

## Rail-to-Rail Input/Output Quad Operational Amplifier

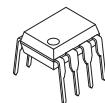
### ■ GENERAL DESCRIPTION

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



NJM2734M



NJM2734E

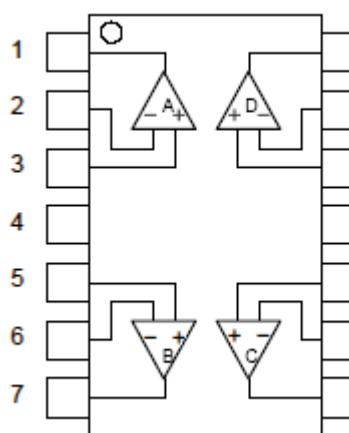


NJM2734V

### ■ 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  $V_{OH} \geq 4.9V / V_{OL} \leq 0.1V$ , at  $V^+ = 5V$ ,  $R_L = 20k\Omega$
- Load Drivability  $V_{OH} \geq 4.75V / V_{OL} \leq 0.25V$ , at  $V^+ = 5V$ ,  $R_L = 2k\Omega$
- Offset Voltage 5mV max.
- Slew Rate 0.4V/ $\mu$ s typ.
- Low Input Voltage Noise 10nV/ $\sqrt{\text{Hz}}$  typ.
- Adequate phase margin  $\Phi_M = 75\text{deg}$ . typ., at  $R_L = 2k\Omega$
- Bipolar Technology
- Package Outline DIP14, DMP14, EMP14, SSOP14

### ■ PIN CONFIGURATION



#### PIN FUNCTION

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

NJM2734D

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# NJM2734

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	7.0	V
Differential Input Voltage Range	V <sub>ID</sub>	±1.0 (Note1)	V
Common Mode Input Voltage Range	V <sub>IC</sub>	0 ~ 7.0 (Note1)	V
Power Dissipation	P <sub>D</sub>	(DIP14) 700 (DMP14) 520 (Note2) (EMP14) 720 (Note2) (SSOP14) 450 (Note2)	mW
Operating Temperature Range	T <sub>opr</sub>	-40~+85	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

(Note1) For supply voltage less than 7V, the absolute maximum input voltage is equal to the supply voltage.

(Note2) 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 <sup>+</sup>	1.8 to 6.0	V

## ■ ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=5V, Ta=25°C)

### •DC CHARACTERISTICS

(V<sup>+</sup>=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	No signal applied	-	1.2	1.8	mA
Input Offset Voltage	V <sub>IO</sub>		-	1	5	mV
Input Bias Current	I <sub>B</sub>		-	50	250	nA
Input Offset Current	I <sub>IO</sub>		-	5	100	nA
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> =2kΩ to 2.5V	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 2.5V≤V <sub>CM</sub> ≤5V (Note3) CMR -: 0V≤V <sub>CM</sub> ≤2.5V (Note3)	55	70	-	dB
Supply Voltage Rejection Ratio	SVR	V <sup>+</sup> /V <sup>-</sup> =±2.0V ~ ±3.0V	70	85	-	dB
Maximum Output Voltage 1	V <sub>OH1</sub>	R <sub>L</sub> =20kΩ to 2.5V	4.9	4.95	-	V
Maximum Output Voltage 2	V <sub>OL1</sub>	R <sub>L</sub> =20kΩ to 2.5V	-	0.05	0.1	V
Input Common Mode Voltage Range	V <sub>ICM</sub>	R <sub>L</sub> =2kΩ to 2.5V	4.75	4.85	-	V
	V <sub>OL2</sub>	R <sub>L</sub> =2kΩ to 2.5V	-	0.15	0.25	V
	V <sub>ICM</sub>	CMR≥55dB	0	-	5	V

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

CMR+ is measured with 2.5V≤V<sub>CM</sub>≤5.0 and CMR- is measured with 0V≤V<sub>CM</sub>≤2.5V.

### •AC CHARACTERISTICS

(V<sup>+</sup>=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	R <sub>L</sub> =2kΩ to 2.5V	-	1	-	MHz
Phase Margin	Φ <sub>M</sub>	R <sub>L</sub> =2kΩ to 2.5V	-	75	-	Deg
Equivalent Input Noise Voltage	V <sub>NI</sub>	f=1kHz	-	10	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz R <sub>L</sub> =2kΩ to 2.5V, V <sub>O</sub> =1.2Vrms	-	133	-	dB

### •TRANSIENT CHARACTERISTICS

(V<sup>+</sup>=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R <sub>L</sub> =2kΩ to 2.5V	-	0.4	-	V/μs

■ ELECTRICAL CHARACTERISTICS ( $V^+=3V$ ,  $T_a=25^\circ C$ )

## ● DC CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	No signal applied	-	1	1.8	mA
Input Offset Voltage	V <sub>IO</sub>		-	1	5	mV
Input Bias Current	I <sub>B</sub>		-	50	250	nA
Input Offset Current	I <sub>IO</sub>		-	5	100	nA
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> =2kΩ to 1.5V	60	84	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 1.5V≤V <sub>CM</sub> ≤3V (Note4) CMR-: 0V≤V <sub>CM</sub> ≤1.5V (Note4)	48	63	-	dB
Supply Voltage Rejection Ratio	SVR	V <sup>+</sup> /V <sup>-</sup> =±1.2V ~ ±2.0V	68	83	-	dB
Maximum Output Voltage 1	V <sub>OH1</sub>	R <sub>L</sub> =20kΩ to 1.5V	2.9	2.95	-	V
	V <sub>OL1</sub>	R <sub>L</sub> =20kΩ to 1.5V	-	0.05	0.1	V
Maximum Output Voltage 2	V <sub>OH2</sub>	R <sub>L</sub> =2kΩ to 1.5V	2.75	2.85	-	V
	V <sub>OL2</sub>	R <sub>L</sub> =2kΩ to 1.5V	-	0.15	0.25	V
Input Common Mode Voltage Range	V <sub>ICM</sub>	CMR≥48dB	0	-	3	V

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

CMR+ is measured with 1.5V≤V<sub>CM</sub>≤3.0 and CMR- is measured with 0V≤V<sub>CM</sub>≤1.5V.

