

# 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 mm<sup>2</sup>
- 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

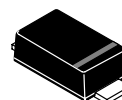
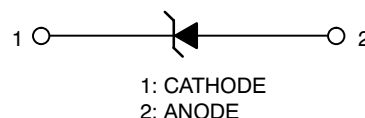
Device Meets MSL 1 Requirements



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### 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<br>(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 $\mu$ s) (Note 1) SMF60A - SMF170A                 | $P_{pk}$              | 175         | W                          |
| Maximum $P_{pk}$ Dissipation (PW-10/1000 $\mu$ s) (Note 1) SMF5.0A - SMF58A                 | $P_{pk}$              | 200         | W                          |
| Maximum $P_{pk}$ Dissipation @ $T_A = 25^\circ\text{C}$ , (PW-8/20 $\mu$ s) (Note 2)        | $P_{pk}$              | 1000        | W                          |
| DC Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 3)<br>Derate above $25^\circ\text{C}$ | $P_D$                 | 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 | $^\circ\text{C}$           |

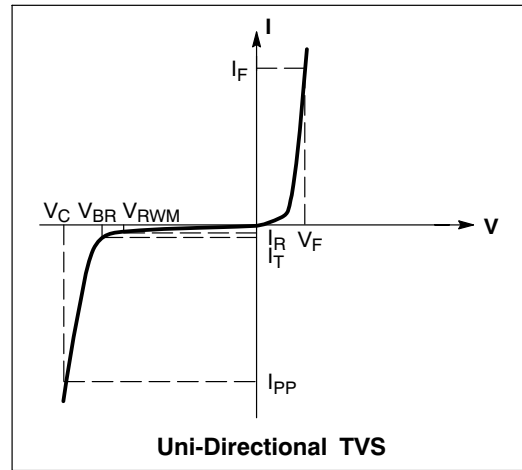
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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)  | ( $\mu\text{A}$ ) | (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  $25^\circ\text{C}$ .

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

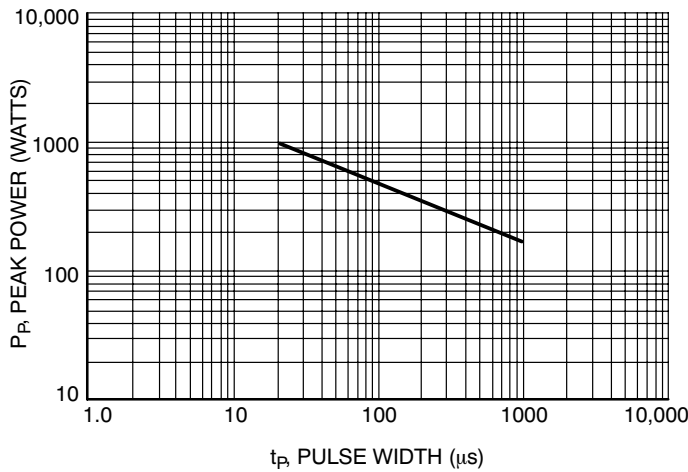
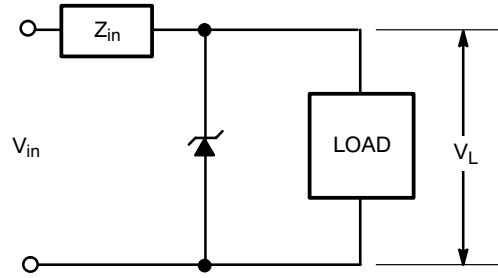


