# Zener Voltage Regulators

## 500 mW SOD−123 Surface Mount

# MMSZ52xxxT1G Series, SZMMSZ52xxxT1G Series

Three complete series of Zener diodes are offered in the convenient, surface mount plastic SOD−123 package. These devices provide a convenient alternative to the leadless 34−package style. Zener voltage in this series are specified with device junction in thermal equilibrium.

### Features

- 500 mW Rating on FR−4 or FR−5 Board
- Wide Zener Reverse Voltage Range − 2.4 V to 110 V @ Thermal Equilibrium*
- Package Designed for Optimal Automated Board Assembly
- Small Package Size for High Density Applications
- General Purpose, Medium Current
- ESD Rating of Class 3 (> 16 kV) per Human Body Model
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These are Pb−Free Devices

**Mechanical Characteristics:**
**CASE:** Void-free, transfer-molded, thermosetting plastic case
**FINISH:** Corrosion resistant finish, easily solderable
**MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES:** 260°C for 10 Seconds
**POLARITY:** Cathode indicated by polarity band
**FLAMMABILITY RATING:** UL 94 V−0

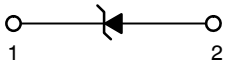
### MAXIMUM RATINGS

| Rating | Symbol | Max | Units |
|---|---|---|---|
| Total Power Dissipation on FR−5 Board, (Note 1) @ $T_L$ = 75°C<br>Derated above 75°C | $P_D$ | 500<br>6.7 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient (Note 2) | $R_{\theta JA}$ | 340 | °C/W |
| Thermal Resistance, Junction−to−Lead (Note 2) | $R_{\theta JL}$ | 150 | °C/W |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
1. FR−5 = 3.5 X 1.5 inches, using the minimum recommended footprint.
2. Thermal Resistance measurement obtained via infrared Scan Method.

*For additional info on thermal equilibrium, please download, **onsemi** TVS/Zener Theory and Design Considerations Handbook, HBD854/D.

**SOD−123**
**CASE 425**
**STYLE 1**




### 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† |
|---|---|---|
| MMSZ52xxBT1G, SZMMSZ52xxBT1G | SOD−123 (Pb−Free) | 3,000 / Tape & Reel |
| MMSZ52xxCT1G, SZMMSZ52xxCT1G | SOD−123 (Pb−Free) | 3,000 / Tape & Reel |
| MMSZ52xxBT3G, SZMMSZ52xxBT3G | SOD−123 (Pb−Free) | 10,000 / Tape & Reel |
| MMSZ52xxCT3G, SZMMSZ52xxCT3G | SOD−123 (Pb−Free) | 10,000 / Tape & Reel |

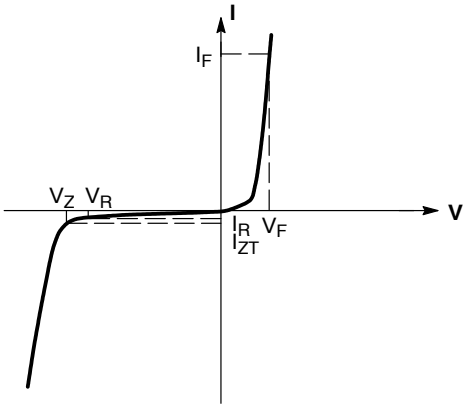
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

### DEVICE MARKING INFORMATION

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

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted, $V_F$ = 0.95 V Max. @ $I_F$ = 10 mA)

| Symbol | Parameter |
|---|---|
| $V_Z$ | Reverse Zener Voltage @ $I_{ZT}$ |
| $I_{ZT}$ | Reverse Current |
| $Z_{ZT}$ | Maximum Zener Impedance @ $I_{ZT}$ |
| $I_{ZK}$ | Reverse Current |
| $Z_{ZK}$ | Maximum Zener Impedance @ $I_{ZK}$ |
| $I_R$ | Reverse Leakage Current @ $V_R$ |
| $V_R$ | Reverse Voltage |
| $I_F$ | Forward Current |
| $V_F$ | Forward Voltage @ $I_F$ |




