



# LM308A

## Precision Operational Amplifier

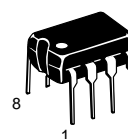
The LM308A operational amplifier provides high input impedance, low input offset and temperature drift, and low noise. These characteristics are made possible by use of a special Super Beta processing technology. This amplifier is particularly useful for applications where high accuracy and low drift 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



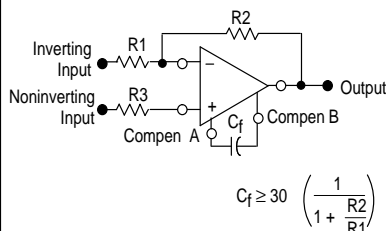
**N SUFFIX**  
PLASTIC PACKAGE  
CASE 626



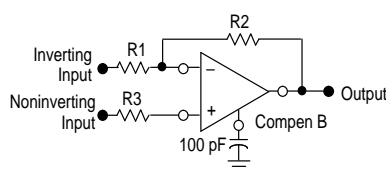
**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751  
(SO-8)

### Frequency Compensation

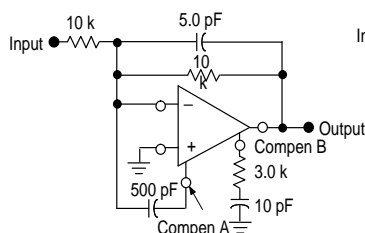
#### Standard Compensation



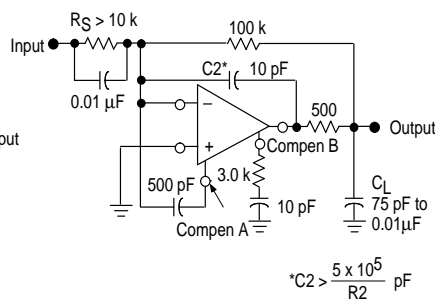
#### Modified Compensation



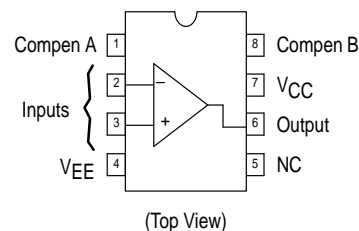
#### Standard Feedforward Compensation



#### Feedforward Compensations for Decoupling Load Capacitance



### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Operating Temperature Range	Package
LM308AN LM308AD	T <sub>A</sub> = 0° to +70°C	Plastic DIP SO-8

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

Rating	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}, V_{EE}$	$\pm 18$	Vdc
Input Voltage (See Note 1)	$V_I$	$\pm 15$	V
Input Differential Current ( See Note 2)	$I_{ID}$	$\pm 10$	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  $\pm 15$  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 ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ )	$I_{CC}, I_{EE}$	–	$\pm 0.3$	$\pm 0.8$	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 ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ )	$V_{ICR}$	$\pm 14$	–	–	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 ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ , $R_L = 10\text{ k}\Omega$ )	$V_{OR}$	$\pm 13$	$\pm 14$	–	V

