MMSZ4678T1 SERIES

Designer's™ Data Sheet

Surface Mount Silicon Zener Diodes

Plastic SOD-123 Package

PLASTIC SURFACE MOUNT ZENER DIODES 500 MILLIWATTS 1.8–91 VOLTS

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

1: CATHODE
2: ANODE

MMSZ4678T1 thru MMSZ4717T1

- Low Operating Currents, Low Leakage, Sharp Breakdown Characteristics
- Wide Voltage Range — 1.8 to 43 Volts

CASE 425, STYLE 1
PLASTIC

DEVICE RATING (T_A = 25°C unless otherwise noted)

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

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

MMSZ4678T1 Series

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted [1], (V_F = 0.9 V Max. @ I_F = 10 mA for all types)

Type Number	Marking	Zener Voltage V_Z @ I_{ZT} = 50 μA Volts [1] [2]			Max Reverse Leakage Current I_R @ V_R μA	Test Voltage V_R Volts
		Nom	Min	Max		
MMSZ4678T1	CC	1.8	1.71	1.89	7.5	1
MMSZ4679T1	CD	2.0	1.90	2.10	5	1
MMSZ4680T1	CE	2.2	2.09	2.31	4	1
MMSZ4681T1	CF	2.4	2.28	2.52	2	1
MMSZ4682T1	CH	2.7	2.57	2.84	1	1
MMSZ4683T1	CJ	3.0	2.85	3.15	0.8	1
MMSZ4684T1	CK	3.3	3.14	3.47	7.5	1.5
MMSZ4685T1	CM	3.6	3.42	3.78	7.5	2
MMSZ4686T1	CN	3.9	3.71	4.10	5	2
MMSZ4687T1	CP	4.3	4.09	4.52	4	2
MMSZ4688T1	CT	4.7	4.47	4.94	10	3
MMSZ4689T1	CU	5.1	4.85	5.36	10	3
MMSZ4690T1	CV	5.6	5.32	5.88	10	4
MMSZ4691T1	CA	6.2	5.89	6.51	10	5
MMSZ4692T1	CX	6.8	6.46	7.14	10	5.1
MMSZ4693T1	CY	7.5	7.13	7.88	10	5.7
MMSZ4694T1	CZ	8.2	7.79	8.61	1	6.2
MMSZ4695T1	DC	8.7	8.27	9.14	1	6.6
MMSZ4696T1	DD	9.1	8.65	9.56	1	6.9
MMSZ4697T1	DE	10	9.50	10.50	1	7.6
MMSZ4698T1	DF	11	10.45	11.55	0.05	8.4
MMSZ4699T1	DH	12	11.40	12.60	0.05	9.1
MMSZ4700T1	DJ	13	12.35	13.65	0.05	9.8
MMSZ4701T1	DK	14	13.30	14.70	0.05	10.6
MMSZ4702T1	DM	15	14.25	15.75	0.05	11.4
MMSZ4703T1	DN	16	15.20	16.80	0.05	12.1
MMSZ4704T1	DP	17	16.15	17.85	0.05	12.9
MMSZ4705T1	DT	18	17.10	18.90	0.05	13.6
MMSZ4706T1	DU	19	18.05	19.95	0.05	14.4
MMSZ4707T1	DV	20	19.00	21.00	0.01	15.2
MMSZ4708T1	DA	22	20.90	23.10	0.01	16.7
MMSZ4709T1	DZ	24	22.80	25.20	0.01	18.2
MMSZ4710T1	DY	25	23.75	26.25	0.01	19.00
MMSZ4711T1	EA	27	25.65	28.35	0.01	20.4
MMSZ4712T1	EC	28	26.60	29.40	0.01	21.2
MMSZ4713T1	ED	30	28.50	31.50	0.01	22.8
MMSZ4714T1	EE	33	31.35	34.65	0.01	25.0
MMSZ4715T1	EF	36	34.20	37.80	0.01	27.3
MMSZ4716T1	EH	39	37.05	40.95	0.01	29.6
MMSZ4717T1	EJ	43	40.85	45.15	0.01	32.6

[1] Nominal zener voltage is measured with the device junction in thermal equilibrium at T_L = 30°C ± 1°C.
[2] All part numbers shown indicate a V_Z tolerance of ±5%

