

Precision, Dual, JFET Input Operational Amplifier

■ FEATURES

- Low Input Offset Voltage
- Low Input Offset Voltage Drift
- Low Supply Current
- High Slew Rate
- Wide Bandwidth
- Low Noise
- Low Input Bias Current
- No Phase Reversal
- RF noise Immunity
- Guaranteed Temperature
- Operating Voltage
- Package

$V_{IO}=400\mu V$ max.
 $V_{IO}=700\mu V$ max.
 $(T_a = -40^\circ C \text{ to } +125^\circ C)$
 $\Delta V_{IO}/\Delta T=5\mu V/^\circ C$ max.
 $(T_a = -40^\circ C \text{ to } +125^\circ C)$
 $I_{CC}=3mA$ max.
 $SR=20V/\mu s$ typ.
 $f_t=7MHz$ typ.
 $e_n=10nV/\sqrt{Hz}$
 $(\text{at } f=1kHz \text{ typ.})$
 $I_B=80pA$ max.
 $(\text{at } T_a=25^\circ C)$

$T_{opr} = -40^\circ C \text{ to } +125^\circ C$
 $V_{opr} = \pm 4.5V \text{ to } \pm 16V$
 MSOP8 (VSP8)
 meet JEDEC MO-187-DA
 SOP8 JEDEC 150 mil

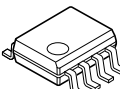
■ GENERAL DESCRIPTION

The NJM8512 is a dual high precision JFET input operational amplifier featuring low offset, low offset drift, low bias current, high slew rate, low noise and wide operating temperature range.

The precision performance, high speed and low noise make the NJM8512 especially suitable for filter and amplification of high speed and small signal in instruments, automated test equipment, sensors and other precision applications.

■ PACKAGE OUTLINE


 NJM8512AR
 NJM8512BR
 (MSOP8 (VSP8))

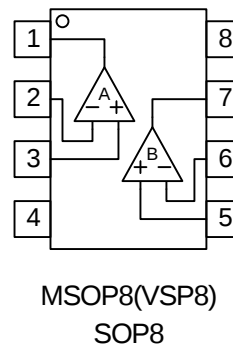

 NJM8512AE
 NJM8512BE
 (SOP8)

■ APPLICATIONS

- Current Sensor
- Photodiode Amplification
- Reference Voltage Circuit
- Automatic Test Equipment

■ PIN CONFIGURATION

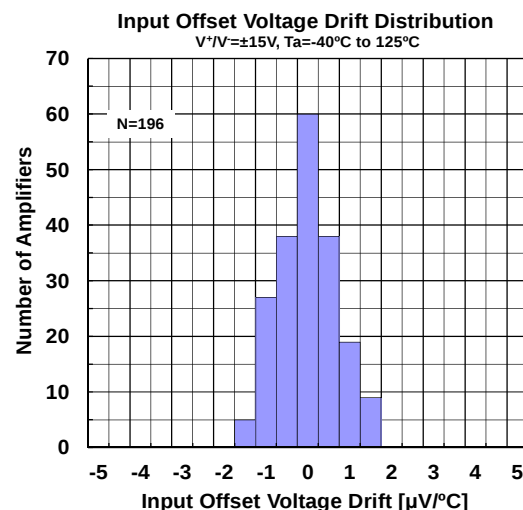
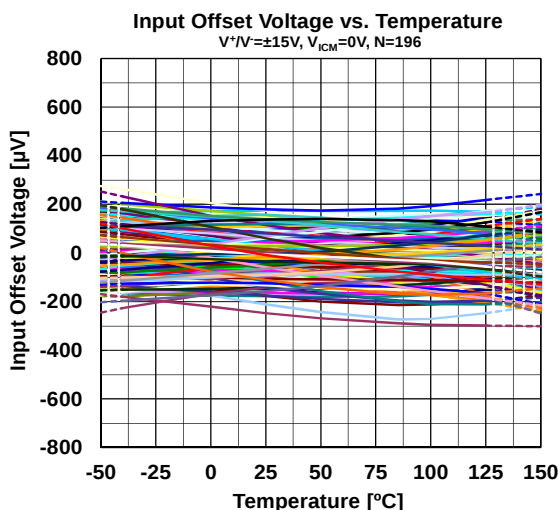
(Top View)



PIN FUNCTION

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

■ ELECTRICAL CHARACTERISTICS



NJM8512

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted.)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+V^-	±18	V
Differential Input Voltage	V_{ID}	±36 (Note1)	V
Input Voltage	V_{IN}	$V^- - 0.3$ to $V^+ + 0.3$ (Note2)	V
Input Current	I_{IN}	±10(Note3)	mA
Power Dissipation MSOP8 (VSP8) SOP8	P_D	(2-layer / 4-layer) 595(Note4) / 805 (Note4) 690 (Note4) / 1000 (Note4)	mW
Output Short-Circuit Duration		Infinite($T_a = 25^\circ\text{C}$) (Note4)	
Operating Temperature Range	T_{opr}	-40 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

(Note1) Differential Input Voltage is the voltage difference between +INPUT and -INPUT.

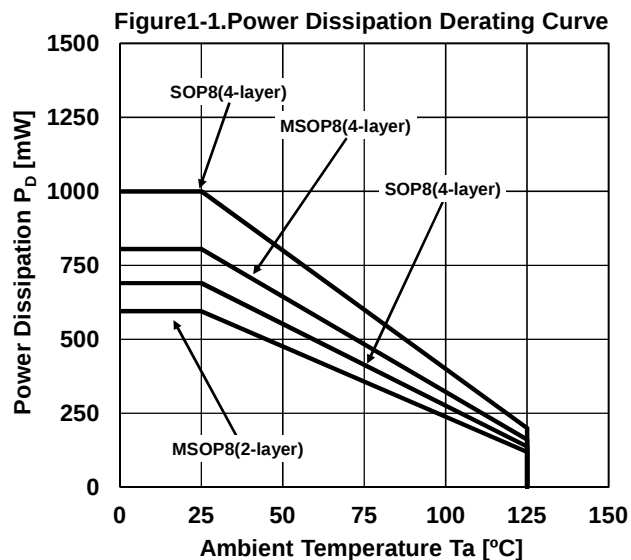
(Note2) The normal operation will establish when any input is within the Common Mode Input Voltage Range of electrical characteristics.

(Note3) If the input voltage exceeds the supply voltage, the input current must be limited 10 mA or less by using a restriction resistance.

(Note4) 2-layer : EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting.

4-layer : EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting.

See Figure "Fig.1-1 : Power Dissipation Curve" when ambient temperature is over 25°C.



■ RECOMMENDED OPERATING VOLTAGE (Ta=25°C)

PARAMETER	SYMBOL	RATING	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+V^-		±4.5	-	±16	V

■ ELECTRICAL CHARACTERISTICS ($V^+ / V^- = \pm 15V$, $T_a = 25^\circ C$, $V_{ICM} = 0V$, unless otherwise noted.)

