

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

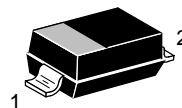
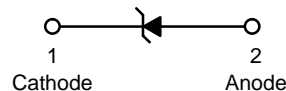
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur 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
3. Thermal Resistance measurement obtained via infrared Scan Method



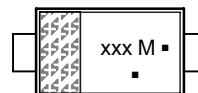
ON Semiconductor®

<http://onsemi.com>



SOD-123  
CASE 425  
STYLE 1

#### MARKING DIAGRAM



xxx = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
MMSZxxxET1	SOD-123 (Pb-Free)	3000/Tape & Reel
MMSZxxxET3	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.

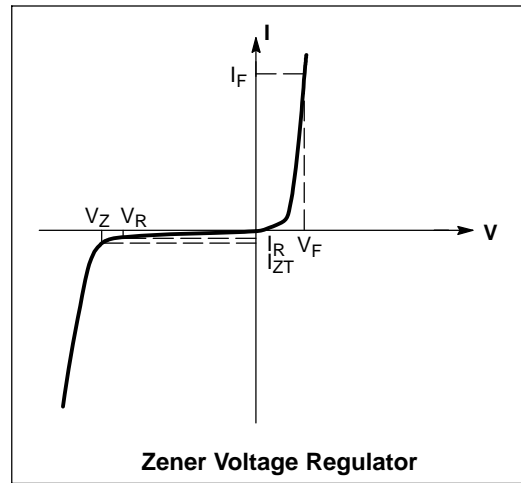
#### DEVICE MARKING INFORMATION

See specific marking information in the device marking column of the Electrical Characteristics table on page 3 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 @ $I_F$



## 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	$V_{Z1}$ (V) (Notes 4 and 5)			$Z_{ZT1}$ (Note 6)	$V_{Z2}$ (V) (Notes 4 and 5)		$Z_{ZT2}$ (Note 6)	Max Reverse 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, G	CL1	2.28	2.4	2.52	100	1.7	2.1	600	50	1
MMSZ2V7ET1, G	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, G	CL4	3.14	3.3	3.47	95	2.3	2.9	600	5	1
MMSZ3V6ET1, G	CL5	3.42	3.6	3.78	90	2.7	3.3	600	5	1
MMSZ3V9ET1, G	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, G</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, G	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, G	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, G	CN2	14.25	15	15.75	30	13.7	15.5	200	0.05	10.5
MMSZ16ET1, G	CN3	15.20	16	16.80	40	15.2	17.0	200	0.05	11.2
<b>MMSZ18ET1, G</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>
MMSZ20ET1, G	CN5	19.00	20	21.00	55	18.7	21.1	225	0.05	14
MMSZ22ET1, G	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

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 kHz.

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

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

## 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	$V_{Z1}$ (V) (Notes 7 and 8)			$Z_{ZT1}$ (Note 9)	$V_{Z2}$ (V) (Notes 7 and 8)		$Z_{ZT2}$ (Note 9)	Max Reverse Leakage Current	
		@ $I_{ZT1} = 2\text{ mA}$				@ $I_{ZT2} = 0.1\text{ mA}$		@ $I_{ZT2} = 0.5\text{ mA}$	$I_R$ @ $V_R$	
		Min	Nom	Max	$\Omega$	Min	Max	$\Omega$	$\mu\text{A}$	V
MMSZ27ET1, G	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, G	CP4	40.85	43	45.15	150	39.7	46	375	0.05	30.1
MMSZ47ET1	CP5	44.65	47	49.35	170	43.7	50	375	0.05	32.9
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

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

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

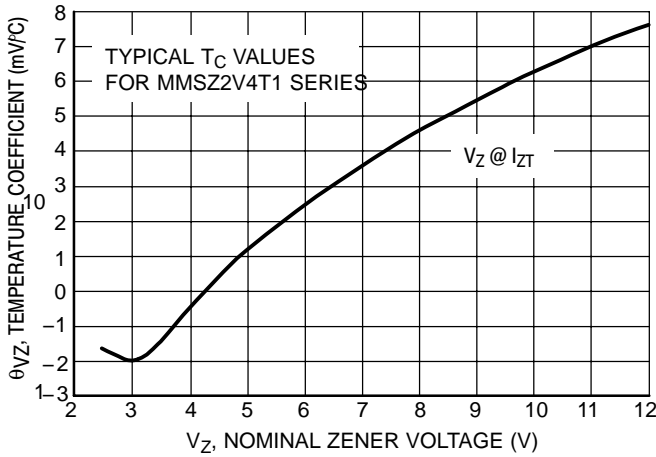
9.  $Z_{ZT}$  and  $Z_{ZK}$  are measured by dividing the AC voltage drop across the device by the AC current applied. The specified limits are for  $I_{Z(AC)} = 0.1 I_{Z(DC)}$ , with the AC frequency = 1 kHz.

