Rail-to-Rail Input/Output Quad Operational Amplifier

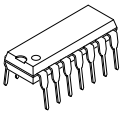
■ GENERAL DESCRIPTION

NJM2734 is a Rail-to-Rail Input/Output quad operational amplifier featuring Low power, low noise and operation from 1.8V.

Rail-to-Rail Input/Output provides wide dynamic range, is from ground to power supply level. In addition to ground sensing applications, NJM2734 enable to be applied to Hi-side sensing applications.

The features are low noise and low operating voltage for battery management, portable audio applications, and others.

■ PACKAGE OUTLINE



NJM2734D

NJM2734V

NJM2734M

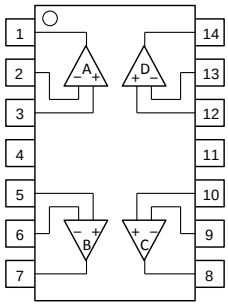
NJM2734SCC

■ FEATURES

●Operating Voltage	1.8 to 6.0V
●Rail-to-Rail Input	V_{ICM}= 0 to 5.0V, at V^+=5V
●Rail-to-Rail Output	V_{OH}≥4.9V/ V_{OL}≤0.1V, at V^+=5V, R_L=20kΩ
●Load Drivability	V_{OH}≥4.75V/ V_{OL}≤0.25V, at V^+=5V, R_L=2kΩ
●Offset Voltage	5mV max.
●Slew Rate	0.4V/μs typ.
●Low Input Voltage Noise	10nV/√Hz typ.
●Adequate phase margin	Φ_M=75deg. typ., at R_L=2kΩ
●Bipolar Technology	
●Package Outline	DIP14 , DMP14 , SSOP14 , PCSP20-CC

■ PIN CONFIGURATION

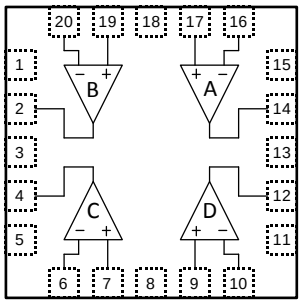
○NJM2734D,NJM2734V,NJM2734M

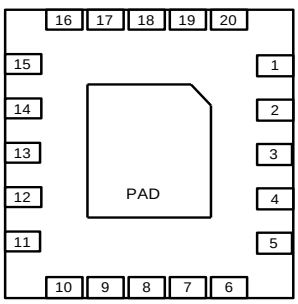


PIN FUNCTION

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

○NJM2734SCC





PIN FUNCTION

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

(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.

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25˚C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	7.0	V
Differential Input Voltage Range	V_{ID}	±1.0 (Note4)	V
Common Mode Input Voltage Range	V_{IC}	0 ~ 7.0 (Note4)	V
Power Dissipation	P_D	(DIP14) 700 (DMP14) 520 (Note5) (SSOP14) 450 (Note5) (PCSP20−CC)400(Note5)	mW
Operating Temperature Range	T_{opr}	-40~+85	˚C
Storage Temperature Range	T_{stg}	-40~+125	˚C

(Note4) For supply voltage less than 7V, the absolute maximum input voltage is equal to the supply voltage.

(Note5) On the PCB " EIA/JEDEC (76.2 × 114.3 × 1.6mm, two layers, FR-4) "

■ RECOMMENDED OPERATING CONDITION

(Ta=25˚C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+	1.8 to 6.0	V

■ ELECTRICAL CHARACTERISTICS (V^+=5V, Ta=25˚C)

●DC CHARACTERISTICS (V^+=5V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	No signal applied	-	1.2	1.8	mA
Input Offset Voltage	V_{IO}		-	1	5	mV
Input Bias Current	I_B		-	50	250	nA
Input Offset Current	I_{IO}		-	5	100	nA
Large Signal Voltage Gain	A_V	R_L=2kΩ to 2.5V	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 2.5V≤V_{CM} ≤5V (Note6) CMR -: 0V≤V_{CM}≤2.5V (Note6)	55	70		dB
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±2.0V ~ ±3.0V	70	85	-	dB
Maximum Output Voltage 1	V_{OH1}	R_L=20kΩ to 2.5V	4.9	4.95	-	V
	V_{OL1}	R_L=20kΩ to 2.5V	-	0.05	0.1	V
Maximum Output Voltage 2	V_{OH2}	R_L=2kΩ to 2.5V	4.75	4.85	-	V
	V_{OL2}	R_L=2kΩ to 2.5V	-	0.15	0.25	V
Input Common Mode Voltage Range	V_{ICM}	CMR≥55dB	0	-	5	V

(Note6) CMR is represented by either CMR+ or CMR- has lower value.

CMR+ is measured with 2.5V≤V_{CM}≤5.0 and CMR- is measured with 0V≤V_{CM}≤2.5V.

●AC CHARACTERISTICS (V^+=5V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	R_L=2kΩ to 2.5V	-	1	-	MHz
Phase Margin	Φ_M	R_L=2kΩ to 2.5V	-	75	-	Deg
Equivalent Input Noise Voltage	V_{NI}	f=1kHz	-	10	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz R_L=2kΩ to 2.5V, Vo=1.2Vrms	-	133	-	dB

●TRANSIENT CHARACTERISTICS (V^+=5V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R_L=2kΩ to 2.5V	-	0.4	-	V/μs

■ ELECTRICAL CHARACTERISTICS (V^+=3V, Ta=25˚C)

●DC CHARACTERISTICS (V^+=3V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	No signal applied	-	1	1.8	mA
Input Offset Voltage	V_{IO}		-	1	5	mV
Input Bias Current	I_B		-	50	250	nA
Input Offset Current	I_{IO}		-	5	100	nA
Large Signal Voltage Gain	A_V	R_L=2kΩ to 1.5V	60	84	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 1.5V≤V_{CM}≤3V (Note7) CMR -: 0V≤V_{CM}≤1.5V (Note7)	48	63		dB
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±1.2V ~ ±2.0V	68	83	-	dB
Maximum Output Voltage 1	V_{OH1}	R_L=20kΩ to 1.5V	2.9	2.95	-	V
	V_{OL1}	R_L=20kΩ to 1.5V	-	0.05	0.1	V
Maximum Output Voltage 2	V_{OH2}	R_L=2kΩ to 1.5V	2.75	2.85	-	V
	V_{OL2}	R_L=2kΩ to 1.5V	-	0.15	0.25	V
Input Common Mode Voltage Range	V_{ICM}	CMR≥48dB	0	-	3	V

(Note7) CMR is represented by either CMR+ or CMR-has lower value.

