



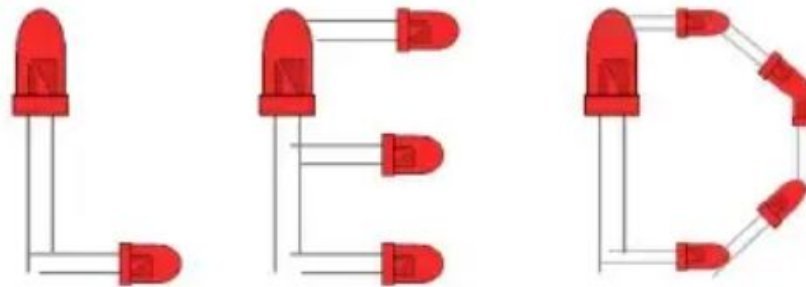
Basics of Electronics Engineering (EC142)

Presented By:

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Chitkara University, Punjab, India

- Introduction to Electronics
- Familiarization with basic electronic components.
- Semiconductor Theory
- Review of PN junction operation
- Plot and analyse V-I Characteristics of PN-Junction Diode
- Diode Applications – Rectifier, Clipper
- Special purpose diodes
 - Light Emitting Diode
 - Zener Diode
 - Varactor Diode
 - Photodiode



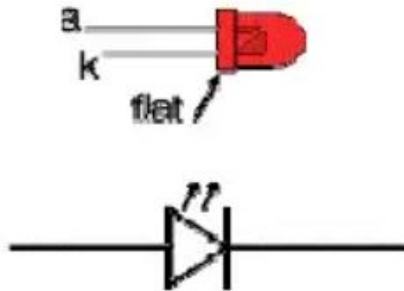
LIGHT EMITTING DIODES

Light Emitting Diode



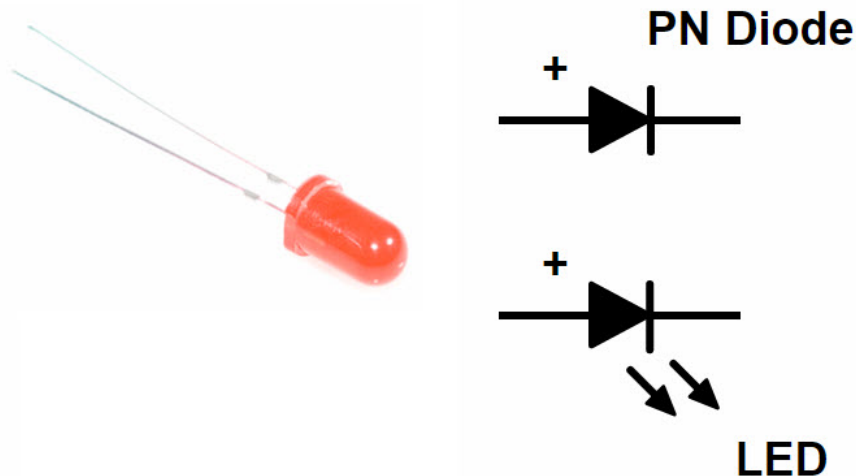
A light emitting diode (LED) is essentially a PN junction opto-semiconductor that emits a monochromatic (single color) light when operated in a forward biased direction.

LEDs convert electrical energy into light energy. They are frequently used as "pilot" lights in electronic appliances to indicate whether the circuit is closed or not.



Light Emitting Diode

- LED is a semiconductor light source.
- It consists of a PN Junction Diode.
- When voltage is applied to the LED, electrons and holes recombine in the PN Junction and release energy in the form of light (Photons).
- The light emitted by an LED is usually monochromatic i.e. of single color and the color is dependent on the energy band gap of the semiconductor.
- Light Emitting Diodes can be manufactured to emit all the wavelengths of visible spectrum i.e. from Red (620nm to 750nm) to blue – violet (380nm to 490nm).

