

Electronic Devices

Lecture 10 **Types of Diodes**

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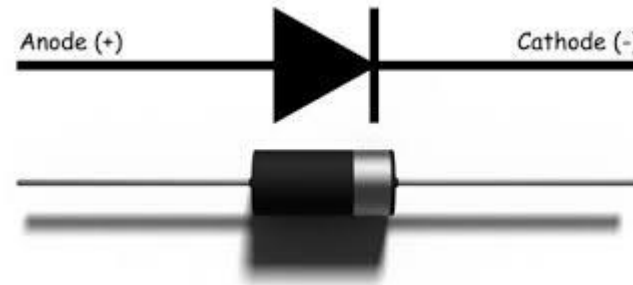
Types of Diodes and Their uses

1- PN Junction Diode:

It is used to allow current to flow in one direction, while blocking current flow in the opposite direction.

Applications:

Rectifier- Clipper- Clamper

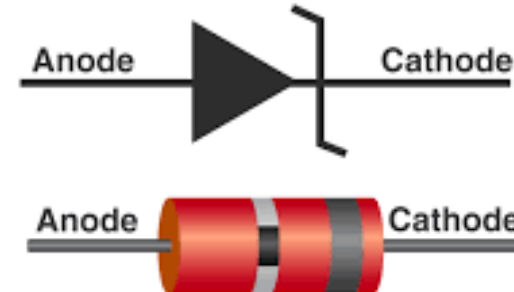


2- Zener Diode:

It is a special type of diode designed to reliably allow current to flow "backwards" when a certain set reverse voltage, known as the *Zener voltage*, is reached.

Applications:

Regulator



3- Light Emitting Diode “LED”:

The theory in LED is simple, we have 2 sides: n-side “ having free electrons” and p-side “ having free holes”, the orbit of a free electron is larger than orbit of a hole.

A free electron is at higher energy level than a hole, because of this after free electrons cross the junction they radiate energy when they fall into holes, this energy comes off as heat and light.

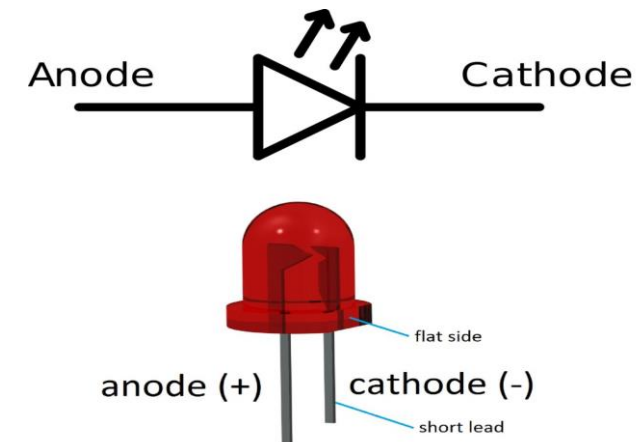
Material:

Materials used in fabrication must to be semitransparent material, Si & Ge are opaque so, none of light escapes.

GaAs “ Gallium Arsenide” → Infrared radiation (invisible)

GaAsP “ Gallium- Arsenide-Phosphide” → Red or yellow light

GaP “ Gallium Phosphide” → Red or green light



Advantages of LED:

- 1- Long life (more than 20 years)
- 2- low voltage (1 : 2 V)
- 3- Fast on-off switching (nanoseconds)

Applications:

- Seven Segments
- Low thickness T.V

4- Photodiode

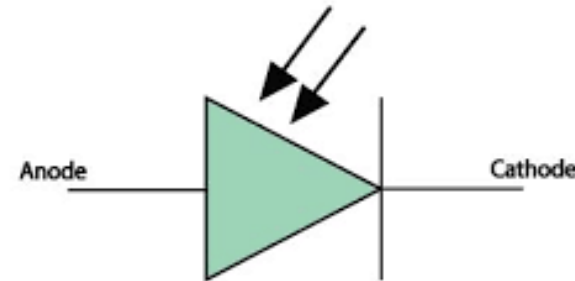
While LEDs emit light, photodiodes are sensitive to received light. They are constructed so, their P-N junction can be exposed to the outside through a clear window or lens.

A photodiode is optimized for its sensitivity to light. In this diode, glass window lets photons pass, the incoming photons create free electrons and holes which is the no. of minority carrier because the reverse bias is the normal way to operate a photodiode.

