

# MMSZ2V4ET1 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.

#### Specification 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
- Peak Power – 225 W (8 X 20  $\mu$ s)

#### 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        |
|-----------------------------------------------------------------------------------------------------|-----------------|----------------|-------------|
| Peak Power Dissipation @ 20 $\mu$ s (Note 1)<br>@ $T_L \leq 25^\circ\text{C}$                       | $P_{pk}$        | 225            | Watts       |
| Total Power Dissipation on FR-5 Board,<br>(Note 2) @ $T_L = 75^\circ\text{C}$<br>Derated above 75°C | $P_D$           | 500<br>6.7     | mW<br>mW/°C |
| Thermal Resistance –<br>Junction-to-Ambient (Note 3)                                                | $R_{\theta JA}$ | 340            | °C/W        |
| Thermal Resistance –<br>Junction-to-Lead (Note 3)                                                   | $R_{\theta JL}$ | 150            | °C/W        |
| Junction and Storage<br>Temperature Range                                                           | $T_J, T_{stg}$  | -55 to<br>+150 | °C          |

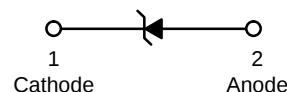
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur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

1. Nonrepetitive current pulse per Figure 11
2. FR-5 = 3.5 X 1.5 inches, using the On minimum recommended footprint as shown in Figure 12.
3. Thermal Resistance measurement obtained via infrared Scan Method



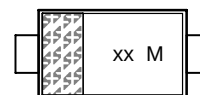
**ON Semiconductor®**

<http://onsemi.com>



**SOD-123  
CASE 425  
STYLE 1**

#### MARKING DIAGRAM



xx = Specific Device Code  
M = Date Code

#### ORDERING INFORMATION

| Device     | Package | Shipping†          |
|------------|---------|--------------------|
| MMSZxxxET1 | SOD-123 | 3000/Tape & Reel   |
| MMSZxxxET3 | SOD-123 | 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.