TYPICAL CHARACTERISTICS

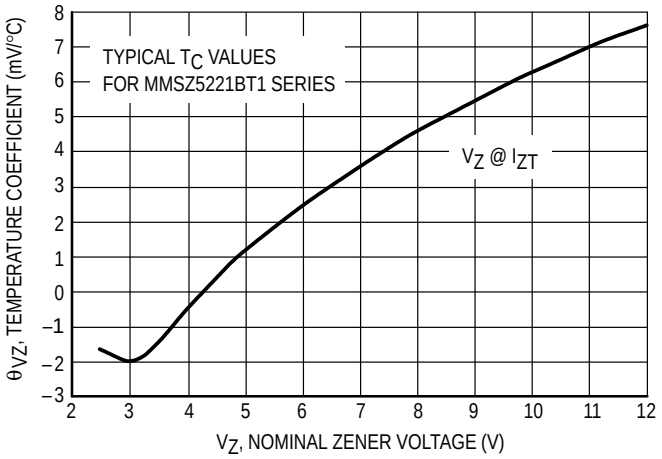


Figure 1. Temperature Coefficients (Temperature Range –55°C to +150°C)

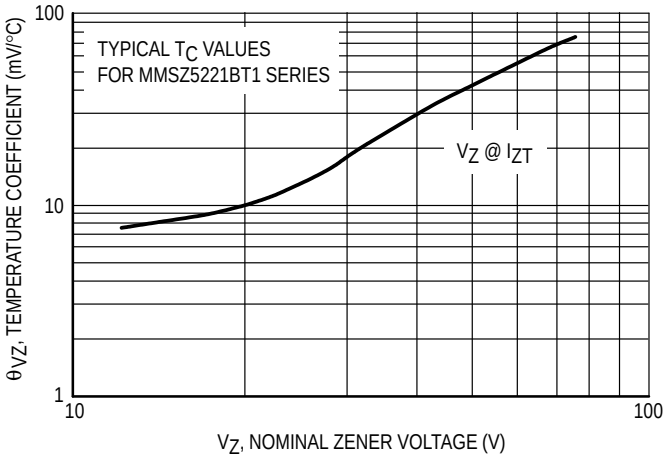


Figure 2. Temperature Coefficients (Temperature Range –55°C to +150°C)

