Major Zener diode specifications

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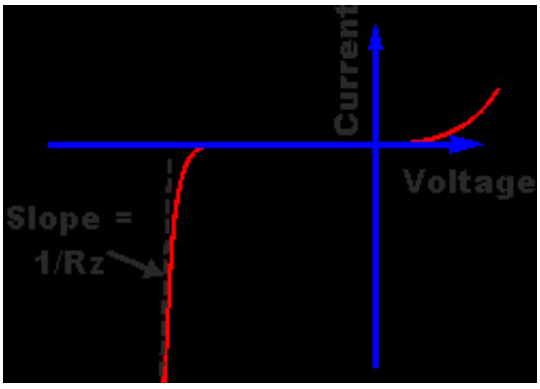
Categories : Basic Electronics

When looking at the specification sheet for a Zener diode there are several parameters that will be included. Each details a different element of its performance and is required to ensure it operates correctly within any circuit.

- ***Voltage Vz:*** The Zener voltage or reverse voltage specification of the diode is often designated by the letters Vz. Voltages are available over a wide range of values, often following the E24 ranges, although not all diodes are bound by this convention.

  Values generally start at around 2.4 V although not all ranges extend as low as this. Values below this are not available. Ranges may extend top anywhere in the region of 47 V to 200 V, dependent upon the actual Zener diode range. Maximum voltages for SMD variants are often around 47 V.
- ***Current :*** The current, IZM, of a Zener diode is the maximum current that can flow through a Zener diode at its rated voltage, VZ.

  Typically there is also a minimum current required for the operation of the diode. As a rough rule of thumb, this can be around 5 to 10 mA for a typical leaded 400 mW device. Below this current level, the diode does not break down adequately to maintain its stated voltage.
- ***Zener resistance Rz:*** The IV characteristic of the Zener diode is not completely vertical in the breakdown region. This means that for slight changes in current, there will be a small change in the voltage across the diode. The voltage change for a given change in current is the resistance of the diode. This value of resistance, often termed the resistance is designated Rz.



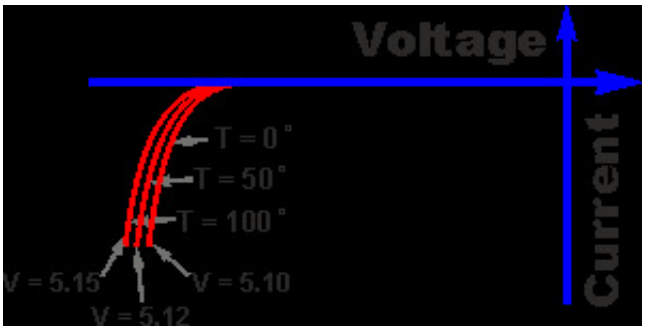
Zener diode resistance

The inverse of the slope shown is referred to as the dynamic resistance of the diode, and this parameter is often noted in the manufacturers' datasheets. Typically the slope does not vary much for different current levels, provided they are between about 0.1 and 1 times the rated current Izt.

- ***Power rating:*** All Zener diodes have a power rating that should not be exceeded. This defines the maximum power that can be dissipated by the package, and it is the product of the voltage across the diode multiplied by the current flowing through it.

  For example many small leaded devices have a dissipation of 400mW at 20°C, but larger varieties are available with much higher dissipation levels. Surface mount varieties are also available, but generally have lower dissipation levels in view of the package size and their ability for heat removal.

  Common power ratings for leaded devices include 400mW (most common), 500 mW, 1W, 5W. Values for surface mount devices may be around 200, 350, 500 mW with occasional devices extending up to 1 W.
- ***Voltage tolerance:*** With diodes being marked and sorted to meet the E12 or E24 value ranges, typical tolerance specifications for the diode are ±5%. Some datasheets may specify the voltage as a typical voltage and then provide a maximum and minimum.
- ***Temperature stability:*** For many applications, the temperature stability of the Zener diode is important. It is well known that the voltage of the diode varies according to temperature. In fact the two mechanisms that are used to provide breakdown within these diodes have opposite temperature coefficients, and one effect dominates below about 5 Volts and the other above. Accordingly diodes with voltages around 5 V tend to provide the best temperature stability.



Zener diode temperature characteristic

- ***Junction temperature:*** In order to ensure the reliability of the diode, the temperature of the diode junction is key. Even though the case may be sufficiently cool, the active area can still be very much hotter. As a result, some manufacturers specify the operating range for the junction itself. For normal design, a suitable margin is normally retained between the

maximum expected temperature within the equipment and the junction. The equipment internal temperature will again be higher than the temperature external to the equipment. Carer must be taken to ensure that individual items do not become too hot despite the ambient temperature outside the equipment.

- ***Package:*** Zener diodes are specified in a variety of different packages. The main choice is between surface mount and traditional leaded devices. However the package chosen will often define the package heat dissipation level.