## ● AC CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	R <sub>L</sub> =2kΩ to 1.5V	-	1	-	MHz
Phase Margin	Φ <sub>M</sub>	R <sub>L</sub> =2kΩ to 1.5V	-	75	-	Deg
Equivalent Input Noise Voltage	V <sub>NI</sub>	f=1kHz	-	10	-	nV/√Hz
Amp to Amp Separation	CS	f=1kHz R <sub>L</sub> =2kΩ to 1.5V, V <sub>O</sub> =0.7Vrms	-	130	-	dB

## ● TRANSIENT CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R <sub>L</sub> =2kΩ to 1.5V	-	0.35	-	V/μs

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## ■ ELECTRICAL CHARACTERISTICS ( $V^+=1.8V$ , $T_a=25^\circ C$ )

### • DC CHARACTERISTICS

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

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	$A_V$	$R_L=2k\Omega$ to 0.9V	60	83	-	dB
Common Mode Rejection Ratio	CMR	CMR+: $0.9 \leq V_{CM} \leq 1.8V$ (Note5) CMR-: $0V \leq V_{CM} \leq 0.9V$ (Note5)	40	55	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+/V^- = \pm 0.9V \sim \pm 1.2V$	65	80	-	dB
Maximum Output Voltage 1	$V_{OH1}$	$R_L=20k\Omega$ to 0.9V	1.7	1.75	-	V
	$V_{OL1}$	$R_L=20k\Omega$ to 0.9V	-	0.05	0.1	V
Maximum Output Voltage 2	$V_{OH2}$	$R_L=2k\Omega$ to 0.9V	1.55	1.65	-	V
	$V_{OL2}$	$R_L=2k\Omega$ to 0.9V	-	0.15	0.25	V
Input Common Mode Voltage Range	$V_{ICM}$	CMR $\geq 40dB$	0	-	1.8	V

(Note5) CMR is represented by either CMR+ or CMR-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

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

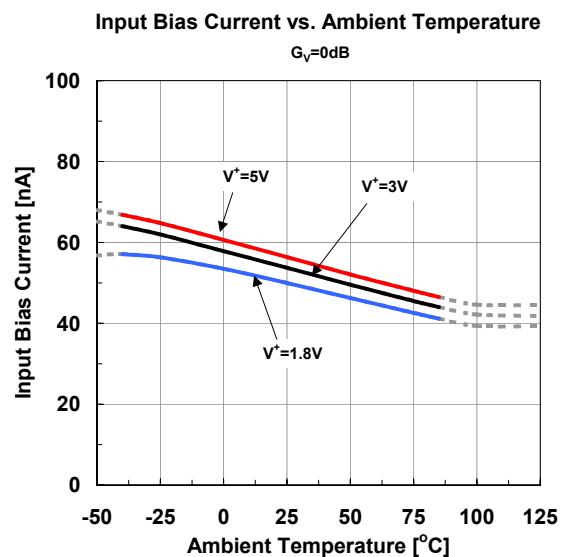
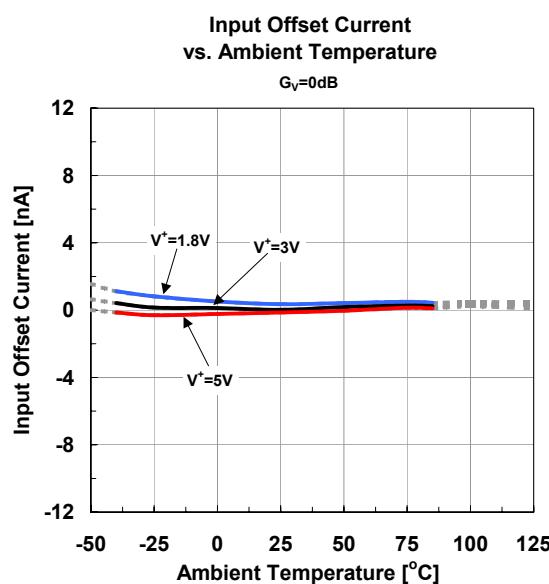
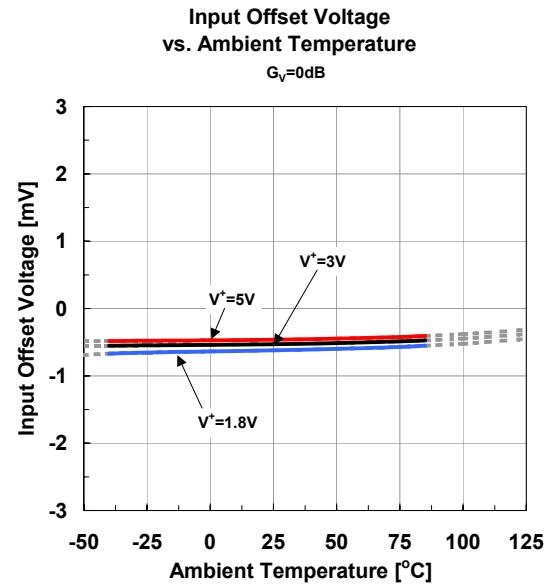
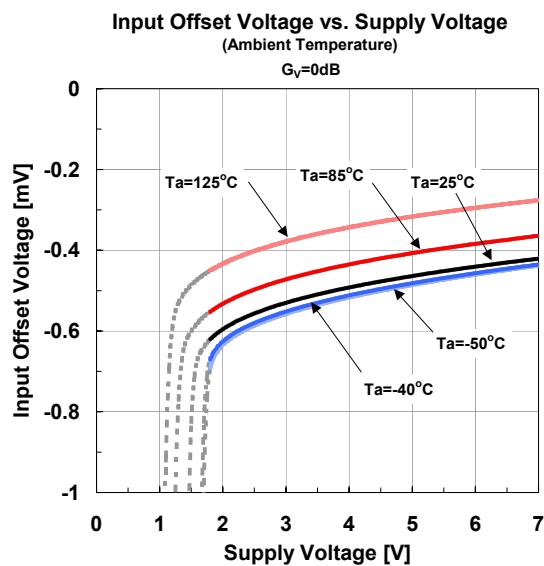
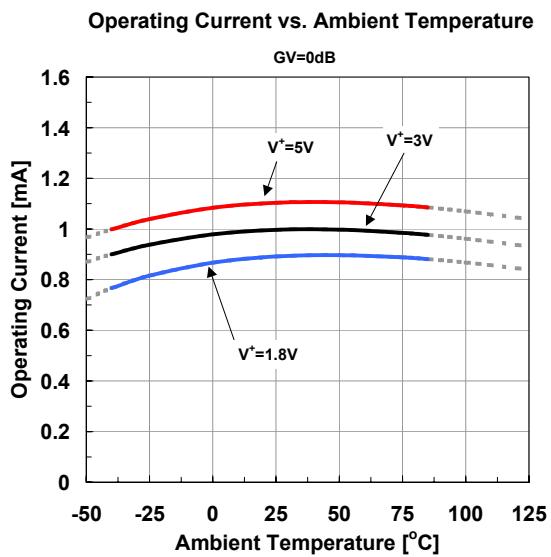
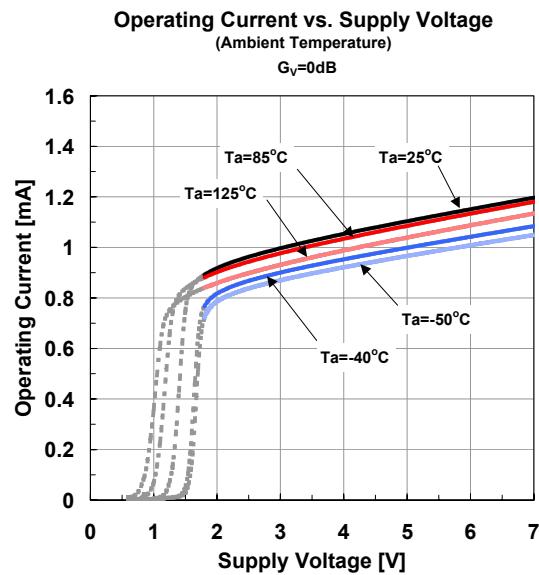
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain Bandwidth	GB	$R_L=2k\Omega$ to 0.9V	-	1	-	MHz
Phase Margin	$\Phi_M$	$R_L=2k\Omega$ to 0.9V	-	75	-	Deg
Equivalent Input Noise Voltage	$V_{NI}$	f=1kHz	-	10	-	nV/ $\sqrt{Hz}$
Amp to Amp Separation	CS	f=1kHz $R_L=2k\Omega$ to 0.9V, $V_o=0.4V_{rms}$	-	125	-	dB

