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

■GENERAL DESCRIPTION

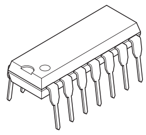
NJM2747 is a low noise Rail-to-Rail Output quad operational amplifier.

Rail-to-Rail Output function provides wide dynamic range, is from ground to power supply level. And Input range rails from ground level.

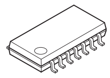
It is suitable for audio section of portable sets, PCs and any General-purpose applications.

NJM2747SCC is available in the small PCSP package, which saves space on printed circuit boards and suitable for small portable devices.

■PACKAGE OUTLINE



NJM2747D



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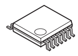
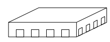


NJM2747V



NJM2747SCC

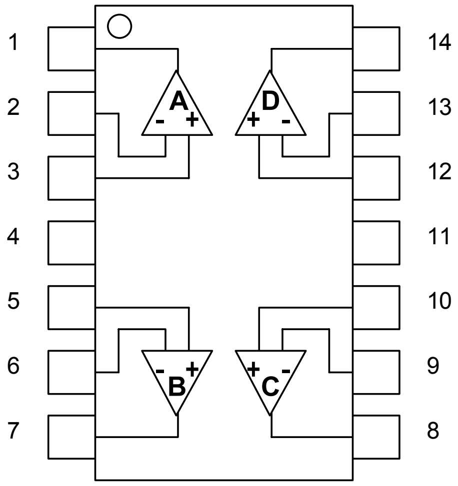
■ FEATURES

●Operating Voltage	2.5V to 14V
●Rail-to-Rail Output	V_{OH} ≥4.9V Typ. (at V^+=5V, R_L=5kΩ)
	V_{OL} ≤0.1V Typ. (at V^+=5V, R_L=5kΩ)
●Offset Voltage	1mV Typ.
●Slew Rate	3.5V/µs Typ.
. ●Low Distortion	0.001% Typ. (at V^+=5V, f=1kHz)
. ●Low Input Voltage Noise	10nV/√Hz Typ. (at f=1kHz)
●Bipolar Technology	
●Package Outline	
NJM2747D	DIP14 (Lead insertion type)
NJM2747M	DMP14 (Surface mount type)
NJM2747V	SSOP14 (Surface mount type)
NJM2747SCC	PCSP20-CC (Surface mount type very small size package)

■ **PIN CONFIGURATION**

● **NJM2747D**, **NJM2747M**, **NJM2747V**

(Top View)

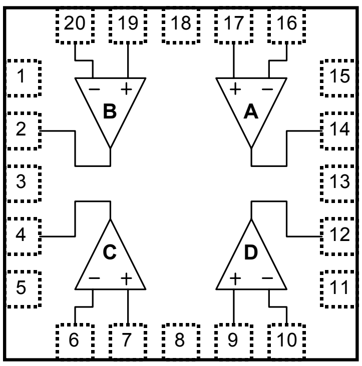


PIN FUNCTION

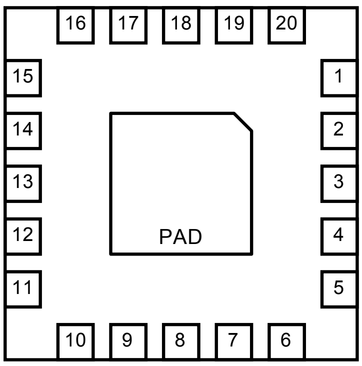
1. OUTPUT A	8. OUTPUT C
2. –INPUT A	9. –INPUT C
3. +INPUT A	10. +INPUT C
4. V^+	11. GND
5. +INPUT B	12. +INPUT D
6. –INPUT B	13. –INPUT D
7. OUTPUT B	14. OUTPUT D

● **NJM2747SCC**

(Top View)



(Bottom View)



PIN FUNCTION

1. NC	11. NC
2. OUTPUT B	12. OUTPUT D
3. NC	13. NC
4. OUTPUT C	14. OUTPUT A
5. NC	15. NC
6. –INPUT C	16. –INPUT A
7. +INPUT C	17. +INPUT A
8. GND	18. V^+
9. +INPUT D	19. +INPUT B
10. –INPUT D	20. –INPUT B

(Note1) The NC pin and the PAD should connect with a GND terminal.
(Note2) The NC pin is electrically not connected to the die in a package.
(Note3) The PAD is electrically not connected to the backside of the die. The PAD cannot be used as GND pin.
(Note4) NJM2747SCC package size is [W: 2.7mm, D: 2.7mm, H: 0.8mm]. Please confirm the size information by a package specification.

