

## Features

- Zener Voltage From 5.1V to 200V
- Halogen Free Available Upon Request By Adding Suffix "-HF"
- Moisture Sensitivity Level 1
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant (Note1)("P" Suffix Designates Compliant. See Ordering Information)

## Maximum Ratings

- Operating Junction Temperature Range(Note2): -55°C to +200°C
- Storage Temperature Range: -55°C to +200°C
- Maximum Thermal Resistance: 15°C/W from Junction to Lead
- Maximum Thermal Resistance: 83°C/W from Junction to Ambient

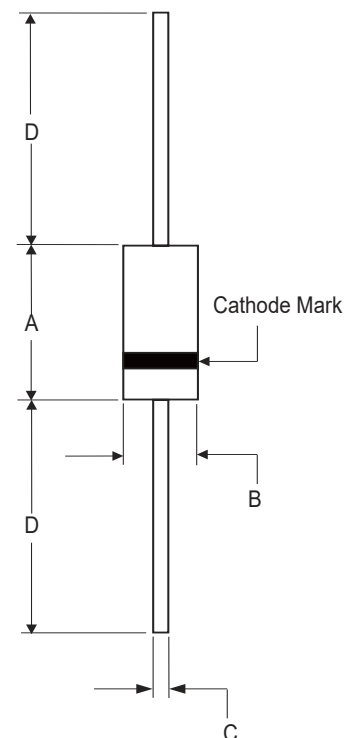
| Parameter               | Symbol         | Rating  | Conditions           |
|-------------------------|----------------|---------|----------------------|
| Power Dissipation       | P <sub>D</sub> | 5.0W    | T <sub>L</sub> =75°C |
| Power Derating          |                | 67mW/°C | Above 75°C           |
| Maximum Forward Voltage | V <sub>F</sub> | 1.2V    | I <sub>F</sub> =1.0A |

Note:

1. High Temperature Solder Exemption Applied, See EU Directive Annex 7a.
2. Max Operating Temperature for DC Conditions is 150°C, But not to Exceed 200°C for Pulsed Conditions With Low Duty Cycle or Non-Repetitive.

# 5 Watt Zener Diode 5.1 to 200 Volts

## DO-15



### DIMENSIONS

| DIM | INCHES |       | MM    |       | NOTE |
|-----|--------|-------|-------|-------|------|
|     | MIN    | MAX   | MIN   | MAX   |      |
| A   | 0.230  | 0.300 | 5.80  | 7.60  |      |
| B   | 0.104  | 0.140 | 2.60  | 3.60  |      |
| C   | 0.026  | 0.035 | 0.70  | 0.90  |      |
| D   | 1.000  | ----- | 25.40 | ----- |      |

