

Photodiode characteristics

Important Characteristics of Photodiodes

How Photodiodes Work and Their Applications

A photodiode is a semiconductor diode made of silicon, germanium, or compound semiconductor. It converts light energy into electrical current in reverse bias, and not in the forward bias. Unlike other diodes, it is containing a p-n junction and is designed to operate in the reverse bias before the breakdown voltage.

Photodiodes are also known by other names, such as Photo-detector, Photo-sensor, Light detector. Construction of Photodiode It is equipped with two metal wires and is mounted in a plastic or metal housing with a transparent window. The photodiode is constructed in such a way that it is fully exposed to light through its transparent body.

When light strikes the junction, a current or voltage develops. A light detector may have a larger area to enhance photo response. It is capable of detecting radiation from the optical domain and transforming it into an electrical signal.

In electrical diagrams, as shown in the above figure, a photodiode is referred to as a diode with three arrows pointing toward it. The three arrows symbolize the incident radiation on the photodiode. It is not to be confused with the designation of the LED whose arrows point away. Modern electronic devices use them extensively.

The creation of electron-hole pairs in the depletion region can be seen in the above figure. A reverse-biased photodiode produces a current proportional to the light intensity. The depletion region is comprised the blue-filled circles and white circles. Blue circles represent electrons and the holes are white circles. These are semiconductor diodes in which the amount of reverse current depends on the illumination.

Infra-Red (IR) sensitive devices use indium antimonide (InSb), indium-gallium arsenide (InGaAs), germanium (Ge), or cadmium-mercury telluride (HgCdTe). UV-sensitive devices typically use silicon carbide (SiC).

Silicon (Si) photodiodes are sensitive to visible light. Various materials can be used to make photodiodes. The commonly used materials are silicon (Si), germanium (Ge), indium gallium arsenide (InGaAs), and Indium antimonide (InSb). The choice of the semiconductor material is determined by the properties such as sensitivity, cut-off frequency, dark current, etc.

The photodiodes must desire wavelength range to perform these requirements. They are suitable for the

wavelength ranges given in the table below.

The symbol of the photodiode is the same as that of a normal p-n junction diode, except it has arrows striking the diode. The arrows striking the diode show light or photons. Modes of Operation of Photodiode It depends on the mode of the operation (forward or reverse bias). Based on the biasing applied to them, the diodes can be operated in one of three modes.

1. Photovoltaic mode 2. Photoconductive mode 3. Avalanche diode mode

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Web: <https://kary.com.pl/contact-us/>

Email: energystorage2000@gmail.com

WhatsApp: 8613816583346

