

MMSZxxxT1G Series, SZMMSZxxxT1G Series

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 56 V
- Package Designed for Optimal Automated Board Assembly
- Small Package Size for High Density Applications
- ESD Rating of Class 3 (> 16 kV) per Human Body Model
- AEC-Q101 Qualified and PPAP Capable
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- 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, (Note 1) @ $T_L = 75^\circ\text{C}$ Derated above 75°C | P_D | 500 6.7 | mW 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 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-5 = 3.5 X 1.5 inches.
2. Thermal Resistance measurement obtained via infrared Scan Method.

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

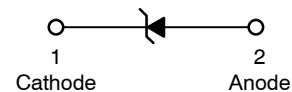


ON Semiconductor®

<http://onsemi.com>



**SOD-123
CASE 425
STYLE 1**



MARKING DIAGRAM



- xx = Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|--------------|----------------------|-------------------------|
| MMSZxxxT1G | SOD-123 (Pb-Free) | 3,000 / Tape & Reel |
| SZMMSZxxxT1G | SOD-123 (Pb-Free) | 3,000 / Tape & Reel |
| MMSZxxxT3G | SOD-123 (Pb-Free) | 10,000 / Tape & Reel |
| SZMMSZxxxT3G | 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.

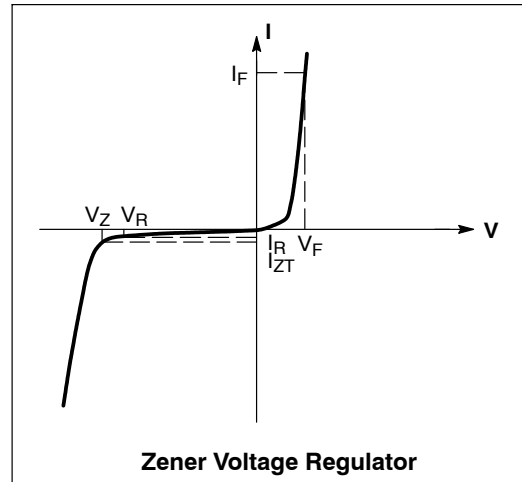
DEVICE MARKING INFORMATION

See specific marking information in the device marking column of the Electrical Characteristics table on page 2 of this data sheet.

MMSZxxxT1G Series, SZMMSZxxxT1G 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_R | Reverse Leakage Current @ V_R |
| V_R | Reverse Voltage |
| I_F | Forward Current |
| V_F | Forward Voltage @ I_F |



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 | V_{Z1} (Volts) (Notes 3 and 4) | | | Z_{ZT1} (Note 5) | V_{Z2} (Volts) (Notes 3 and 4) | | Z_{ZT2} (Note 5) | Max Reverse Leakage Current | |
|-----------------------|----------------|-------------------------------------|------------|--------------|-----------------------|-------------------------------------|-------------|-----------------------|-----------------------------|-------------|
| | | @ $I_{ZT1} = 5\text{ mA}$ | | | Ω | @ $I_{ZT2} = 1\text{ mA}$ | | Ω | $I_R @ V_R$ | |
| | | Min | Nom | Max | | Min | Max | | μA | Volts |
| MMSZ2V4T1G | T1 | 2.28 | 2.4 | 2.52 | 100 | 1.7 | 2.1 | 600 | 50 | 1 |
| MMSZ2V7T1G | T2 | 2.57 | 2.7 | 2.84 | 100 | 1.9 | 2.4 | 600 | 20 | 1 |
| MMSZ3V0T1G | T3 | 2.85 | 3.0 | 3.15 | 95 | 2.1 | 2.7 | 600 | 10 | 1 |
| MMSZ3V3T1G | T4 | 3.14 | 3.3 | 3.47 | 95 | 2.3 | 2.9 | 600 | 5 | 1 |
| MMSZ3V6T1G | T5 | 3.42 | 3.6 | 3.78 | 90 | 2.7 | 3.3 | 600 | 5 | 1 |
| MMSZ3V9T1G | U1 | 3.71 | 3.9 | 4.10 | 90 | 2.9 | 3.5 | 600 | 3 | 1 |
| MMSZ4V3T1G | U2 | 4.09 | 4.3 | 4.52 | 90 | 3.3 | 4.0 | 600 | 3 | 1 |
| MMSZ4V7T1G | U3 | 4.47 | 4.7 | 4.94 | 80 | 3.7 | 4.7 | 500 | 3 | 2 |
| MMSZ5V1T1G | U4 | 4.85 | 5.1 | 5.36 | 60 | 4.2 | 5.3 | 480 | 2 | 2 |
| MMSZ5V6T1G/T3G | U5 | 5.32 | 5.6 | 5.88 | 40 | 4.8 | 6.0 | 400 | 1 | 2 |
| MMSZ6V2T1G | V1 | 5.89 | 6.2 | 6.51 | 10 | 5.6 | 6.6 | 150 | 3 | 4 |
| MMSZ6V8T1G | V2 | 6.46 | 6.8 | 7.14 | 15 | 6.3 | 7.2 | 80 | 2 | 4 |
| MMSZ7V5T1G | V3 | 7.13 | 7.5 | 7.88 | 15 | 6.9 | 7.9 | 80 | 1 | 5 |
| MMSZ8V2T1G | V4 | 7.79 | 8.2 | 8.61 | 15 | 7.6 | 8.7 | 80 | 0.7 | 5 |
| MMSZ9V1T1G | V5 | 8.65 | 9.1 | 9.56 | 15 | 8.4 | 9.6 | 100 | 0.5 | 6 |
| MMSZ10T1G | A1 | 9.50 | 10 | 10.50 | 20 | 9.3 | 10.6 | 150 | 0.2 | 7 |
| MMSZ11T1G | A2 | 10.45 | 11 | 11.55 | 20 | 10.2 | 11.6 | 150 | 0.1 | 8 |
| MMSZ12T1G | A3 | 11.40 | 12 | 12.60 | 25 | 11.2 | 12.7 | 150 | 0.1 | 8 |
| MMSZ13T1G | A4 | 12.35 | 13 | 13.65 | 30 | 12.3 | 14.0 | 170 | 0.1 | 8 |
| MMSZ15T1G | A5 | 14.25 | 15 | 15.75 | 30 | 13.7 | 15.5 | 200 | 0.05 | 10.5 |
| MMSZ16T1G | X1 | 15.20 | 16 | 16.80 | 40 | 15.2 | 17.0 | 200 | 0.05 | 11.2 |
| MMSZ18T1G/T3G | X2 | 17.10 | 18 | 18.90 | 45 | 16.7 | 19.0 | 225 | 0.05 | 12.6 |
| MMSZ20T1G | X3 | 19.00 | 20 | 21.00 | 55 | 18.7 | 21.1 | 225 | 0.05 | 14 |
| MMSZ22T1G | X4 | 20.90 | 22 | 23.10 | 55 | 20.7 | 23.2 | 250 | 0.05 | 15.4 |
| MMSZ24T1G | X5 | 22.80 | 24 | 25.20 | 70 | 22.7 | 25.5 | 250 | 0.05 | 16.8 |

