Electrical Circuit and Electronics

Optoelectronic Devices

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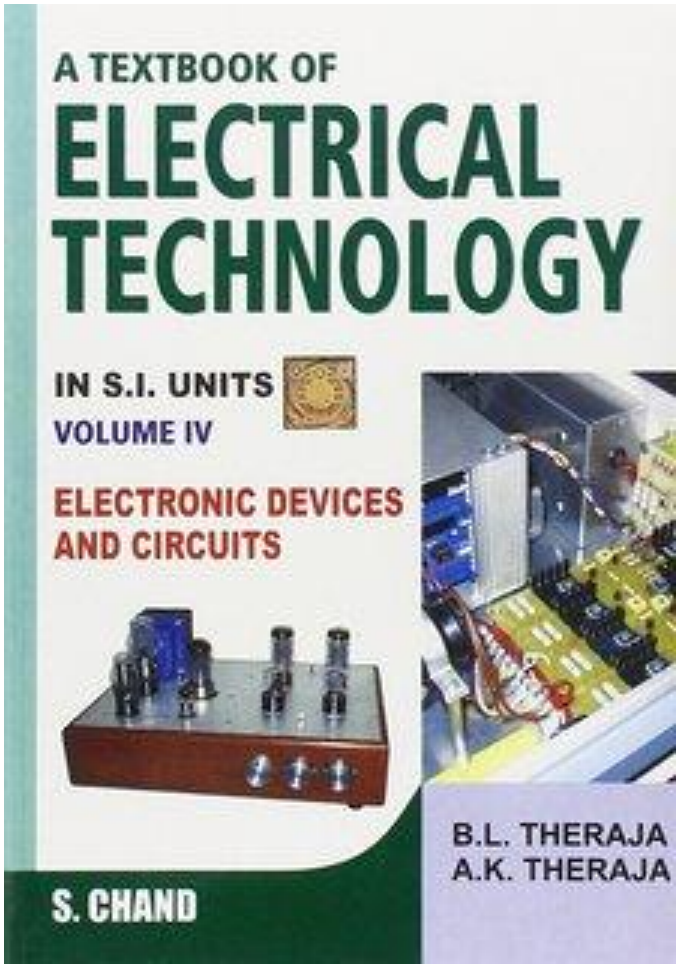
Reference Books Recommended

- **A Textbook of Electrical Technology**

VOLUME: IV

(Electronic Devices and Circuits)

- B. L. Theraja



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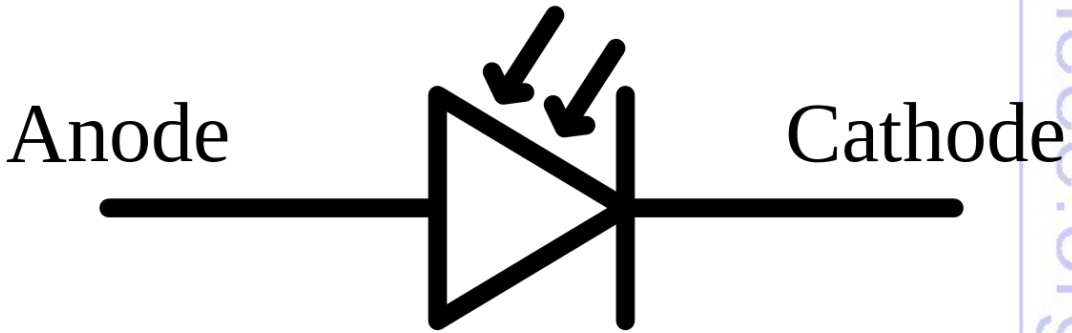
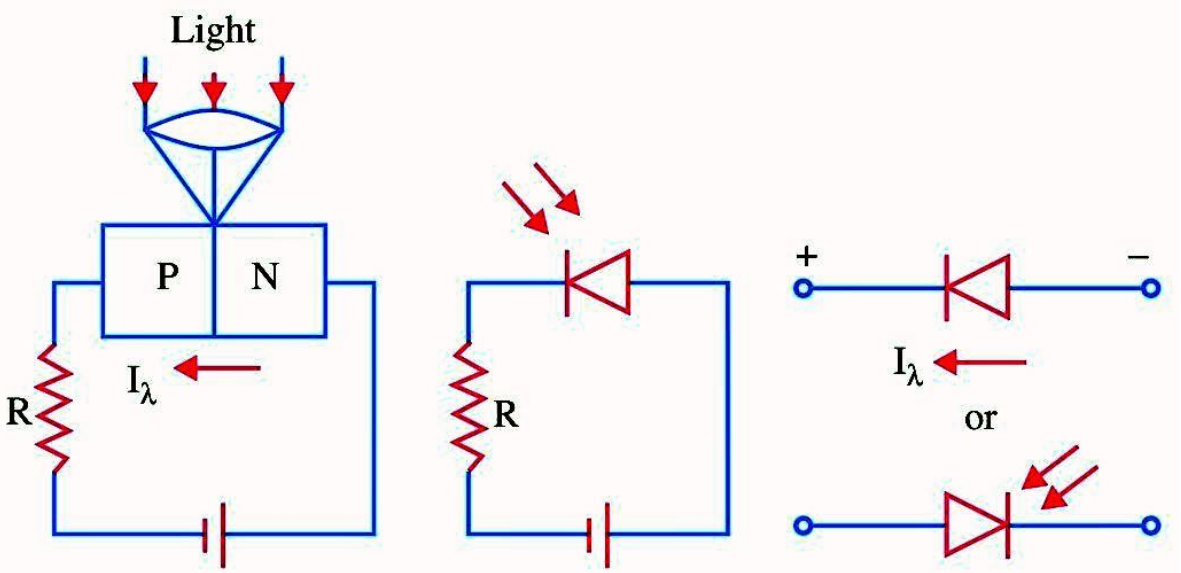
Photodiode

