

Designer's™ Data Sheet **Surface Mount Silicon Zener Diodes** **Plastic SOD-123 Package**

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.

- 500 mW Rating on FR-4 or FR-5 Board
- Package Designed for Optimal Automated Board Assembly
- Corrosion Resistant Finish, Easily Solderable
- ESD Rating of Class 3 (exceeding 16 kV) per the Human Body Model
- Small Package Size for High Density Applications
- Available in 8 mm Tape and Reel
 - Add "T1" to the device number to order the 7 inch/3000 unit reel.
 - Add "T3" to the device number to order the 13 inch/10,000 unit reel.
- Wafer Fab Location: Phoenix, Arizona
 Assembly/Test Location: Seremban, Malaysia

MMSZ2V4T1 thru MMSZ75T1

- Specified Similar to European BZV55C Series
- Wide Voltage Range — 2.4 to 75 Volts

MMSZ2V4T1 **SERIES**

**PLASTIC SURFACE
 MOUNT
 ZENER DIODES
 500 MILLIWATTS
 1.8–91 VOLTS**

1 —  — 2

**1: CATHODE
 2: ANODE**



**CASE 425, STYLE 1
 PLASTIC**

DEVICE RATING ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Power Dissipation on FR-4 or FR-5 Board [1] Derate above $T_L = 75^\circ\text{C}$	P_D —	500 6.7	mW mW/ $^\circ\text{C}$
Thermal Resistance Junction to Lead [2] Thermal Resistance Junction to Ambient [2]	$R_{\theta JL}$ $R_{\theta JA}$	150 340	$^\circ\text{C/W}$
Junction Temperature Range	T_J	–55 to +150	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	–55 to +150	$^\circ\text{C}$
Lead Solder Temperature – Maximum (10 sec. duration)	—	260	$^\circ\text{C}$

[1] FR-4 or FR-5 = 3.5 x 1.5 inches, using the Motorola minimum recommended footprint as shown in Figure 11.

[2] Thermal Resistance measurement obtained via Infrared Scan Method

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

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Thermal Clad is a trademark of the Bergquist Company.

Preferred devices are Motorola recommended choices for future use and best overall value.