### • TRANSIENT CHARACTERISTICS

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

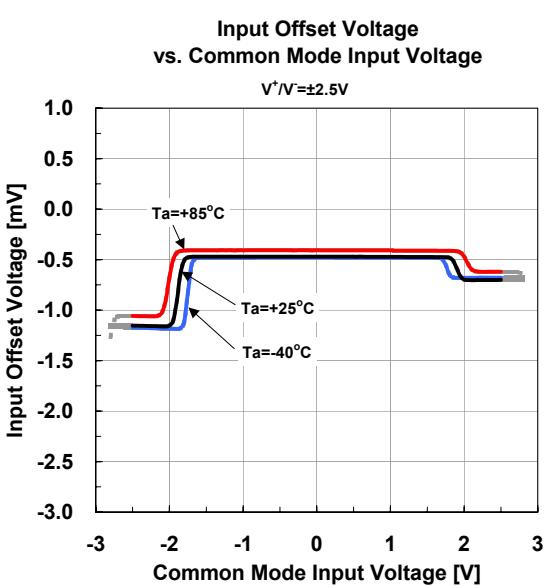
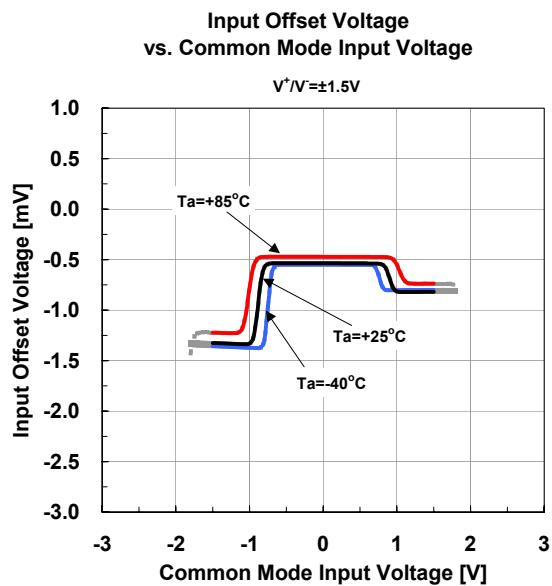
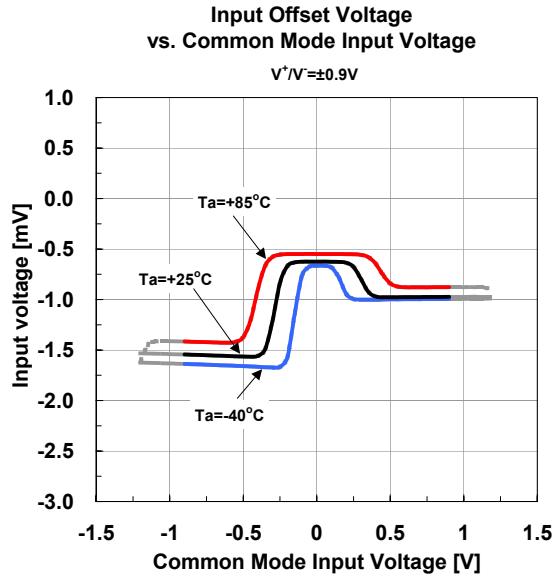
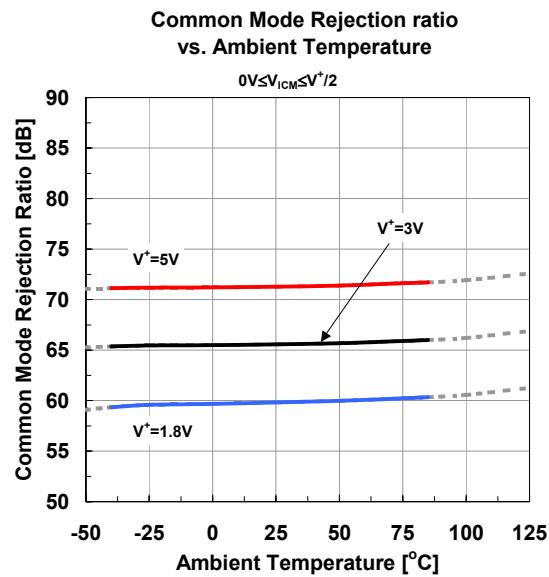
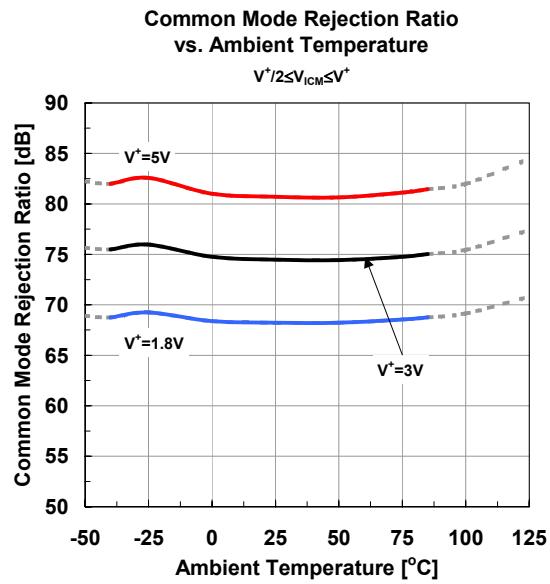
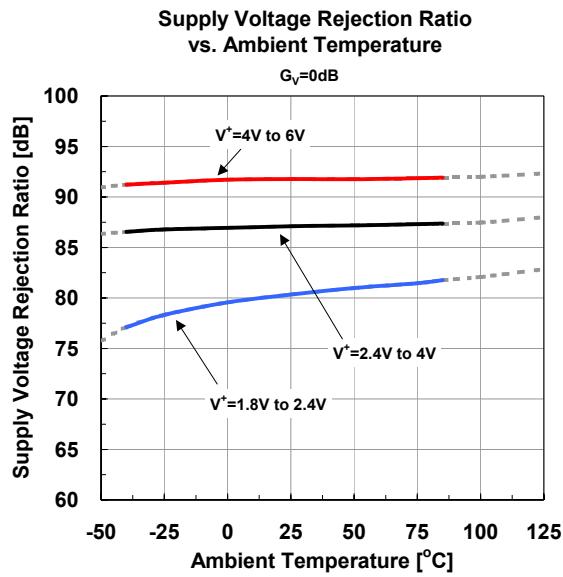
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	$R_L=2k\Omega$ to 0.9V	-	0.3	-	V/ $\mu s$

