

# 1SMB5913BT3 Series

Preferred Device

## 3 Watt Plastic Surface Mount Zener Voltage Regulators

This complete new line of 3 Watt 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
- Pb-Free Packages are Available

### 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          | $\text{mW}/^\circ\text{C}$ |
|                                                                                                                                      |                 | 25          | $^\circ\text{C}/\text{W}$  |
| 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         | $\text{mW}/^\circ\text{C}$ |
|                                                                                                                                      |                 | 226         | $^\circ\text{C}/\text{W}$  |
| Operating and Storage Temperature Range                                                                                              | $T_J, T_{stg}$  | -65 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.

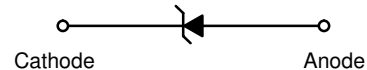
1. FR-4 board, using recommended footprint.



ON Semiconductor®

<http://onsemi.com>

### 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†        |
|--------------|------------------|------------------|
| 1SMB59xxBT3  | SMB              | 2500/Tape & Reel |
| 1SMB59xxBT3G | SMB<br>(Pb-Free) | 2500/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.

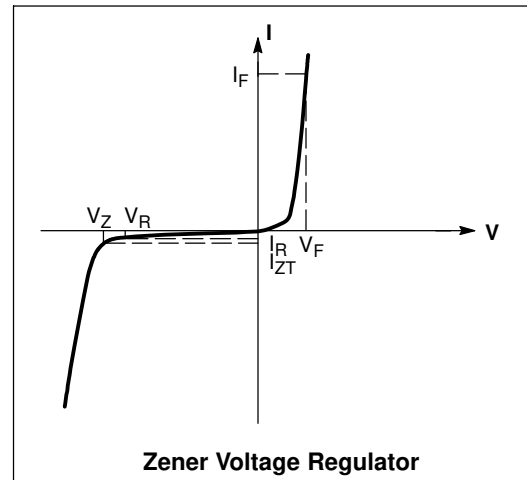
Preferred devices are recommended choices for future use and best overall value.

## 1SMB5913BT3 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           |



# 1SMB5913BT3 Series

## ELECTRICAL CHARACTERISTICS (Devices listed in **bold, italic** are ON Semiconductor Preferred devices.)

(T<sub>L</sub> = 30°C unless otherwise noted, V<sub>F</sub> = 1.5 V Max. @ I<sub>F</sub> = 200 mA(dc) for all types)