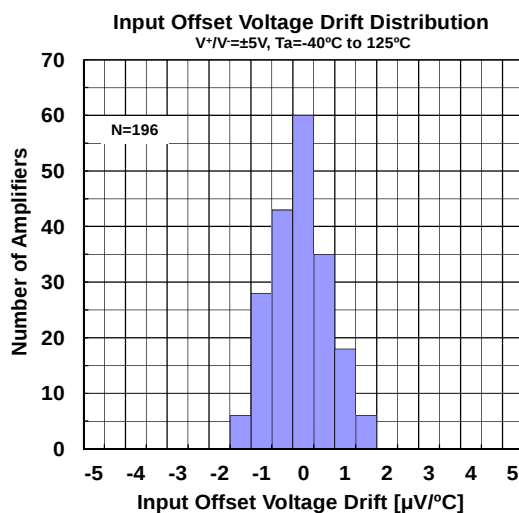
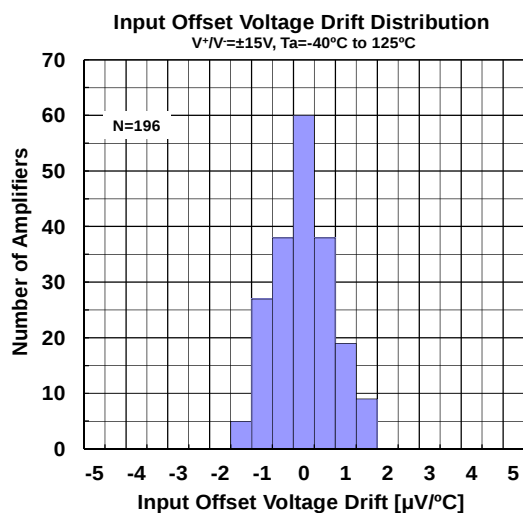
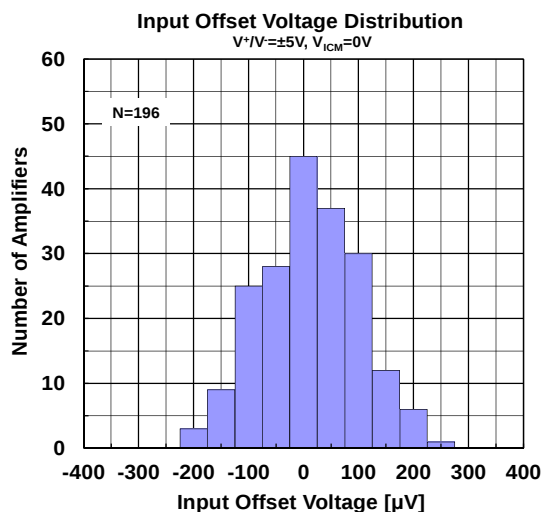
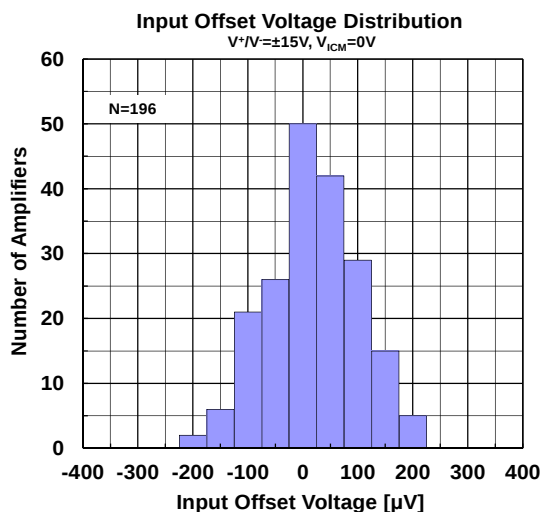
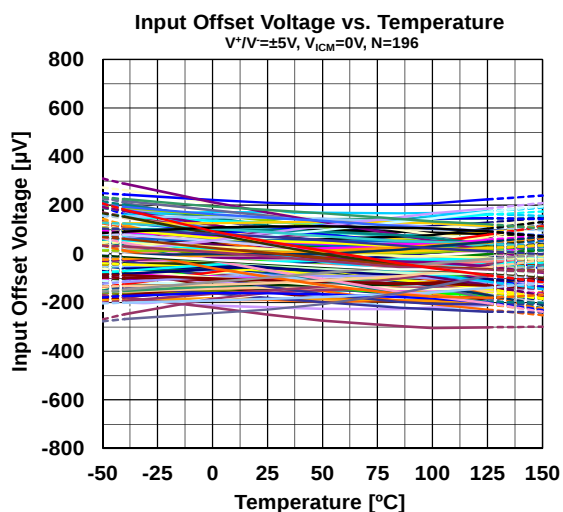
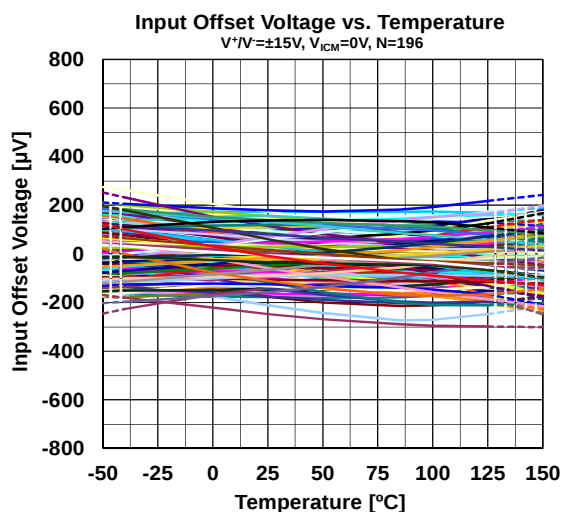
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Characteristics						
Input Offset Voltage						
NJM8512BR/NJM8512BE	V_{IO1}		-	80	400	μV
	V_{IO2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	700	μV
NJM8512AR/NJM8512AE	V_{IO1}		-	80	800	μV
	V_{IO2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	1400	μV
Input Offset Voltage Drift						
NJM8512BR/NJM8512BE	$\Delta V_{IO} / \Delta T$	$T_a = -40^\circ C$ to $125^\circ C$	-	0.8	5	$\mu V / ^\circ C$
NJM8512AR/NJM8512AE	$\Delta V_{IO} / \Delta T$	$T_a = -40^\circ C$ to $125^\circ C$	-	1	9	$\mu V / ^\circ C$
Input Bias Current	I_{B1}		-	25	80	pA
	I_{B2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	35	nA
Input Offset Current	I_{IO1}		-	6	75	pA
	I_{IO2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	2	nA
Common Mode Input Voltage Range	V_{ICM1}	CMR 86dB	-12.5	-	+12.5	V
	V_{ICM2}	CMR 80dB, $T_a = -40^\circ C$ to $125^\circ C$	-12.5	-	+12.5	V
Common Mode Rejection Ratio	CMR1	$V_{CM} = -12.5V$ to $+12.5V$	86	108	-	dB
	CMR2	$V_{CM} = -12.5V$ to $+12.5V$, $T_a = -40^\circ C$ to $125^\circ C$	80	-	-	dB
	CMR3	$V_{CM} = -10V$ to $+10V$	100	120	-	dB
Voltage Gain	A_{V1}	$R_L = 2k\Omega$, $V_O = -13.5V$ to $+13.5V$	90	100	-	dB
	A_{V2}	$R_L = 2k\Omega$, $V_O = -13.5V$ to $+13.5V$, $T_a = -40^\circ C$ to $125^\circ C$	82	-	-	dB
	A_{V3}	$R_L = 10k\Omega$, $V_O = -13.5V$ to $+13.5V$	98	106	-	dB
Input capacitance	C_{IN}		-	10	-	pF
Channel Separation	CS	DC	-	125	-	dB
Output Characteristics						