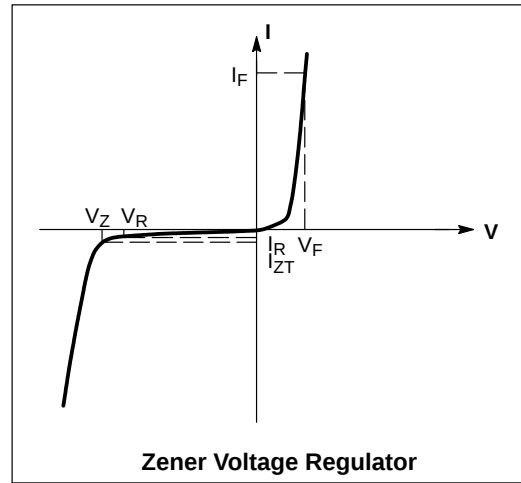
#### DEVICE MARKING INFORMATION

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

## MMSZ2V4ET1 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 | $V_{Z1}$ (V)<br>(Notes 4 and 5) |            |              | $Z_{ZT1}$<br>(Note 6) | $V_{Z2}$ (V)<br>(Notes 4 and 5) |             | $Z_{ZT2}$<br>(Note 6) | Leakage Current |             |
|-------------------|----------------|---------------------------------|------------|--------------|-----------------------|---------------------------------|-------------|-----------------------|-----------------|-------------|
|                   |                | @ $I_{ZT1} = 5\text{ mA}$       |            |              |                       | @ $I_{ZT2} = 1\text{ mA}$       |             |                       | $I_R$ @ $V_R$   |             |
|                   |                | Min                             | Nom        | Max          | $\Omega$              | Min                             | Max         | $\Omega$              | $\mu\text{A}$   | V           |
| MMSZ2V4ET1        | CL1            | 2.28                            | 2.4        | 2.52         | 100                   | 1.7                             | 2.1         | 600                   | 50              | 1           |
| MMSZ2V7ET1        | CL2            | 2.57                            | 2.7        | 2.84         | 100                   | 1.9                             | 2.4         | 600                   | 20              | 1           |
| MMSZ3V0ET1        | CL3            | 2.85                            | 3.0        | 3.15         | 95                    | 2.1                             | 2.7         | 600                   | 10              | 1           |
| MMSZ3V3ET1        | CL4            | 3.14                            | 3.3        | 3.47         | 95                    | 2.3                             | 2.9         | 600                   | 5               | 1           |
| MMSZ3V6ET1        | CL5            | 3.42                            | 3.6        | 3.78         | 90                    | 2.7                             | 3.3         | 600                   | 5               | 1           |
| MMSZ3V9ET1        | CL6            | 3.71                            | 3.9        | 4.10         | 90                    | 2.9                             | 3.5         | 600                   | 3               | 1           |
| MMSZ4V3ET1        | CL7            | 4.09                            | 4.3        | 4.52         | 90                    | 3.3                             | 4.0         | 600                   | 3               | 1           |
| MMSZ4V7ET1        | CL8            | 4.47                            | 4.7        | 4.94         | 80                    | 3.7                             | 4.7         | 500                   | 3               | 2           |
| <b>MMSZ5V1ET1</b> | <b>CL9</b>     | <b>4.85</b>                     | <b>5.1</b> | <b>5.36</b>  | <b>60</b>             | <b>4.2</b>                      | <b>5.3</b>  | <b>480</b>            | <b>2</b>        | <b>2</b>    |
| <b>MMSZ5V6ET1</b> | <b>CM1</b>     | <b>5.32</b>                     | <b>5.6</b> | <b>5.88</b>  | <b>40</b>             | <b>4.8</b>                      | <b>6.0</b>  | <b>400</b>            | <b>1</b>        | <b>2</b>    |
| <b>MMSZ6V2ET1</b> | <b>CM2</b>     | <b>5.89</b>                     | <b>6.2</b> | <b>6.51</b>  | <b>10</b>             | <b>5.6</b>                      | <b>6.6</b>  | <b>150</b>            | <b>3</b>        | <b>4</b>    |
| MMSZ6V8ET1        | CM3            | 6.46                            | 6.8        | 7.14         | 15                    | 6.3                             | 7.2         | 80                    | 2               | 4           |
| MMSZ7V5ET1        | CM4            | 7.13                            | 7.5        | 7.88         | 15                    | 6.9                             | 7.9         | 80                    | 1               | 5           |
| MMSZ8V2ET1        | CM5            | 7.79                            | 8.2        | 8.61         | 15                    | 7.6                             | 8.7         | 80                    | 0.7             | 5           |
| MMSZ9V1ET1        | CM6            | 8.65                            | 9.1        | 9.56         | 15                    | 8.4                             | 9.6         | 100                   | 0.5             | 6           |
| MMSZ10ET1         | CM7            | 9.50                            | 10         | 10.50        | 20                    | 9.3                             | 10.6        | 150                   | 0.2             | 7           |
| MMSZ11ET1         | CM8            | 10.45                           | 11         | 11.55        | 20                    | 10.2                            | 11.6        | 150                   | 0.1             | 8           |
| MMSZ12ET1         | CM9            | 11.40                           | 12         | 12.60        | 25                    | 11.2                            | 12.7        | 150                   | 0.1             | 8           |
| MMSZ13ET1         | CN1            | 12.35                           | 13         | 13.65        | 30                    | 12.3                            | 14.0        | 170                   | 0.1             | 8           |
| MMSZ15ET1         | CN2            | 14.25                           | 15         | 15.75        | 30                    | 13.7                            | 15.5        | 200                   | 0.05            | 10.5        |
| MMSZ16ET1         | CN3            | 15.20                           | 16         | 16.80        | 40                    | 15.2                            | 17.0        | 200                   | 0.05            | 11.2        |
| <b>MMSZ18ET1</b>  | <b>CN4</b>     | <b>17.10</b>                    | <b>18</b>  | <b>18.90</b> | <b>45</b>             | <b>16.7</b>                     | <b>19.0</b> | <b>225</b>            | <b>0.05</b>     | <b>12.6</b> |

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

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

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

6.  $Z_{ZT}$  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 =  $1\text{ kHz}$ .