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

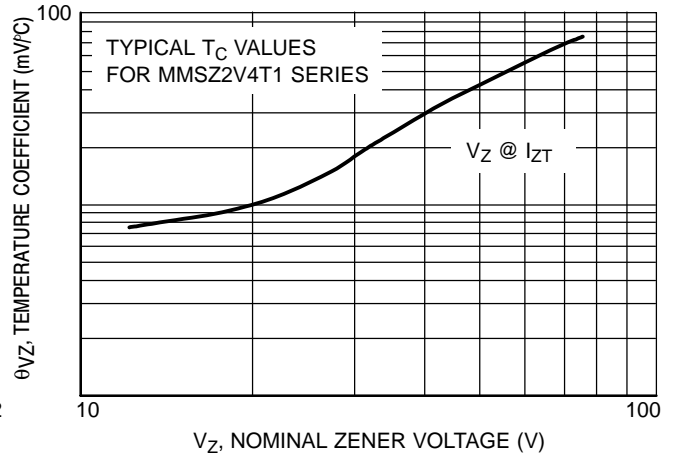
\* The "G" suffix indicates Pb-Free package available.

# MMSZ2V4ET1 Series

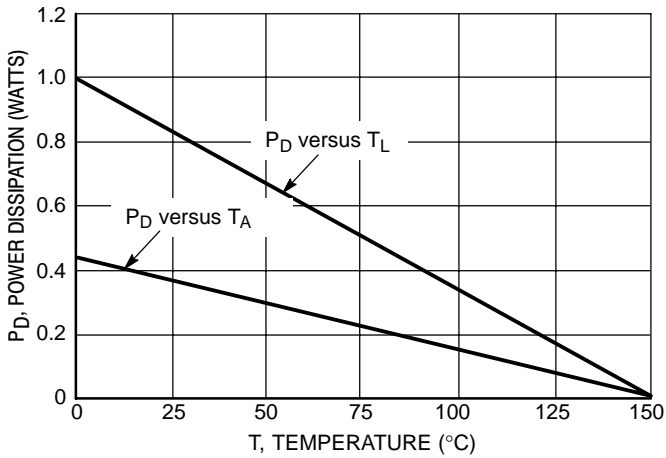
## TYPICAL CHARACTERISTICS



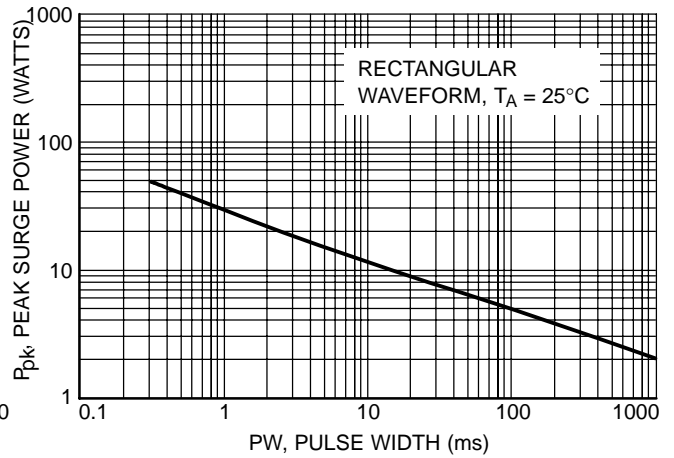
**Figure 1. Temperature Coefficients (Temperature Range -55°C to +150°C)**



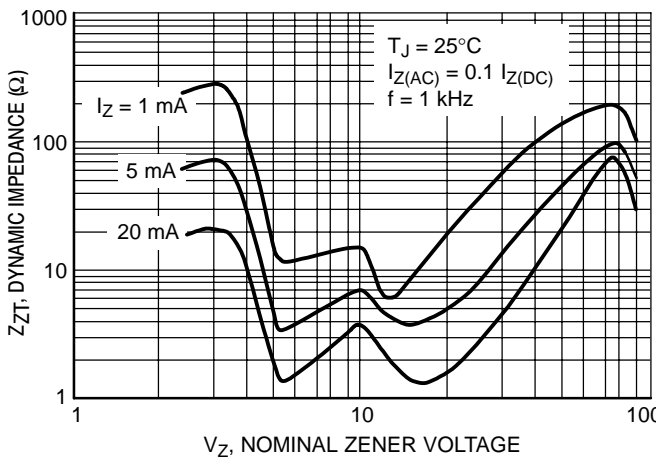
**Figure 2. Temperature Coefficients (Temperature Range -55°C to +150°C)**