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	15	V
Differential Input Voltage Range	V_{ID}	±15 (Note5)	V
Common Mode Input Voltage Range	V_{ICM}	0 to 15 (Note5)	V
Power Dissipation	P_D	870 [DIP14] 450 [DMP14] (Note6), 420 [SSOP14] (Note6), 380 [PCSP20-CC] (Note6), 560 [DMP14] (Note7), 520 [SSOP14] (Note7), 550 [PCSP20-CC] (Note7),	mW
Operating Temperature Range	T_{opr}	-40 to +85	°C
Storage Temperature Range	T_{stg}	-50 to +125	°C

(Note5) For supply voltage less than 15V, the absolute maximum input voltage is equal to the supply voltage.

(Note6) On the PCB " EIA/JEDEC (76.2×114.3×1.6mm, two layers, FR-4) "

(Note7) On the PCB " EIA/JEDEC (76.2×114.3×1.6mm, four layers, FR-4) "

(Note8) Do not exceed "Power dissipation: PD" in which power dissipation in IC is shown by the absolute maximum rating.
Refer to following Figure 1A and Figure 1B for a permissible loss when ambient temperature (Ta) is Ta≥25°C.

Figure 1A : Power Dissipation – Ambient Temperature

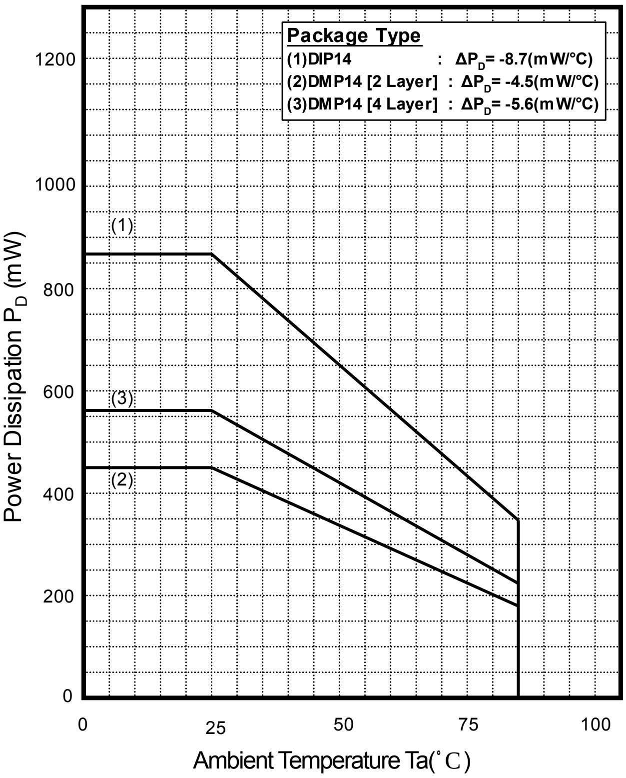
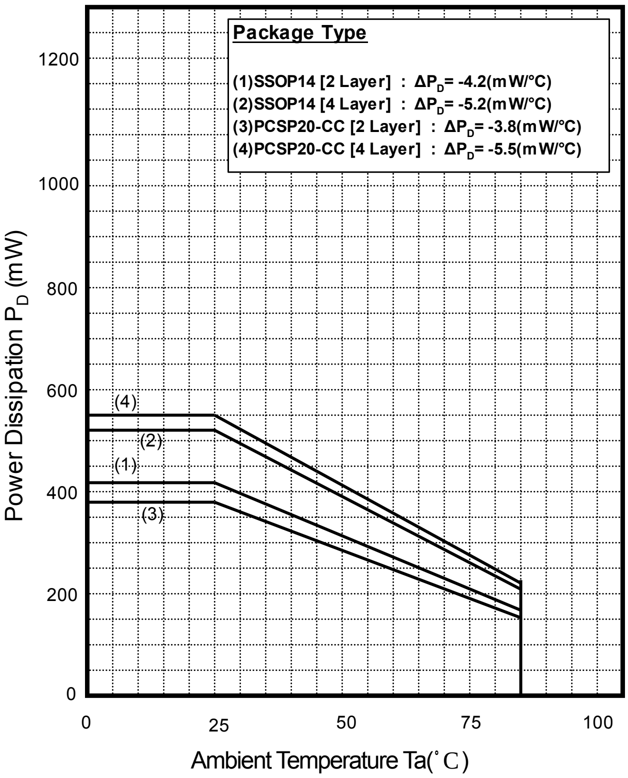


Figure 1B : Power Dissipation – Ambient Temperature



■ OPERATING VOLTAGE (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	2.5 to 14 (Note8)	V

■ ELECTRICAL CHARACTERISTICS

●DC CHARACTERISTICS (V^+=5V,Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	R_L=∞, V_{IN}=2.5V, No Signal Apply	-	8	11	mA
Input Offset Voltage	V_{IO}	R_S ≤ 10kΩ	-	1	6	mV
Input Bias Current	I_B		-	100	350	nA
Input Offset Current	I_{IO}		-	5	100	nA
Large Signal Voltage Gain	A_V	R_L≥10kΩ to 2.5V, Vo=0.5V to 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
Output Voltage	V_{OH}	R_L=5kΩ to 2.5V	4.75	4.9	-	V
	V_{OL}	R_L=5kΩ to 2.5V	-	0.1	0.25	V
Input Common Mode Voltage Range	V_{ICM}	CMR ≥ 60dB	0	-	4	V

