

# MMSZ5221BT1 Series

Preferred Device

## Zener Voltage Regulators

### 500 mW SOD-123 Surface Mount

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.

#### Features

- 500 mW Rating on FR-4 or FR-5 Board
- Wide Zener Reverse Voltage Range – 2.4 V to 110 V
- 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
- Pb-Free Packages are Available

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

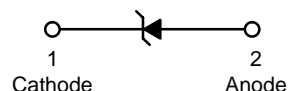
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur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

1. FR-5 = 3.5 X 1.5 inches, using the minimum recommended footprint.
2. Thermal Resistance measurement obtained via infrared Scan Method.



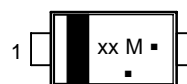
ON Semiconductor®

<http://onsemi.com>



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†         |
|--------------|----------------------|-------------------|
| MMSZ52xxBT1  | SOD-123              | 3000/Tape & Reel  |
| MMSZ52xxBT1G | SOD-123<br>(Pb-Free) | 3000/Tape & Reel  |
| MMSZ52xxBT3  | SOD-123              | 10000/Tape & Reel |
| MMSZ52xxBT3G | SOD-123<br>(Pb-Free) | 10000/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

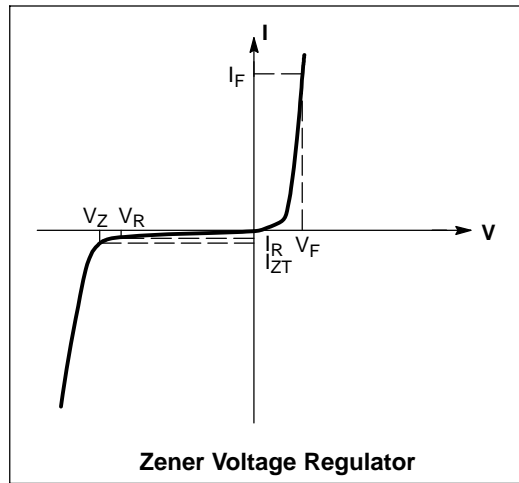
See specific marking information in the device marking column of the Electrical Characteristics table on page 3 of this data sheet.

Devices listed in **bold, italic** are ON Semiconductor **Preferred** devices. Preferred devices are recommended choices for future use and best overall value.

