



**THE DATASHEET OF
1SMB5940BT3G**



1SMB59xxBT3G Series, SZ1SMB59xxT3G Series

3 Watt Plastic Surface Mount Zener Voltage Regulators

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 @ $T_L = 75^\circ\text{C}$ Measured at Zero Lead Length Derate Above 75°C | P_D | 3.0 | W |
| Thermal Resistance from Junction-to-Lead | $R_{\theta JL}$ | 40 25 | $\text{mW}/^\circ\text{C}$ $^\circ\text{C}/\text{W}$ |
| Maximum Steady State Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note) Derate Above 25°C | P_D | 550 4.4 | mW $\text{mW}/^\circ\text{C}$ |
| Thermal Resistance from Junction-to-Ambient | $R_{\theta JA}$ | 226 | $^\circ\text{C}/\text{W}$ |
| Operating and Storage Temperature Range | T_J, T_{stg} | -65 to +150 | $^\circ\text{C}$ |

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 ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



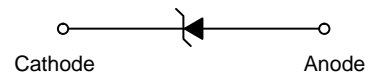
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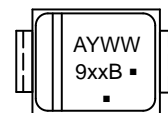
PLASTIC SURFACE MOUNT ZENER VOLTAGE REGULATOR DIODES 3.3–200 V, 3 W DC POWER



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† |
|----------------|------------------|------------------------|
| 1SMB59xxBT3G | SMB (Pb-Free) | 2,500 / Tape & Reel |
| SZ1SMB59xxBT3G | SMB (Pb-Free) | 2,500 / 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.

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 ON Semiconductor Preferred devices.)

| Device* (Note 2) | Device Marking | Zener Voltage (Note 3) | | | | Zener Impedance (Note 4) | | | Leakage Current | | I_{ZM} mA(dc) |
|---------------------|-------------------|------------------------|------------|--------------|-------------|--------------------------|---------------------|-------------|-----------------|-------------|--------------------|
| | | 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 | |
| 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 |
| 1SMB5915BT3G | 915B | 3.70 | 3.9 | 4.10 | 96.1 | 7.5 | 500 | 1 | 25 | 1 | 384 |
| 1SMB5916BT3G | 916B | 4.08 | 4.3 | 4.52 | 87.2 | 6 | 500 | 1 | 5 | 1 | 348 |
| 1SMB5917BT3G | 917B | 4.46 | 4.7 | 4.94 | 79.8 | 5 | 500 | 1 | 5 | 1.5 | 319 |
| 1SMB5918BT3G | 918B | 4.84 | 5.1 | 5.36 | 73.5 | 4 | 350 | 1 | 5 | 2 | 294 |
| 1SMB5919BT3G | 919B | 5.32 | 5.6 | 5.88 | 66.9 | 2 | 250 | 1 | 5 | 3 | 267 |
| 1SMB5920BT3G | 920B | 5.89 | 6.2 | 6.51 | 60.5 | 2 | 200 | 1 | 5 | 4 | 241 |
| 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 |
| 1SMB5923BT3G | 923B | 7.79 | 8.2 | 8.61 | 45.7 | 3.5 | 400 | 0.5 | 5 | 6.5 | 182 |
| 1SMB5924BT3G | 924B | 8.64 | 9.1 | 9.56 | 41.2 | 4 | 500 | 0.5 | 5 | 7 | 164 |
| 1SMB5925BT3G | 925B | 9.5 | 10 | 10.5 | 37.5 | 4.5 | 500 | 0.25 | 5 | 8 | 150 |
| 1SMB5926BT3G | 926B | 10.45 | 11 | 11.55 | 34.1 | 5.5 | 550 | 0.25 | 1 | 8.4 | 136 |
| 1SMB5927BT3G | 927B | 11.4 | 12 | 12.6 | 31.2 | 6.5 | 550 | 0.25 | 1 | 9.1 | 125 |
| 1SMB5928BT3G | 928B | 12.35 | 13 | 13.65 | 28.8 | 7 | 550 | 0.25 | 1 | 9.9 | 115 |
| 1SMB5929BT3G | 929B | 14.25 | 15 | 15.75 | 25 | 9 | 600 | 0.25 | 1 | 11.4 | 100 |
| 1SMB5930BT3G | 930B | 15.2 | 16 | 16.8 | 23.4 | 10 | 600 | 0.25 | 1 | 12.2 | 93 |
| 1SMB5931BT3G | 931B | 17.1 | 18 | 18.9 | 20.8 | 12 | 650 | 0.25 | 1 | 13.7 | 83 |
| 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 |
| 1SMB5934BT3G | 934B | 22.8 | 24 | 25.2 | 15.6 | 19 | 700 | 0.25 | 1 | 18.2 | 62 |
| 1SMB5935BT3G | 935B | 25.65 | 27 | 28.35 | 13.9 | 23 | 700 | 0.25 | 1 | 20.6 | 55 |
| 1SMB5936BT3G | 936B | 28.5 | 30 | 31.5 | 12.5 | 28 | 750 | 0.25 | 1 | 22.8 | 50 |
| 1SMB5937BT3G | 937B | 31.35 | 33 | 34.65 | 11.4 | 33 | 800 | 0.25 | 1 | 25.1 | 45 |
| 1SMB5938BT3G | 938B | 34.2 | 36 | 37.8 | 10.4 | 38 | 850 | 0.25 | 1 | 27.4 | 41 |
| 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 |
| 1SMB5949BT3G | 949B | 95 | 100 | 105 | 3.7 | 250 | 3100 | 0.25 | 1 | 76 | 15 |
| 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°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.