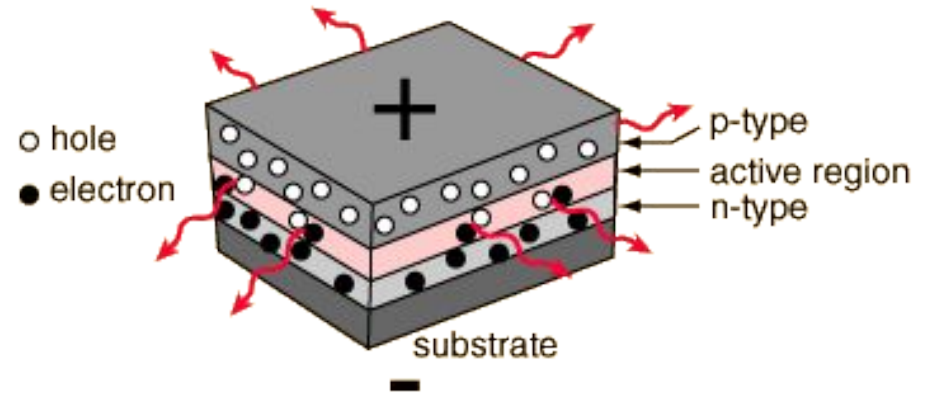


LIGHT EMITTING DIODE

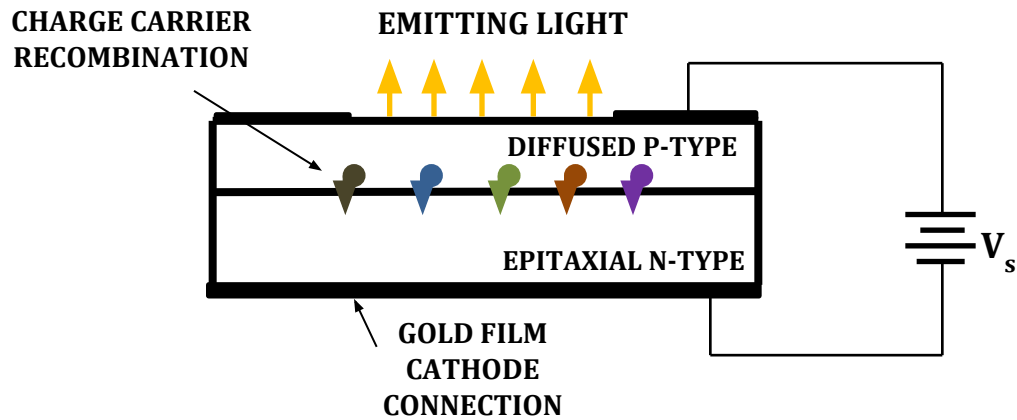
Structure



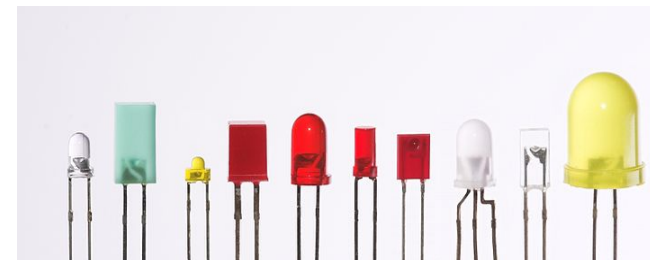
LED Symbol



LED Structure

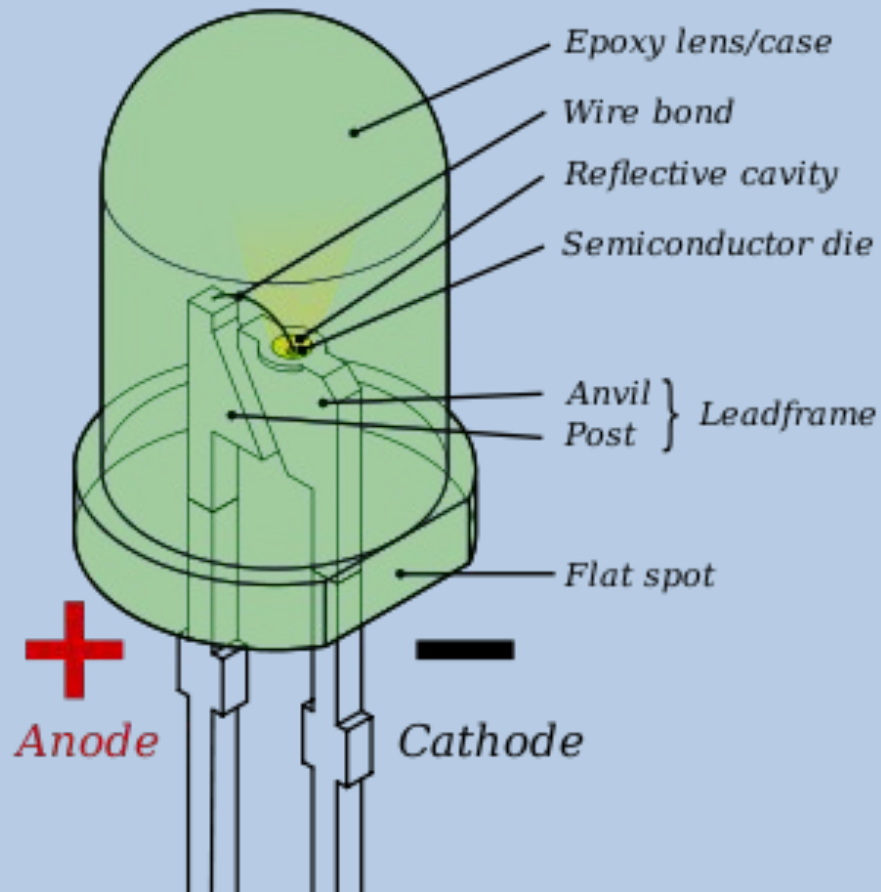


Schematic View of LED Structure

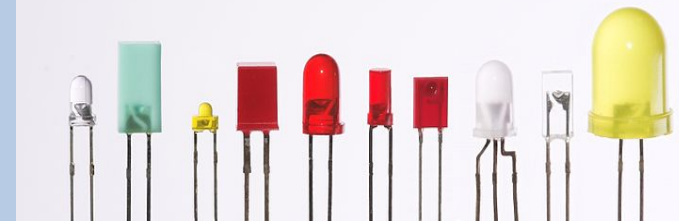




