

# MMSZxxxT1 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 $75^\circ\text{C}$	$P_D$	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.

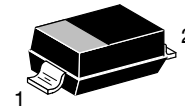
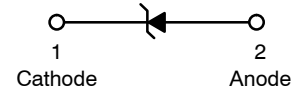
1. FR-5 = 3.5 X 1.5 inches.

2. Thermal Resistance measurement obtained via infrared Scan Method.



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**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†
MMSZxxxT1	SOD-123 (Pb-Free)	3000/Tape & Reel
SZMMSZxxxT1G	SOD-123 (Pb-Free)	3000/Tape & Reel
MMSZxxxT3	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.

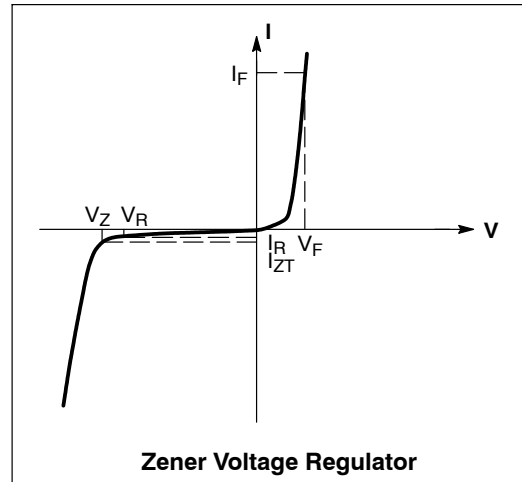
#### DEVICE MARKING INFORMATION

See specific marking information in the device marking column of the Electrical Characteristics table on page 3 of this data sheet.

## MMSZxxxT1 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 @ $I_F$



## MMSZxxxT1 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 <sup>†</sup>	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	
		@ $I_{ZT1} = 5\text{ mA}$				@ $I_{ZT2} = 1\text{ mA}$			$I_R @ V_R$	
		Min	Nom	Max	$\Omega$	Min	Max	$\Omega$	$\mu\text{A}$	Volts
SZ/MMSZ2V4T1	T1	2.28	2.4	2.52	100	1.7	2.1	600	50	1
SZ/MMSZ2V7T1	T2	2.57	2.7	2.84	100	1.9	2.4	600	20	1
MMSZ3V0T1*	T3	2.85	3.0	3.15	95	2.1	2.7	600	10	1
SZ/MMSZ3V3T1	T4	3.14	3.3	3.47	95	2.3	2.9	600	5	1
SZ/MMSZ3V6T1	T5	3.42	3.6	3.78	90	2.7	3.3	600	5	1
SZ/MMSZ3V9T1	U1	3.71	3.9	4.10	90	2.9	3.5	600	3	1
SZ/MMSZ4V3T1	U2	4.09	4.3	4.52	90	3.3	4.0	600	3	1
SZ/MMSZ4V7T1	U3	4.47	4.7	4.94	80	3.7	4.7	500	3	2
<b>SZ/MMSZ5V1T1</b>	<b>U4</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>SZ/MMSZ5V6T1*</b>	<b>U5</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>SZ/MMSZ6V2T1*</b>	<b>V1</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>
SZ/MMSZ6V8T1	V2	6.46	6.8	7.14	15	6.3	7.2	80	2	4
SZ/MMSZ7V5T1	V3	7.13	7.5	7.88	15	6.9	7.9	80	1	5
SZ/MMSZ8V2T1	V4	7.79	8.2	8.61	15	7.6	8.7	80	0.7	5
SZ/MMSZ9V1T1	V5	8.65	9.1	9.56	15	8.4	9.6	100	0.5	6
SZ/MMSZ10T1	A1	9.50	10	10.50	20	9.3	10.6	150	0.2	7
SZ/MMSZ11T1	A2	10.45	11	11.55	20	10.2	11.6	150	0.1	8
SZ/MMSZ12T1	A3	11.40	12	12.60	25	11.2	12.7	150	0.1	8
SZ/MMSZ13T1	A4	12.35	13	13.65	30	12.3	14.0	170	0.1	8
SZ/MMSZ15T1	A5	14.25	15	15.75	30	13.7	15.5	200	0.05	10.5
SZ/MMSZ16T1	X1	15.20	16	16.80	40	15.2	17.0	200	0.05	11.2
<b>SZ/MMSZ18T1</b>	<b>X2</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>
SZ/MMSZ20T1	X3	19.00	20	21.00	55	18.7	21.1	225	0.05	14
SZ/MMSZ22T1	X4	20.90	22	23.10	55	20.7	23.2	250	0.05	15.4
SZ/MMSZ24T1	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.

†The "G" suffix indicates Pb-Free package available.