Applications:

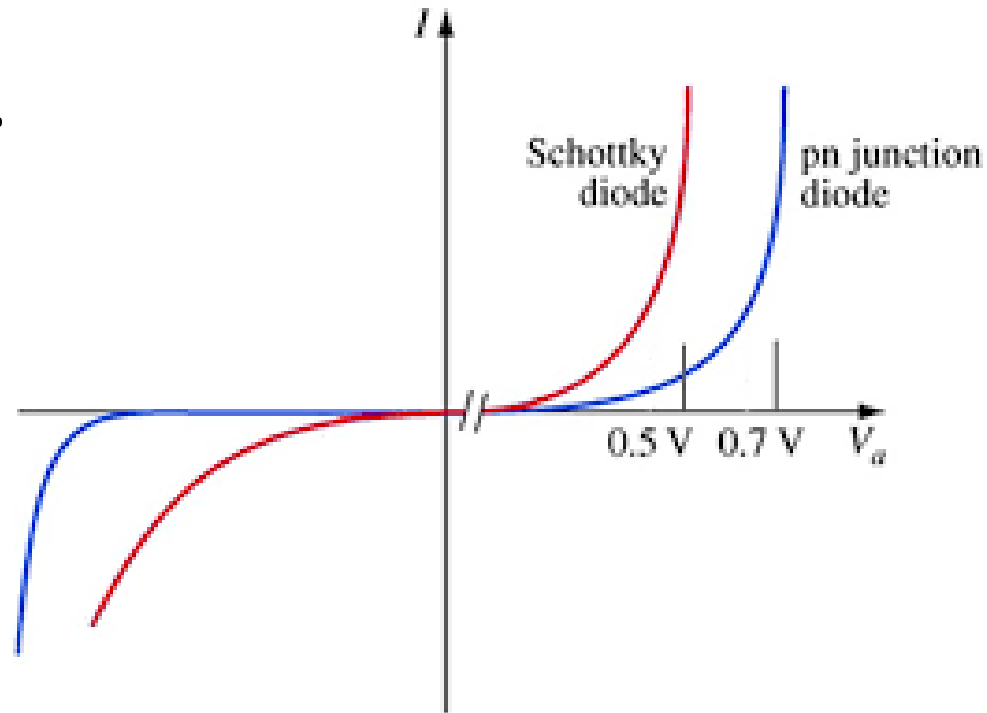
CD players

Solar cells



5- Schottky Barrier Diodes

- This diode has a junction formed by a metal and extrinsic semiconductors, because of differences in carrier concentrations in two materials, a potential barrier exists.
- When Aluminum-Silicon junction is formed it called Schottky diode.
- Differences between junction diode & Schottky:
 - V_f is lower in Schottky.
 - I_s reverse current is higher.



Advantages of Schottky:

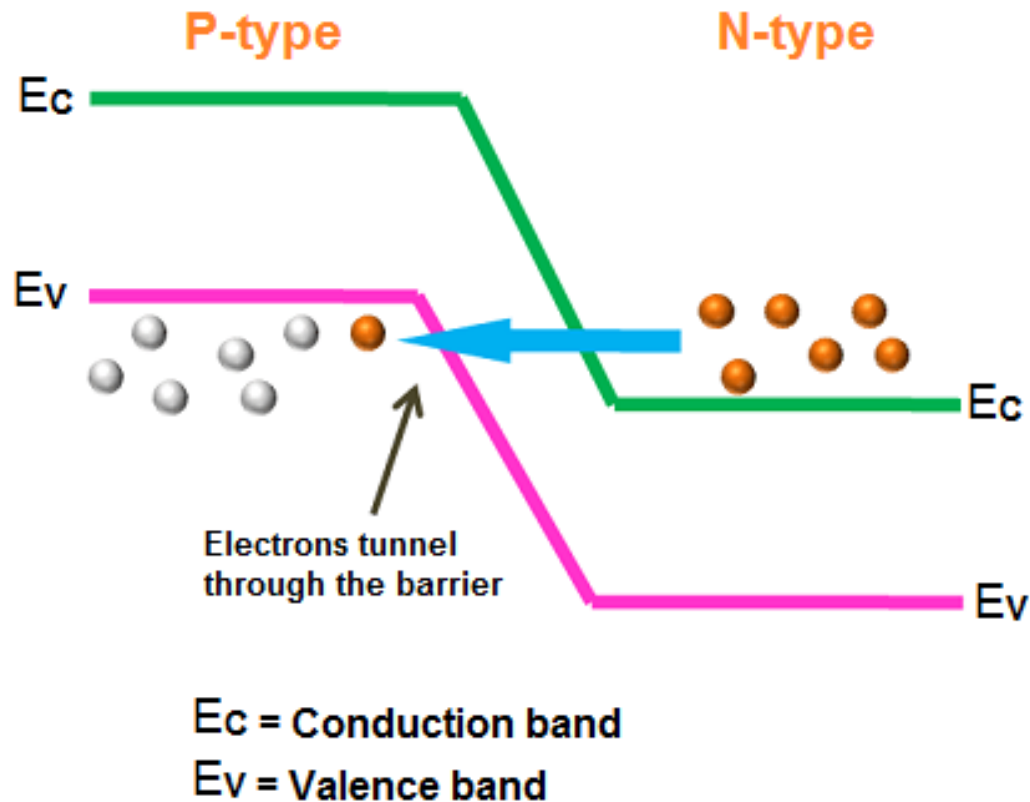
It switches faster than junction diodes “ switching means switches from ON to OFF and visa versa”