MMSZ2V4T1 Series

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

Type Number	Marking	Zener Voltage V_{Z1} (Volts) @ $I_{ZT1} = 5\text{ mA}$ [1][2]			Max Zener Impedance Z_{ZT1} @ $I_{ZT1} = 5\text{ mA}$ [3] Ω	Max Reverse Leakage Current		Zener Voltage V_{Z2} (Volts) @ $I_{ZT2} = 1\text{ mA}$ [1]		Max Zener Impedance Z_{ZT2} @ $I_{ZT1} = 1\text{ mA}$ [3] Ω
		Nom	Min	Max		I_R μA	@ V_R Volts	Min	Max	
MMSZ2V4T1	T1	2.4	2.28	2.52	100	50	1	1.7	2.1	600
MMSZ2V7T1	T2	2.7	2.57	2.84	100	20	1	1.9	2.4	600
MMSZ3V0T1	T3	3.0	2.85	3.15	95	10	1	2.1	2.7	600
MMSZ3V3T1	T4	3.3	3.14	3.47	95	5	1	2.3	2.9	600
MMSZ3V6T1	T5	3.6	3.42	3.78	90	5	1	2.7	3.3	600
MMSZ3V9T1	U1	3.9	3.71	4.10	90	3	1	2.9	3.5	600
MMSZ4V3T1	U2	4.3	4.09	4.52	90	3	1	3.3	4.0	600
MMSZ4V7T1	U3	4.7	4.47	4.94	80	3	2	3.7	4.7	500
MMSZ5V1T1	U4	5.1	4.85	5.36	60	2	2	4.2	5.3	480
MMSZ5V6T1	U5	5.6	5.32	5.88	40	1	2	4.8	6.0	400
MMSZ6V2T1	V1	6.2	5.89	6.51	10	3	4	5.6	6.6	150
MMSZ6V8T1	V2	6.8	6.46	7.14	15	2	4	6.3	7.2	80
MMSZ7V5T1	V3	7.5	7.13	7.88	15	1	5	6.9	7.9	80
MMSZ8V2T1	V4	8.2	7.79	8.61	15	0.7	5	7.6	8.7	80
MMSZ9V1T1	V5	9.1	8.65	9.56	15	0.5	6	8.4	9.6	100
MMSZ10T1	A1	10	9.50	10.50	20	0.2	7	9.3	10.6	150
MMSZ11T1	A2	11	10.45	11.55	20	0.1	8	10.2	11.6	150
MMSZ12T1	A3	12	11.40	12.60	25	0.1	8	11.2	12.7	150
MMSZ13T1	A4	13	12.35	13.65	30	0.1	8	12.3	14.0	170
MMSZ15T1	A5	15	14.25	15.75	30	0.05	10.5	13.7	15.5	200
MMSZ16T1	X1	16	15.20	16.80	40	0.05	11.2	15.2	17.0	200
MMSZ18T1	X2	18	17.10	18.90	45	0.05	12.6	16.7	19.0	225
MMSZ20T1	X3	20	19.00	21.00	55	0.05	14	18.7	21.1	225
MMSZ22T1	X4	22	20.80	23.10	55	0.05	15.4	20.7	23.2	250
MMSZ24T1	X5	24	22.80	25.20	70	0.05	16.8	22.7	25.5	250
MMSZ27T1	Y1	27	25.65	28.35	80	0.05	18.9	25	28.9	300
MMSZ30T1	Y2	30	28.50	31.50	80	0.05	21	27.8	32	300
MMSZ33T1	Y3	33	31.35	34.65	80	0.05	23.1	30.8	35	325
MMSZ36T1	Y4	36	34.20	37.80	90	0.05	25.2	33.8	38	350
MMSZ39T1	Y5	39	37.05	40.95	130	0.05	27.3	36.7	41	350
MMSZ43T1	Z1	43	40.85	45.15	150	0.05	30.1	39.7	46	375
MMSZ47T1	Z2	47	44.65	49.35	170	0.05	32.9	43.7	50	375
MMSZ51T1	Z3	51	48.45	53.55	180	0.05	35.7	47.6	54	400
MMSZ56T1	Z4	56	53.20	58.80	200	0.05	39.2	51.5	60	425
MMSZ62T1	Z5	62	58.90	65.10	215	0.05	43.4	57.4	66	450
MMSZ68T1	Z6	68	64.60	71.40	240	0.05	47.6	63.4	72	475
MMSZ75T1	Z7	75	71.25	78.75	255	0.05	52.5	69.4	79	500

[1] Zener voltage is measured with the zener current applied for $PW = 1.0\text{ ms}$.

[2] All part numbers shown indicate a V_Z tolerance of $\pm 5\%$.

[3] Z_{ZT1} and Z_{ZT2} 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.

[4] The zener impedance, Z_{ZT2} , for the 27 through 75 volt types is tested at 0.5 mA rather than the test current of 0.1 mA used for V_{Z2} .

MMSZ2V4T1 Series

TYPICAL CHARACTERISTICS

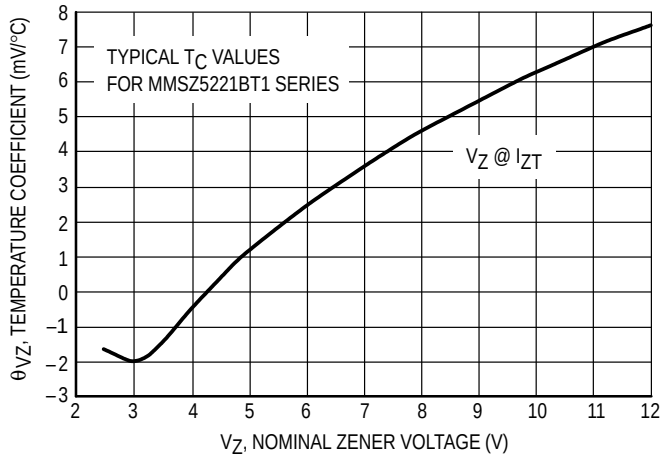


Figure 1. Temperature Coefficients
(Temperature Range -55°C to +150°C)