CMR+ is measured with 1.5V≤V_{CM}≤3.0 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	GB	R_L=2kΩ to 1.5V	-	1	-	MHz
Phase Margin	Φ_M	R_L=2kΩ to 1.5V	-	75	-	Deg
Equivalent Input Noise Voltage	V_{NI}	f=1kHz	-	10	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz R_L=2kΩ to 1.5V, Vo=0.7Vrms	-	130	-	dB

●TRANSIENT CHARACTERISTICS (V^+=3V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R_L=2kΩ to 1.5V	-	0.35	-	V/μs

■ **ELECTRICAL CHARACTERISTICS** (V^+=1.8V, Ta=25˚C)

●DC CHARACTERISTICS (V^+=1.8V, Ta=25˚C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	No signal applied	-	0.9	1.6	mA
Input Offset Voltage	V_{IO}		-	1	5	mV
Input Bias Current	I_B		-	50	250	nA
Input Offset Current	I_{IO}		-	5	100	nA
Large Signal Voltage Gain	A_V	R_L=2kΩ to 0.9V	60	83	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 0.9≤V_{CM}≤1.8V (Note8) CMR-:0V≤V_{CM}≤0.9V (Note8)	40	55		dB
Supply Voltage Rejection Ratio	SVR	V^+/V^-=±0.9V ~ ±1.2V	65	80	-	dB
Maximum Output Voltage 1	V_{OH1}	R_L=20kΩ to 0.9V	1.7	1.75	-	V
	V_{OL1}	R_L=20kΩ to 0.9V	-	0.05	0.1	V
Maximum Output Voltage 2	V_{OH2}	R_L=2kΩ to 0.9V	1.55	1.65	-	V
	V_{OL2}	R_L=2kΩ to 0.9V	-	0.15	0.25	V
Input Common Mode Voltage Range	V_{ICM}	CMR≥40dB	0	-	1.8	V

(Note8) CMR is represented by either CMR+ or CMR-has lower value.

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

●AC CHARACTERISTICS (V^+=1.8V, Ta=25˚C)

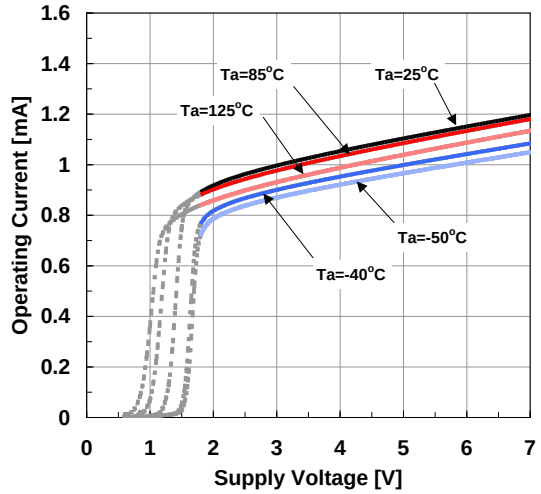
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	R_L=2kΩ t o 0.9V	-	1	-	MHz
Phase Margin	Φ_M	R_L=2kΩ to 0.9V	-	75	-	Deg
Equivalent Input Noise Voltage	V_{NI}	f=1kHz	-	10	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz R_L=2kΩ to 0.9V, Vo=0.4Vrms	-	125	-	dB

●TRANSIENT CHARACTERISTICS (V^+=1.8V, Ta=25˚C)

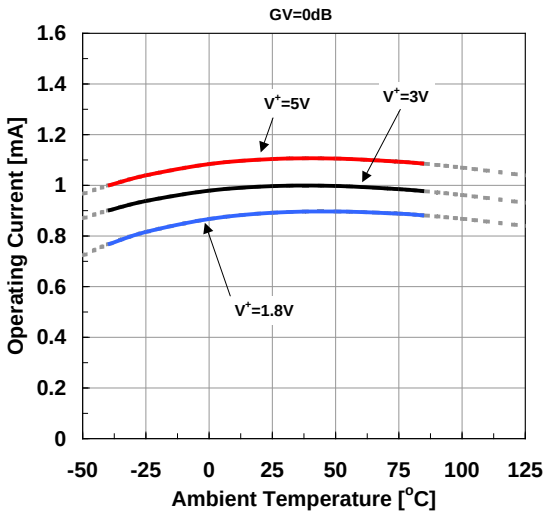
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R_L=2kΩ to 0.9V	-	0.3	-	V/μs

■ Typical Characteristics

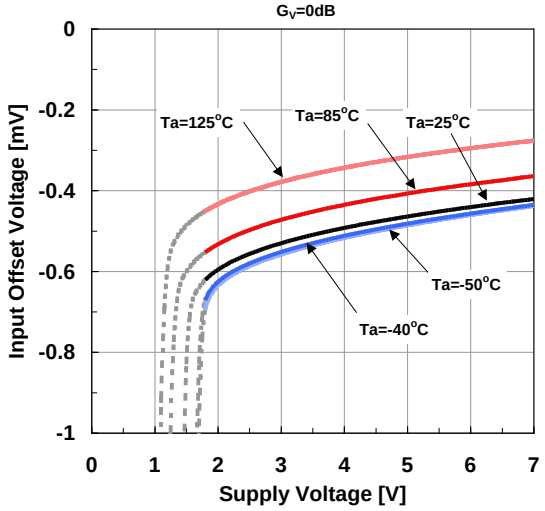
Operating Current vs. Supply Voltage
(Ambient Temperature)
G_V=0dB



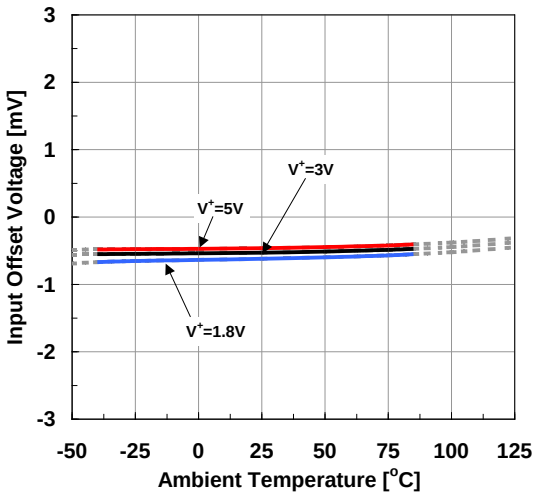
Operating Current vs. Ambient Temperature
GV=0dB



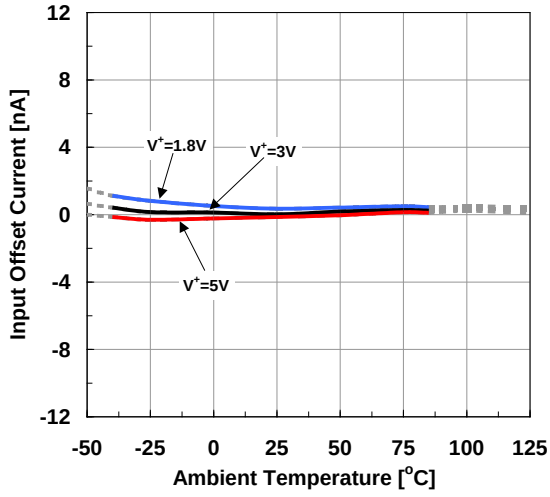
Input Offset Voltage vs. Supply Voltage
(Ambient Temperature)
G_V=0dB