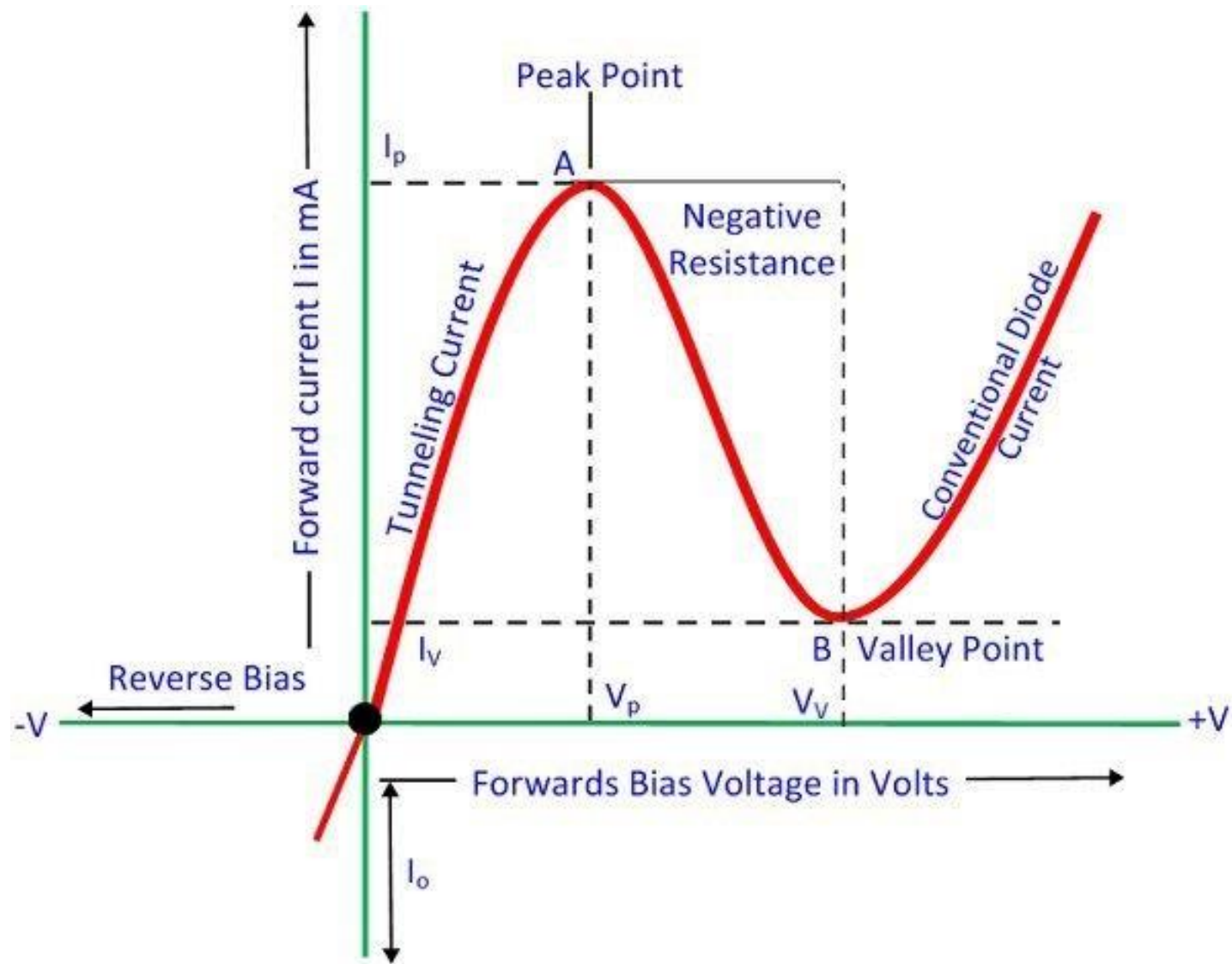
Applications:

Because it switches faster it used in digital circuit applications such as computers because it switched On & Off so quickly.

6- Tunnel Diode

The tunnel diodes are normal P-N junction diode but with heavily doping concentration makes a very thin depletion region and this changes the characteristics of P-N junction diode. The width of depletion region of 10nm.





Material:

Most common tunnel diodes are made from Germanium or gallium arsenide, Tunnel diode is difficult to manufacture with Silicon.

Applications:

- 1- very high speed switching (speed of light), because of the thickness of depletion region.
- 2- It is as a high frequency oscillator.

Oscillator:

Electronic circuit produces a repetitive oscillating electronic signal “ sine wave or square wave” Oscillator convert DC signal from power supply to Ac signal.