

SMF5.0AT1 Series

Zener Transient Voltage Suppressor SOD-123 Flat Lead Package

The SMF5.0A Series is designed to protect voltage sensitive components from high voltage, high energy transients. Excellent clamping capability, high surge capability, low zener impedance and fast response time. Because of its small size, it is ideal for use in cellular phones, portable devices, business machines, power supplies and many other industrial/consumer applications.

Features

- Stand-off Voltage: 5 – 170 Volts
- Peak Power – 200 Watts @ 1 ms (SMF5.0A – SMF58A)
– 175 Watts @ 1 ms (SMF60A – SMF170A)
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage
- Response Time is Typically < 1 ns
- ESD Rating of Class 3 (> 16 kV) per Human Body Model
IEC61000-4-2 Level 4 ESD Protection
IEC61000-4-4 40 A ESD Protection
- Low Profile – Maximum Height of 1.0 mm
- Small Footprint – Footprint Area of 8.45 mm²
- Supplied in 8 mm Tape and Reel – 3,000 Units per Reel
- Cathode Indicated by Polarity Band
- Lead Orientation in Tape: Cathode Lead to Sprocket Holes
- Pb-Free Packages are Available

Mechanical Characteristics:

CASE: Void-free, transfer-molded, thermosetting plastic
Epoxy Meets UL 94 V-0

LEAD FINISH: 100% Matte Sn (Tin)

MOUNTING POSITION: Any

QUALIFIED MAX REFLOW TEMPERATURE: 260°C

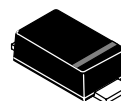
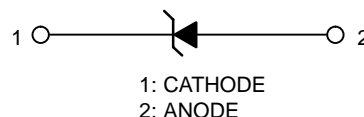
Device Meets MSL 1 Requirements



ON Semiconductor®

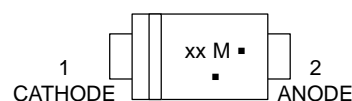
<http://onsemi.com>

**PLASTIC SURFACE MOUNT
ZENER OVERVOLTAGE
TRANSIENT SUPPRESSOR
5 – 170 VOLTS
200 WATT PEAK POWER**



**SOD-123FL
CASE 498
PLASTIC**

MARKING DIAGRAM



xx = Device Code (Refer to page 3)

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------|------------------------|------------------|
| SMFxxxAT1 | SOD-123FL | 3000/Tape & Reel |
| SMFxxxAT1G | SOD-123FL (Pb-Free) | 3000/Tape & Reel |

†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.

DEVICE MARKING INFORMATION

See specific marking information in the device marking column of the Electrical Characteristics table on page 3 of this data sheet.

SMF5.0AT1 Series

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|-----------------------|-------------|----------------------------|
| Maximum P_{pk} Dissipation (PW=10/1000 μ s) (Note 1) SMF60A – SMF170A | P_{pk} | 175 | W |
| Maximum P_{pk} Dissipation (PW=10/1000 μ s) (Note 1) SMF5.0A – SMF58A | P_{pk} | 200 | W |
| Maximum P_{pk} Dissipation @ $T_A = 25^\circ\text{C}$, (PW=8/20 μ s) (Note 2) | P_{pk} | 1000 | W |
| DC Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 3) Derate above 25°C | P_D | 385 | mW |
| Thermal Resistance, Junction-to-Ambient (Note 3) | $R_{\theta JA}$ | 4.0 | $\text{mW}/^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Lead (Note 3) | $R_{\theta Jcathode}$ | 325 | $^\circ\text{C}/\text{W}$ |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

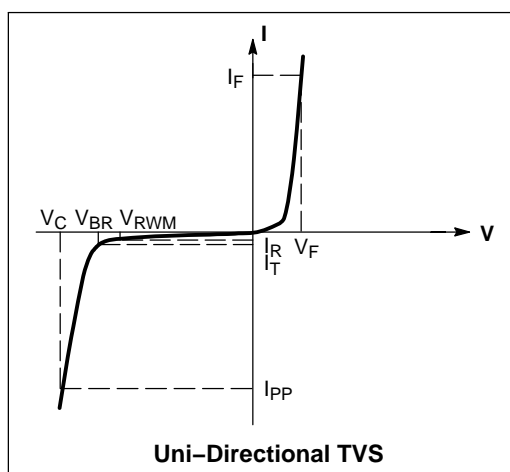
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur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

