

# 1N6373 - 1N6381 Series (ICTE-5 - ICTE-36, MPTE-5 - MPTE-45)

## 1500 Watt Peak Power Mosorb™ Zener Transient Voltage Suppressors

### Unidirectional\*

Mosorb devices are designed to protect voltage sensitive components from high voltage, high-energy transients. They have excellent clamping capability, high surge capability, low zener impedance and fast response time. These devices are ON Semiconductor's exclusive, cost-effective, highly reliable Surmetic™ axial leaded package and are ideally-suited for use in communication systems, numerical controls, process controls, medical equipment, business machines, power supplies and many other industrial/consumer applications, to protect CMOS, MOS and Bipolar integrated circuits.

### Specification Features

- Working Peak Reverse Voltage Range – 5.0 V to 45 V
- Peak Power – 1500 Watts @ 1 ms
- ESD Rating of Class 3 (>16 KV) per Human Body Model
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5 μA Above 10 V
- Response Time is Typically < 1 ns
- Pb-Free Packages are Available\*

### Mechanical Characteristics

**CASE:** Void-free, transfer-molded, thermosetting plastic

**FINISH:** All external surfaces are corrosion resistant and leads are readily solderable

### MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES:

230°C, 1/16" from the case for 10 seconds

**POLARITY:** Cathode indicated by polarity band

**MOUNTING POSITION:** Any

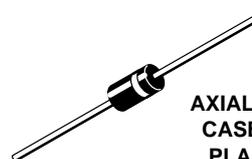
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



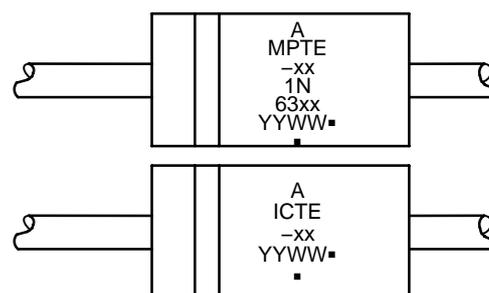
ON Semiconductor®

<http://onsemi.com>



AXIAL LEAD  
CASE 41A  
PLASTIC

### MARKING DIAGRAMS



- A = Assembly Location
- MPTE-xx = ON Device Code
- 1N63xx = JEDEC Device Code
- ICTE-xx = ON Device Code
- YY = Year
- WW = Work Week
- = Pb-Free Package
- (Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
MPTE-xx, G	Axial Lead (Pb-Free)	500 Units/Box
MPTE-xxRL4, G	Axial Lead (Pb-Free)	1500/Tape & Reel
ICTE-xx, G	Axial Lead (Pb-Free)	500 Units/Box
ICTE-xxRL4, G	Axial Lead (Pb-Free)	1500/Tape & Reel
1N63xx, G	Axial Lead (Pb-Free)	500 Units/Box
1N63xxRL4, G	Axial Lead (Pb-Free)	1500/Tape & Reel