## MMSZ2V4ET1 Series

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

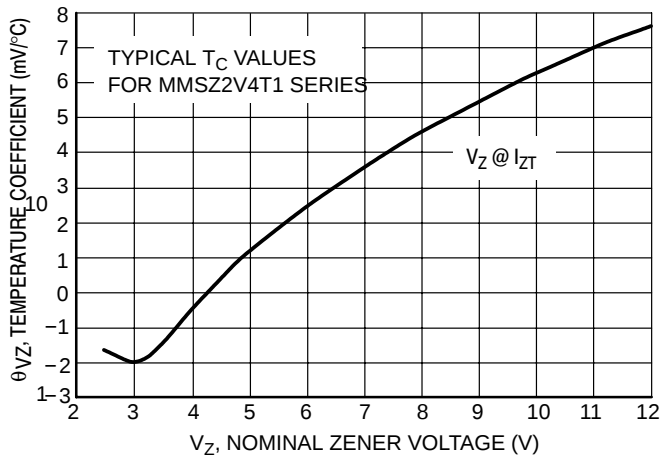
| Device                  | Device Marking    | $V_{Z1}\text{ (V)}$<br>(Notes 4 and 5) |                  |                     | $Z_{ZT1}$<br>(Note 6) | $V_{Z2}\text{ (V)}$<br>(Notes 4 and 5) |                  | $Z_{ZT2}$<br>(Note 6) | Leakage Current    |                    |
|-------------------------|-------------------|----------------------------------------|------------------|---------------------|-----------------------|----------------------------------------|------------------|-----------------------|--------------------|--------------------|
|                         |                   | @ $I_{ZT1} = 5\text{ mA}$              |                  |                     |                       | @ $I_{ZT2} = 1\text{ mA}$              |                  |                       | $I_R @ V_R$        |                    |
|                         |                   | Min                                    | Nom              | Max                 | $\Omega$              | Min                                    | Max              | $\Omega$              | $\mu\text{A}$      | V                  |
| MMSZ20ET1               | CN5               | 19.00                                  | 20               | 21.00               | 55                    | 18.7                                   | 21.1             | 225                   | 0.05               | 14                 |
| MMSZ22ET1               | CN6               | 20.90                                  | 22               | 23.10               | 55                    | 20.7                                   | 23.2             | 250                   | 0.05               | 15.4               |
| MMSZ24ET1               | CN7               | 22.80                                  | 24               | 25.20               | 70                    | 22.7                                   | 25.5             | 250                   | 0.05               | 16.8               |
| MMSZ27ET1               | CN8               | 25.65                                  | 27               | 28.35               | 80                    | 25                                     | 28.9             | 300                   | 0.05               | 18.9               |
| MMSZ30ET1               | CN9               | 28.50                                  | 30               | 31.50               | 80                    | 27.8                                   | 32               | 300                   | 0.05               | 21                 |
| MMSZ33ET1               | CP1               | 31.35                                  | 33               | 34.65               | 80                    | 30.8                                   | 35               | 325                   | 0.05               | 23.1               |
| MMSZ36ET1               | CP2               | 34.20                                  | 36               | 37.80               | 90                    | 33.8                                   | 38               | 350                   | 0.05               | 25.2               |
| <b><i>MMSZ39ET1</i></b> | <b><i>CP3</i></b> | <b><i>37.05</i></b>                    | <b><i>39</i></b> | <b><i>40.95</i></b> | <b><i>130</i></b>     | <b><i>36.7</i></b>                     | <b><i>41</i></b> | <b><i>350</i></b>     | <b><i>0.05</i></b> | <b><i>27.3</i></b> |
| MMSZ43ET1               | CP4               | 40.85                                  | 43               | 45.15               | 150                   | 39.7                                   | 46               | 375                   | 0.05               | 30.1               |
| MMSZ47ET1               | CP5               |                                        |                  |                     |                       |                                        |                  |                       |                    |                    |
| MMSZ51ET1               | CP6               | 48.45                                  | 51               | 53.55               | 180                   | 47.6                                   | 54               | 400                   | 0.05               | 35.7               |
| MMSZ56ET1               | CP7               | 53.20                                  | 56               | 58.80               | 200                   | 51.5                                   | 60               | 425                   | 0.05               | 39.2               |

