

# 3 Watt Plastic Surface Mount Zener Voltage Regulators

## 1SMB59xxBT3G Series, SZ1SMB59xxT3G Series

This complete new line of 3 W Zener diodes offers the following advantages.

### Features

- Zener Voltage Range – 3.3 V to 200 V
- ESD Rating of Class 3 (> 16 kV) per Human Body Model
- Flat Handling Surface for Accurate Placement
- Package Design for Top Side or Bottom Circuit Board Mounting
- AEC-Q101 Qualified and PPAP Capable – SZ1SMB59xxT3G
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These are Pb-Free Devices\*

### Mechanical Characteristics:

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

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

**MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES:** 260°C for 10 Seconds

**LEADS:** Modified L-Bend providing more contact area to bond pads

**POLARITY:** Cathode indicated by polarity band

**FLAMMABILITY RATING:** UL 94 V-0

### MAXIMUM RATINGS

| Rating   | Symbol          | Value       | Unit          |
|--|-----------------|-------------|---------------|
| Maximum Steady State Power Dissipation @ $T_L = 75^\circ\text{C}$<br>Measured at Zero Lead Length<br>Derate Above $75^\circ\text{C}$ | $P_D$           | 3.0         | W             |
| Thermal Resistance from Junction-to-Lead   | $R_{\theta JL}$ | 40<br>25    | mW/°C<br>°C/W |
| Maximum Steady State Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note)<br>Derate Above $25^\circ\text{C}$                          | $P_D$           | 550         | mW            |
| Thermal Resistance from Junction-to-Ambient  | $R_{\theta JA}$ | 4.4<br>226  | mW/°C<br>°C/W |
| Operating and Storage Temperature Range  | $T_J, T_{stg}$  | -65 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.

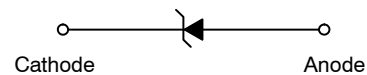
1. FR-4 board, using recommended footprint.

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

## PLASTIC SURFACE MOUNT ZENER VOLTAGE REGULATOR DIODES 3.3–200 V, 3 W DC POWER



SMB  
CASE 403A  
PLASTIC



### MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- WW = Work Week
- 9xxB = Device Code (Refer to page 3)
- = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device         | Package          | Shipping <sup>†</sup>  |
|----------------|------------------|------------------------|
| 1SMB59xxBT3G   | SMB<br>(Pb-Free) | 2,500 /<br>Tape & Reel |
| SZ1SMB59xxBT3G | SMB<br>(Pb-Free) | 2,500 /<br>Tape & Reel |

<sup>†</sup>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.

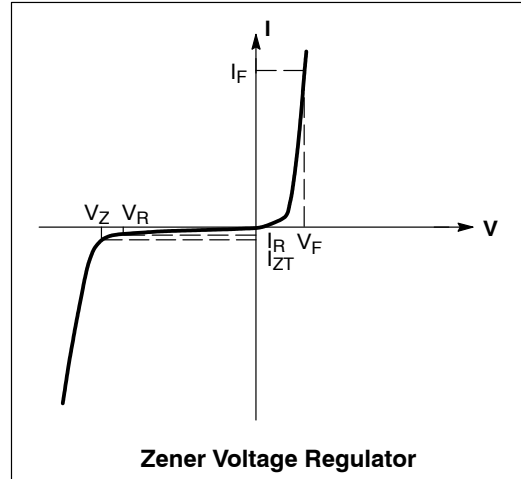
# 1SMB59xxBT3G Series, SZ1SMB59xxT3G Series

## ELECTRICAL CHARACTERISTICS

( $T_L = 30^\circ\text{C}$  unless otherwise noted,

$V_F = 1.5\text{ V Max. @ } I_F = 200\text{ mA(dc)}$  for all types)

| 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 @ $I_F$            |
| $I_{ZM}$ | Maximum DC Zener Current           |



# 1SMB59xxBT3G Series, SZ1SMB59xxT3G Series

**ELECTRICAL CHARACTERISTICS** ( $T_L = 30^\circ\text{C}$  unless otherwise noted,  $V_F = 1.5\text{ V Max.}$  @  $I_F = 200\text{ mA(dc)}$  for all types)  
 (Devices listed in **bold, italic** are onsemi Preferred devices.)