| Device*<br>(Note 2)   | Device<br>Marking | Zener Voltage (Note 3) |            |              |                   | Zener Impedance (Note 4)          |                                   |                                 | Leakage Current |             | I <sub>ZM</sub> |
|-----------------------|-------------------|------------------------|------------|--------------|-------------------|-----------------------------------|-----------------------------------|---------------------------------|-----------------|-------------|-----------------|
|                       |                   | V <sub>Z</sub> (Volts) |            |              | @ I <sub>ZT</sub> | Z <sub>YT</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       |                 |
| 1SMB5913BT3, G        | 913B              | 3.13                   | 3.3        | 3.47         | 113.6             | 10                                | 500                               | 1                               | 100             | 1           | 454             |
| 1SMB5914BT3, G        | 914B              | 3.42                   | 3.6        | 3.78         | 104.2             | 9                                 | 500                               | 1                               | 75              | 1           | 416             |
| <b>1SMB5915BT3, G</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>1SMB5916BT3, G</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>1SMB5917BT3, G</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>1SMB5918BT3, G</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>1SMB5919BT3, G</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>1SMB5920BT3, G</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>      |
| 1SMB5921BT3, G        | 921B              | 6.46                   | 6.8        | 7.14         | 55.1              | 2.5                               | 200                               | 1                               | 5               | 5.2         | 220             |
| 1SMB5922BT3, G        | 922B              | 7.12                   | 7.5        | 7.88         | 50                | 3                                 | 400                               | 0.5                             | 5               | 6           | 200             |
| <b>1SMB5923BT3, G</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>      |
| 1SMB5924BT3, G        | 924B              | 8.64                   | 9.1        | 9.56         | 41.2              | 4                                 | 500                               | 0.5                             | 5               | 7           | 164             |
| <b>1SMB5925BT3, G</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>1SMB5926BT3, G</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>1SMB5927BT3, G</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>      |
| 1SMB5928BT3, G        | 928B              | 12.35                  | 13         | 13.65        | 28.8              | 7                                 | 550                               | 0.25                            | 1               | 9.9         | 115             |
| <b>1SMB5929BT3, G</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>      |
| 1SMB5930BT3, G        | 930B              | 15.2                   | 16         | 16.8         | 23.4              | 10                                | 600                               | 0.25                            | 1               | 12.2        | 93              |
| <b>1SMB5931BT3, G</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>       |
| 1SMB5932BT3, G        | 932B              | 19                     | 20         | 21           | 18.7              | 14                                | 650                               | 0.25                            | 1               | 15.2        | 75              |
| 1SMB5933BT3, G        | 933B              | 20.9                   | 22         | 23.1         | 17                | 17.5                              | 650                               | 0.25                            | 1               | 16.7        | 68              |
| <b>1SMB5934BT3, G</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>1SMB5935BT3, G</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>1SMB5936BT3, G</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>       |
| 1SMB5937BT3, G        | 937B              | 31.35                  | 33         | 34.65        | 11.4              | 33                                | 800                               | 0.25                            | 1               | 25.1        | 45              |
| <b>1SMB5938BT3, G</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>       |
| 1SMB5939BT3, G        | 939B              | 37.05                  | 39         | 40.95        | 9.6               | 45                                | 900                               | 0.25                            | 1               | 29.7        | 38              |
| 1SMB5940BT3, G        | 940B              | 40.85                  | 43         | 45.15        | 8.7               | 53                                | 950                               | 0.25                            | 1               | 32.7        | 34              |
| 1SMB5941BT3, G        | 941B              | 44.65                  | 47         | 49.35        | 8                 | 67                                | 1000                              | 0.25                            | 1               | 35.8        | 31              |
| 1SMB5942BT3, G        | 942B              | 48.45                  | 51         | 53.55        | 7.3               | 70                                | 1100                              | 0.25                            | 1               | 38.8        | 29              |
| 1SMB5943BT3, G        | 943B              | 53.2                   | 56         | 58.8         | 6.7               | 86                                | 1300                              | 0.25                            | 1               | 42.6        | 26              |
| 1SMB5944BT3, G        | 944B              | 58.9                   | 62         | 65.1         | 6                 | 100                               | 1500                              | 0.25                            | 1               | 47.1        | 24              |
| 1SMB5945BT3, G        | 945B              | 64.6                   | 68         | 71.4         | 5.5               | 120                               | 1700                              | 0.25                            | 1               | 51.7        | 22              |
| 1SMB5946BT3, G        | 946B              | 71.25                  | 75         | 78.75        | 5                 | 140                               | 2000                              | 0.25                            | 1               | 56          | 20              |
| 1SMB5947BT3, G        | 947B              | 77.9                   | 82         | 86.1         | 4.6               | 160                               | 2500                              | 0.25                            | 1               | 62.2        | 18              |
| 1SMB5948BT3, G        | 948B              | 86.45                  | 91         | 95.55        | 4.1               | 200                               | 3000                              | 0.25                            | 1               | 69.2        | 16              |
| <b>1SMB5949BT3, G</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>       |
| 1SMB5950BT3, G        | 950B              | 104.5                  | 110        | 115.5        | 3.4               | 300                               | 4000                              | 0.25                            | 1               | 83.6        | 13              |
| 1SMB5951BT3, G        | 951B              | 114                    | 120        | 126          | 3.1               | 380                               | 4500                              | 0.25                            | 1               | 91.2        | 12              |
| 1SMB5952BT3, G        | 952B              | 123.5                  | 130        | 136.5        | 2.9               | 450                               | 5000                              | 0.25                            | 1               | 98.8        | 11              |
| 1SMB5953BT3, G        | 953B              | 142.5                  | 150        | 157.5        | 2.5               | 600                               | 6000                              | 0.25                            | 1               | 114         | 10              |
| 1SMB5954BT3, G        | 954B              | 152                    | 160        | 168          | 2.3               | 700                               | 6500                              | 0.25                            | 1               | 121.6       | 9               |
| 1SMB5955BT3, G        | 955B              | 171                    | 180        | 189          | 2.1               | 900                               | 7000                              | 0.25                            | 1               | 136.8       | 8               |
| 1SMB5956BT3, G        | 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 ±5%.