A photodiode is a semiconductor device that converts light into current. The current is generated when photons are absorbed in the photodiode. A small amount of current is also produced when no light is present (Dark Current).



Ref: Theraja: Article 53.5: page 2093

Photodiode



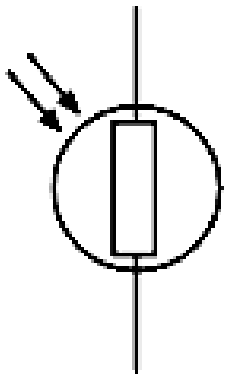
Applications of Photodiode:

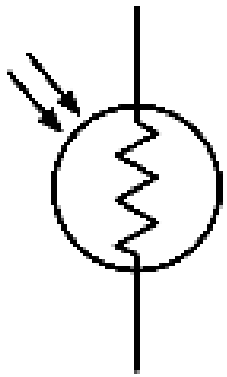
1. detection, both visible and invisible ;
2. demodulation ;
3. switching ;
4. logic circuit that require stability and high speed ;
5. character recognition ;
6. Optical communication equipment ;
7. encoders etc.

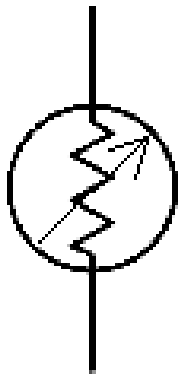
Ref: Theraja: Article 53.5: page 2093

Light Dependent Resistor (LDR)

It is a semiconductor device whose resistance varies inversely with the intensity of light that falls upon it. It is also known as photoresistive cell / photoresistor / Photoconductive Cell.