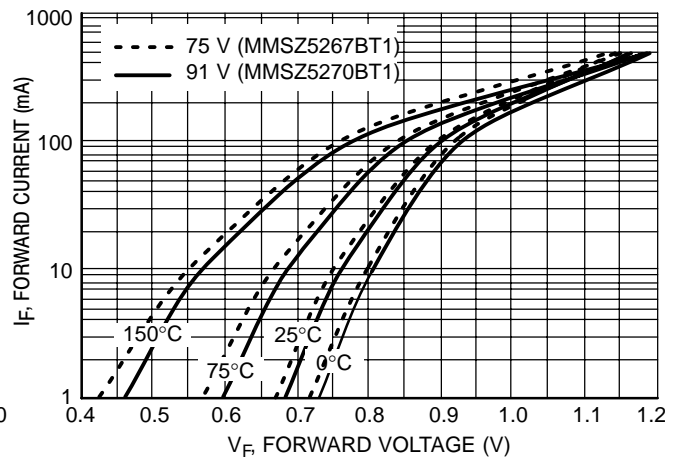
**Figure 3. Steady State Power Derating**



**Figure 4. Maximum Nonrepetitive Surge Power**



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



**Figure 6. Typical Forward Voltage**

# MMSZ2V4ET1 Series

## TYPICAL CHARACTERISTICS

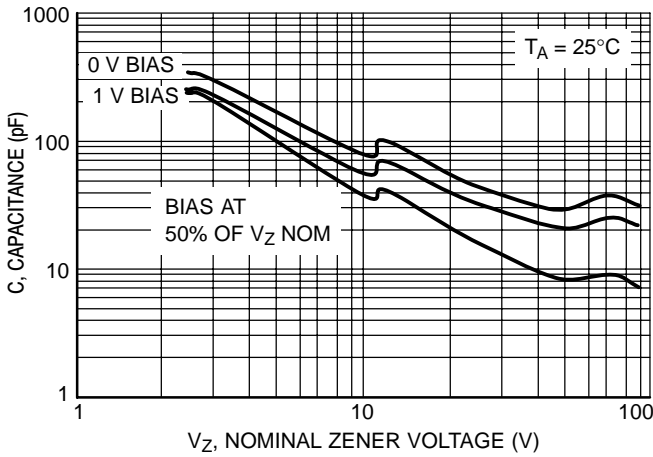


Figure 7. Typical Capacitance

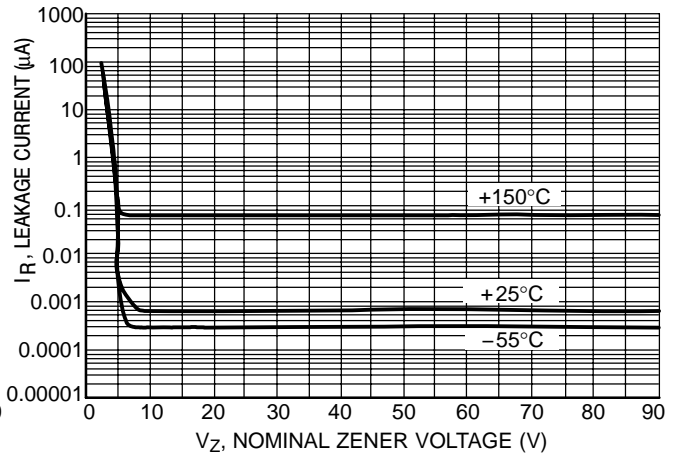


Figure 8. Typical Leakage Current

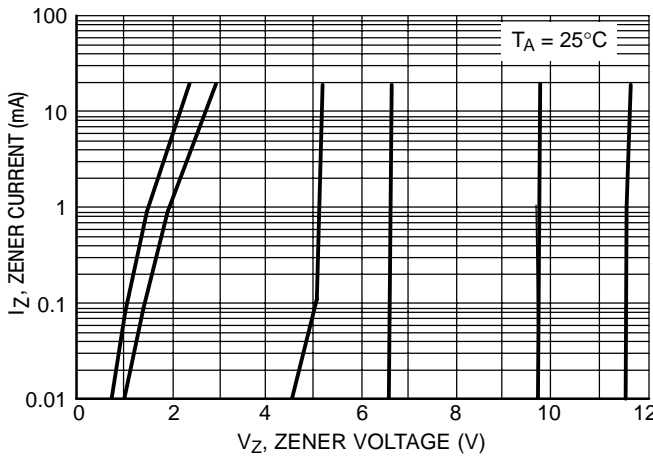


Figure 9. Zener Voltage versus Zener Current  
( $V_Z$  Up to 12 V)

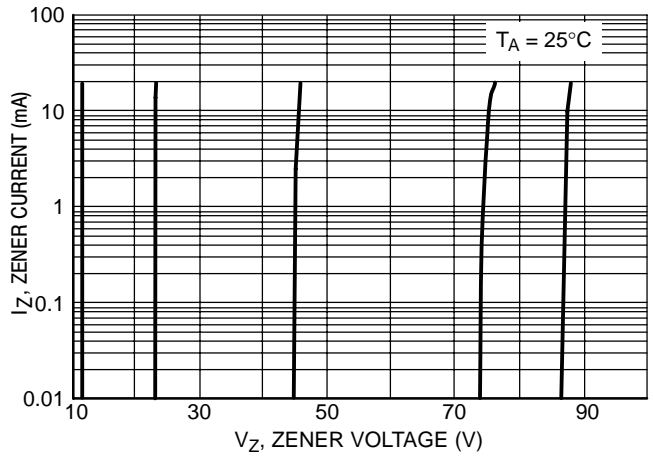


Figure 10. Zener Voltage versus Zener Current  
(12 V to 91 V)

