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National Semiconductor

LMP8671
LMP8672
LMP8674

July 29, 2011

Single, Dual, and Quad 40V Low Noise Precision Amplifiers

General Description

The LMP8671/2/4 combines great precision, low noise and a large operating voltage range to provide a high SNR and a wide dynamic range. Its AC performance allows it to be used over a wide frequency without degradation. It is the ideal choice for applications requiring DC precision and low noise such as precision PLL filters, multi feedback and multi pole active filters, GPS receivers and precision control loop systems. The LMP8671/2/4 offers an extremely high open loop gain of 135dB, low voltage noise density (2.5nV/$\sqrt{Hz}$), and a superb linearity of 0.000009%. These characteristics drastically reduce gain error which is a challenge in accurate systems requiring higher gains such as data acquisition systems.

To ensure that the most challenging loads are driven without compromise, the LMP8671/2/4 has a high slew rate of ±20V/µs and an output current capability of ±26mA.

The LMP8671/2 family of high-voltage amplifiers are available in SOIC-8, the LMP8674 in SOIC-14.

Key Specifications

- Input Offset Voltage 0.4mV
- TC V_{OS} 2µV/°C (max)
- Power Supply Voltage Range ±2.5V to ±20V
- Voltage Noise Density 2.5nV/$\sqrt{Hz}$
- Slew Rate ±20V/µs
- Gain Bandwidth Product 55MHz
- Open Loop Gain 135dB
- Input Bias Current 10nA

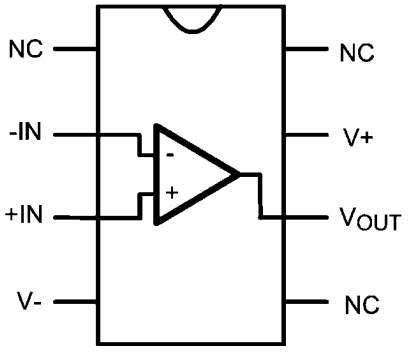
Features

- Output short circuit protection
- PSRR and CMRR exceed 110dB
- Best in class linearity (135dB)

Applications

- Low noise industrial applications including test, measurement, and ultrasound
- Precision Active Filters
- PLL Filters
- 4-20mA Current Loops
- Motor Control

Connection Diagrams



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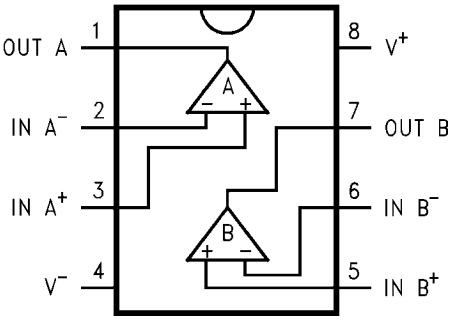
Order Number LMP8671MA
See NS Package Number — M08A



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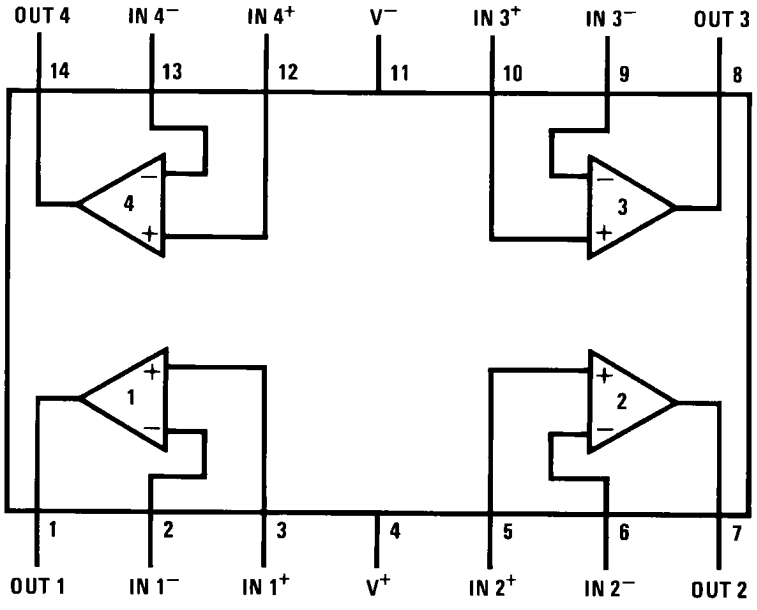
Order Number LMP8672MA
See NS Package Number — M08A