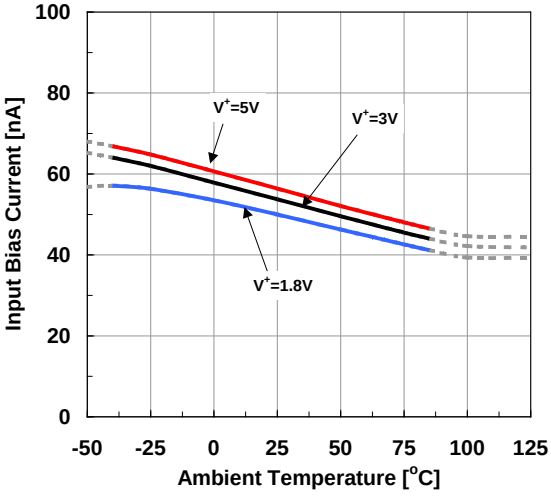
Input Offset Voltage
vs. Ambient Temperature
G_V=0dB



Input Offset Current
vs. Ambient Temperature
G_V=0dB

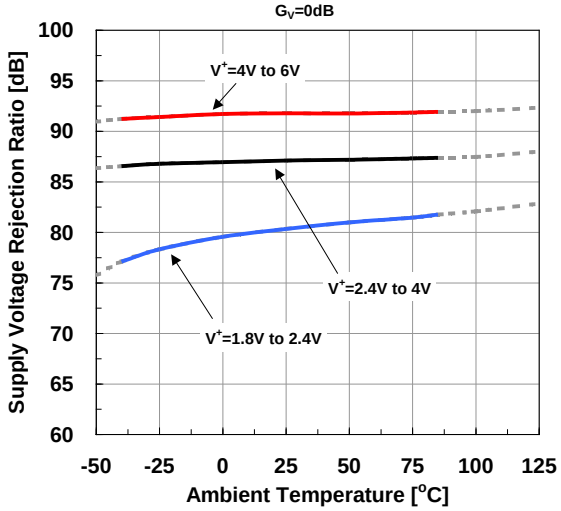


Input Bias Current vs. Ambient Temperature
G_V=0dB

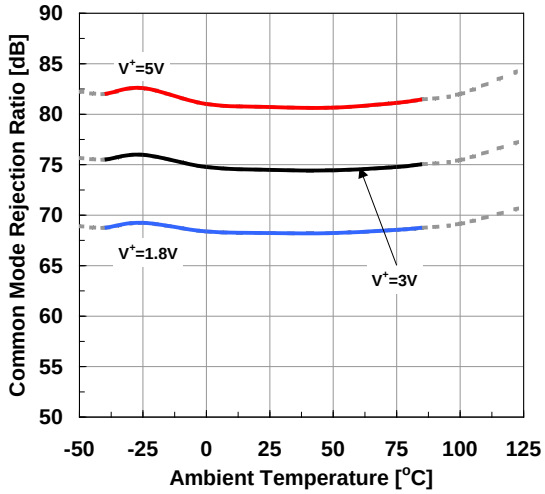


■ Typical Characteristics

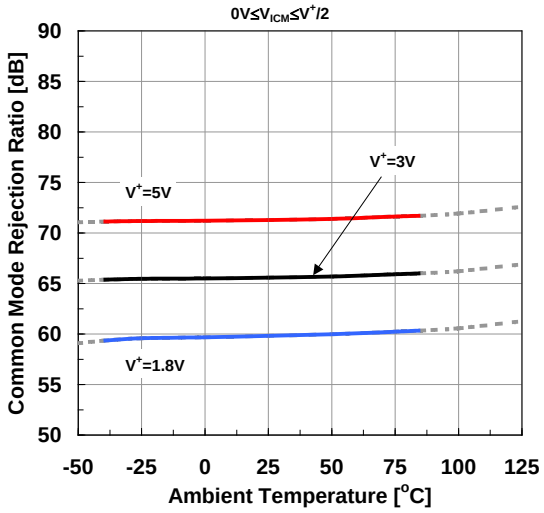
Supply Voltage Rejection Ratio
vs. Ambient Temperature



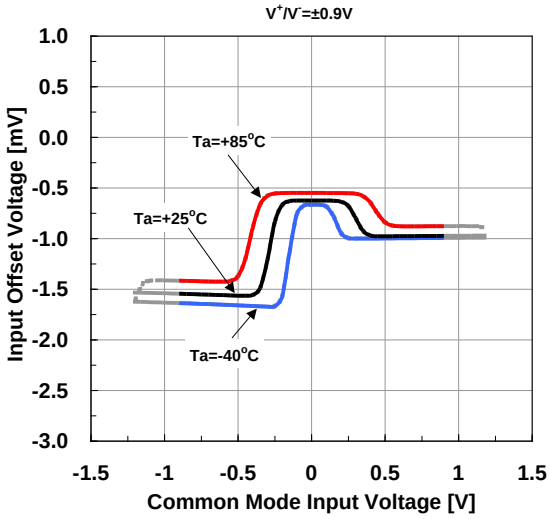
Common Mode Rejection Ratio
vs. Ambient Temperature



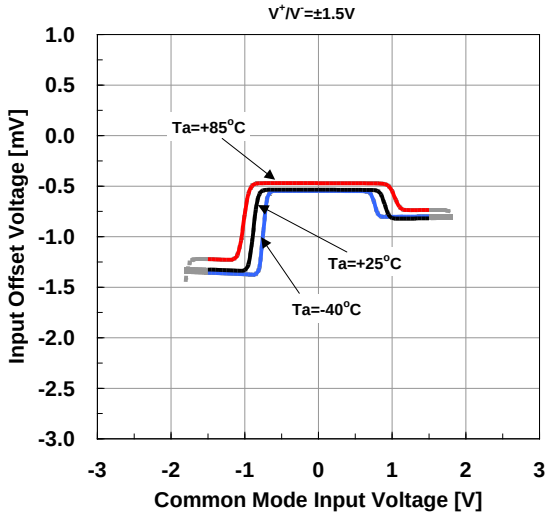
Common Mode Rejection ratio
vs. Ambient Temperature



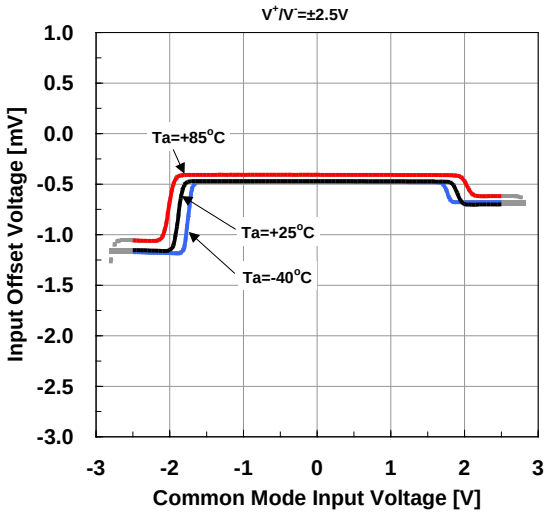
Input Offset Voltage
vs. Common Mode Input Voltage