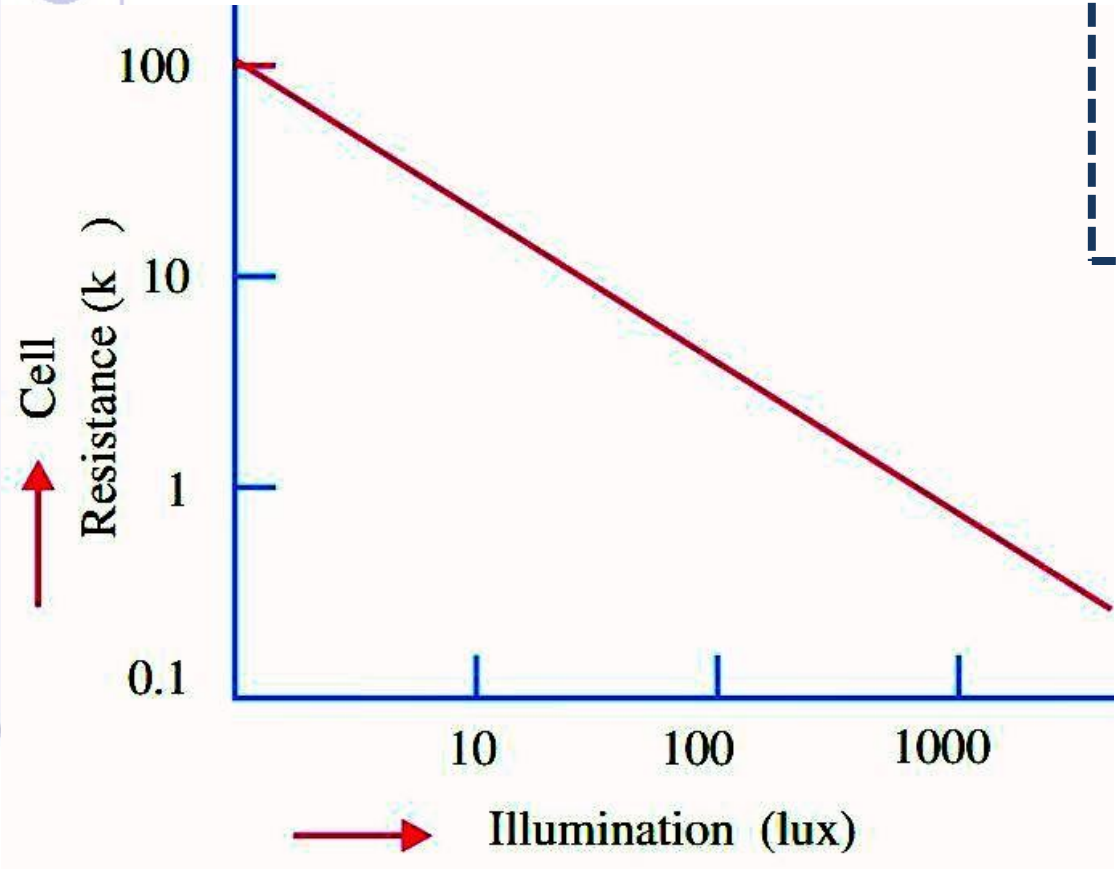






Ref: Theraja: Article 53.7: page 2094

Light Dependent Resistor (LDR)



HOMEWORK

Book: B L Theraja

Page: 2095

Example: 53.1

Difference Between Photodiode & LDR

- Photodiode is used in applications that can only do with two values: either on or off; LDR varies the light depending on certain factors.
- Photodiode has a quicker response time as opposed to LDR which is analog.
- LDR is a bidirectional resistor whereas photo diode is a unidirectional resistor.

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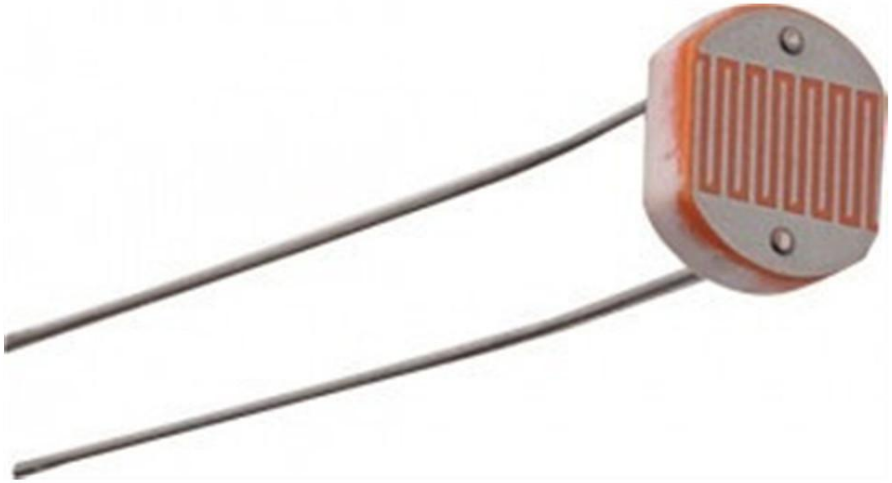
Ref: Theraja: Article 53.7: page 2095

Photoconductive Cell



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Ref: Theraja: Article 53.7: page 2095

Light Emitting Diode (LED)

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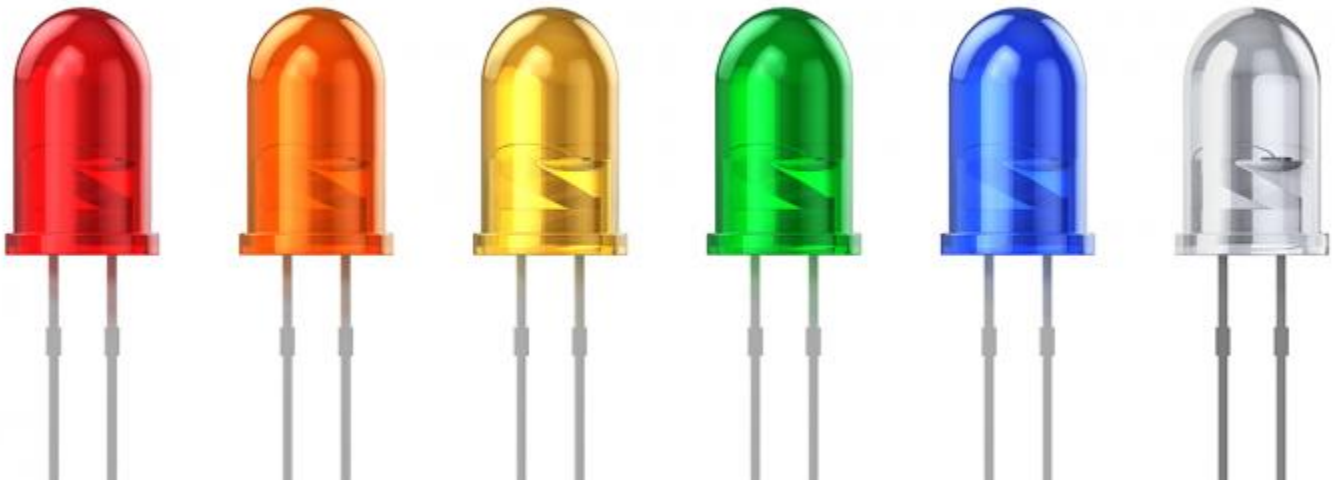
Ref: Theraja: Article 53.2: page 2088

