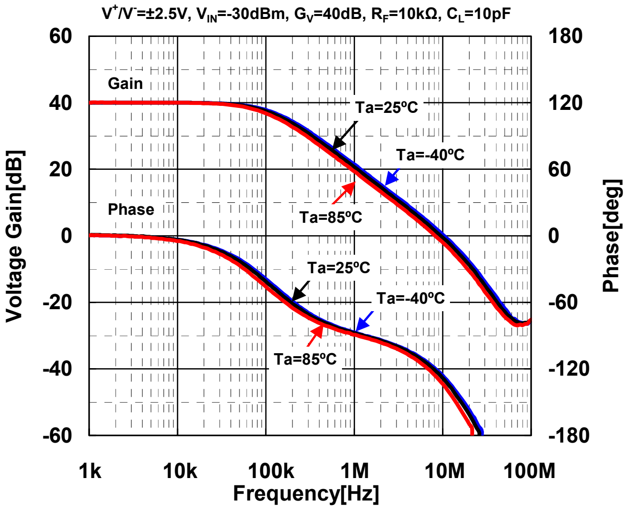
40dBGain/Phase vs. Frequency (Temperature)
V^+/V^-=±1.25V, V_{IN}=-30dBm, G_V=40dB, R_F=10kΩ, C_L=10pF



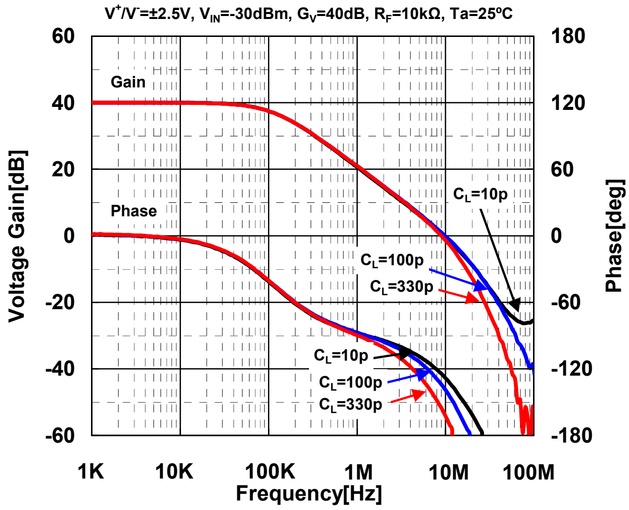
40dBGain/Phase vs. Frequency (Load Capacitance)
V^+/V^-=±1.25V, V_{IN}=-30dBm, G_V=40dB, R_F=10kΩ, Ta=25ºC



40dBGain/Phase vs. Frequency (Temperature)
V^+/V^-=±2.5V, V_{IN}=-30dBm, G_V=40dB, R_F=10kΩ, C_L=10pF



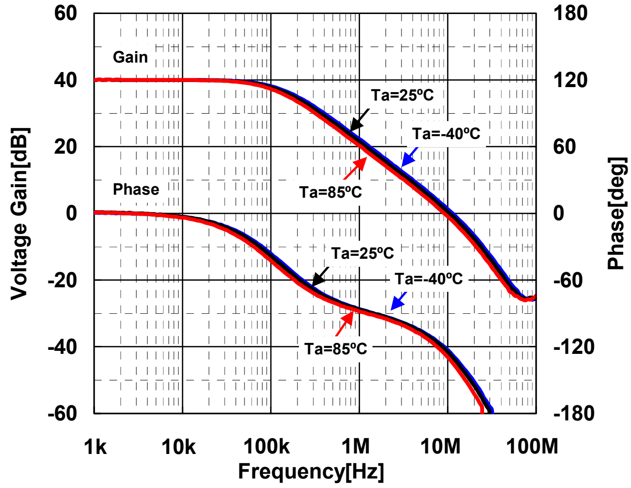
40dBGain/Phase vs. Frequency (Load Capacitance)
V^+/V^-=±2.5V, V_{IN}=-30dBm, G_V=40dB, R_F=10kΩ, Ta=25ºC