Anatomy



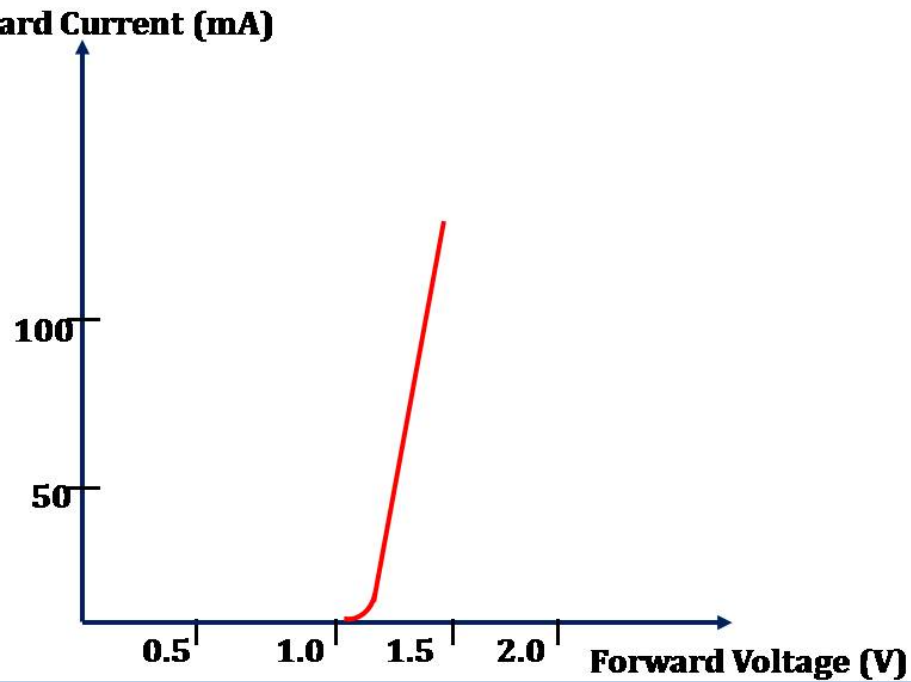
Anatomy of an LED



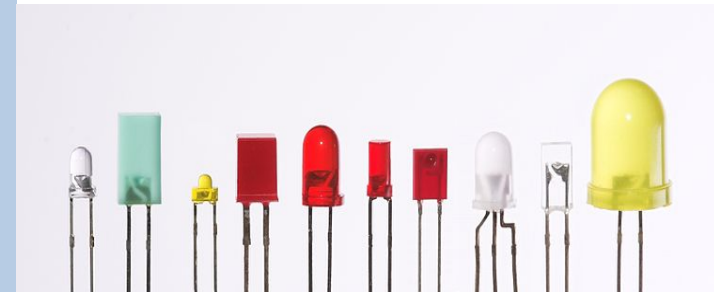
LIGHT EMITTING DIODE

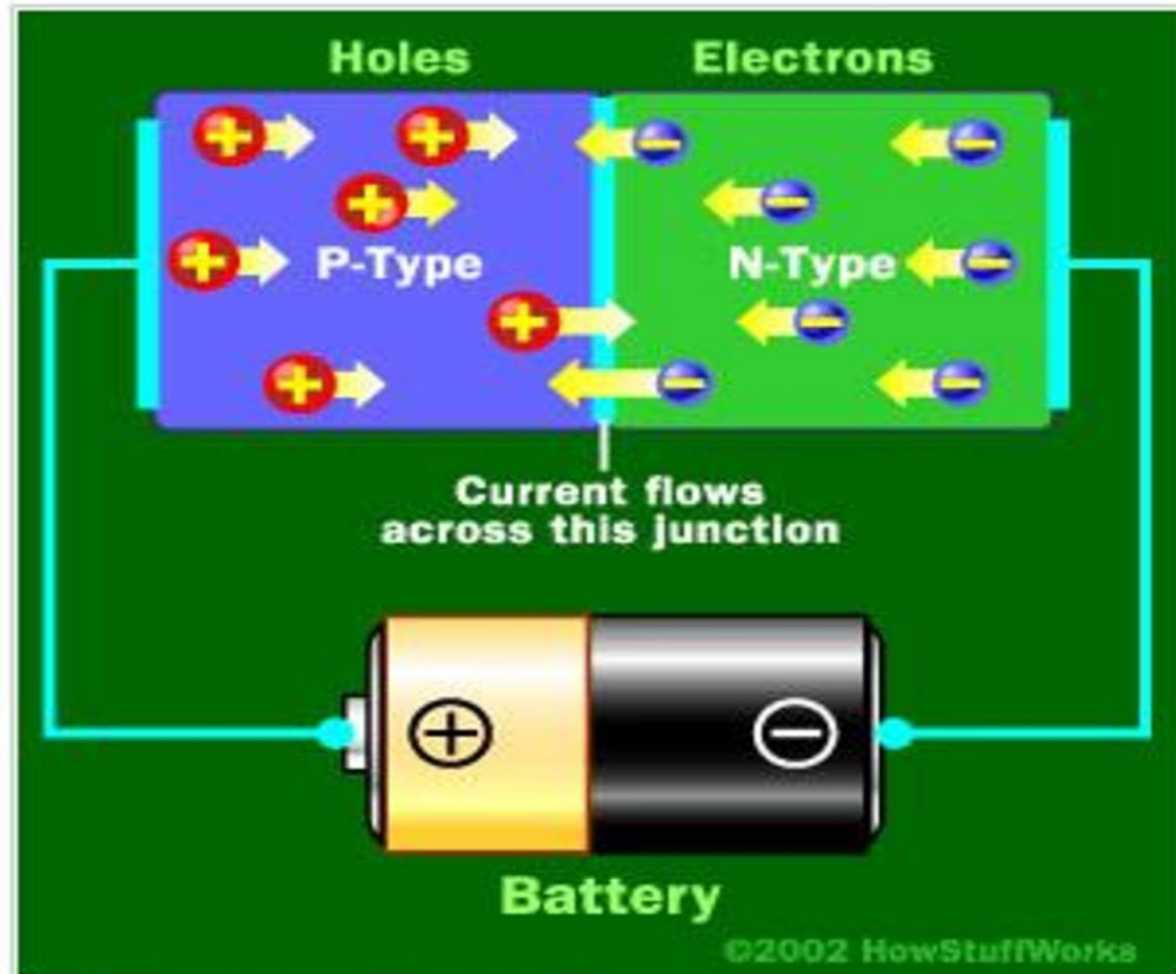


Characteristics

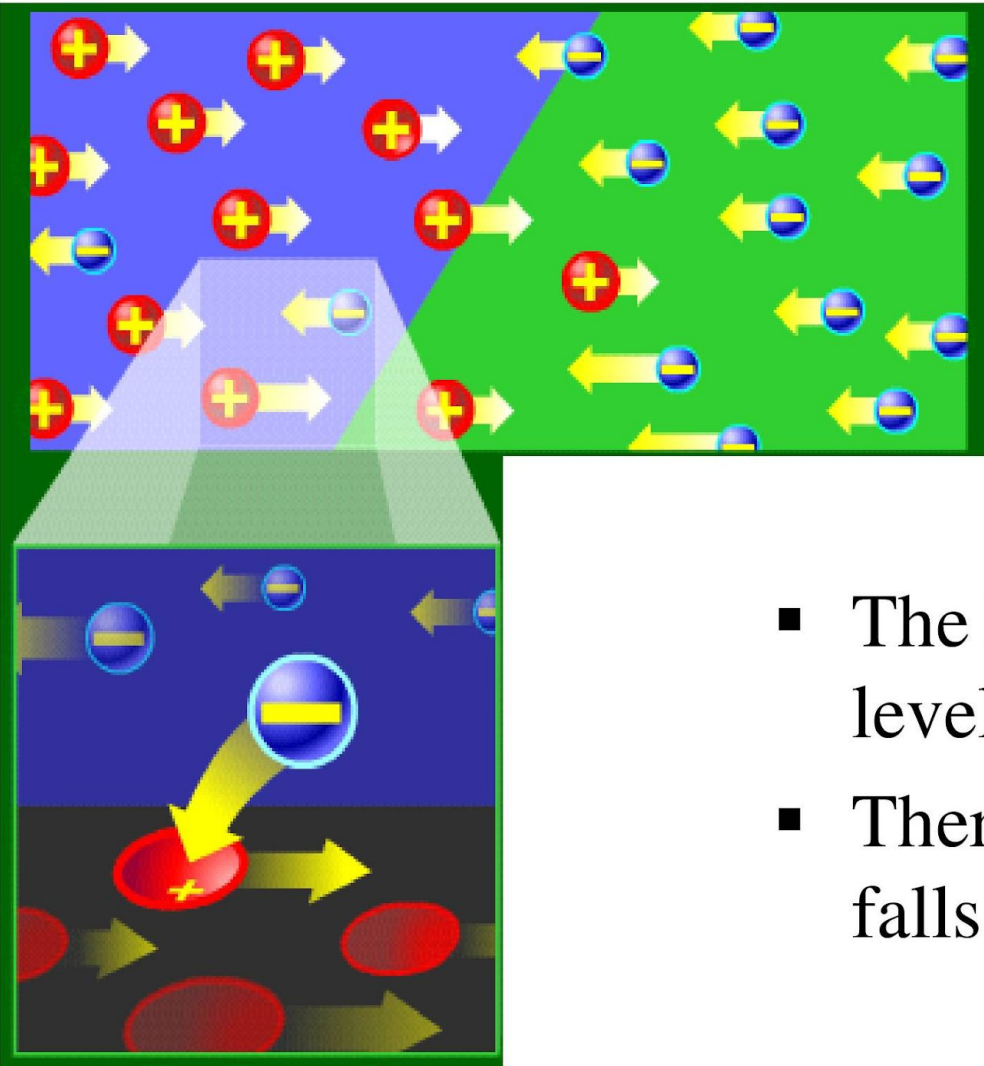


Forward Bias VI Curve

