



## 1SMB2EZ6.8~1SMB2EZ100

### GLASS PASSIVATED JUNCTION SILICON ZENER DIODES

**VOLTAGE** 6.8 to 100 Volts **POWER** 2.0 Watts

**SMB/DO-214AA**

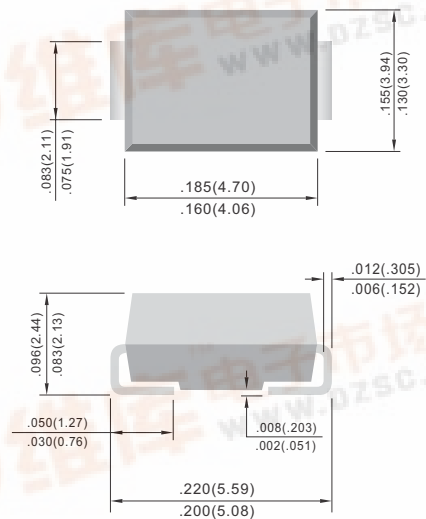
Unit: inch (mm)

#### FEATURES

- Low profile package
- Built-in strain relief
- Low inductance
- Typical  $I_D$  less than 1.0μA above 11V
- Plastic package has Underwriters Laboratory Flammability Classification 94V-O
- High temperature soldering : 260°C /10 seconds at terminals
- Pb free product are available : 99% Sn can meet RoHS environment substance directive request

#### MECHANICAL DATA

Case: JEDEC DO-214AA, Molded plastic over passivated junction  
Terminals: Solder plated, solderable per MIL-STD-750, Method 2026  
Polarity: Indicated by cathode band  
Standard packing: 12mm tape (E1A-481)  
Weight: 0.003 ounce, 0.093 gram



### MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified.

| Parameter                                                                                           | Symbol         | Value       | Units          |
|-----------------------------------------------------------------------------------------------------|----------------|-------------|----------------|
| Peak Pulse Power Dissipation on TA=50°C (Notes A)<br>Derate above 70°C                              | $P_D$          | 2.0<br>24.0 | Watts<br>mW/°C |
| Peak Forward Surge Current 8.3ms single half sine-wave<br>superimposed on rated load (JEDEC method) | $I_{FSM}$      | 15          | Amps           |
| Operating Junction and Storage Temperature Range                                                    | $T_J, T_{STG}$ | -55 to +150 | °C             |