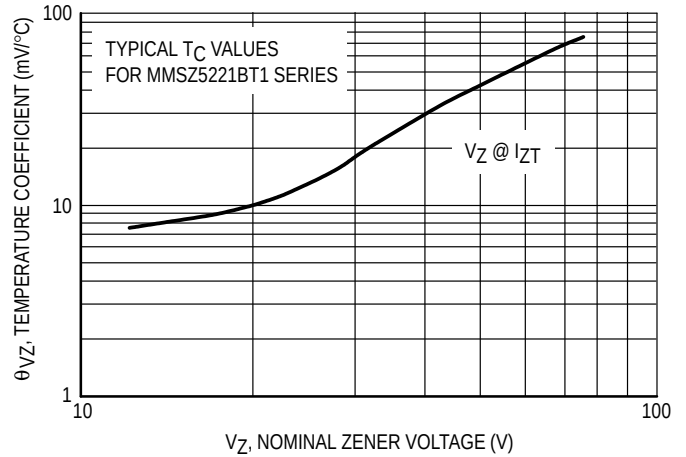


Figure 2. Temperature Coefficients
(Temperature Range -55°C to +150°C)

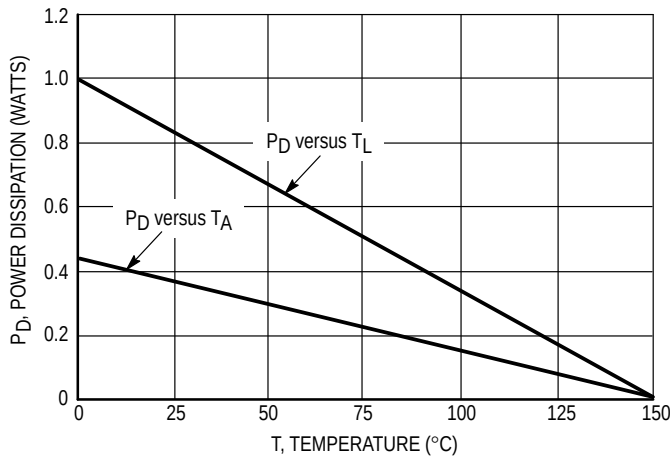


Figure 3. Steady State Power Derating

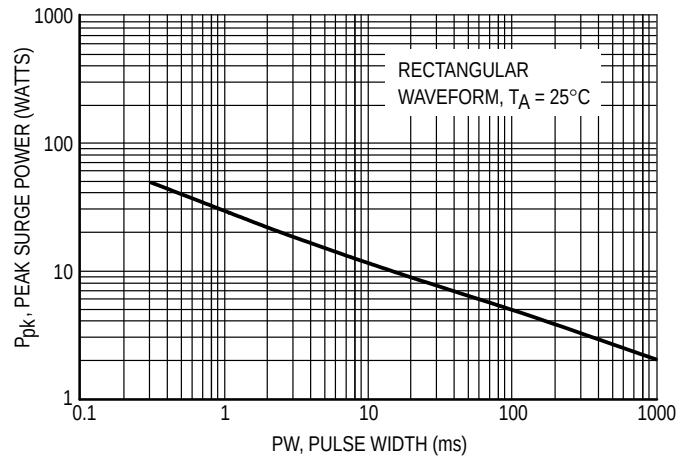


Figure 4. Maximum Nonrepetitive Surge Power

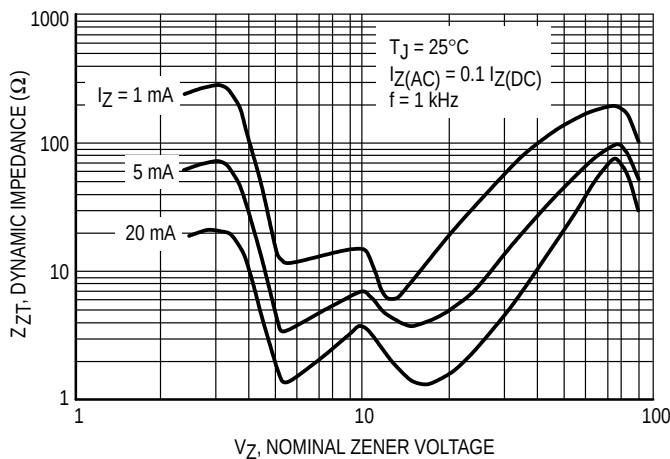


Figure 5. Effect of Zener Voltage on
Zener Impedance

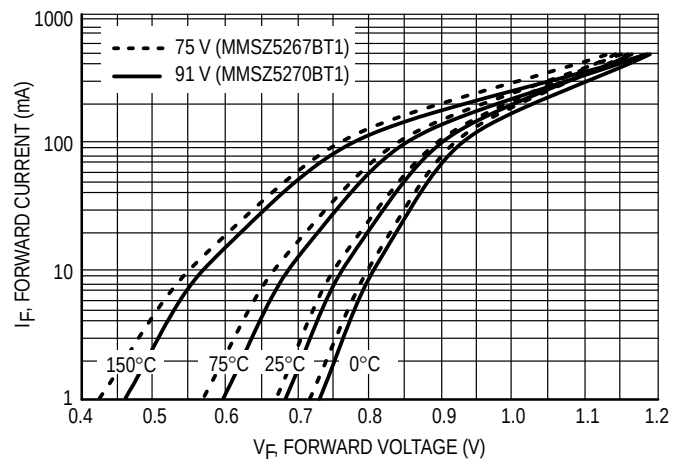


Figure 6. Typical Forward Voltage

MMSZ2V4T1 Series

TYPICAL CHARACTERISTICS

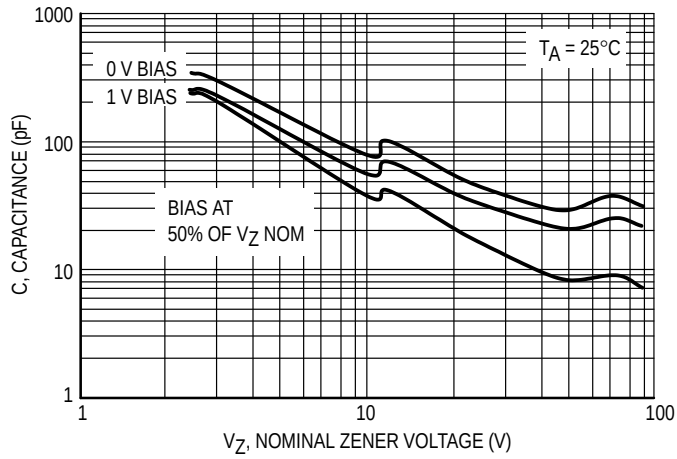


Figure 7. Typical Capacitance

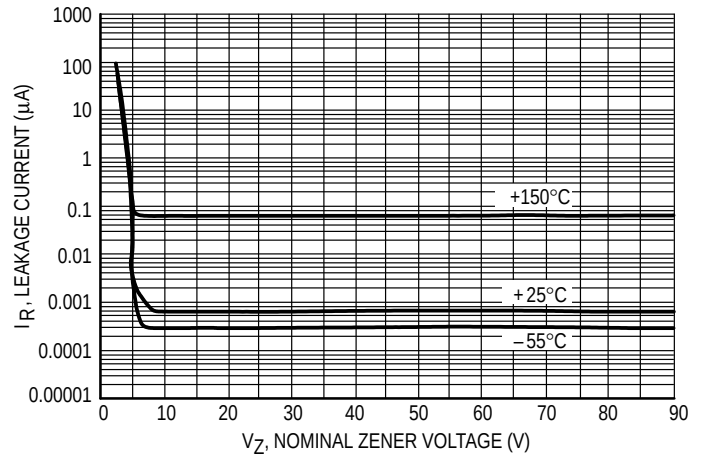


Figure 8. Typical Leakage Current

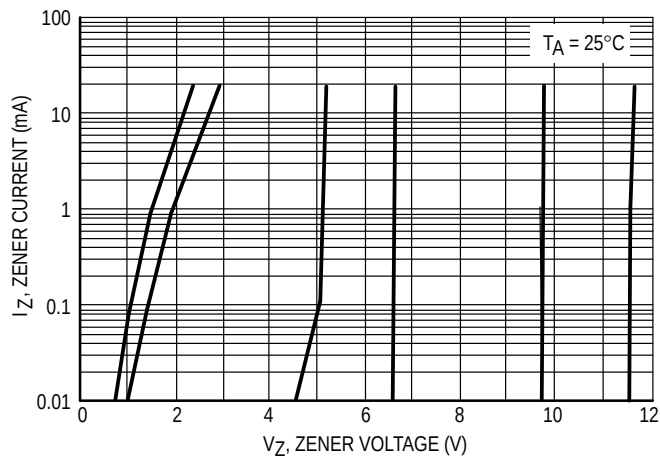


Figure 9. Zener Voltage versus Zener Current
(V_Z Up to 12 V)