Light Emitting Diode (LED)



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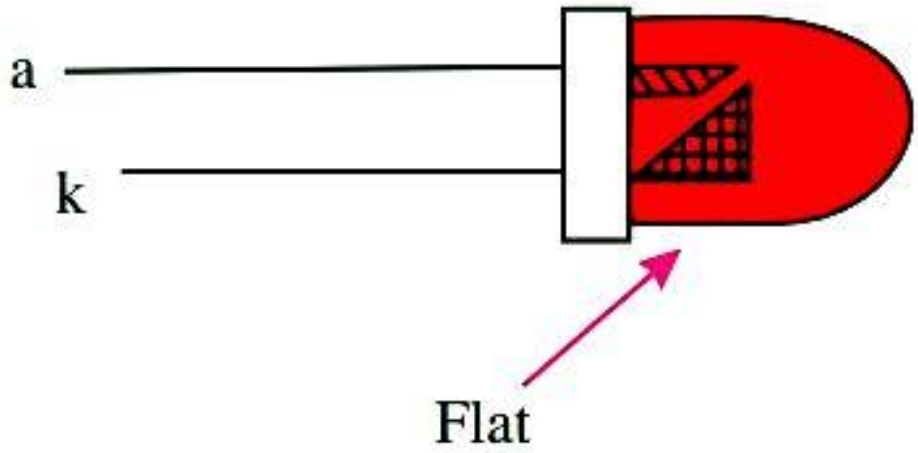

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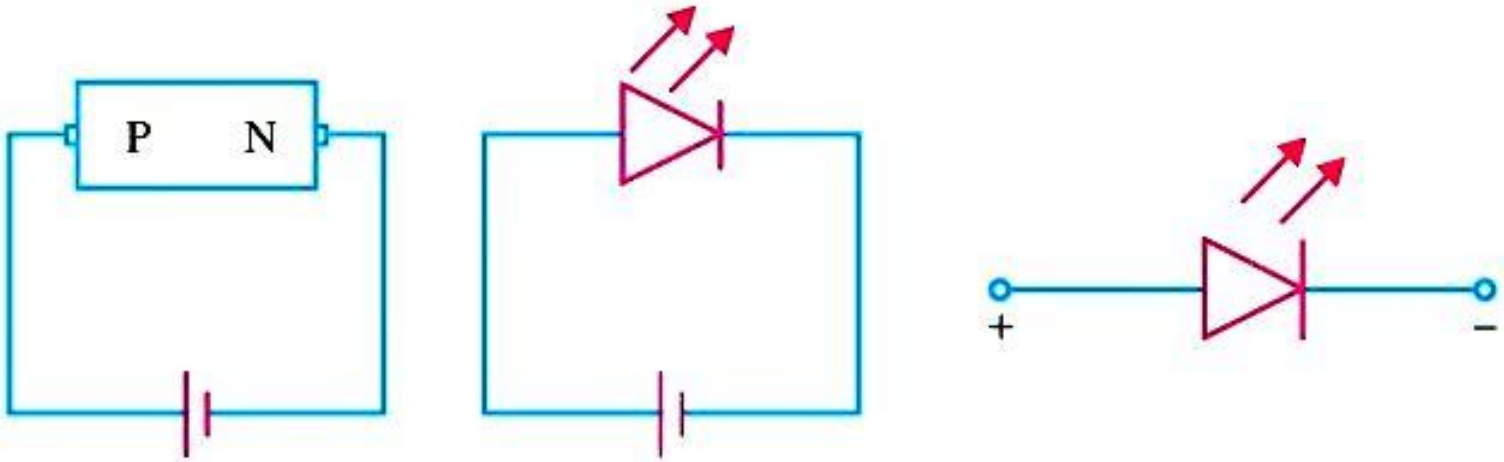

