

LM308A

Precision Operational Amplifier

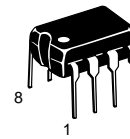
The LM308A operational amplifier provides high input impedance, low input offset and temperature drift, and low noise. These characteristics are made possible by use of a special Super Beta processing technology. This amplifier is particularly useful for applications where high accuracy and low drift performance are essential. In addition high speed performance may be improved by employing feedforward compensation techniques to maximize slew rate without compromising other performance criteria.

The LM308A offers extremely low input offset voltage and drift specifications allowing usage in even the most critical applications without external offset nulling.

- Operation from a Wide Range of Power Supply Voltages
- Low Input Bias and Offset Currents
- Low Input Offset Voltage and Guaranteed Offset Voltage Drift Performance
- High Input Impedance

SUPER GAIN OPERATIONAL AMPLIFIER

SEMICONDUCTOR TECHNICAL DATA



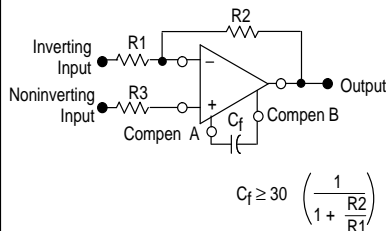
N SUFFIX
PLASTIC PACKAGE
CASE 626



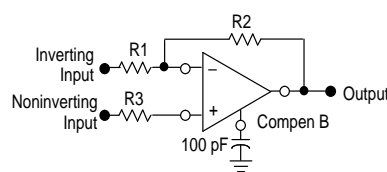
D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO-8)

Frequency Compensation

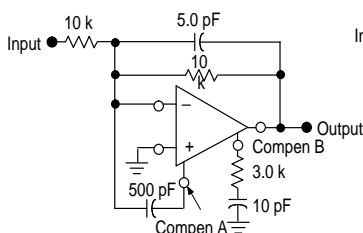
Standard Compensation



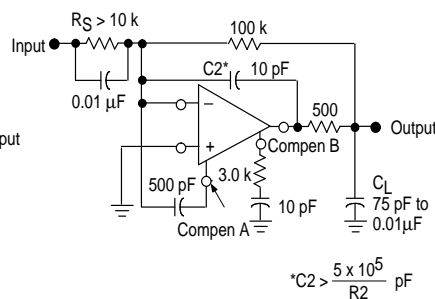
Modified Compensation



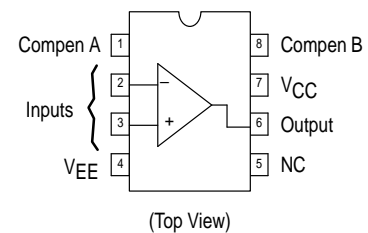
Standard Feedforward Compensation



Feedforward Compensations for Decoupling Load Capacitance



PIN CONNECTIONS



ORDERING INFORMATION

Device	Operating Temperature Range	Package
LM308AN LM308AD	$T_A = 0^\circ \text{ to } +70^\circ\text{C}$	Plastic DIP SO-8

LM308A

MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$, unless otherwise noted.)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}, V_{EE}	± 18	Vdc
Input Voltage (See Note 1)	V_I	± 15	V
Input Differential Current (See Note 2)	I_{ID}	± 10	mA
Output Short Circuit Duration	t_{SC}	Indefinite	
Operating Ambient Temperature Range	T_A	0 to +70	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$
Junction Temperature	T_J	+150	$^\circ\text{C}$

- NOTES:** 1. For supply voltages less than $\pm 15\text{ V}$, the maximum input voltage is equal to the supply voltage.
 2. The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1.0 V is applied between the inputs, unless some limiting resistance is used.

ELECTRICAL CHARACTERISTICS (Unless otherwise noted these specifications apply for supply voltages of $+5.0\text{ V} \leq V_{CC} \leq +15\text{ V}$ and $-5.0\text{ V} \geq V_{EE} \geq -15\text{ V}$, $T_A = +25^\circ\text{C}$.)

Characteristic	Symbol	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	–	0.3	0.5	mV
Input Offset Current	I_{IO}	–	0.2	1.0	nA
Input Bias Current	I_{IB}	–	1.5	7.0	nA
Input Resistance	r_i	10	40	–	$\text{M}\Omega$
Power Supply Currents ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$)	I_{CC}, I_{EE}	–	± 0.3	± 0.8	mA
Large Signal Voltage Gain ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $V_O = \pm 10\text{ V}$, $R_L \geq 10\text{ k}\Omega$)	A_{VOL}	80	300	–	V/mV

The following specifications apply over the operating temperature range.