Input Offset Voltage
vs. Common Mode Input Voltage

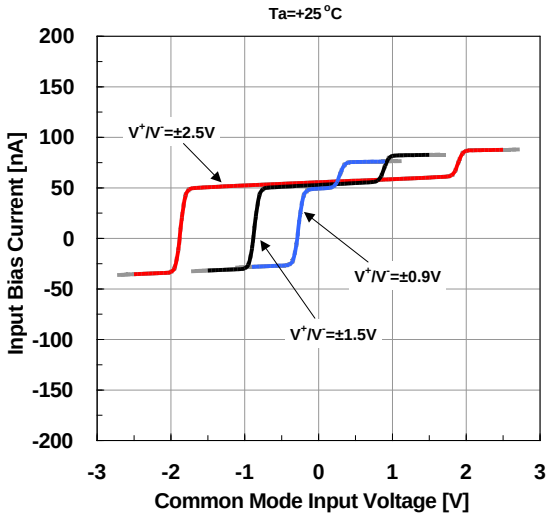


Input Offset Voltage
vs. Common Mode Input Voltage

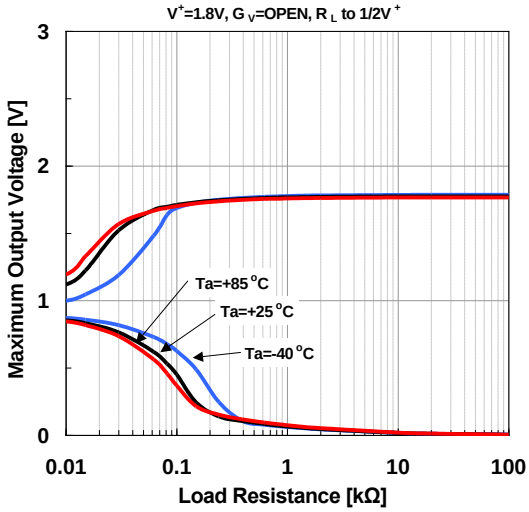


■ Typical Characteristics

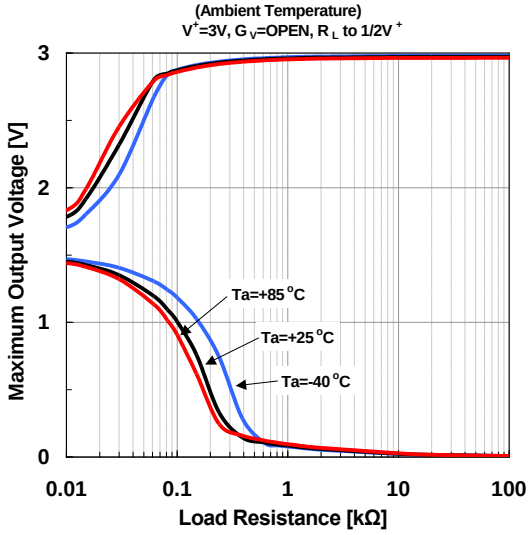
Input bias Current
vs. Common Mode Input Voltage



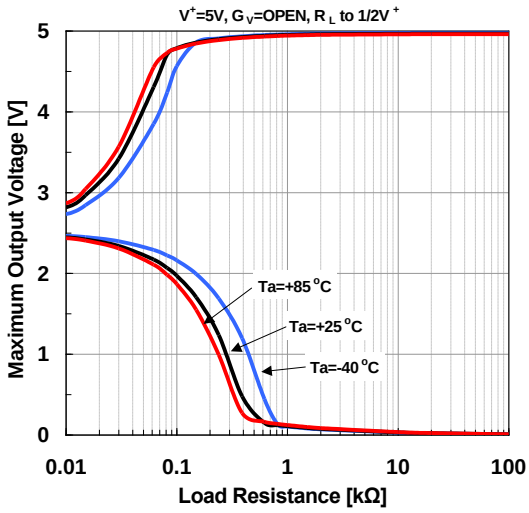
Maximum Output Voltage
vs. Load Resistance
(Ambient Temperature)



Maximum Output Voltage
vs. Load Resistance
(Ambient Temperature)

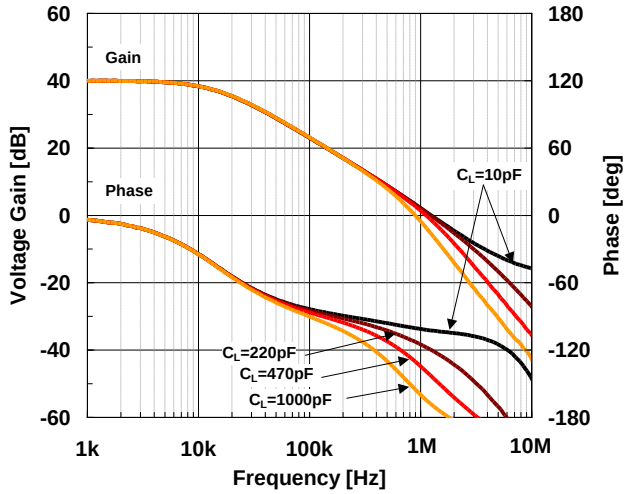


Maximum Output Voltage
vs. Load Resistance
(Ambient Temperature)

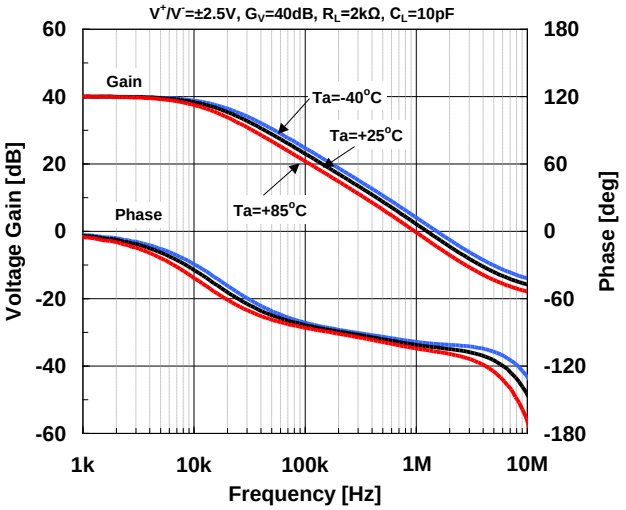


■ Typical Characteristics

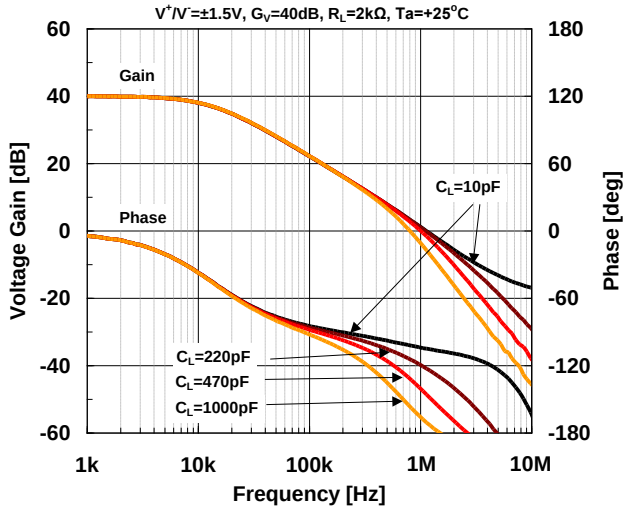
Voltage Gain/Phase vs. Frequency
(Capacitive Load)
V^+/V^-=±2.5V, G_V=40dB, R_L=2kΩ, Ta=+25°C