### 3. ZENER VOLTAGE (V<sub>Z</sub>) MEASUREMENT

Nominal Zener voltage is measured with the device junction in thermal equilibrium with ambient temperature at 25°C.

4. **ZENER IMPEDANCE (Z<sub>Z</sub>) DERIVATION** Z<sub>YT</sub> and Z<sub>ZK</sub> are measured by dividing the ac voltage drop across the device by the ac current applied. The specified limits are for I<sub>Z(ac)</sub> = 0.1 I<sub>Z(dc)</sub> with the ac frequency = 60 Hz.

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

# 1SMB5913BT3 Series

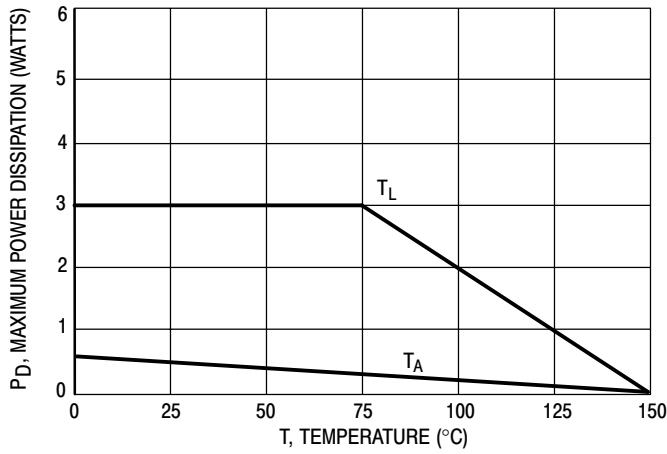


Figure 1. Steady State Power Derating

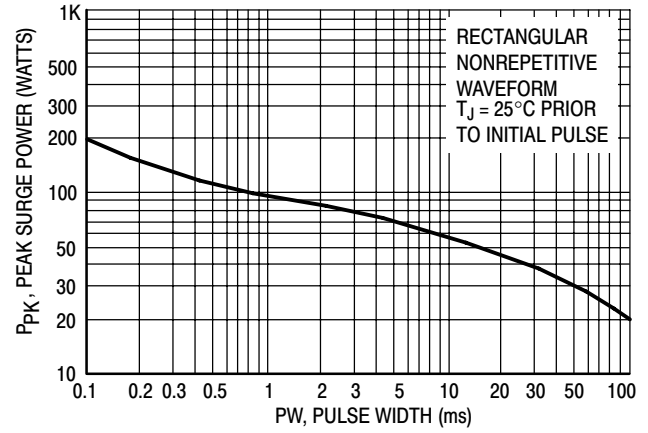