Maximum Output Voltage	V_{OH1}	$R_L = 10k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	+14.0	+14.2	-	V
	V_{OL1}	$R_L = 10k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	-	-14.9	-14.6	V
	V_{OH2}	$R_L = 2k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	+13.8	+14.1	-	V
	V_{OL2}	$R_L = 2k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	-	-14.8	-14.4	V
	V_{OH31}	$R_L = 600\Omega$	+13.5	+13.9	-	V
	V_{OH32}	$R_L = 600\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	+11.4	-	-	V
	V_{OL41}	$R_L = 600\Omega$	-	-14.3	-13.8	V
	V_{OL42}	$R_L = 600\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	-	-	-12.1	V
Supply Characteristics						
Supply Current	I_{CC1}	$G_V = +1$, $R_L = \infty$	-	2.6	3.0	mA
	I_{CC2}	$G_V = +1$, $R_L = \infty$, $T_a = -40^\circ C$ to $125^\circ C$	-	-	3.3	mA
Supply Voltage Rejection Ratio	SVR1	$V^+ / V^- = \pm 4.5V$ to $\pm 16V$	86	110	-	dB
	SVR2	$V^+ / V^- = \pm 4.5V$ to $\pm 16V$, $T_a = -40^\circ C$ to $125^\circ C$	80	-	-	dB
Dynamic Performance						
Unity Gain Frequency	fT	$G_V = +100$, $R_L = 2k\Omega$, $C_L = 10pF$	-	7	-	MHz
Slew Rate	+SR	RISE, $G_V = +1$, $V_{IN} = 1V_{pp}$, $R_L = 2k\Omega$	-	20	-	V/ μs
	-SR	FALL, $G_V = +1$, $V_{IN} = 1V_{pp}$, $R_L = 2k\Omega$	-	20	-	V/ μs
Settling Time	ts1	To 0.1%, 0V to 10V step, $G_V = +1$	-	0.7	-	μs
	ts2	To 0.01%, 0V to 10V step, $G_V = +1$	-	1.0	-	μs
Phase Margin	Φ_M		-	70	-	deg
Total Harmonic Distortion	THD	f0=1kHz, $G_V = +1$, $R_L = 2k\Omega$	-	0.0004	-	%
Noise Performance						
Input Voltage Noise Density	V_{NI}	f0=0.1Hz to 10Hz	-	0.9	-	μV_{pp}
	en1	f0=10Hz	-	20	-	nV/ $\sqrt{Hz}$
	en2	f0=100Hz	-	11	-	nV/ $\sqrt{Hz}$
	en3	f0=1kHz	-	10	-	nV/ $\sqrt{Hz}$
	en4	f0=10kHz	-	9	-	nV/ $\sqrt{Hz}$