| Device*<br>(Note 2) | Device<br>Marking | Zener Voltage (Note 3) |            |              |             | Zener Impedance (Note 4) |                     |             | Leakage Current |             | $I_{ZM}$<br>mA(dc) |
|---------------------|-------------------|------------------------|------------|--------------|-------------|--------------------------|---------------------|-------------|-----------------|-------------|--------------------|
|                     |                   | $V_Z$ (Volts)          |            |              | @ $I_{ZT}$  | $Z_{ZT}$ @ $I_{ZT}$      | $Z_{ZK}$ @ $I_{ZK}$ |             | $I_R$ @ $V_R$   |             |                    |
|                     |                   | Min                    | Nom        | Max          | mA          | $\Omega$                 | $\Omega$            | mA          | $\mu\text{A}$   | Volts       |                    |
| 1SMB5913BT3G        | 913B              | 3.13                   | 3.3        | 3.47         | 113.6       | 10                       | 500                 | 1           | 100             | 1           | 454                |
| 1SMB5914BT3G        | 914B              | 3.42                   | 3.6        | 3.78         | 104.2       | 9                        | 500                 | 1           | 75              | 1           | 416                |
| <b>1SMB5915BT3G</b> | <b>915B</b>       | <b>3.70</b>            | <b>3.9</b> | <b>4.10</b>  | <b>96.1</b> | <b>7.5</b>               | <b>500</b>          | <b>1</b>    | <b>25</b>       | <b>1</b>    | <b>384</b>         |
| <b>1SMB5916BT3G</b> | <b>916B</b>       | <b>4.08</b>            | <b>4.3</b> | <b>4.52</b>  | <b>87.2</b> | <b>6</b>                 | <b>500</b>          | <b>1</b>    | <b>5</b>        | <b>1</b>    | <b>348</b>         |
| <b>1SMB5917BT3G</b> | <b>917B</b>       | <b>4.46</b>            | <b>4.7</b> | <b>4.94</b>  | <b>79.8</b> | <b>5</b>                 | <b>500</b>          | <b>1</b>    | <b>5</b>        | <b>1.5</b>  | <b>319</b>         |
| <b>1SMB5918BT3G</b> | <b>918B</b>       | <b>4.84</b>            | <b>5.1</b> | <b>5.36</b>  | <b>73.5</b> | <b>4</b>                 | <b>350</b>          | <b>1</b>    | <b>5</b>        | <b>2</b>    | <b>294</b>         |
| <b>1SMB5919BT3G</b> | <b>919B</b>       | <b>5.32</b>            | <b>5.6</b> | <b>5.88</b>  | <b>66.9</b> | <b>2</b>                 | <b>250</b>          | <b>1</b>    | <b>5</b>        | <b>3</b>    | <b>267</b>         |
| <b>1SMB5920BT3G</b> | <b>920B</b>       | <b>5.89</b>            | <b>6.2</b> | <b>6.51</b>  | <b>60.5</b> | <b>2</b>                 | <b>200</b>          | <b>1</b>    | <b>5</b>        | <b>4</b>    | <b>241</b>         |
| 1SMB5921BT3G        | 921B              | 6.46                   | 6.8        | 7.14         | 55.1        | 2.5                      | 200                 | 1           | 5               | 5.2         | 220                |
| 1SMB5922BT3G        | 922B              | 7.12                   | 7.5        | 7.88         | 50          | 3                        | 400                 | 0.5         | 5               | 6           | 200                |
| <b>1SMB5923BT3G</b> | <b>923B</b>       | <b>7.79</b>            | <b>8.2</b> | <b>8.61</b>  | <b>45.7</b> | <b>3.5</b>               | <b>400</b>          | <b>0.5</b>  | <b>5</b>        | <b>6.5</b>  | <b>182</b>         |
| 1SMB5924BT3G        | 924B              | 8.64                   | 9.1        | 9.56         | 41.2        | 4                        | 500                 | 0.5         | 5               | 7           | 164                |