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

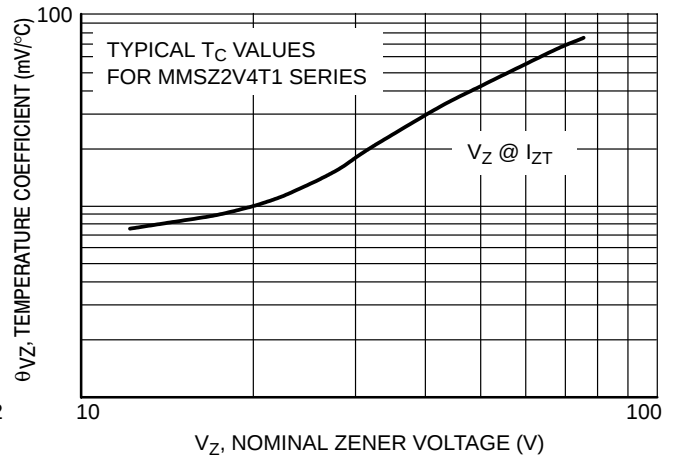
4. The type numbers shown have a standard tolerance of  $\pm 5\%$  on the nominal Zener Voltage.
5. Tolerance and Voltage Designation: Zener Voltage (VZ) is measured with the Zener Current applied for  $PW = 1\text{ ms}$ .
6.  $Z_{ZT}$  and  $Z_{ZK}$  are measured by dividing the AC voltage drop across 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.

# MMSZ2V4ET1 Series

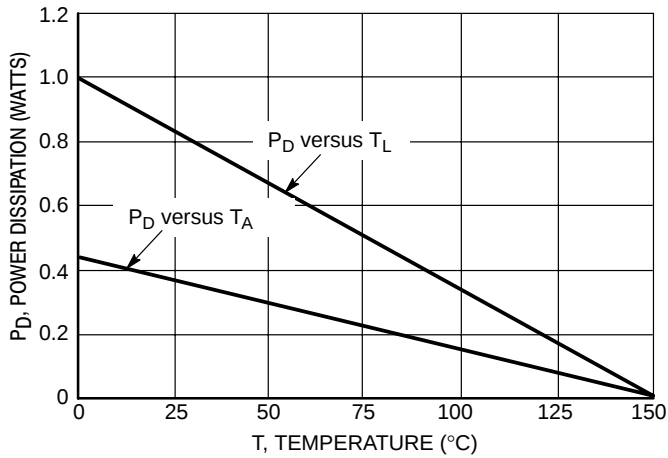
## TYPICAL CHARACTERISTICS



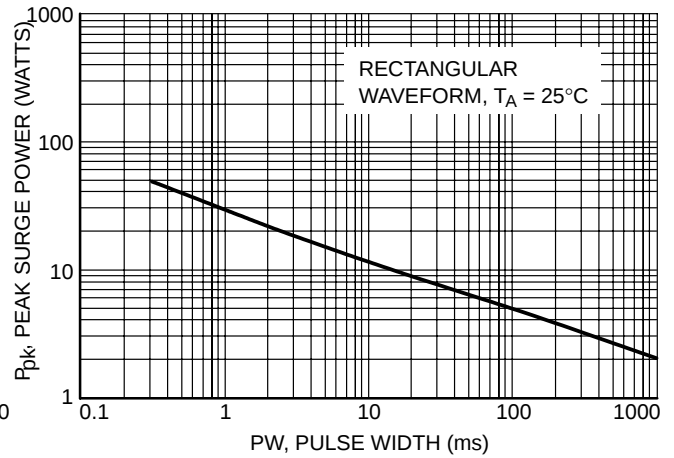
**Figure 1. Temperature Coefficients**  
(Temperature Range -55°C to +150°C)



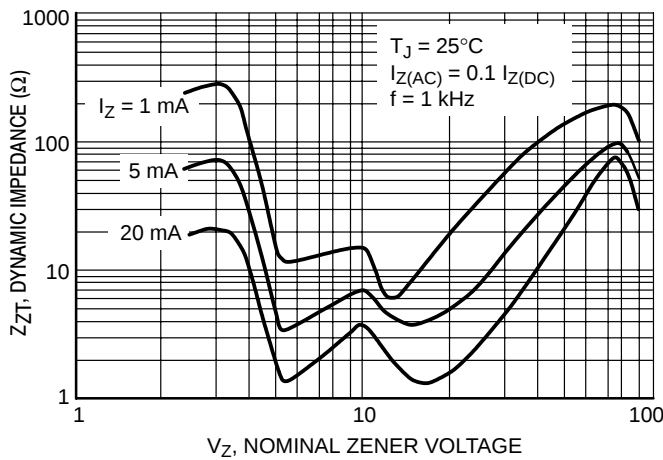
**Figure 2. Temperature Coefficients**  
(Temperature Range -55°C to +150°C)