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

4. Tolerance and Voltage Designation: Zener Voltage (V_Z) is measured with the Zener Current applied for $PW = 1\text{ ms}$.

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.

*Include SZ-prefix devices where applicable.

MMSZxxxT1G Series, SZMMSZxxxT1G 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 | V _{Z1} (Volts) (Notes 6 and 7) | | | Z _{ZT1} (Note 8) | V _{Z2} (Volts) (Notes 6 and 7) | | Z _{ZT2} (Note 8) | Max Reverse Leakage Current | |
|---------------|----------------|--|-----|-------|------------------------------|--|------|------------------------------|-----------------------------|-------|
| | | @ I _{ZT1} = 2 mA | | | Ω | @ I _{ZT2} = 0.1 mA | | Ω | @ I _{ZT2} = 0.5 mA | |
| | | Min | Nom | Max | | Min | Max | | μA | Volts |
| MMSZ27T1G/T3G | Y1 | 25.65 | 27 | 28.35 | 80 | 25 | 28.9 | 300 | 0.05 | 18.9 |
| MMSZ30T1G | Y2 | 28.50 | 30 | 31.50 | 80 | 27.8 | 32 | 300 | 0.05 | 21 |
| MMSZ33T1G | Y3 | 31.35 | 33 | 34.65 | 80 | 30.8 | 35 | 325 | 0.05 | 23.1 |
| MMSZ36T1G | Y4 | 34.20 | 36 | 37.80 | 90 | 33.8 | 38 | 350 | 0.05 | 25.2 |
| MMSZ39T1G | Y5 | 37.05 | 39 | 40.95 | 130 | 36.7 | 41 | 350 | 0.05 | 27.3 |
| MMSZ43T1G | Z1 | 40.85 | 43 | 45.15 | 150 | 39.7 | 46 | 375 | 0.05 | 30.1 |
| MMSZ47T1G | Z2 | 44.65 | 47 | 49.35 | 170 | 43.7 | 50 | 375 | 0.05 | 32.9 |
| MMSZ51T1G | Z3 | 48.45 | 51 | 53.55 | 180 | 47.6 | 54 | 400 | 0.05 | 35.7 |
| MMSZ56T1G | Z4 | 53.20 | 56 | 58.80 | 200 | 51.5 | 60 | 425 | 0.05 | 39.2 |

6. The type numbers shown have a standard tolerance of $\pm 5\%$ on the nominal Zener Voltage.
 7. Tolerance and Voltage Designation: Zener Voltage (V_Z) is measured with the Zener Current applied for $PW = 1\text{ ms}$.
 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.
- *Include SZ-prefix devices where applicable.