Figure 1. Pulse Rating Curve

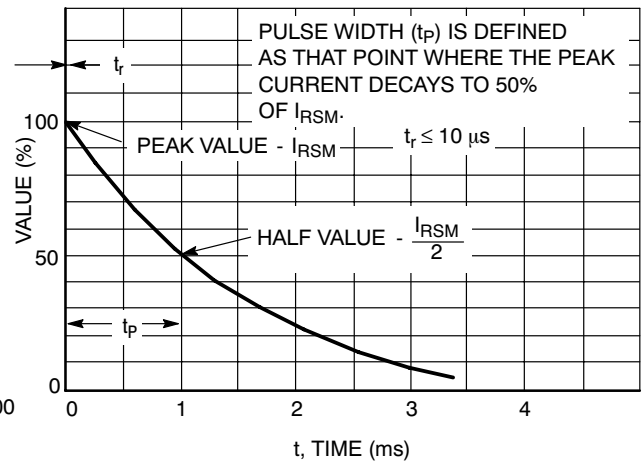


Figure 2. 10 X 1000  $\mu s$  Pulse Waveform

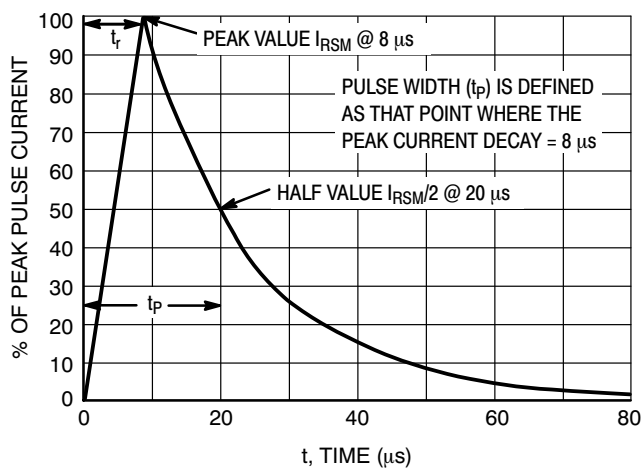


Figure 3. 8 X 20  $\mu s$  Pulse Waveform

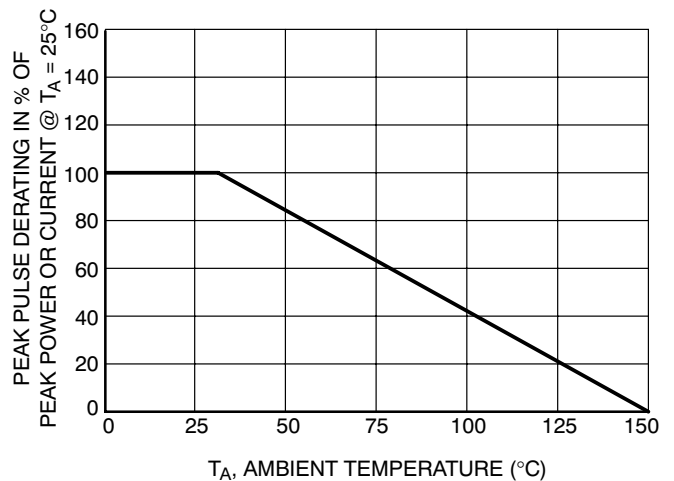


Figure 4. Pulse Derating Curve

## SMF5.0AT1 Series

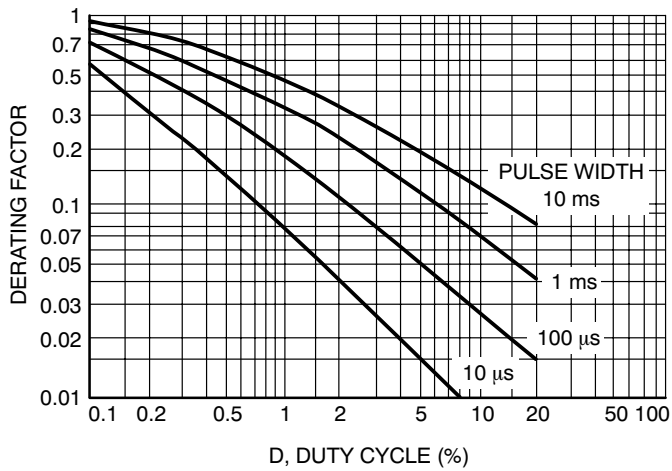


Figure 5. Typical Derating Factor for Duty Cycle

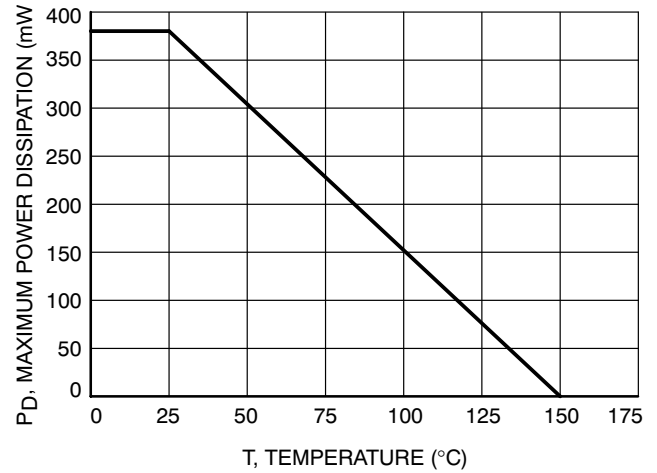


Figure 6. Steady State Power Derating

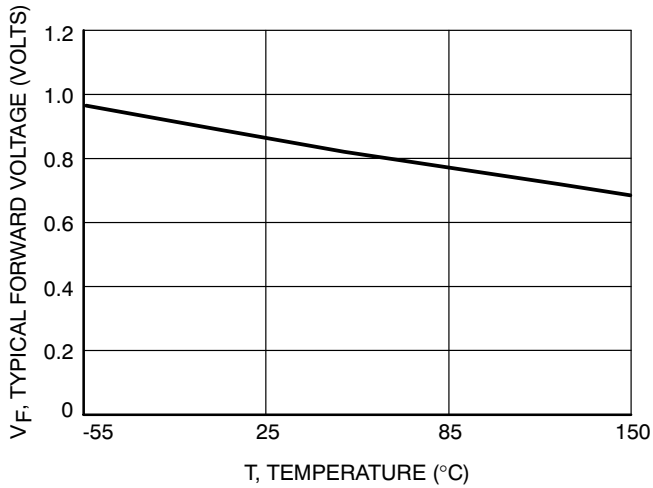