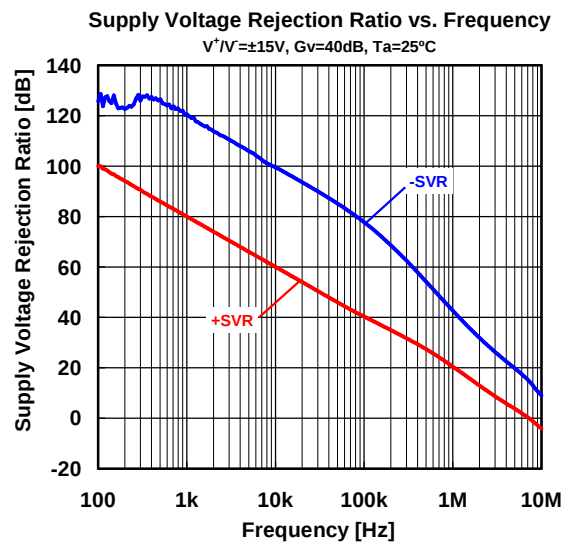
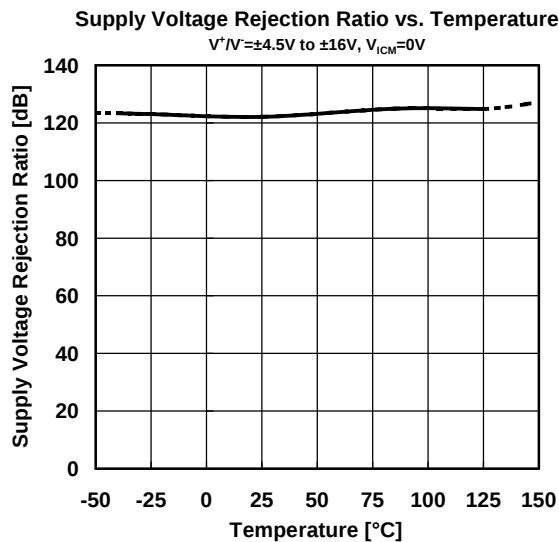
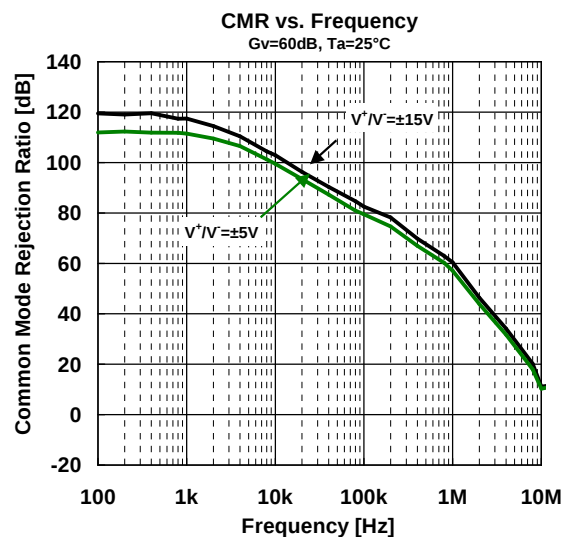
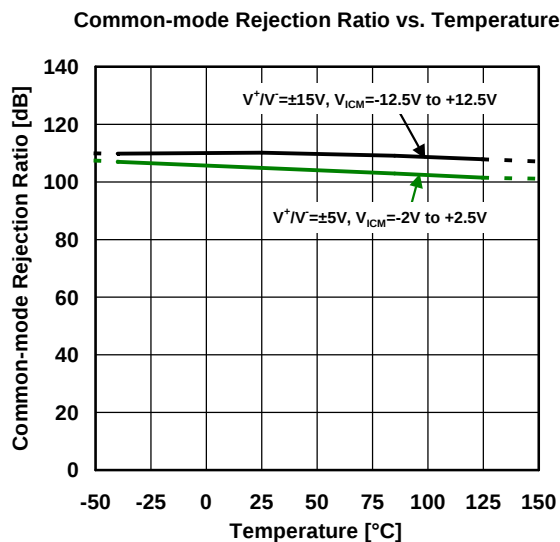
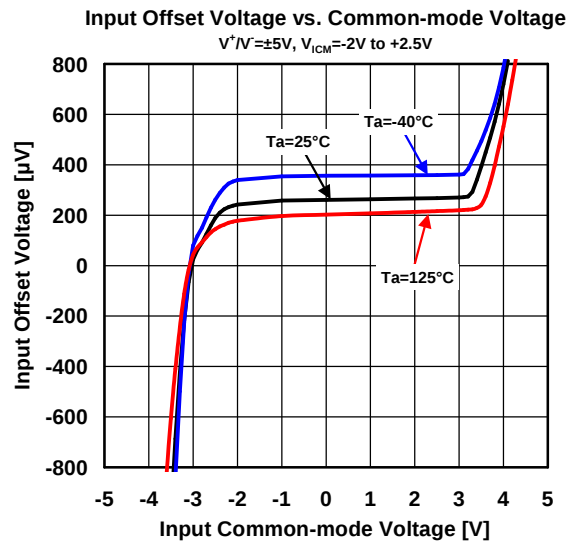
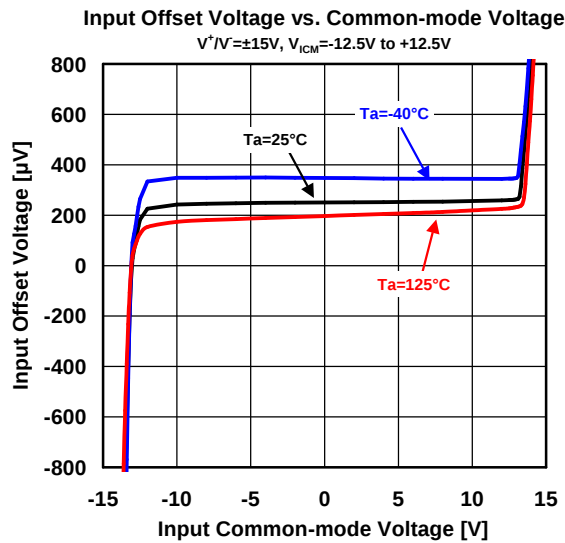
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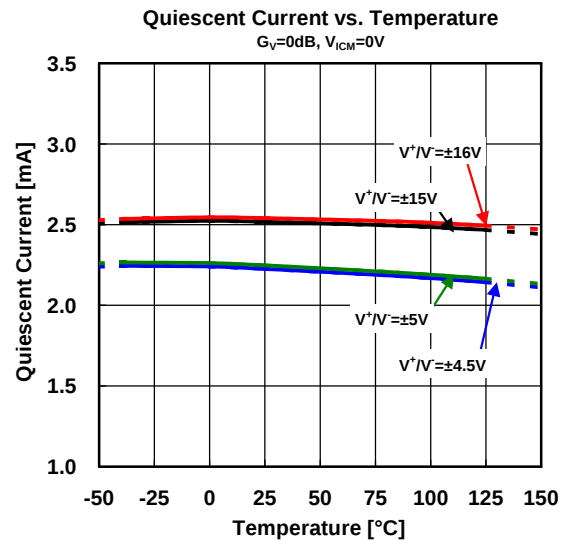
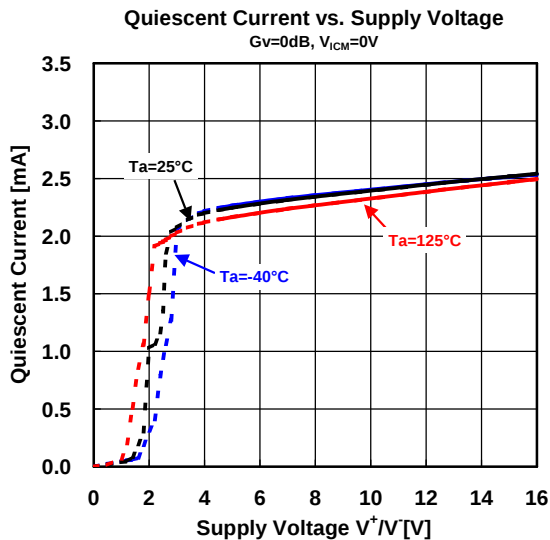
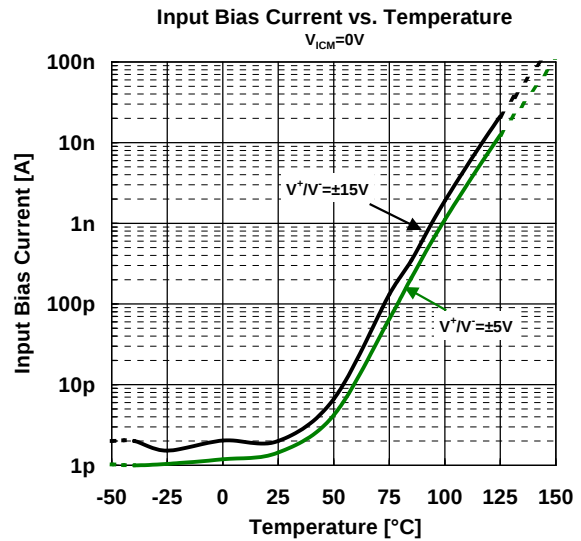
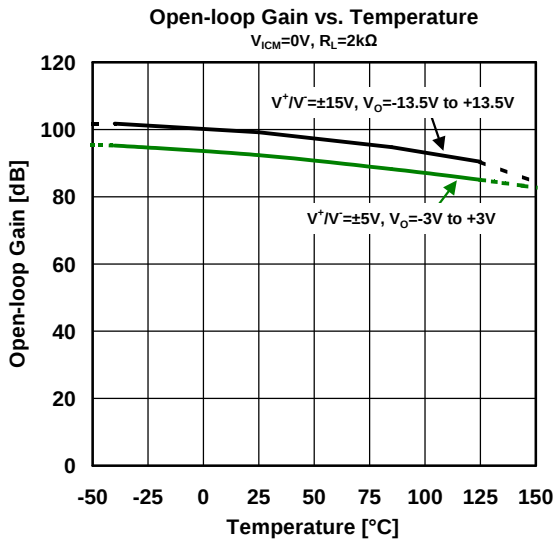
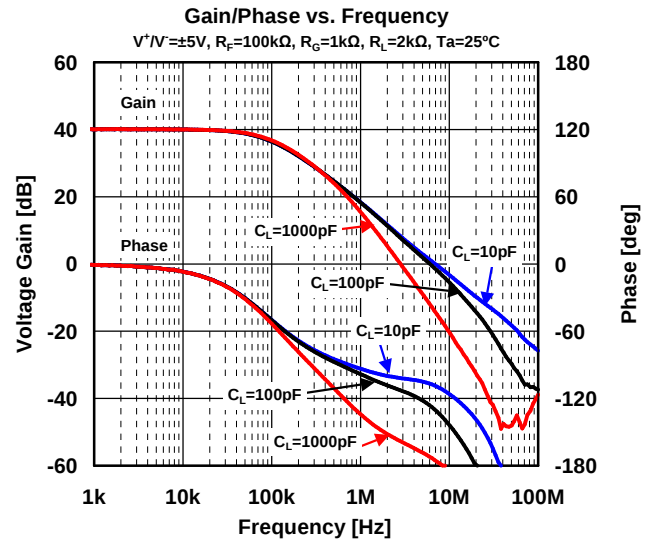
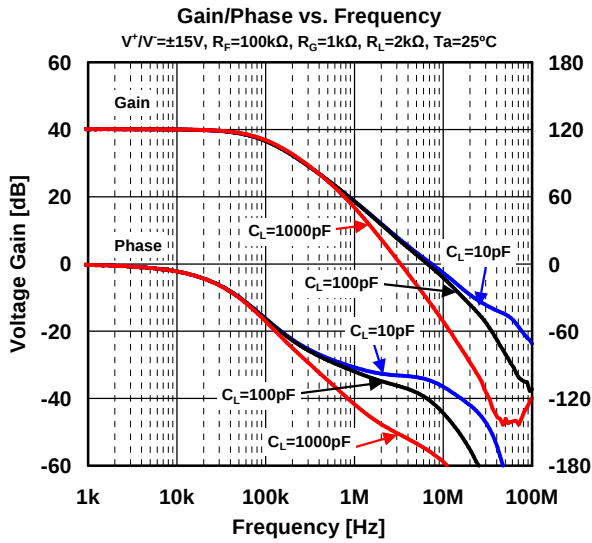
■ELECTRICAL CHARACTERISTICS ($V^+V^- = \pm 5V$, $T_a = 25^\circ C$, $V_{ICM} = 0V$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Characteristics						
Input Offset Voltage						
NJM8512BR/NJM8512BE	V_{IO1}		-	80	400	μV
	V_{IO2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	700	μV
NJM8512AR/NJM8512AE	V_{IO1}		-	80	800	μV
	V_{IO2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	1400	μV
Input Offset Voltage Drift						
NJM8512BR/NJM8512BE	$\Delta V_{IO}/\Delta T$	$T_a = -40^\circ C$ to $125^\circ C$	-	0.8	5	$\mu V/^\circ C$
NJM8512AR/NJM8512AE	$\Delta V_{IO}/\Delta T$	$T_a = -40^\circ C$ to $125^\circ C$	-	1	9	$\mu V/^\circ C$
Input Bias Current	I_{B1}		-	21	75	pA
	I_{B2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	31	nA
Input Offset Current	I_{IO1}		-	5	50	pA
	I_{IO2}	$T_a = -40^\circ C$ to $125^\circ C$	-	-	2	nA
Common Mode Input Voltage Range	V_{ICM1}	CMR 86dB	-2	-	+2.5	V
	V_{ICM2}	CMR 80dB, $T_a = -40^\circ C$ to $125^\circ C$	-2	-	+2.5	V
Common Mode Rejection Ratio	CMR1	$V_{CM} = -2V$ to $+2.5V$	86	108	-	dB
	CMR2	$V_{CM} = -2V$ to $+2.5V$, $T_a = -40^\circ C$ to $125^\circ C$	80	-	-	dB
	CMR3	$V_{CM} = -1V$ to $+2V$	92	113	-	dB
Voltage Gain	A_{V1}	$R_L = 2k\Omega$, $V_O = -3V$ to $+3V$	85	93	-	dB