●AC CHARACTERISTICS (V^+=5V,Ta=25°C)

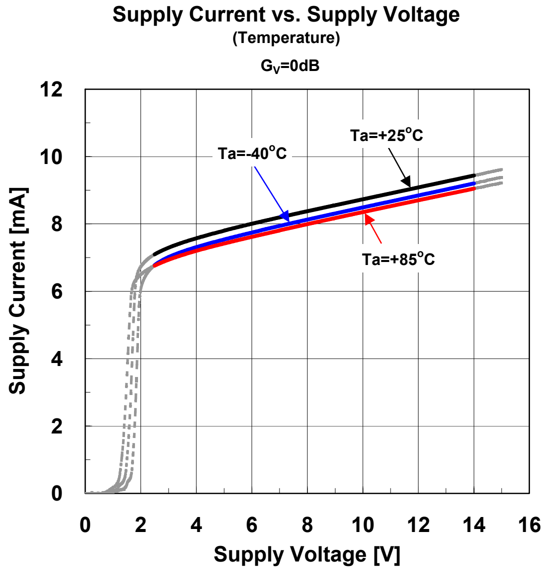
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	f=10kHz	-	10	-	MHz
Phase Margin	Φ_M	R_L=10kΩ, C_L=10pF	-	75	-	Deg
Equivalent Input Noise Voltage	V_{NI}	f=1kHz, V_{CM}=2.5V	-	10	-	nV/√Hz
Total Harmonic Distortion	THD	f=1kHz, A_V=+2 R_L=10kΩ to 2.5V, Vo=1.5Vrms	-	0.001	-	%
Amp to Amp Separation	CS	f=1kHz R_L=10kΩ to 2.5V, Vo=1.5Vrms	-	120	-	dB

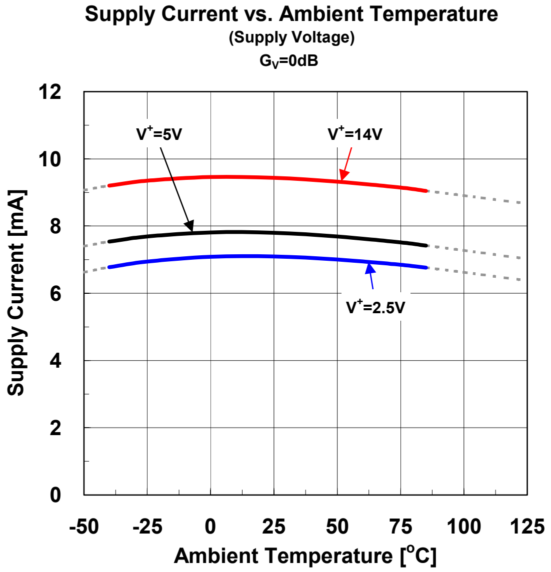
●AC CHARACTERISTICS (V^+=5V,Ta=25°C)

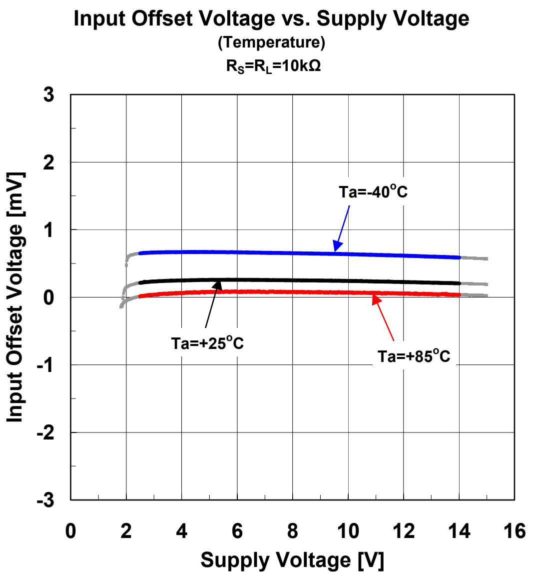
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	(Note 9), A_V=1, V_{IN}=2Vpp R_L=10kΩ to 2.5V C_L=10pF to 2.5V	-	3.5	-	V/μs

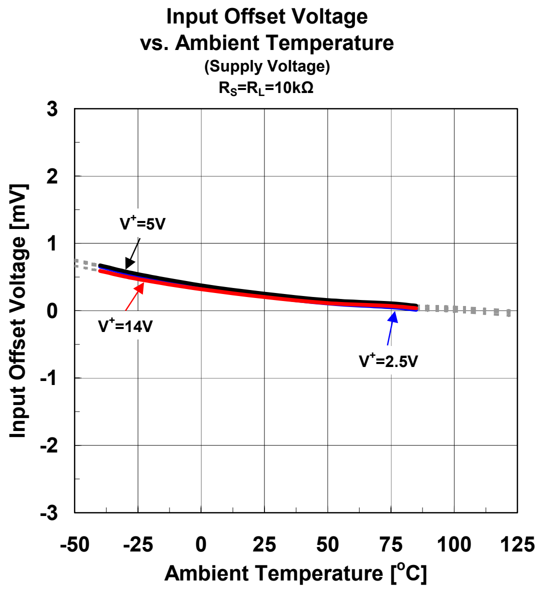
(Note 9) Number specified is the slower of the positive and negative slew rates.