1. Non-repetitive current pulse at $T_A = 25^\circ\text{C}$, per waveform of Figure 2.
2. Non-repetitive current pulse at $T_A = 25^\circ\text{C}$, per waveform of Figure 3.
3. Mounted with recommended minimum pad size, DC board FR-4.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted, $V_F = 3.5\text{ V Max.}$ @ I_F (Note 4) = 12 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 |
| I_F | Forward Current |
| V_F | Forward Voltage @ I_F |

4. 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.



SMF5.0AT1 Series

ELECTRICAL CHARACTERISTICS ($T_L = 30^\circ\text{C}$ unless otherwise noted, $V_F = 1.25$ Volts @ 200 mA)

| Device* | Marking | V_{RWM} (V) | V_{BR} @ I_T (V) (Note 6) | | | I_T | I_R @ V_{RWM} | $V_{C(Max)}$ | $I_{PP(Max)}$ (A) |
|------------|---------|---------------|-------------------------------|-------|------|-------|-------------------|--------------|-------------------|
| | | (Note 5) | Min | Nom | Max | (mA) | (μA) | (V) | (Note 7) |
| SMF5.0A, G | KE | 5 | 6.4 | 6.7 | 7 | 10 | 400 | 9.2 | 21.7 |
| SMF6.0A, G | KG | 6 | 6.67 | 7.02 | 7.37 | 10 | 400 | 10.3 | 19.4 |
| SMF6.5A, G | KK | 6.5 | 7.22 | 7.6 | 7.98 | 10 | 250 | 11.2 | 17.9 |
| SMF7.0A, G | KM | 7 | 7.78 | 8.2 | 8.6 | 10 | 100 | 12 | 16.7 |
| SMF7.5A, G | KP | 7.5 | 8.33 | 8.77 | 9.21 | 1 | 50 | 12.9 | 15.5 |
| SMF8.0A, G | KR | 8 | 8.89 | 9.36 | 9.83 | 1 | 25 | 13.6 | 14.7 |
| SMF8.5A, G | KT | 8.5 | 9.44 | 9.92 | 10.4 | 1 | 10 | 14.4 | 13.9 |
| SMF9.0A, G | KV | 9 | 10 | 10.55 | 11.1 | 1 | 5 | 15.4 | 13.0 |
| SMF10A, G | KX | 10 | 11.1 | 11.7 | 12.3 | 1 | 2.5 | 17 | 11.8 |
| SMF11A, G | KZ | 11 | 12.2 | 12.85 | 13.5 | 1 | 2.5 | 18.2 | 11.0 |
| SMF12A, G | LE | 12 | 13.3 | 14 | 14.7 | 1 | 2.5 | 19.9 | 10.1 |
| SMF13A, G | LG | 13 | 14.4 | 15.15 | 15.9 | 1 | 1 | 21.5 | 9.3 |
| SMF14A, G | LK | 14 | 15.6 | 16.4 | 17.2 | 1 | 1 | 23.2 | 8.6 |
| SMF15A, G | LM | 15 | 16.7 | 17.6 | 18.5 | 1 | 1 | 24.4 | 8.2 |
| SMF16A, G | LP | 16 | 17.8 | 18.75 | 19.7 | 1 | 1 | 26 | 7.7 |
| SMF17A, G | LR | 17 | 18.9 | 19.9 | 20.9 | 1 | 1 | 27.6 | 7.2 |
| SMF18A, G | LT | 18 | 20 | 21 | 22.1 | 1 | 1 | 29.2 | 6.8 |