\*Not Available in the 10,000/Tape & Reel.

## MMSZxxxT1 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 <sup>†</sup>	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	
		@ $I_{ZT1} = 2\text{ mA}$				@ $I_{ZT2} = 0.1\text{ mA}$		@ $I_{ZT2} = 0.5\text{ mA}$	$I_R$ @ $V_R$	
		Min	Nom	Max	$\Omega$	Min	Max	$\Omega$	$\mu\text{A}$	Volts
SZ/MMSZ27T1/T3	Y1	25.65	27	28.35	80	25	28.9	300	0.05	18.9
SZ/MMSZ30T1*	Y2	28.50	30	31.50	80	27.8	32	300	0.05	21
SZ/MMSZ33T1	Y3	31.35	33	34.65	80	30.8	35	325	0.05	23.1
SZ/MMSZ36T1*	Y4	34.20	36	37.80	90	33.8	38	350	0.05	25.2
SZ/MMSZ39T1*	Y5	37.05	39	40.95	130	36.7	41	350	0.05	27.3
MMSZ43T1*	Z1	40.85	43	45.15	150	39.7	46	375	0.05	30.1
MMSZ47T1	Z2	44.65	47	49.35	170	43.7	50	375	0.05	32.9
MMSZ51T1*	Z3	48.45	51	53.55	180	47.6	54	400	0.05	35.7
MMSZ56T1	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.

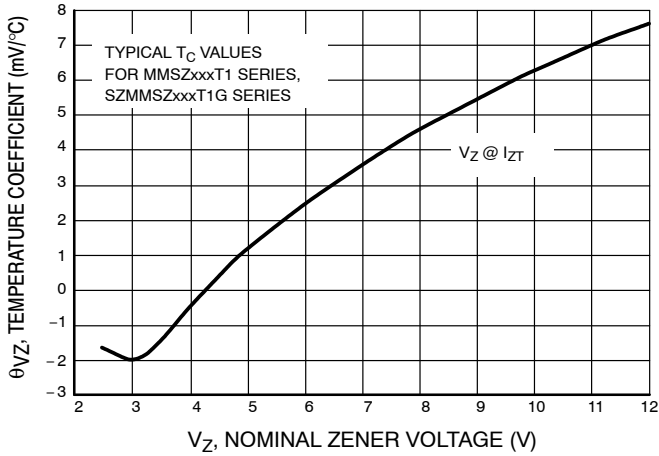
The specified limits are for  $I_{Z(AC)} = 0.1 I_{Z(DC)}$ , with the AC frequency = 1 kHz.

<sup>†</sup>The "G" suffix indicates Pb-Free package available.

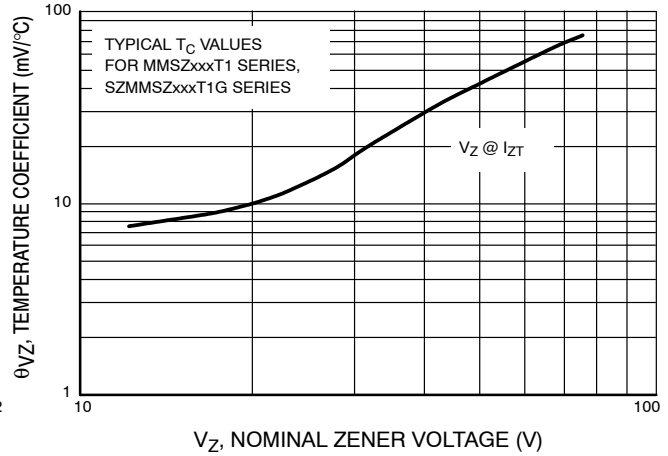
\*Not Available in the 10,000/Tape & Reel.