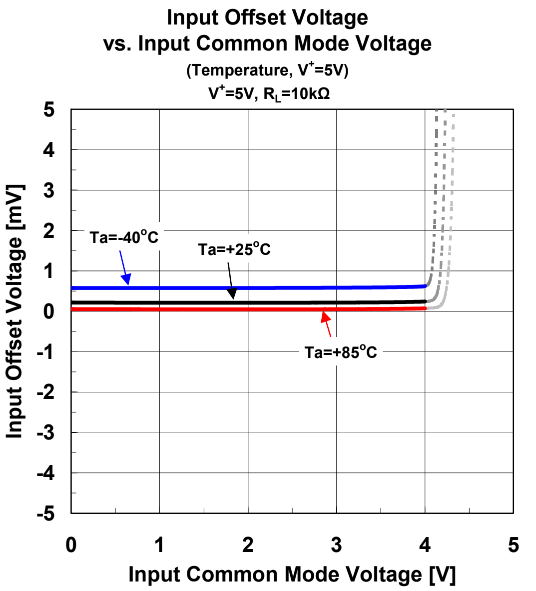
■ TYPICAL CHARACTERISTICS





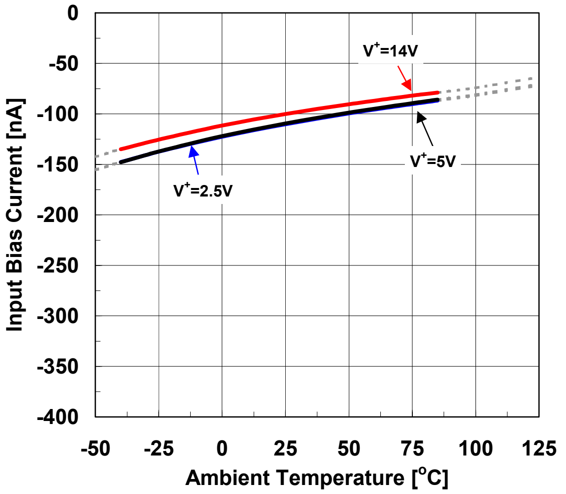




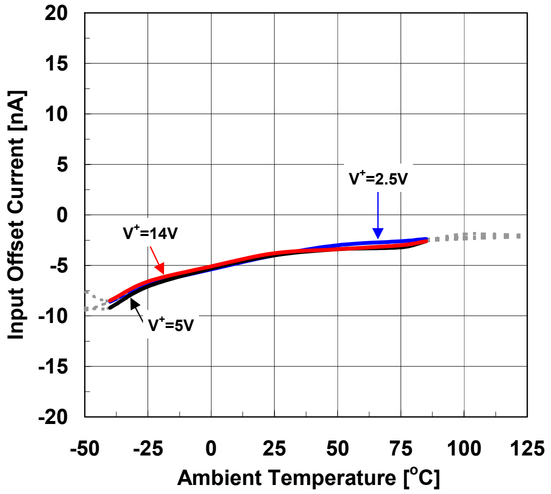


■ TYPICAL CHARACTERISTICS

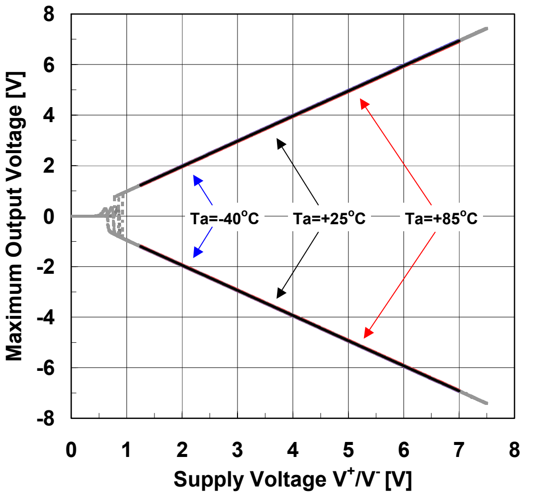
Input Bias Current vs. Ambient Temperature
(Supply Voltage)
R_L=10kΩ