| <b>1SMB5925BT3G</b> | <b>925B</b>       | <b>9.5</b>             | <b>10</b>  | <b>10.5</b>  | <b>37.5</b> | <b>4.5</b>               | <b>500</b>          | <b>0.25</b> | <b>5</b>        | <b>8</b>    | <b>150</b>         |
| <b>1SMB5926BT3G</b> | <b>926B</b>       | <b>10.45</b>           | <b>11</b>  | <b>11.55</b> | <b>34.1</b> | <b>5.5</b>               | <b>550</b>          | <b>0.25</b> | <b>1</b>        | <b>8.4</b>  | <b>136</b>         |
| <b>1SMB5927BT3G</b> | <b>927B</b>       | <b>11.4</b>            | <b>12</b>  | <b>12.6</b>  | <b>31.2</b> | <b>6.5</b>               | <b>550</b>          | <b>0.25</b> | <b>1</b>        | <b>9.1</b>  | <b>125</b>         |
| 1SMB5928BT3G        | 928B              | 12.35                  | 13         | 13.65        | 28.8        | 7                        | 550                 | 0.25        | 1               | 9.9         | 115                |
| <b>1SMB5929BT3G</b> | <b>929B</b>       | <b>14.25</b>           | <b>15</b>  | <b>15.75</b> | <b>25</b>   | <b>9</b>                 | <b>600</b>          | <b>0.25</b> | <b>1</b>        | <b>11.4</b> | <b>100</b>         |
| 1SMB5930BT3G        | 930B              | 15.2                   | 16         | 16.8         | 23.4        | 10                       | 600                 | 0.25        | 1               | 12.2        | 93                 |
| <b>1SMB5931BT3G</b> | <b>931B</b>       | <b>17.1</b>            | <b>18</b>  | <b>18.9</b>  | <b>20.8</b> | <b>12</b>                | <b>650</b>          | <b>0.25</b> | <b>1</b>        | <b>13.7</b> | <b>83</b>          |
| 1SMB5932BT3G        | 932B              | 19                     | 20         | 21           | 18.7        | 14                       | 650                 | 0.25        | 1               | 15.2        | 75                 |
| 1SMB5933BT3G        | 933B              | 20.9                   | 22         | 23.1         | 17          | 17.5                     | 650                 | 0.25        | 1               | 16.7        | 68                 |
| <b>1SMB5934BT3G</b> | <b>934B</b>       | <b>22.8</b>            | <b>24</b>  | <b>25.2</b>  | <b>15.6</b> | <b>19</b>                | <b>700</b>          | <b>0.25</b> | <b>1</b>        | <b>18.2</b> | <b>62</b>          |
| <b>1SMB5935BT3G</b> | <b>935B</b>       | <b>25.65</b>           | <b>27</b>  | <b>28.35</b> | <b>13.9</b> | <b>23</b>                | <b>700</b>          | <b>0.25</b> | <b>1</b>        | <b>20.6</b> | <b>55</b>          |
| <b>1SMB5936BT3G</b> | <b>936B</b>       | <b>28.5</b>            | <b>30</b>  | <b>31.5</b>  | <b>12.5</b> | <b>28</b>                | <b>750</b>          | <b>0.25</b> | <b>1</b>        | <b>22.8</b> | <b>50</b>          |
| 1SMB5937BT3G        | 937B              | 31.35                  | 33         | 34.65        | 11.4        | 33                       | 800                 | 0.25        | 1               | 25.1        | 45                 |
| <b>1SMB5938BT3G</b> | <b>938B</b>       | <b>34.2</b>            | <b>36</b>  | <b>37.8</b>  | <b>10.4</b> | <b>38</b>                | <b>850</b>          | <b>0.25</b> | <b>1</b>        | <b>27.4</b> | <b>41</b>          |
| 1SMB5939BT3G        | 939B              | 37.05                  | 39         | 40.95        | 9.6         | 45                       | 900                 | 0.25        | 1               | 29.7        | 38                 |