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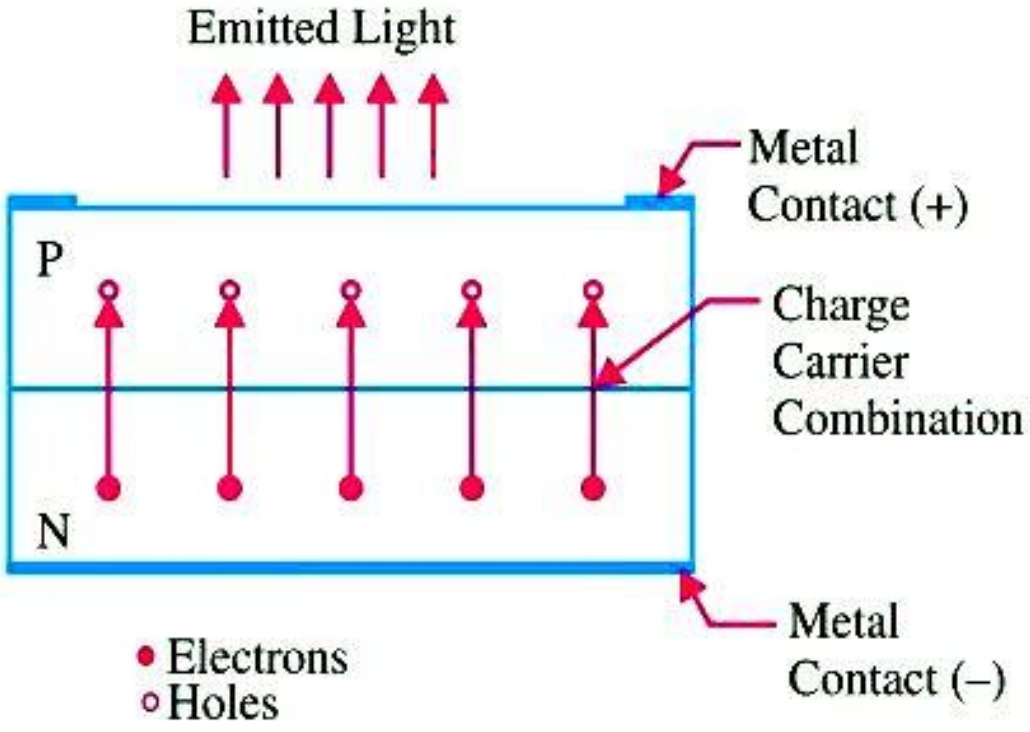

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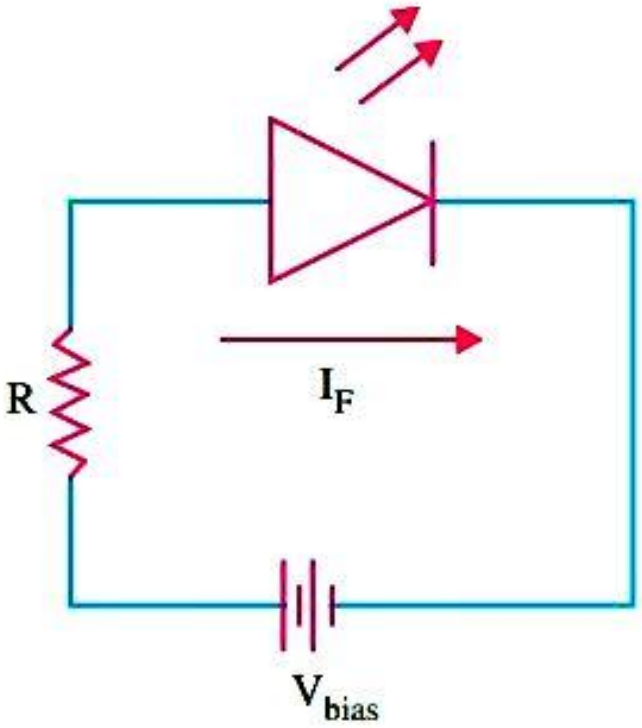

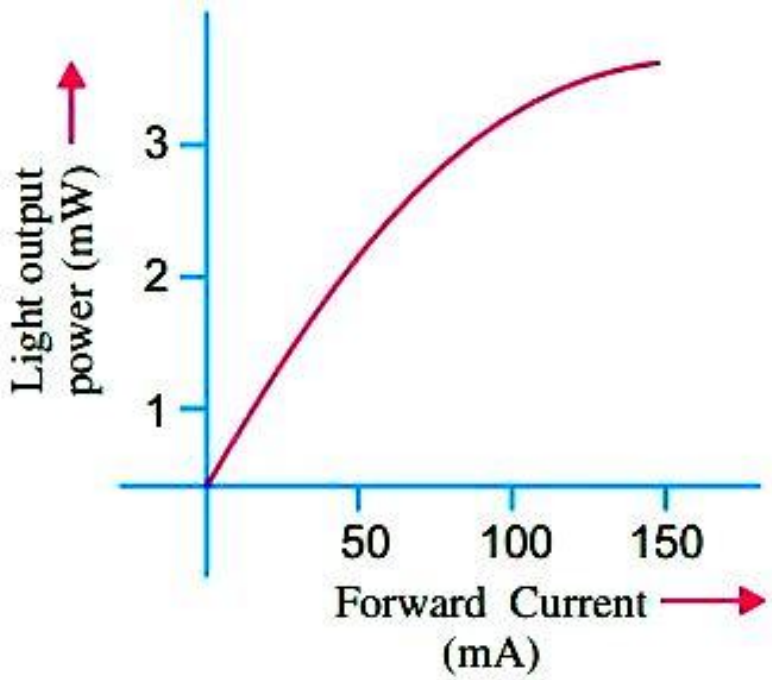

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Ref: Theraja: Article 53.2: page 2088

Light Emitting Diode (LED)

Applications:

1. LEDs are used in burglar-alarm systems;
2. for solid-state video displays which are rapidly replacing cathode-ray tubes (CRT);
3. in image sensing circuits used for 'picturephone';
4. in the field of optical fibre communication systems where high-radiance GaAs diodes are matched into the silica-fibre optical cable;
5. in data links and remote controllers;
6. in arrays of different types for displaying alphanumeric (letters and numbers) or supplying input power to lasers or for entering information into optical computer memories;
7. for numeric displays in hand-held or pocket calculators.