## MMSZ5221BT1 Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.95\text{ V Max. @ } I_F = 10\text{ mA}$ )

| 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 @ $I_F$            |



## MMSZ5221BT1 Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.9\text{ V Max.}$  @  $I_F = 10\text{ mA}$ )

| Device                | Device Marking | Zener Voltage (Notes 3 and 4) |            |              |                   | Zener Impedance (Note 5)          |                                   |             | Leakage Current                 |            |
|-----------------------|----------------|-------------------------------|------------|--------------|-------------------|-----------------------------------|-----------------------------------|-------------|---------------------------------|------------|
|                       |                | V <sub>Z</sub> (Volts)        |            |              | @ I <sub>ZT</sub> | Z <sub>ZT</sub> @ I <sub>ZT</sub> | Z <sub>ZK</sub> @ I <sub>ZK</sub> |             | I <sub>R</sub> @ V <sub>R</sub> |            |
|                       |                | Min                           | Nom        | Max          | mA                | Ω                                 | Ω                                 | mA          | μA                              | Volts      |
| <b>MMSZ5221BT1, G</b> | <b>C1</b>      | <b>2.28</b>                   | <b>2.4</b> | <b>2.52</b>  | <b>20</b>         | <b>30</b>                         | <b>1200</b>                       | <b>0.25</b> | <b>100</b>                      | <b>1</b>   |
| <b>MMSZ5222BT1, G</b> | <b>C2</b>      | <b>2.38</b>                   | <b>2.5</b> | <b>2.63</b>  | <b>20</b>         | <b>30</b>                         | <b>1250</b>                       | <b>0.25</b> | <b>100</b>                      | <b>1</b>   |
| MMSZ5223BT1, G        | C3             | 2.57                          | 2.7        | 2.84         | 20                | 30                                | 1300                              | 0.25        | 75                              | 1          |
| MMSZ5224BT1, G        | C4             | 2.66                          | 2.8        | 2.94         | 20                | 30                                | 1400                              | 0.25        | 75                              | 1          |
| <b>MMSZ5225BT1, G</b> | <b>C5</b>      | <b>2.85</b>                   | <b>3.0</b> | <b>3.15</b>  | <b>20</b>         | <b>29</b>                         | <b>1600</b>                       | <b>0.25</b> | <b>50</b>                       | <b>1</b>   |
| MMSZ5226BT1, G        | D1             | 3.14                          | 3.3        | 3.47         | 20                | 28                                | 1600                              | 0.25        | 25                              | 1          |
| MMSZ5227BT1, G        | D2             | 3.42                          | 3.6        | 3.78         | 20                | 24                                | 1700                              | 0.25        | 15                              | 1          |
| MMSZ5228BT1, G        | D3             | 3.71                          | 3.9        | 4.10         | 20                | 23                                | 1900                              | 0.25        | 10                              | 1          |
| <b>MMSZ5229BT1, G</b> | <b>D4</b>      | <b>4.09</b>                   | <b>4.3</b> | <b>4.52</b>  | <b>20</b>         | <b>22</b>                         | <b>2000</b>                       | <b>0.25</b> | <b>5</b>                        | <b>1</b>   |
| <b>MMSZ5230BT1, G</b> | <b>D5</b>      | <b>4.47</b>                   | <b>4.7</b> | <b>4.94</b>  | <b>20</b>         | <b>19</b>                         | <b>1900</b>                       | <b>0.25</b> | <b>5</b>                        | <b>2</b>   |
| <b>MMSZ5231BT1, G</b> | <b>E1</b>      | <b>4.85</b>                   | <b>5.1</b> | <b>5.36</b>  | <b>20</b>         | <b>17</b>                         | <b>1600</b>                       | <b>0.25</b> | <b>5</b>                        | <b>2</b>   |
| <b>MMSZ5232BT1, G</b> | <b>E2</b>      | <b>5.32</b>                   | <b>5.6</b> | <b>5.88</b>  | <b>20</b>         | <b>11</b>                         | <b>1600</b>                       | <b>0.25</b> | <b>5</b>                        | <b>3</b>   |
| MMSZ5233BT1, G        | E3             | 5.70                          | 6.0        | 6.30         | 20                | 7                                 | 1600                              | 0.25        | 5                               | 3.5        |