## ■ Typical Characteristics



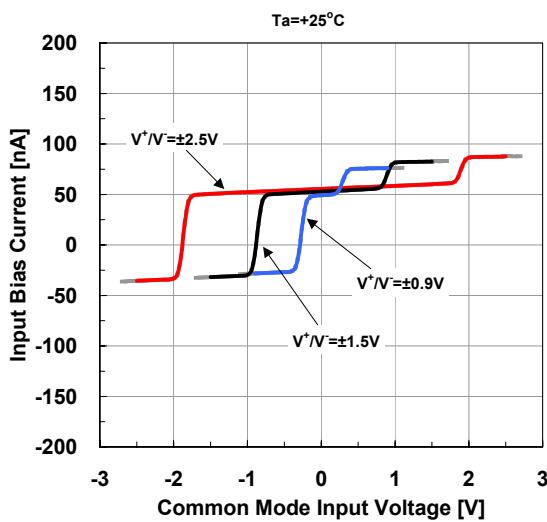
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## ■ Typical Characteristics



## ■ Typical Characteristics

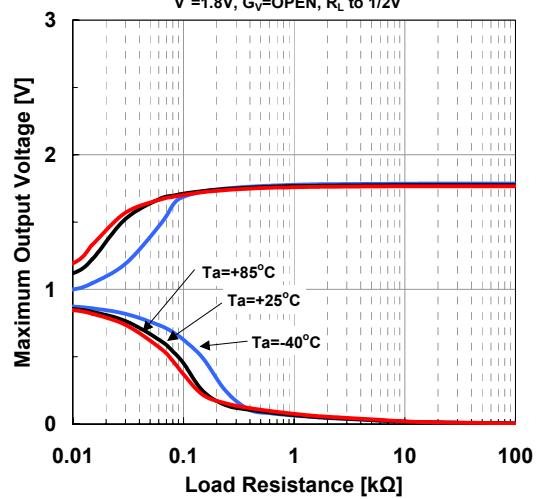
**Input bias Current  
vs. Common Mode Input Voltage**



**Maximum Output Voltage  
vs. Load Resistance**

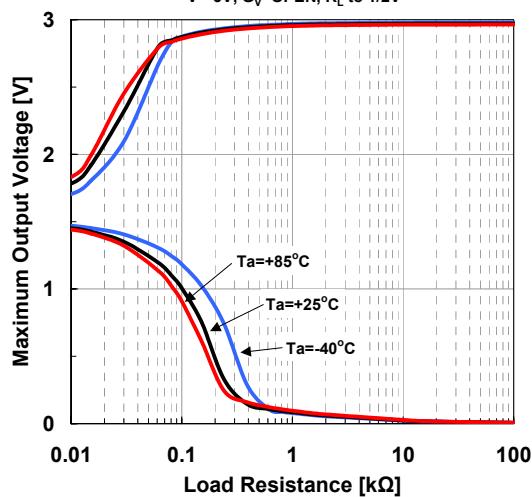
(Ambient Temperature)

$V^+ = 1.8V$ ,  $G_V = \text{OPEN}$ ,  $R_L$  to  $1/2V^+$



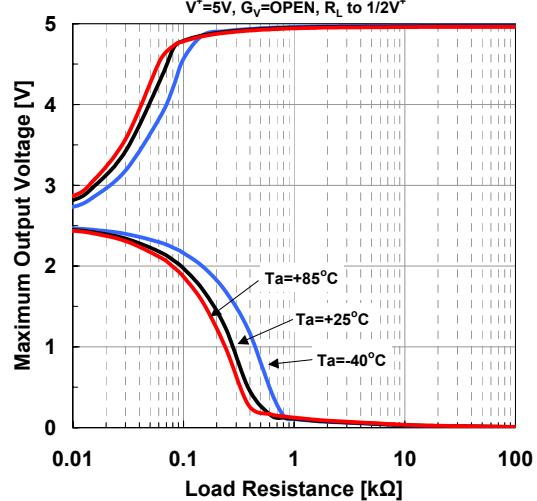
**Maximum Output Voltage  
vs. Load Resistance  
(Ambient Temperature)**