**Zener Voltage Regulator**

**5% TOLERANCE FG ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted, $V_F$ = 0.9 V Max. @ $I_F$ = 10 mA)

| Device* | Device Marking | Zener Voltage (Notes 3 and 4) | | | | Zener Impedance (Note 5) | | | Leakage Current | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_Z$ (Volts) | | | @ $I_{ZT}$ | $Z_{ZT}$ @ $I_{ZT}$ | $Z_{ZK}$ @ $I_{ZK}$ | | $I_R$ @ $V_R$ | |
| | | Min | Nom | Max | mA | Ω | Ω | mA | μA | Volts |
| MMSZ5221BT1G | C1 | 2.28 | 2.4 | 2.52 | 20 | 30 | 1200 | 0.25 | 100 | 1 |
| MMSZ5222BT1G | C2 | 2.38 | 2.5 | 2.63 | 20 | 30 | 1250 | 0.25 | 100 | 1 |
| MMSZ5223BT1G | C3 | 2.57 | 2.7 | 2.84 | 20 | 30 | 1300 | 0.25 | 75 | 1 |
| MMSZ5224BT1G | C4 | 2.66 | 2.8 | 2.94 | 20 | 30 | 1400 | 0.25 | 75 | 1 |
| MMSZ5225BT1G | C5 | 2.85 | 3.0 | 3.15 | 20 | 29 | 1600 | 0.25 | 50 | 1 |
| MMSZ5226BT1G | D1 | 3.14 | 3.3 | 3.47 | 20 | 28 | 1600 | 0.25 | 25 | 1 |
| MMSZ5227BT1G | D2 | 3.42 | 3.6 | 3.78 | 20 | 24 | 1700 | 0.25 | 15 | 1 |
| MMSZ5228BT1G | D3 | 3.71 | 3.9 | 4.10 | 20 | 23 | 1900 | 0.25 | 10 | 1 |
| MMSZ5229BT1G | D4 | 4.09 | 4.3 | 4.52 | 20 | 22 | 2000 | 0.25 | 5 | 1 |
| MMSZ5230BT1G | D5 | 4.47 | 4.7 | 4.94 | 20 | 19 | 1900 | 0.25 | 5 | 2 |
| MMSZ5231BT1G | E1 | 4.85 | 5.1 | 5.36 | 20 | 17 | 1600 | 0.25 | 5 | 2 |
| MMSZ5232BT1G | E2 | 5.32 | 5.6 | 5.88 | 20 | 11 | 1600 | 0.25 | 5 | 3 |
| MMSZ5233BT1G | E3 | 5.70 | 6.0 | 6.30 | 20 | 7 | 1600 | 0.25 | 5 | 3.5 |
| MMSZ5234BT1G | E4 | 5.89 | 6.2 | 6.51 | 20 | 7 | 1000 | 0.25 | 5 | 4 |
| MMSZ5235BT1G | E5 | 6.46 | 6.8 | 7.14 | 20 | 5 | 750 | 0.25 | 3 | 5 |
| MMSZ5236BT1G | F1 | 7.13 | 7.5 | 7.88 | 20 | 6 | 500 | 0.25 | 3 | 6 |
| MMSZ5237BT1G | F2 | 7.79 | 8.2 | 8.61 | 20 | 8 | 500 | 0.25 | 3 | 6.5 |
| MMSZ5238BT1G | F3 | 8.27 | 8.7 | 9.14 | 20 | 8 | 600 | 0.25 | 3 | 6.5 |
| MMSZ5239BT1G | F4 | 8.65 | 9.1 | 9.56 | 20 | 10 | 600 | 0.25 | 3 | 7 |
| MMSZ5240BT1G | F5 | 9.50 | 10 | 10.50 | 20 | 17 | 600 | 0.25 | 3 | 8 |
| MMSZ5241BT1G | H1 | 10.45 | 11 | 11.55 | 20 | 22 | 600 | 0.25 | 2 | 8.4 |
| MMSZ5242BT1G/T3G | H2 | 11.40 | 12 | 12.60 | 20 | 30 | 600 | 0.25 | 1 | 9.1 |
| MMSZ5243BT1G | H3 | 12.35 | 13 | 13.65 | 9.5 | 13 | 600 | 0.25 | 0.5 | 9.9 |
| MMSZ5244BT1G | H4 | 13.30 | 14 | 14.70 | 9.0 | 15 | 600 | 0.25 | 0.1 | 10 |