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Figure 1. Steady State Power Derating

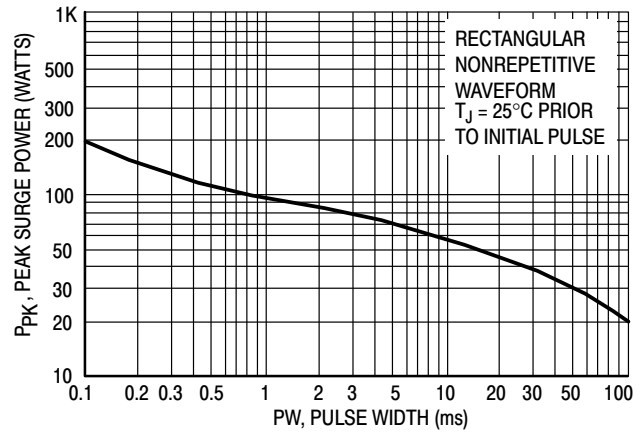


Figure 2. Maximum Surge Power



Figure 3. Zener Voltage - To 12 Volts



Figure 4. Zener Voltage - 14 To 200 Volts



Figure 5. $V_Z = 3.3$ thru 10 Volts

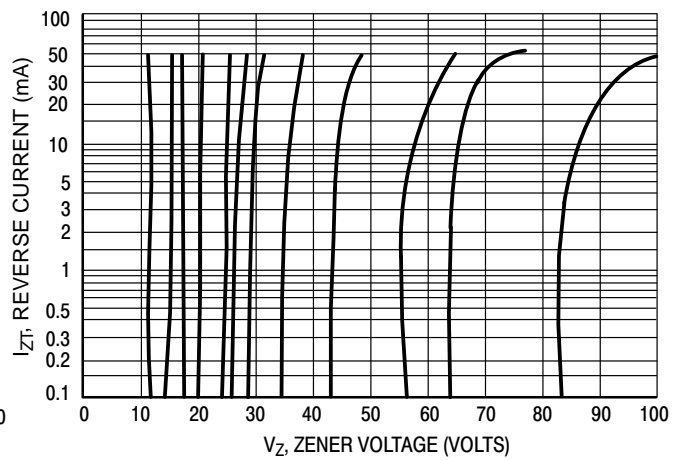


Figure 6. $V_Z = 12$ thru 82 Volts

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Figure 7. Effect of Zener Voltage

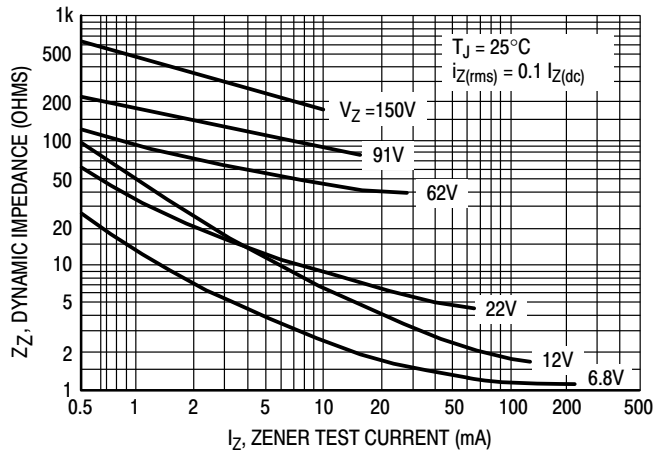


Figure 8. Effect of Zener Current

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

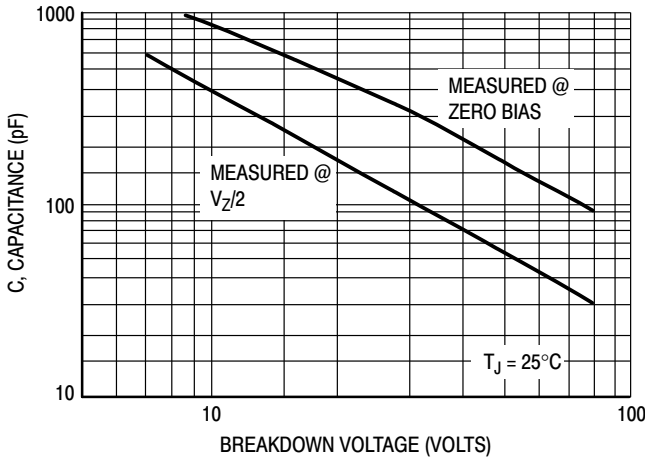


Figure 9. Capacitance Curve

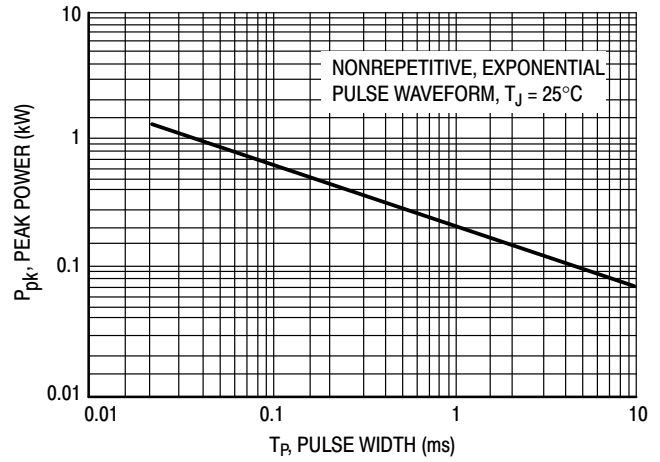


Figure 10. Typical Pulse Rating Curve



Figure 11. Pulse Waveform



Figure 12. Pulse Waveform

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PACKAGE DIMENSIONS

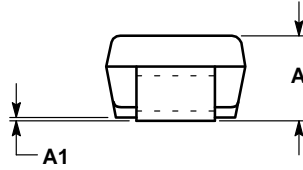
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NOTES:

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 | | |



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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