## 1N6373 – 1N6381 Series (ICTE-5 – ICTE-36, MPTE-5 – MPTE-45)

### MAXIMUM RATINGS

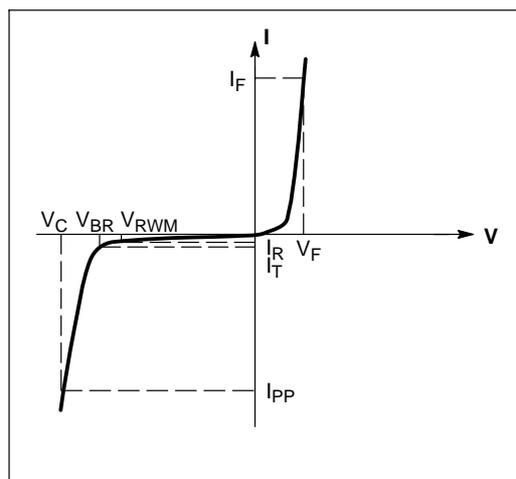
Rating	Symbol	Value	Unit
Peak Power Dissipation (Note 1) @ $T_L \leq 25^\circ\text{C}$	$P_{PK}$	1500	W
Steady State Power Dissipation @ $T_L \leq 75^\circ\text{C}$ , Lead Length = 3/8" Derated above $T_L = 75^\circ\text{C}$	$P_D$	5.0 20	W mW/°C
Thermal Resistance, Junction-to-Lead	$R_{\theta JL}$	20	°C/W
Forward Surge Current (Note 2) @ $T_A = 25^\circ\text{C}$	$I_{FSM}$	200	A
Operating and Storage Temperature Range	$T_J, T_{stg}$	- 65 to +175	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Nonrepetitive current pulse per Figure 5 and derated above  $T_A = 25^\circ\text{C}$  per Figure 2.
  2. 1/2 sine wave (or equivalent square wave),  $PW = 8.3$  ms, duty cycle = 4 pulses per minute maximum.
- \*Please see 1N6382 – 1N6389 (ICTE-10C – ICTE-36C, MPTE-8C – MPTE-45C) for Bidirectional Devices.

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted, $V_F = 3.5$ V Max. @ $I_F$ (Note 3) = 100 A)

Symbol	Parameter
$I_{PP}$	Maximum Reverse Peak Pulse Current
$V_C$	Clamping Voltage @ $I_{PP}$
$V_{RWM}$	Working Peak Reverse Voltage
$I_R$	Maximum Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current
$\Theta V_{BR}$	Maximum Temperature Variation of $V_{BR}$
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$



**Uni-Directional TVS**

## 1N6373 – 1N6381 Series (ICTE–5 – ICTE–36, MPTE–5 – MPTE–45)

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 3.5\text{ V Max.}$  @  $I_F$  (Note 3) = 100 A)

JEDEC Device† (ON Device)	Device Marking	$V_{RWM}$ (Note 4) (Volts)	$I_R$ @ $V_{RWM}$ ( $\mu\text{A}$ )	Breakdown Voltage				$V_C$ @ $I_{PP}$ (Note 6)		$V_C$ (Volts) (Note 6)		$\Theta V_{BR}$ ( $\text{mV}/^\circ\text{C}$ )
				$V_{BR}$ (Note 5) (Volts)			@ $I_T$ (mA)	$V_C$ (Volts)	$I_{PP}$ (A)	@ $I_{PP} =$ 1 A	@ $I_{PP} =$ 10 A	
				Min	Nom	Max						
1N6373, G (MPTE–5, G)	1N6373 MPTE–5	5.0	300	6.0	–	–	1.0	9.4	160	7.1	7.5	4.0
1N6374, G (MPTE–8, G)	1N6374 MPTE–8	8.0	25	9.4	–	–	1.0	15	100	11.3	11.5	8.0
1N6375, G (MPTE–10, G)	1N6375 MPTE–10	10	2.0	11.7	–	–	1.0	16.7	90	13.7	14.1	12
1N6376, G (MPTE–12, G)	1N6376 MPTE–12	12	2.0	14.1	–	–	1.0	21.2	70	16.1	16.5	14
1N6377, G (MPTE–15, G)	1N6377 MPTE–15	15	2.0	17.6	–	–	1.0	25	60	20.1	20.6	18
1N6379, G (MPTE–22, G)	1N6379 MPTE–22	22	2.0	25.9	–	–	1.0	37.5	40	29.8	32	26
1N6380, G (MPTE–36, G)	1N6380 MPTE–36	36	2.0	42.4	–	–	1.0	65.2	23	50.6	54.3	50
1N6381, G (MPTE–45, G)	1N6381 MPTE–45	45	2.0	52.9	–	–	1.0	78.9	19	63.3	70	60
ICTE–5, G	ICTE–5	5.0	300	6.0	–	–	1.0	9.4	160	7.1	7.5	4.0
ICTE–10, G	ICTE–10	10	2.0	11.7	–	–	1.0	16.7	90	13.7	14.1	8.0
ICTE–12, G	ICTE–12	12	2.0	14.1	–	–	1.0	21.2	70	16.1	16.5	12
ICTE–15, G	ICTE–15	15	2.0	17.6	–	–	1.0	25	60	20.1	20.6	14
ICTE–18, G	ICTE–18	18	2.0	21.2	–	–	1.0	30	50	24.2	25.2	18
ICTE–22, G	ICTE–22	22	2.0	25.9	–	–	1.0	37.5	40	29.8	32	21
ICTE–36, G	ICTE–36	36	2.0	42.4	–	–	1.0	65.2	23	50.6	54.3	26