| MMSZ5245BT1G | H5 | 14.25 | 15 | 15.75 | 8.5 | 16 | 600 | 0.25 | 0.1 | 11 |
| MMSZ5246BT1G | J1 | 15.20 | 16 | 16.80 | 7.8 | 17 | 600 | 0.25 | 0.1 | 12 |
| MMSZ5247BT1G | J2 | 16.15 | 17 | 17.85 | 7.4 | 19 | 600 | 0.25 | 0.1 | 13 |
| MMSZ5248BT1G | J3 | 17.10 | 18 | 18.90 | 7.0 | 21 | 600 | 0.25 | 0.1 | 14 |
| MMSZ5249BT1G | J4 | 18.05 | 19 | 19.95 | 6.6 | 23 | 600 | 0.25 | 0.1 | 14 |
| MMSZ5250BT1G | J5 | 19.00 | 20 | 21.00 | 6.2 | 25 | 600 | 0.25 | 0.1 | 15 |
| MMSZ5251BT1G | K1 | 20.90 | 22 | 23.10 | 5.6 | 29 | 600 | 0.25 | 0.1 | 17 |
| MMSZ5252BT1G | K2 | 22.80 | 24 | 25.20 | 5.2 | 33 | 600 | 0.25 | 0.1 | 18 |
| MMSZ5253BT1G | K3 | 23.75 | 25 | 26.25 | 5.0 | 35 | 600 | 0.25 | 0.1 | 19 |
| MMSZ5254BT1G/T3G | K4 | 25.65 | 27 | 28.35 | 4.6 | 41 | 600 | 0.25 | 0.1 | 21 |
| MMSZ5255BT1G | K5 | 26.60 | 28 | 29.40 | 4.5 | 44 | 600 | 0.25 | 0.1 | 21 |
| MMSZ5256BT1G | M1 | 28.50 | 30 | 31.50 | 4.2 | 49 | 600 | 0.25 | 0.1 | 23 |
| MMSZ5257BT1G | M2 | 31.35 | 33 | 34.65 | 3.8 | 58 | 700 | 0.25 | 0.1 | 25 |
| MMSZ5258BT1G/T3G | M3 | 34.20 | 36 | 37.80 | 3.4 | 70 | 700 | 0.25 | 0.1 | 27 |
| MMSZ5259BT1G | M4 | 37.05 | 39 | 40.95 | 3.2 | 80 | 800 | 0.25 | 0.1 | 30 |
| MMSZ5260BT1G | M5 | 40.85 | 43 | 45.15 | 3.0 | 93 | 900 | 0.25 | 0.1 | 33 |
| MMSZ5261BT1G | N1 | 44.65 | 47 | 49.35 | 2.7 | 105 | 1000 | 0.25 | 0.1 | 36 |
| MMSZ5262BT1G | N2 | 48.45 | 51 | 53.55 | 2.5 | 125 | 1100 | 0.25 | 0.1 | 39 |
| MMSZ5263BT1G | N3 | 53.20 | 56 | 58.80 | 2.2 | 150 | 1300 | 0.25 | 0.1 | 43 |
| MMSZ5264BT1G | N4 | 57.00 | 60 | 63.00 | 2.1 | 170 | 1400 | 0.25 | 0.1 | 46 |
| MMSZ5265BT1G | N5 | 58.90 | 62 | 65.10 | 2.0 | 185 | 1400 | 0.25 | 0.1 | 47 |
| MMSZ5266BT1G | P1 | 64.60 | 68 | 71.40 | 1.8 | 230 | 1600 | 0.25 | 0.1 | 52 |
| MMSZ5267BT1G | P2 | 71.25 | 75 | 78.75 | 1.7 | 270 | 1700 | 0.25 | 0.1 | 56 |
| MMSZ5268BT1G | P3 | 77.90 | 82 | 86.10 | 1.5 | 330 | 2000 | 0.25 | 0.1 | 62 |
| MMSZ5269BT1G | P4 | 82.65 | 87 | 91.35 | 1.4 | 370 | 2200 | 0.25 | 0.1 | 68 |
| MMSZ5270BT1G | P5 | 86.45 | 91 | 95.55 | 1.4 | 400 | 2300 | 0.25 | 0.1 | 69 |
| MMSZ5272BT1G/T3G | R2 | 104.5 | 110 | 115.5 | 1.1 | 750 | 3000 | 0.25 | 0.1 | 84 |

*Includes SZ-prefix devices where applicable.