Figure 2. Maximum Surge Power

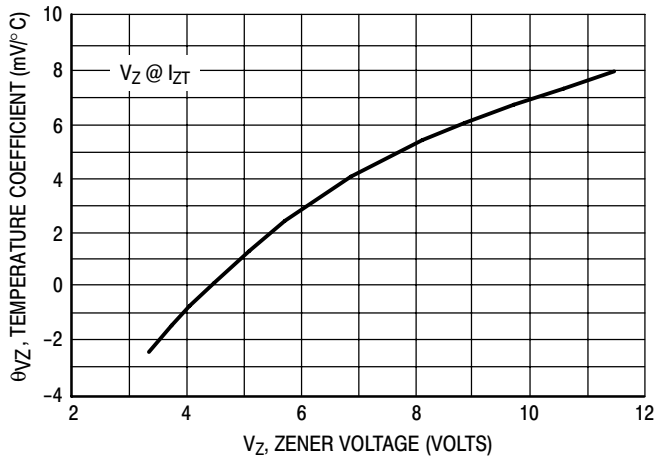


Figure 3. Zener Voltage - To 12 Volts

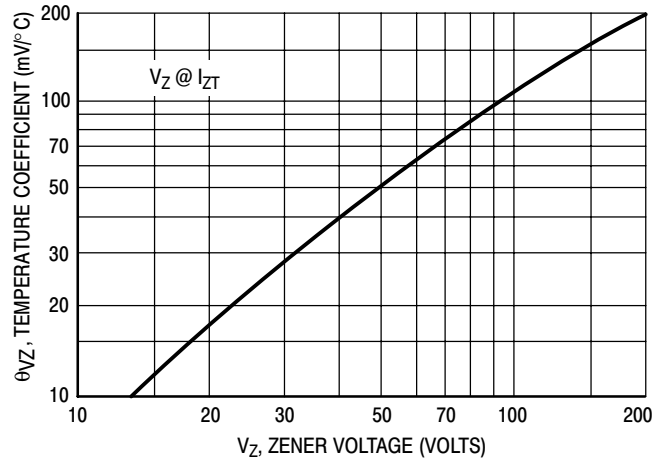


Figure 4. Zener Voltage - 14 To 200 Volts

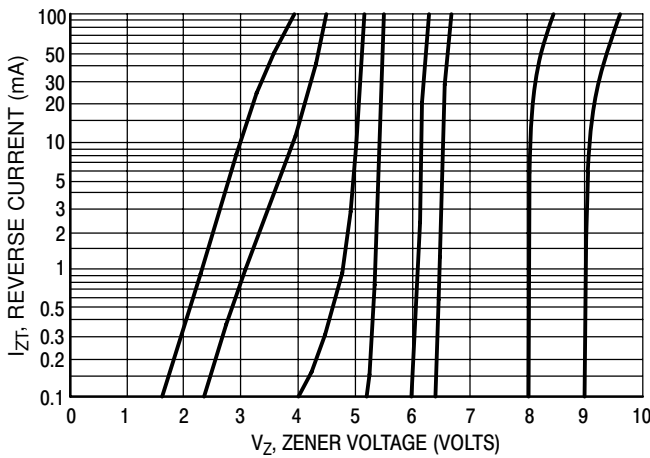


Figure 5.  $V_Z = 3.3$  thru 10 Volts

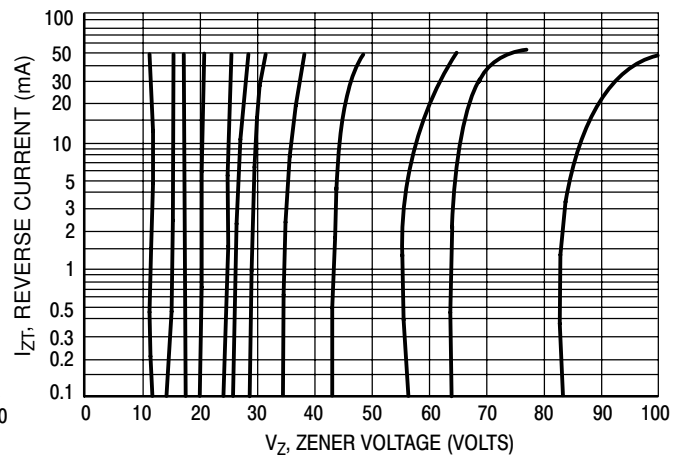


Figure 6.  $V_Z = 12$  thru 82 Volts

# 1SMB5913BT3 Series

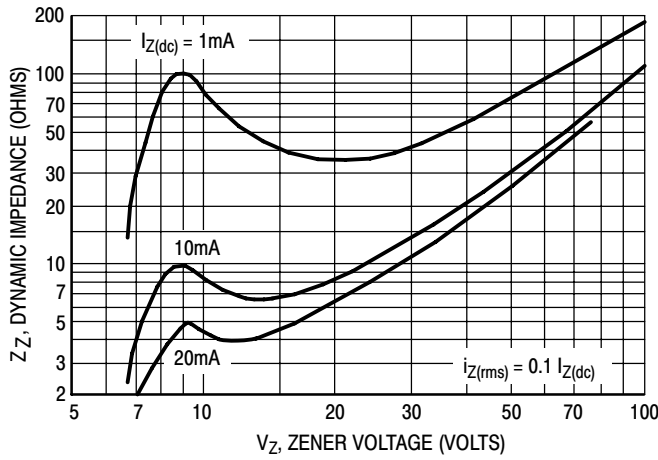


Figure 7. Effect of Zener Voltage

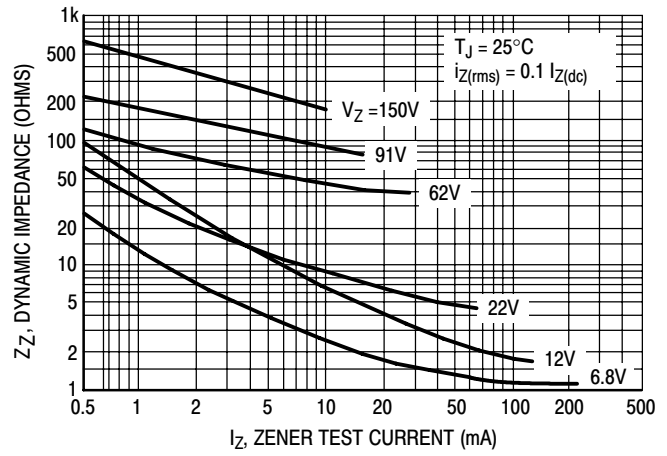


Figure 8. Effect of Zener Current

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