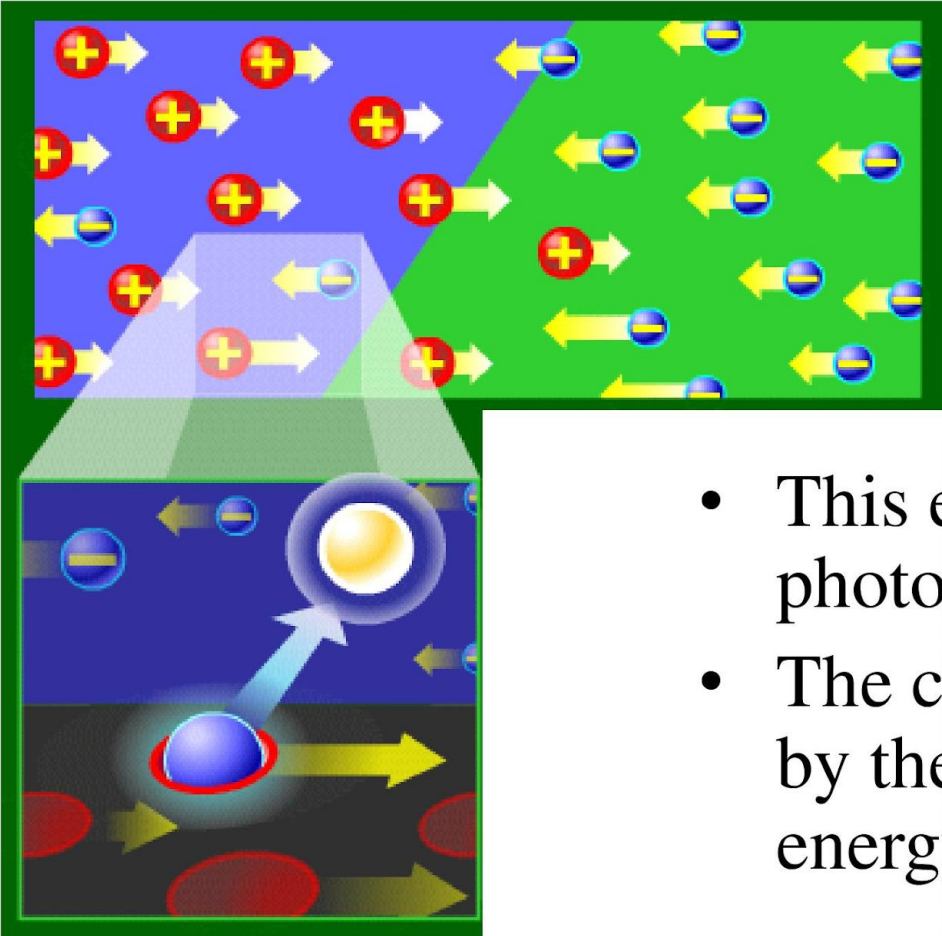




When the negative end of the circuit is hooked up to the N-type layer and the positive end is hooked up to P-type layer, electrons and holes start moving and the depletion zone disappears.



- The holes exist at a lower energy level than the free electrons.