Figure 1. Input Bias and Input Offset Currents

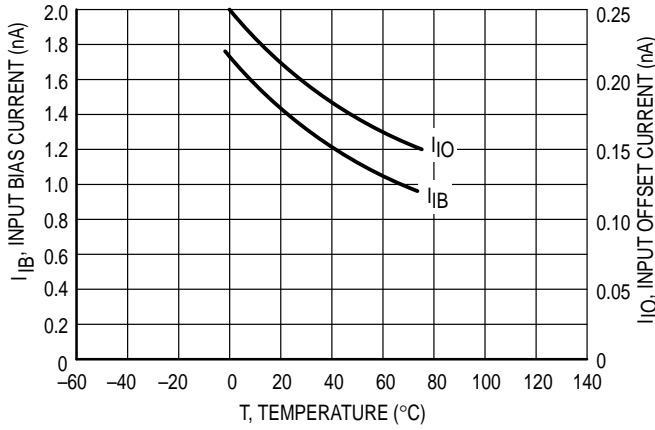


Figure 2. Maximum Equivalent Input Offset Voltage Error versus Input Resistance

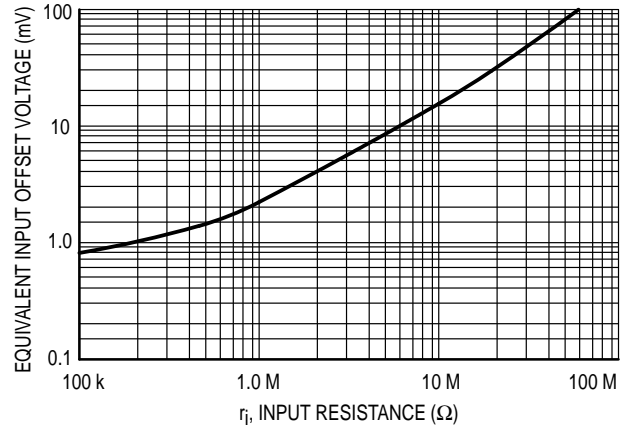


Figure 3. Voltage Gain versus Supply Voltages

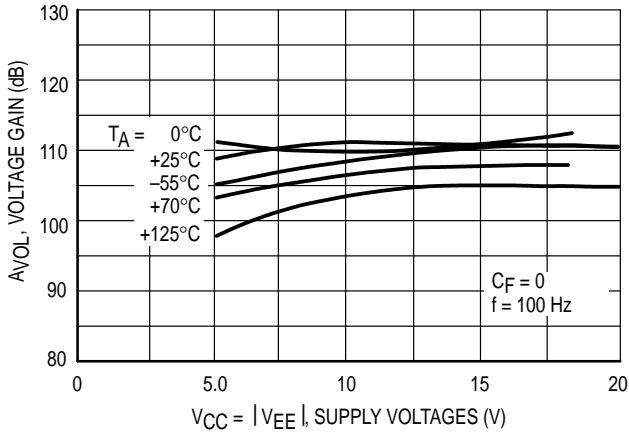


Figure 4. Power Supply Currents versus Power Supply Voltages

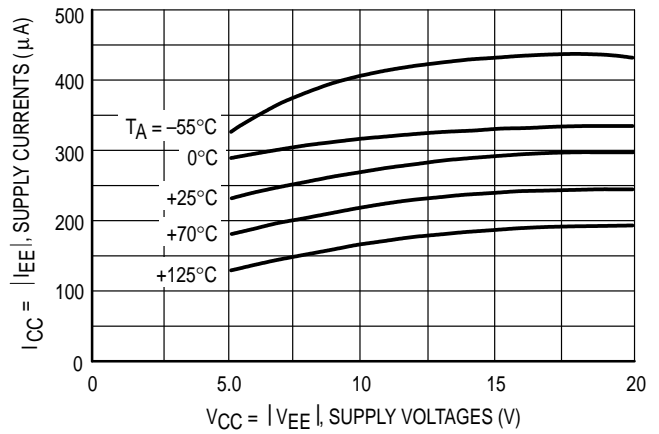


Figure 5. Open Loop Frequency Response

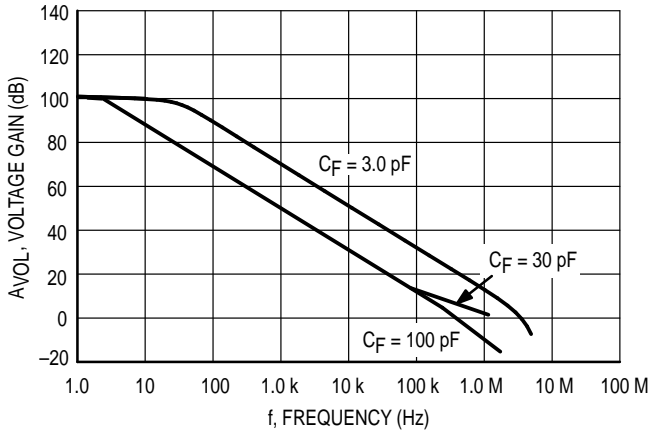
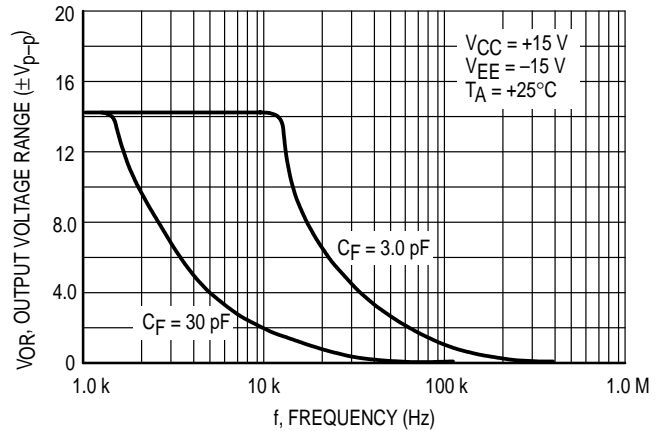