#### NOTES:

A. Mounted on 5.0mm<sup>2</sup> (.013mm thick) land areas.

B. Measured on 8.3ms, and single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum



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| Part Number           | Nominal Zener Voltage            |        |        | Maximum Zener Impedance           |                 |                                   |                 | Max. Reverse Leakage Current    |       | Marking Code | Package |
|-----------------------|----------------------------------|--------|--------|-----------------------------------|-----------------|-----------------------------------|-----------------|---------------------------------|-------|--------------|---------|
|                       | V <sub>Z</sub> @ I <sub>ZT</sub> |        |        | Z <sub>ZT</sub> @ I <sub>ZT</sub> | I <sub>ZT</sub> | Z <sub>ZK</sub> @ I <sub>ZK</sub> | I <sub>ZK</sub> | I <sub>R</sub> @ V <sub>R</sub> |       |              |         |
|                       | Nom. V                           | Min. V | Max. V | Ohms                              | mA              | Ohms                              | mA              | μA                              | V     |              |         |
| 2.0 watt Zener Diodes |                                  |        |        |                                   |                 |                                   |                 |                                 |       |              |         |
| 1SMB2EZ6.8            | 6.8                              | 6.46   | 7.14   | 2                                 | 73.5            | 700                               | 1.00            | 5.00                            | 4.00  | 2006         | SMB     |
| 1SMB2EZ7.5            | 7.5                              | 7.13   | 7.88   | 2                                 | 66.5            | 700                               | 0.50            | 5.00                            | 5.00  | 2007         | SMB     |
| 1SMB2EZ8.2            | 8.2                              | 7.79   | 8.61   | 2                                 | 61.0            | 700                               | 0.50            | 5.00                            | 6.00  | 2008         | SMB     |
| 1SMB2EZ8.7            | 8.7                              | 8.27   | 9.14   | 2                                 | 58.0            | 700                               | 0.50            | 4.00                            | 6.60  | 20A8         | SMB     |
| 1SMB2EZ9.1            | 9.1                              | 8.65   | 9.56   | 3                                 | 55.0            | 700                               | 0.50            | 3.00                            | 7.00  | 2009         | SMB     |
| 1SMB2EZ10             | 10                               | 9.50   | 10.50  | 4                                 | 50.0            | 700                               | 0.25            | 3.00                            | 7.60  | 2010         | SMB     |
| 1SMB2EZ11             | 11                               | 10.45  | 11.55  | 4                                 | 45.5            | 700                               | 0.25            | 1.00                            | 8.40  | 2011         | SMB     |
| 1SMB2EZ12             | 12                               | 11.40  | 12.60  | 5                                 | 41.5            | 700                               | 0.25            | 1.00                            | 9.10  | 2012         | SMB     |
| 1SMB2EZ13             | 13                               | 12.35  | 13.65  | 5                                 | 38.5            | 700                               | 0.25            | 0.50                            | 9.90  | 2013         | SMB     |
| 1SMB2EZ14             | 14                               | 13.30  | 14.70  | 6                                 | 35.7            | 700                               | 0.25            | 0.50                            | 10.60 | 2014         | SMB     |
| 1SMB2EZ15             | 15                               | 14.25  | 15.75  | 7                                 | 33.4            | 700                               | 0.25            | 0.50                            | 11.40 | 2015         | SMB     |
| 1SMB2EZ16             | 16                               | 15.20  | 16.80  | 8                                 | 31.2            | 700                               | 0.25            | 0.50                            | 12.20 | 2016         | SMB     |
| 1SMB2EZ17             | 17                               | 16.15  | 17.85  | 9                                 | 29.4            | 750                               | 0.25            | 0.50                            | 13.00 | 2017         | SMB     |
| 1SMB2EZ18             | 18                               | 17.10  | 18.90  | 10                                | 27.8            | 750                               | 0.25            | 0.50                            | 13.70 | 2018         | SMB     |
| 1SMB2EZ19             | 19                               | 18.05  | 19.95  | 11                                | 26.3            | 750                               | 0.25            | 0.50                            | 14.40 | 2019         | SMB     |
| 1SMB2EZ20             | 20                               | 19.00  | 21.00  | 11                                | 25.0            | 750                               | 0.25            | 0.50                            | 15.20 | 2020         | SMB     |
| 1SMB2EZ22             | 22                               | 20.90  | 23.10  | 12                                | 22.8            | 750                               | 0.25            | 0.50                            | 16.70 | 2022         | SMB     |
| 1SMB2EZ24             | 24                               | 22.80  | 25.20  | 13                                | 20.8            | 750                               | 0.25            | 0.50                            | 18.20 | 2024         | SMB     |
| 1SMB2EZ25             | 25                               | 23.75  | 26.25  | 14                                | 20.0            | 750                               | 0.25            | 0.50                            | 19.00 | 2025         | SMB     |
| 1SMB2EZ27             | 27                               | 25.65  | 28.35  | 18                                | 18.5            | 750                               | 0.25            | 0.50                            | 20.60 | 2027         | SMB     |
| 1SMB2EZ28             | 28                               | 26.60  | 29.40  | 18                                | 17.0            | 750                               | 0.25            | 0.50                            | 21.30 | 2028         | SMB     |
| 1SMB2EZ30             | 30                               | 28.50  | 31.50  | 20                                | 16.6            | 1000                              | 0.25            | 0.50                            | 22.50 | 2030         | SMB     |
| 1SMB2EZ33             | 33                               | 31.35  | 34.65  | 23                                | 15.1            | 1000                              | 0.25            | 0.50                            | 25.10 | 2033         | SMB     |
| 1SMB2EZ36             | 36                               | 34.20  | 37.80  | 25                                | 13.9            | 1000                              | 0.25            | 0.50                            | 27.40 | 2036         | SMB     |
| 1SMB2EZ39             | 39                               | 37.05  | 40.95  | 30                                | 12.8            | 1000                              | 0.25            | 0.50                            | 29.70 | 2039         | SMB     |
| 1SMB2EZ43             | 43                               | 40.85  | 45.15  | 35                                | 11.6            | 1500                              | 0.25            | 0.50                            | 32.70 | 2043         | SMB     |
| 1SMB2EZ47             | 47                               | 44.65  | 49.35  | 40                                | 10.6            | 1500                              | 0.25            | 0.50                            | 35.80 | 2047         | SMB     |
| 1SMB2EZ51             | 51                               | 48.45  | 53.55  | 48                                | 9.8             | 1500                              | 0.25            | 0.50                            | 38.80 | 2051         | SMB     |
| 1SMB2EZ56             | 56                               | 53.20  | 58.80  | 55                                | 9.0             | 2000                              | 0.25            | 0.50                            | 42.60 | 2056         | SMB     |
| 1SMB2EZ60             | 60                               | 57.00  | 63.00  | 58                                | 8.5             | 2000                              | 0.25            | 0.50                            | 45.60 | 2060         | SMB     |
| 1SMB2EZ62             | 62                               | 58.90  | 65.10  | 60                                | 8.1             | 2000                              | 0.25            | 0.50                            | 47.10 | 2062         | SMB     |
| 1SMB2EZ68             | 68                               | 64.60  | 71.40  | 75                                | 7.4             | 2000                              | 0.25            | 0.50                            | 51.70 | 2068         | SMB     |
| 1SMB2EZ75             | 75                               | 71.25  | 78.75  | 90                                | 6.7             | 2000                              | 0.25            | 0.50                            | 56.00 | 2075         | SMB     |
| 1SMB2EZ82             | 82                               | 77.90  | 86.10  | 100                               | 6.1             | 3000                              | 0.25            | 0.50                            | 62.20 | 2082         | SMB     |
| 1SMB2EZ87             | 87                               | 82.65  | 91.35  | 120                               | 5.8             | 3000                              | 0.25            | 0.50                            | 66.10 | 2087         | SMB     |
| 1SMB2EZ91             | 91                               | 86.45  | 95.55  | 125                               | 5.5             | 3000                              | 0.25            | 0.50                            | 69.20 | 2091         | SMB     |
| 1SMB2EZ100            | 100                              | 95.00  | 105.00 | 175                               | 5.0             | 3000                              | 0.25            | 0.50                            | 76.00 | 2100         | SMB     |