Input Offset Voltage	V_{IO}	–	–	0.73	mV
Input Offset Current	I_{IO}	–	–	1.5	nA
Average Temperature Coefficient of Input Offset Voltage $T_A (\text{min}) \leq T_A \leq T_A (\text{max})$	$\Delta V_{IO}/\Delta T$	–	1.0	5.0	$\mu\text{V}/^\circ\text{C}$
Average Temperature Coefficient of Input Offset Current	$\Delta I_{IO}/\Delta T$	–	2.0	10	$\text{pA}/^\circ\text{C}$
Input Bias Current	I_{IB}	–	–	10	nA
Large Signal Voltage Gain ($V_{CC} +15\text{ V}$, $V_{EE} = -15\text{ V}$, $V_O = \pm 10\text{ V}$, $R_L \geq 10\text{ k}\Omega$)	A_{VOL}	60	–	–	V/mV
Input Voltage Range ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$)	V_{ICR}	± 14	–	–	V
Common Mode Rejection ($R_S \leq 50\text{ k}\Omega$)	CMR	96	110	–	dB
Supply Voltage Rejection ($R_S \leq 50\text{ k}\Omega$)	PSR	96	110	–	dB
Output Voltage Range ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $R_L = 10\text{ k}\Omega$)	V_{OR}	± 13	± 14	–	V