3. Square waveform,  $PW = 8.3\text{ ms}$ , non-repetitive duty cycle.

4. A transient suppressor is normally selected according to the maximum working peak reverse voltage ( $V_{RWM}$ ), which should be equal to or greater than the dc or continuous peak operating voltage level.

5.  $V_{BR}$  measured at pulse test current  $I_T$  at an ambient temperature of  $25^\circ\text{C}$  and minimum voltage in  $V_{BR}$  is to be controlled.

6. Surge current waveform per Figure 5 and derate per Figures 1 and 2.

†The “G” suffix indicates Pb–Free package available.

# 1N6373 – 1N6381 Series (ICTE-5 – ICTE-36, MPTE-5 – MPTE-45)

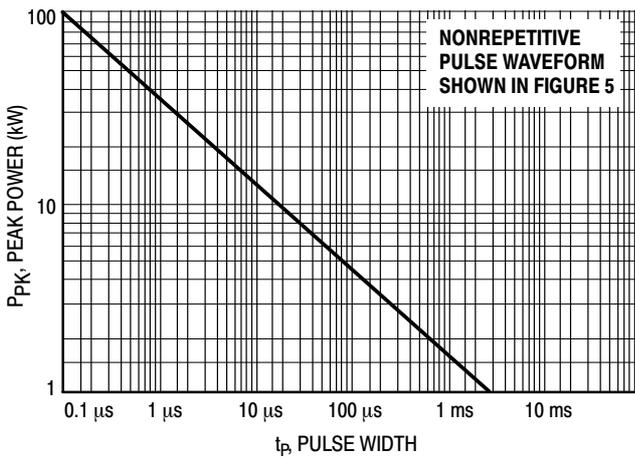


Figure 1. Pulse Rating Curve

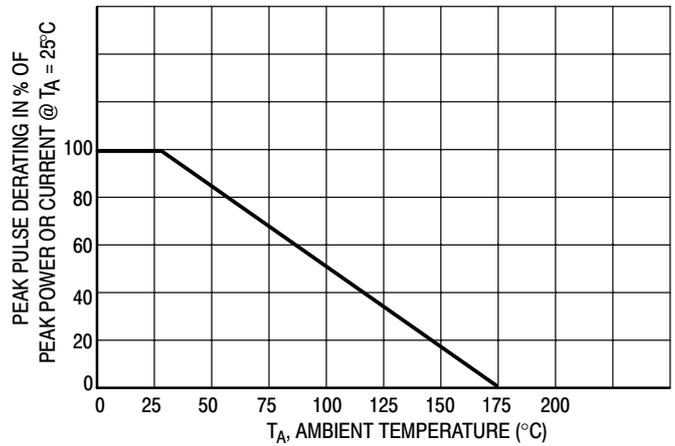


Figure 2. Pulse Derating Curve

## 1N6373, ICTE-5, MPTE-5, through 1N6389, ICTE-45, C, MPTE-45, C

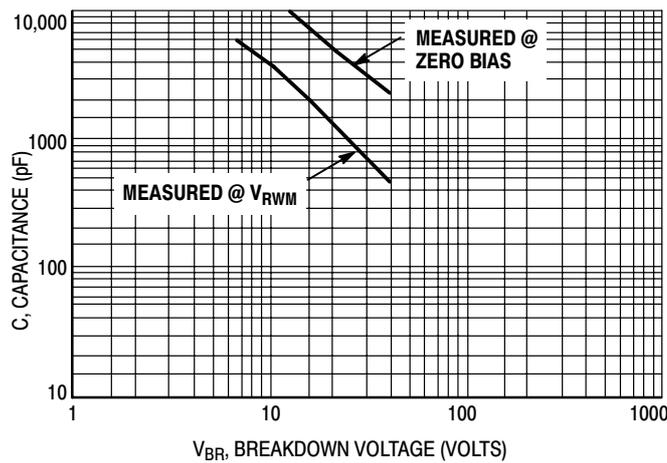


Figure 3. Capacitance versus Breakdown Voltage

