

# 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.

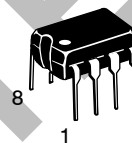
- Operation from a Wide Range of Power Supply Voltages
- Low Input Bias and Offset Currents
- Low Input Offset Voltage and Guaranteed Offset Voltage Drift Performance
- High Input Impedance



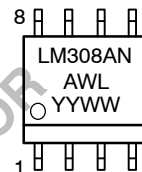
ON Semiconductor

<http://onsemi.com>

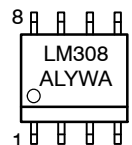
### MARKING DIAGRAMS



PDIP-8  
N SUFFIX  
CASE 626

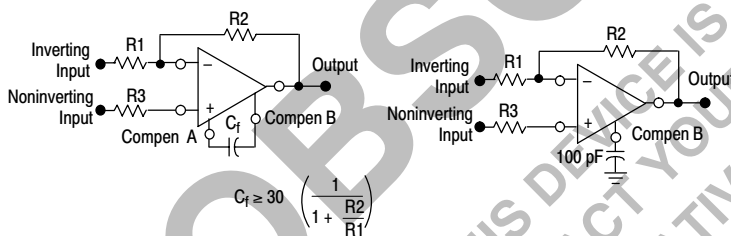


SO-8  
D SUFFIX  
CASE 751



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week

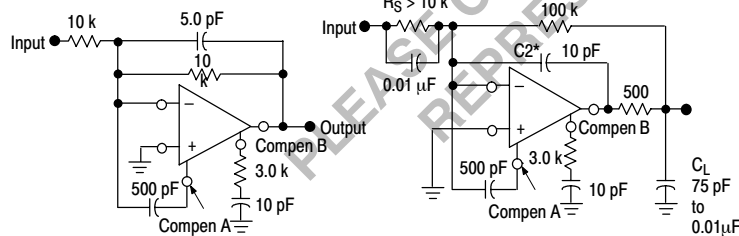
### Frequency Compensation



$$C_f \geq 30 \left( \frac{1}{1 + \frac{R_2}{R_1}} \right)$$

Standard Compensation

Modified Compensation

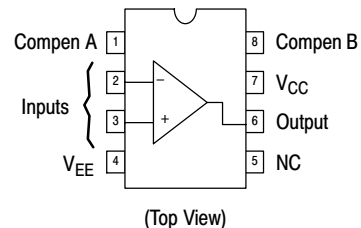


Standard Feedforward Compensation

Feedforward Compensations for Decoupling Load Capacitance

$$*C_2 > \frac{5 \times 10^5}{R_2} \text{ pF}$$

### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Package	Shipping
LM308AN	PDIP-8	50 Units/Rail
LM308AD	SO-8	98 Units/Rail
LM308ADR2	SO-8	2500 Tape & Reel

# LM308A

## MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Power Supply Voltage	V <sub>CC</sub> , V <sub>EE</sub>	±18	Vdc
Input Voltage (Note 1)	V <sub>I</sub>	±15	V
Input Differential Current (Note 2)	I <sub>ID</sub>	±10	mA
Output Short Circuit Duration	t <sub>SC</sub>	Indefinite	–
Operating Ambient Temperature Range	T <sub>A</sub>	0 to +70	°C
Storage Temperature Range	T <sub>stg</sub>	–65 to +150	°C
Junction Temperature	T <sub>J</sub>	+150	°C

- For supply voltages less than ±15 V, the maximum input voltage is equal to the supply voltage.
- 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 V ≤ V<sub>CC</sub> ≤ +15 V and –5.0 V ≥ V<sub>EE</sub> ≥ –15 V, T<sub>A</sub> = +25°C.)

Characteristic	Symbol	Min	Typ	Max	Unit
Input Offset Voltage	V <sub>IO</sub>	–	0.3	0.5	mV
Input Offset Current	I <sub>IO</sub>	–	0.2	1.0	nA
Input Bias Current	I <sub>IB</sub>	–	1.5	7.0	nA
Input Resistance	r <sub>i</sub>	10	40	–	MΩ
Power Supply Currents (V <sub>CC</sub> = +15 V, V <sub>EE</sub> = –15 V)	I <sub>CC</sub> , I <sub>EE</sub>	–	±0.3	±0.8	mA
Large Signal Voltage Gain (V <sub>CC</sub> = +15 V, V <sub>EE</sub> = –15 V, V <sub>O</sub> = ±10 V, R <sub>L</sub> ≥ 10 kΩ)	A <sub>VOL</sub>	80	300	–	V/mV