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Order Number LMP8674MA
See NS Package Number — M14A

Absolute Maximum Ratings (*Note 1*, *Note 2*)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Power Supply Voltage ($V_S = V^+ - V^-$)	46V
Storage Temperature	−65°C to 150°C
Input Voltage	(V-) − 0.7V to (V+) + 0.7V
Output Short Circuit (*Note 3*)	Continuous
Power Dissipation	Internally Limited
ESD Rating (*Note 4*)	2000V
ESD Rating (*Note 5*)	
Pins 1, 4, 7 and 8	200V
Pins 2, 3, 5 and 6	100V
Junction Temperature	150°C
Thermal Resistance	
θ_{JA} (SO)	145°C/W

For soldering specifications, see product folder at www.national.com and www.national.com/ms/MS/MS-SOLDERING.pdf

Operating Ratings

Temperature Range	
$T_{MIN} \le T_A \le T_{MAX}$	$-40°C \le T_A \le 125°C$
Supply Voltage Range	
LMP8671/2/4	$\pm 2.5V \le V_S \le \pm 22V$

Electrical Characteristics for the LMP8671/2/4 (*Note 1*)

The following specifications apply for $V_S = \pm 20V$, $R_L = 2k\Omega$, $R_{SOURCE} = 10\Omega$, $f_{IN} = 1kHz$, $T_A = 25°C$, unless otherwise specified. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	LMP8671/2/4		Units (Limits)
			Typical (*Note 6*)	Limit (*Note 7*)	
V_{OS}	Offset Voltage		±100	±400 **±750**	µV (max)
$\Delta V_{OS}/\Delta Temp$	Average Input Offset Voltage Drift vs Temperature	$-40°C \le T_A \le 125°C$	0.1	2	µV/°C (max)
I_B	Input Bias Current	$V_{CM} = 0V$			
		LMP8671/4	10	±75 **±95**	nA (max)
		$V_{CM} = 0V$			
		LMP8672	50	±200 **±250**	nA (max)
I_{OS}	Input Offset Current	$V_{CM} = 0V$			
		LMP8671/4	11	±50 **±95**	nA (max)
		$V_{CM} = 0V$			
		LMP8672	25	±100 **±125**	nA (max)
$\Delta I_{OS}/\Delta Temp$	Input Bias Current Drift vs Temperature	$-40°C \le T_A \le 125°C$	0.2		nA/°C
V_{IN-CM}	Common-Mode Input Voltage Range		+17.1 −16.9		V (min) V (min)
Z_{IN}	Differential Input Impedance		30		kΩ
	Common Mode Input Impedance	−10V<Vcm<10V	1000		MΩ
e_n	Equivalent Input Noise Voltage	20Hz to 20kHz	0.34	0.65	μV_{RMS} (max)
	Equivalent Input Noise Density	f = 1kHz	2.5	4.7	$nV/\sqrt{Hz}$ (max)
i_n	Current Noise Density	f = 1kHz f = 10Hz	1.6 3.1		$pA/\sqrt{Hz}$
THD+N	Total Harmonic Distortion + Noise	$A_V = 1$, $V_{OUT} = 3V_{rms}$, $R_L = 600\Omega$	0.00003	0.00009	% (max)
t_S	Settling time	$A_V = -1$, 10V step, $C_L = 100pF$ 0.1% error range	1.2		µs
GBWP	Gain Bandwidth Product		55	45	MHz (min)

Symbol	Parameter	Conditions	LMP8671/2/4		Units (Limits)
			Typical (*Note 6*)	Limit (*Note 7*)	
SR	Slew Rate		±20	±15	V/µs (min)
PSRR	Average Input Offset Voltage Shift vs Power Supply Voltage	(*Note 8*)	125	110 **100**	dB (min)
CMRR	Common-Mode Rejection	–15V≤Vcm≤15V	115	105 **100**	dB (min)
A_{VOL}	Open Loop Voltage Gain	–15V ≤ Vout ≤ 15V R_L = 2kΩ	135	125	dB (min)
V_{OUTMAX}	Maximum Output Voltage Swing	R_L = 2kΩ	±19.0	±18.8 ±18.6	V (min)
I_{OUT-CC}	Instantaneous Short Circuit Current		+53 –42		mA
R_{OUT}	Output Impedance	f_{IN} = 10kHz Closed-Loop Open-Loop	 0.01 13		Ω
I_{OUT}	Output Current	R_L = 2kΩ	9.5	9.3	mA (min)
I_S	Total Quiescent Current	I_{OUT} = 0mA			
		LMP8671	5	6 **8**	mA (max)
		LMP8672	12.5	16	mA (max)
		LMP8674	20	22	mA (max)