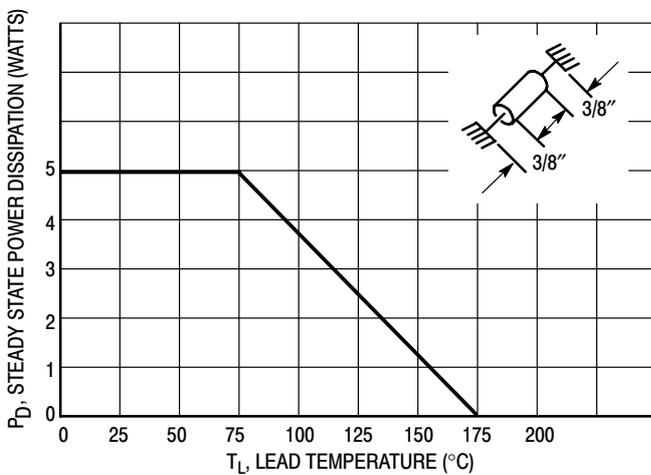


Figure 4. Steady State Power Derating

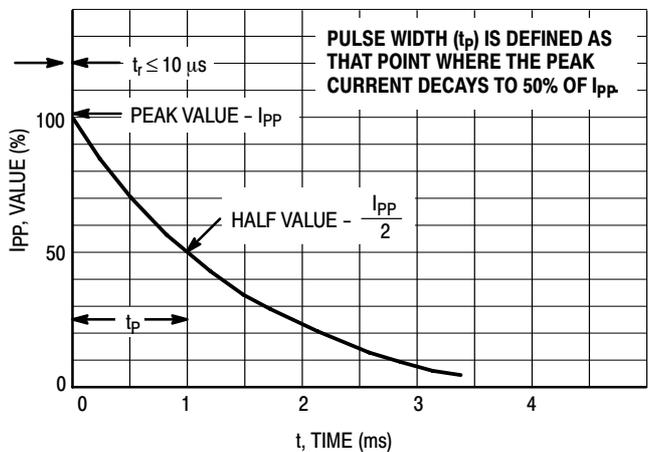


Figure 5. Pulse Waveform

# 1N6373 – 1N6381 Series (ICTE-5 – ICTE-36, MPTE-5 – MPTE-45)

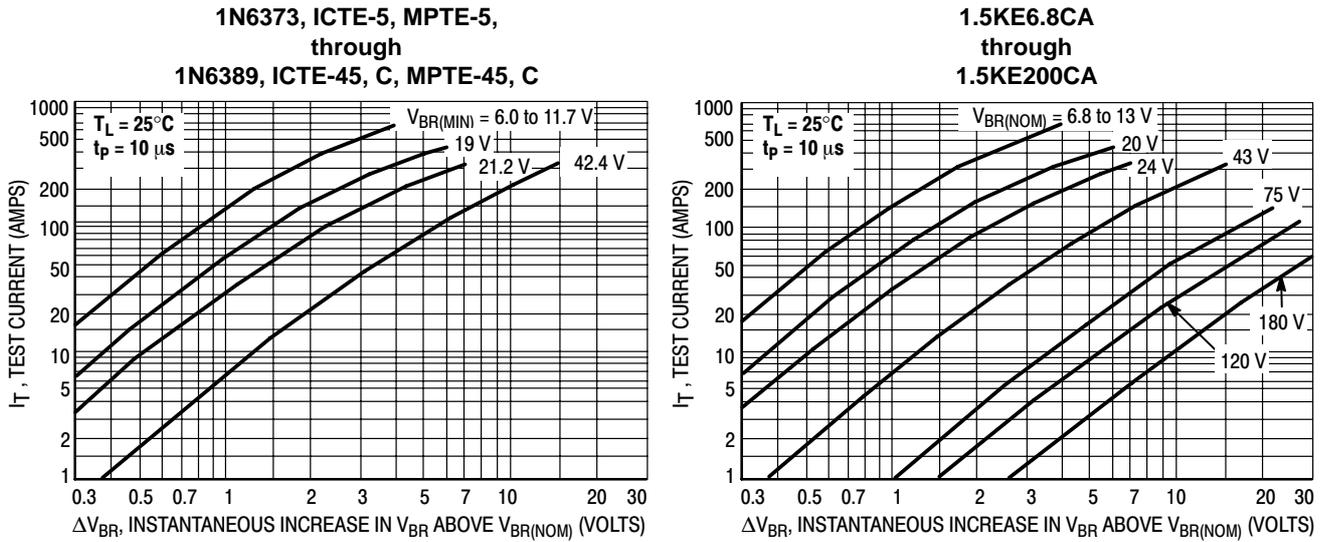


Figure 6. Dynamic Impedance

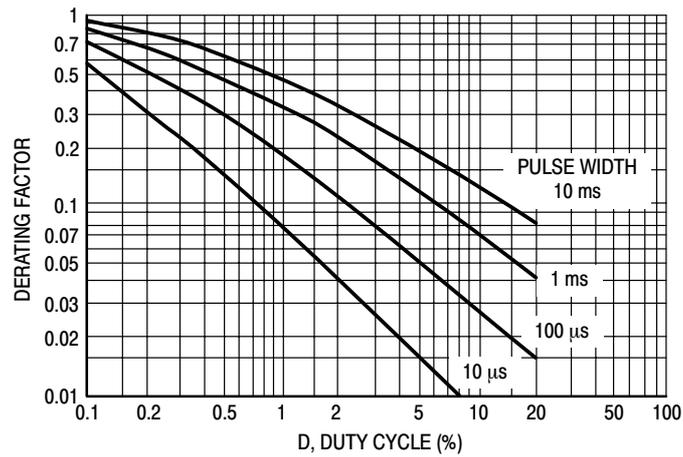


Figure 7. Typical Derating Factor for Duty Cycle

# 1N6373 – 1N6381 Series (ICTE-5 – ICTE-36, MPTE-5 – MPTE-45)

## APPLICATION NOTES

### RESPONSE TIME

In most applications, the transient suppressor device is placed in parallel with the equipment or component to be protected. In this situation, there is a time delay associated with the capacitance of the device and an overshoot condition associated with the inductance of the device and the inductance of the connection method. The capacitance effect is of minor importance in the parallel protection scheme because it only produces a time delay in the transition from the operating voltage to the clamp voltage as shown in Figure 8.

The inductive effects in the device are due to actual turn-on time (time required for the device to go from zero current to full current) and lead inductance. This inductive effect produces an overshoot in the voltage across the equipment or component being protected as shown in Figure 9. Minimizing this overshoot is very important in the application, since the main purpose for adding a transient suppressor is to clamp voltage spikes. These devices have excellent response time, typically in the picosecond range and negligible inductance. However, external inductive effects could produce unacceptable overshoot. Proper

circuit layout, minimum lead lengths and placing the suppressor device as close as possible to the equipment or components to be protected will minimize this overshoot.