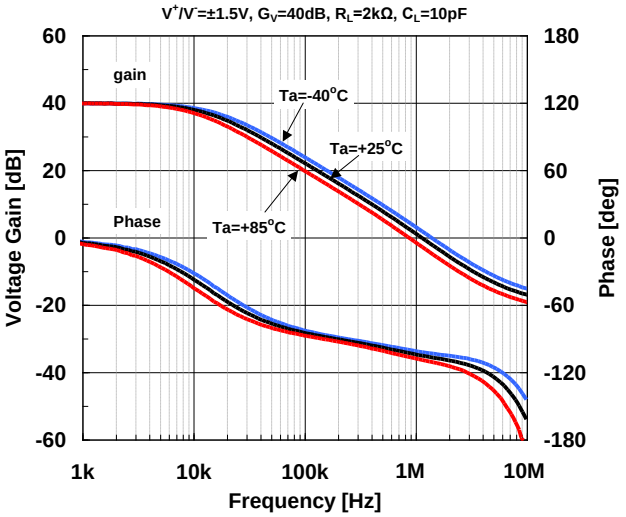
Voltage Gain/Phase vs. Frequency
(Ambient Temperature)
V^+/V^-=±2.5V, G_V=40dB, R_L=2kΩ, C_L=10pF



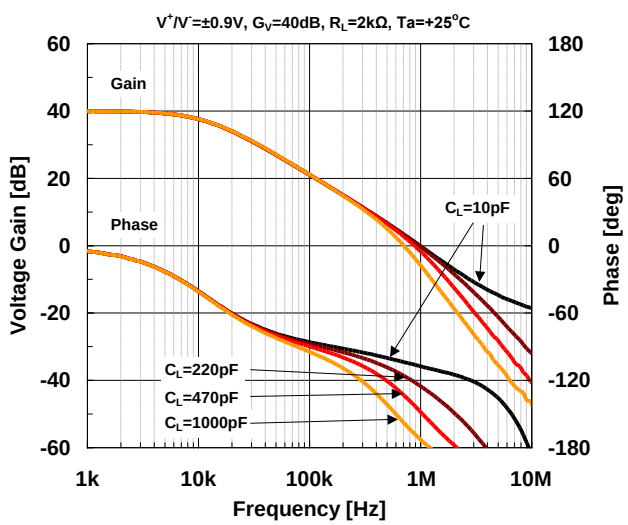
Voltage Gain/Phase vs. Frequency
(Capacitive Load)
V^+/V^-=±1.5V, G_V=40dB, R_L=2kΩ, Ta=+25°C



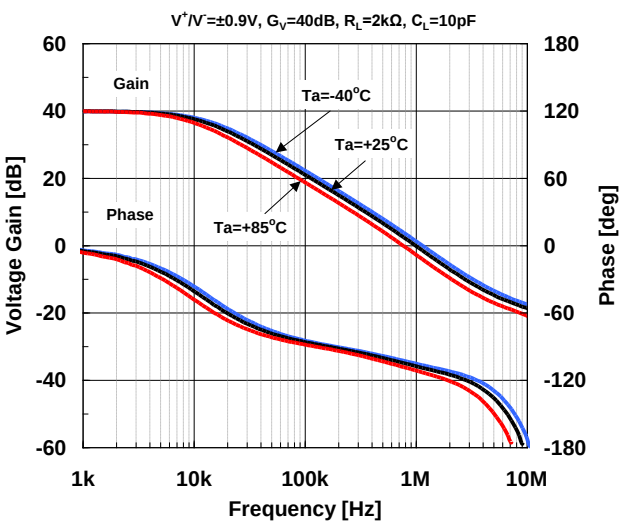
Voltage Gain/Phase vs. Frequency
(Ambient Temperature)
V^+/V^-=±1.5V, G_V=40dB, R_L=2kΩ, C_L=10pF



Voltage gain/Phase vs. Frequency
(Capacitive Load)
V^+/V^-=±0.9V, G_V=40dB, R_L=2kΩ, Ta=+25°C

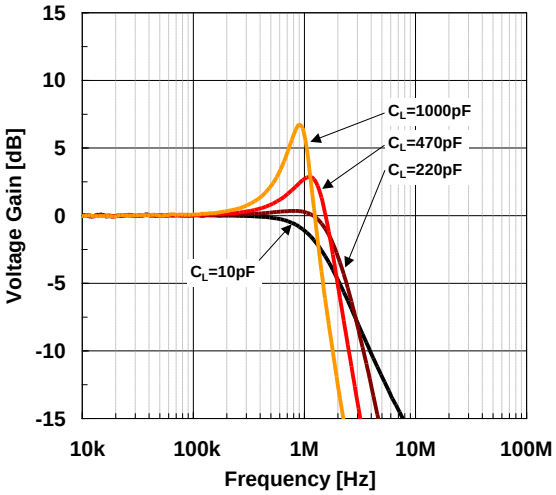


Voltage Gain/Phase vs. Frequency
(Ambient Temperature)
V^+/V^-=±0.9V, G_V=40dB, R_L=2kΩ, C_L=10pF

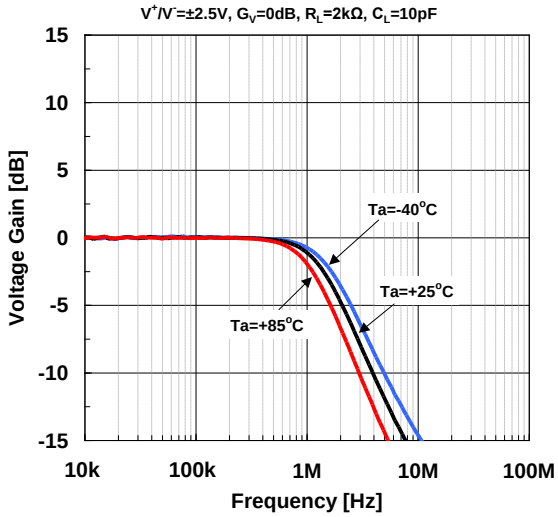


■ Typical Characteristics

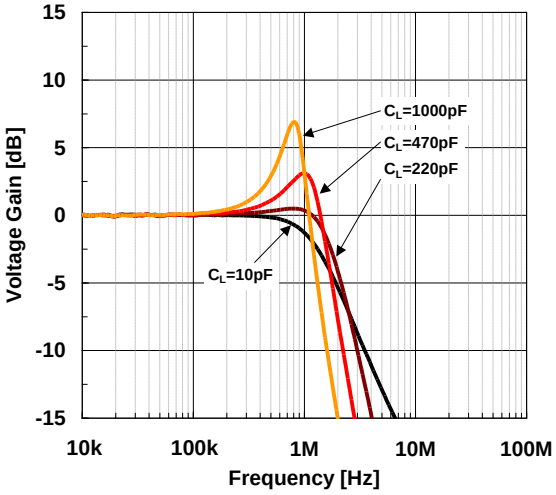
Voltage Gain vs. Frequency
(Voltage Follower, Capacitive Load)
V^+/V^-=±2.5V, G_V=0dB, R_L=2kΩ, Ta=+25°C