### The following specifications apply over the operating temperature range.

Input Offset Voltage	V <sub>IO</sub>	–	–	0.73	mV
Input Offset Current	I <sub>IO</sub>	–	–	1.5	nA
Average Temperature Coefficient of Input Offset Voltage T <sub>A</sub> (min) ≤ T <sub>A</sub> ≤ T <sub>A</sub> (max)	ΔV <sub>IO</sub> /ΔT	–	1.0	5.0	μV/°C
Average Temperature Coefficient of Input Offset Current	ΔI <sub>IO</sub> /ΔT	–	2.0	10	pA/°C
Input Bias Current	I <sub>IB</sub>	–	–	10	nA
Large Signal Voltage Gain (V <sub>CC</sub> = +15 V, V <sub>EE</sub> = –15 V, V <sub>O</sub> = ±10 V, R <sub>L</sub> ≥ 10 kΩ)	A <sub>VOL</sub>	60	–	–	V/mV
Input Voltage Range (V <sub>CC</sub> = +15 V, V <sub>EE</sub> = –15 V)	V <sub>ICR</sub>	±14	–	–	V
Common Mode Rejection (R <sub>S</sub> ≤ 50 kΩ)	CMR	96	110	–	dB
Supply Voltage Rejection (R <sub>S</sub> ≤ 50 kΩ)	PSR	96	110	–	dB
Output Voltage Range (V <sub>CC</sub> = +15 V, V <sub>EE</sub> = –15 V, R <sub>L</sub> = 10 kΩ)	V <sub>OR</sub>	±13	±14	–	V

