

1.7 ZENER DIODE

A Zener diode is a type of diode that permits current not only in the forward direction like a normal diode, but also in the reverse direction if the voltage is larger than the breakdown voltage known as "Zener knee voltage" or "Zener voltage". The device was named after Clarence Zener, who discovered this electrical property.

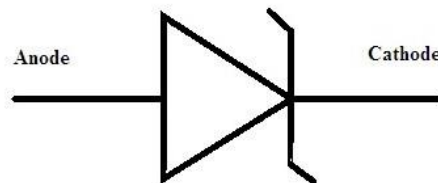


Figure: 1.7.1 Zener Diode Symbol

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 136]

- However, the Zener Diode or "Breakdown Diode" as they are sometimes called, are basically the same as the standard PN junction diode but are specially designed to have a low pre- determined Reverse Breakdown Voltage that takes advantage of this high reverse voltage.
- The point at which a zener diode breaks down or conducts is called the "Zener Voltage" (V_z).The Zener diode is like a general-purpose signal diode consisting of a silicon PN junction.
- When biased in the forward direction it behaves just like a normal signal diode passing the rated current, but when a reverse voltage is applied to it the reverse saturation Current remains fairly constant over a wide range of voltages.
- The reverse voltage increases until the diodes breakdown voltage V_B is reached at Which point a process called Avalanche Breakdown occurs in the depletion layer and the current flowing through the zener diode increases dramatically to the maximum circuit value (which is usually limited by a series resistor).
- This breakdown voltage point is called the "zener voltage" for zener diodes.

Avalanche Breakdown: There is a limit for the reverse voltage. Reverse voltage can increase until the diode breakdown voltage reaches. This point is called Avalanche Break down region. At this stage maximum current will flow through the zener diode. This breakdown point is referred as -Zener voltage.

The point at which current flows can be very accurately controlled (to less than 1% tolerance) in the doping stage of the diodes construction giving the diode a specific zener breakdown voltage, (V_Z) ranging from a few volts up to a few hundred volts. This zener breakdown voltage on the I-V curve is almost a vertical straight line.

Zener diode characteristics

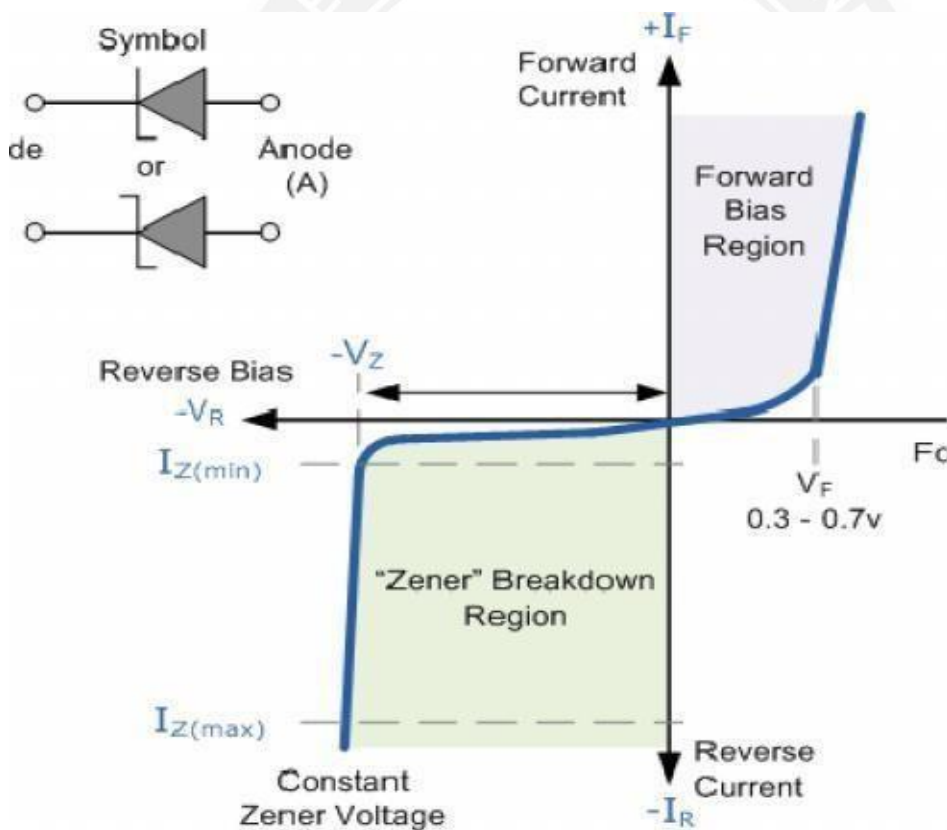


Figure: 1.7.2 Zener diode V I Characteristics

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 137]