| <b>MMSZ5234BT1, G</b> | <b>E4</b>      | <b>5.89</b>                   | <b>6.2</b> | <b>6.51</b>  | <b>20</b>         | <b>7</b>                          | <b>1000</b>                       | <b>0.25</b> | <b>5</b>                        | <b>4</b>   |
| MMSZ5235BT1, G        | E5             | 6.46                          | 6.8        | 7.14         | 20                | 5                                 | 750                               | 0.25        | 3                               | 5          |
| MMSZ5236BT1, G        | F1             | 7.13                          | 7.5        | 7.88         | 20                | 6                                 | 500                               | 0.25        | 3                               | 6          |
| MMSZ5237BT1, G        | F2             | 7.79                          | 8.2        | 8.61         | 20                | 8                                 | 500                               | 0.25        | 3                               | 6.5        |
| MMSZ5238BT1, G        | F3             | 8.27                          | 8.7        | 9.14         | 20                | 8                                 | 600                               | 0.25        | 3                               | 6.5        |
| MMSZ5239BT1, G        | F4             | 8.65                          | 9.1        | 9.56         | 20                | 10                                | 600                               | 0.25        | 3                               | 7          |
| <b>MMSZ5240BT1, G</b> | <b>F5</b>      | <b>9.50</b>                   | <b>10</b>  | <b>10.50</b> | <b>20</b>         | <b>17</b>                         | <b>600</b>                        | <b>0.25</b> | <b>3</b>                        | <b>8</b>   |
| MMSZ5241BT1, G        | H1             | 10.45                         | 11         | 11.55        | 20                | 22                                | 600                               | 0.25        | 2                               | 8.4        |
| <b>MMSZ5242BT1, G</b> | <b>H2</b>      | <b>11.40</b>                  | <b>12</b>  | <b>12.60</b> | <b>20</b>         | <b>30</b>                         | <b>600</b>                        | <b>0.25</b> | <b>1</b>                        | <b>9.1</b> |
| MMSZ5243BT1, G        | H3             | 12.35                         | 13         | 13.65        | 9.5               | 13                                | 600                               | 0.25        | 0.5                             | 9.9        |
| MMSZ5244BT1, G        | H4             | 13.30                         | 14         | 14.70        | 9.0               | 15                                | 600                               | 0.25        | 0.1                             | 10         |
| <b>MMSZ5245BT1, G</b> | <b>H5</b>      | <b>14.25</b>                  | <b>15</b>  | <b>15.75</b> | <b>8.5</b>        | <b>16</b>                         | <b>600</b>                        | <b>0.25</b> | <b>0.1</b>                      | <b>11</b>  |
| <b>MMSZ5246BT1, G</b> | <b>J1</b>      | <b>15.20</b>                  | <b>16</b>  | <b>16.80</b> | <b>7.8</b>        | <b>17</b>                         | <b>600</b>                        | <b>0.25</b> | <b>0.1</b>                      | <b>12</b>  |
| MMSZ5247BT1, G        | J2             | 16.15                         | 17         | 17.85        | 7.4               | 19                                | 600                               | 0.25        | 0.1                             | 13         |
| <b>MMSZ5248BT1, G</b> | <b>J3</b>      | <b>17.10</b>                  | <b>18</b>  | <b>18.90</b> | <b>7.0</b>        | <b>21</b>                         | <b>600</b>                        | <b>0.25</b> | <b>0.1</b>                      | <b>14</b>  |
| MMSZ5250BT1, G        | J5             | 19.00                         | 20         | 21.00        | 6.2               | 25                                | 600                               | 0.25        | 0.1                             | 15         |
| MMSZ5251BT1, G        | K1             | 20.90                         | 22         | 23.10        | 5.6               | 29                                | 600                               | 0.25        | 0.1                             | 17         |
| <b>MMSZ5252BT1, G</b> | <b>K2</b>      | <b>22.80</b>                  | <b>24</b>  | <b>25.20</b> | <b>5.2</b>        | <b>33</b>                         | <b>600</b>                        | <b>0.25</b> | <b>0.1</b>                      | <b>18</b>  |
| MMSZ5253BT1, G        | K3             | 23.75                         | 25         | 26.25        | 5.0               | 35                                | 600                               | 0.25        | 0.1                             | 19         |