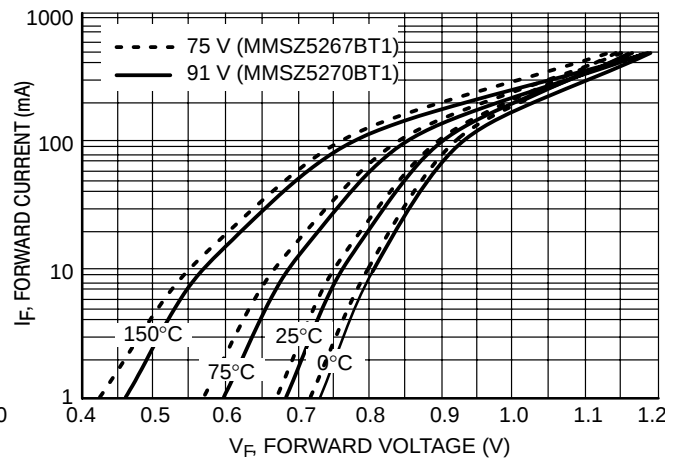
**Figure 3. Steady State Power Derating**



**Figure 4. Maximum Nonrepetitive Surge Power**



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



**Figure 6. Typical Forward Voltage**

# MMSZ2V4ET1 Series

## TYPICAL CHARACTERISTICS

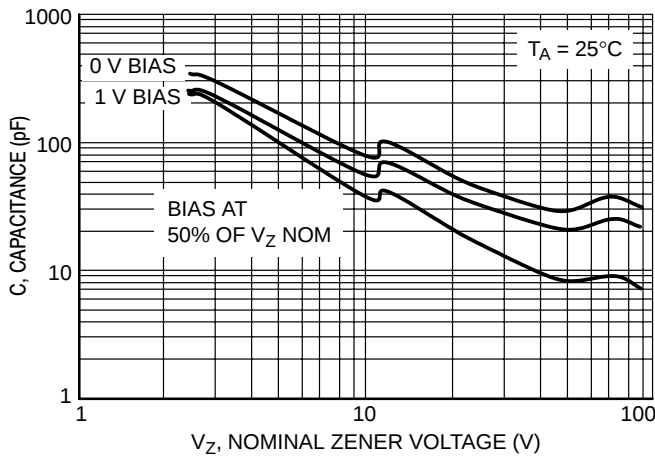


Figure 7. Typical Capacitance

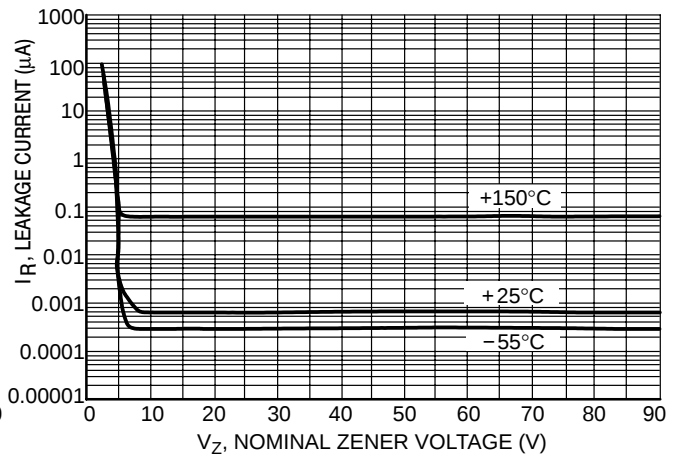


Figure 8. Typical Leakage Current

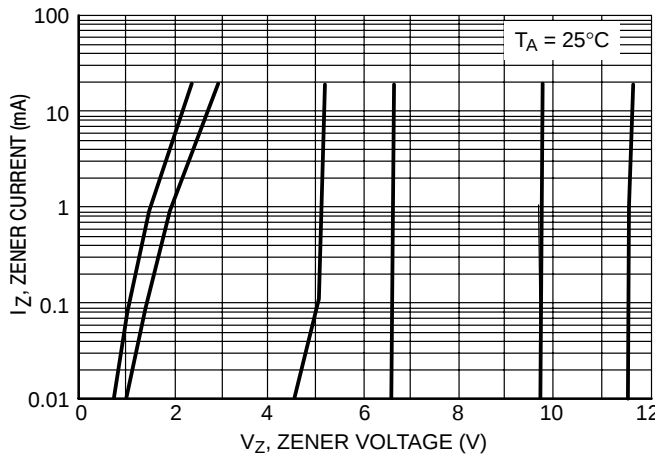


Figure 9. Zener Voltage versus Zener Current  
( $V_Z$  Up to 12 V)