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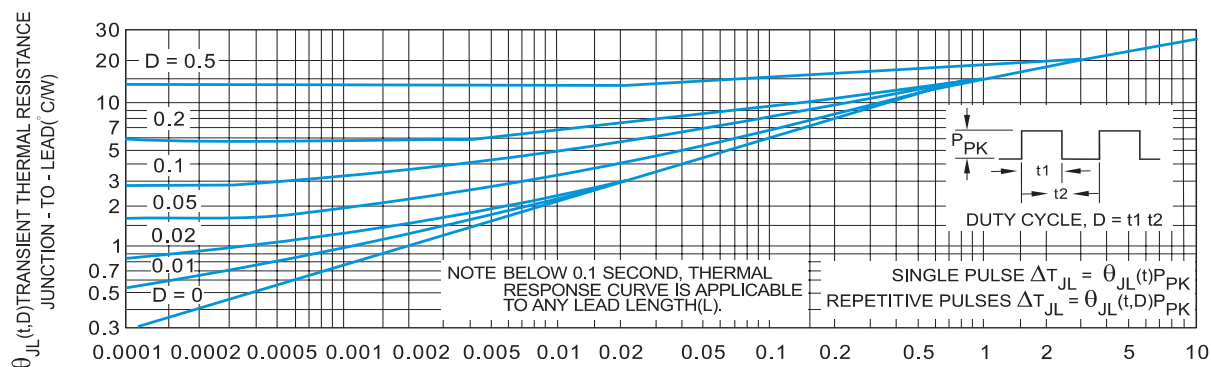


