

Rail-to-Rail Input/Output Dual Operational Amplifier

■ GENERAL DESCRIPTION

The NJM2732 is a Rail-to-Rail Input/Output dual 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, NJM2732 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.

■ 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/ μ s typ.
- Low Input Voltage Noise 10nV/ $\sqrt{\text{Hz}}$ typ. at $f = 1\text{kHz}$
- Adequate phase margin $\Phi_M = 75\text{deg}$. typ., at $R_L = 2k\Omega$, voltage follower
- Bipolar Technology
- Package Outline DIP8, DMP8, SSOP8, TVSP8
SOP8 JEDEC 150mil

■ PACKAGE OUTLINE



NJM2732D
(DIP8)



NJM2732M
(DMP8)



NJM2732E
(SOP8)



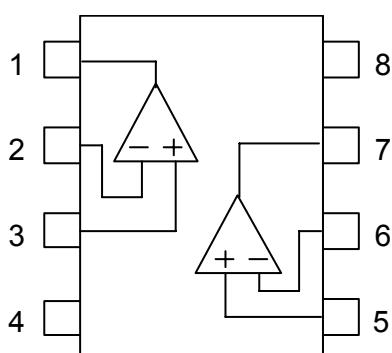
NJM2732V
(SSOP8)



NJM2732RB1
(TVSP8)

■ PIN CONFIGURATION

(Top View)



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

NJM2732D

NJM2732M

NJM2732E

NJM2732V

NJM2732RB1

NJM2732

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V ⁺	7.0	V
Differential Input Voltage Range	V _{ID}	±1.0	V
Common Mode Input Voltage Range	V _{IC}	0 ~ 7.0 (Note1)	V
Power Dissipation	P _D	(DIP8) 500 (DMP8) 300 (SOP8) 320 (SSOP8) 250 (TVSP8) 320	mW
Operating Temperature Range	T _{opr}	-40~+85	°C
Storage Temperature Range	T _{stg}	-40~+125	°C

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

■ 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	-	580	900	µA
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	60	85	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 2.5V≤V _{CM} ≤5V CMR-: 0V≤V _{CM} ≤2.5V (Note2)	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	4.9	4.95	-	V
Maximum Output Voltage 2	V _{OL1}	R _L =20kΩ	-	0.05	0.1	V
Input Common Mode Voltage Range	V _{ICM}	V _{CM} =2.5V	0	-	5	V

(Note2) 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	-	1	-	MHz
Phase Margin	Φ _M	R _L =2kΩ	-	75	-	Deg
Equivalent Input Noise Voltage	V _{NI}	f=1kHz	-	10	-	nV/√Hz

•TRANSIENT CHARACTERISTICS

(V⁺=5V, Ta=25°C)

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

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

● DC CHARACTERISTICS

(V⁺=3V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I _{CC}	No signal applied	-	510	880	µA
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	60	84	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 1.5V≤V _{CM} ≤3V CMR-: 0V≤V _{CM} ≤1.5V (Note3)	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	2.9	2.95	-	V
	V _{OL1}	R _L =20kΩ	-	0.05	0.1	V
Maximum Output Voltage 2	V _{OH2}	R _L =2kΩ	2.75	2.85	-	V
	V _{OL2}	R _L =2kΩ	-	0.15	0.25	V
Input Common Mode Voltage Range	V _{ICM}	CMR≥48dB	0	-	3	V

(Note3) 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	-	1	-	MHz
Phase Margin	Φ _M	R _L =2kΩ	-	75	-	Deg
Equivalent Input Noise Voltage	V _{NI}	f=1kHz	-	10	-	nV/√Hz

● TRANSIENT CHARACTERISTICS

(V⁺=3V, Ta=25°C)

