What is a Photodiode

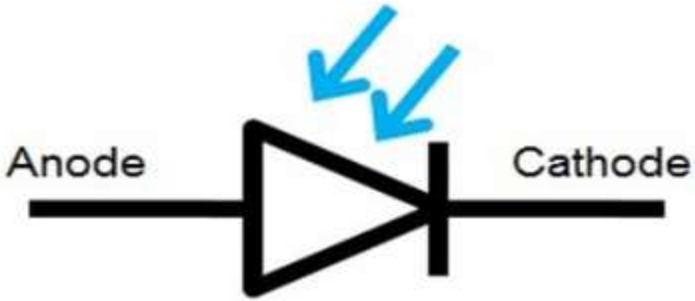
- A photodiode is one type of light detector, used to convert the light into current or voltage based on the mode of operation of the device.
- It comprises of optical filters, built-in lenses and also surface areas.
- These diodes have a slow response time when the surface area of the photodiode increases.
- Photodiodes are alike to regular semiconductor diodes.

What is a Photodiode

- Some photodiodes will look like a light emitting diode.
- They have two terminals coming from the end.
- The smaller end of the diode is the cathode terminal.
- While the longer end of the diode is the anode terminal.

What is a Photodiode

- See the following schematic diagram for the anode and cathode side.



Photodiode symbol

- Under forward bias condition, conventional current will flow from the anode to the cathode, following the arrow in the diode symbol.

- Photocurrent flows in the reverse direction.

What is a Photodiode

Photodiode

Types of Photodiode

- The types of the photodiodes can be classified based on its construction and functions as follows.

  - PN Photodiode
  - Schottky Photo Diode
  - PIN Photodiode
  - Avalanche Photodiode

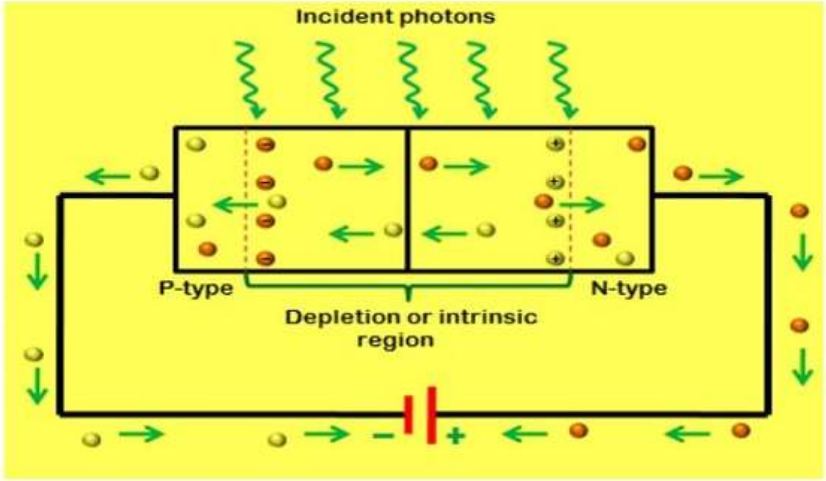
Working of Photodiode

- When a photon of ample energy strikes the diode.
- It makes a couple of an electron-hole.
- This mechanism is also called as the inner photoelectric effect.
- If the absorption arises in the depletion region junction.
- Then the carriers are removed from the junction by the inbuilt electric field of the depletion region.

Working of Photodiode

- The holes in the region move toward the anode, and electrons move toward the cathode, and a photocurrent will be generated.
- The entire current through the diode is the sum of the absence of light and the photocurrent.
- So the absent current must be reduced to maximize the sensitivity of the device.