3. "B" Suffix Type numbers shown have a standard tolerance of ±5% on the nominal Zener voltages.
4. Nominal Zener voltage is measured with the device junction in thermal equilibrium at $T_L$ = 30°C ±1°C.
5. $Z_{ZT}$ and $Z_{ZK}$ are measured by dividing the AC voltage drop across the device by the ac current applied. The specified limits are for $I_{Z(AC)}$ = 0.1 $I_{Z(dc)}$ with the AC frequency = 1 kHz.

**2% TOLERANCE FG ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted, $V_F$ = 0.9 V Max. @ $I_F$ = 10 mA)

| Device* | Device Marking | Zener Voltage (Notes 6 and 7) | | | | Zener Impedance (Note 8) | | | Leakage Current | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_Z$ (Volts) | | | @ $I_{ZT}$ | $Z_{ZT}$ @ $I_{ZT}$ | $Z_{ZK}$ @ $I_{ZK}$ | | $I_R$ @ $V_R$ | |
| | | Min | Nom | Max | mA | Ω | Ω | mA | μA | Volts |
| MMSZ5226CT1G | TD | 3.234 | 3.3 | 3.366 | 20 | 28 | 1600 | 0.25 | 25 | 1 |
| MMSZ5231CT1G | TG | 4.998 | 5.1 | 5.202 | 20 | 17 | 1600 | 0.25 | 5 | 2 |
| MMSZ5232CT1G | TH | 5.488 | 5.6 | 5.712 | 20 | 11 | 1600 | 0.25 | 5 | 3 |
| MMSZ5245CT1G | TK | 14.70 | 15 | 15.30 | 8.5 | 16 | 600 | 0.25 | 0.1 | 11 |
| MMSZ5248CT1G | TL | 17.64 | 18 | 18.36 | 7.0 | 21 | 600 | 0.25 | 0.1 | 14 |
| MMSZ5250CT1G | TN | 19.60 | 20 | 20.40 | 6.2 | 25 | 600 | 0.25 | 0.1 | 15 |
| MMSZ5252CT1G | TQ | 23.52 | 24 | 24.48 | 5.2 | 33 | 600 | 0.25 | 0.1 | 18 |
| MMSZ5256CT1G | TW | 29.40 | 30 | 30.60 | 4.2 | 49 | 600 | 0.25 | 0.1 | 23 |
| MMSZ5258CT1G | TX | 35.28 | 36 | 36.72 | 3.4 | 70 | 700 | 0.25 | 0.1 | 27 |

6. “C” Suffix Type numbers shown have a standard tolerance of ±2% on the nominal Zener voltages.
7. Nominal Zener voltage is measured with the device junction in thermal equilibrium at $T_L$ = 30°C ±1°C.
8. $Z_{ZT}$ and $Z_{ZK}$ are measured by dividing the AC voltage drop across the device by the ac current applied. The specified limits are for $I_{Z(AC)}$ = 0.1 $I_{Z(dc)}$ with the AC frequency = 1 kHz.

*Includes SZ-prefix devices where applicable.