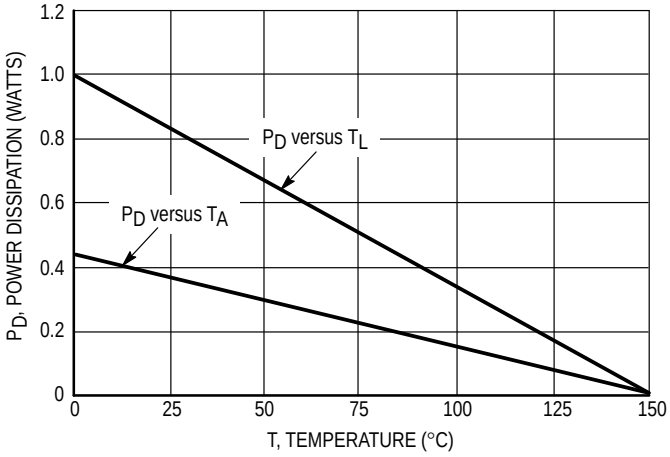


Figure 3. Steady State Power Derating

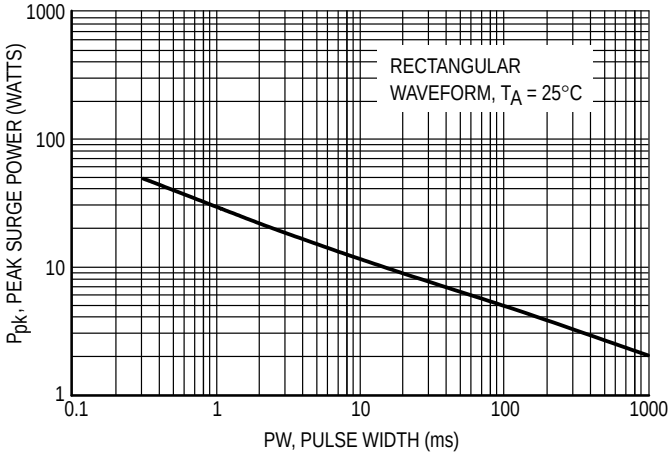


Figure 4. Maximum Nonrepetitive Surge Power

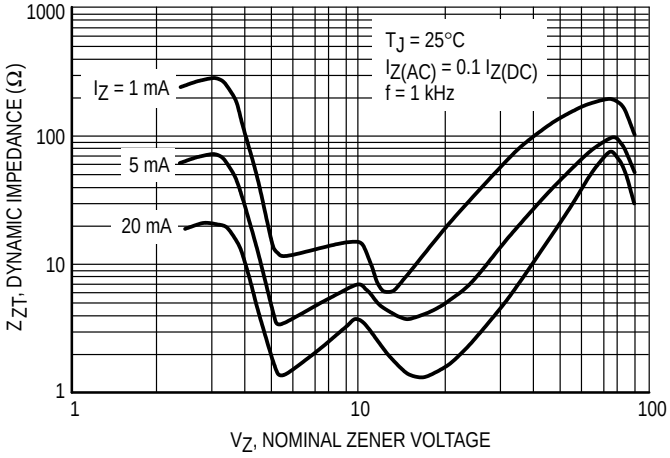


Figure 5. Effect of Zener Voltage on Zener Impedance

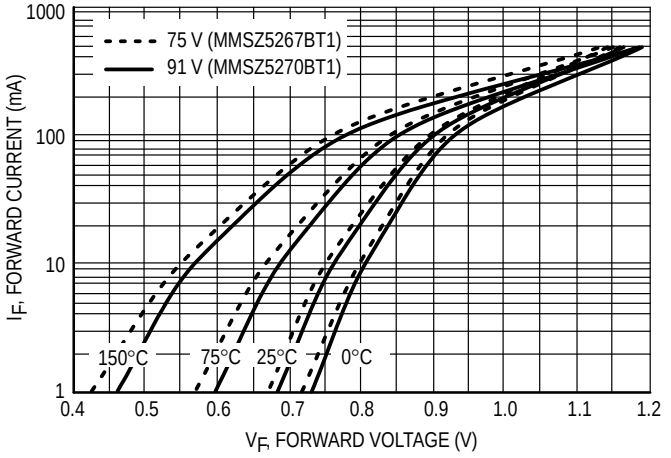


Figure 6. Typical Forward Voltage

TYPICAL CHARACTERISTICS

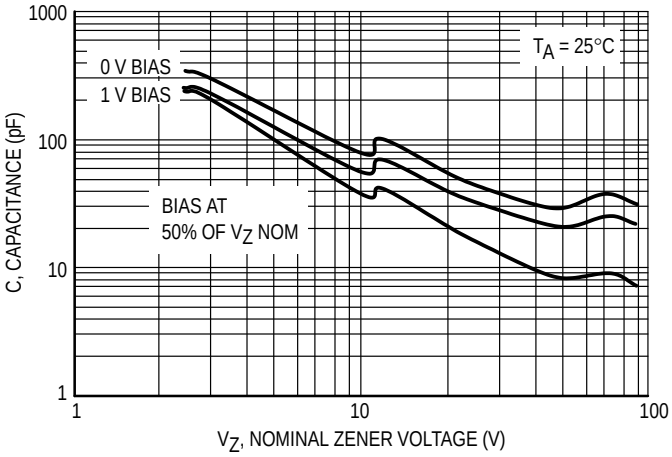


Figure 7. Typical Capacitance

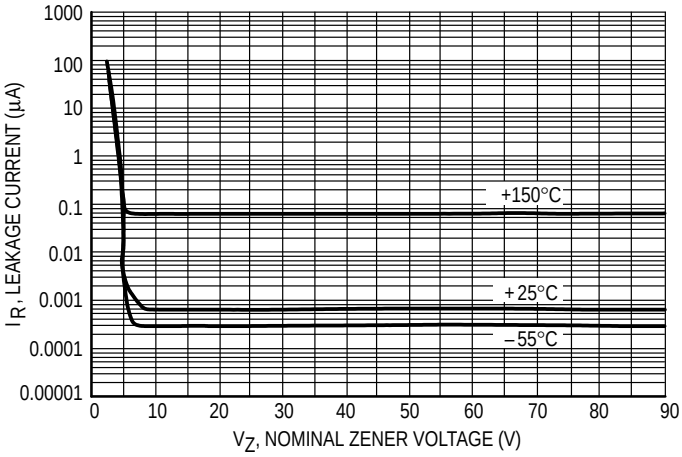


Figure 8. Typical Leakage Current

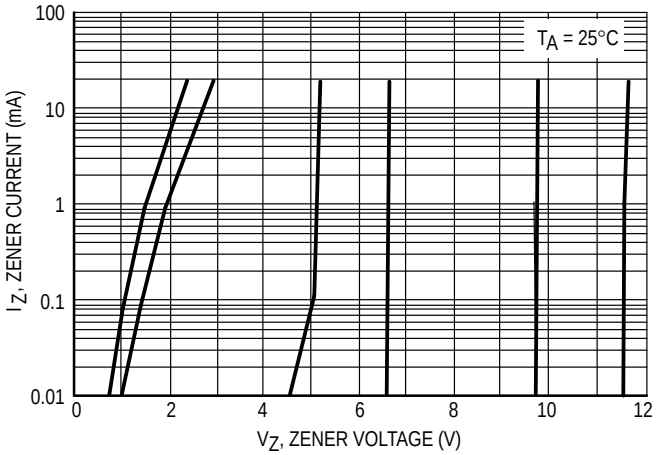


Figure 9. Zener Voltage versus Zener Current (V_Z Up to 12 V)

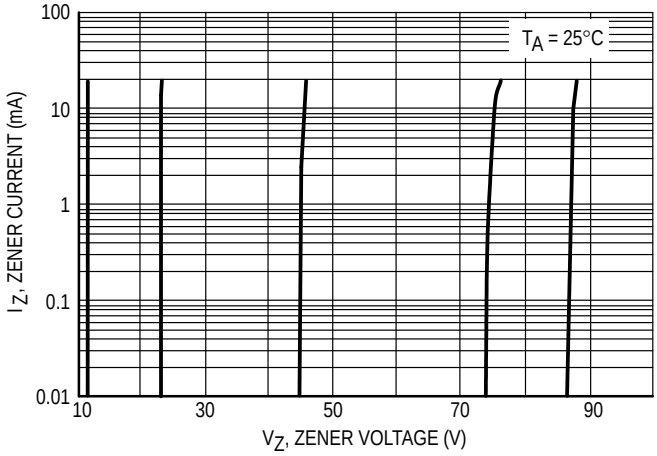


Figure 10. Zener Voltage versus Zener Current (12 V to 91 V)

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.

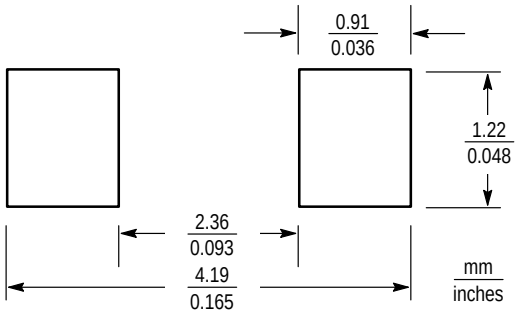


Figure 11. Minimum Recommended Footprint

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.

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