**Electrical Characteristics @ 25°C Unless Otherwise Specified**

| MCC Part Number | Regulator Voltage | Test Current | Maximum Dynamic Impedance | Maximum Reverse Current | Test Voltage | Maximum Regulator Current | Maximum Dynamic Knee Impedance | Maximum Surge Current | Maximum Voltage Regulation | MARKING CODE |
|-----------------|-------------------|--------------|---------------------------|-------------------------|--------------|---------------------------|--------------------------------|-----------------------|----------------------------|--------------|
|                 | $V_Z$             | $I_Z$        | $Z_{ZT}$                  | $I_R$                   | $V_R$        | $I_{ZM}$                  | $Z_{ZK} @ 1.0mA$               | $I_{ZSM}$             |                            |              |
|                 | V                 | mA           | $\Omega$                  | $\mu A$                 | V            | mA                        | $\Omega$                       | A                     | V                          |              |
| 1N5338B         | 5.1               | 240          | 1.5                       | 1                       | 1            | 930                       | 400                            | 14.4                  | 0.39                       | 1N5338B      |
| 1N5339B         | 5.6               | 220          | 1                         | 1                       | 2            | 865                       | 400                            | 13.4                  | 0.25                       | 1N5339B      |
| 1N5340B         | 6                 | 200          | 1                         | 1                       | 3            | 790                       | 300                            | 12.7                  | 0.19                       | 1N5340B      |
| 1N5341B         | 6.2               | 200          | 1                         | 1                       | 3            | 765                       | 200                            | 12.4                  | 0.1                        | 1N5341B      |
| 1N5342B         | 6.8               | 175          | 1                         | 10                      | 5.2          | 700                       | 200                            | 11.5                  | 0.15                       | 1N5342B      |
| 1N5343B         | 7.5               | 175          | 1.5                       | 10                      | 5.7          | 630                       | 200                            | 10.7                  | 0.15                       | 1N5343B      |
| 1N5344B         | 8.2               | 150          | 1.5                       | 10                      | 6.2          | 580                       | 200                            | 10                    | 0.2                        | 1N5344B      |
| 1N5345B         | 8.7               | 150          | 2                         | 10                      | 6.6          | 545                       | 200                            | 9.5                   | 0.2                        | 1N5345B      |
| 1N5346B         | 9.1               | 150          | 2                         | 7.5                     | 6.9          | 520                       | 150                            | 9.2                   | 0.22                       | 1N5346B      |
| 1N5347B         | 10                | 125          | 2                         | 5                       | 7.6          | 475                       | 125                            | 8.6                   | 0.22                       | 1N5347B      |
| 1N5348B         | 11                | 125          | 2.5                       | 5                       | 8.4          | 430                       | 125                            | 8                     | 0.25                       | 1N5348B      |
| 1N5349B         | 12                | 100          | 2.5                       | 2                       | 9.1          | 395                       | 125                            | 7.5                   | 0.25                       | 1N5349B      |
| 1N5350B         | 13                | 100          | 2.5                       | 1                       | 9.9          | 365                       | 100                            | 7                     | 0.25                       | 1N5350B      |
| 1N5351B         | 14                | 100          | 2.5                       | 1                       | 10.6         | 340                       | 75                             | 6.7                   | 0.25                       | 1N5351B      |
| 1N5352B         | 15                | 75           | 2.5                       | 1                       | 11.5         | 315                       | 75                             | 6.3                   | 0.25                       | 1N5352B      |
| 1N5353B         | 16                | 75           | 2.5                       | 1                       | 12.2         | 295                       | 75                             | 6                     | 0.3                        | 1N5353B      |
| 1N5354B         | 17                | 70           | 2.5                       | 0.5                     | 12.9         | 280                       | 75                             | 5.8                   | 0.35                       | 1N5354B      |
| 1N5355B         | 18                | 65           | 2.5                       | 0.5                     | 13.7         | 264                       | 75                             | 5.5                   | 0.4                        | 1N5355B      |
| 1N5356B         | 19                | 65           | 3                         | 0.5                     | 14.4         | 250                       | 75                             | 5.3                   | 0.4                        | 1N5356B      |
| 1N5357B         | 20                | 65           | 3                         | 0.5                     | 15.2         | 237                       | 75                             | 5.1                   | 0.4                        | 1N5357B      |
| 1N5358B         | 22                | 50           | 3.5                       | 0.5                     | 16.7         | 216                       | 75                             | 4.7                   | 0.45                       | 1N5358B      |
| 1N5359B         | 24                | 50           | 3.5                       | 0.5                     | 18.2         | 198                       | 100                            | 4.4                   | 0.55                       | 1N5359B      |
| 1N5360B         | 25                | 50           | 4                         | 0.5                     | 19           | 190                       | 110                            | 4.3                   | 0.55                       | 1N5360B      |