# MMSZxxxT1 Series, SZMMSZxxxT1G Series

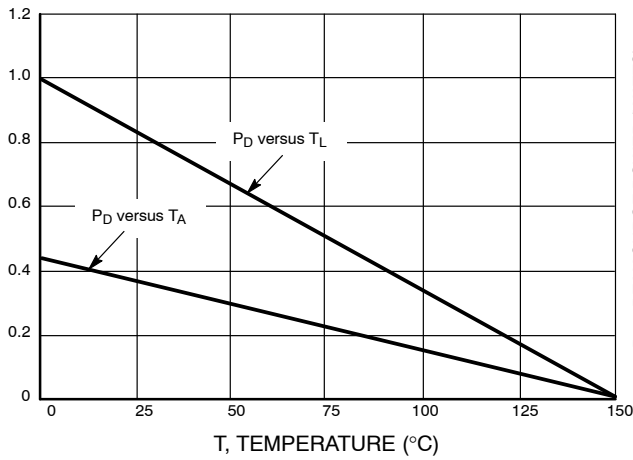
## TYPICAL CHARACTERISTICS



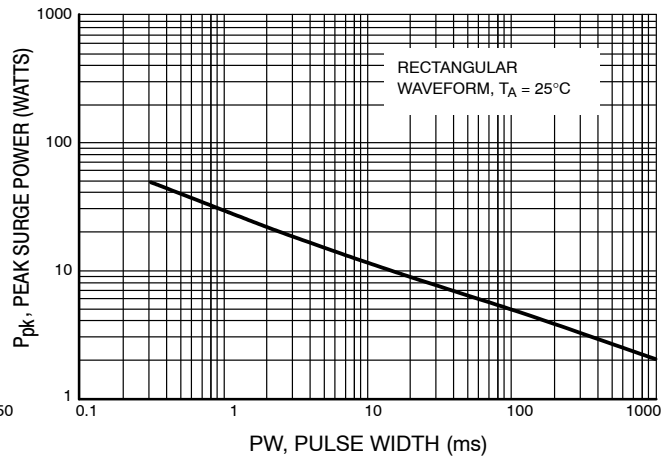
**Figure 1. Temperature Coefficients  
(Temperature Range -55°C to +150°C)**



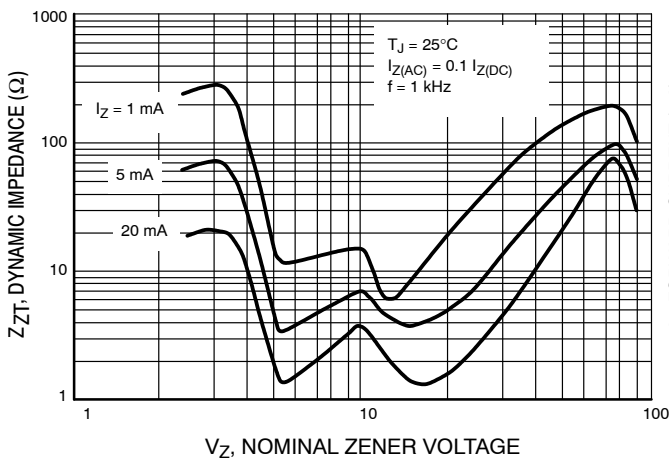
**Figure 2. Temperature Coefficients  
(Temperature Range -55°C to +150°C)**



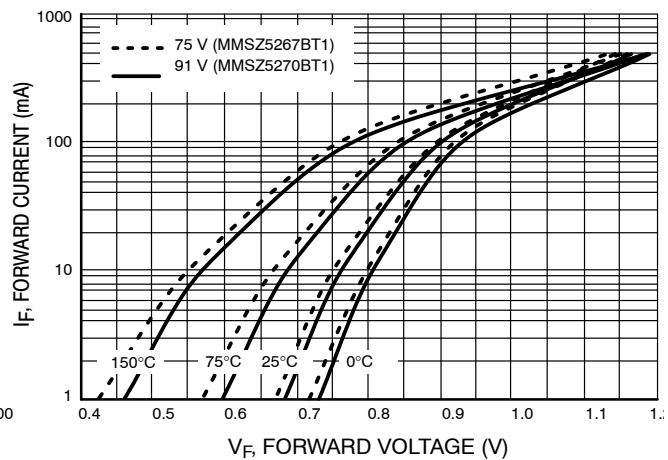
**Figure 3. Steady State Power Derating**



**Figure 4. Maximum Nonrepetitive Surge Power**



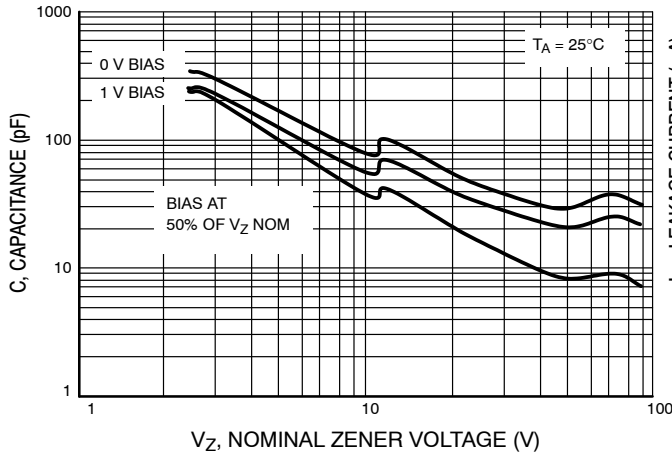
**Figure 5. Effect of Zener Voltage on  
Zener Impedance**