## TYPICAL CHARACTERISTICS

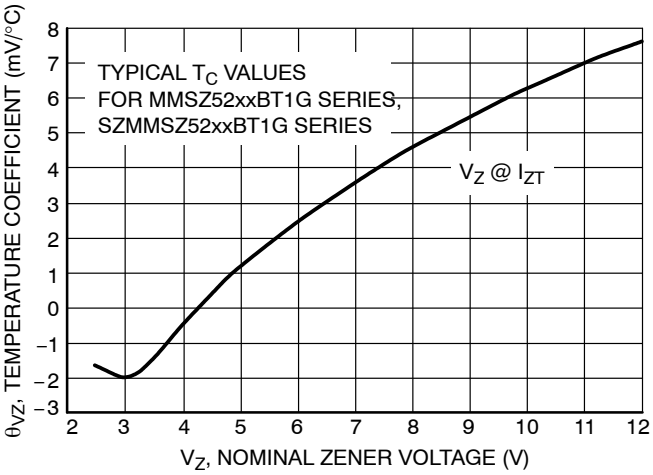



**Figure 1. Temperature Coefficients (Temperature Range −55°C to +150°C)**

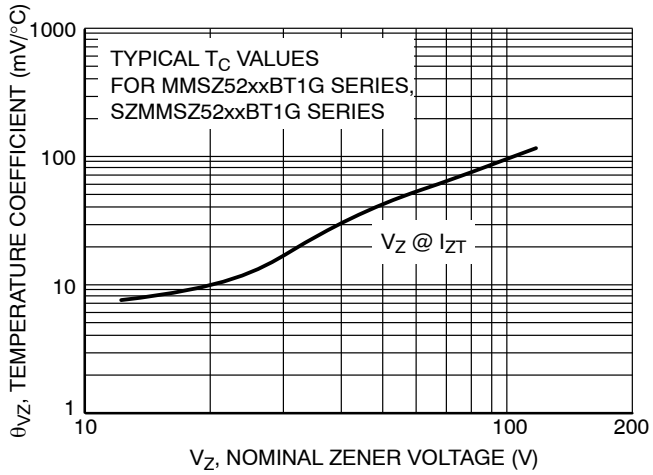



**Figure 2. Temperature Coefficients (Temperature Range −55°C to +150°C)**

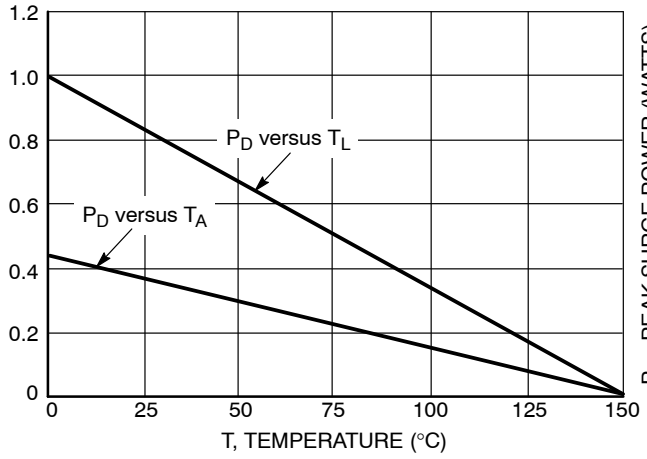



**Figure 3. Steady State Power Derating**

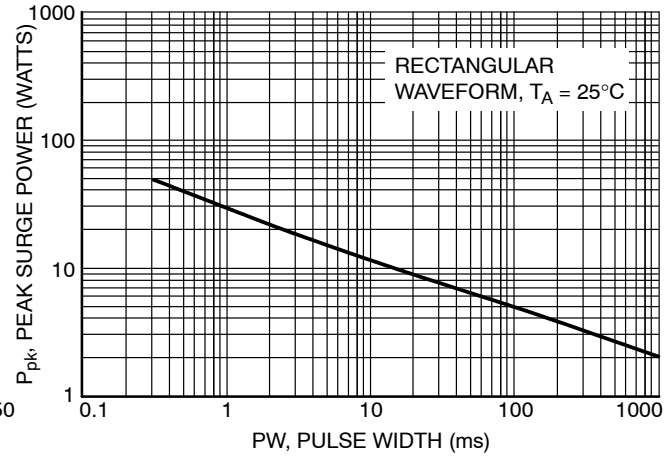