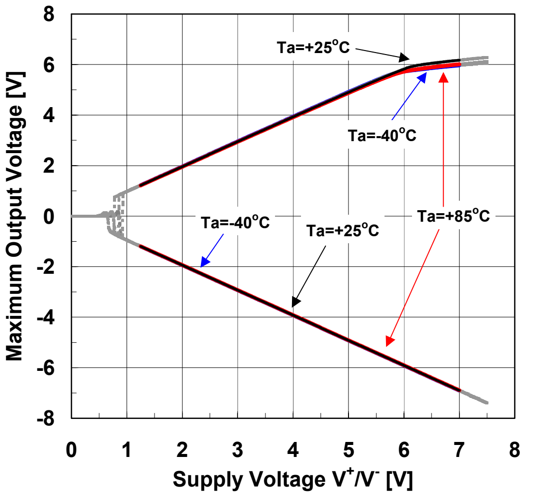
Input Offset Current vs. Ambient Temperature (Supply Voltage)
R_L=10kΩ



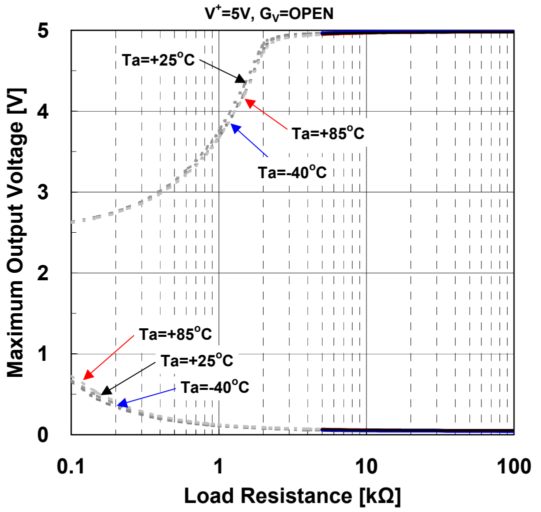
Maximum Output Voltage vs. Supply Voltage
(Temperature, R_L=10kΩ)
G_V=OPEN, R_L=10kΩ



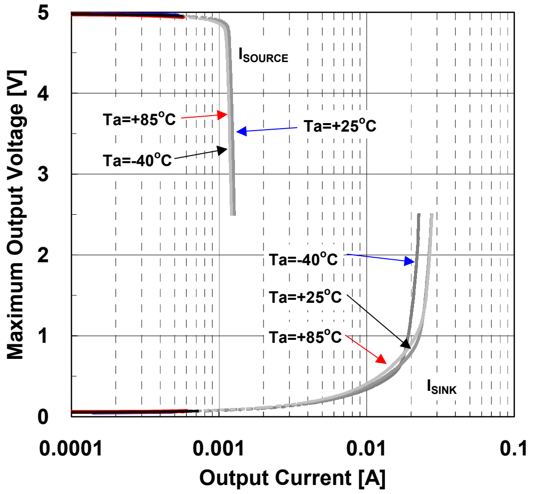
Maximum Output Voltage vs. Supply Voltage
(Temperature, R_L=5kΩ)
G_V=OPEN, R_L=10kΩ



