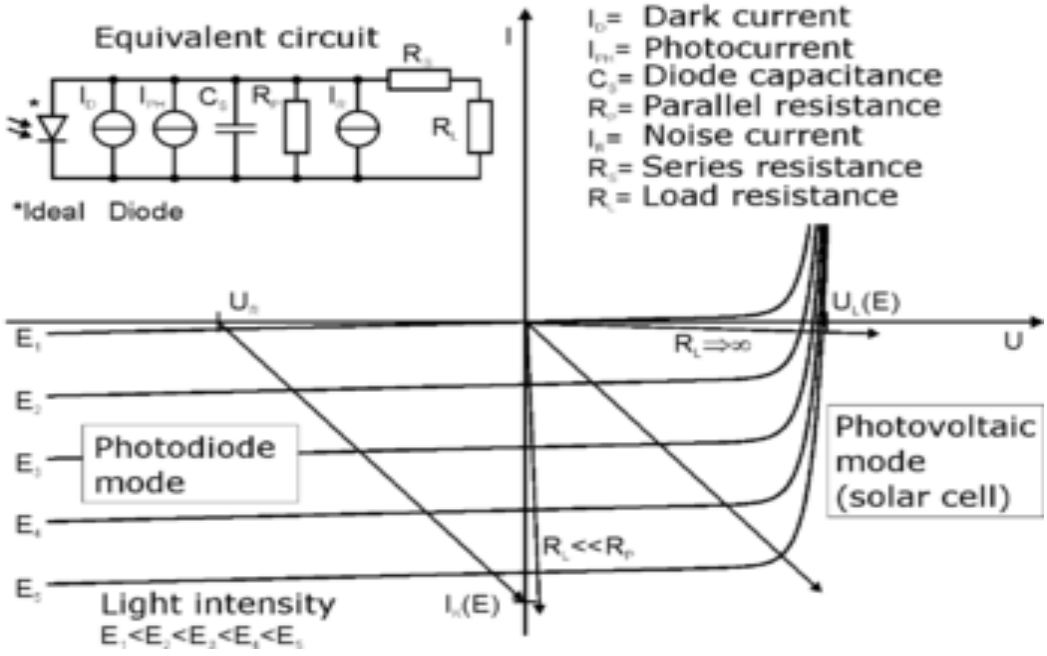
# PHOTO-DIODE

A photodiode is a type of photo-detector capable of converting light into either current or voltage, depending upon the mode of operation. The common, traditional solar cell used to generate electric solar power is a large area photodiode.

Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fiber connection to allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiode use a PIN junction rather than a p-n junction, to increase the speed of response. A photodiode is designed to operate in reverse bias.

**Principle of operation**

A photodiode is a p-n junction or PIN structure. When a photon of sufficient energy strikes the diode, it excites an electron, thereby creating a free electron (and a positively charged electron hole). This mechanism is also known as the inner photoelectric effect. If the absorption occurs in the junction's depletion region, or one diffusion length away from it, these carriers are swept from the junction by the built-in field of the depletion region. Thus holes move toward the anode, and electrons toward the cathode, and a photocurrent is produced. This photocurrent is the sum of both the dark current (without light) and the light current, so the dark current must be minimized to enhance the sensitivity of the device.


Equivalent circuit
*Ideal Diode
I
$I_D$= Dark current
$I_{ph}$= Photocurrent
$C_D$= Diode capacitance
$R_D$= Parallel resistance
$I_R$= Noise current
$R_S$= Series resistance
$R_L$= Load resistance
$U_R$
$U_L(E)$
U
$R_L \Rightarrow \infty$
$E_1$
$E_2$
$E_3$
$E_4$
$E_5$
Photodiode mode
Photovoltaic mode (solar cell)
$R_L << R_D$
Light intensity
$E_1<E_2<E_3<E_4<E_5$
$I_K(E)$