Working of Photodiode



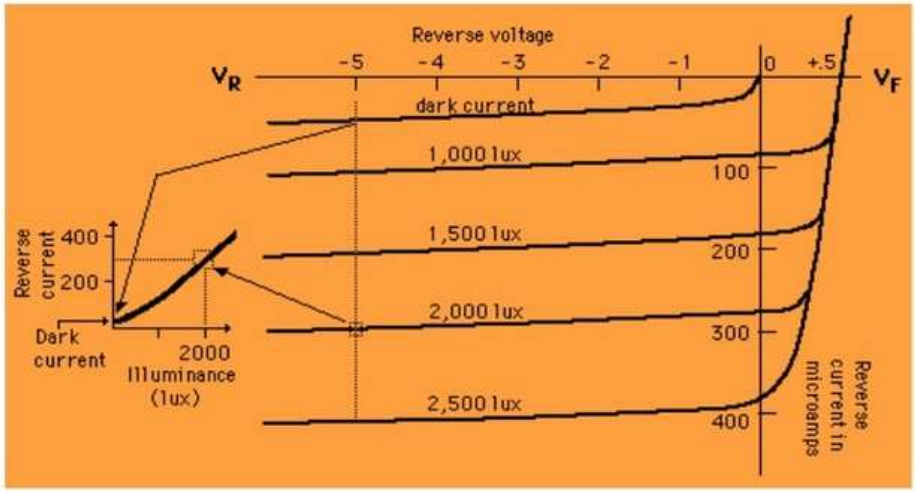
PN Junction Diode

V-I Characteristics of Photodiode

- A photodiode continually operates in a reverse bias mode.
- The photocurrent is nearly independent of reverse bias voltage which is applied.
- For zero luminance, the photocurrent is almost zero excluding for small dark current.

V-I Characteristics of Photodiode

- The characteristics of the photodiode are shown clearly in the following figure.



Applications of Photodiode

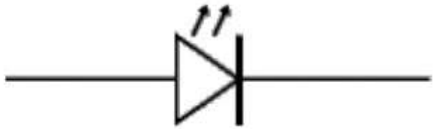
- The applications of photodiodes involve in similar applications of photodetectors like charge-coupled devices, photoconductors, and photomultiplier tubes.
- These diodes are used in consumer electronics devices like smoke detectors, compact disc players, televisions and remote controls in VCRs.
- It uses in consumer devices like clock radios, camera light meters, and street lights.

D. **Reference**

Light Emitting Diode (LED)

Introduction

- A light emitting diode (LED) is essentially a PN junction opto-semiconductorthat 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.

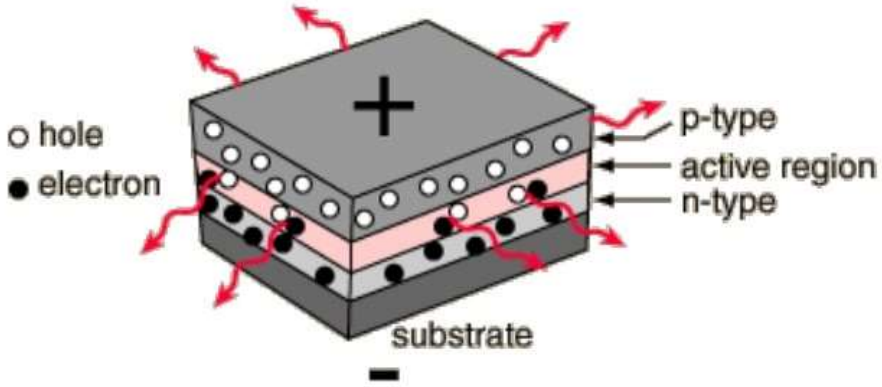


- The most important part of a light emitting diode (LED) is the semi-conductor chip located in the center of the bulb as shown at the right image.
- The chip has two regions separated by a junction.

1. **P region**

2. **N region**

- The **p region** is dominated by positive electric charges, and the **n region** is dominated by negative electric charges.
- The junction acts as a barrier to the flow of electrons between the p and the n regions.
- When sufficient voltage is applied to the chip, the electrons which is in **n region** cross the junction and transfer into the **p region**. This results in current flow.


hole
electron
+
p-type
active region
n-type
substrate
−

Introduction

- A Liquid Crystal Display (LCD) is a thin , flat panel display device used for electronically displaying information such as text ,images and moving picture.
- LCD is used in Computer monitors, Televisions , Instrument panels, Gaming devices etc.
- Polarization of lights is used here to display objects.

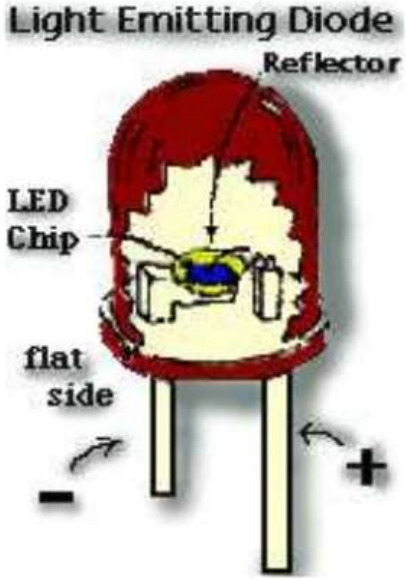
How LCDs work

- Liquid crystals can adopt a twisted up structure and when we apply electricity to them, they straighten out again. This is the key how LCD displays turn pixels on and off.
- The polarization property of light is used in LCD screen to switch its colored pixels on or off. At the back of the screen, there is a bright light that shines out towards the viewer. In front of this, there are the millions of pixels, each one made up of smaller areas called sub-pixels, that are colored Red, Green, or Blue.