| MMSZ5254BT1, G        | K4             | 25.65                         | 27         | 28.35        | 4.6               | 41                                | 600                               | 0.25        | 0.1                             | 21         |
| MMSZ5255BT1, G        | K5             | 26.60                         | 28         | 29.40        | 4.5               | 44                                | 600                               | 0.25        | 0.1                             | 21         |
| MMSZ5256BT1, G        | M1             | 28.50                         | 30         | 31.50        | 4.2               | 49                                | 600                               | 0.25        | 0.1                             | 23         |
| MMSZ5257BT1, G        | M2             | 31.35                         | 33         | 34.65        | 3.8               | 58                                | 700                               | 0.25        | 0.1                             | 25         |
| MMSZ5258BT1, G        | M3             | 34.20                         | 36         | 37.80        | 3.4               | 70                                | 700                               | 0.25        | 0.1                             | 27         |
| MMSZ5259BT1, G        | M4             | 37.05                         | 39         | 40.95        | 3.2               | 80                                | 800                               | 0.25        | 0.1                             | 30         |
| MMSZ5260BT1, G        | M5             | 40.85                         | 43         | 45.15        | 3.0               | 93                                | 900                               | 0.25        | 0.1                             | 33         |
| <b>MMSZ5261BT1, G</b> | <b>N1</b>      | <b>44.65</b>                  | <b>47</b>  | <b>49.35</b> | <b>2.7</b>        | <b>105</b>                        | <b>1000</b>                       | <b>0.25</b> | <b>0.1</b>                      | <b>36</b>  |
| MMSZ5262BT1, G        | N2             | 48.45                         | 51         | 53.55        | 2.5               | 125                               | 1100                              | 0.25        | 0.1                             | 39         |
| MMSZ5263BT1, G        | N3             | 53.20                         | 56         | 58.80        | 2.2               | 150                               | 1300                              | 0.25        | 0.1                             | 43         |
| MMSZ5264BT1, G        | N4             | 57.00                         | 60         | 63.00        | 2.1               | 170                               | 1400                              | 0.25        | 0.1                             | 46         |
| MMSZ5265BT1, G        | N5             | 58.90                         | 62         | 65.10        | 2.0               | 185                               | 1400                              | 0.25        | 0.1                             | 47         |
| MMSZ5266BT1, G        | P1             | 64.60                         | 68         | 71.40        | 1.8               | 230                               | 1600                              | 0.25        | 0.1                             | 52         |
| MMSZ5267BT1, G        | P2             | 71.25                         | 75         | 78.75        | 1.7               | 270                               | 1700                              | 0.25        | 0.1                             | 56         |
| MMSZ5268BT1, G        | P3             | 77.90                         | 82         | 86.10        | 1.5               | 330                               | 2000                              | 0.25        | 0.1                             | 62         |
| MMSZ5269BT1           | P4             | 82.65                         | 87         | 91.35        | 1.4               | 370                               | 2200                              | 0.25        | 0.1                             | 68         |
| MMSZ5270BT1, G        | P5             | 86.45                         | 91         | 95.55        | 1.4               | 400                               | 2300                              | 0.25        | 0.1                             | 69         |
| MMSZ5272BT1, G        | R2             | 104.5                         | 110        | 115.5        | 1.1               | 750                               | 3000                              | 0.25        | 0.1                             | 84         |