Note 1: "*Absolute Maximum Ratings*" indicate limits beyond which damage to the device may occur, including inoperability and degradation of device reliability and/or performance. Functional operation of the device and/or non-degradation at the *Absolute Maximum Ratings* or other conditions beyond those indicated in the *Recommended Operating Conditions* is not implied. The *Recommended Operating Conditions* indicate conditions at which the device is functional and the device should not be operated beyond such conditions. All voltages are measured with respect to the ground pin, unless otherwise specified.

Note 2: The *Electrical Characteristics* tables list guaranteed specifications under the listed *Recommended Operating Conditions* except as otherwise modified or specified by the *Electrical Characteristics Conditions* and/or Notes. Typical specifications are estimations only and are not guaranteed.

Note 3: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{JMAX}, θ_{JA}, and the ambient temperature, T_A. The maximum allowable power dissipation is $P_{DMAX} = (T_{JMAX} - T_A) / \theta_{JA}$ or the number given in *Absolute Maximum Ratings*, whichever is lower.

Note 4: Human body model, applicable std. JESD22-A114C.

Note 5: Machine model, applicable std. JESD22-A115-A.

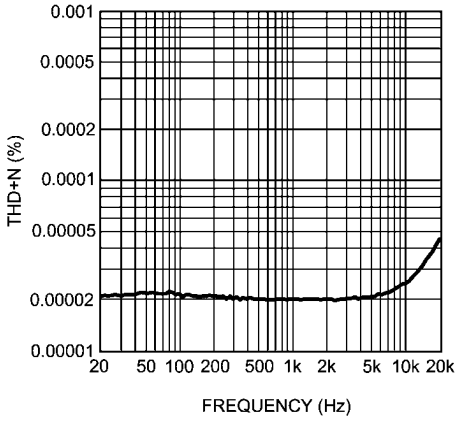
Note 6: Typical values represent most likely parametric norms at T_A = +25ºC, and at the *Recommended Operation Conditions* at the time of product characterization and are not guaranteed.

Note 7: Datasheet min/max specification limits are guaranteed by test or statistical analysis.

Note 8: PSRR is measured as follows: For V_S, V_{OS} is measured at two supply voltages, ±5V and ±20V, PSRR = $|20\log(\Delta V_{OS}/\Delta V_S)|$.

Typical Performance Characteristics

THD+N vs Frequency
$+V_{CC} = -V_{EE} = 15V$, $V_O = 3V_{RMS}$,
$R_L = 600\Omega$



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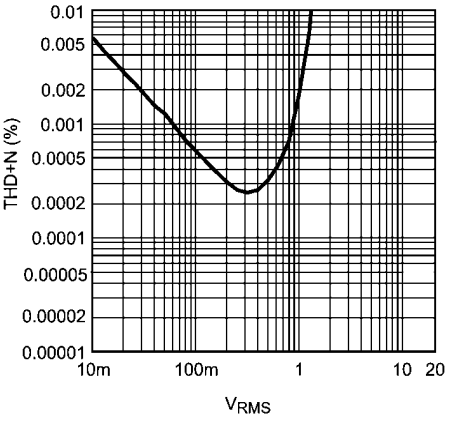
THD+N vs Output Voltage
$V_{CC} = 2.5V$, $V_{EE} = -2.5V$, $R_L = 600\ \Omega$



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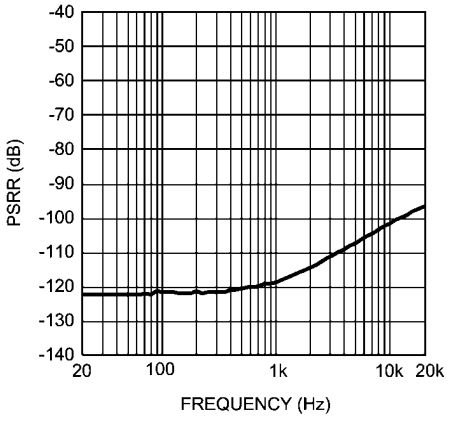
PSRR+ vs Frequency
$V_{CC} = 2.5V$, $V_{EE} = -2.5V$,
$R_L = 2k\Omega$, $V_{RIPPLE} = 200mV_{PP}$