■ TYPICAL CHARACTERISTICS

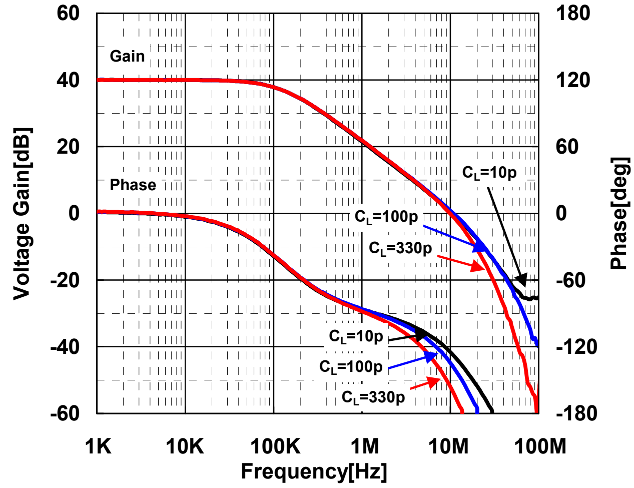
40dBGain/Phase vs. Frequency (Temperature)

V^+/V^-=±7.0V, V_{IN}=-30dBm, G_V=40dB, R_F=10kΩ, C_L=10pF



40dBGain/Phase vs. Frequency (Load Capacitance)

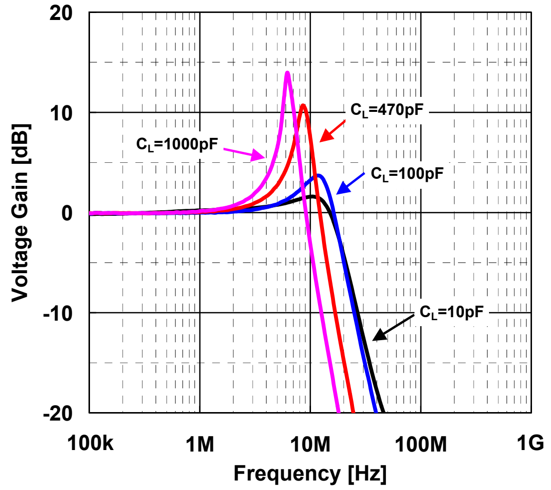
V^+/V^-=±7.0V, V_{IN}=-30dBm, G_V=40dB, R_F=10kΩ, Ta=25ºC



V.F. Peak vs. Frequency

(Load Capacitance)

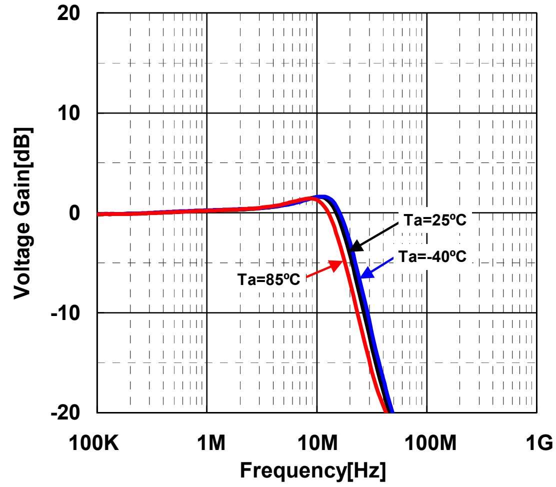
V^+/V^-=±2.5V, G_V=0dB, Ta=25ºC



V.F. Peak vs. Frequency

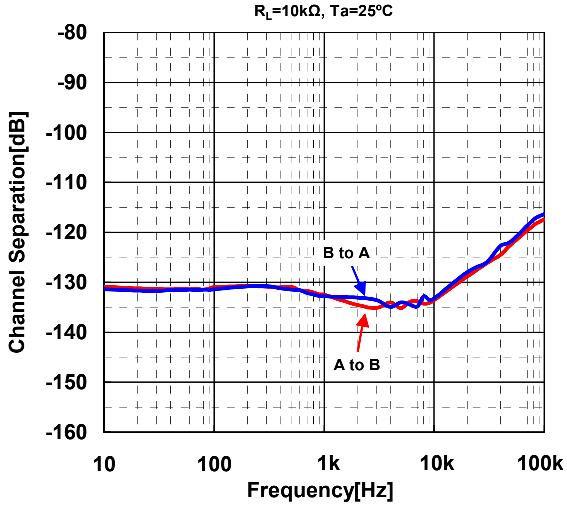
(Temperature)