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

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

● DC CHARACTERISTICS

(V⁺=1.8V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I _{CC}	No signal applied	-	460	800	µA
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	60	83	-	dB
Common Mode Rejection Ratio	CMR	CMR+: 0.9V≤V _{CM} ≤1.8V CMR-: 0V≤V _{CM} ≤0.9V (Note4)	48	55	-	dB
Supply Voltage Rejection Ratio	SVR	V ⁺ /V=±1.2V ~ ±2.0V	65	80	-	dB
Maximum Output Voltage 1	V _{OH1}	R _L =20kΩ	1.7	1.75	-	V
	V _{OL1}	R _L =20kΩ	-	0.05	0.1	V
Maximum Output Voltage 2	V _{OH2}	R _L =2kΩ	1.55	1.65	-	V
	V _{OL2}	R _L =2kΩ	-	0.15	0.25	V
Input Common Mode Voltage Range	V _{ICM}	CMR≥40dB	0	-	1.8	V

(Note4) 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	-	1	-	MHz
Phase Margin	Φ _M	R _L =2kΩ	-	75	-	Deg
Equivalent Input Noise Voltage	V _{NI}	f=1kHz	-	10	-	nV/√Hz

● TRANSIENT CHARACTERISTICS

(V⁺=1.8V, Ta=25°C)

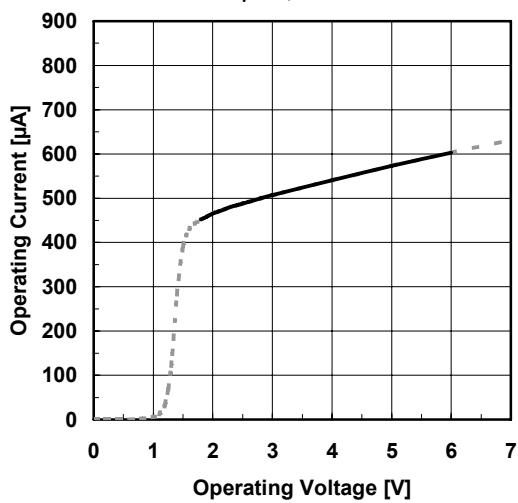
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate	SR	R _L =2kΩ	-	0.3	-	V/µs

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■ TYPICAL CHARACTERISTICS

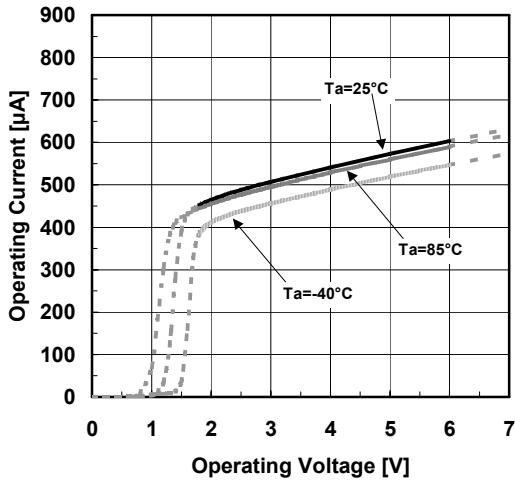
Operating Current vs Operating Voltage

$G_V=0\text{dB}$, $T_a=25^\circ\text{C}$



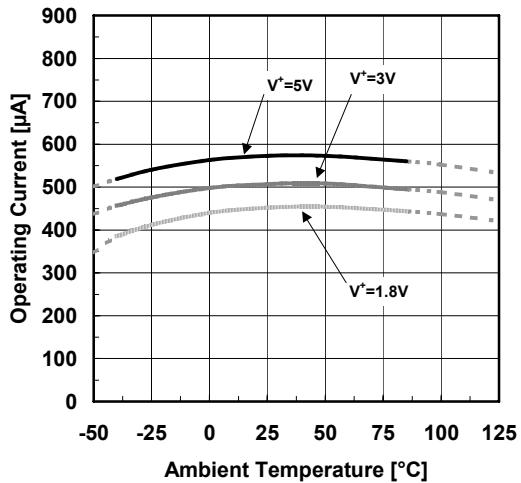
Operating Current vs. Operating Voltage
(correlation with T_a)