| 1N5361B         | 27                | 50           | 5                         | 0.5                     | 20.6         | 176                       | 120                            | 4.1                   | 0.6                        | 1N5361B      |
| 1N5362B         | 28                | 50           | 6                         | 0.5                     | 21.2         | 170                       | 130                            | 3.9                   | 0.6                        | 1N5362B      |
| 1N5363B         | 30                | 40           | 8                         | 0.5                     | 22.8         | 158                       | 140                            | 3.7                   | 0.6                        | 1N5363B      |
| 1N5364B         | 33                | 40           | 10                        | 0.5                     | 25.1         | 144                       | 150                            | 3.5                   | 0.6                        | 1N5364B      |
| 1N5365B         | 36                | 30           | 11                        | 0.5                     | 27.4         | 132                       | 160                            | 3.3                   | 0.65                       | 1N5365B      |
| 1N5366B         | 39                | 30           | 14                        | 0.5                     | 29.7         | 122                       | 170                            | 3.1                   | 0.65                       | 1N5366B      |
| 1N5367B         | 43                | 30           | 20                        | 0.5                     | 32.7         | 110                       | 190                            | 2.8                   | 0.7                        | 1N5367B      |
| 1N5368B         | 47                | 25           | 25                        | 0.5                     | 35.8         | 100                       | 210                            | 2.7                   | 0.8                        | 1N5368B      |
| 1N5369B         | 51                | 25           | 27                        | 0.5                     | 38.8         | 93                        | 230                            | 2.5                   | 0.9                        | 1N5369B      |
| 1N5370B         | 56                | 20           | 35                        | 0.5                     | 42.6         | 86                        | 280                            | 2.3                   | 1                          | 1N5370B      |
| 1N5371B         | 60                | 20           | 40                        | 0.5                     | 45.5         | 79                        | 350                            | 2.2                   | 1.2                        | 1N5371B      |
| 1N5372B         | 62                | 20           | 42                        | 0.5                     | 47.1         | 76                        | 400                            | 2.1                   | 1.35                       | 1N5372B      |
| 1N5373B         | 68                | 20           | 44                        | 0.5                     | 51.7         | 70                        | 500                            | 2                     | 1.5                        | 1N5373B      |
| 1N5374B         | 75                | 20           | 45                        | 0.5                     | 56           | 63                        | 620                            | 1.9                   | 1.6                        | 1N5374B      |
| 1N5375B         | 82                | 15           | 65                        | 0.5                     | 62.2         | 58                        | 720                            | 1.8                   | 1.8                        | 1N5375B      |
| 1N5376B         | 87                | 15           | 75                        | 0.5                     | 66           | 54.5                      | 760                            | 1.7                   | 2                          | 1N5376B      |
| 1N5377B         | 91                | 15           | 75                        | 0.5                     | 69.2         | 52.5                      | 760                            | 1.6                   | 2.2                        | 1N5377B      |
| 1N5378B         | 100               | 12           | 90                        | 0.5                     | 76           | 47.5                      | 800                            | 1.5                   | 2.3                        | 1N5378B      |
| 1N5379B         | 110               | 12           | 125                       | 0.5                     | 83.6         | 43                        | 1000                           | 1.4                   | 2.5                        | 1N5379B      |
| 1N5380B         | 120               | 10           | 170                       | 0.5                     | 91.2         | 39.5                      | 1150                           | 1.3                   | 2.5                        | 1N5380B      |
| 1N5381B         | 130               | 10           | 190                       | 0.5                     | 98.8         | 36.6                      | 1250                           | 1.2                   | 2.5                        | 1N5381B      |
| 1N5382B         | 140               | 8            | 230                       | 0.5                     | 106          | 34                        | 1500                           | 1.2                   | 2.5                        | 1N5382B      |
| 1N5383B         | 150               | 8            | 330                       | 0.5                     | 114          | 31.6                      | 1500                           | 1.1                   | 3                          | 1N5383B      |
| 1N5384B         | 160               | 8            | 350                       | 0.5                     | 122          | 29.4                      | 1650                           | 1.1                   | 3                          | 1N5384B      |
| 1N5385B         | 170               | 8            | 380                       | 0.5                     | 129          | 28                        | 1750                           | 1                     | 3                          | 1N5385B      |
| 1N5386B         | 180               | 5            | 430                       | 0.5                     | 137          | 26.4                      | 1750                           | 1                     | 4                          | 1N5386B      |
| 1N5387B         | 190               | 5            | 450                       | 0.5                     | 144          | 25                        | 1850                           | 0.9                   | 5                          | 1N5387B      |
| 1N5388B         | 200               | 5            | 480                       | 0.5                     | 152          | 23.6                      | 1850                           | 0.9                   | 5                          | 1N5388B      |