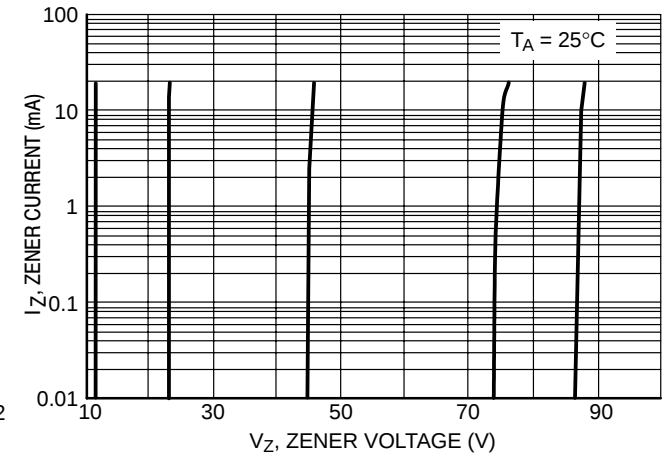


Figure 10. Zener Voltage versus Zener Current  
(12 V to 91 V)

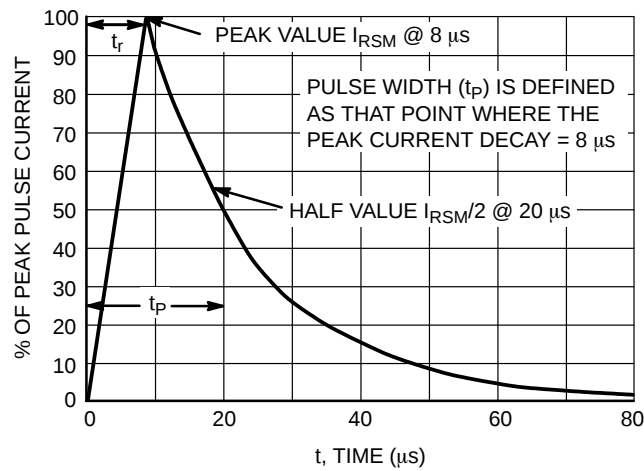
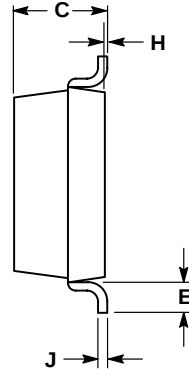
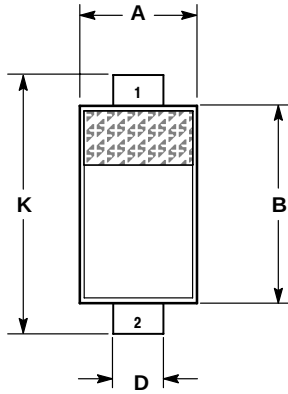


Figure 11.  $8 \times 20 \mu s$  Pulse Waveform

# MMSZ2V4ET1 Series

## PACKAGE DIMENSIONS

**SOD-123**  
CASE 425-04  
ISSUE C

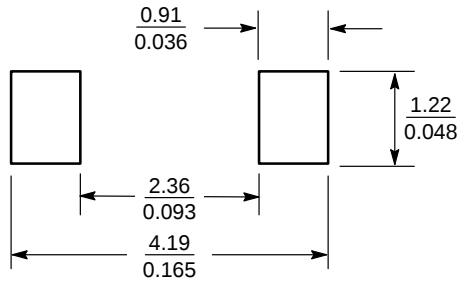


NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.055  | 0.071 | 1.40        | 1.80 |
| B   | 0.100  | 0.112 | 2.55        | 2.85 |
| C   | 0.037  | 0.053 | 0.95        | 1.35 |
| D   | 0.020  | 0.028 | 0.50        | 0.70 |
| E   | 0.01   | ---   | 0.25        | ---  |
| H   | 0.000  | 0.004 | 0.00        | 0.10 |
| J   | ---    | 0.006 | ---         | 0.15 |
| K   | 0.140  | 0.152 | 3.55        | 3.85 |

STYLE 1:  
PIN 1. CATHODE  
2. ANODE

## SOLDERING FOOTPRINT



SCALE 10:1 (mm/inches)

**Figure 12. SOD-123**

**ON Semiconductor** and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.