- Therefore when a free electrons falls it losses energy

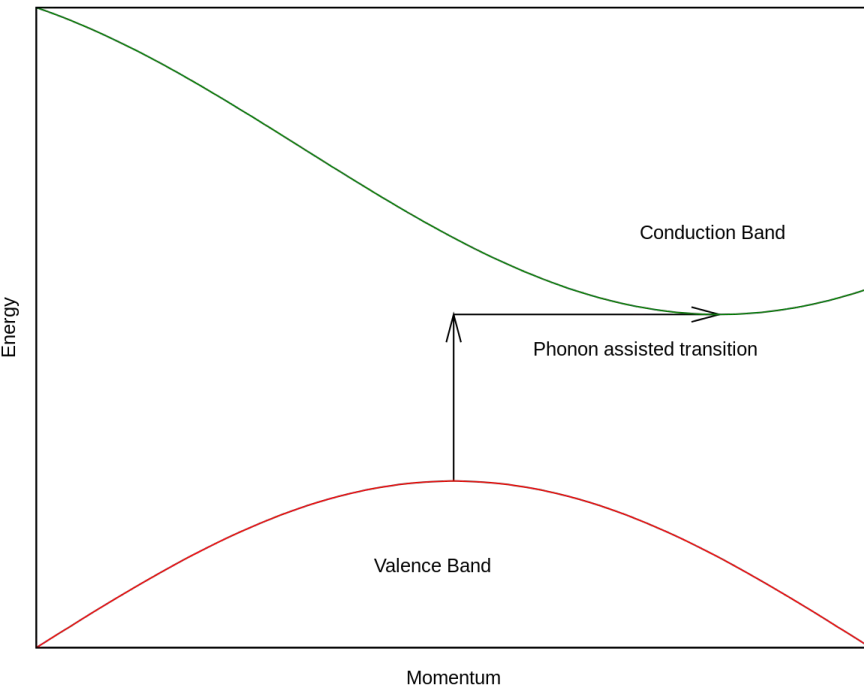


- This energy is emitted in a form of a photon, which causes light.
- The color of the light is determined by the fall of the electron and hence energy level of the photon.