Maximum Output Voltage vs. Load Resistance
(Temperature, V+=5V)
V+=5V, G_V=OPEN

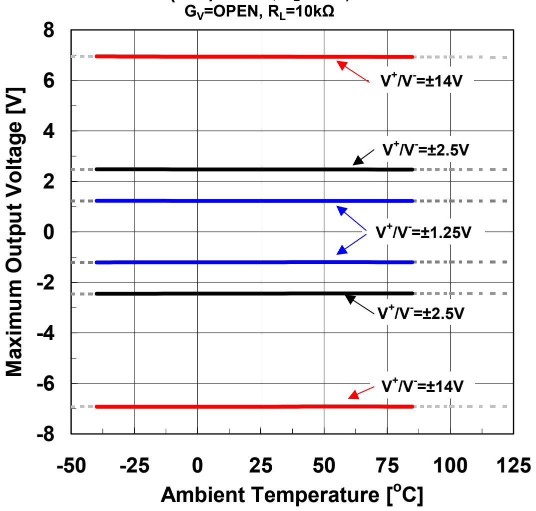


Maximum Output Voltage vs. Output Current
(Temperature, V+=5V)
V+=5V, G_V=OPEN

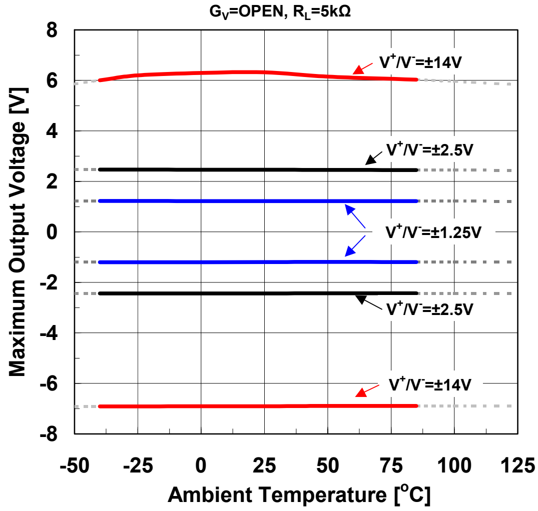


■ TYPICAL CHARACTERISTICS

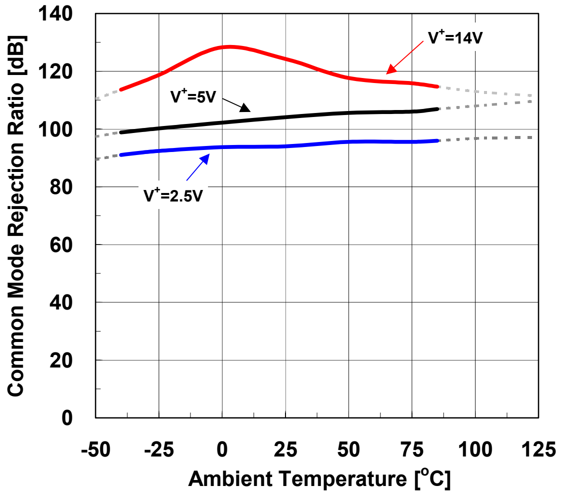
Maximum Output Voltage
vs. Ambient Temperature
(Temperature, R_L=10kΩ)
G_V=OPEN, R_L=10kΩ



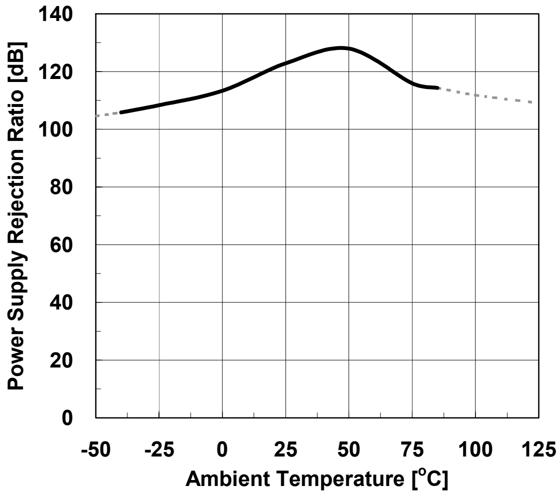
Maximum Output Voltage
vs. Ambient Temperature
(Temperature, R_L=5kΩ)
G_V=OPEN, R_L=5kΩ



Common Mode Rejection Ratio
vs. Ambient Temperature (Supply Voltage)
R_L=10kΩ, 0V ≤ V_{ICM} ≤ V^+-1V