	A_{V2}	$R_L = 2k\Omega$, $V_O = -3V$ to $+3V$, $T_a = -40^\circ C$ to $125^\circ C$	80	-	-	dB
	A_{V3}	$R_L = 10k\Omega$, $V_O = -3V$ to $+3V$	90	100	-	dB
Input capacitance	C_{IN}		-	10	-	pF
Channel Separation	CS	DC	-	125	-	dB
Output Characteristics						
Maximum Output Voltage	V_{OH1}	$R_L = 10k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	+4.1	+4.3	-	V
	V_{OL1}	$R_L = 10k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	-	-4.9	-4.7	V
	V_{OH2}	$R_L = 2k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	+3.9	+4.2	-	V
	V_{OL2}	$R_L = 2k\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	-	-4.9	-4.5	V
	V_{OH31}	$R_L = 600\Omega$	+3.7	+4.1	-	V
	V_{OH32}	$R_L = 600\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	+3.6	-	-	V
	V_{OL41}	$R_L = 600\Omega$	-	-4.8	-4.3	V
	V_{OL42}	$R_L = 600\Omega$, $T_a = -40^\circ C$ to $125^\circ C$	-	-	-4.2	V
Supply Characteristics						
Supply Current	I_{CC1}	$G_V = +1$, $R_L = \infty$	-	2.0	3.0	mA
	I_{CC2}	$G_V = +1$, $R_L = \infty$, $T_a = -40^\circ C$ to $125^\circ C$	-	-	3.3	mA
Dynamic Performance						
Unity Gain Frequency	fT	$G_V = +100$, $R_L = 2k\Omega$, $C_L = 10pF$	-	7	-	MHz
Slew Rate	+SR	RISE, $G_V = +1$, $V_{IN} = 1V_{pp}$, $R_L = 2k\Omega$	-	18	-	V/ μs
	-SR	FALL, $G_V = +1$, $V_{IN} = 1V_{pp}$, $R_L = 2k\Omega$	-	18	-	V/ μs
Settling Time	ts1	To 0.1%, 0V to 4V step, $G_V = +1$	-	0.5	-	μs
Phase Margin	Φ_M		-	65	-	deg
Total Harmonic Distortion	THD	$f_o = 1kHz$, $G_V = +1$, $R_L = 2k\Omega$	-	0.0005	-	%
Noise Performance						
Input Voltage Noise Density	V_{NI}	$f_o = 0.1Hz$ to $10Hz$	-	0.9	-	μV_{pp}
	en1	$f_o = 10Hz$	-	20	-	nV/ $\sqrt{Hz}$
	en2	$f_o = 100Hz$	-	11	-	nV/ $\sqrt{Hz}$
	en3	$f_o = 1kHz$	-	10	-	nV/ $\sqrt{Hz}$
	en4	$f_o = 10kHz$	-	9	-	nV/ $\sqrt{Hz}$