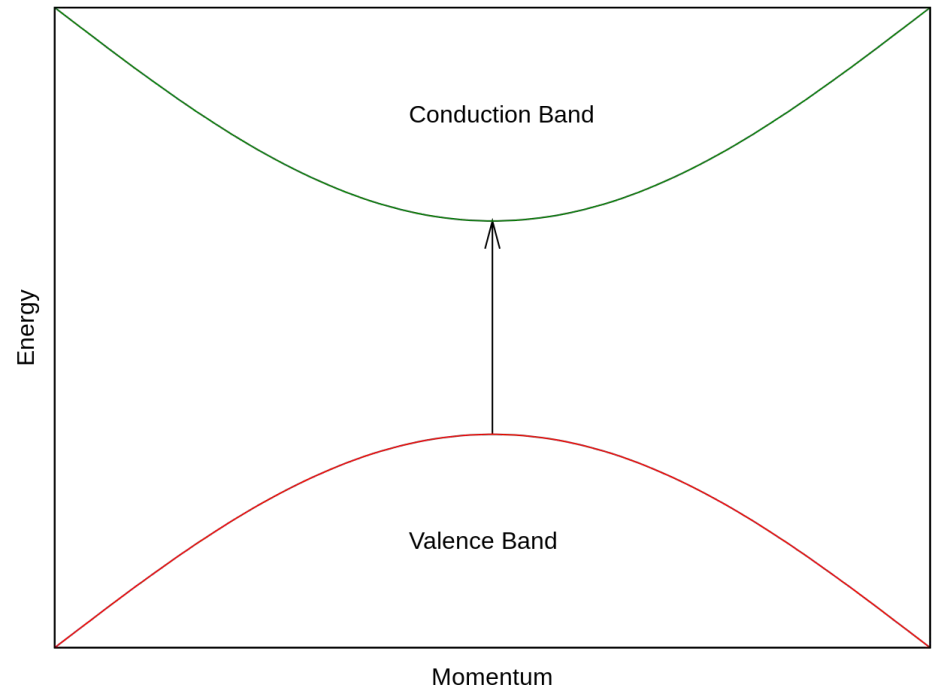
Band Gap

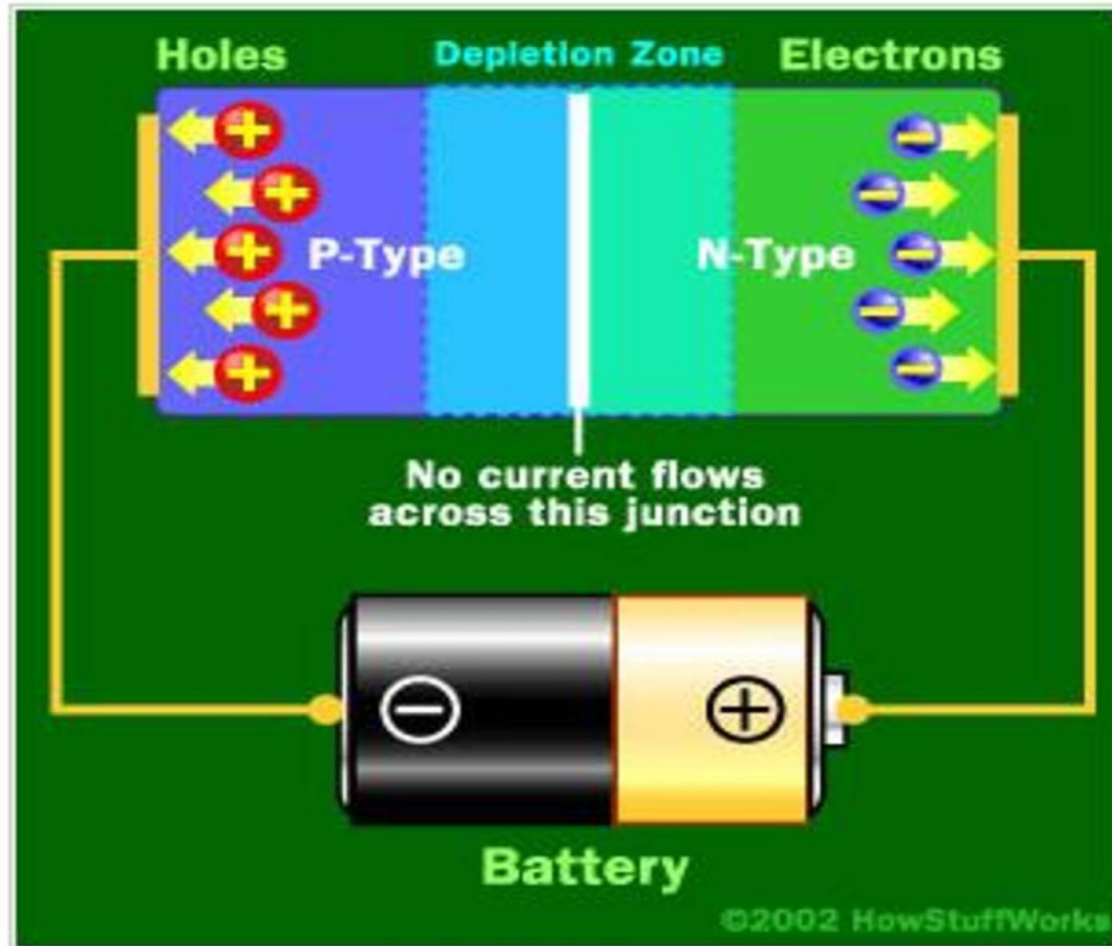


Indirect Band Gap

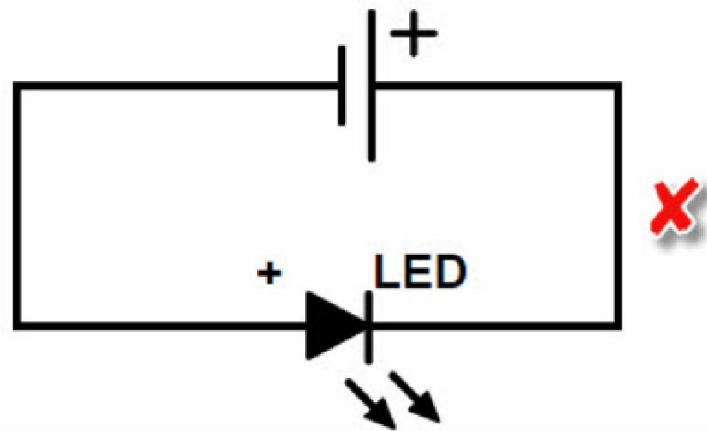
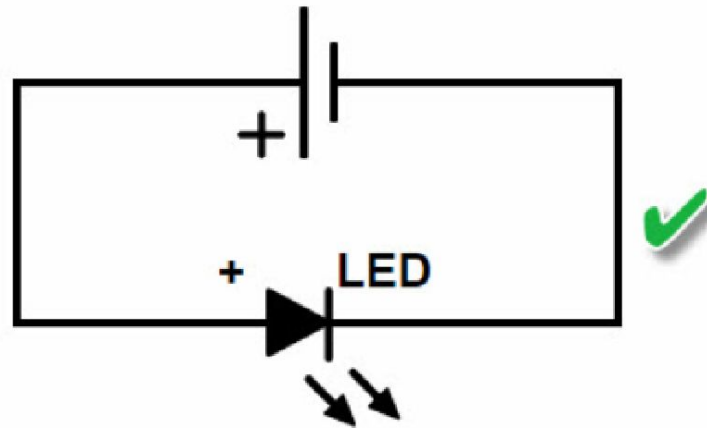