$G_V=0\text{dB}$, $T_a=25^\circ\text{C}$



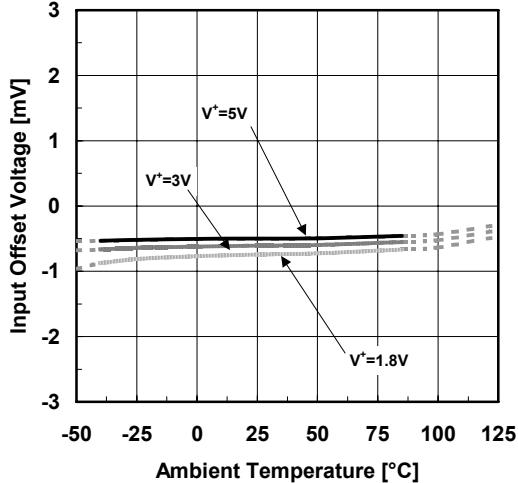
Operating Current
vs. Ambient Temperature

$G_V=0\text{dB}$



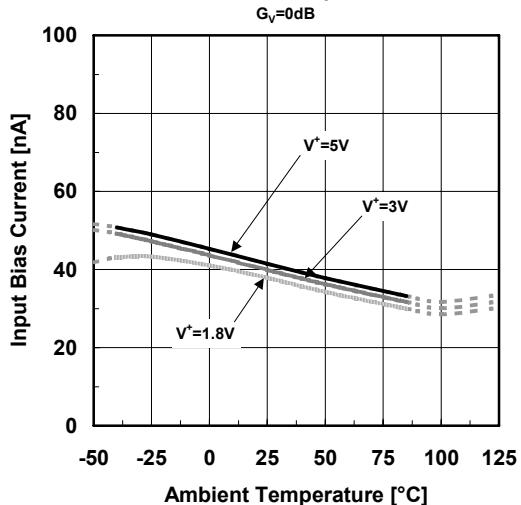
Input Offset Voltage
vs. Ambient Temperature

$G_V=0\text{dB}$



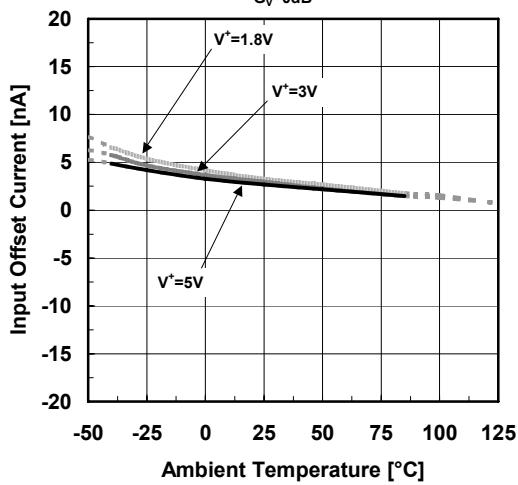
Input Bias Current
vs. Ambient Temperature