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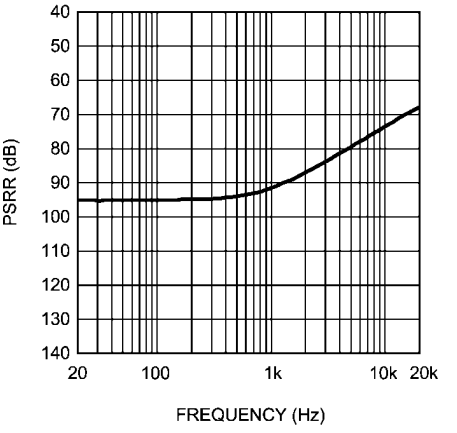
PSRR– vs Frequency
$V_{CC} = 2.5V$, $V_{EE} = -2.5V$,
$R_L = 2k\Omega$, $V_{RIPPLE} = 200mV_{PP}$



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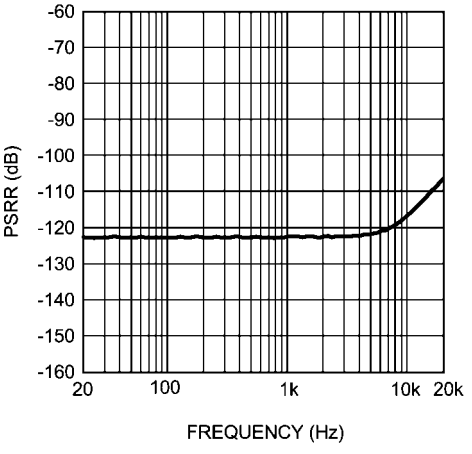
PSRR+ vs Frequency
$V_{CC} = 15V$, $V_{EE} = -15V$,
$R_L = 2k\Omega$, $V_{RIPPLE} = 200mV_{PP}$



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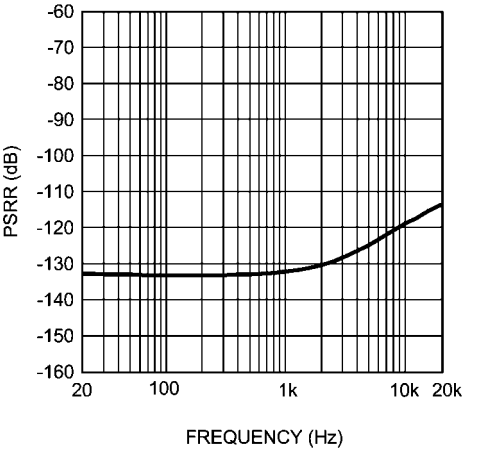
PSRR– vs Frequency
$V_{CC} = 15V$, $V_{EE} = -15V$,
$R_L = 2k\Omega$, $V_{RIPPLE} = 200mV_{PP}$



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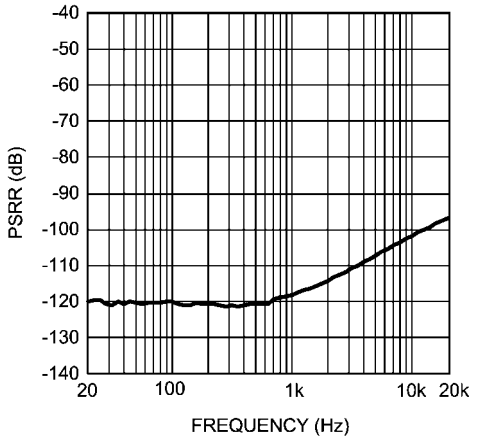
PSRR+ vs Frequency
V_{CC} = 15V, V_{EE} = −15V,
R_L = 600Ω, V_{RIPPLE} = 200mV_{PP}



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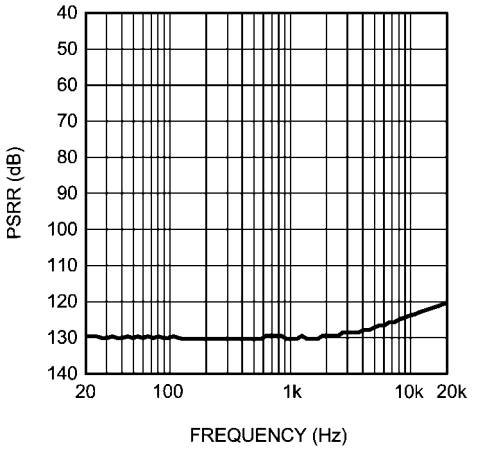
PSRR− vs Frequency
V_{CC} = 15V, V_{EE} = −15V,
R_L = 600Ω, V_{RIPPLE} = 200mV_{PP}