Figure 7. Forward Voltage

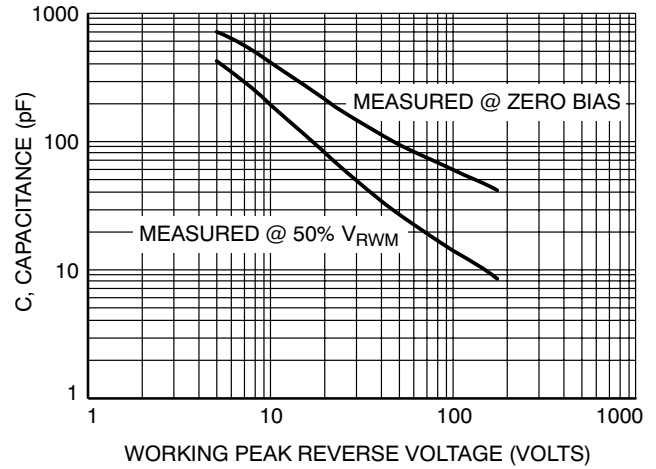
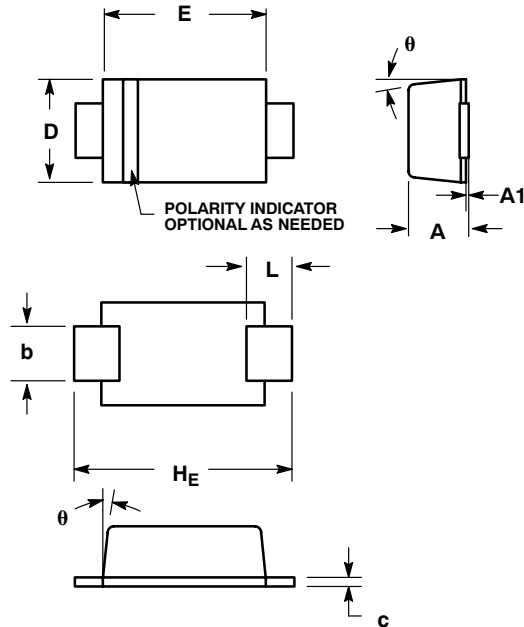


Figure 8. Capacitance versus Working Peak Reverse Voltage

# SMF5.0AT1 Series

## PACKAGE DIMENSIONS

SOD-123FL  
CASE 498-01  
ISSUE A

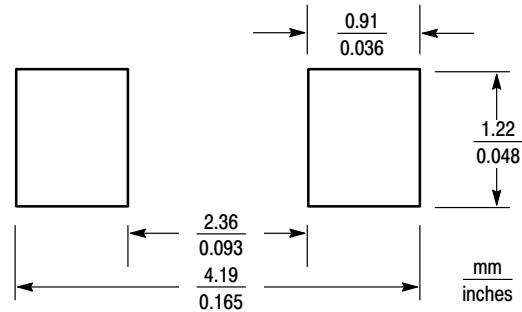


### NOTES:

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 |
| HE    | 3.40        | 3.60 | 3.80 | 0.134  | 0.142 | 0.150 |
| theta | 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.

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