$V^+ = 3V$ ,  $G_V = \text{OPEN}$ ,  $R_L$  to  $1/2V^+$



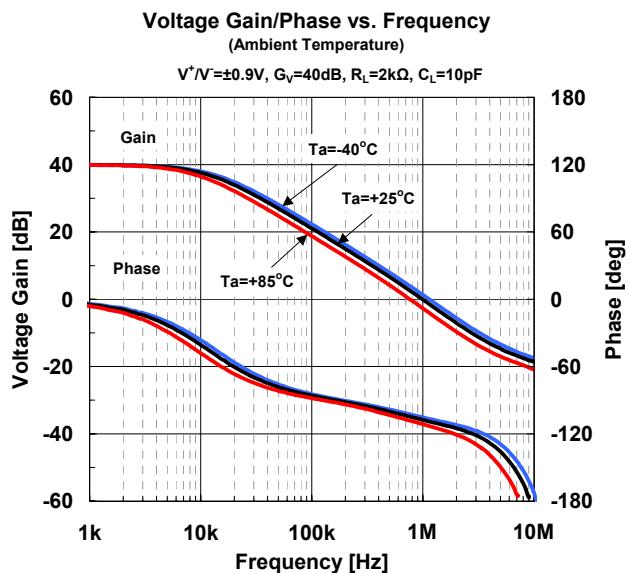
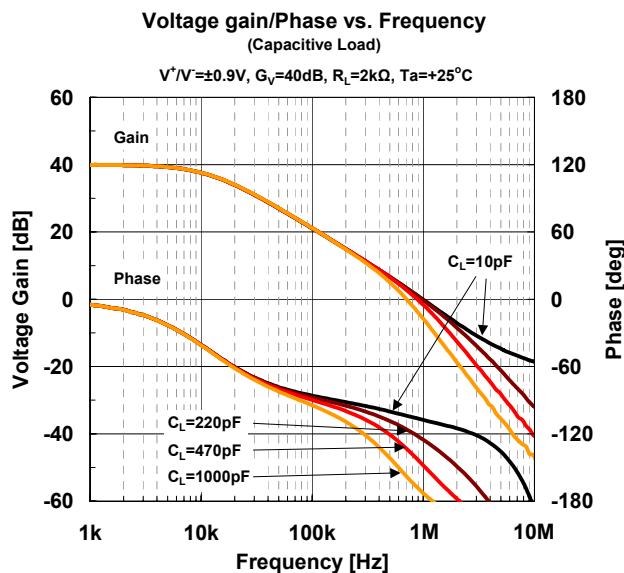
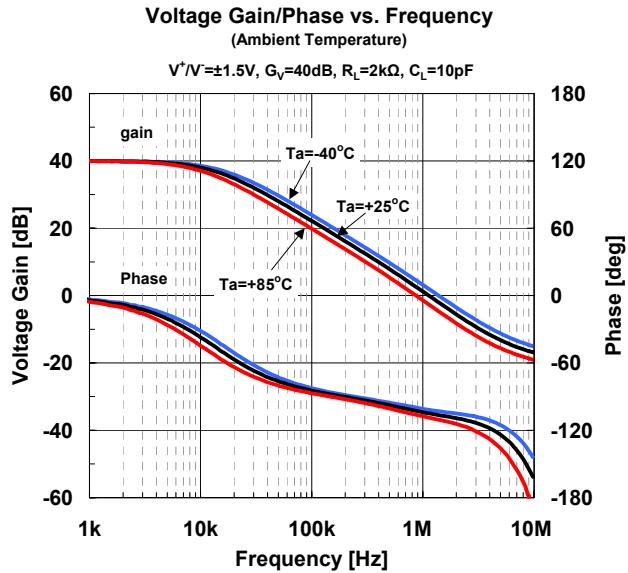
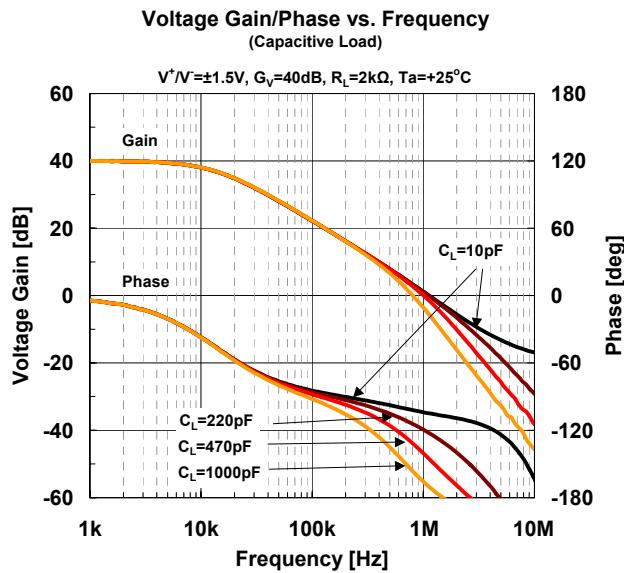
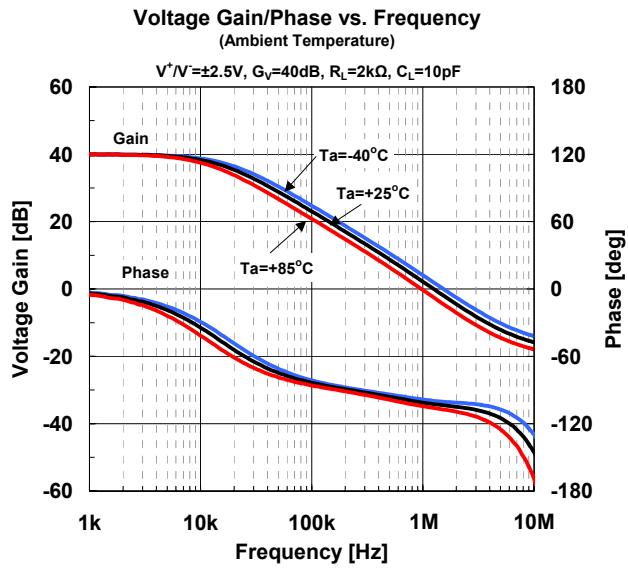
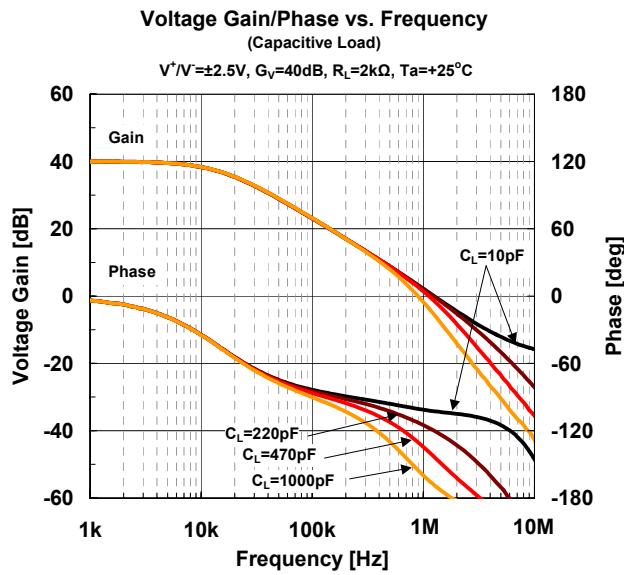
**Maximum Output Voltage  
vs. Load Resistance  
(Ambient Temperature)**