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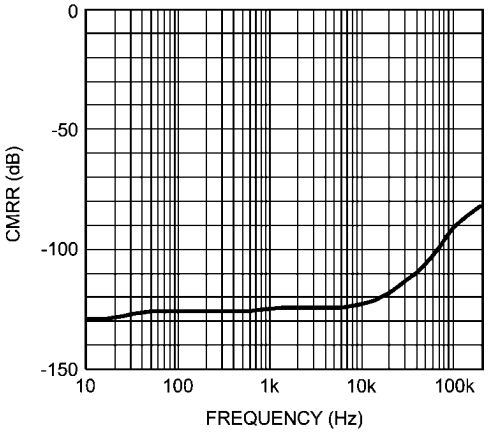
CMRR vs Frequency
V_{CC} = 15V, V_{EE} = −15V, R_L = 600Ω



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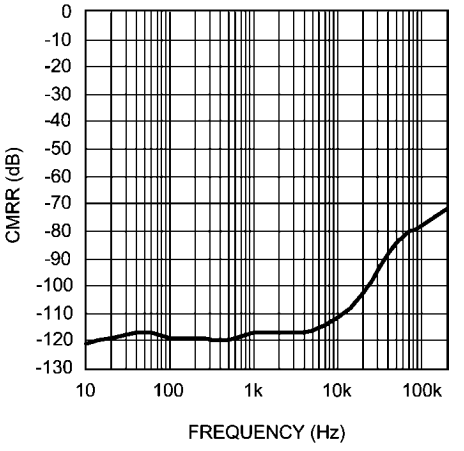
CMRR vs Frequency
V_{CC} = 15V, V_{EE} = −15V, R_L = 2kΩ



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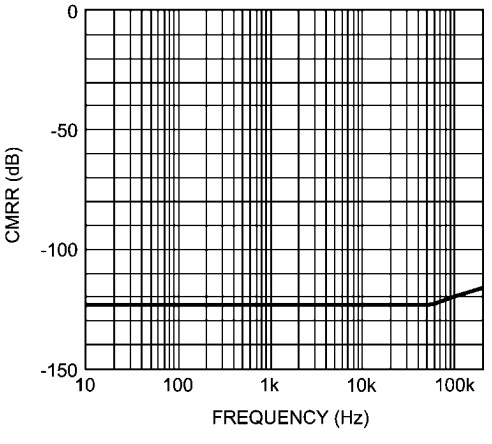
CMRR vs Frequency
V_{CC} = 2.5V, V_{EE} = −2.5V, R_L = 600Ω



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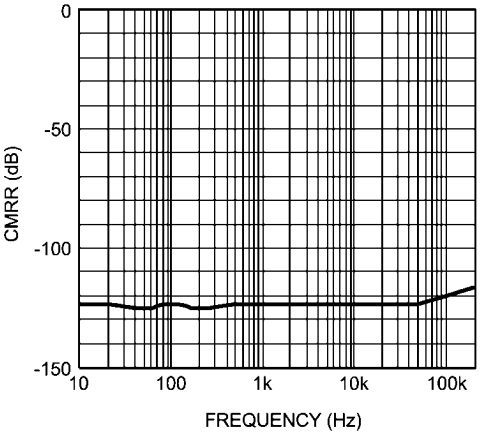
CMRR vs Frequency
V_{CC} = 2.5V, V_{EE} = −2.5V, R_L = 2kΩ



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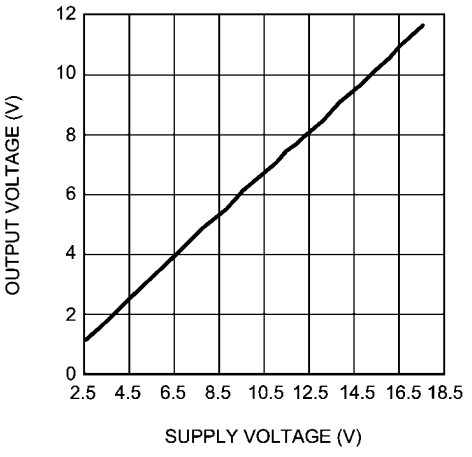
Output Voltage vs Supply Voltage
THD+N = 1%, R_L = 2kΩ