| 1SMB5940BT3G        | 940B              | 40.85                  | 43         | 45.15        | 8.7         | 53                       | 950                 | 0.25        | 1               | 32.7        | 34                 |
| 1SMB5941BT3G        | 941B              | 44.65                  | 47         | 49.35        | 8           | 67                       | 1000                | 0.25        | 1               | 35.8        | 31                 |
| 1SMB5942BT3G        | 942B              | 48.45                  | 51         | 53.55        | 7.3         | 70                       | 1100                | 0.25        | 1               | 38.8        | 29                 |
| 1SMB5943BT3G        | 943B              | 53.2                   | 56         | 58.8         | 6.7         | 86                       | 1300                | 0.25        | 1               | 42.6        | 26                 |
| 1SMB5944BT3G        | 944B              | 58.9                   | 62         | 65.1         | 6           | 100                      | 1500                | 0.25        | 1               | 47.1        | 24                 |
| 1SMB5945BT3G        | 945B              | 64.6                   | 68         | 71.4         | 5.5         | 120                      | 1700                | 0.25        | 1               | 51.7        | 22                 |
| 1SMB5946BT3G        | 946B              | 71.25                  | 75         | 78.75        | 5           | 140                      | 2000                | 0.25        | 1               | 56          | 20                 |
| 1SMB5947BT3G        | 947B              | 77.9                   | 82         | 86.1         | 4.6         | 160                      | 2500                | 0.25        | 1               | 62.2        | 18                 |
| 1SMB5948BT3G        | 948B              | 86.45                  | 91         | 95.55        | 4.1         | 200                      | 3000                | 0.25        | 1               | 69.2        | 16                 |
| <b>1SMB5949BT3G</b> | <b>949B</b>       | <b>95</b>              | <b>100</b> | <b>105</b>   | <b>3.7</b>  | <b>250</b>               | <b>3100</b>         | <b>0.25</b> | <b>1</b>        | <b>76</b>   | <b>15</b>          |
| 1SMB5951BT3G        | 951B              | 114                    | 120        | 126          | 3.1         | 380                      | 4500                | 0.25        | 1               | 91.2        | 12                 |
| 1SMB5952BT3G        | 952B              | 123.5                  | 130        | 136.5        | 2.9         | 450                      | 5000                | 0.25        | 1               | 98.8        | 11                 |
| 1SMB5953BT3G        | 953B              | 142.5                  | 150        | 157.5        | 2.5         | 600                      | 6000                | 0.25        | 1               | 114         | 10                 |
| 1SMB5954BT3G        | 954B              | 152                    | 160        | 168          | 2.3         | 700                      | 6500                | 0.25        | 1               | 121.6       | 9                  |
| 1SMB5955BT3G        | 955B              | 171                    | 180        | 189          | 2.1         | 900                      | 7000                | 0.25        | 1               | 136.8       | 8                  |
| 1SMB5956BT3G        | 956B              | 190                    | 200        | 210          | 1.9         | 1200                     | 8000                | 0.25        | 1               | 152         | 7                  |