Figure 1. Input Bias and Input Offset Currents

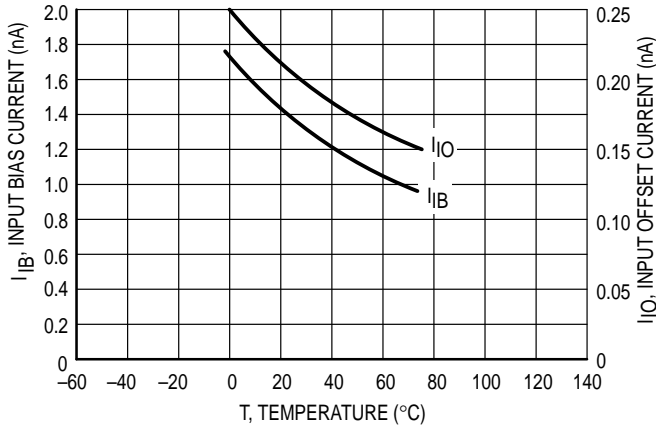


Figure 2. Maximum Equivalent Input Offset Voltage Error versus Input Resistance

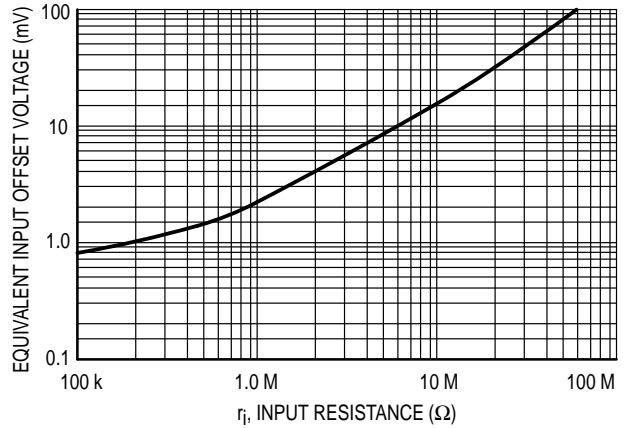


Figure 3. Voltage Gain versus Supply Voltages

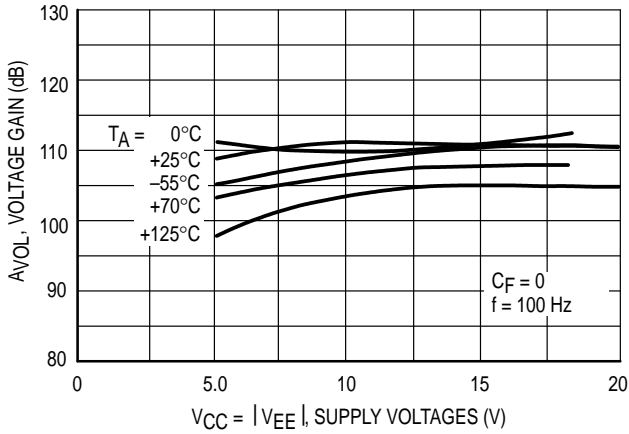


Figure 4. Power Supply Currents versus Power Supply Voltages

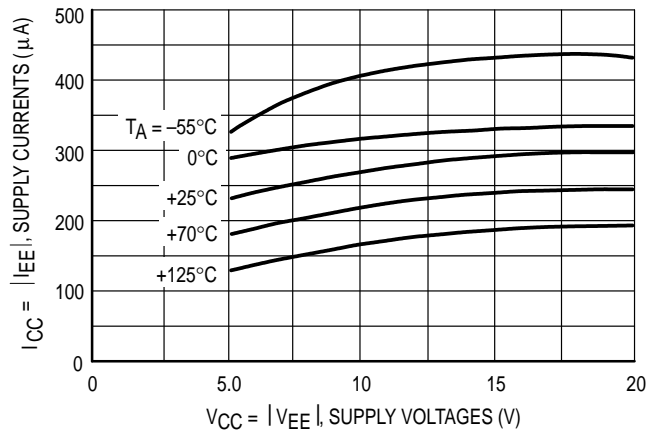


Figure 5. Open Loop Frequency Response

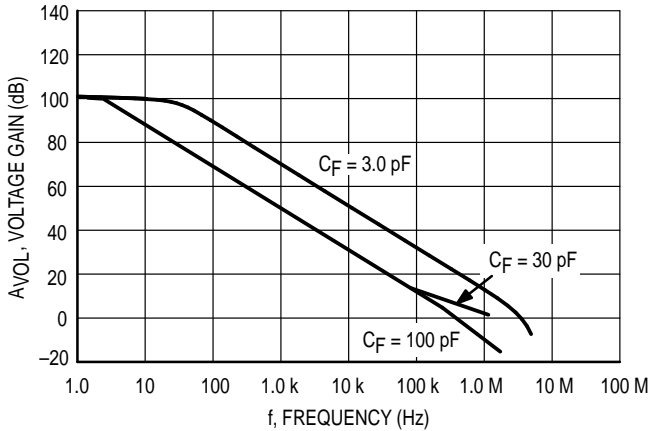
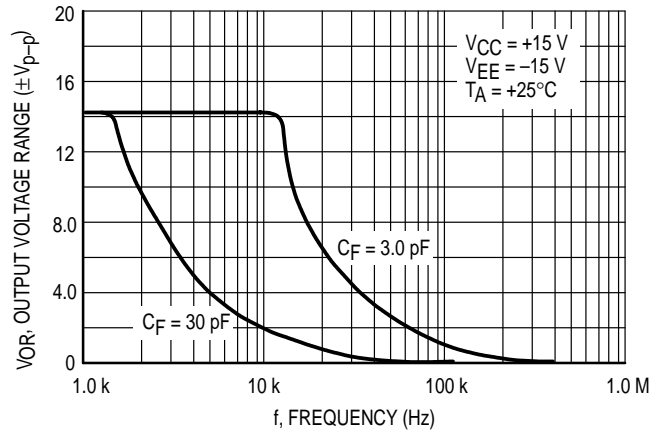


Figure 6. Large Signal Frequency Response



LM308A

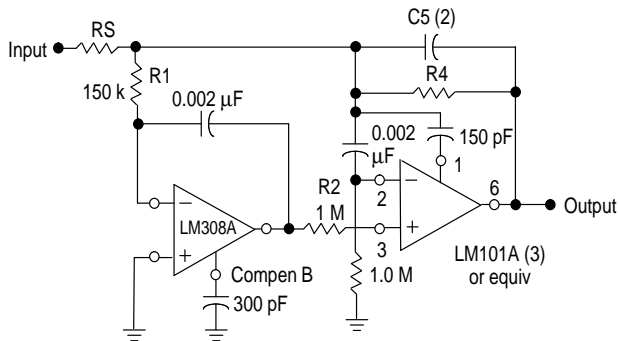
SUGGESTED DESIGN APPLICATIONS

INPUT GUARDING

Special care must be taken in the assembly of printed circuit boards to take full advantage of the low input currents of the LM308A amplifier. Boards must be thoroughly cleaned with alcohol and blown dry with compressed air. After cleaning, the boards should be coated with epoxy or silicone rubber to prevent contamination.