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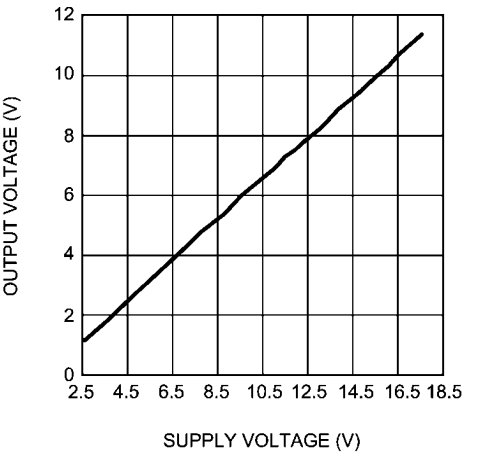
Output Voltage vs Supply Voltage
THD+N = 1%, R_L = 600Ω



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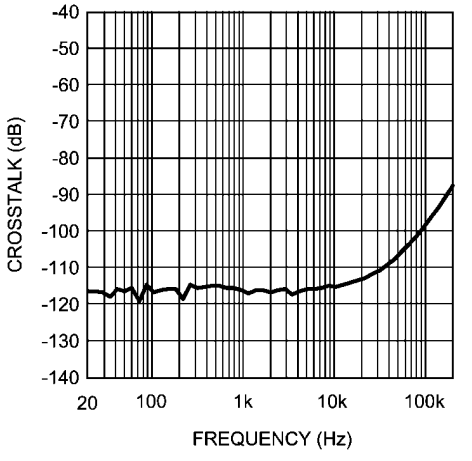
Crosstalk vs Frequency
V_{CC} = 15V, V_{EE} = −15V, R_L = 2kΩ



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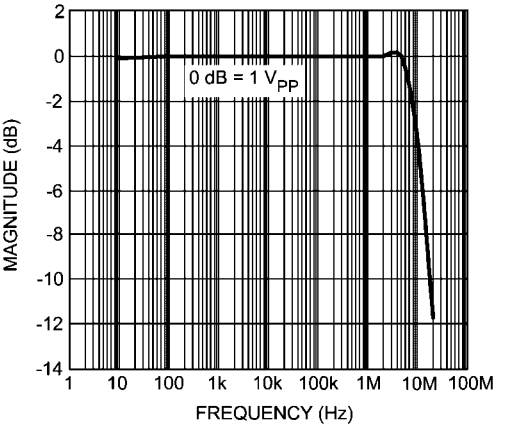
Full Power Bandwidth vs Frequency



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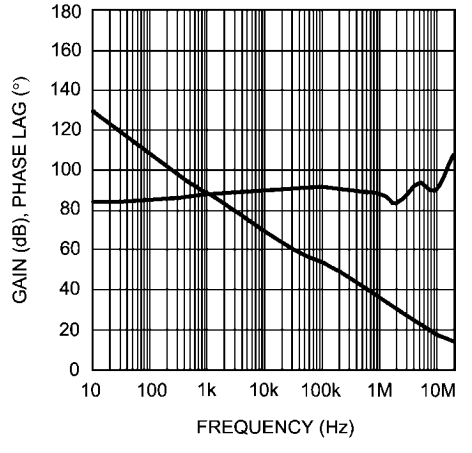
Gain Phase vs Frequency



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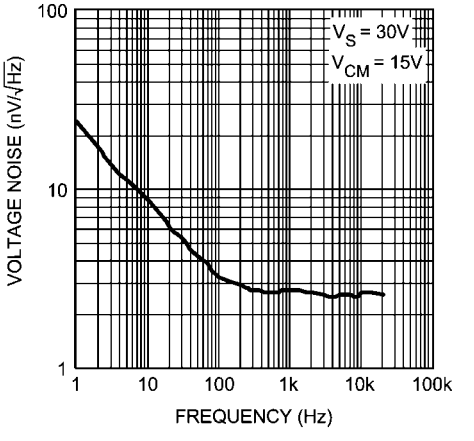
Voltage Noise Density vs Frequency



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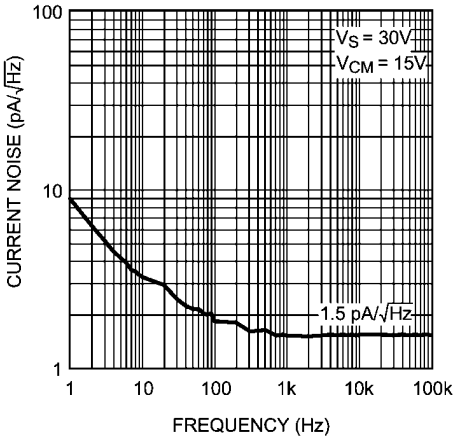
Current Noise Density vs Frequency