$G_V=0\text{dB}$

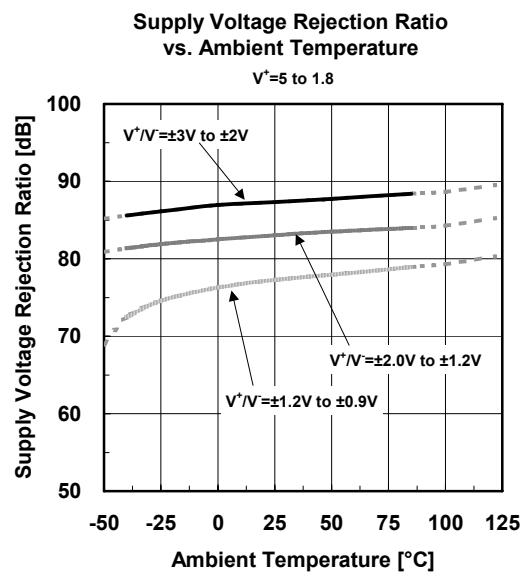
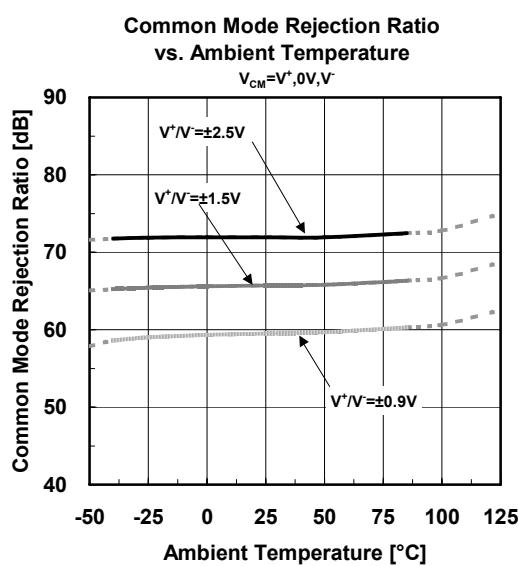
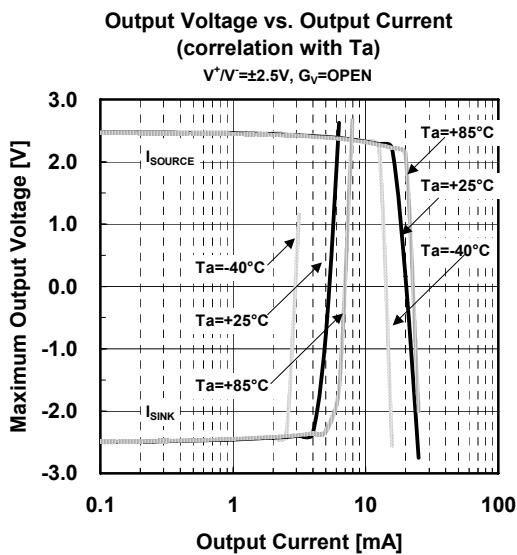
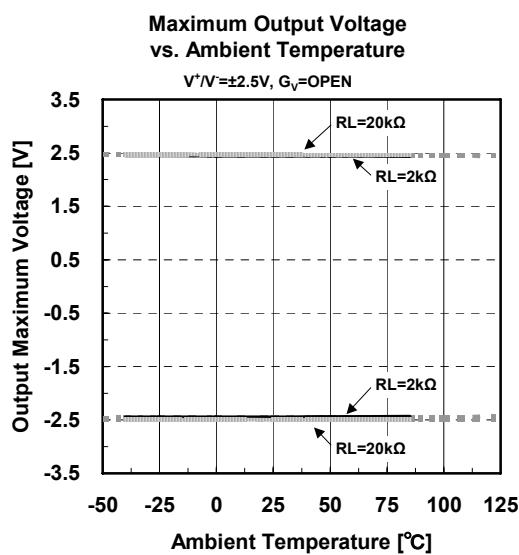
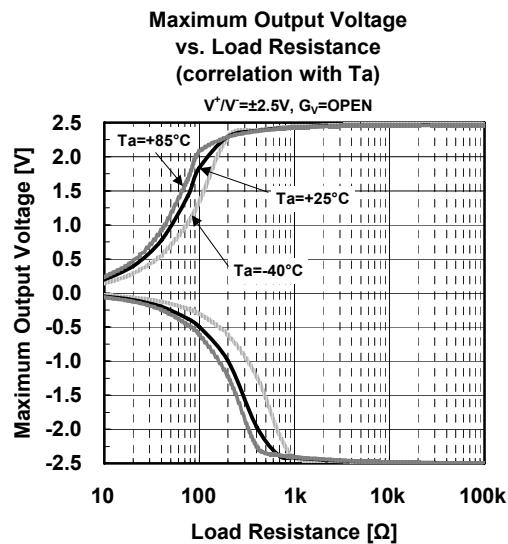
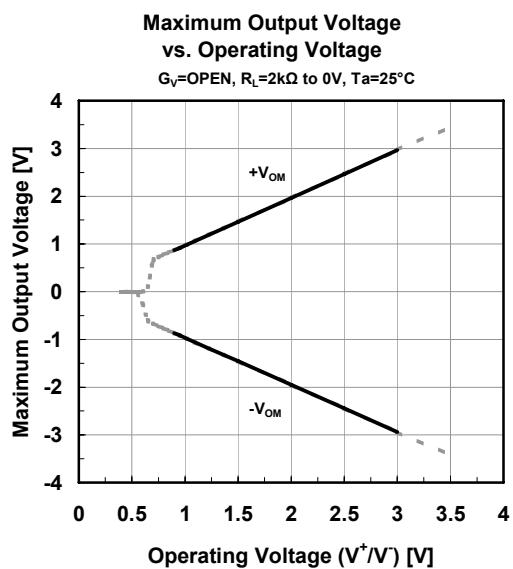