Some input impedance represented by  $Z_{in}$  is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

### DUTY CYCLE DERATING

The data of Figure 1 applies for non-repetitive conditions and at a lead temperature of 25°C. If the duty cycle increases, the peak power must be reduced as indicated by the curves of Figure 7. Average power must be derated as the lead or ambient temperature rises above 25°C. The average power derating curve normally given on data sheets may be normalized and used for this purpose.

At first glance the derating curves of Figure 7 appear to be in error as the 10 ms pulse has a higher derating factor than the 10  $\mu$ s pulse. However, when the derating factor for a given pulse of Figure 7 is multiplied by the peak power value of Figure 1 for the same pulse, the results follow the expected trend.

### TYPICAL PROTECTION CIRCUIT

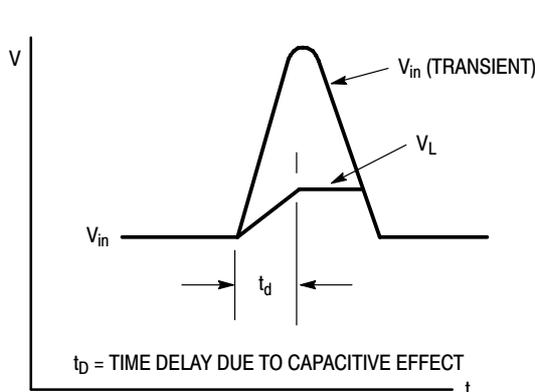
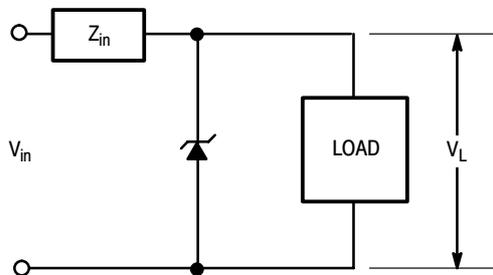


Figure 8.

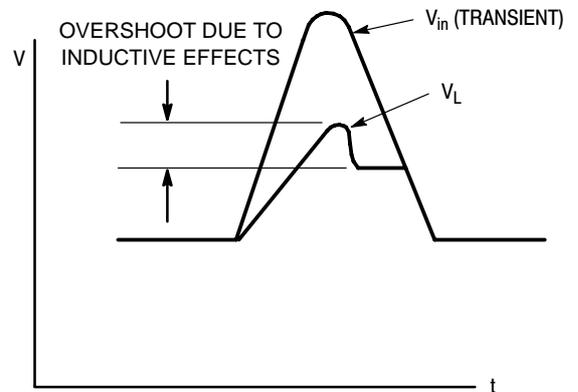
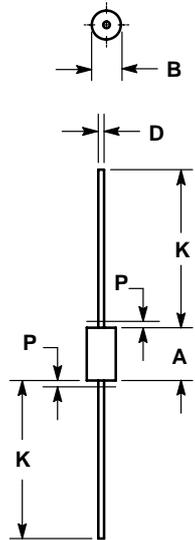


Figure 9.

# 1N6373 – 1N6381 Series (ICTE-5 – ICTE-36, MPTE-5 – MPTE-45)

## MOSORB CASE 41A-04 ISSUE D



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. LEAD FINISH AND DIAMETER UNCONTROLLED IN DIMENSION P.
4. 041A-01 THRU 041A-03 OBSOLETE, NEW STANDARD 041A-04.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.335	0.374	8.50	9.50
B	0.189	0.209	4.80	5.30
D	0.038	0.042	0.96	1.06
K	1.000	---	25.40	---
P	---	0.050	---	1.27

## 1N6373 – 1N6381 Series (ICTE-5 – ICTE-36, MPTE-5 – MPTE-45)

Mosorb and Surmetic are trademarks of Semiconductor Components Industries, LLC.

**ON Semiconductor** and  are registered 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. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

#### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

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

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

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

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your  
local Sales Representative.