FIGURE 1. TYPICAL THERMAL RESPONSE L,

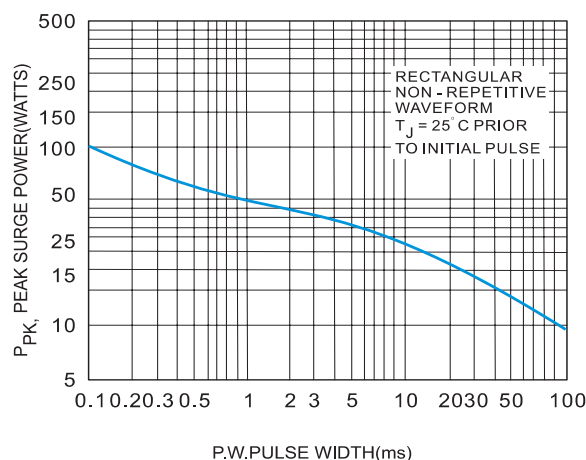


FIGURE 2. MAXIMUM SURGE POWER

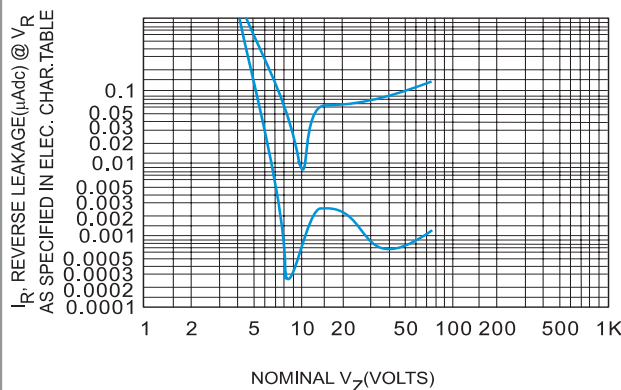


FIGURE 3. TYPICAL REVERSE LEAKAGE

### APPLICATION NOTE:

Since the actual voltage available from a given zener diode is temperature dependent, it is necessary to determine junction temperature under any set of operating conditions in order to calculate its value. The following procedure is recommended:

Lead Temperature,  $T_L$ , should be determined from:

$$T_L = \theta_{LA} P_D + T_A$$

$\theta_{LA}$  is the lead-to-ambient thermal resistance ( $^\circ\text{C}/\text{W}$ ) and  $P_D$  is the power dissipation. The value for  $\theta_{LA}$  will vary and depends on the device mounting method.  $\theta_{LA}$  is generally 30-40  $^\circ\text{C}/\text{W}$  for the various clips and tie points in common use and for printed circuit board wiring.

The temperature of the lead can also be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of  $T_L$ , the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}$$

$\Delta T_{JL}$  is the increase in junction temperature above the lead temperature and may be found from Figure 2 for a train of power pulses or from Figure 10 for dc power.

$$\Delta T_{JL} = \theta_{JL} P_D$$

For worst-case design, using expected limits of  $I_Z$ , limits of  $P_D$  and the extremes of  $T_J$  ( $\Delta T_J$ ) may be estimated. Changes in voltage,  $V_Z$ , can then be found from:

$$\Delta V = \theta_{VZ} \Delta T_J$$

$\theta_{VZ}$ , the zener voltage temperature coefficient, is found from Figures 5 and 6.

Under high power-pulse operation, the zener voltage will vary with time and may also be affected significantly by the zener resistance. For best regulation, keep current excursions as low as possible.

Data of Figure 2 should not be used to compute surge capability. Surge limitations are given in Figure 3. They are lower than would be expected by considering only junction temperature, as current crowding effects cause temperatures to be extremely high in small spots resulting in device degradation should the limits of Figure 3 be exceeded.

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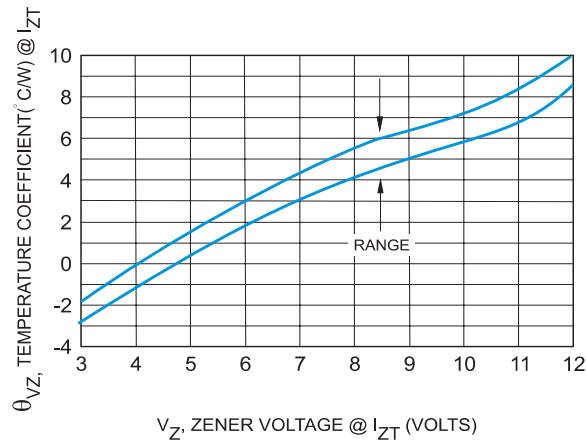


