

PHOTO DETECTORS

Photodetectors are the devices that convert the incoming optical signal into an electrical signal known as O/E converter.

There are many types of photodetectors -

photodiodes

phototransistors

photoconductive detectors etc.

PHOTODIODE

It is a reverse biased P-N junction diode which converts light energy to electric energy. It is also known as photo sensor or light detector.

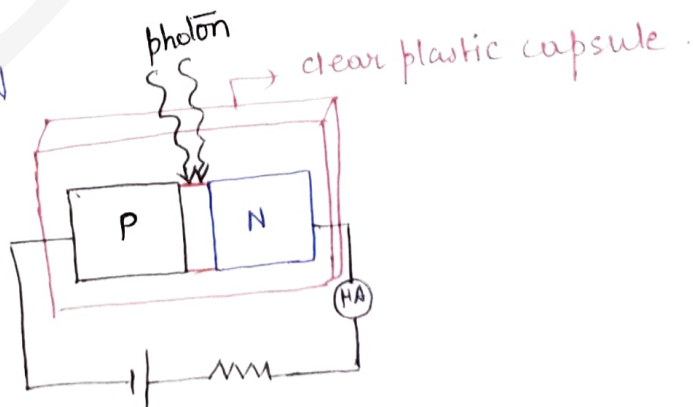
SYMBOL



PRINCIPLE

Photodiode works on the principle of internal photo-electric effect. When a light is incident on the depletion region of a P-N junction diode, e^- & hole pairs are produced, which contribute to photoconductivity.

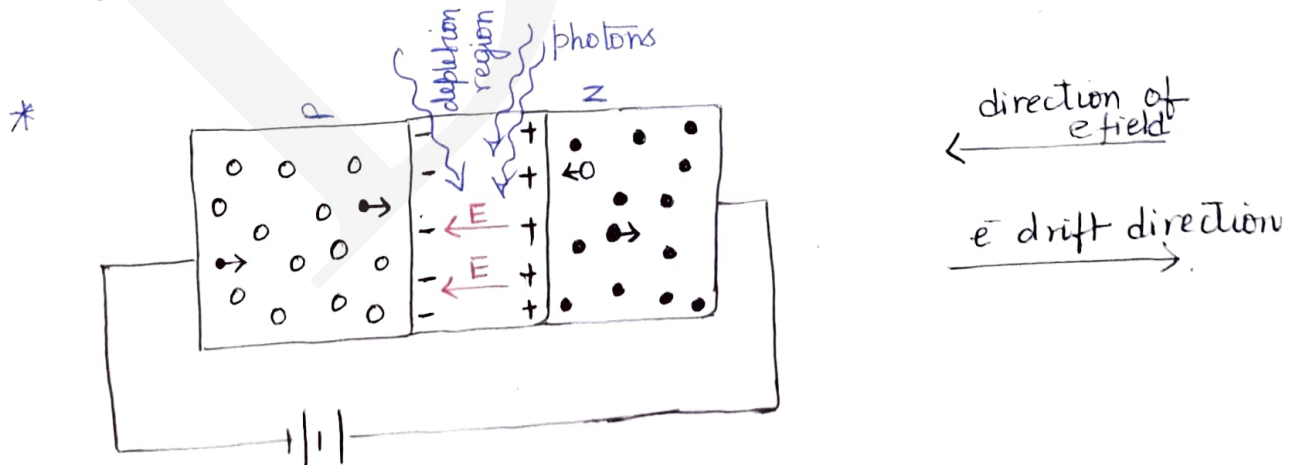
CONSTRUCTION



- * A semiconducting material is doped with trivalent- and pentavalent- impurity on either sides to form P and N regions of the diode.
- * At the junction of the P & N region, a depletion region is formed which is devoid of majority carriers.
- * Junction diode is reverse biased and a μA is connected to the ckt.
- * Diode is encapsulated in a transparent plastic capsule through which light is allowed to fall on the junction.

WORKING

- * When a photodiode is not illuminated and reverse bias is applied a small amount of current due to drifting of minority carriers is observed. This is DARK CURRENT. I_d .



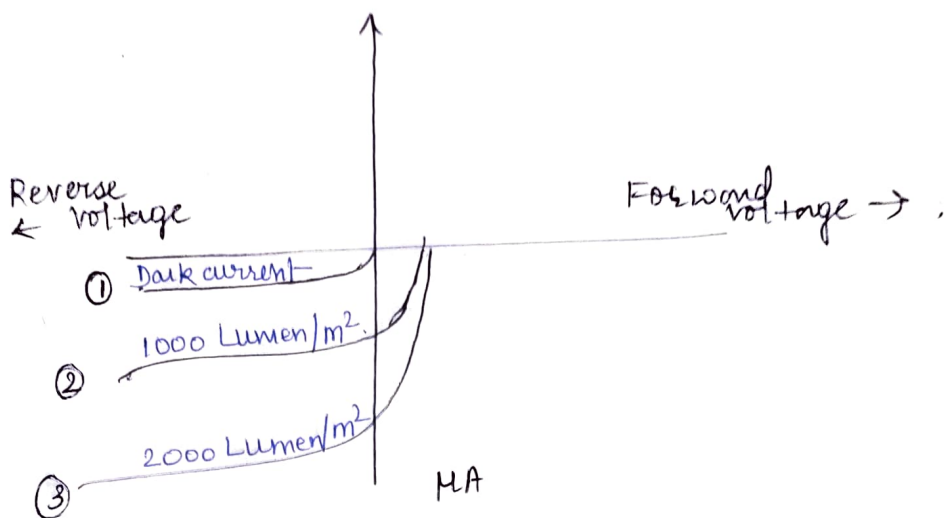
In reverse bias condition the depletion region grows and a voltage gradient is generated which set up strong electric field in the depletion region.

- * When light shines on the depletion region, then photons generate e^- , hole pairs. Due to the internal electric field, electrons are drifted towards N side and holes are drifted towards P side.
- * In this manner, e^- -hole pairs which are generated in proportion to the amount of incident light are collected in N & P type layer/region.
- * If an external ckt is connected between P & N region the e^- will flow away from N & holes from P towards the opposite electrodes respectively, constituting short ckt current I_s . I_s is proportional to intensity of incident light-

Total reverse current-
$$I = I_s + I_d$$

V-I CHARACTERISTICS

- * In dark state small reverse bias current flow marked by ① in the graph.



* When light strikes, as the ^{illumination} increases, the reverse current increases, thus the measure of current is directly proportional to illumination level.

* Only for dark current, at zero voltage the current is zero.

APPLICATIONS

1. Light detection system
2. Light-operated switches.
3. Variable resistance device controlled by light.
4. Switch on the current at very fast rate.
5. High-speed reading of computer punched cards and tapes.