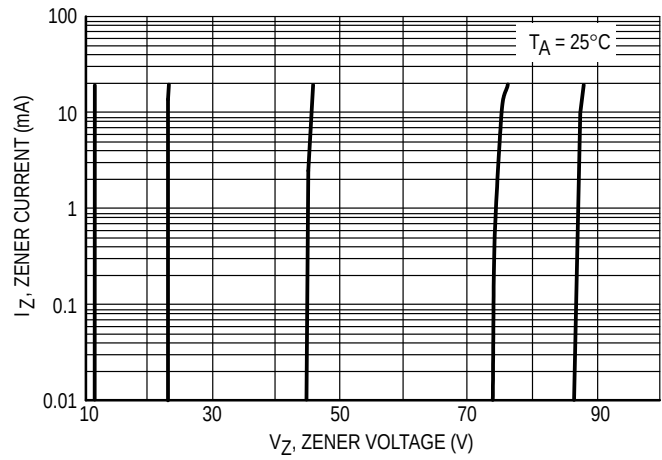


Figure 10. Zener Voltage versus Zener Current
(12 V to 91 V)

MMSZ2V4T1 Series

INFORMATION FOR USING THE SOD-123 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINTS FOR SURFACE MOUNT APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to ensure proper solder connection interface between the board and the package.

The minimum recommended footprint for the SOD-123 is shown at the right.

The SOD-123 package can be used on existing surface mount boards which have been designed for the leadless 34 package style. The footprint compatibility makes conversion from leadless 34 to SOD-123 straightforward.

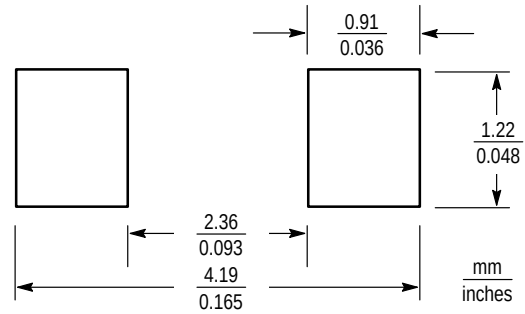


Figure 11. Minimum Recommended Footprint

SOD-123 POWER DISSIPATION

The power dissipation of the SOD-123 is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient; and the operating temperature, T_A . Using the values provided on the data sheet for the SOD-123 package, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum

ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 0.37 watts.

$$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{340^\circ\text{C/W}} = 0.37 \text{ watts}$$

The 340°C/W for the SOD-123 package assumes using recommended footprint shown on FR-4 glass epoxy printed circuit board. Another alternative is to use a ceramic substrate or an aluminum core board such as Thermal Clad™. By using an aluminum core board material such as Thermal Clad, the power dissipation can be doubled using the same footprint.