3. The type numbers shown have a standard tolerance of  $\pm 5\%$  on the nominal Zener voltage.

4. Nominal Zener voltage is measured with the device junction in thermal equilibrium at  $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$ .

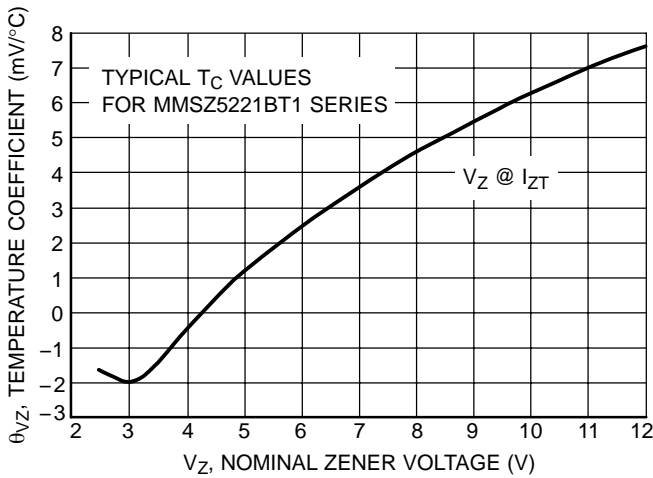
5.  $Z_{ZT}$  and  $Z_{ZK}$  are measured by dividing the AC voltage drop across the device by the ac current applied.

The specified limits are for  $I_{Z(AC)} = 0.1 I_{Z(dc)}$  with the AC frequency = 1 KHz.