2. **TOLERANCE AND TYPE NUMBER DESIGNATION** The type numbers listed indicate a tolerance of  $\pm 5\%$ .

3. **ZENER VOLTAGE ( $V_Z$ ) MEASUREMENT**

Nominal Zener voltage is measured with the device junction in thermal equilibrium with ambient temperature at  $25^\circ\text{C}$ .

4. **ZENER IMPEDANCE ( $Z_Z$ ) DERIVATION**  $Z_{ZT}$  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 = 60 Hz.

\*Include SZ-prefix devices where applicable.

# 1SMB59xxBT3G Series, SZ1SMB59xxT3G Series

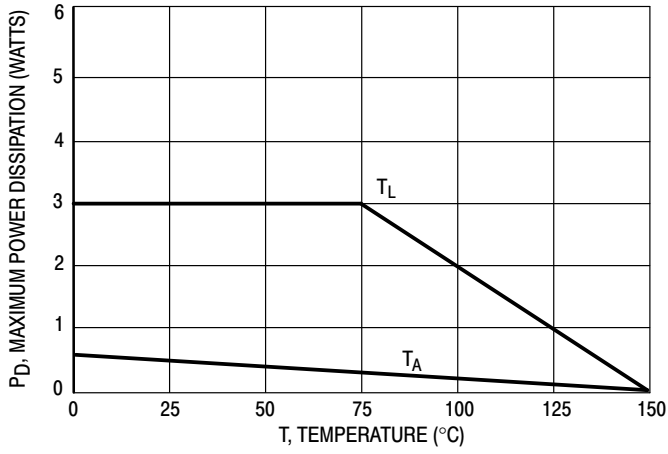


Figure 1. Steady State Power Derating

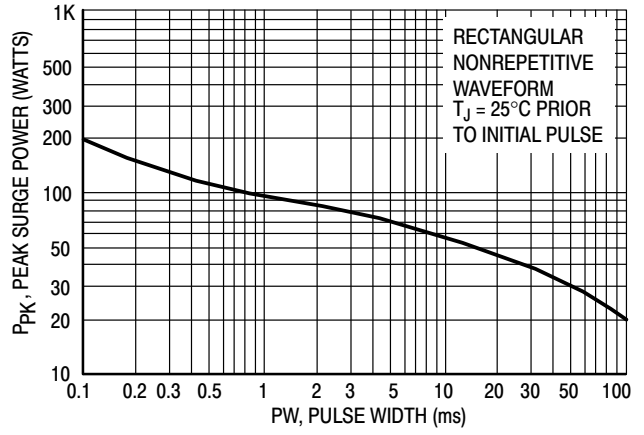


Figure 2. Maximum Surge Power

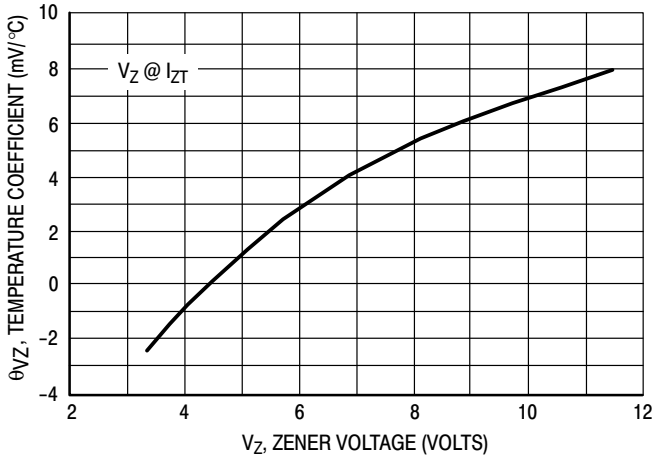


Figure 3. Zener Voltage - To 12 Volts

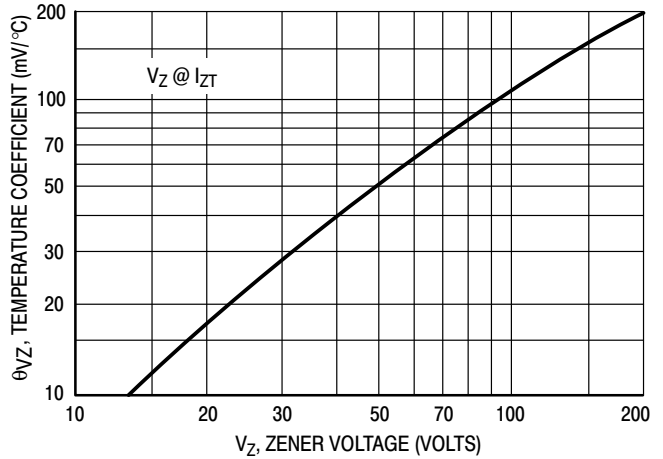