| SMF20A, G | LV | 20 | 22.2 | 23.35 | 24.5 | 1 | 1 | 32.4 | 6.2 |
| SMF22A, G | LX | 22 | 24.4 | 25.6 | 26.9 | 1 | 1 | 35.5 | 5.6 |
| SMF24A, G | LZ | 24 | 26.7 | 28.1 | 29.5 | 1 | 1 | 38.9 | 5.1 |
| SMF26A, G | ME | 26 | 28.9 | 30.4 | 31.9 | 1 | 1 | 42.1 | 4.8 |
| SMF28A, G | MG | 28 | 31.1 | 32.8 | 34.4 | 1 | 1 | 45.4 | 4.4 |
| SMF30A, G | MK | 30 | 33.3 | 35.1 | 36.8 | 1 | 1 | 48.4 | 4.1 |
| SMF33A, G | MM | 33 | 36.7 | 38.7 | 40.6 | 1 | 1 | 53.3 | 3.8 |
| SMF36A, G | MP | 36 | 40 | 42.1 | 44.2 | 1 | 1 | 58.1 | 3.4 |
| SMF40A, G | MR | 40 | 44.4 | 46.8 | 49.1 | 1 | 1 | 64.5 | 3.1 |
| SMF43A, G | MT | 43 | 47.8 | 50.3 | 52.8 | 1 | 1 | 69.4 | 2.9 |
| SMF45A, G | MV | 45 | 50 | 52.65 | 55.3 | 1 | 1 | 72.7 | 2.8 |
| SMF48A, G | MX | 48 | 53.3 | 56.1 | 58.9 | 1 | 1 | 77.4 | 2.6 |
| SMF51A, G | MZ | 51 | 56.7 | 59.7 | 62.7 | 1 | 1 | 82.4 | 2.4 |
| SMF54A, G | NE | 54 | 60 | 63.15 | 66.3 | 1 | 1 | 87.1 | 2.3 |
| SMF58A, G | NG | 58 | 64.4 | 67.8 | 71.2 | 1 | 1 | 93.6 | 2.1 |
| SMF60A, G | NK | 60 | 66.7 | 70.2 | 73.7 | 1 | 1 | 96.8 | 1.8 |
| SMF64A, G | NM | 64 | 71.1 | 74.85 | 78.6 | 1 | 1 | 103 | 1.7 |
| SMF70A, G | NP | 70 | 77.8 | 81.9 | 86 | 1 | 1 | 113 | 1.5 |
| SMF75A, G | NR | 75 | 83.3 | 87.7 | 92.1 | 1 | 1 | 121 | 1.4 |
| SMF78A, G | NT | 78 | 86.7 | 91.25 | 95.8 | 1 | 1 | 126 | 1.4 |
| SMF85A, G | NV | 85 | 94.4 | 99.2 | 104 | 1 | 1 | 137 | 1.3 |
| SMF90A, G | NX | 90 | 100 | 105.5 | 111 | 1 | 1 | 146 | 1.2 |
| SMF100A, G | NZ | 100 | 111 | 117 | 123 | 1 | 1 | 162 | 1.1 |
| SMF110A, G | PE | 110 | 122 | 128.5 | 135 | 1 | 1 | 177 | 1.0 |
| SMF120A, G | PG | 120 | 133 | 140 | 147 | 1 | 1 | 193 | 0.9 |
| SMF130A, G | PK | 130 | 144 | 151.5 | 159 | 1 | 1 | 209 | 0.8 |
| SMF150A, G | PM | 150 | 167 | 176 | 185 | 1 | 1 | 243 | 0.7 |
| SMF160A, G | PP | 160 | 178 | 187.5 | 197 | 1 | 1 | 259 | 0.7 |
| SMF170A, G | PR | 170 | 189 | 199 | 209 | 1 | 1 | 275 | 0.6 |

5. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.

6. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C .

7. Surge current waveform per Figure 2 and derate per Figure 3.

*The "G" suffix indicates Pb-Free package available.