$V^+ = 5V$ ,  $G_V = \text{OPEN}$ ,  $R_L$  to  $1/2V^+$

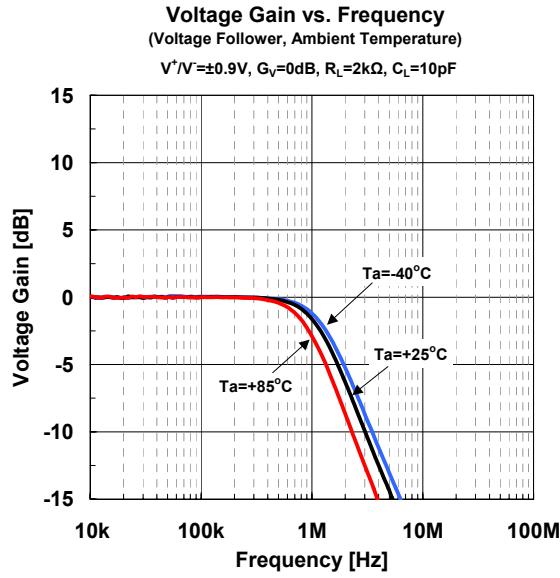
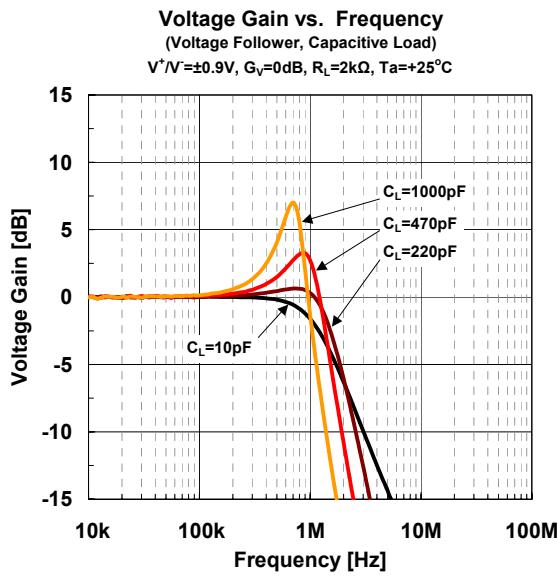
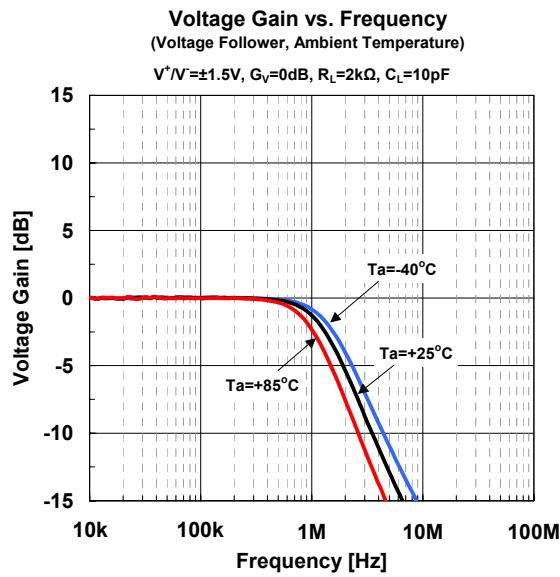
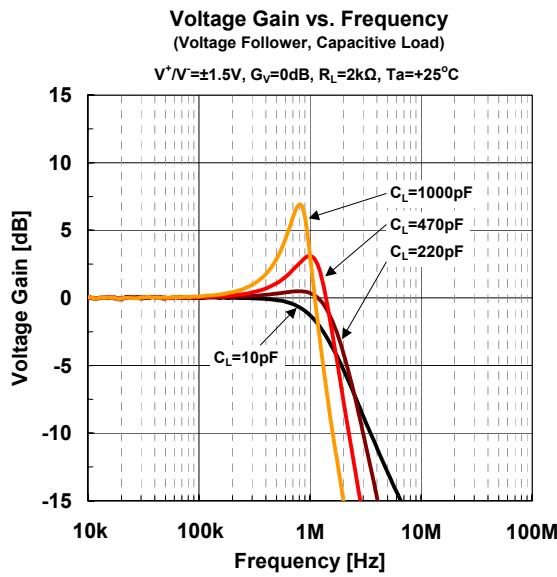
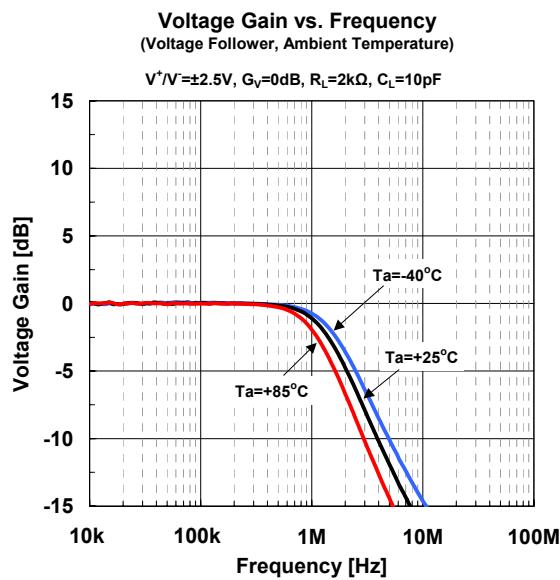
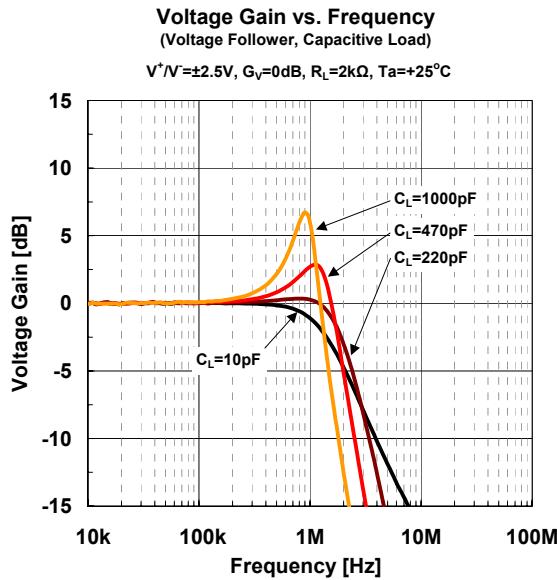


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## ■ Typical Characteristics