Ref: Theraja: Article 53.2: page 2088

Liquid Crystals Display (LCD)

Ref: Theraja: Article 53.4: page 2092

Liquid Crystals Display (LCD)

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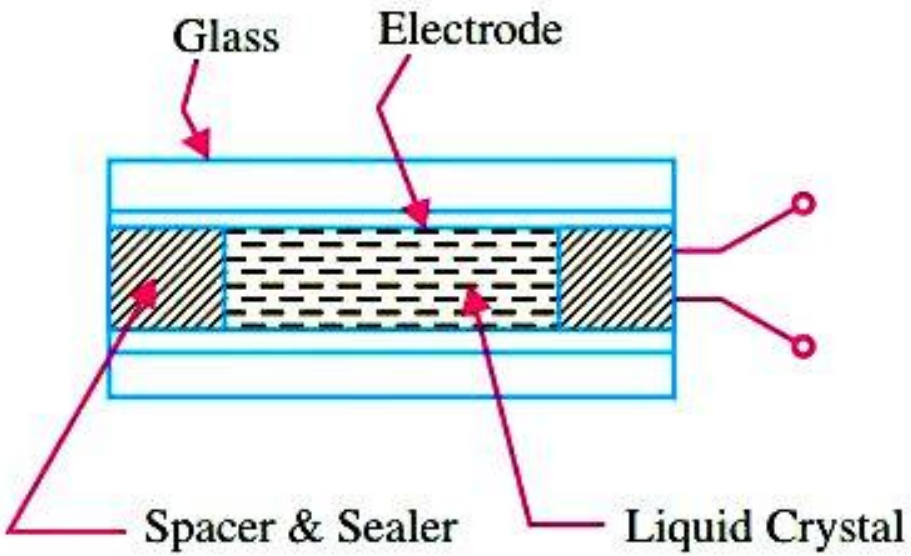
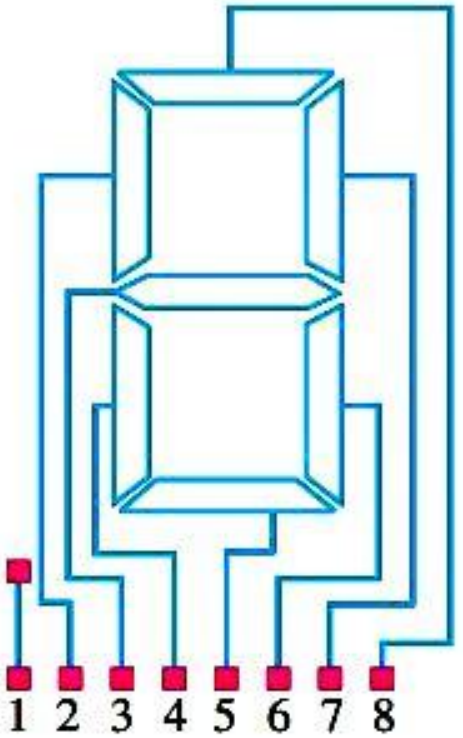
Liquid Crystals Display (LCD)





Ref: Theraja: Article 53.4: page 2092

Liquid Crystals Display (LCD)

Applications:

1. Field-effect LCDs are normally used in watches and portable instruments where source of energy is a prime consideration.
2. Thousands of tiny LCDs are used to form the picture elements (pixels) of the screen in one type of B & W pocket TV receiver.
3. Recent desk top LCD monitors.
4. Note book computer display
5. Cellular phone display, to display data on personal digital assistant (PDAs) such as Palm V*x*

Ref: Theraja: Article 53.4: page 2092

Dust Sensor

The combination of an LED and a photodiode is also used :

(1) as a paper sensor in facsimile machines,
(2) as a tape-end sensor in videotape recorders/players,
(3) as a dirt detector for rinsing in washing machines.