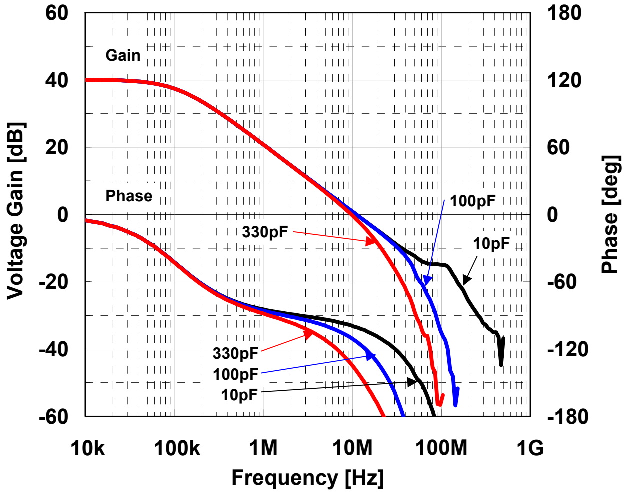


Power Supply Rejection Ratio
vs. Ambient Temperature
R_L=10kΩ, 2.5V ≤ V^+ ≤ 14V

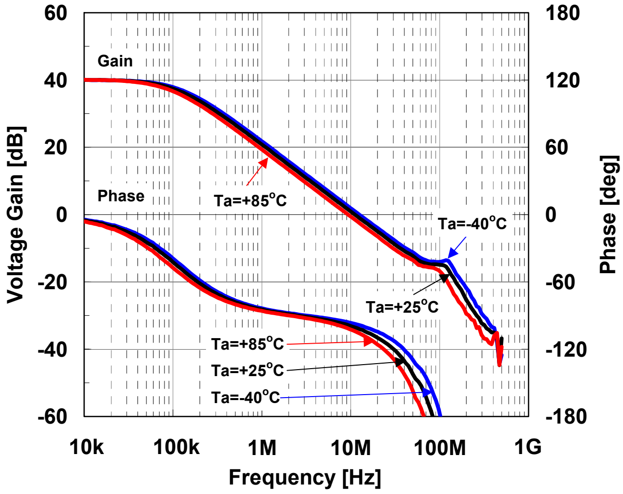


■ TYPICAL CHARACTERISTICS

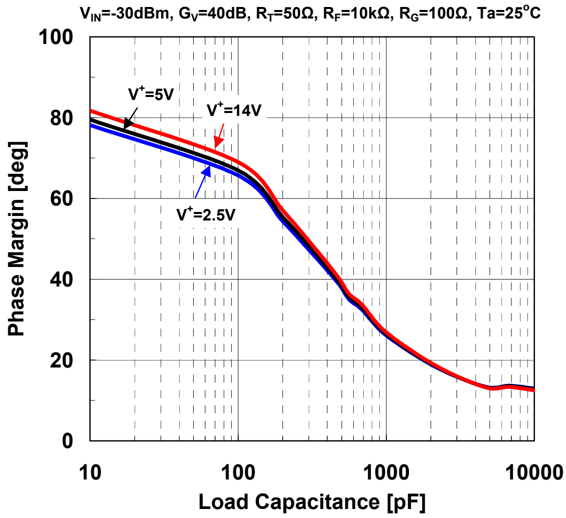
Gain/Phase vs. Frequency (Load Capacitance)
V^+=5V, V_{IN}=-30dBm, G_V=40dB, R_T=50Ω, R_F=10kΩ, R_G=100Ω, Ta=+25°C



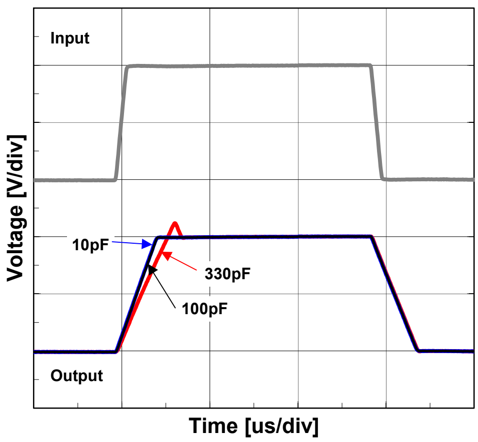
Gain/Phase vs. Frequency (Temperature)
V^+=5V, V_{IN}=-30dBm, G_V=40dB, R_T=50Ω, R_F=10kΩ, R_G=100Ω, C_L=10pF



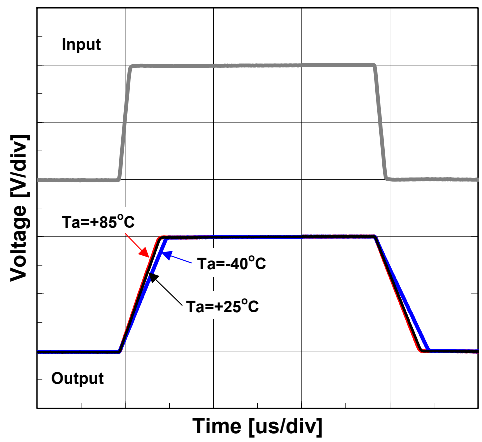
Phase Margin vs. Load Capacitance
(Supply Voltage)
V_{IN}=-30dBm, G_V=40dB, R_T=50Ω, R_F=10kΩ, R_G=100Ω, Ta=25°C



Pulse Response
(Load Capacitance, V^+/V^-=±2.5V)
V^+/V^-=±2.5V, V_{IN}=1Vp-p, A_V=+1, R_L=10kΩ, Ta=25°C



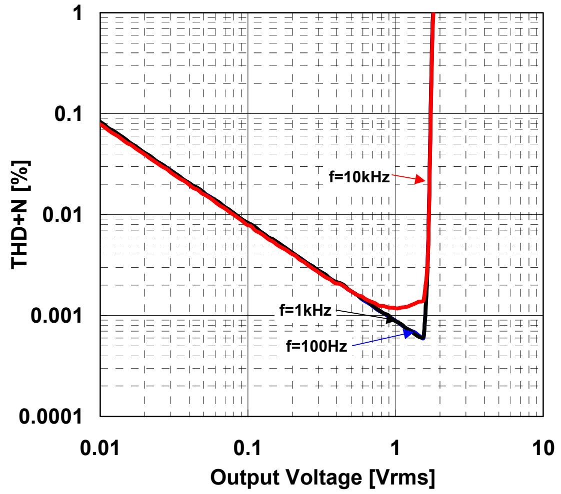
Pulse Response
(Temperature, V^+/V^-=±2.5V)
V^+/V^-=±2.5V, V_{IN}=1Vp-p, A_V=+1, R_L=10kΩ, C_L=10pF