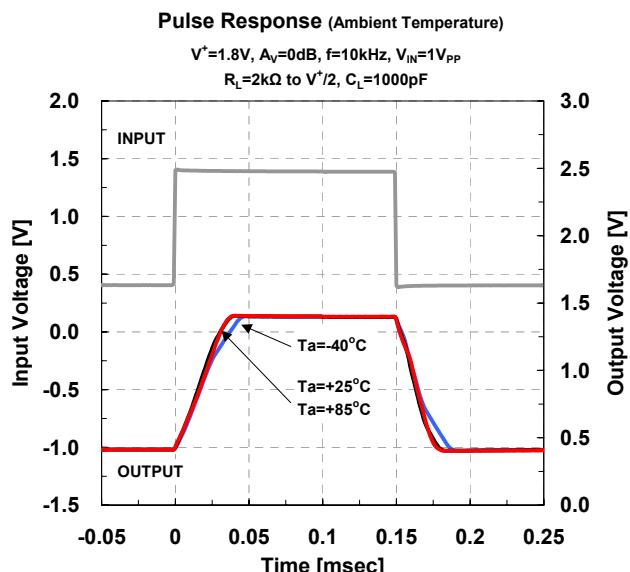
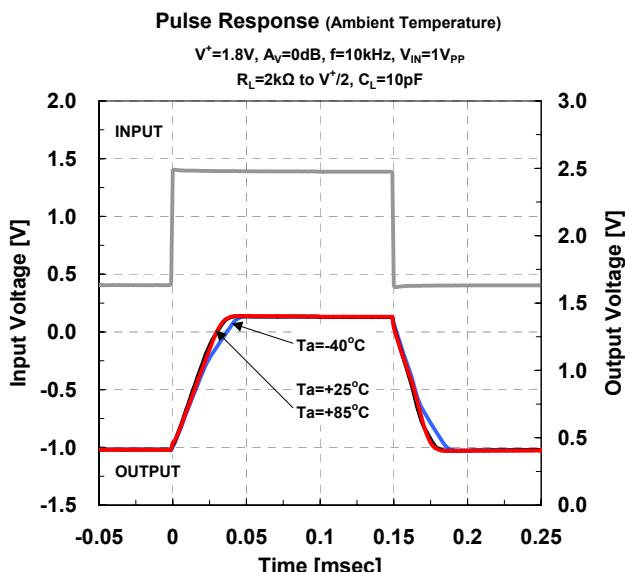
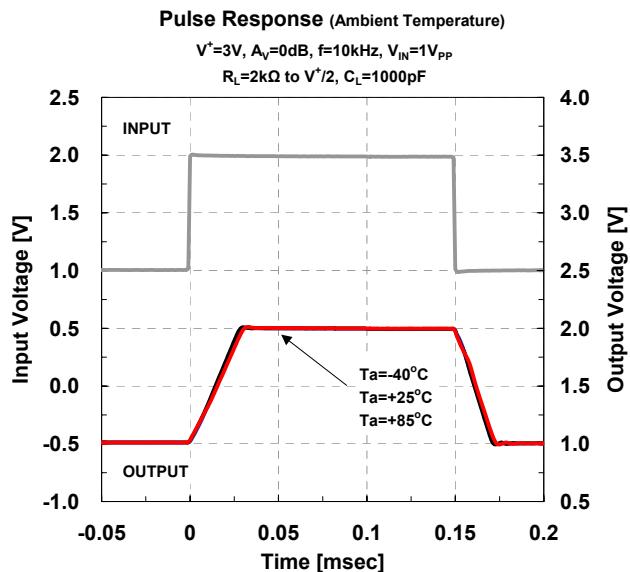
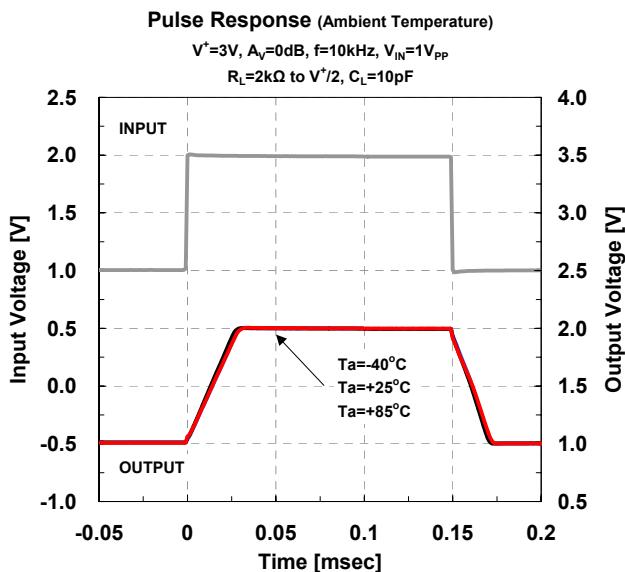
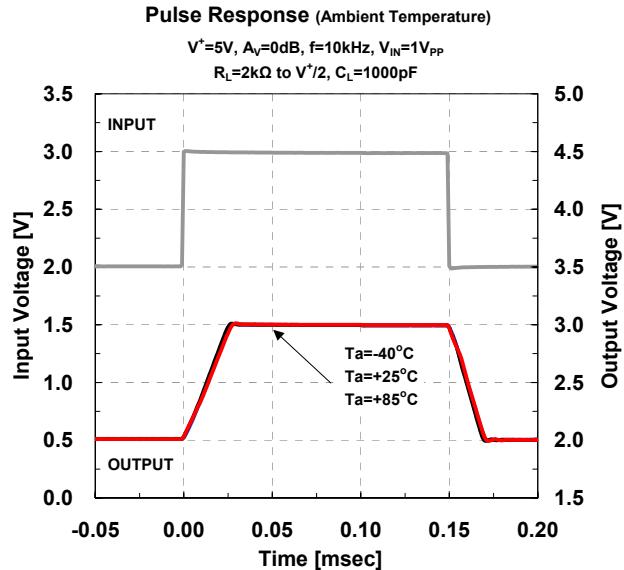
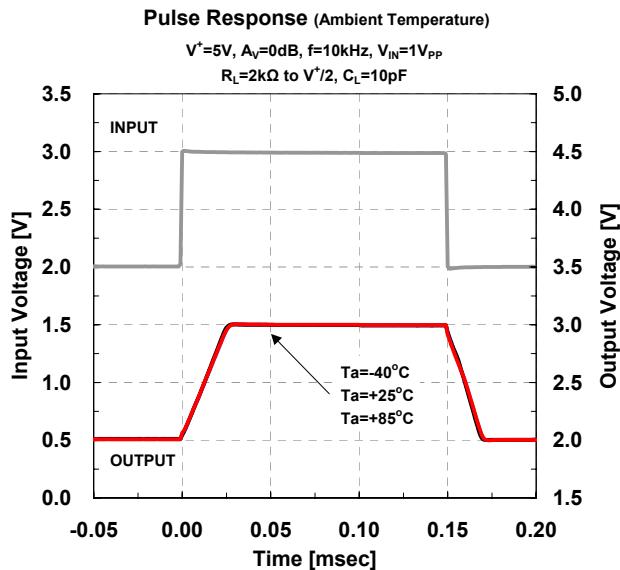


