CSE-1102

Analog Electronics

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Outlines

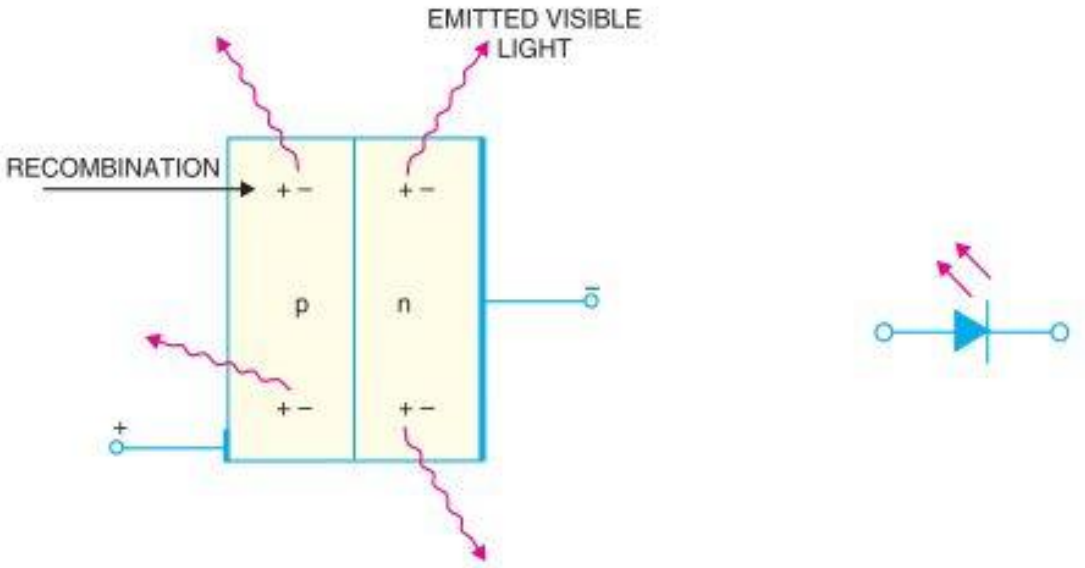
- **Light-Emitting Diode (LED)**
- Photo-diode
- Optoisolator

Light-Emitting Diode (LED)

A light-emitting diode (LED) is a diode that gives off visible light when forward biased.

working of a LED

- When LED is forward biased , the electrons from the n-type material cross the pn junction and recombine with holes in the p-type material.
- These free electrons are in the conduction band and at a higher energy level than the holes in the valence band.
- When recombination takes place, the recombining electrons release energy in the form of heat and light.
- In germanium and silicon diodes, almost the entire energy is given up in the form of heat and emitted light is insignificant.
- However, in materials like gallium arsenide, the number of photons of light energy is sufficient to produce quite intense visible light.



What value of series resistor is required to limit the current through a LED to 20 mA with a forward voltage drop of 1.6 V when connected to a 10V supply?

Example 7.1. *What value of series resistor is required to limit the current through a LED to 20 mA with a forward voltage drop of 1.6 V when connected to a 10V supply ?*

Solution.

$$\text{Series resistor, } R_S = \frac{V_S - V_D}{I_F}$$

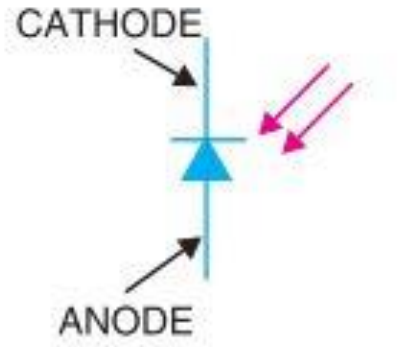
Here $V_S = 10\text{ V};\quad V_D = 1.6\text{ V};\quad I_F = 20\text{ mA} = 20 \times 10^{-3}\text{ A}$

$$\therefore \quad R_S = \frac{10 - 1.6}{20 \times 10^{-3}} = \mathbf{420\ \Omega}$$

Note that resistor R_S is also called *current-limiting resistor.*

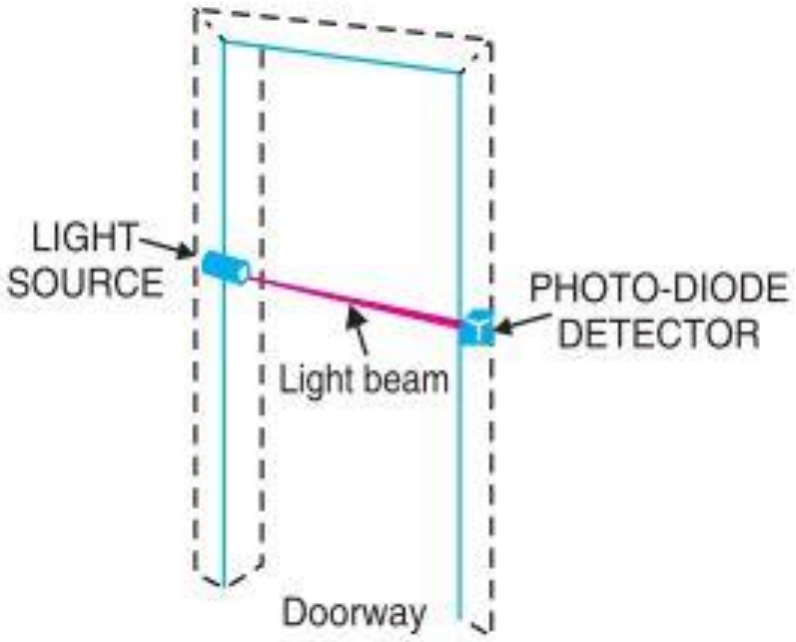
Photo-diode

A photo-diode is a reverse-biased silicon or germanium pn junction in which reverse current increases when the junction is exposed to light.