# LM308A

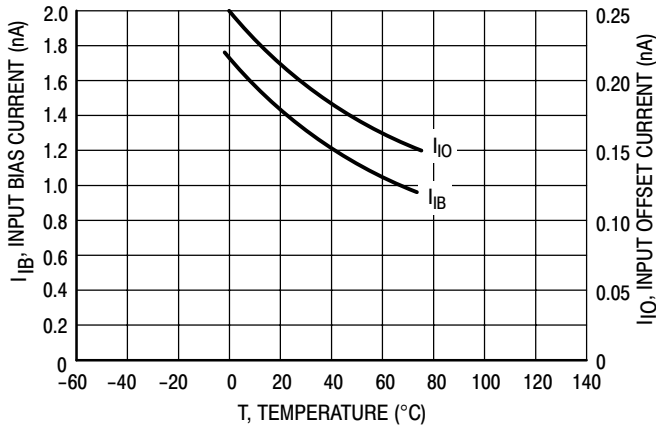


Figure 1. Input Bias and Input Offset Currents

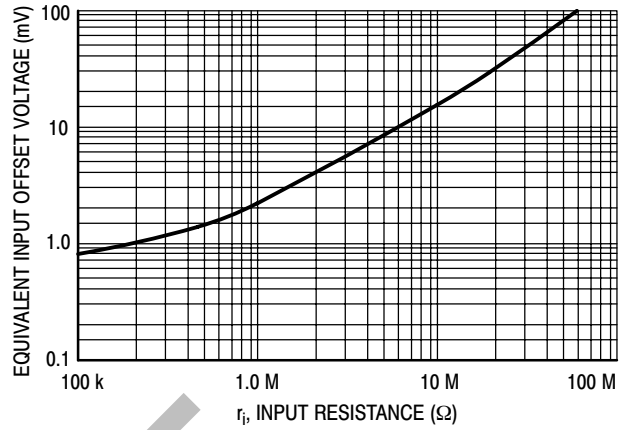


Figure 2. Maximum Equivalent Input Offset Voltage Error versus Input Resistance

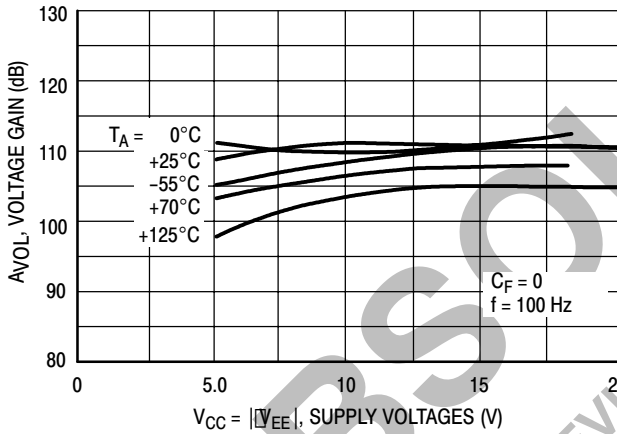


Figure 3. Voltage Gain versus Supply Voltages

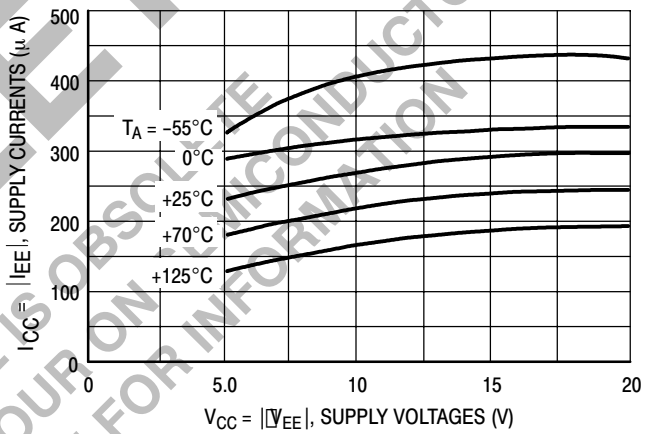


Figure 4. Power Supply Currents versus Power Supply Voltages

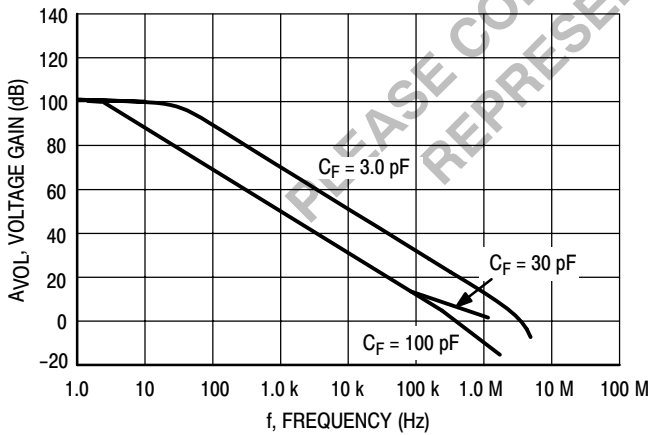


Figure 5. Open Loop Frequency Response

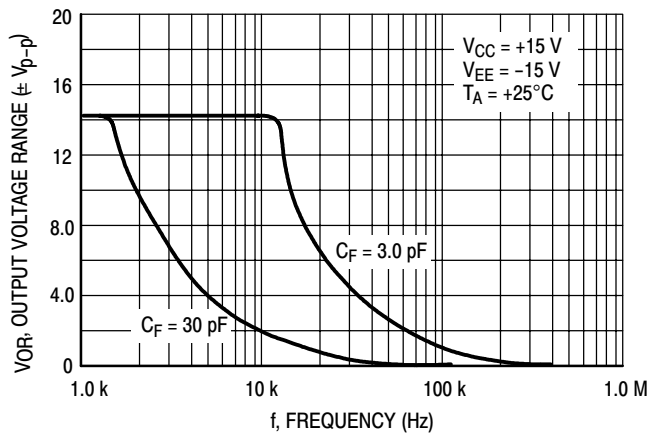


Figure 6. Large Signal Frequency Response

## SUGGESTED DESIGN APPLICATIONS

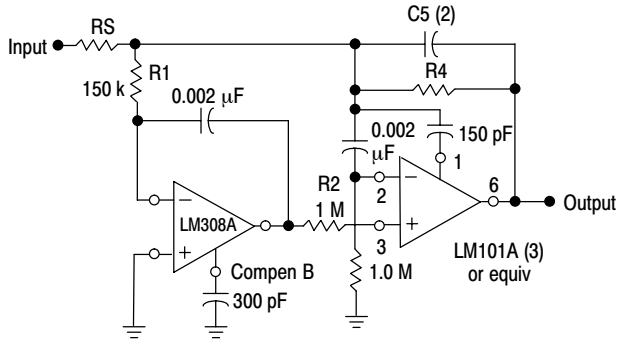
# LM308A

## 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

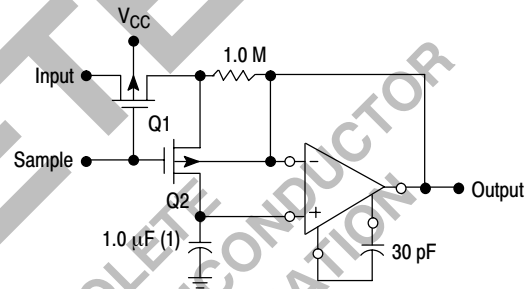