Even with properly cleaned and coated boards, leakage currents may cause trouble at +125°C, particularly since the input pins are adjacent to pins that are at supply potentials. This leakage can be significantly reduced by using guarding to lower the voltage difference between the inputs and adjacent metal runs. The guard, which is a conductive ring surrounding the inputs, is connected to a low-impedance point that is at approximately the same voltage as the inputs. Leakage currents from high voltage pins are then absorbed by the guard.

Figure 7. Fast (1) Summing Amplifier with Low Input Current

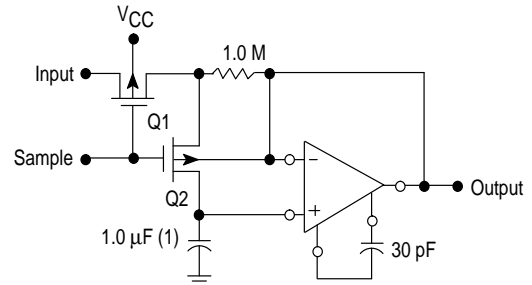


- (1) Power Bandwidth: 250 kHz
Small Signal Bandwidth: 3.5 MHz
Slew Rate: 10 V/μs

- (3) In addition to increasing speed, the LM101A raises high and low frequency gain, increases output drive capability and eliminates thermal feedback.

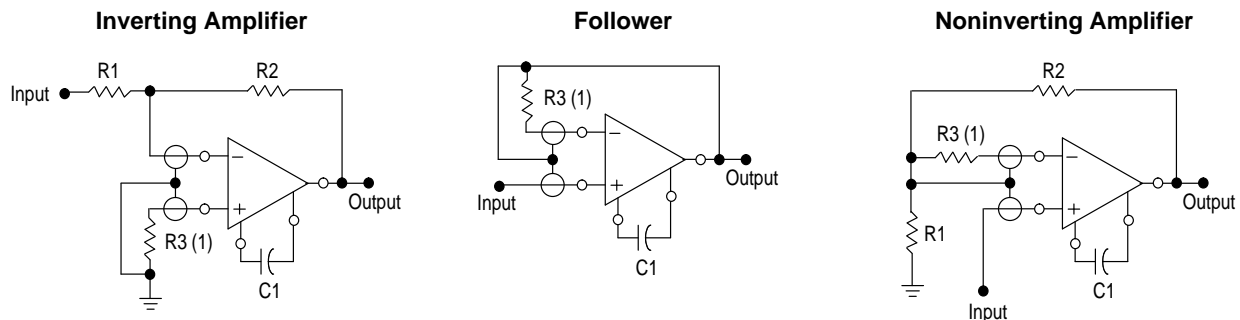
$$(2) C5 = \frac{6 \times 10^{-8}}{R1}$$