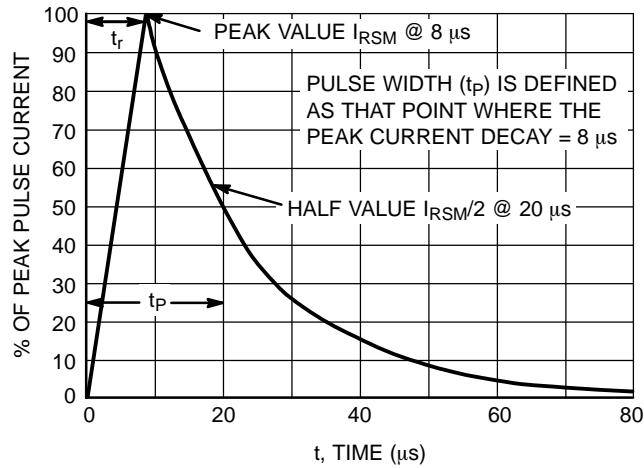
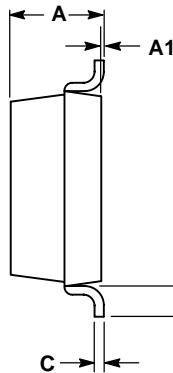
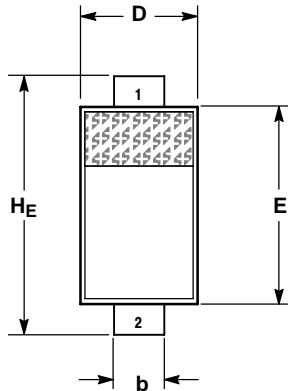


Figure 11.  $8 \times 20 \mu\text{s}$  Pulse Waveform

# MMSZ2V4ET1 Series

## PACKAGE DIMENSIONS

SOD-123  
CASE 425-04  
ISSUE E



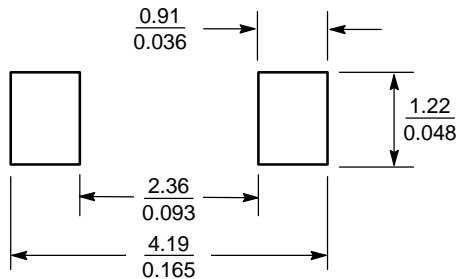
NOTES:

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
H <sub>E</sub>	3.56	3.68	3.86	0.140	0.145	0.152
L	0.25	---	---	0.010	---	---

STYLE 1:  
PIN 1. CATHODE  
2. ANODE

### SOLDERING FOOTPRINT\*



SCALE 10:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

\*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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