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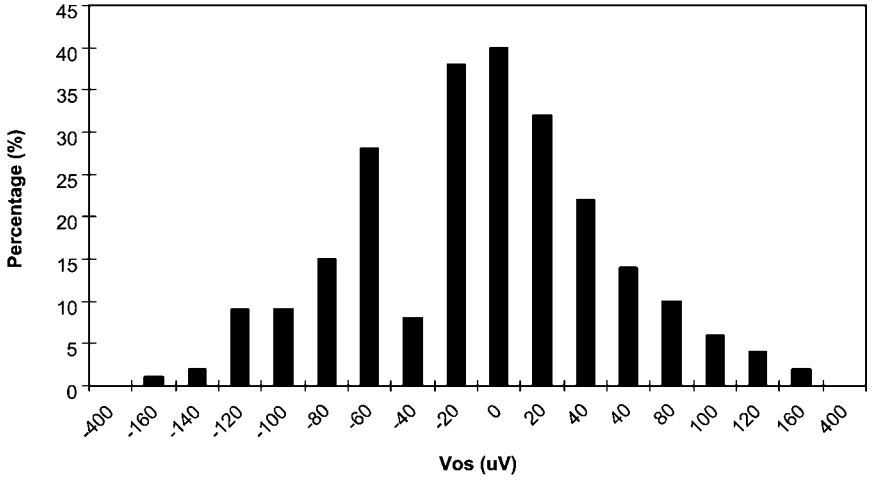
Offset Voltage Distribution
V_{CC} = ±20V



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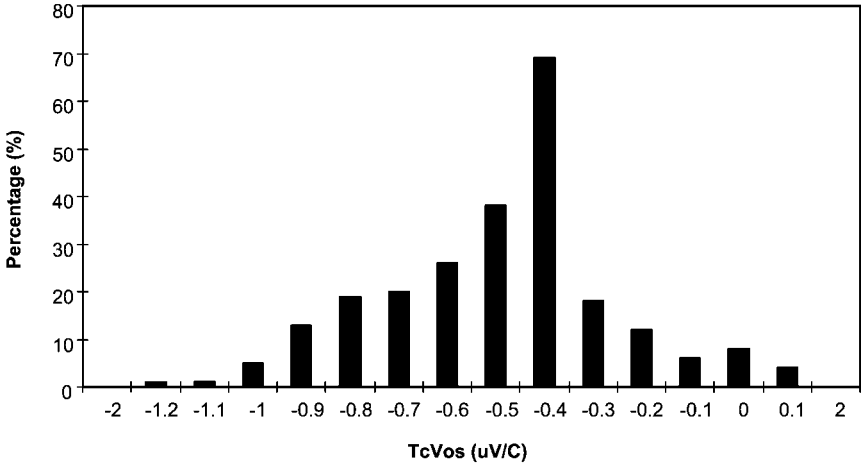
TcVos Distribution
V_{CC} = ±20V