**Figure 4. Maximum Nonrepetitive Surge Power**

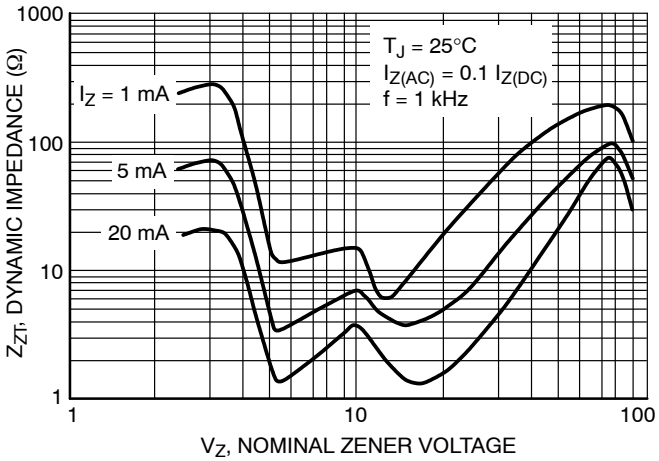



**Figure 5. Effect of Zener Voltage on Zener Impedance**

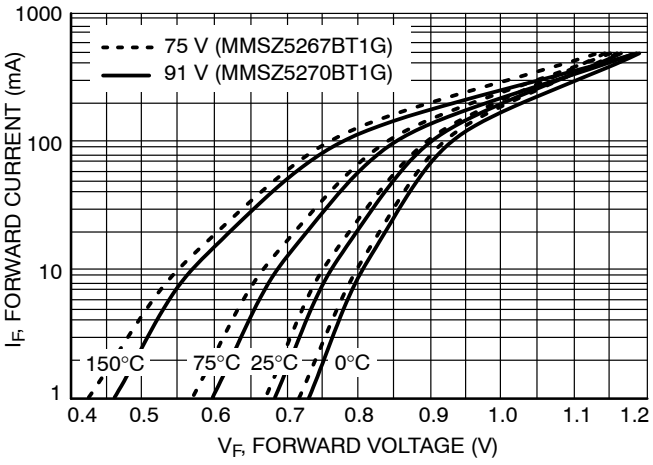



**Figure 6. Typical Forward Voltage**

## TYPICAL CHARACTERISTICS

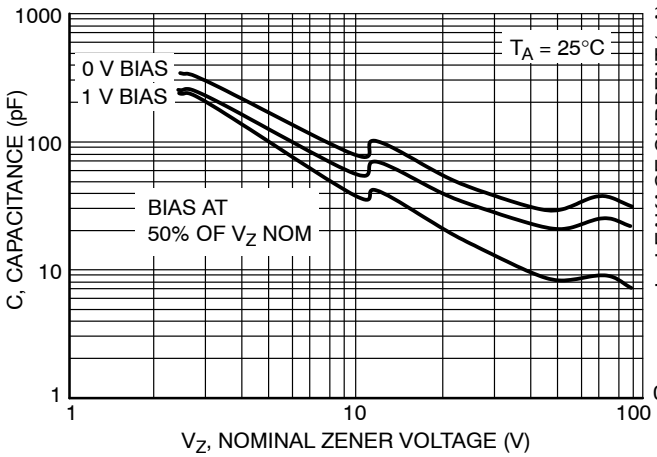



**Figure 7. Typical Capacitance**

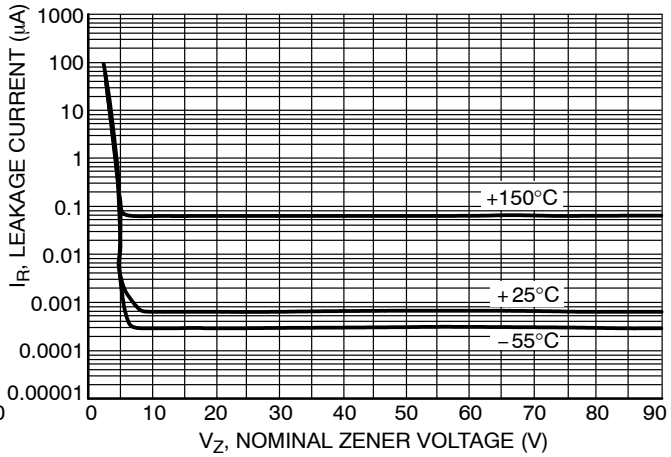