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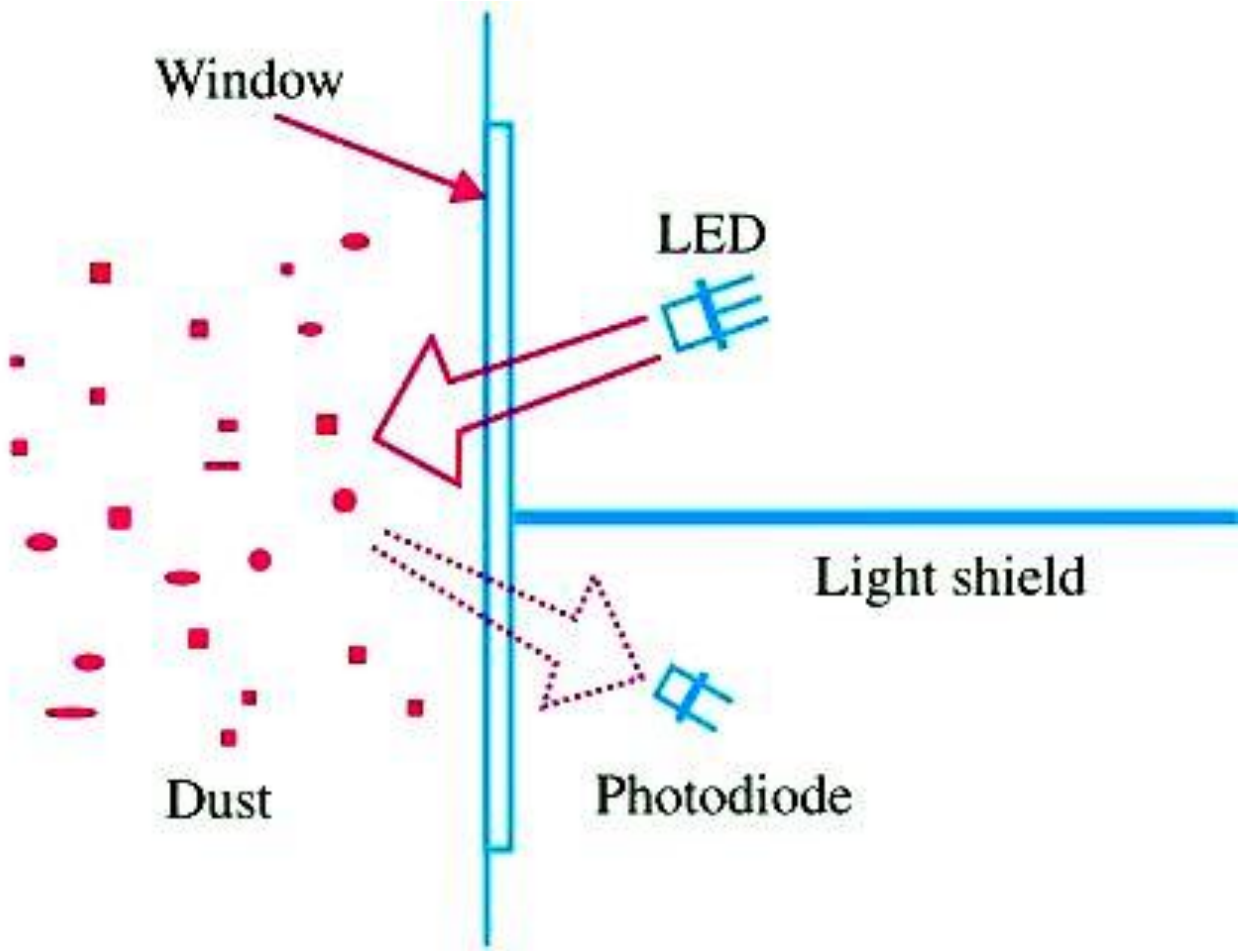
Dust Sensor