SMF5.0AT1 Series

TYPICAL PROTECTION CIRCUIT

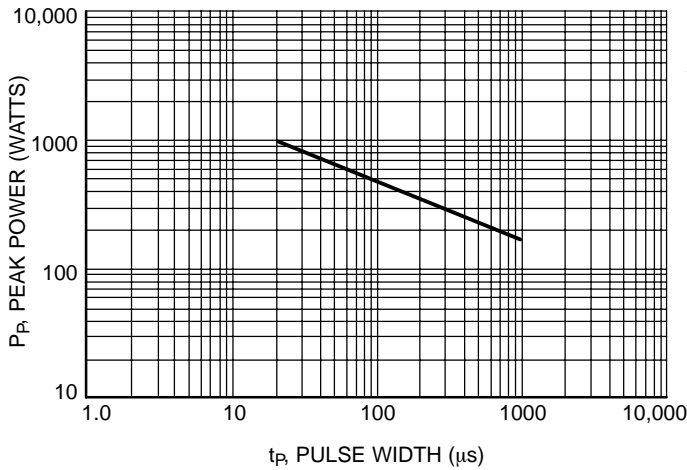
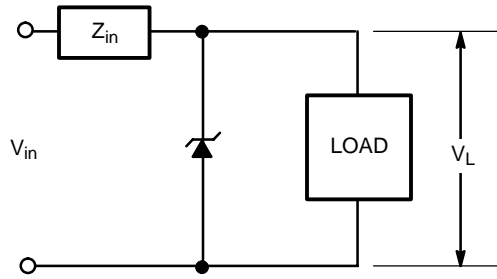