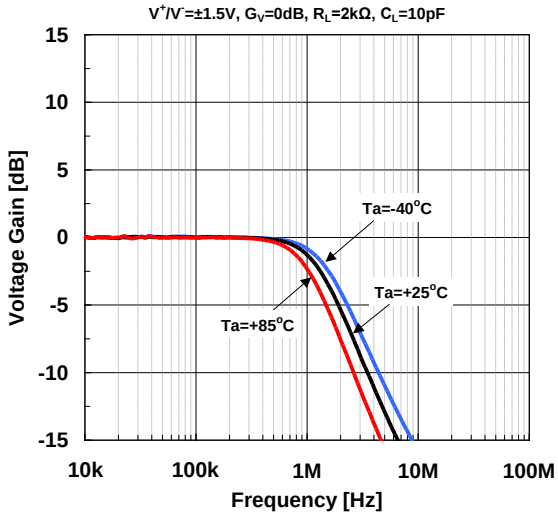
Voltage Gain vs. Frequency
(Voltage Follower, Ambient Temperature)
V^+/V^-=±2.5V, G_V=0dB, R_L=2kΩ, C_L=10pF



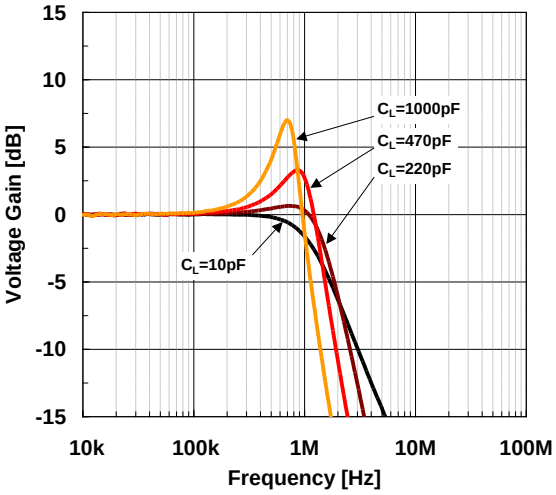
Voltage Gain vs. Frequency
(Voltage Follower, Capacitive Load)
V^+/V^-=±1.5V, G_V=0dB, R_L=2kΩ, Ta=+25°C



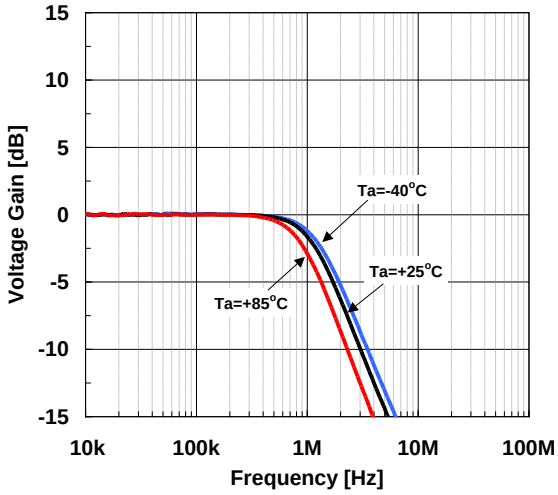
Voltage Gain vs. Frequency
(Voltage Follower, Ambient Temperature)
V^+/V^-=±1.5V, G_V=0dB, R_L=2kΩ, C_L=10pF



Voltage Gain vs. Frequency
(Voltage Follower, Capacitive Load)
V^+/V^-=±0.9V, G_V=0dB, R_L=2kΩ, Ta=+25°C

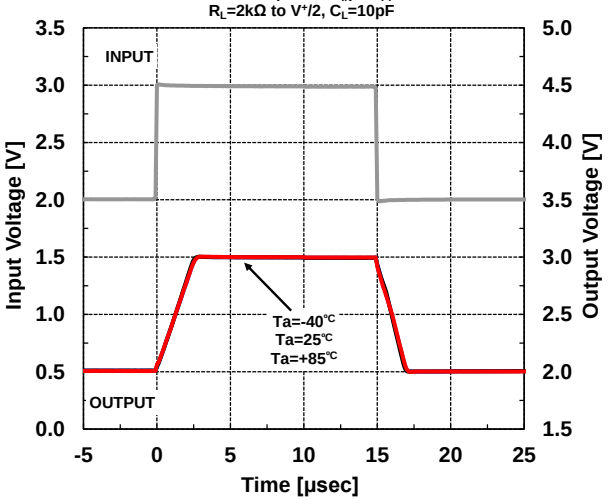


Voltage Gain vs. Frequency
(Voltage Follower, Ambient Temperature)
V^+/V^-=±0.9V, G_V=0dB, R_L=2kΩ, C_L=10pF

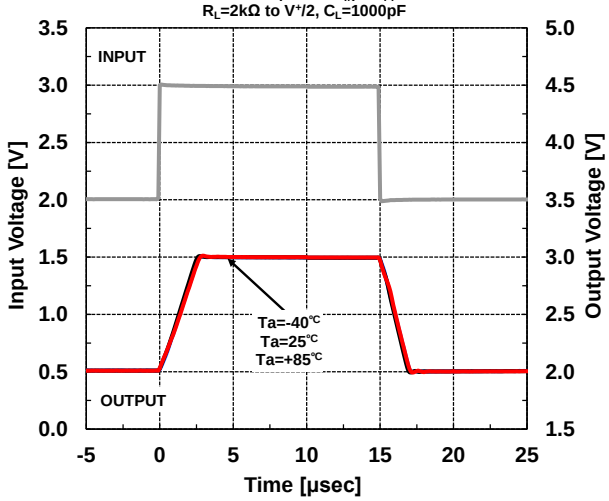


■ Typical Characteristics

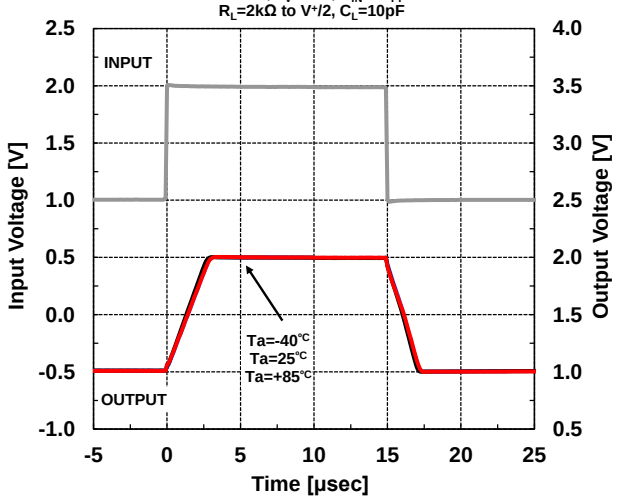
Pulse Response (Ambient Temperature)
V^+=5V, A_V=0dB, V_{IN}=1V_{PP}
R_L=2kΩ to V^+/2, C_L=10pF