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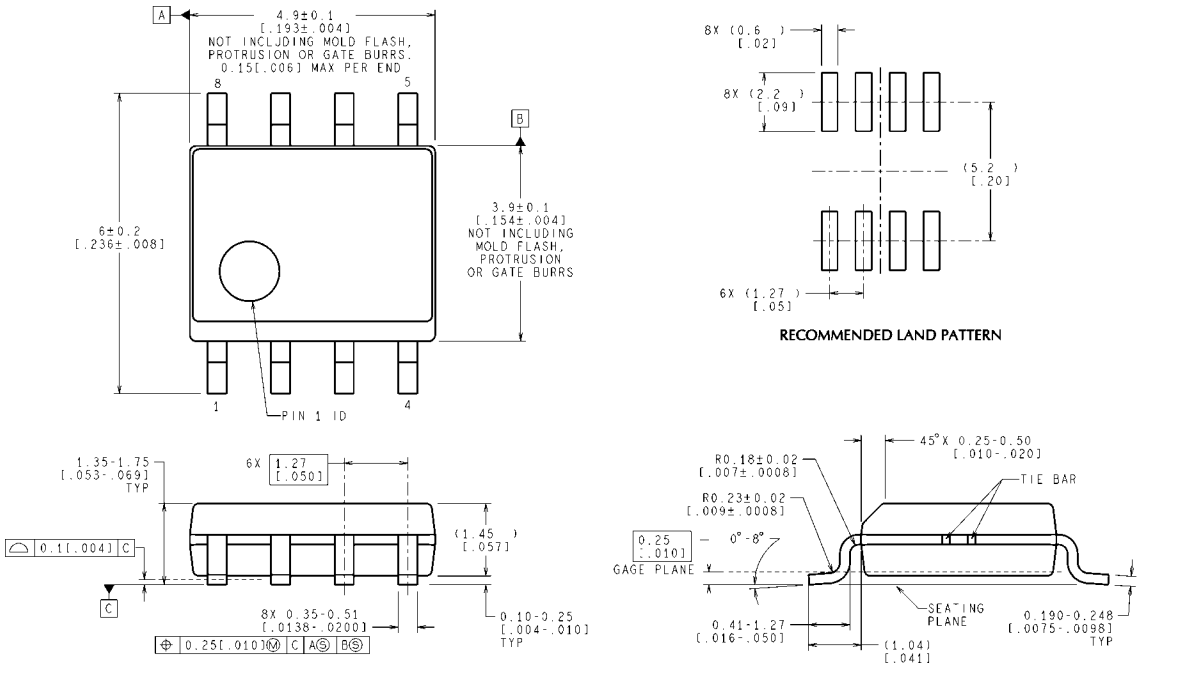
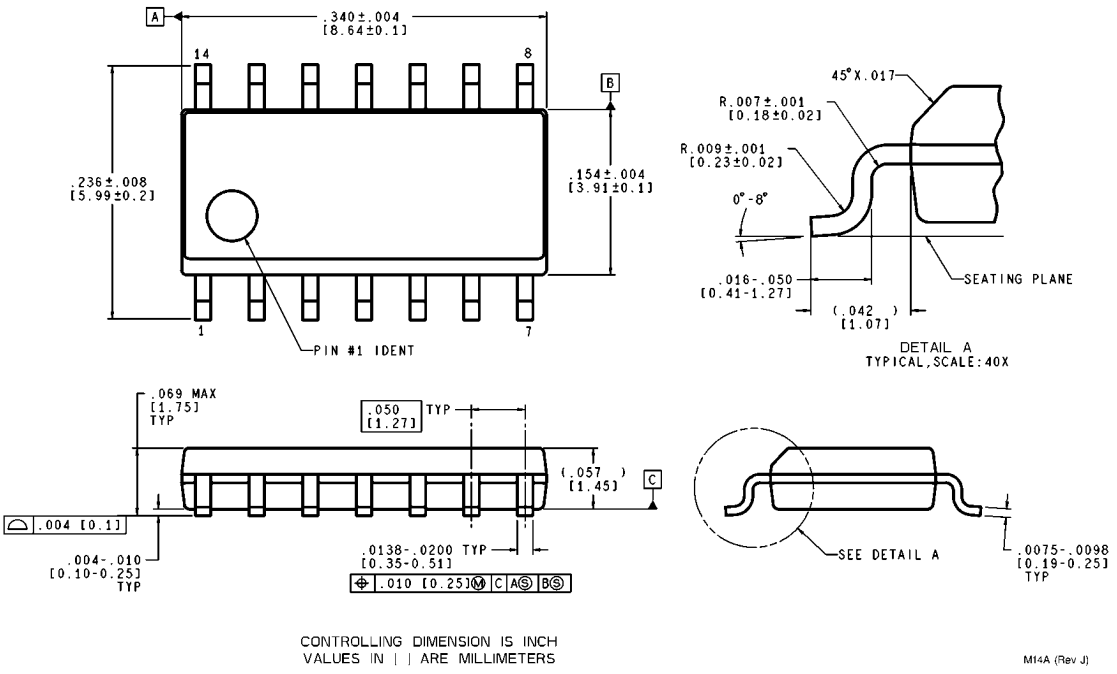
Physical Dimensions inches (millimeters) unless otherwise noted



CONTROLLING DIMENSION IS MILLIMETER
VALUES IN [ ] ARE INCHES
DIMENSIONS IN ( ) FOR REFERENCE ONLY

M08A (Rev M)

Narrow SOIC Package
Order Number LMP8671MA, LMP8672MA
NS Package Number M08A



Narrow SOIC Package
Order Number LMP8674MA
NS Package Number M14A

Notes

Notes

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