ELECTRICAL CHARACTERISTICS

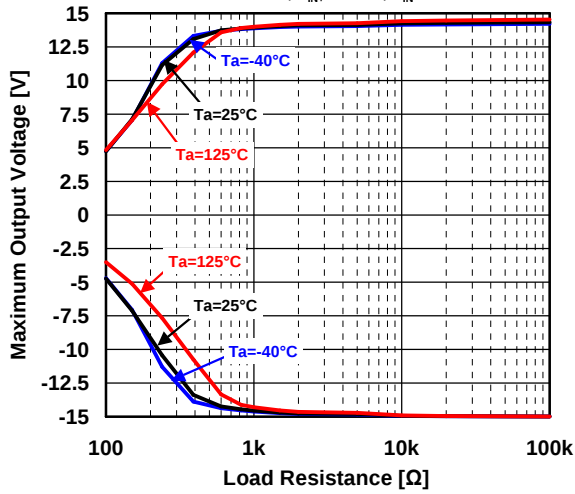






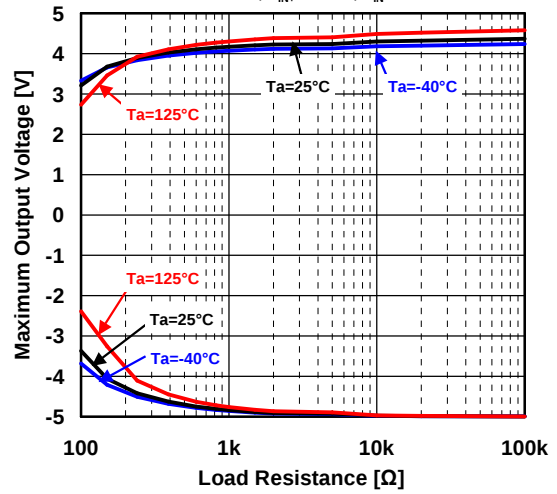
Maximum Output Voltage vs. Load Resistance

$V^+/V^- = \pm 15V$, $V_{IN+} = 1V$, $V_{IN-} = 0V$



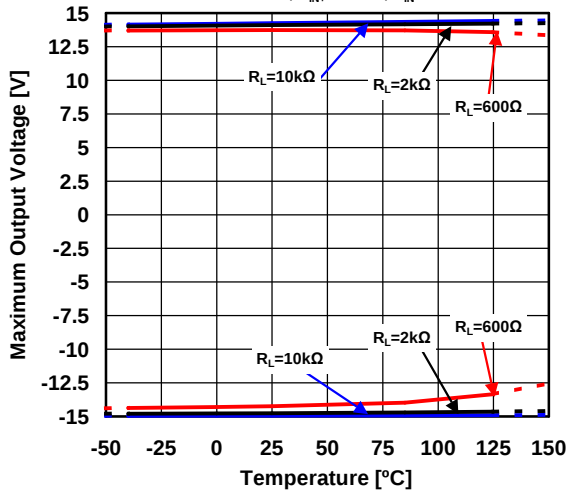
Maximum Output Voltage vs. Load Resistance

$V^+/V^- = \pm 5V$, $V_{IN+} = 1V$, $V_{IN-} = 0V$



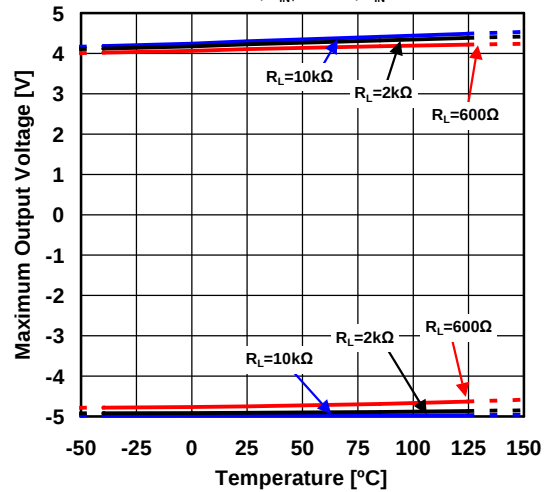
Maximum Output Voltage vs. Temperature

$V^+/V^- = \pm 15V$, $V_{IN+} = 1V$, $V_{IN-} = 0V$



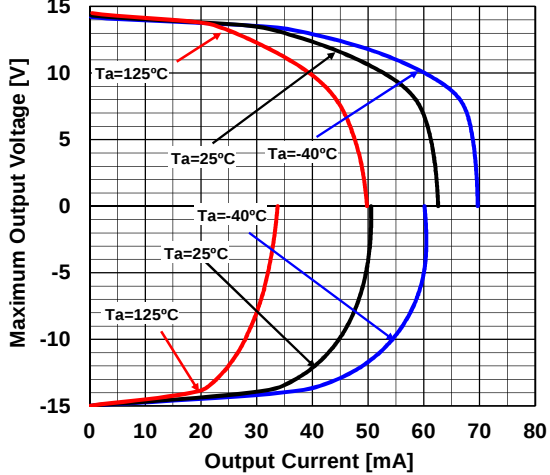
Maximum Output Voltage vs. Temperature

$V^+/V^- = \pm 5V$, $V_{IN+} = 1V$, $V_{IN-} = 0V$



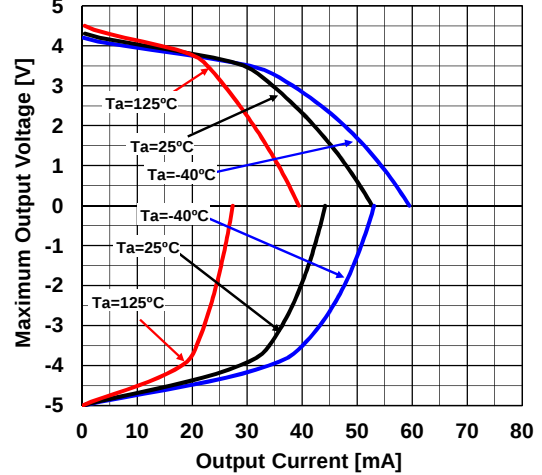
Maximum Output Voltage vs. Output Current