Input Offset Current
vs. Ambient Temperature

$G_V=0\text{dB}$

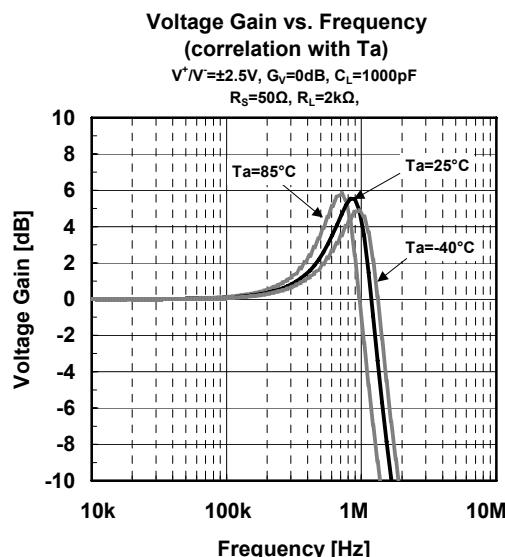
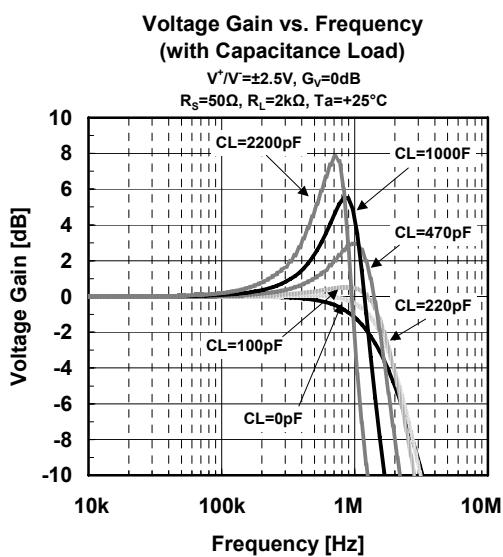
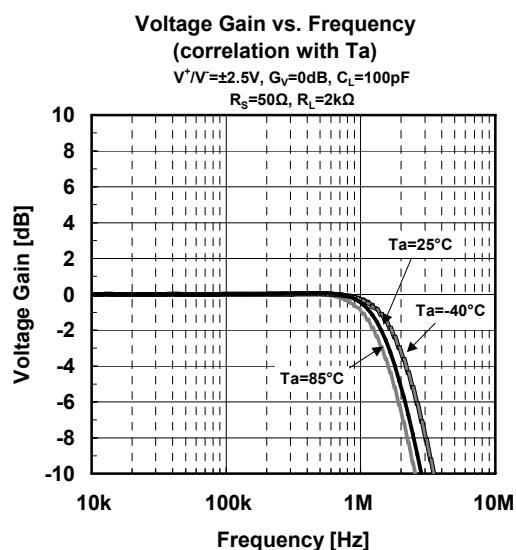
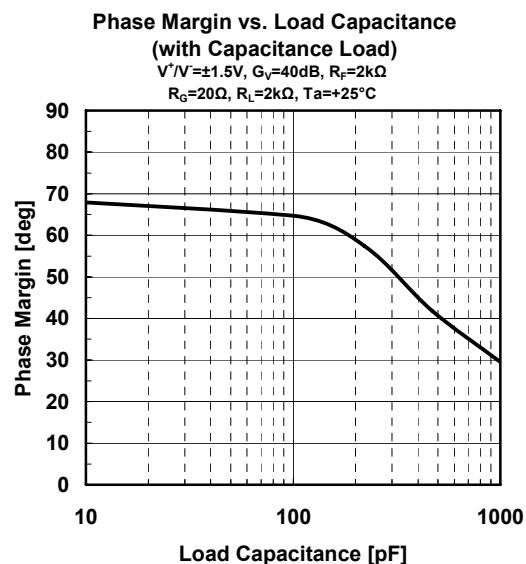
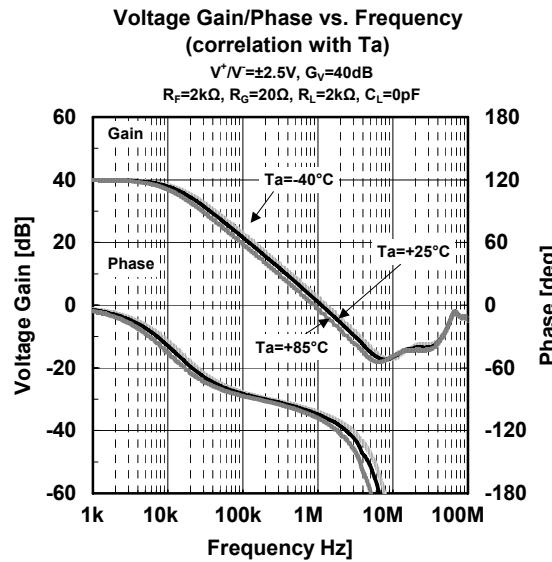
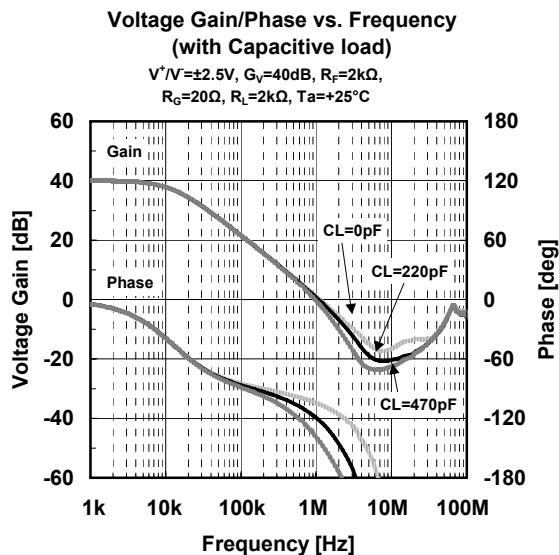