Figure 4. Zener Voltage - 14 To 200 Volts

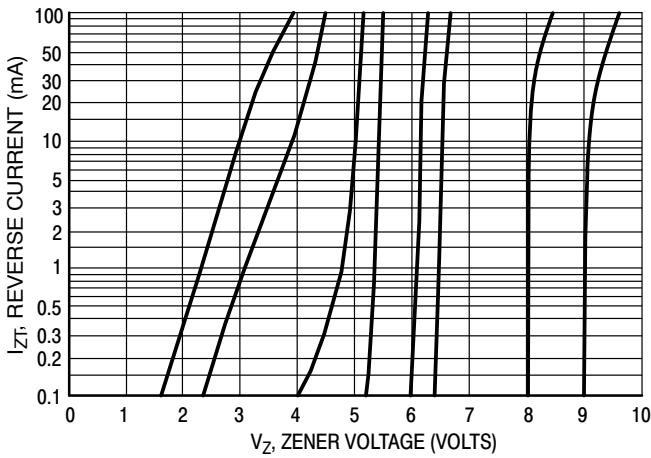


Figure 5.  $V_Z = 3.3$  thru 10 Volts

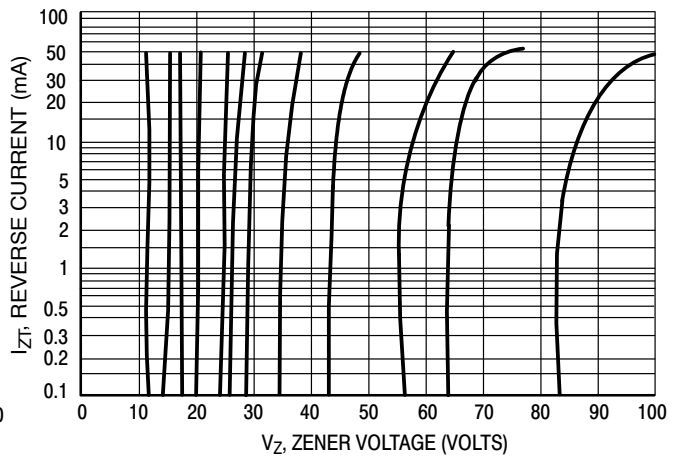


Figure 6.  $V_Z = 12$  thru 82 Volts

# 1SMB59xxBT3G Series, SZ1SMB59xxT3G Series

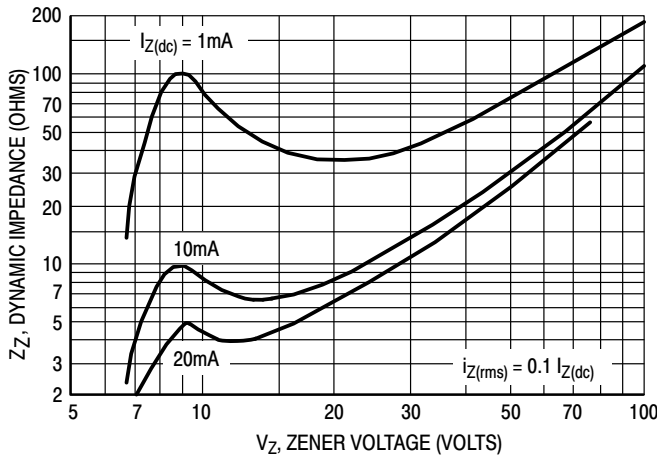


Figure 7. Effect of Zener Voltage

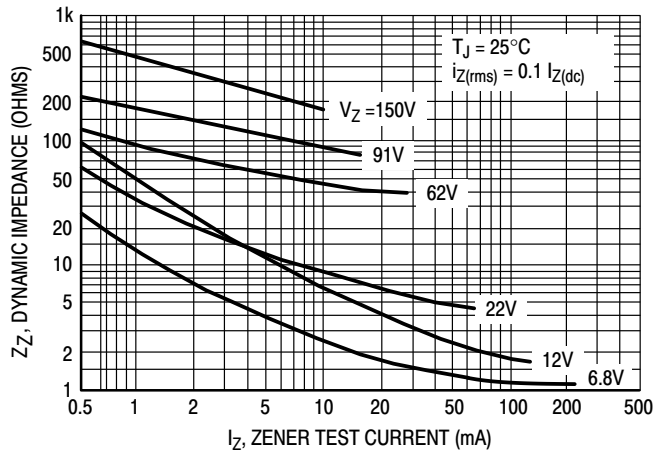


Figure 8. Effect of Zener Current

## Rating and Typical Characteristic Curves ( $T_A = 25^\circ\text{C}$ )

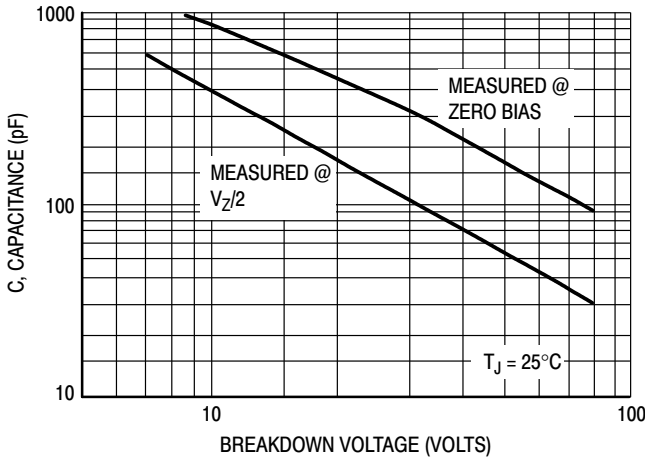


Figure 9. Capacitance Curve

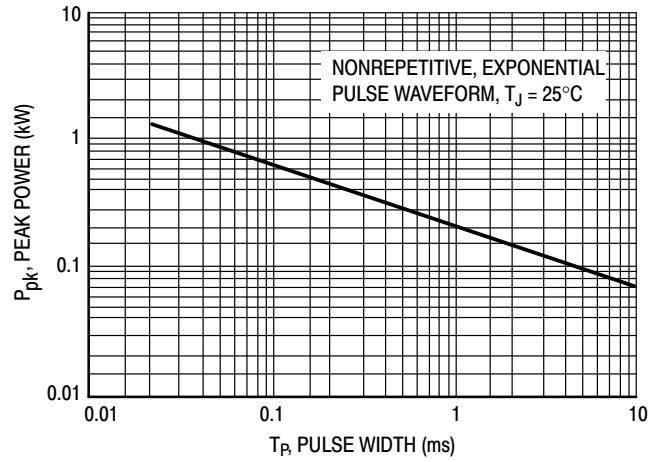


Figure 10. Typical Pulse Rating Curve

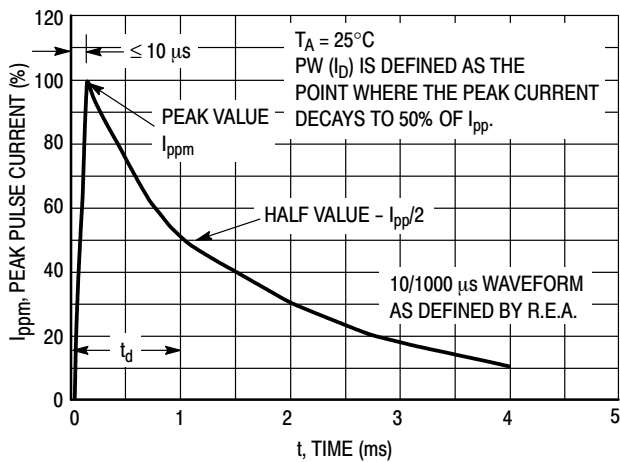


Figure 11. Pulse Waveform

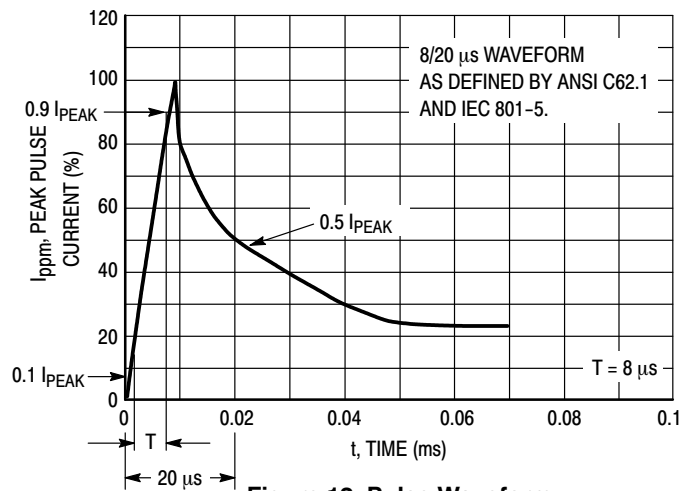