$V^+/V^- = \pm 15V$, $V_{IN+} = 1V$, $V_{IN-} = 0V$



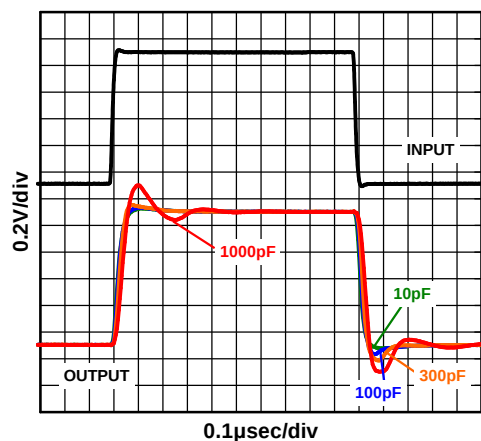
Maximum Output Voltage vs. Output Current

$V^+/V^- = \pm 5V$, $V_{IN+} = 1V$, $V_{IN-} = 0V$



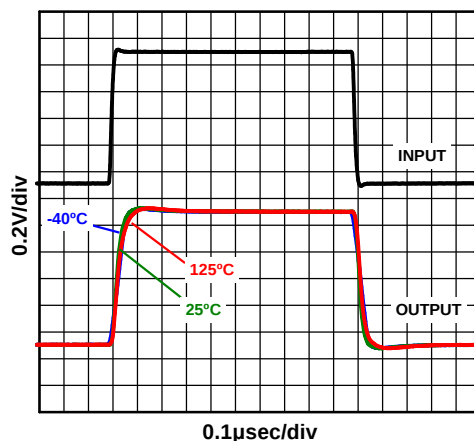
Small-Signal Step Response (Load Capacitance)

$V^+/V^- = \pm 15V$, $G_v = 0dB$, $V_{IN} = 1V_{pp}$, $R_L = 2k\Omega$, $T_a = 25^\circ C$



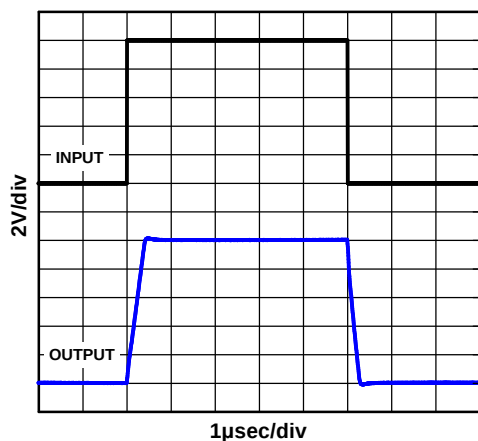
Small-Signal Step Response (Temperature)

$V^+/V^- = \pm 15V$, $G_v = 0dB$, $V_{IN} = 1V_{pp}$, $R_L = 2k\Omega$, $C_L = 10pF$



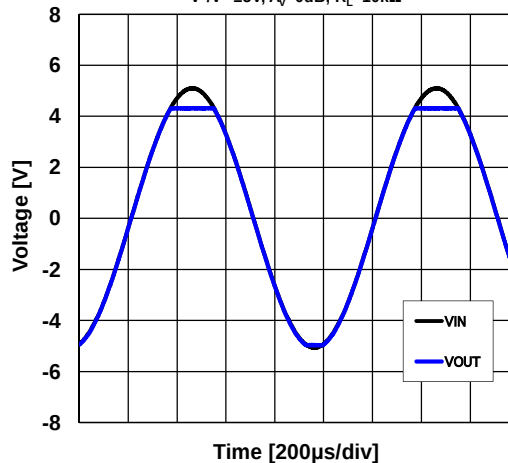
Large Signal Step Response

$V^+/V^- = \pm 15V$, $G_v = 0dB$, $V_{IN} = 10V_{pp}$, $R_L = 2k\Omega$



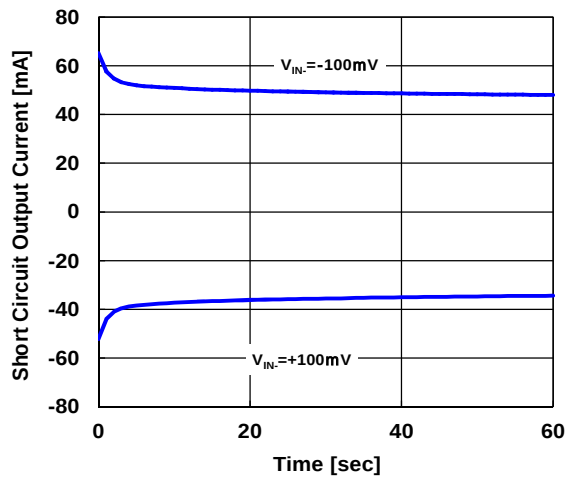
Input Voltage vs. Output Voltage

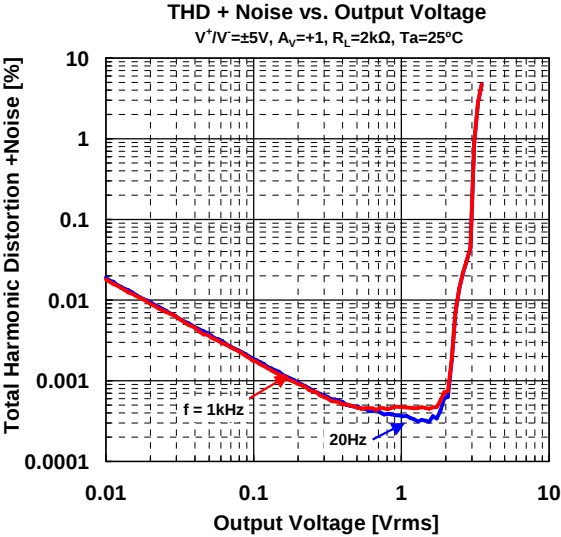
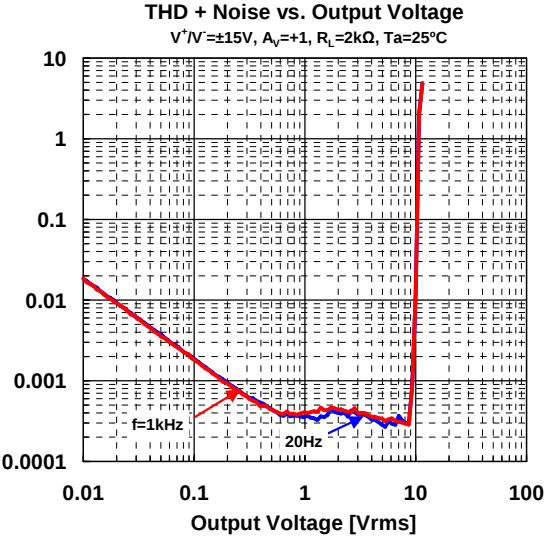
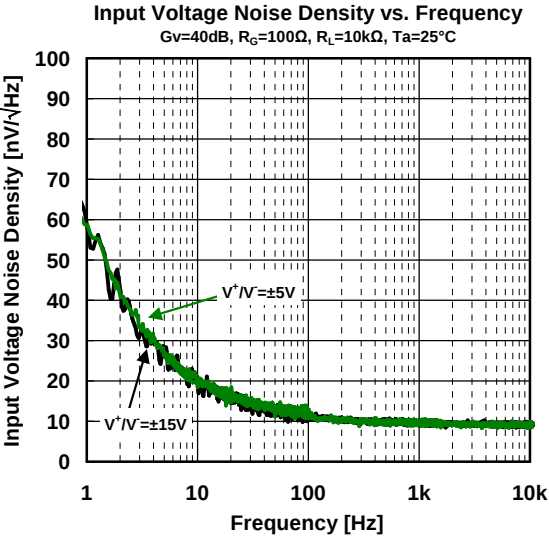
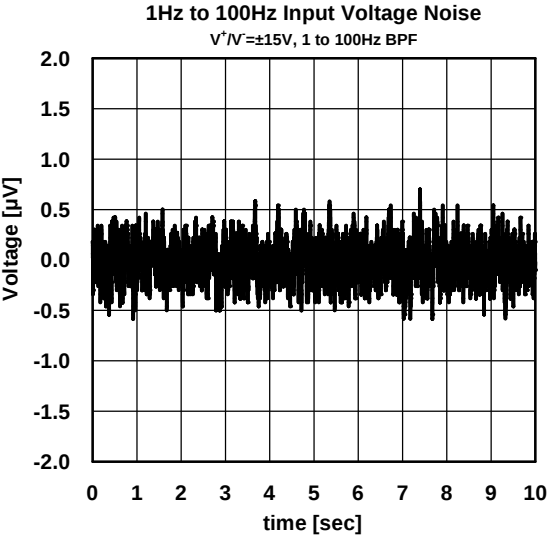
$V^+/V^- = \pm 5V$, $A_v = 0dB$, $R_L = 10k\Omega$