Direct Band Gap





When the positive end of the circuit is hooked up to the N-type layer and the negative end is hooked up to the P-type layer, free electrons collect on one end of the diode and holes collect on the other. The depletion zone gets bigger.





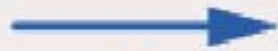
What Determines the color of the LED

- ❖ The material used in the semiconducting element of an LED determines its color.
- ❖ The two main types of LEDs presently used for lighting systems are aluminum gallium indium phosphide (*AlGaInP*, sometimes rearranged as *AlInGaP*) alloys for red, orange and yellow LEDs.
- ❖ Indium gallium nitride (*InGaN*) alloys for green, blue and white LEDs. Slight changes in the composition of these alloys changes the color of the emitted light.



Typical LED Characteristics			
Semiconductor Material	Wavelength	Colour	V_F @ 20mA
GaAs	850-940nm	Infra-Red	1.2v
GaAsP	630-660nm	Red	1.8v
GaAsP	605-620nm	Amber	2.0v
GaAsP:N	585-595nm	Yellow	2.2v
AlGaP	550-570nm	Green	3.5v
SiC	430-505nm	Blue	3.6v
GaN	450nm	White	4.0v

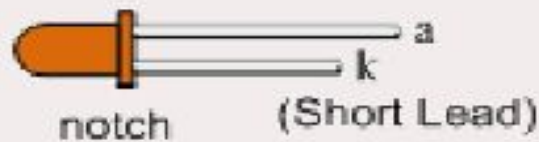
Conventional Current Flow



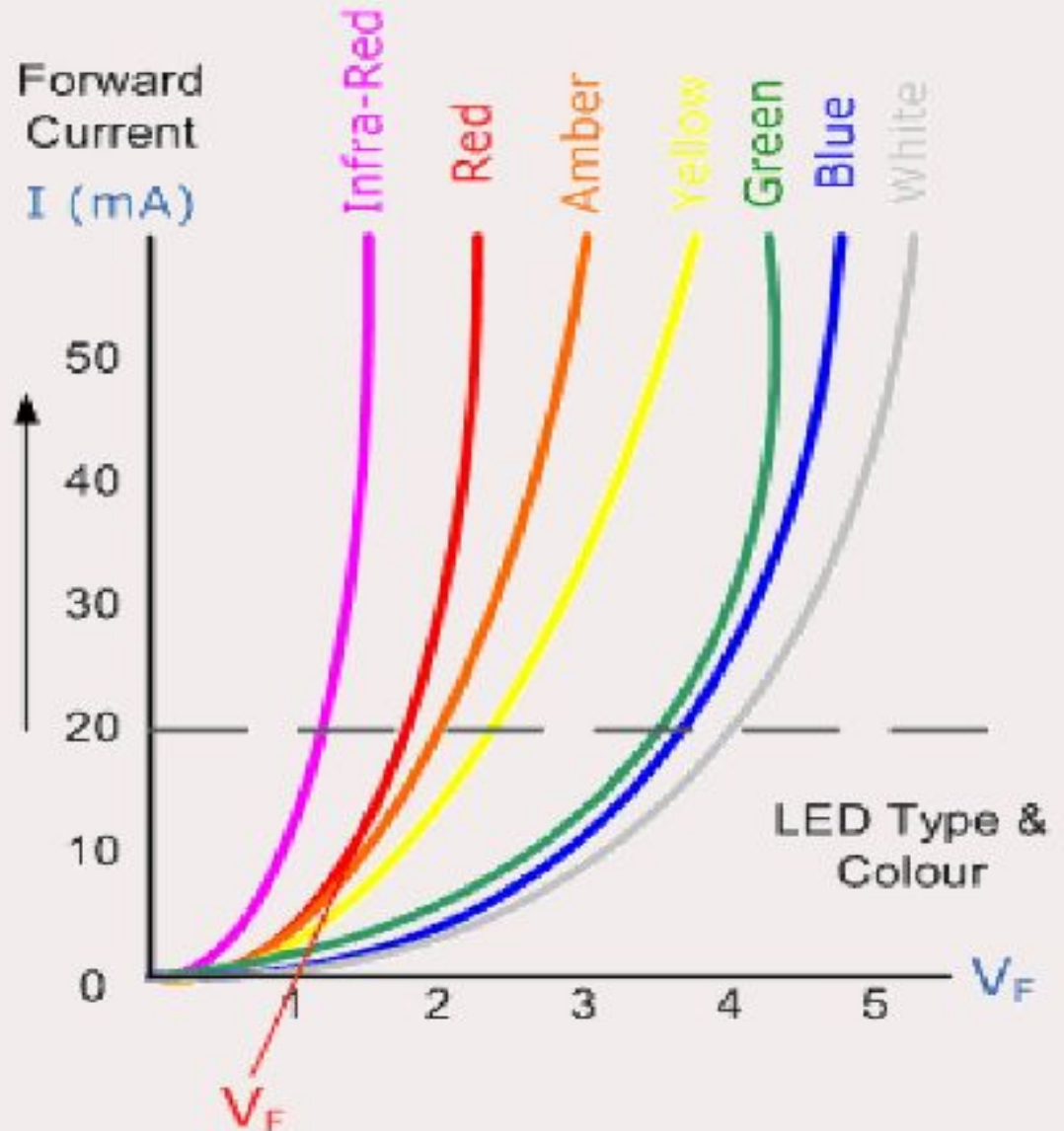
or



Cathode (K)