Figure 12. Pulse Waveform

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

Polarity Band

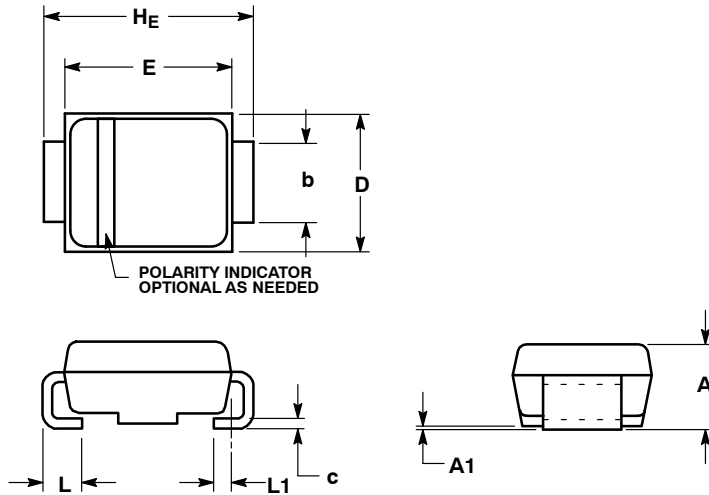


SCALE 1:1

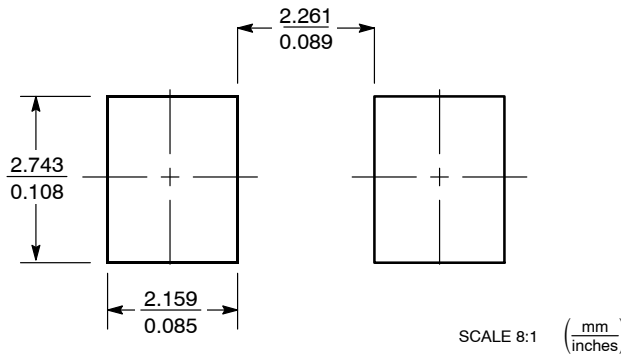
Non-Polarity Band

**SMB**  
CASE 403A-03  
ISSUE J

DATE 19 JUL 2012



**SOLDERING FOOTPRINT\***

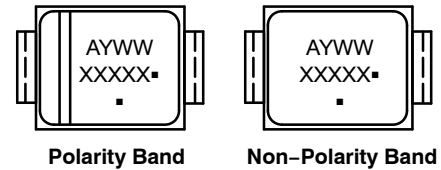


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION b SHALL BE MEASURED WITHIN DIMENSION L1.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 1.95        | 2.30 | 2.47 | 0.077     | 0.091 | 0.097 |
| A1  | 0.05        | 0.10 | 0.20 | 0.002     | 0.004 | 0.008 |
| b   | 1.96        | 2.03 | 2.20 | 0.077     | 0.080 | 0.087 |
| c   | 0.15        | 0.23 | 0.31 | 0.006     | 0.009 | 0.012 |
| D   | 3.30        | 3.56 | 3.95 | 0.130     | 0.140 | 0.156 |
| E   | 4.06        | 4.32 | 4.60 | 0.160     | 0.170 | 0.181 |
| HE  | 5.21        | 5.44 | 5.60 | 0.205     | 0.214 | 0.220 |
| L   | 0.76        | 1.02 | 1.60 | 0.030     | 0.040 | 0.063 |
| L1  | 0.51 REF    |      |      | 0.020 REF |       |       |

**GENERIC MARKING DIAGRAM\***



- XXXXX = Specific Device Code
  - A = Assembly Location
  - Y = Year
  - WW = Work Week
  - = 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.

|                         |                    |  |
|-------------------------|--------------------|--|
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| <b>DESCRIPTION:</b>     | <b>SMB</b>         | <b>PAGE 1 OF 1</b>   |

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