■ TYPICAL CHARACTERISTICS

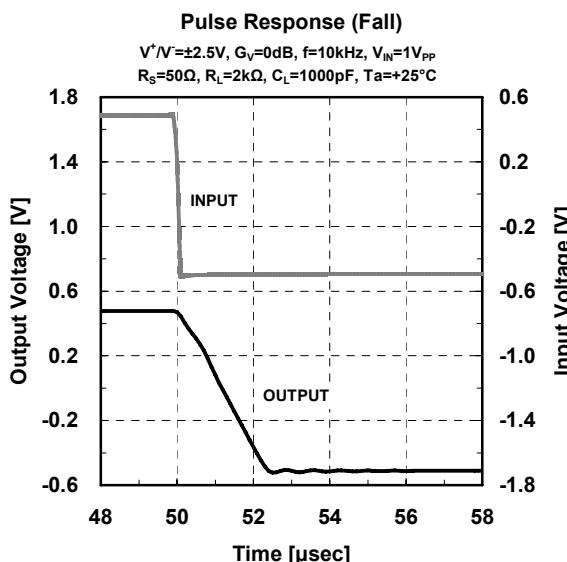
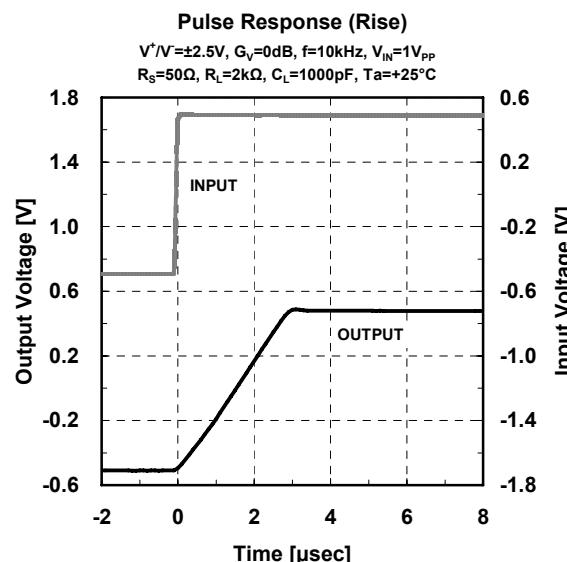
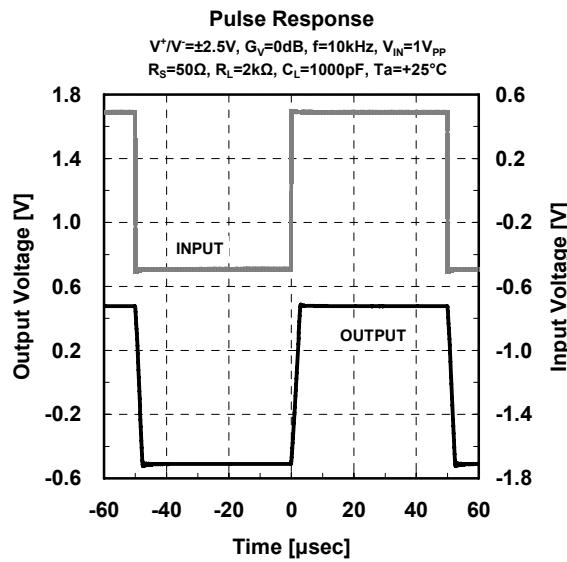