Figure 6. Large Signal Frequency Response



# LM308A

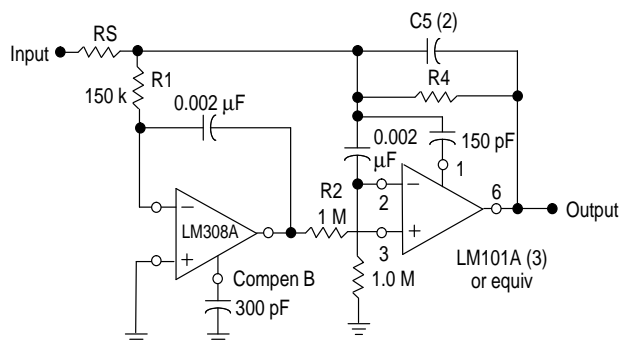
## SUGGESTED DESIGN APPLICATIONS

### 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**

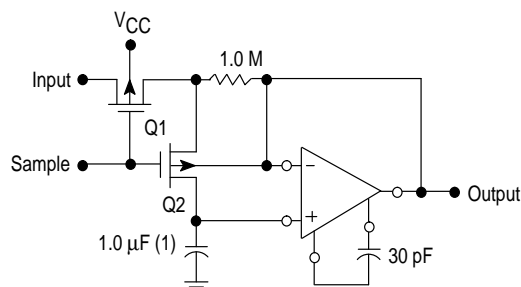


- (1) Power Bandwidth: 250 kHz  
Small Signal Bandwidth: 3.5 MHz  
Slew Rate: 10 V/μs

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

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

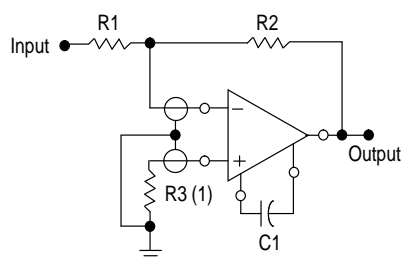
**Figure 8. Sample and Hold**



- (1) Teflon, Polyethylene or Polycarbonate Dielectric Capacitor

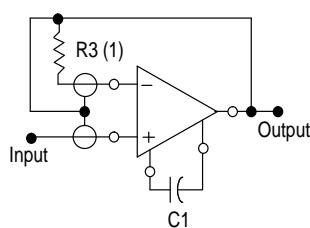
**Figure 9. Connection of Input Guards**

#### Inverting Amplifier

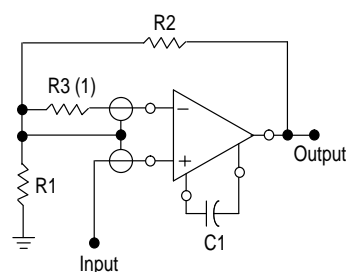


- (1) Used to compensate for large source resistances.