V^+/V^-=±2.5V, G_V=0dB, C_L=10pF



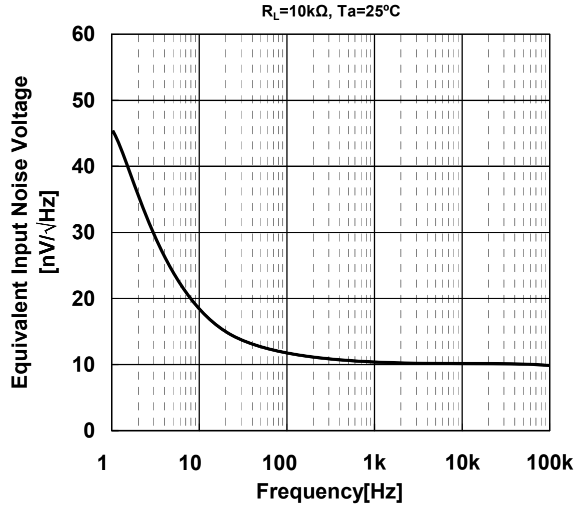
Channel Separation vs. Frequency

V^+/V^-=±2.5V, V_O=1.5Vrms, G_V=40dB, R_F=100kΩ, R_L=10kΩ, Ta=25ºC



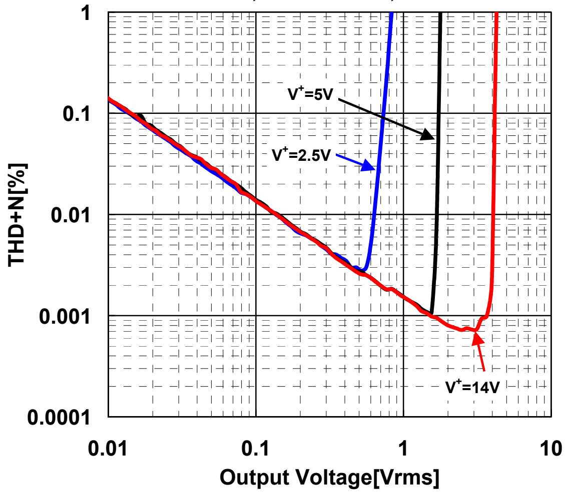
Equivalent Input Noise Voltage vs. Frequency