**Remarks:**

1. TOLERANCE AND VOLTAGE DESIGNATION - The JEDEC type numbers shown indicate a tolerance of +/-10% with guaranteed limits on only  $V_Z$ ,  $I_R$ ,  $I_r$ , and  $V_F$  as shown in the electrical characteristics table. Units with guaranteed limits on all seven parameters are indicated by suffix "B" for +/-5% tolerance.
2. ZENER VOLTAGE ( $V_Z$ ) AND IMPEDANCE ( $Z_{ZT}$  &  $Z_{ZK}$ ) - Test conditions for Zener voltage and impedance are as follows;  $I_Z$  is applied 40+/-10 ms prior to reading. Mounting contacts are located from the inside edge of mounting clips to the body of the diode ( $T_A=25^\circ\text{C}$ )
3. SURGE CURRENT ( $I_r$ ) - Surge current is specified as the maximum allowable peak, non-recurrent square-wave current with a pulse width, PW, of 8.3 ms. The data given in Figure 5 may be used to find the maximum surge current for a square wave of any pulse width between 1 ms and 1000ms by plotting the applicable points on logarithmic paper. Examples of this, using the 6.8v, is shown in Figure 6. Mounting contact located as specified in Note 3. ( $T_A=25^\circ\text{C}$ ).
4. VOLTAGE REGULATION ( $V_Z$ ) - Test conditions for voltage regulation are as follows:  $V_Z$  measurements are made at 10% and then at 50% of the  $I_Z$  max value listed in the electrical characteristics table. The test currents are the same for the 5% and 10% tolerance devices. The test current time duration for each  $V_Z$  measurement is 40+/- 10 ms. ( $T_A=25^\circ\text{C}$ ). Mounting contact located as specified in Note 2.
5. MAXIMUM REGULATOR CURRENT ( $I_{ZM}$ ) - The maximum current shown is based on the maximum voltage of a 5% type unit. Therefore, it applies only to the B-suffix device. The actual  $I_{ZM}$  for any device may not exceed the value of 5 watts divided by the actual  $V_Z$  of the device.  $T_L=75^\circ\text{C}$  at maximum from the device body.

**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 and  $P_D$  is the power dissipation.

Junction Temperature,  $T_J$ , may be found from:

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

$\Delta T_{JL}$  is the increase in junction temperature above the lead temperature and may be found from Figure 7 for a train of power pulses or from Figure 1 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,

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 7 should not be used to compute surge capability. Surge limitations are given in Figure 5. 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 5 be exceeded.