#### Follower



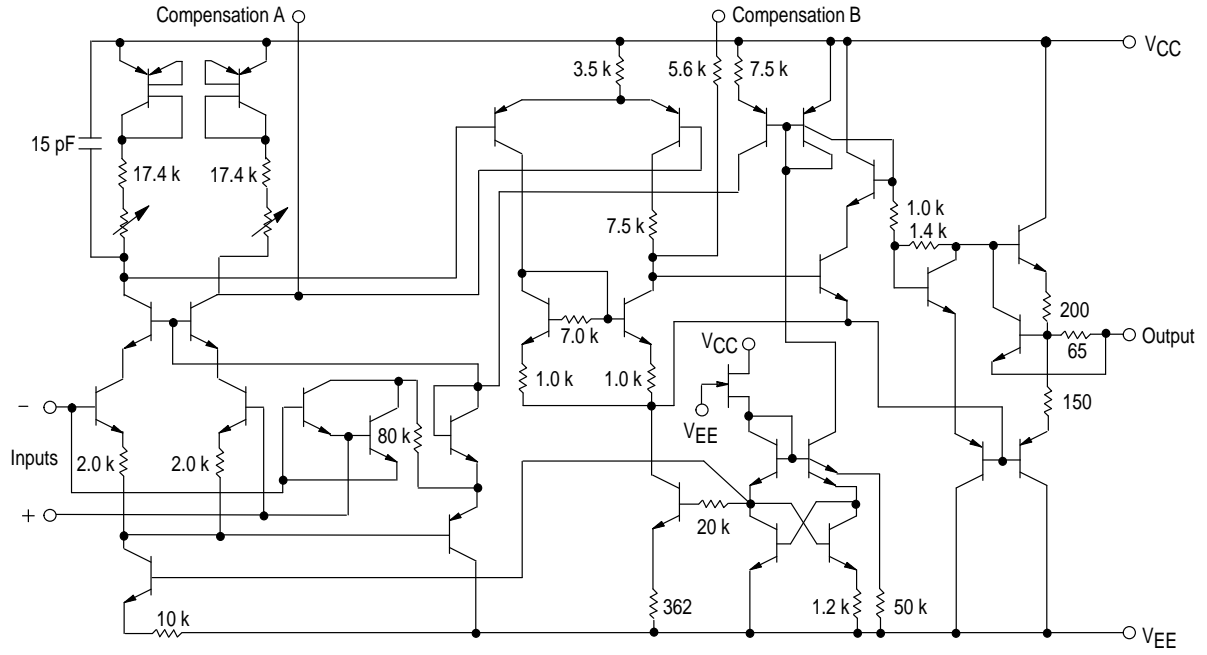
#### Noninverting Amplifier



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

# LM308A

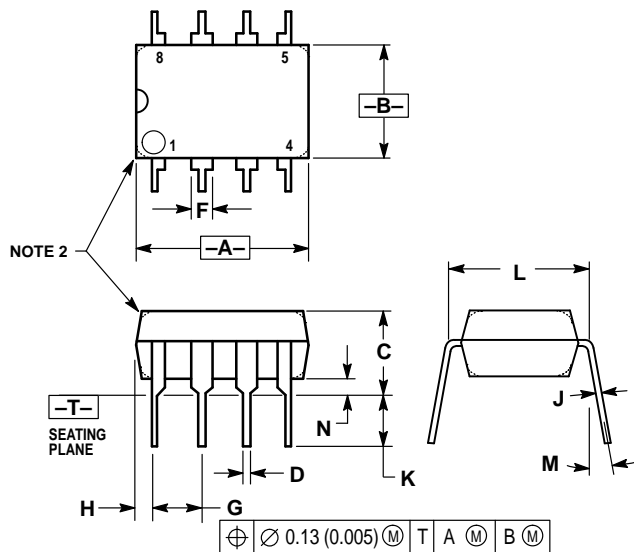
## Representative Circuit Schematic



# LM308A

## OUTLINE DIMENSIONS

### N SUFFIX PLASTIC PACKAGE CASE 626-05 ISSUE K

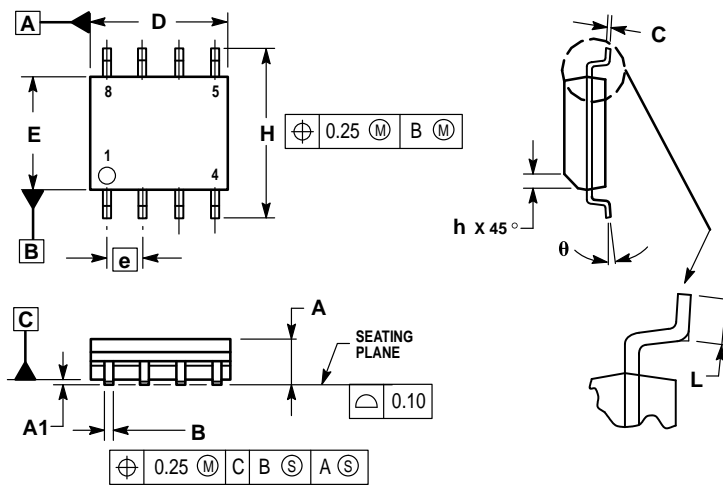


NOTES:

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
theta	0°	7°

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LM308A/D