FIGURE 4 . UNITS TO 12 VOLTS

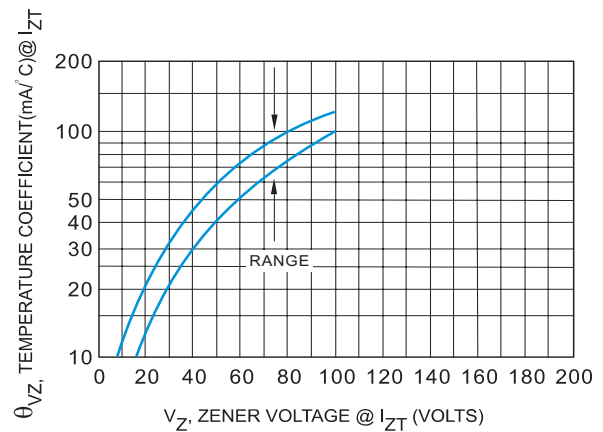


FIGURE 5 . UNIT 10 TO 200 VOLTS

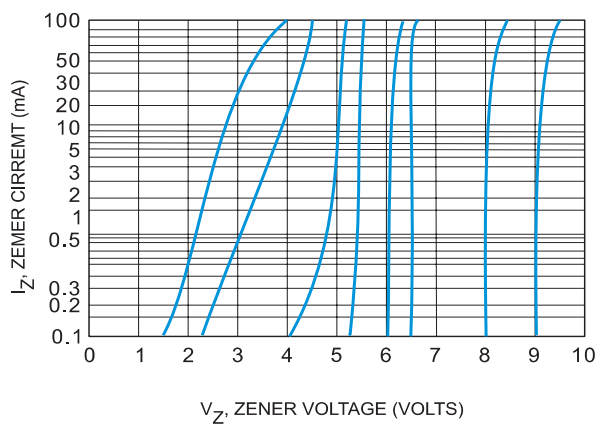


FIGURE 6.  $V_Z = 3.9$  THRU 10 VOLTS

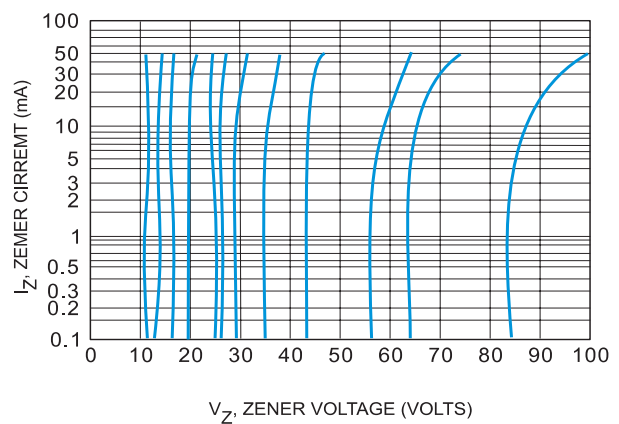


FIGURE 7.  $V_Z = 12$  THRU 82 VOLTS

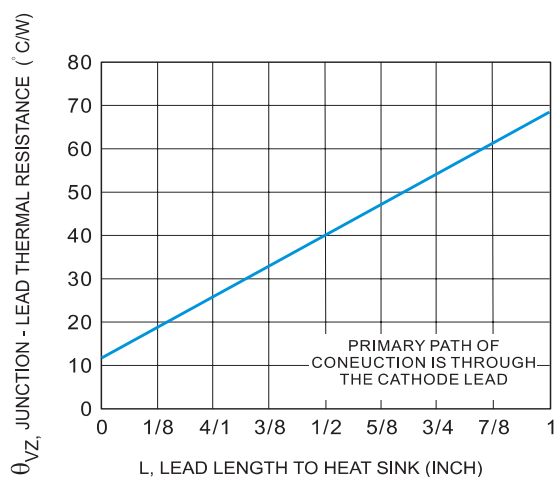


FIGURE 8 . TYPICAL THERMAL RESISTANCE