Figure 8. Sample and Hold



- (1) Teflon, Polyethylene or Polycarbonate Dielectric Capacitor

Figure 9. Connection of Input Guards

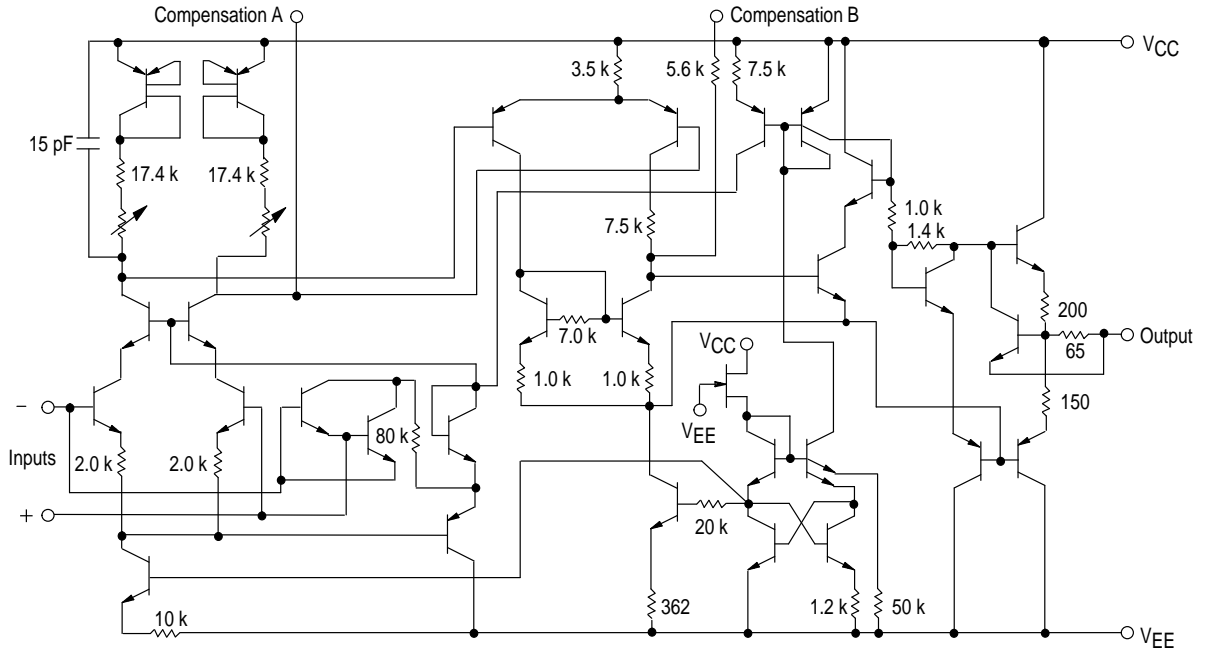


- (1) Used to compensate for large source resistances.

Note: $\frac{R1 R2}{R1 + R2}$ must be an impedance.

LM308A

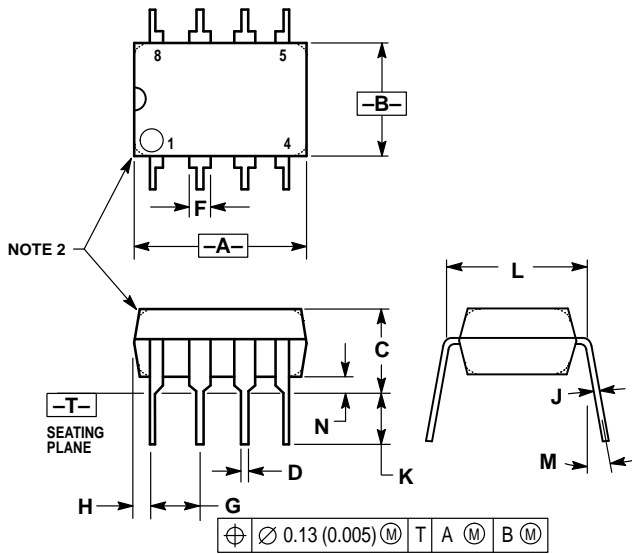
Representative Circuit Schematic



LM308A

OUTLINE DIMENSIONS

N SUFFIX PLASTIC PACKAGE CASE 626-05 ISSUE K

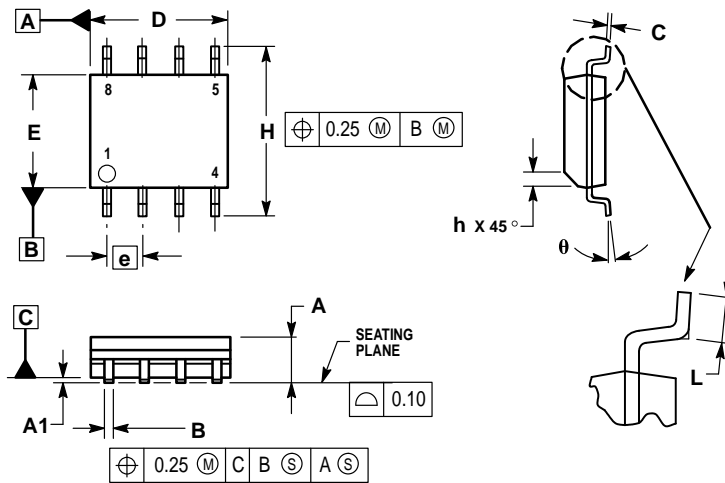


NOTES:

1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

D SUFFIX PLASTIC PACKAGE CASE 751-05 (SO-8) ISSUE R




NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.18	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

LM308A

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

LM308A

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447 or 602-303-5454

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
INTERNET: <http://Design-NET.com>

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-81-3521-8315

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



MOTOROLA



LM308A/D