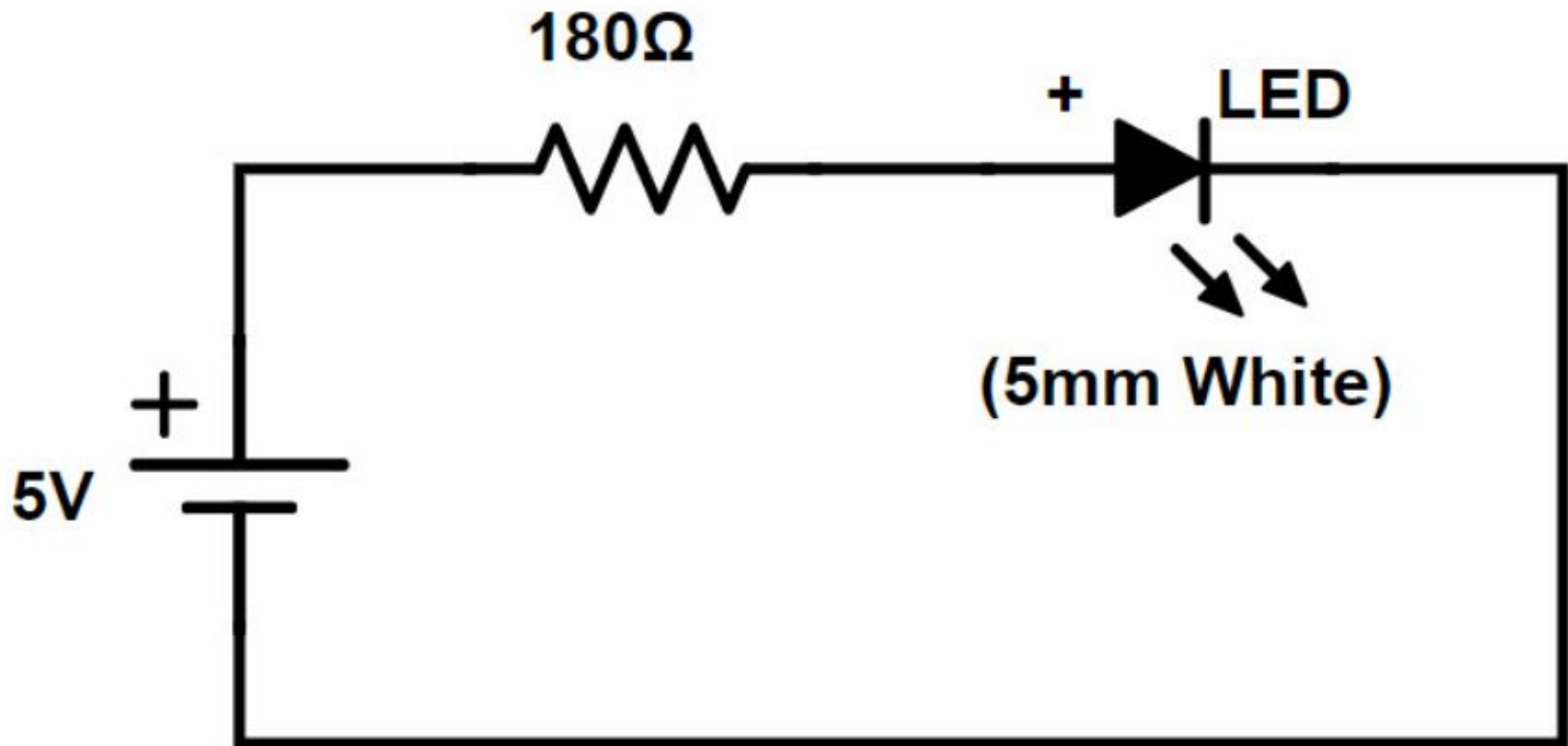


LED and its
I-V Characteristics



Simple LED Circuit

The following image shows the circuit of a simple LED Circuit consisting of a 5mm White LED with a 5V power supply.



- Light Emitting Diodes are almost everywhere. You can find LEDs in Cars, Bikes, Street Lights, Home Lighting, Office Lighting, Mobile Phones, Televisions and many more.
- The reason for such wide range of implementation of LEDs is its advantages over traditional incandescent bulbs and the recent compact fluorescent lamps (CFL).

Few advantages of LEDs over incandescent and CFL light sources are mentioned below:

- Low Power Consumption
- Small Size
- Fast Switching
- Physically Robust
- Long Lasting





- <https://www.electronicshub.org/led-light-emitting-diode/>
- https://drive.google.com/file/d/1dX0utp8ciLXg02YtWGaWmdRK_-WCy33o/view?usp=sharing
- https://drive.google.com/file/d/1d_QVji4NLE4Ebi1_6wh9NEzhCTOViqS3/view?usp=sharing



Thank You