input pins are adjacent to pins that are at supply potentials. This leakage can be significantly reduced by using guarding to lower the voltage difference between the inputs and adjacent metal runs. The guard, which is a conductive ring surrounding the inputs, is connected to a low-impedance point that is at approximately the same voltage as the inputs. Leakage currents from high voltage pins are then absorbed by the guard.



- (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.

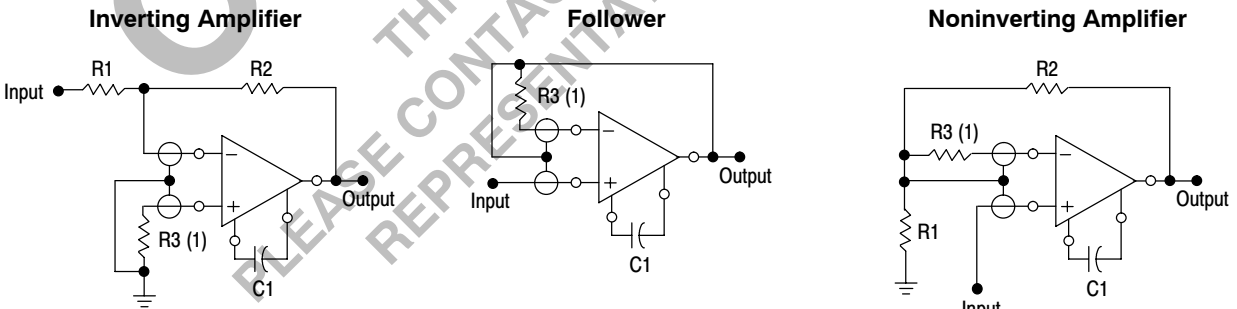
$$(2) C5 = \frac{6 \times 10^{-8}}{R1}$$



- (1) Teflon, Polyethylene or Polycarbonate Dielectric Capacitor

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

Figure 8. Sample and Hold



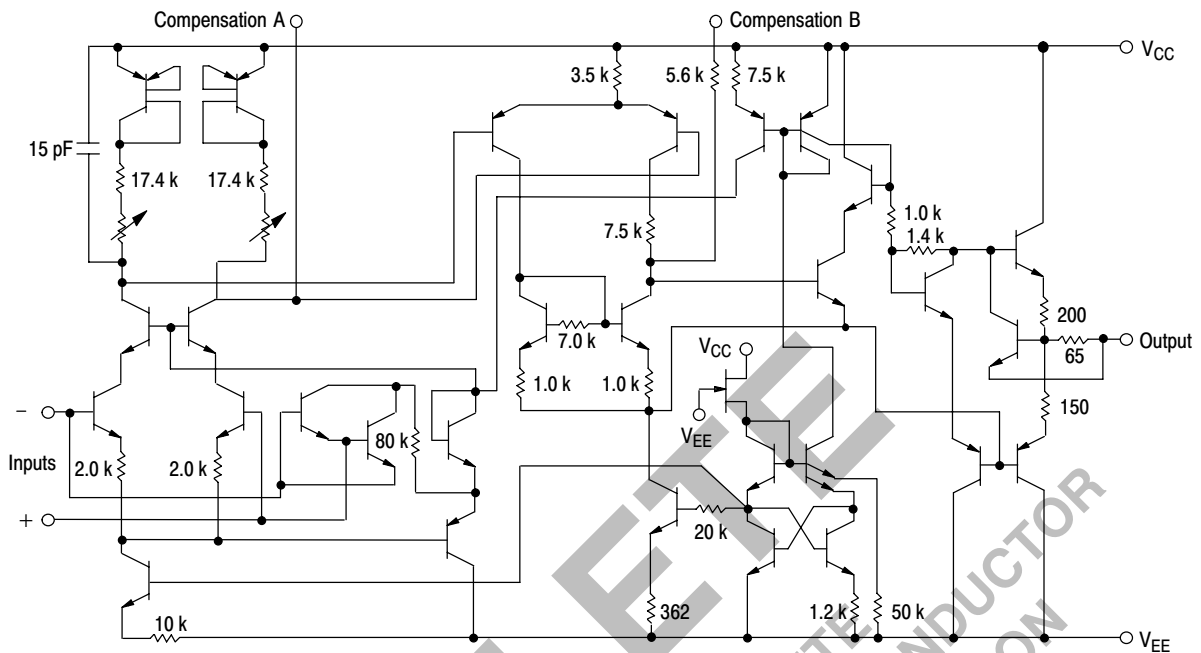
- (1) Used to compensate for large source resistances.