■ TYPICAL CHARACTERISTICS

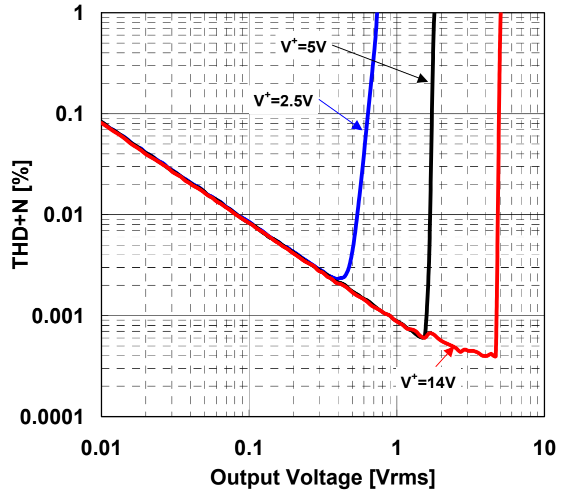
THD+N vs. Output Voltage (Frequency)

V^+=5V, A_V=+2, R_S=600Ω, R_F=5kΩ, R_G=5kΩ, BW=10Hz~80kHz, Ta=25°C



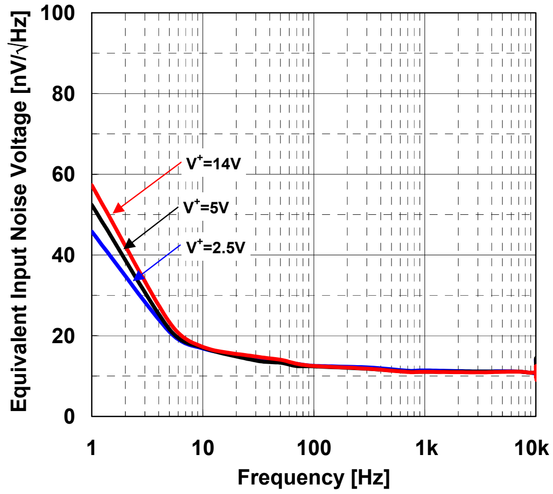
THD+N vs. Output Voltage (Supply Voltage)

f=1kHz, A_V=+2, R_S=600Ω, R_F=5kΩ, R_G=5kΩ, BW=10Hz~80kHz, Ta=25°C



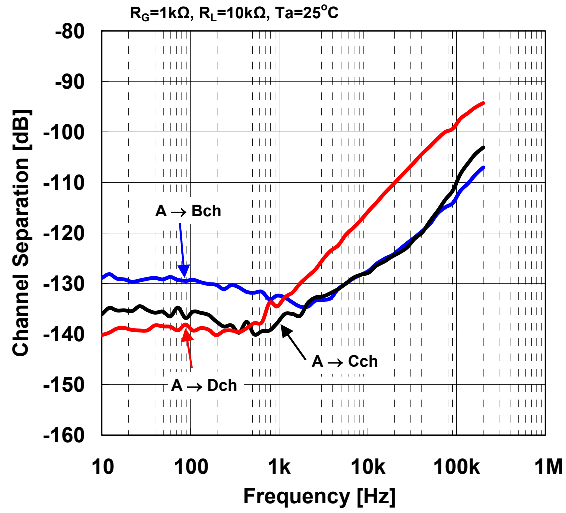
Equivalent Input Noise Voltage vs. Frequency (Supply Voltage)

G_V=60dB, R_T=600Ω, R_F=100kΩ, R_G=100Ω, Ta=25°C



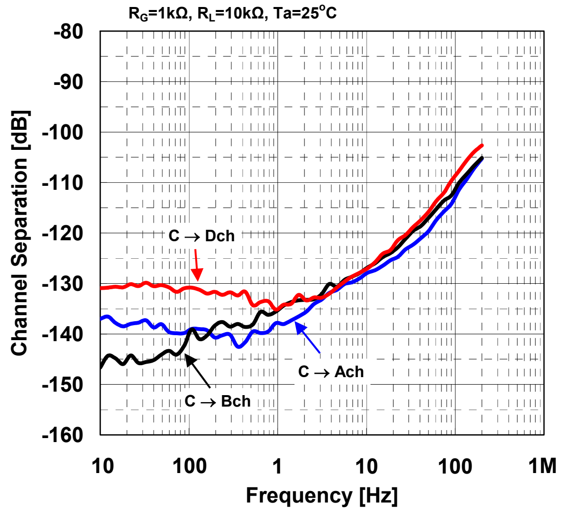
Channel Separation vs. Frequency

V^+=5V, Ach Input, V_O=1.5Vrms, G_V=40dB, R_F=100kΩ, R_G=1kΩ, R_L=10kΩ, Ta=25°C



Channel Separation vs. Frequency

V^+=5V, Cch Input, V_O=1.5Vrms, G_V=40dB, R_F=100kΩ, R_G=1kΩ, R_L=10kΩ, Ta=25°C



■ MEMO

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