ADVANTAGES OF LCD

Brightness	Produces very bright images due to high peak intensity. Very suitable for environments that are brightly lit .
Emissions	Produce considerably lower electric, magnetic and electromagnetic fields than CRTs.
Geometric Distortion	No geometric distortion at the native resolution. Minor distortion can occur for other resolutions.
Power Consumption	Energy efficient. Consume less than 1/3 the power of a comparable CRT. Consume less electricity than a CRT and produce little heat.
Physical Aspects	Take up about 40% less desk space. LCDs are thin and compact.
Screen Shape	Completely flat screen.
Sharpness	At the native resolution, the image is perfectly sharp. Adjustments are required at all other resolutions which can result in measurable degradation to the image.

Working Principle Of LED



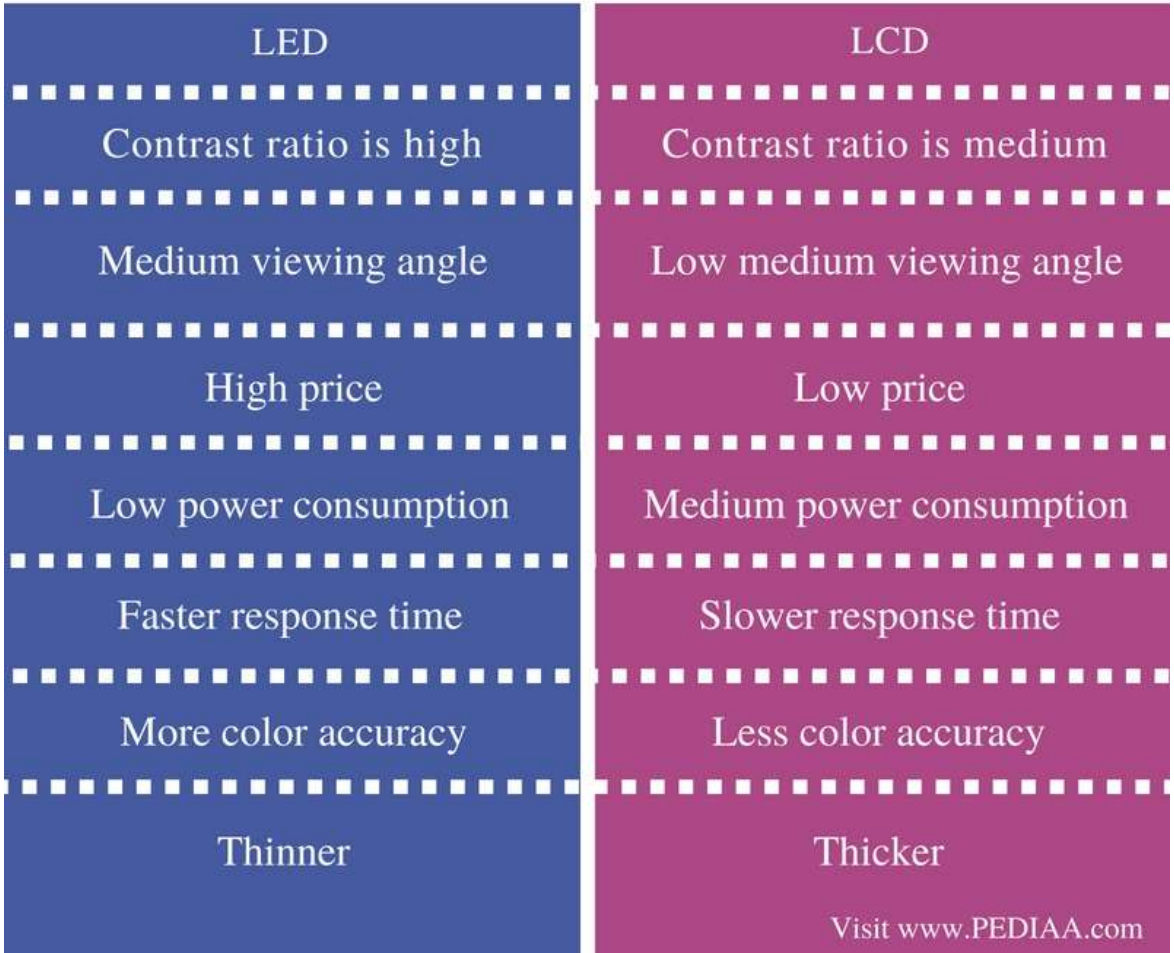
- When sufficient voltage is applied to the chip across the leads of the LED, electrons can move easily in only one direction across the junction between the p and n regions.