**Figure 8. Typical Leakage Current**

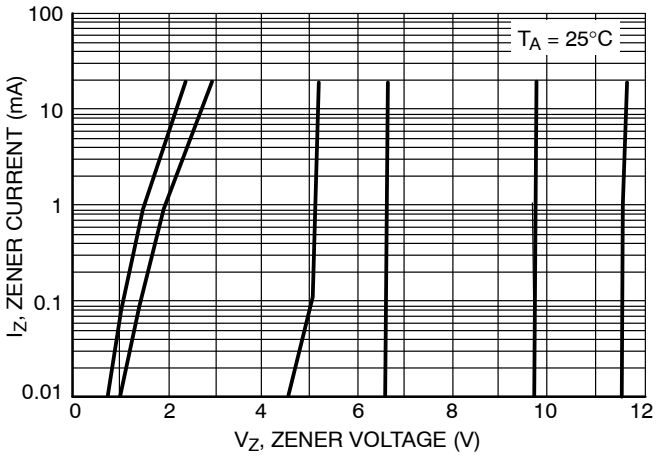



**Figure 9. Zener Voltage versus Zener Current ($V_Z$ Up to 12 V)**

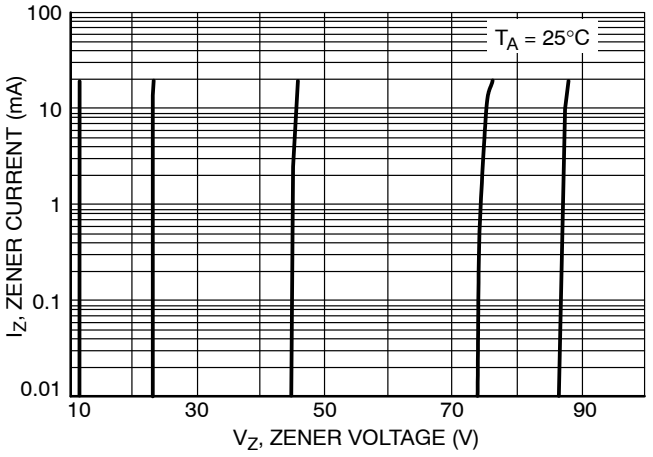



**Figure 10. Zener Voltage versus Zener Current (12 V to 91 V)**

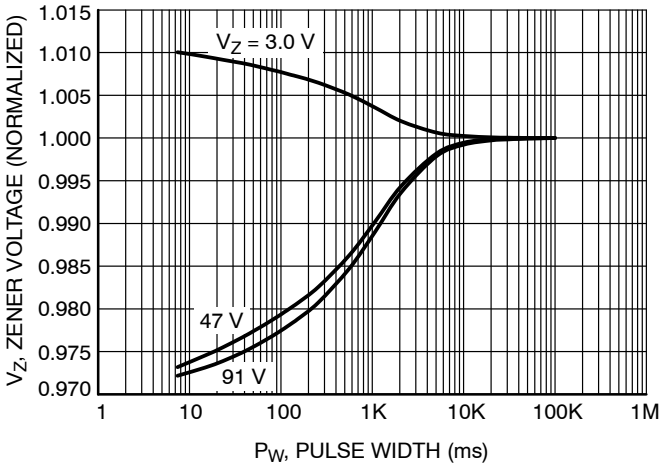



**Figure 11. SOD−123 (plastic) 500 Watt Device**

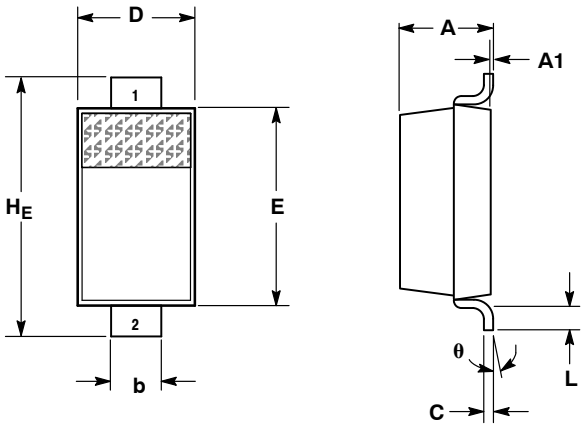
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