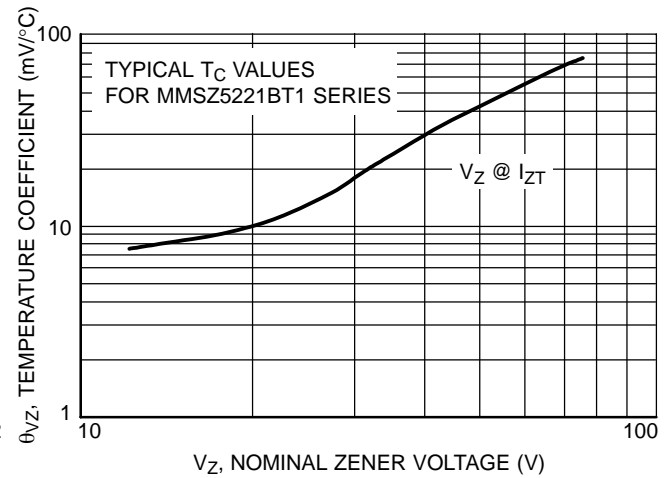
\*The "G" suffix indicates Pb-Free package available.

# MMSZ5221BT1 Series

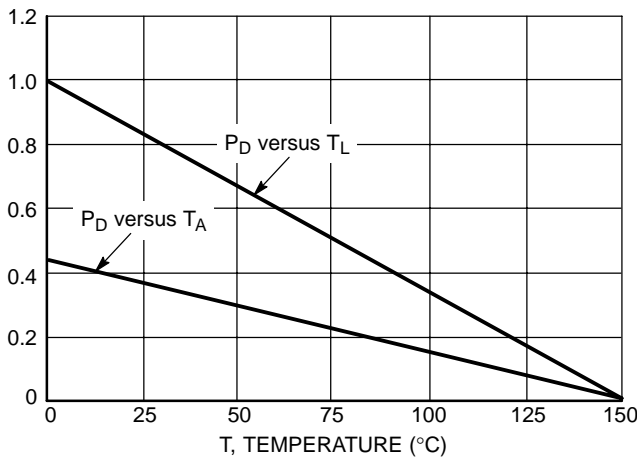
## TYPICAL CHARACTERISTICS



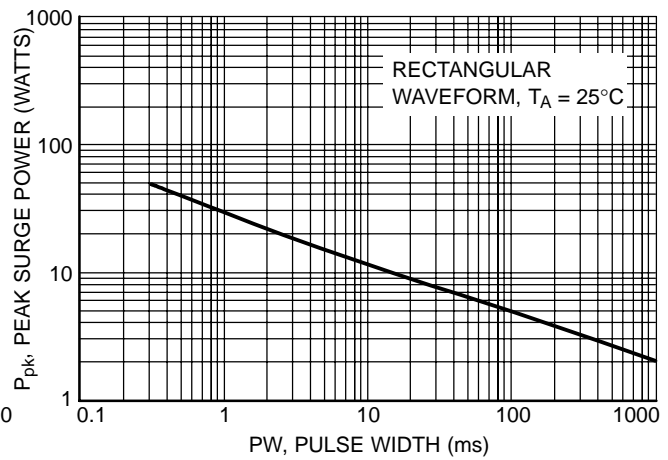
**Figure 1. Temperature Coefficients (Temperature Range -55°C to +150°C)**



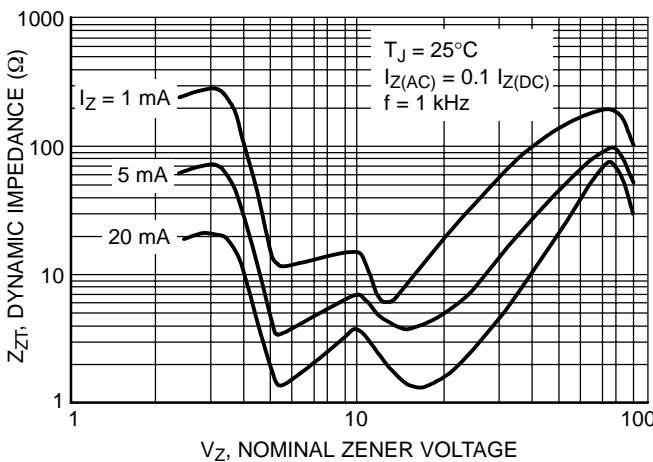
**Figure 2. Temperature Coefficients (Temperature Range -55°C to +150°C)**