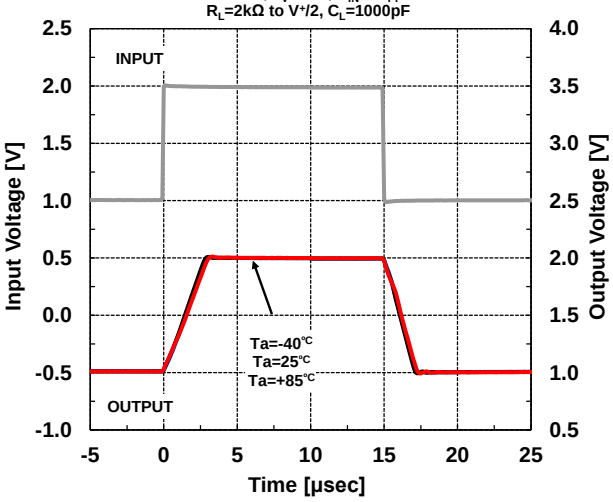
Pulse Response (Ambient Temperature)
V^+=5V, A_V=0dB, V_{IN}=1V_{PP}
R_L=2kΩ to V^+/2, C_L=1000pF



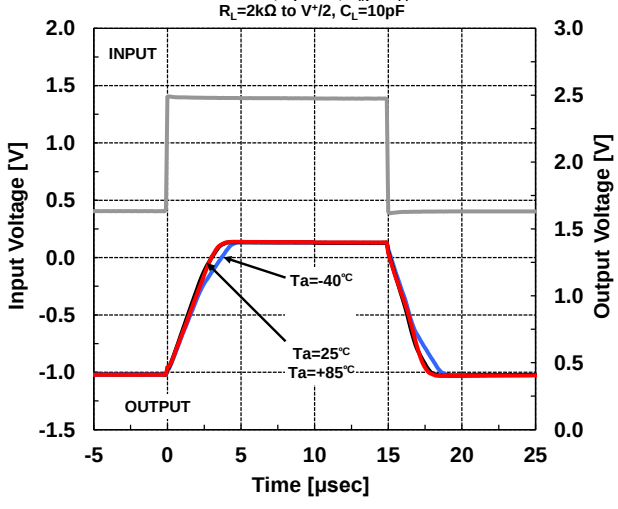
Pulse Response (Ambient Temperature)
V^+=3V, A_V=0dB, V_{IN}=1V_{PP}
R_L=2kΩ to V^+/2, C_L=10pF



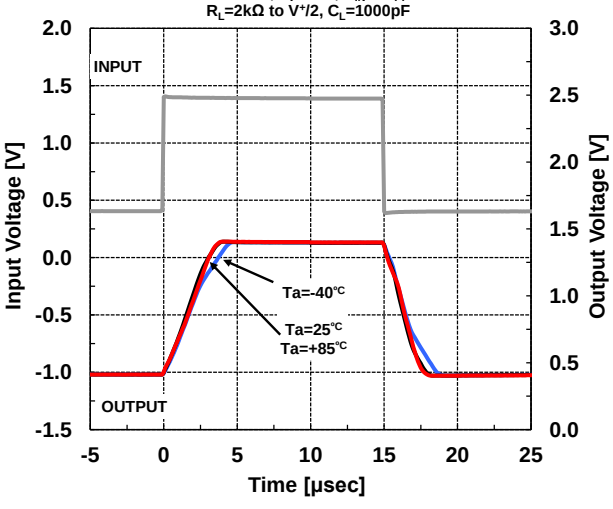
Pulse Response (Ambient Temperature)
V^+=3V, A_V=0dB, V_{IN}=1V_{PP}
R_L=2kΩ to V^+/2, C_L=1000pF



Pulse Response (Ambient Temperature)
V^+=1.8V, A_V=0dB, V_{IN}=1V_{PP}
R_L=2kΩ to V^+/2, C_L=10pF



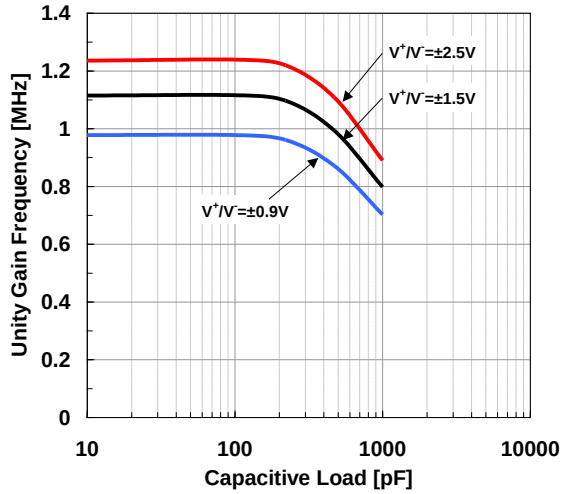
Pulse Response (Ambient Temperature)
V^+=1.8V, A_V=0dB, V_{IN}=1V_{PP}
R_L=2kΩ to V^+/2, C_L=1000pF



■ Typical Characteristics

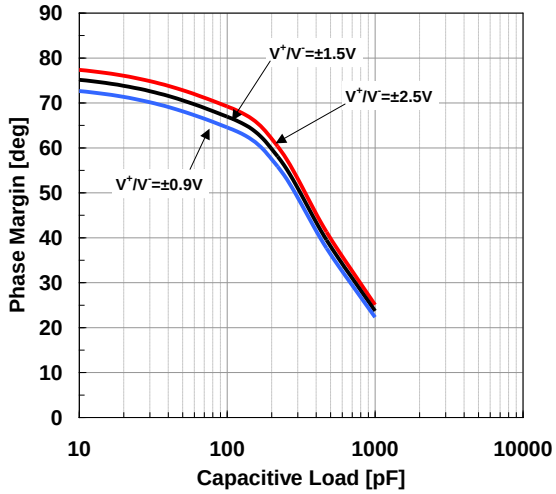
Unity Gain Frequency vs. Capacitive Load