- When a voltage is applied and the current starts to flow, electrons in the n region have sufficient energy to move across the junction into the p region.

Applications

- ❖Display sources.
- ❖Mobile phones.
- ❖Keyboards .
- ❖Digital watches.
- ❖Light sources.

LED VERSUS LCD



What is an oscillator ???

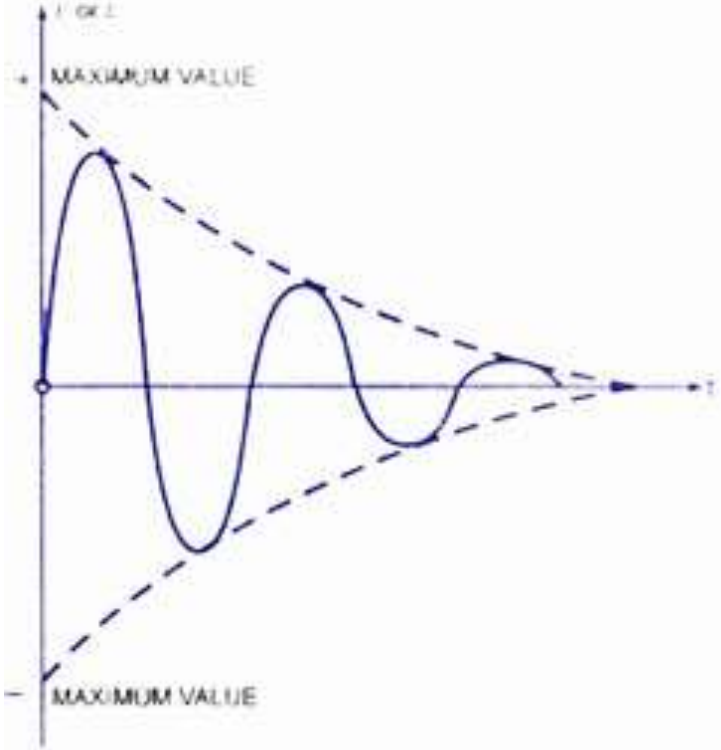
Oscillators are circuits that produce a continuous signal of some type without the need of an input. These signals serve a purpose for a variety of purposes. Communications systems, digital systems (including computers), and test equipment make use of oscillators.

Damped oscillation: A damped oscillation is one that gradually fades away with time. A swinging pendulum, a weight on a spring, and a resistor-inductor-capacitor (RLC) circuit are all examples.

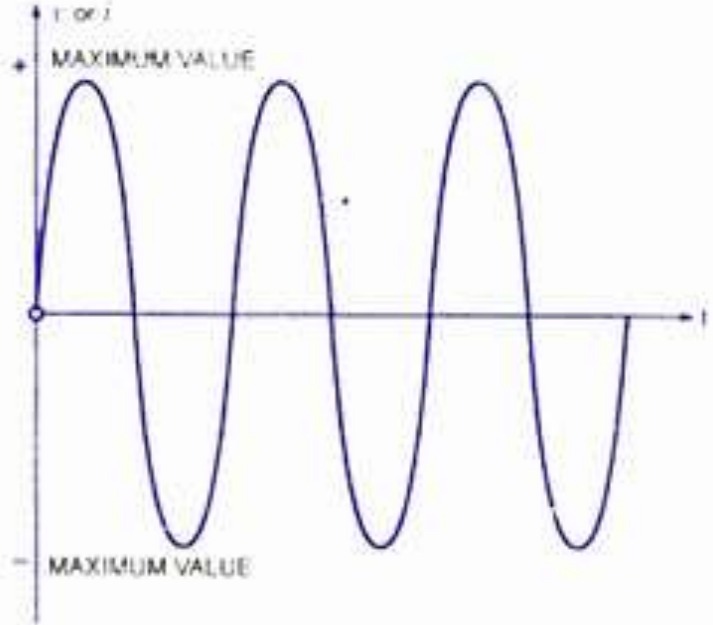
Undamped Oscillations: When a Simple harmonic oscillator oscillates with a constant amplitude that does not fluctuate over time, its oscillations are said to be undamped. Damped Oscillations of S.H.M.

Necessary Conditions for Oscillation

- Two conditions, are required for a sustained state of oscillation:
- 1. The phase shift around the feedback loop must be effectively Zero.
- 2. The voltage gain, around the closed feedback loop (loop gain) must be equal to 1 (unity).



(a) Damped Oscillations



(b) Undamped or Sustained Oscillations