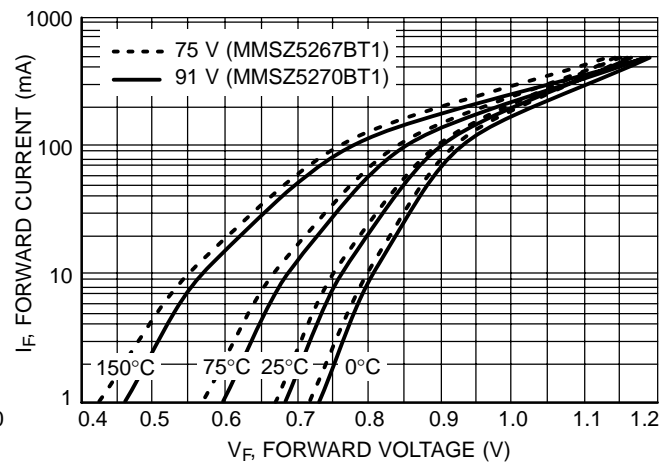
**Figure 3. Steady State Power Derating**



**Figure 4. Maximum Nonrepetitive Surge Power**



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



**Figure 6. Typical Forward Voltage**

# MMSZ5221BT1 Series

## TYPICAL CHARACTERISTICS

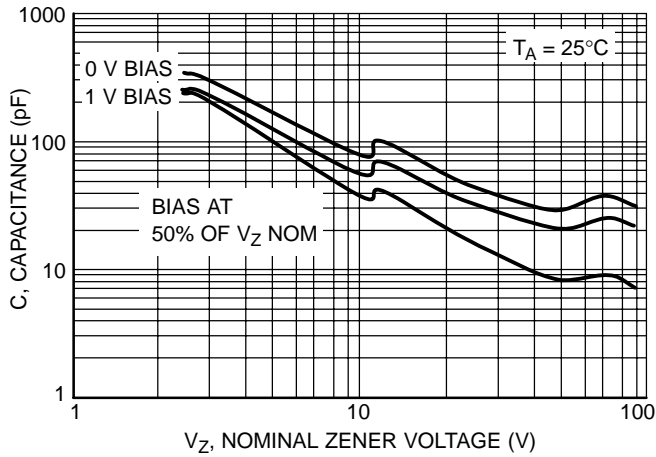


Figure 7. Typical Capacitance

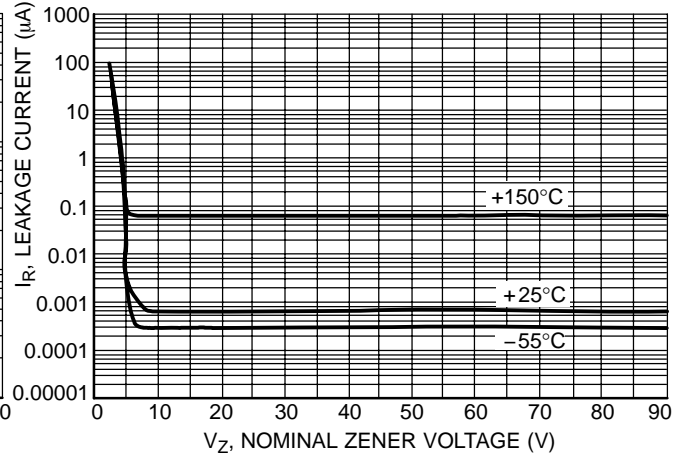


Figure 8. Typical Leakage Current

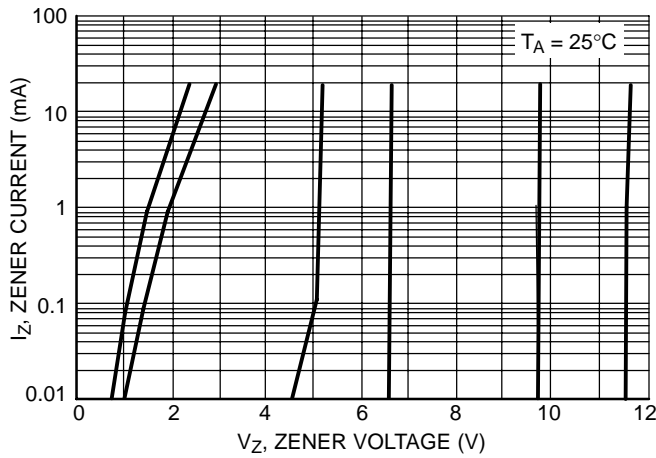


Figure 9. Zener Voltage versus Zener Current ( $V_Z$  Up to 12 V)

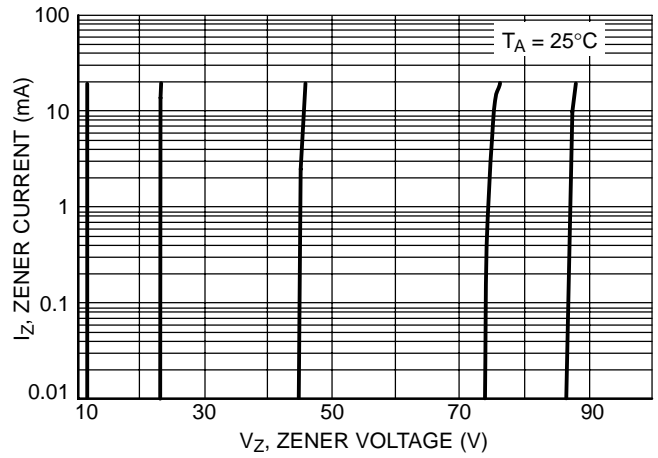
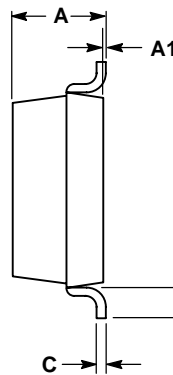
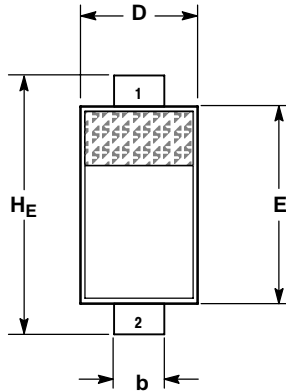


Figure 10. Zener Voltage versus Zener Current (12 V to 91 V)

# MMSZ5221BT1 Series

## PACKAGE DIMENSIONS

SOD-123  
CASE 425-04  
ISSUE E



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

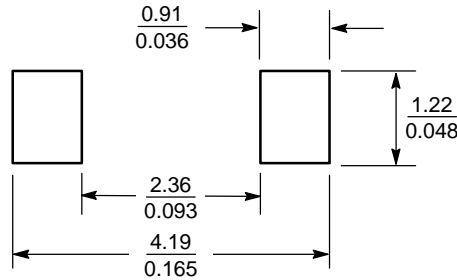
2. CONTROLLING DIMENSION: INCH.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | 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 |
| HE  | 3.56        | 3.68 | 3.86 | 0.140  | 0.145 | 0.152 |
| L   | 0.25        | ---  | ---  | 0.010  | ---   | ---   |

STYLE 1:

PIN 1. CATHODE  
2. ANODE

### SOLDERING FOOTPRINT\*



SCALE 10:1 (mm/inches)

\*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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**MMSZ5221BT1/D**