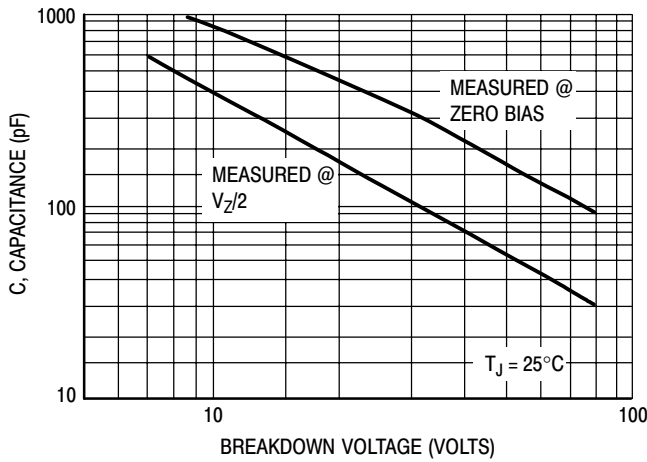


Figure 9. Capacitance Curve

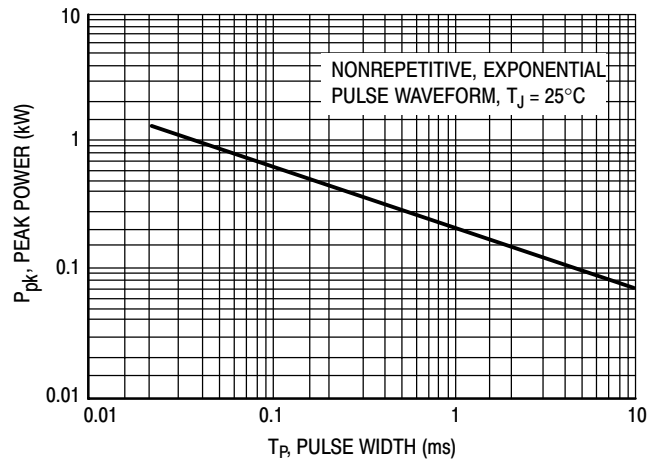


Figure 10. Typical Pulse Rating Curve

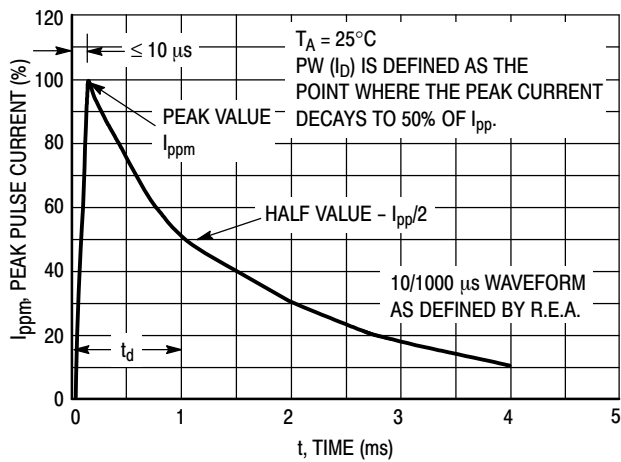


Figure 11. Pulse Waveform

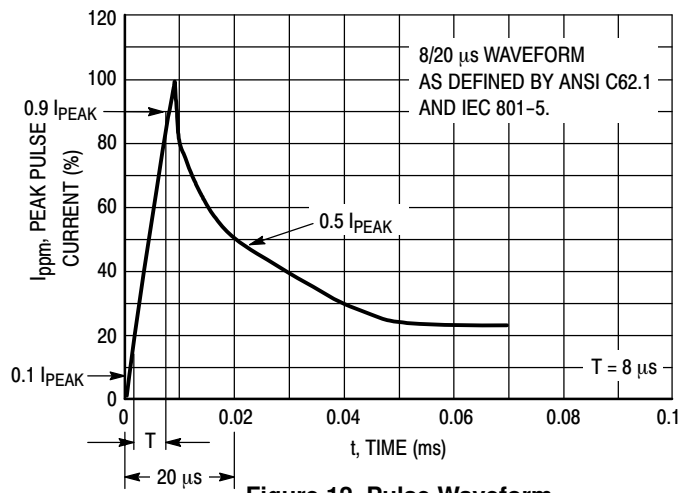
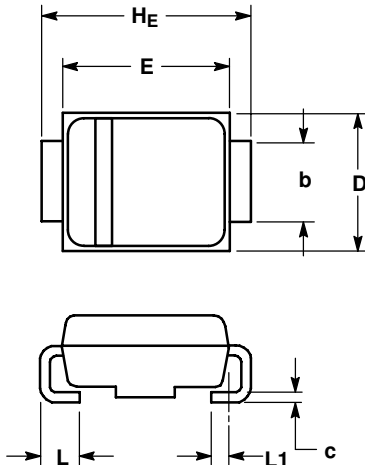


Figure 12. Pulse Waveform

# 1SMB5913BT3 Series

## PACKAGE DIMENSIONS

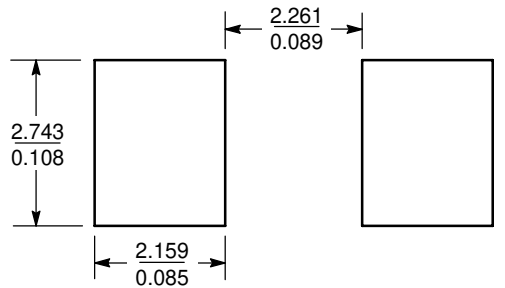
### SMB CASE 403A-03 ISSUE E



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

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 1.90        | 2.13 | 2.41 | 0.075     | 0.084 | 0.095 |
| A1  | 0.05        | 0.10 | 0.15 | 0.002     | 0.004 | 0.006 |
| b   | 1.96        | 2.03 | 2.11 | 0.077     | 0.080 | 0.083 |
| c   | 0.15        | 0.23 | 0.30 | 0.006     | 0.009 | 0.012 |
| D   | 3.30        | 3.56 | 3.81 | 0.130     | 0.140 | 0.150 |
| E   | 4.06        | 4.32 | 4.57 | 0.160     | 0.170 | 0.180 |
| HE  | 5.21        | 5.44 | 5.59 | 0.205     | 0.214 | 0.220 |
| L   | 0.76        | 1.02 | 1.27 | 0.030     | 0.040 | 0.050 |
| L1  | 0.51 REF    |      |      | 0.020 REF |       |       |

### SOLDERING FOOTPRINT\*



SCALE 8:1 (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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