V^+/V^-=±2.5V, G_V=40dB, R_F=20kΩ, R_L=10kΩ, Ta=25ºC

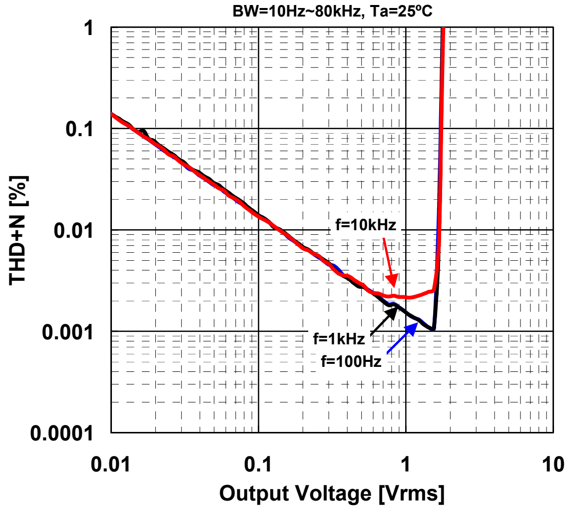


■ TYPICAL CHARACTERISTICS

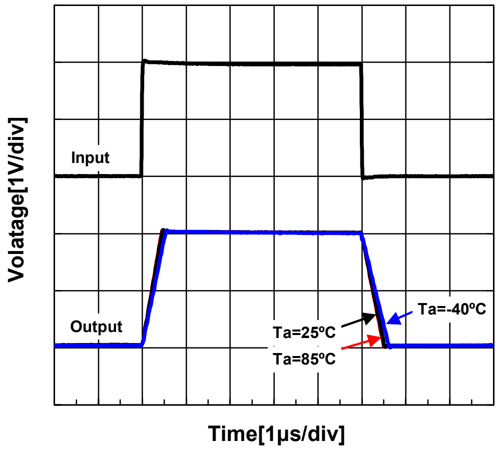
THD vs. Output Voltage
(Supply Voltage)
G_V=6dB, R_S=600Ω, R_F=5kΩ, R_G=5kΩ
f=1kHz, BW=10Hz~80kHz, Ta=25ºC



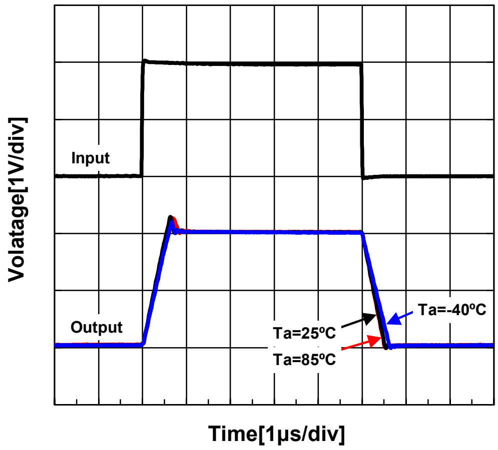
THD vs. Output Voltage (Frequency)
V^+/V^-=±2.5V, G_V=6dB, R_S=600Ω, R_F=5kΩ, R_G=5kΩ,
BW=10Hz~80kHz, Ta=25ºC



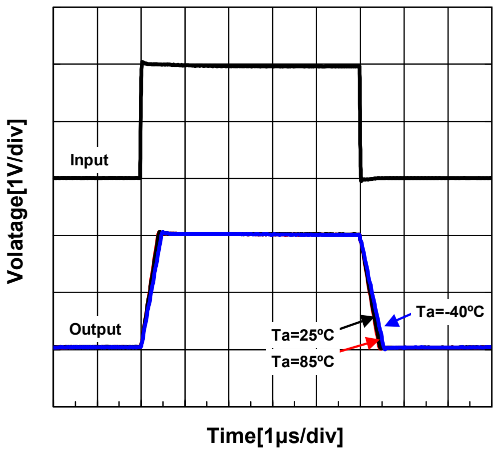
Pulse Response (Temperature)
V^+/V^-=±2.5V, f=100kHz, G_V=0dB, R_L=10kΩ, C_L=10pF



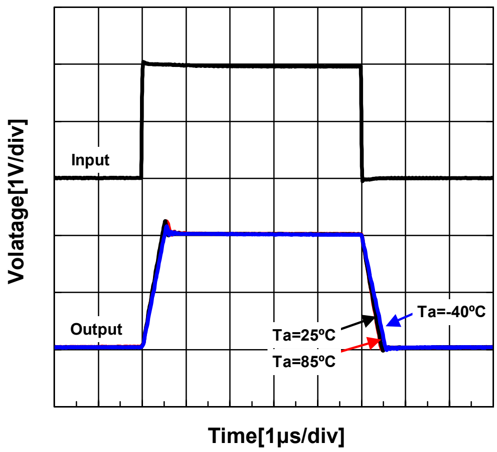
Pulse Response (Temperature)
V^+/V^-=±2.5V, f=100kHz, G_V=0dB, R_L=10kΩ, C_L=330pF



Pulse Response (Temperature)
V^+/V^-=±7.0V, f=100kHz, G_V=0dB, R_L=10kΩ, C_L=10pF



Pulse Response (Temperature)
V^+/V^-=±7.0V, f=100kHz, G_V=0dB, R_L=10kΩ, C_L=330pF



■ MEMO