Figure 1. Pulse Rating Curve

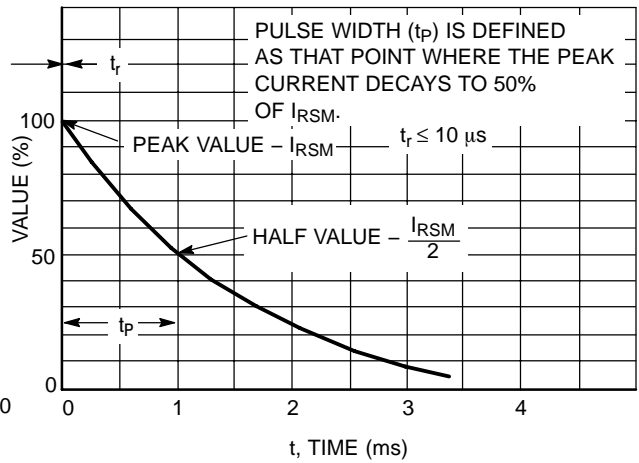


Figure 2. 10 X 1000 μ s Pulse Waveform

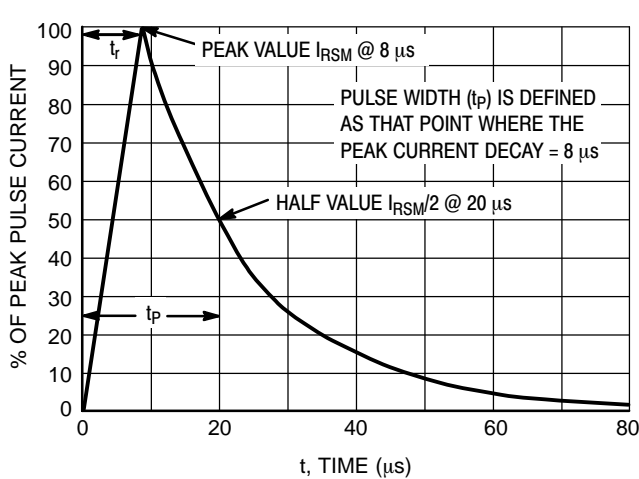


Figure 3. 8 X 20 μ s Pulse Waveform

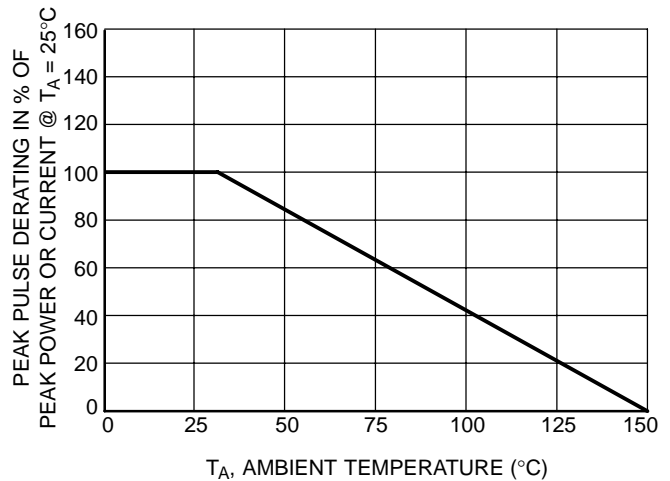


Figure 4. Pulse Derating Curve

SMF5.0AT1 Series

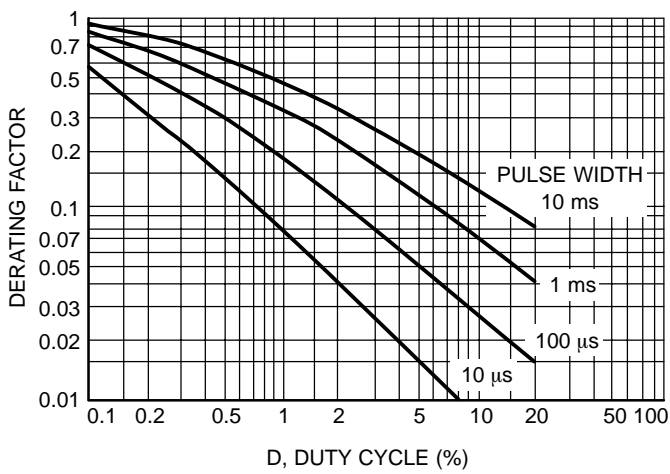


Figure 5. Typical Derating Factor for Duty Cycle

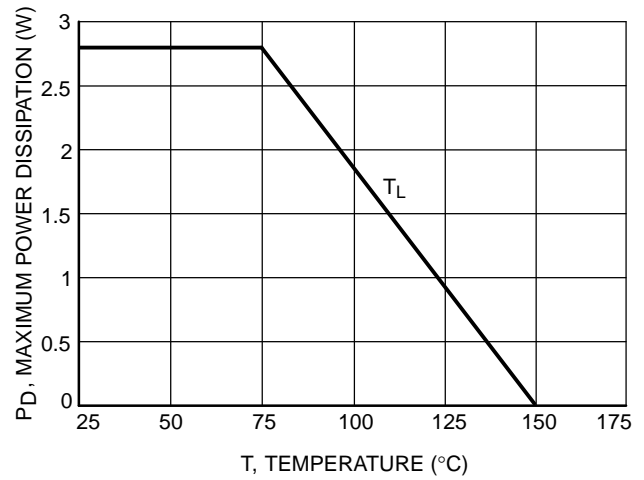


Figure 6. Steady State Power Derating

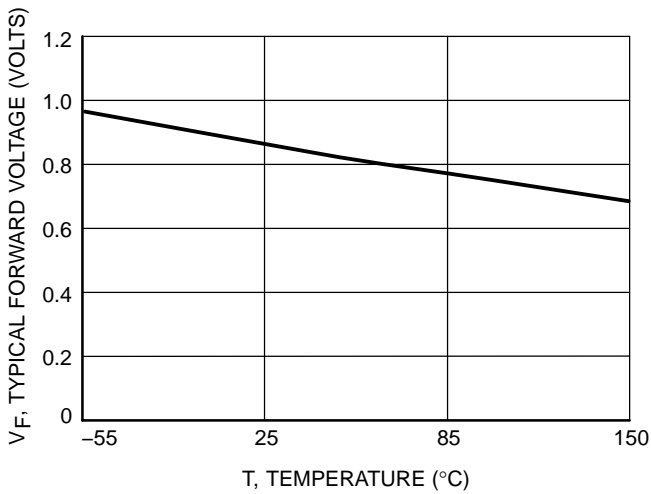


Figure 7. Forward Voltage

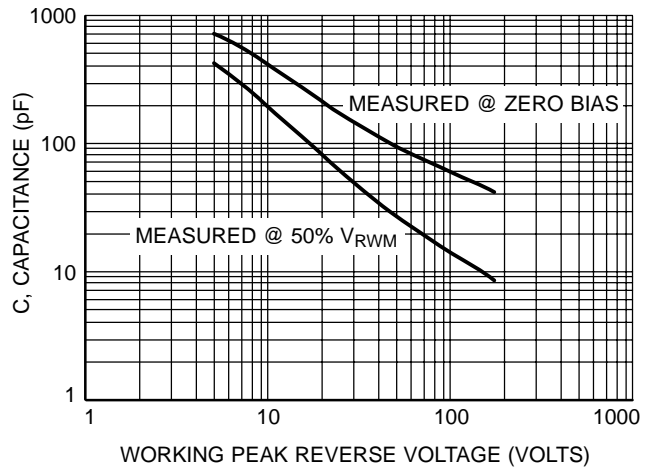
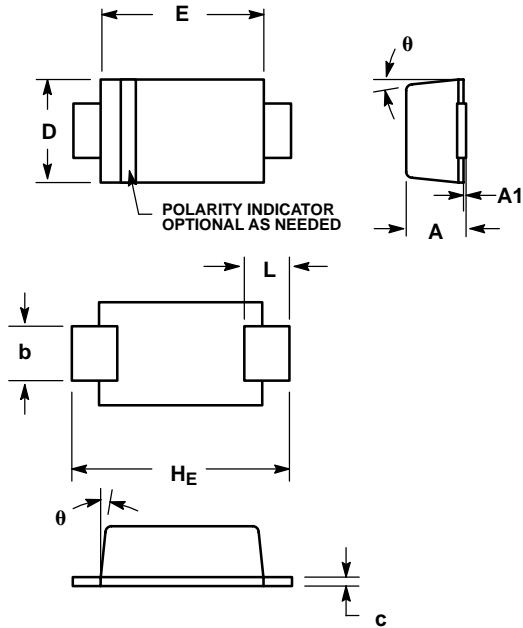


Figure 8. Capacitance versus Working Peak Reverse Voltage

SMF5.0AT1 Series

PACKAGE DIMENSIONS

SOD-123FL
CASE 498-01
ISSUE A

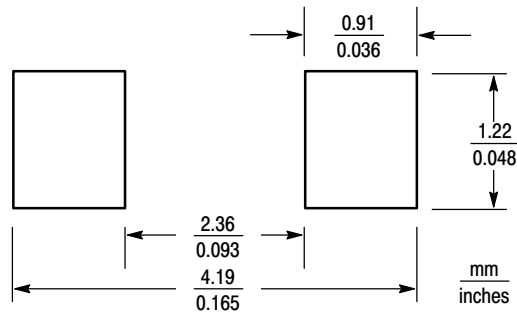


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH.
4. DIMENSIONS D AND J ARE TO BE MEASURED ON FLAT SECTION OF THE LEAD: BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.

| DIM | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|--------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.90 | 0.95 | 1.00 | 0.035 | 0.037 | 0.039 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.70 | 0.90 | 1.10 | 0.028 | 0.035 | 0.043 |
| c | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| D | 1.50 | 1.65 | 1.80 | 0.059 | 0.065 | 0.071 |
| E | 2.50 | 2.70 | 2.90 | 0.098 | 0.106 | 0.114 |
| L | 0.55 | 0.75 | 0.95 | 0.022 | 0.030 | 0.037 |
| H _E | 3.40 | 3.60 | 3.80 | 0.134 | 0.142 | 0.150 |
| θ | 0° | - | 8° | 0° | - | 8° |

SOLDERING FOOTPRINT*



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

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

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.