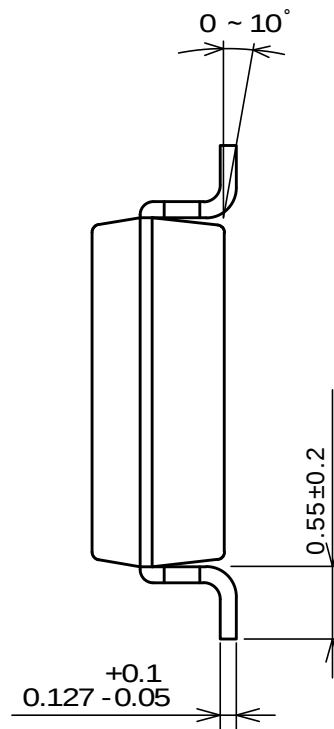
Short Circuit Output Current

$V^+/V^- = \pm 15V$, $V_{IN} = 0V$, $V_O = 0V$, $T_a = 25^\circ C$





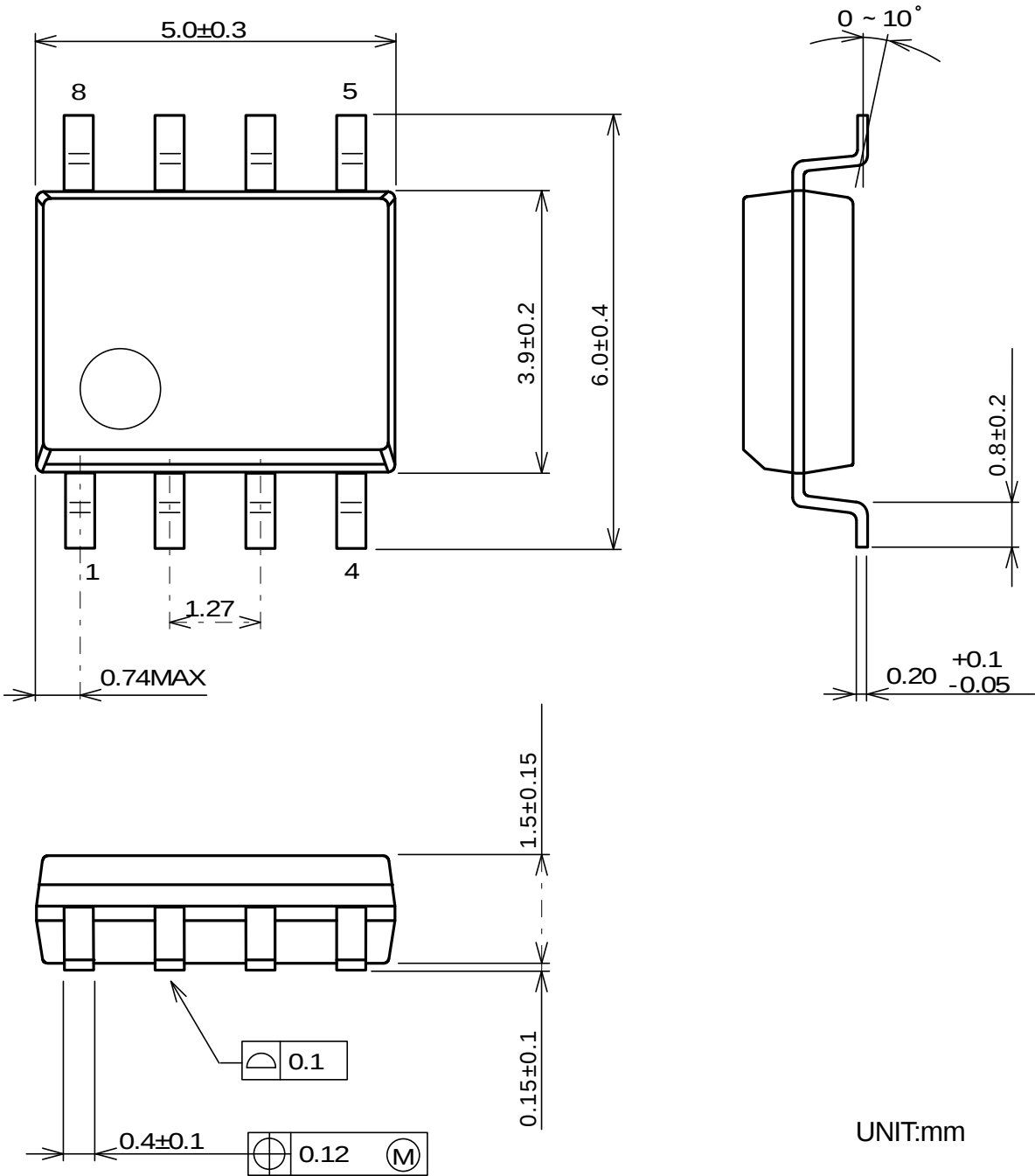
MSOP8(VSP8)



NJM8512

■PACKAGE DIMENSIONS

SOP8 JEDEC 150 mil



[CAUTION]
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