G_V=40dB, R_F=2kΩ, R_G=20Ω, R_S=50Ω, Ta=+25°C



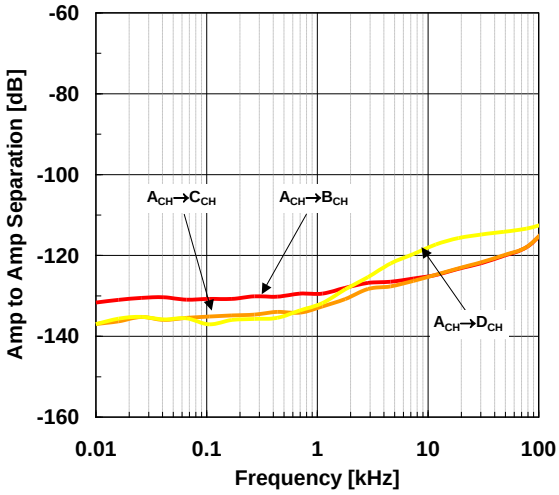
Phase Margin vs. Capacitive Load

G_V=40dB, R_F=2kΩ, R_G=20Ω, R_S=50Ω, Ta=+25°C



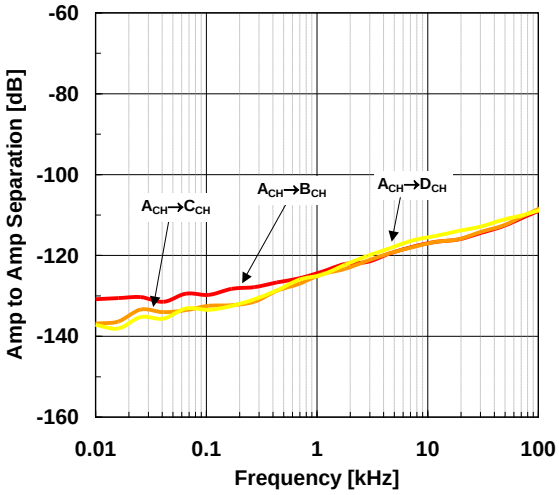
Amp to Amp Separation vs. Frequency

V^+/V^-=±2.5V, G_V=40dB, R_L=2kΩ to 0V, R_F=100kΩ,
V_{IN}=Ach, V_o=3V_{PP}, Ta=25°C



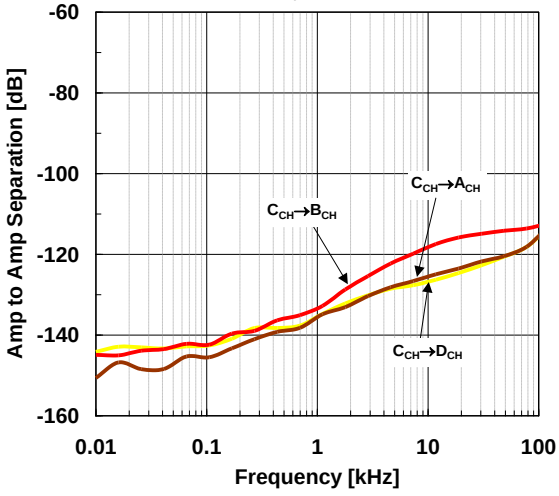
Amp to Amp Separation vs. Frequency

V^+/V^-=±0.9V, G_V=40dB, R_L=2kΩ to 0V, R_F=100kΩ,
V_{IN}=Ach, Vo=1V_{PP}, Ta=25°C



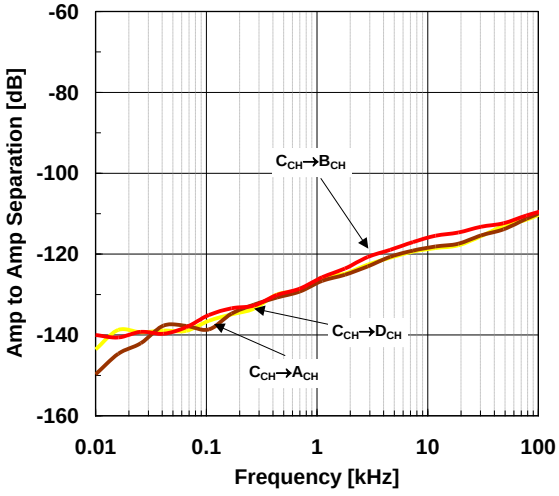
Amp to Amp Separation vs. Frequency

V^+/V^-=±2.5V, G_V=40dB, R_L=2kΩ to 0V, R_F=100kΩ,
V_{IN}=Cch, V_o=3V_{PP}, Ta=25°C



Amp to Amp Separation vs. Frequency

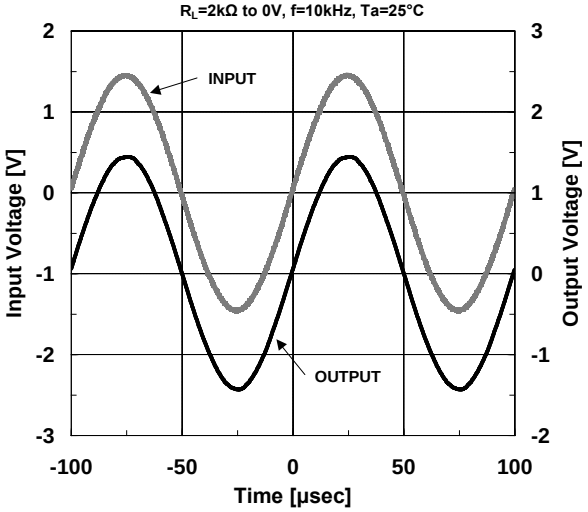
V^+/V^-=±0.9V, G_V=40dB, R_L=2kΩ to 0V, R_F=100kΩ,
V_{IN}=Cch, Vo=1V_{PP}, Ta=25°C



■ Typical Characteristics

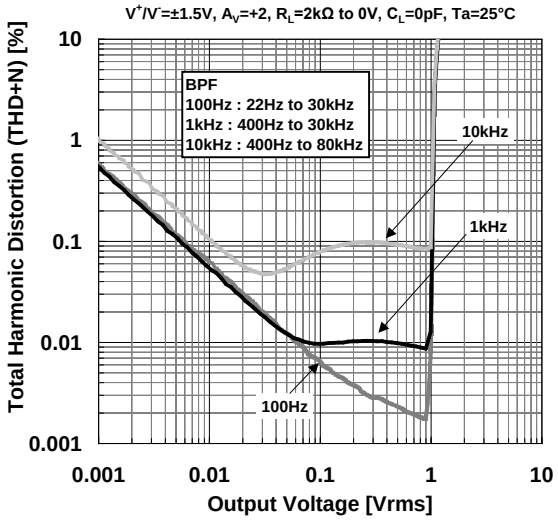
Sine Wave Response

V^+/V^-=±1.5V, A_V=0dB, V_{IN}=3V_{PP}
R_L=2kΩ to 0V, f=10kHz, Ta=25°C



Total Harmonic Distortion vs. Output Voltage

V^+/V^-=±1.5V, A_V=+2, R_L=2kΩ to 0V, C_L=0pF, Ta=25°C



Equivalent Input Noise Voltage vs. Frequency

G_V=40dB, R_L=2kΩ to 0V, C_L=10pF, Ta=25°C