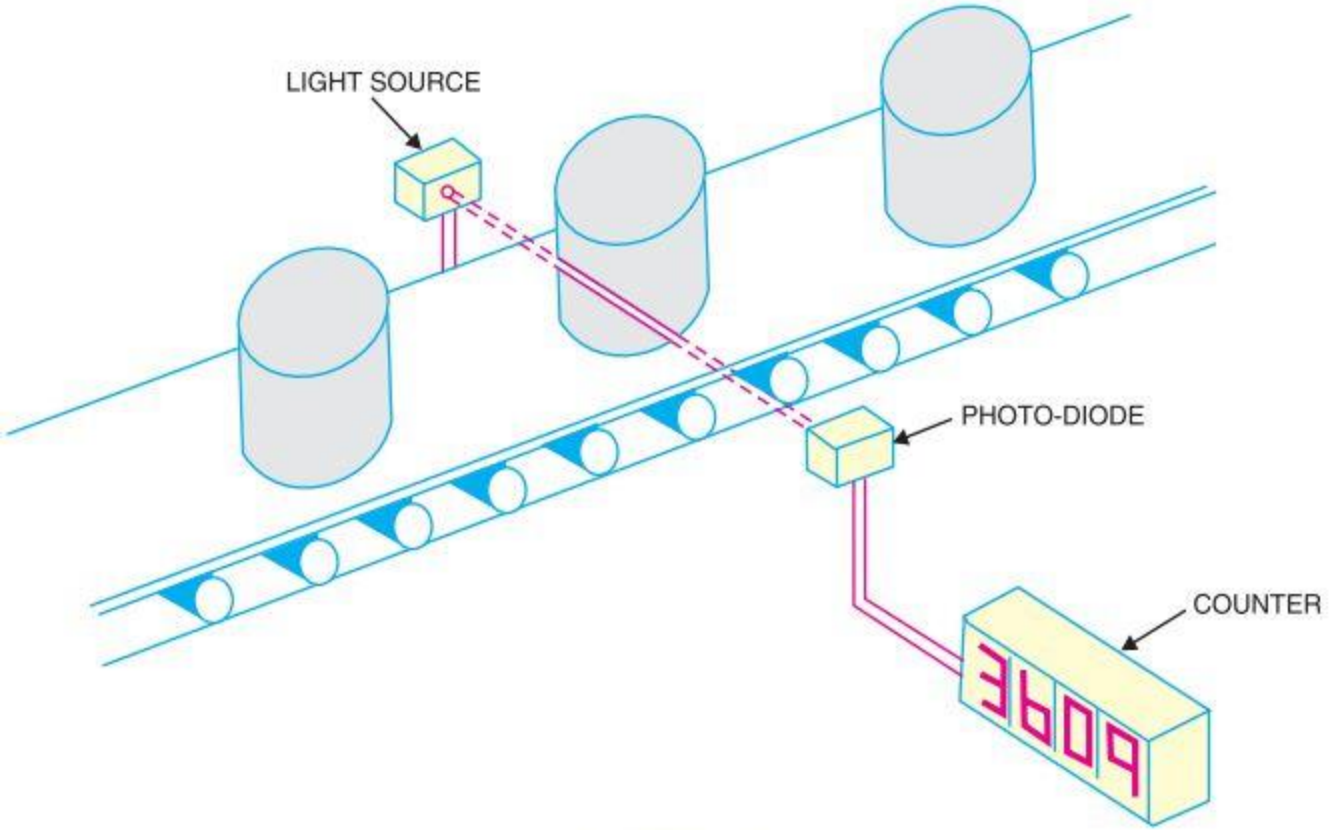
Applications of Photo-diode

1. Alarm circuit using photo-diode:



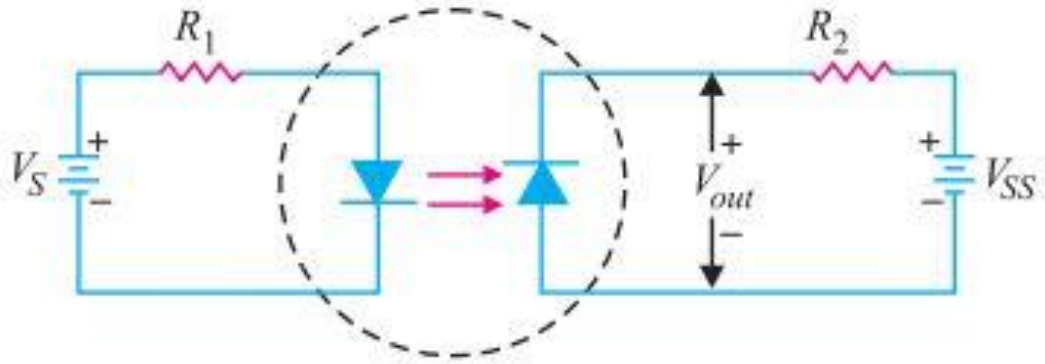
Applications of Photo-diode

2. Counter circuit using photo-diode:



Optoisolator

An optoisolator (also called optocoupler) is a device that uses light to couple a signal from its input (a photoemitter e.g., a LED) to its output (a photodetector e.g., a photo-diode).



Thank You All