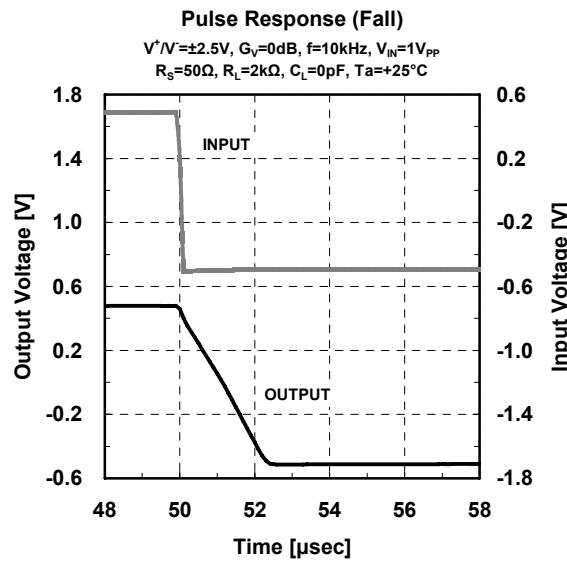
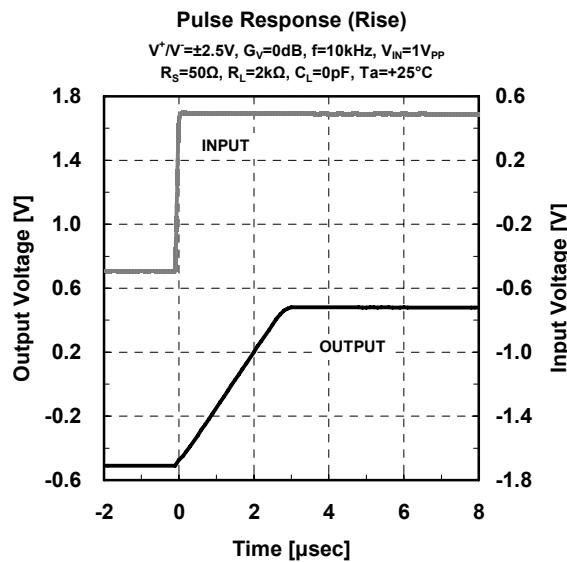
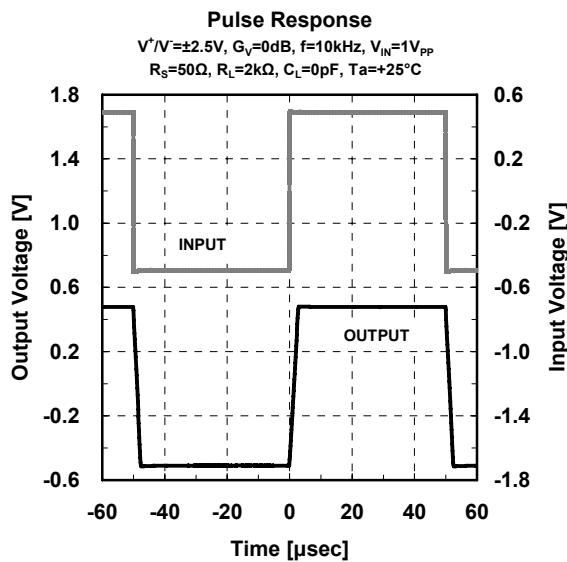