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TYPICAL CHARACTERISTICS

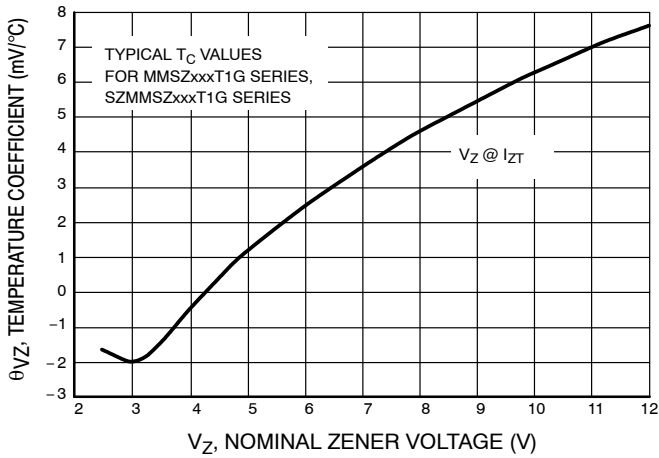


Figure 1. Temperature Coefficients (Temperature Range -55°C to +150°C)

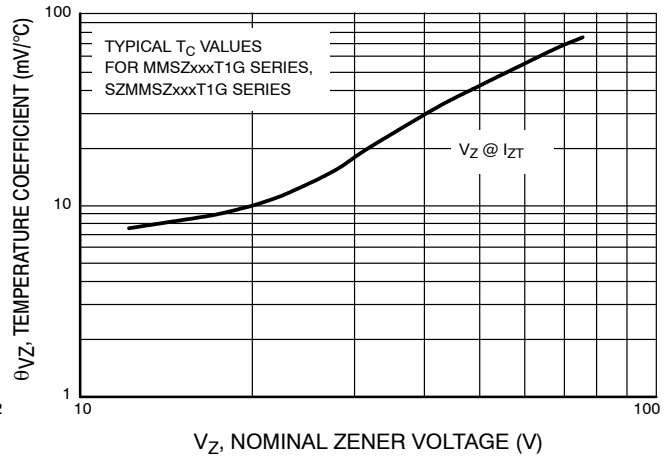


Figure 2. Temperature Coefficients (Temperature Range -55°C to +150°C)

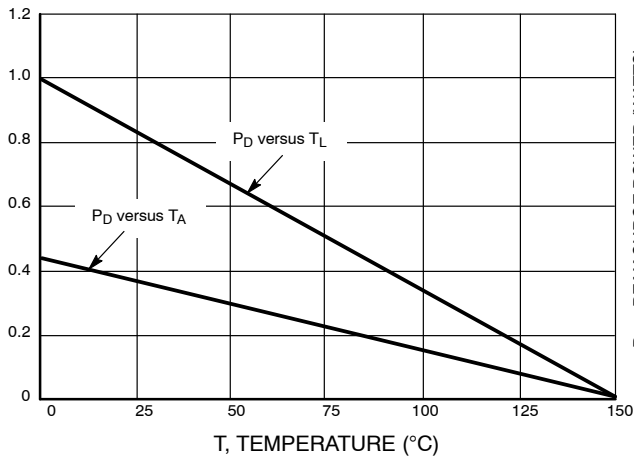


Figure 3. Steady State Power Derating



Figure 4. Maximum Nonrepetitive Surge Power

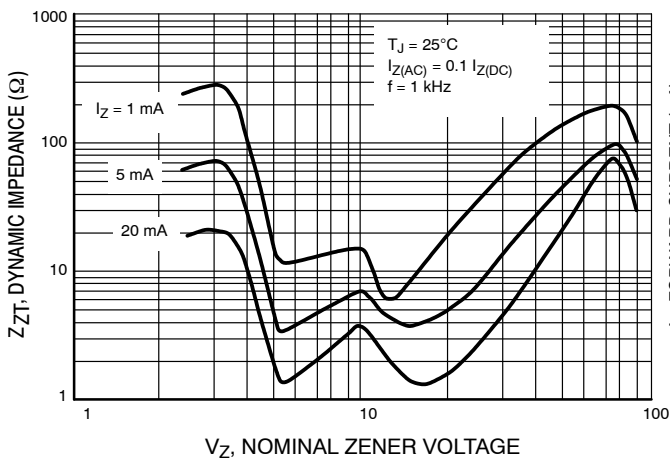


Figure 5. Effect of Zener Voltage on Zener Impedance



Figure 6. Typical Forward Voltage

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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)

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PACKAGE DIMENSIONS

SOD-123
CASE 425-04
ISSUE G

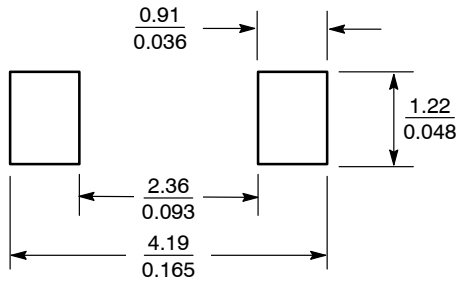


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| 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 | --- | --- |
| theta | 0° | --- | 10° | 0° | --- | 10° |

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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