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

Figure 9. Connection of Input Guards

# LM308A

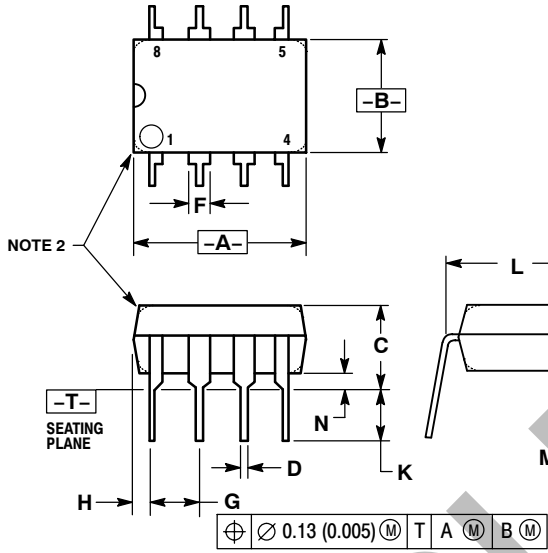
## Representative Circuit Schematic



# LM308A

## PACKAGE DIMENSIONS

PDIP-8  
N SUFFIX  
CASE 626-05  
ISSUE K

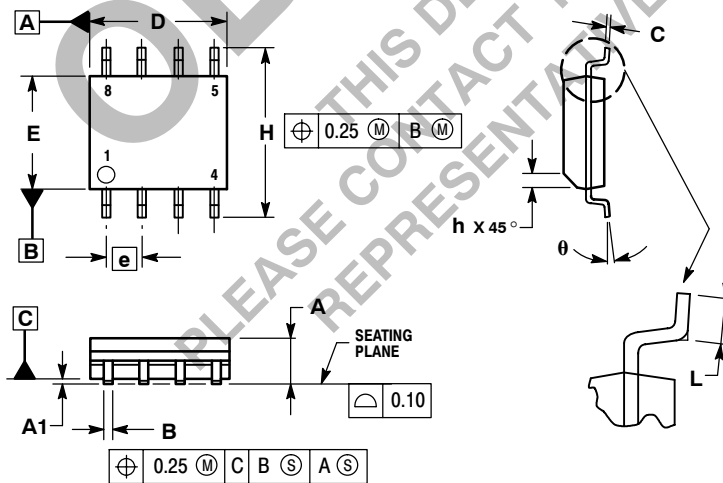


NOTES:

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

SO-8  
D SUFFIX  
CASE 751-06  
ISSUE T



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR 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	0.19	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°

Notes

**OBSOLETE**  
THIS DEVICE IS OBSOLETE  
PLEASE CONTACT YOUR ON SEMICONDUCTOR  
REPRESENTATIVE FOR INFORMATION

**ON Semiconductor** and **ON** are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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 special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC 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. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC 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 SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC 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 SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## PUBLICATION ORDERING INFORMATION

### NORTH AMERICA Literature Fulfillment:

Literature Distribution Center for ON Semiconductor  
 P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com  
 Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (M-F 1:00pm to 5:00pm Munich Time)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (M-F 1:00pm to 5:00pm Toulouse Time)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (M-F 12:00pm to 5:00pm UK Time)  
**Email:** ONlit@hibbertco.com

**EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781**

\*Available from Germany, France, Italy, England, Ireland

### CENTRAL/SOUTH AMERICA:

**Spanish Phone:** 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
 Toll Free from Hong Kong & Singapore:  
**001-800-4422-3781**  
**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2745  
**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.