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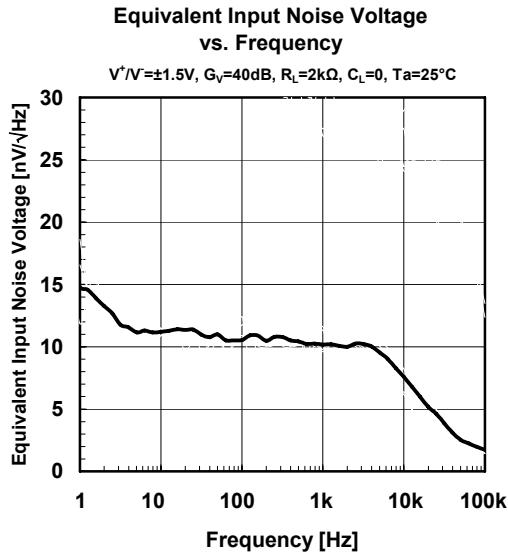
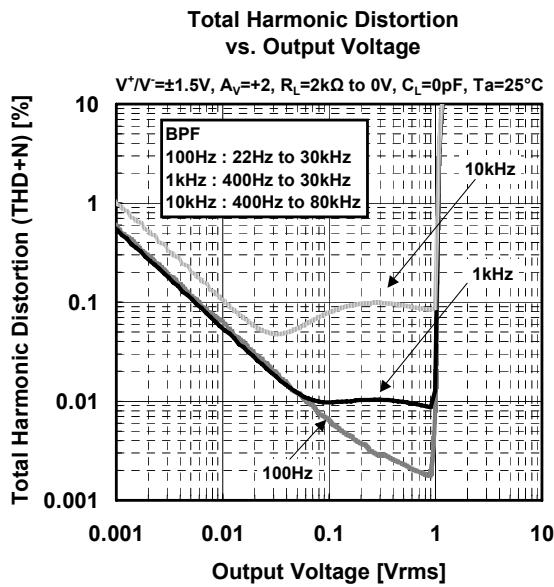
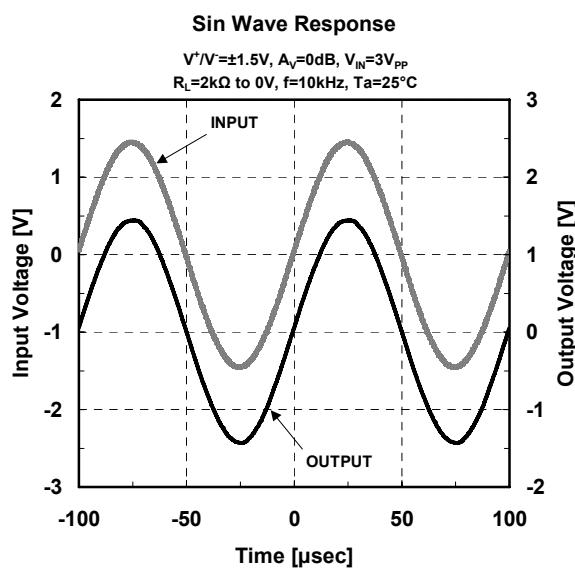


■ TYPICAL CHARACTERISTICS



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■ TYPICAL CHARACTERISTICS



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