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

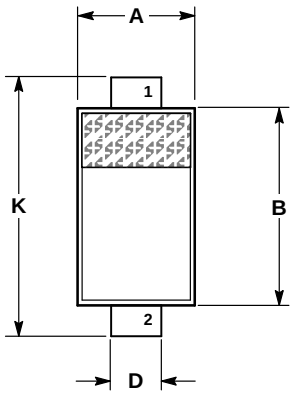
The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize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

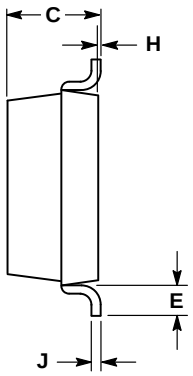
- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the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

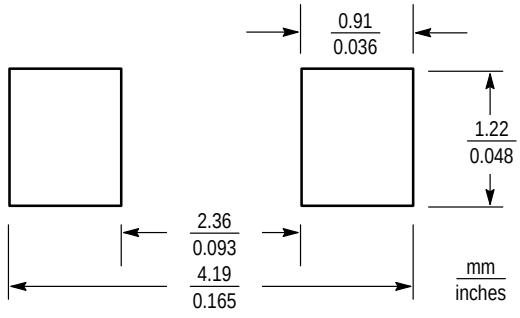
* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

Zener Voltage Regulator Diodes — Surface Mounted

500 mW SOD-123







SOD-123 Footprint

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 425-01 THRU -03 OBSOLETE, NEW STANDARD 425-04.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	1.40	1.80	0.055	0.071
B	2.55	2.85	0.100	0.112
C	0.95	1.35	0.037	0.053
D	0.50	0.70	0.020	0.028
E	0.25	—	0.010	—
H	0.00	0.10	0.000	0.004
J	—	0.15	—	0.006
K	3.55	3.85	0.140	0.152

STYLE 1:
PIN 1. CATHODE
2. ANODE

CASE 425
PLASTIC

(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.)