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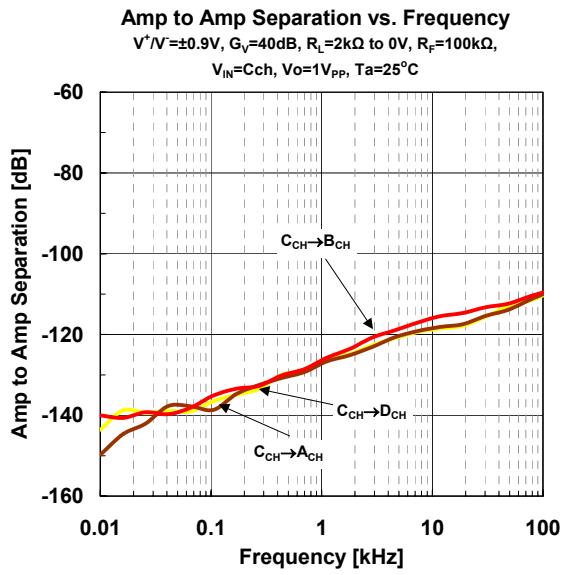
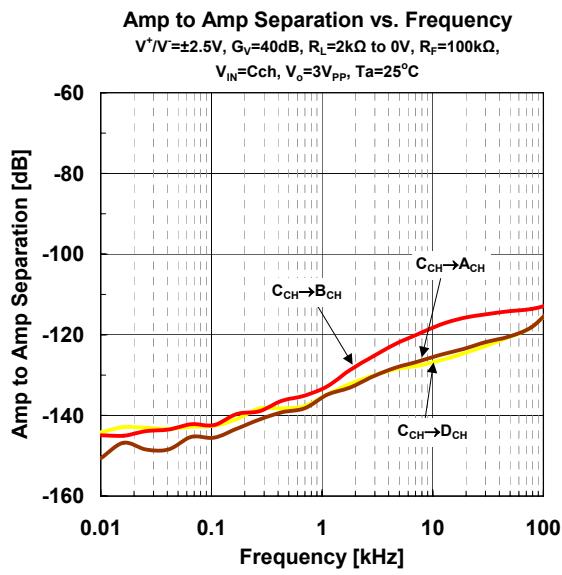
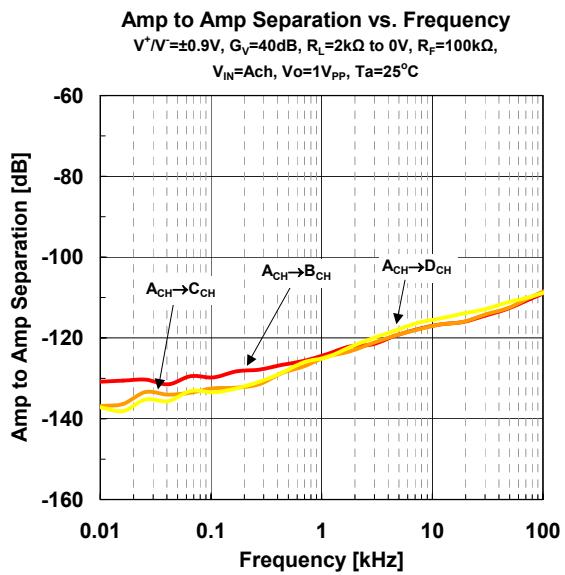
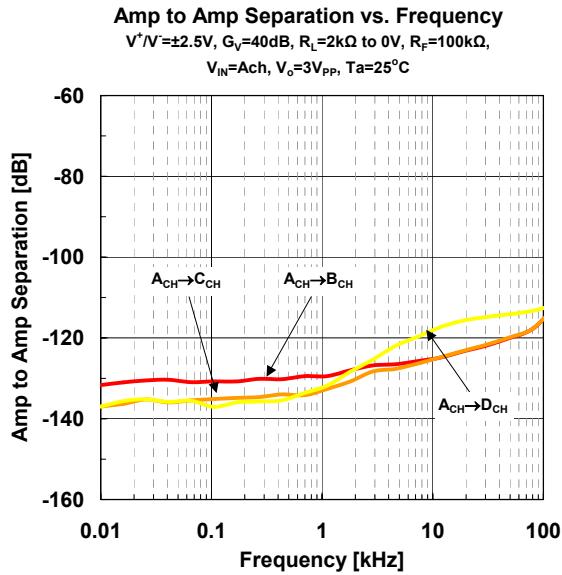
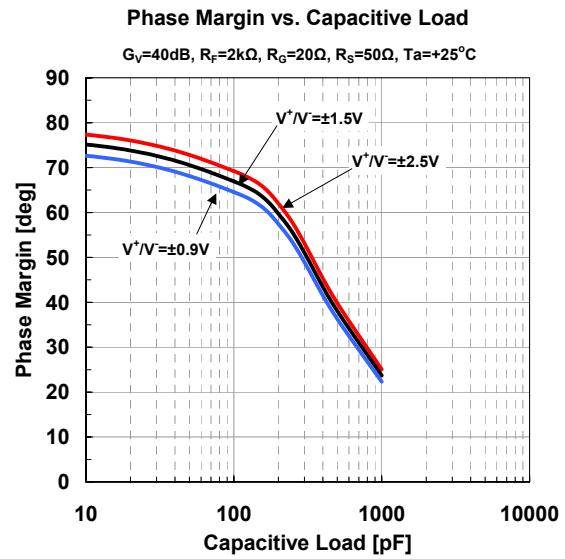
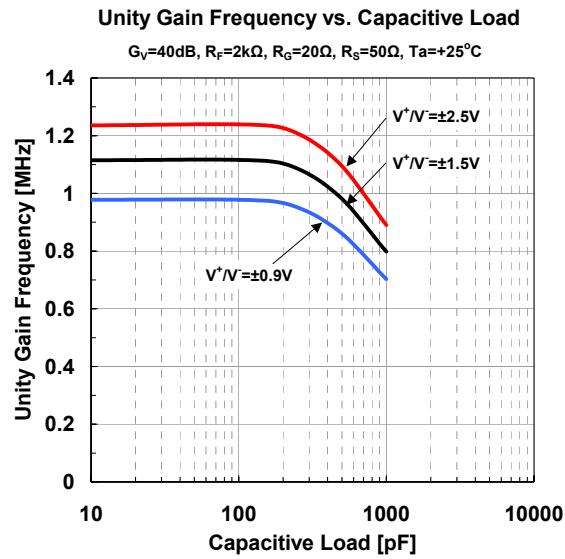


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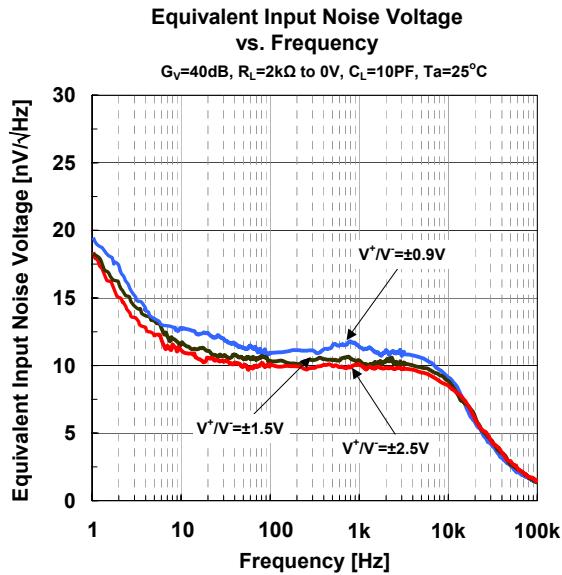
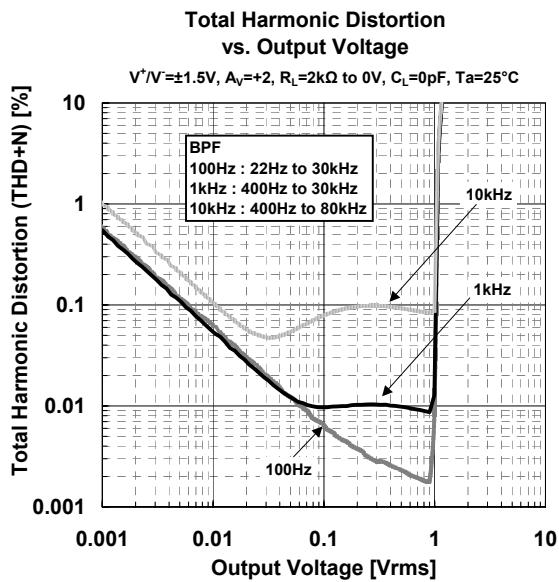
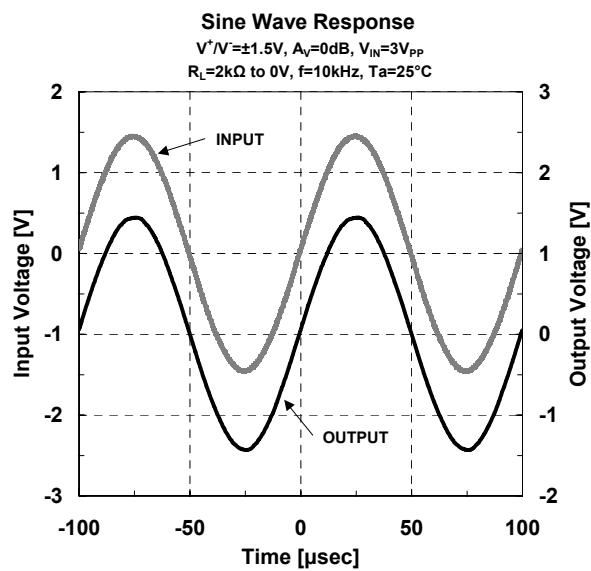


## ■ Typical Characteristics



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## ■ Typical Characteristics



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