**Curve Characteristics**

Fig. 1 - Power Derating Curve

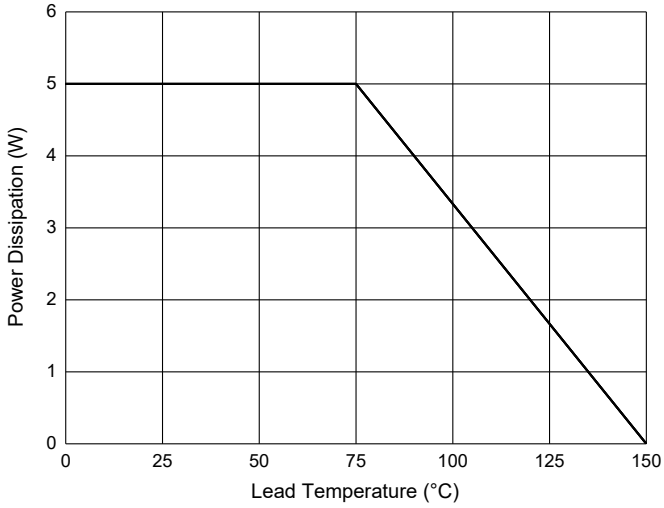


Fig. 2 - Typical Zener Breakdown Characteristics

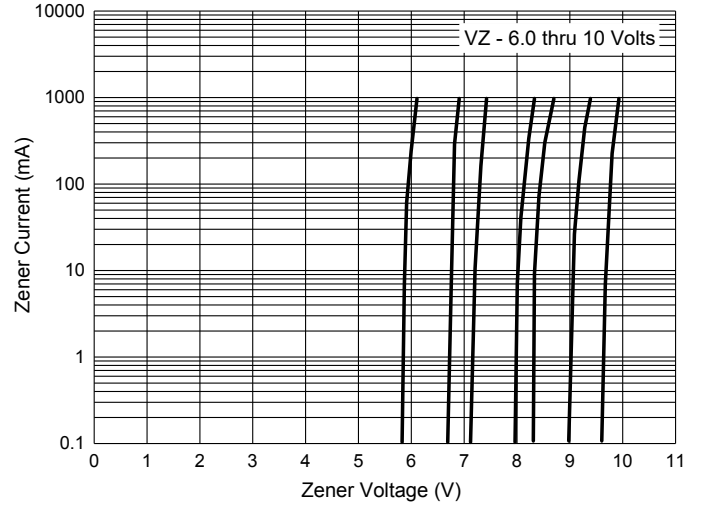


Fig. 3 - Typical Zener Breakdown Characteristics

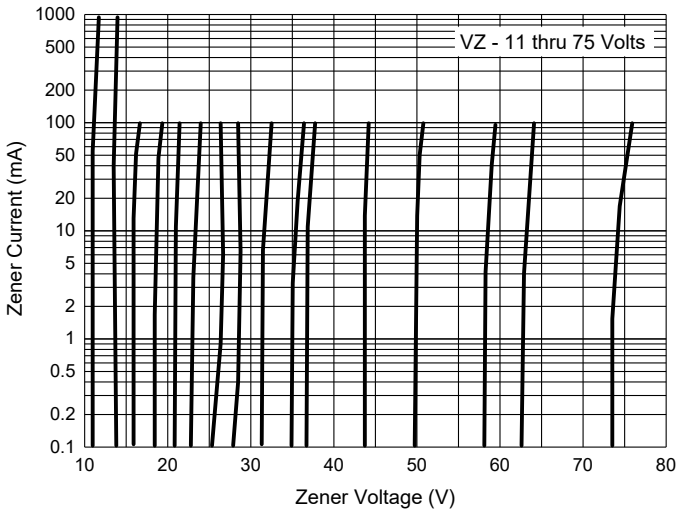


Fig. 4 - Typical Zener Breakdown Characteristics

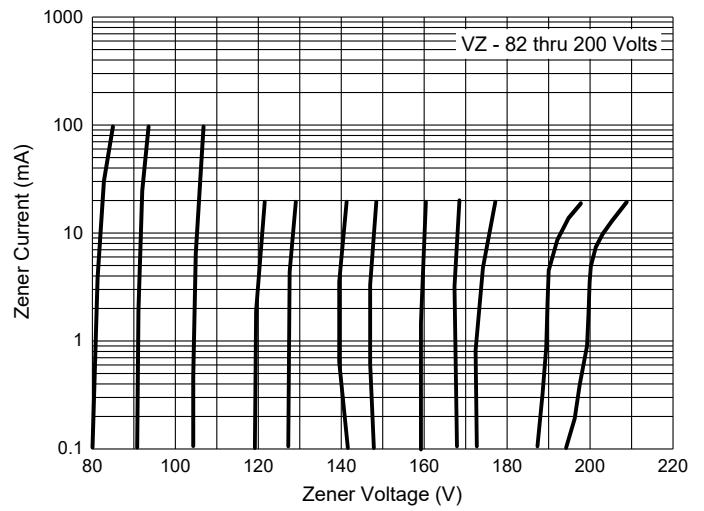


Fig. 5 - Surge Current Characteristics

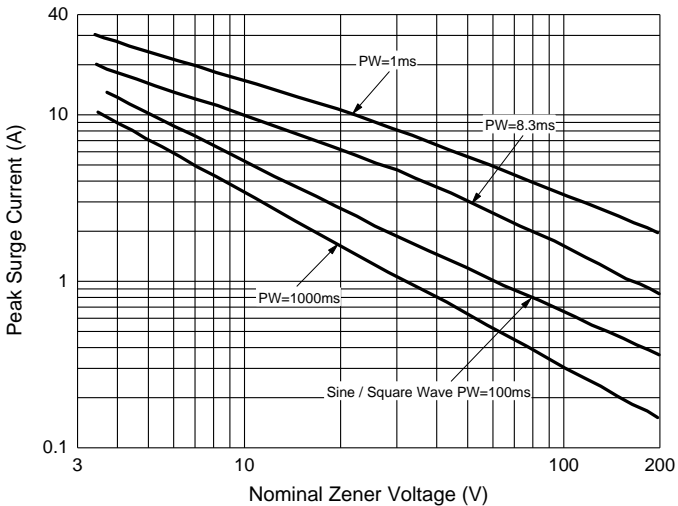
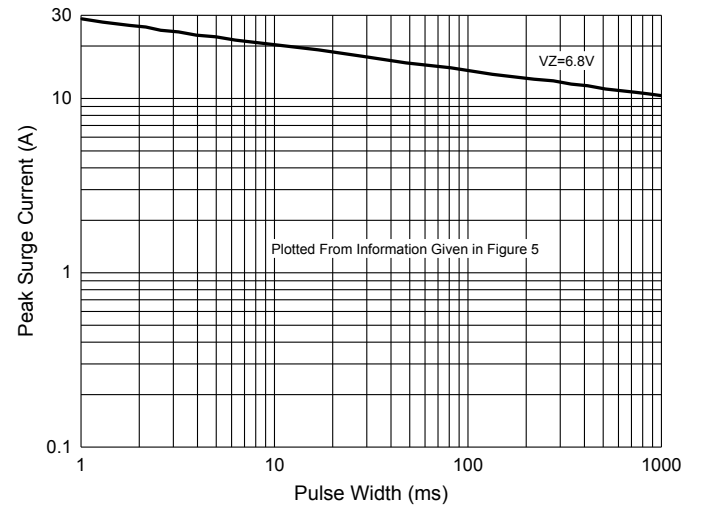
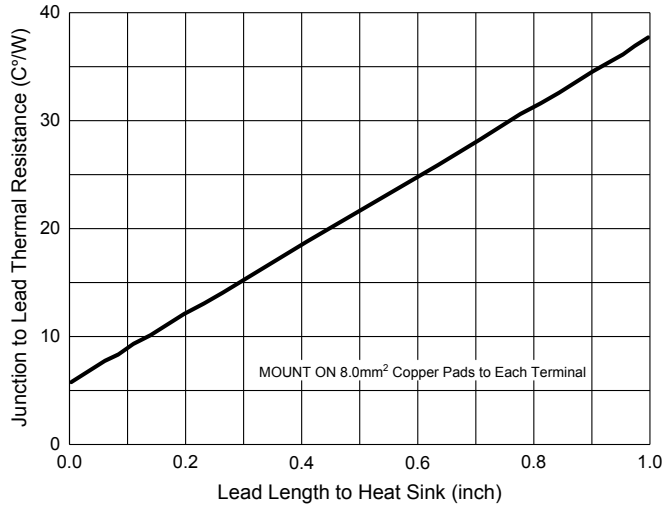


Fig. 6 - Peak Surge Current VS Pulse Width



## Curve Characteristics

Fig. 7 - Typical Thermal Resistance



## Ordering Information

| Device           | Packing                      |
|------------------|------------------------------|
| (Part Number)-TP | Tape&Reel: 4Kpcs/Reel        |
| (Part Number)-AP | Ammo Packing: 3Kpcs/Ammo Box |
| (Part Number)-BP | Bulk: 25Kpcs/Carton          |

Note : Adding "-HF" Suffix For Halogen Free, eg. Part Number-TP-HF

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