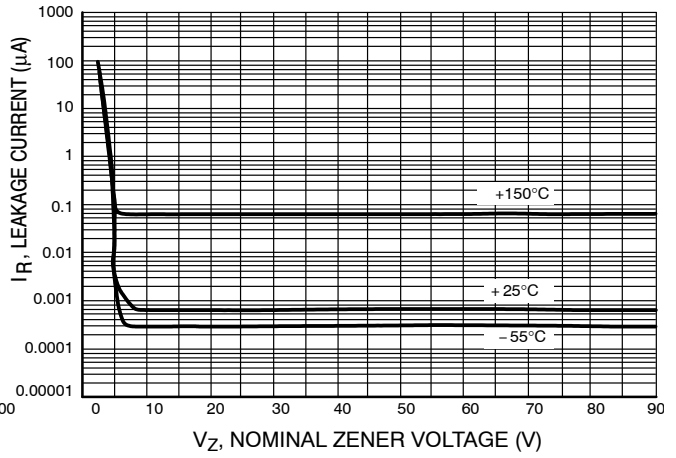
**Figure 6. Typical Forward Voltage**

# MMSZxxxT1 Series, SZMMSZxxxT1G Series

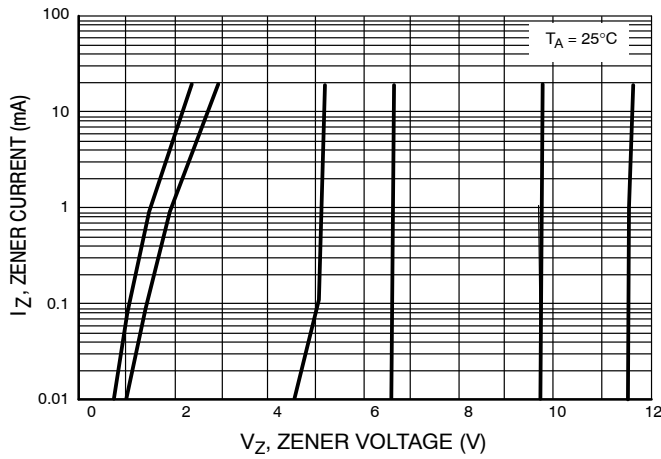
## TYPICAL CHARACTERISTICS



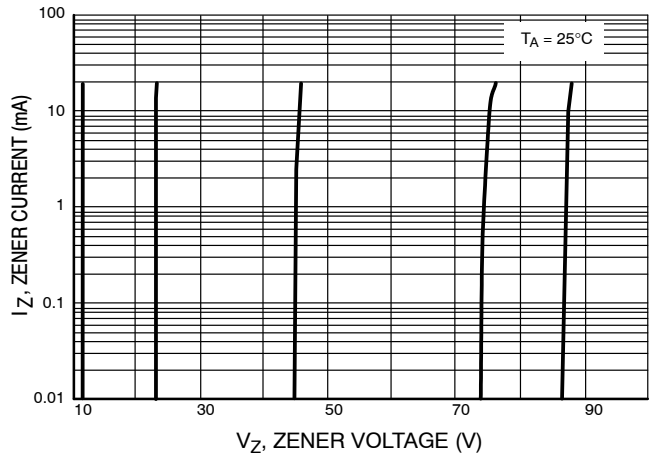
**Figure 7. Typical Capacitance**



**Figure 8. Typical Leakage Current**



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

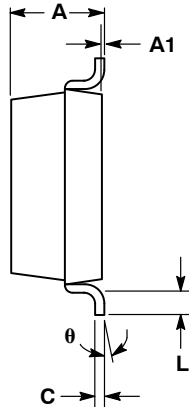
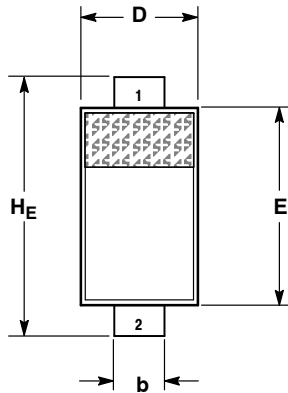


**Figure 10. Zener Voltage versus Zener Current  
(12 V to 91 V)**

# MMSZxxxT1 Series, SZMMSZxxxT1G Series

## PACKAGE DIMENSIONS

SOD-123  
CASE 425-04  
ISSUE G

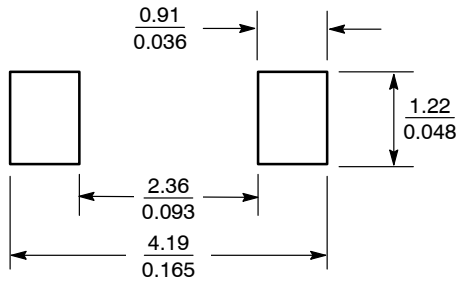


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

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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