SCALE 5:1

**SOD−123**
CASE 425−04
ISSUE G

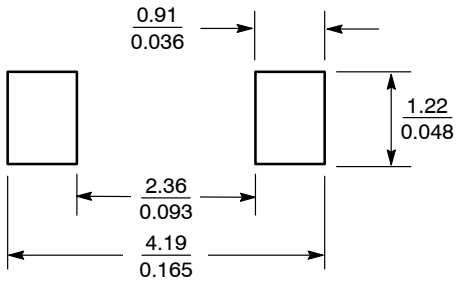
DATE 07 OCT 2009




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.94 | 1.17 | 1.35 | 0.037 | 0.046 | 0.053 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.51 | 0.61 | 0.71 | 0.020 | 0.024 | 0.028 |
| c | --- | --- | 0.15 | --- | --- | 0.006 |
| D | 1.40 | 1.60 | 1.80 | 0.055 | 0.063 | 0.071 |
| E | 2.54 | 2.69 | 2.84 | 0.100 | 0.106 | 0.112 |
| $H_E$ | 3.56 | 3.68 | 3.86 | 0.140 | 0.145 | 0.152 |
| L | 0.25 | --- | --- | 0.010 | --- | --- |
| θ | 0° | --- | 10° | 0° | --- | 10° |

### SOLDERING FOOTPRINT*




SCALE 10:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

### GENERIC MARKING DIAGRAM*


XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

STYLE 1:
PIN 1. CATHODE
2. ANODE

| | | | |
|---|---|---|---|
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| DESCRIPTION: | SOD−123 | | PAGE 1 OF 1 |

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
**Email Requests to:** orderlit@onsemi.com

**onsemi Website:** www.onsemi.com

**TECHNICAL SUPPORT**
**North American Technical Support:**
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊

# Mouser Electronics

Authorized Distributor

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onsemi:

MMSZ5221BT1 MMSZ5221BT1G MMSZ5222BT1 MMSZ5222BT1G MMSZ5223BT1 MMSZ5223BT1G MMSZ5223BT3 MMSZ5224BT1 MMSZ5224BT1G MMSZ5225BT1 MMSZ5225BT1G MMSZ5226BT1 MMSZ5226BT1G MMSZ5226BT3 MMSZ5226BT3G MMSZ5227BT1 MMSZ5227BT1G MMSZ5228BT1 MMSZ5228BT1G MMSZ5228BT3 MMSZ5229BT1 MMSZ5229BT1G MMSZ5229BT3 MMSZ5230BT1 MMSZ5230BT1G MMSZ5230BT3 MMSZ5231BT1 MMSZ5231BT1G MMSZ5231BT3 MMSZ5232BT1 MMSZ5232BT1G MMSZ5233BT1 MMSZ5233BT1G MMSZ5233BT3 MMSZ5234BT1 MMSZ5234BT1G MMSZ5234BT3 MMSZ5234BT3G MMSZ5235BT1 MMSZ5235BT1G MMSZ5235BT3 MMSZ5236BT1 MMSZ5236BT1G MMSZ5236BT3 MMSZ5236BT3G MMSZ5237BT1 MMSZ5237BT1G MMSZ5238BT1 MMSZ5238BT1G MMSZ5239BT1 MMSZ5239BT1G MMSZ5239BT3 MMSZ5240BT1 MMSZ5240BT1G MMSZ5240BT3 MMSZ5241BT1 MMSZ5241BT1G MMSZ5242BT1 MMSZ5242BT1G MMSZ5242BT3 MMSZ5242BT3G MMSZ5243BT1 MMSZ5243BT1G MMSZ5243BT3 MMSZ5244BT1 MMSZ5244BT1G MMSZ5245BT1 MMSZ5245BT1G MMSZ5245BT3 MMSZ5245BT3G MMSZ5246BT1 MMSZ5246BT1G MMSZ5246BT3 MMSZ5246BT3G MMSZ5247BT1 MMSZ5247BT1G MMSZ5248BT1 MMSZ5248BT1G MMSZ5248BT3 MMSZ5249BT1 MMSZ5249BT1G MMSZ5250BT1 MMSZ5250BT1G MMSZ5250BT3 MMSZ5250BT3G MMSZ5251BT1 MMSZ5251BT1G MMSZ5252BT1 MMSZ5252BT1G MMSZ5252BT3 MMSZ5252BT3G MMSZ5253BT1 MMSZ5253BT1G MMSZ5254BT1 MMSZ5254BT1G MMSZ5255BT1 MMSZ5255BT1G MMSZ5255BT3 MMSZ5256BT1 MMSZ5256BT1G