GENERAL SOLDERING PRECAUTIONS

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

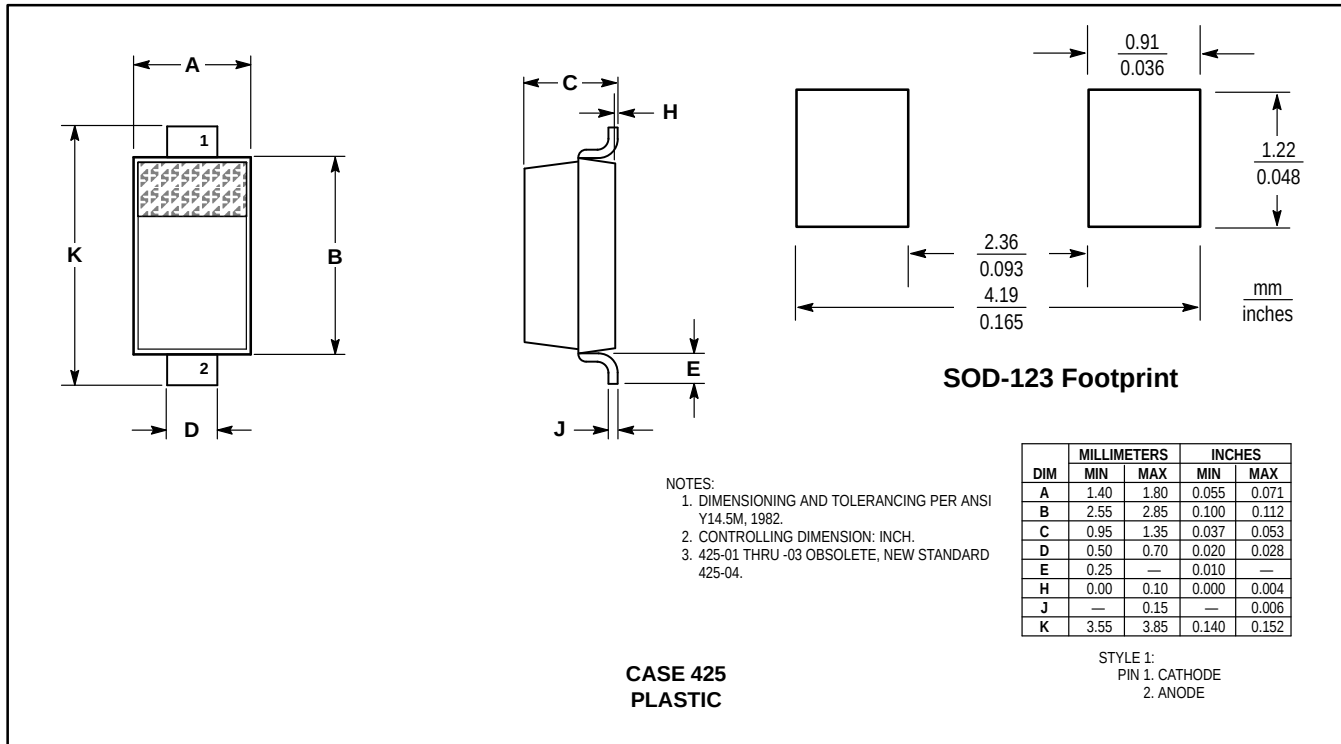
- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.

- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

Zener Voltage Regulator Diodes — Surface Mounted

500 mW SOD-123



(Refer to Section 10 for Surface Mount, Thermal Data and Footprint Information.)

MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

Package Option	Type No. Suffix	MPQ (Units)
Tape and Reel	T1(1)	3K
Tape and Reel	T3(2)	10K

NOTE: 1. The numbers on the suffixes indicate the following:

1. 7" Reel. Cathode lead toward sprocket hole.
2. 13" Reel. Cathode lead toward sprocket hole.

(Refer to Section 10 for more information on Packaging Specifications.)