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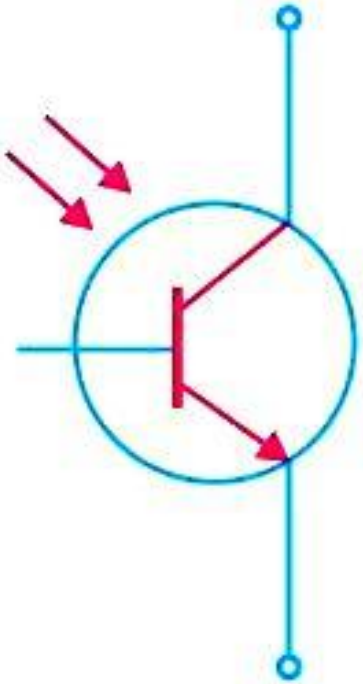
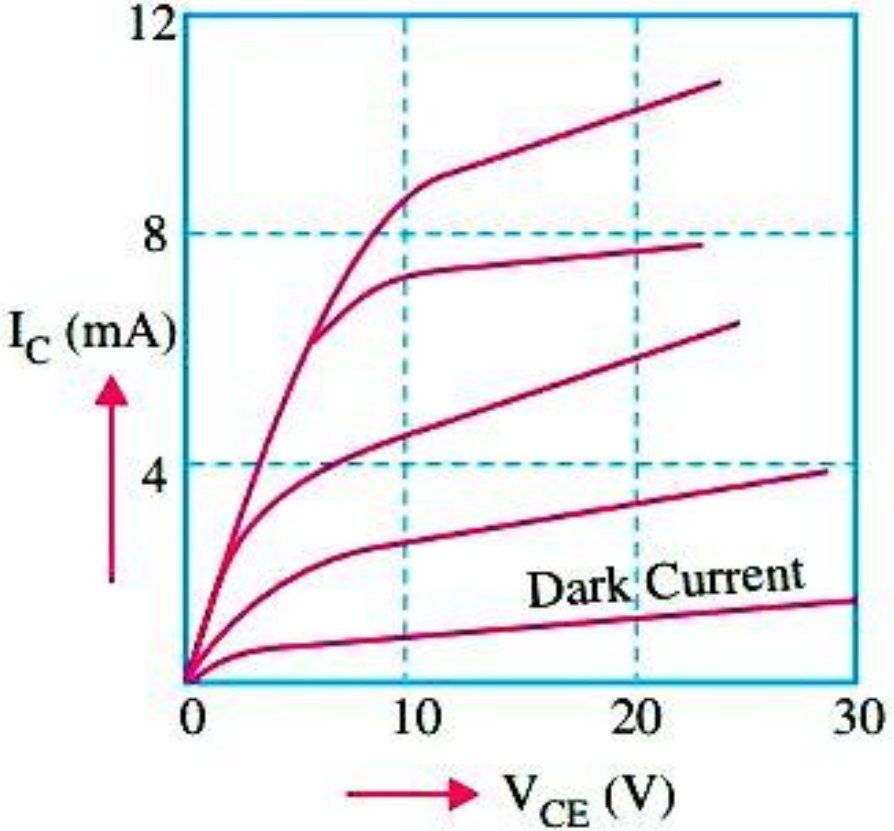
Ref: Theraja: Article 53.6: page 2094

Phototransistor

Ref: Theraja: Article 53.8: page 2095

Phototransistor





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Ref: Theraja: Article 53.8: page 2095

Phototransistor

Silicon NPNs are mostly used as photo transistors. When there is no incident light on the CB junction, there is a small thermally-generated collector to emitter leakage current I_{CEO} which, in this case, is called dark current and is in the *nA* range. When light is incident on the CB junction, a base current I_λ is produced which is directly proportional to the light intensity. Hence, collector current $I_C = \beta I_\lambda$

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Photo Voltaic / Solar Cell

Ref: Theraja: Article 53.10: page 2097

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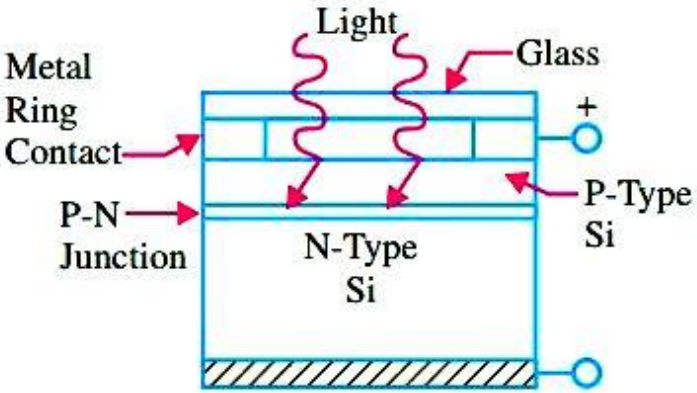
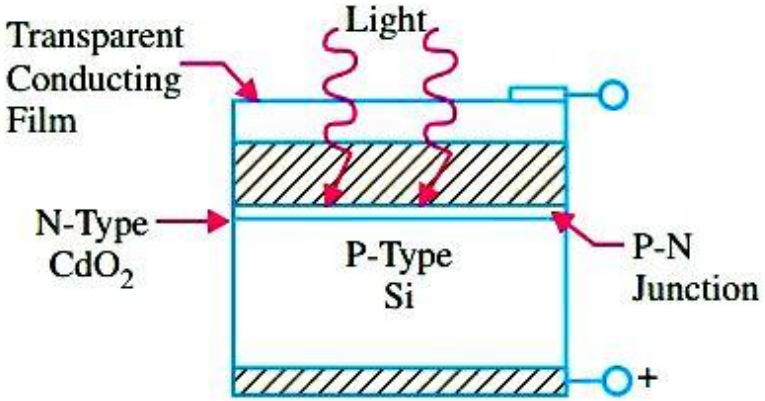
Photo Voltaic / Solar Cell





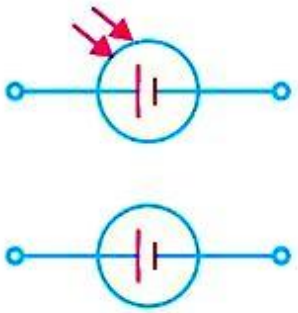


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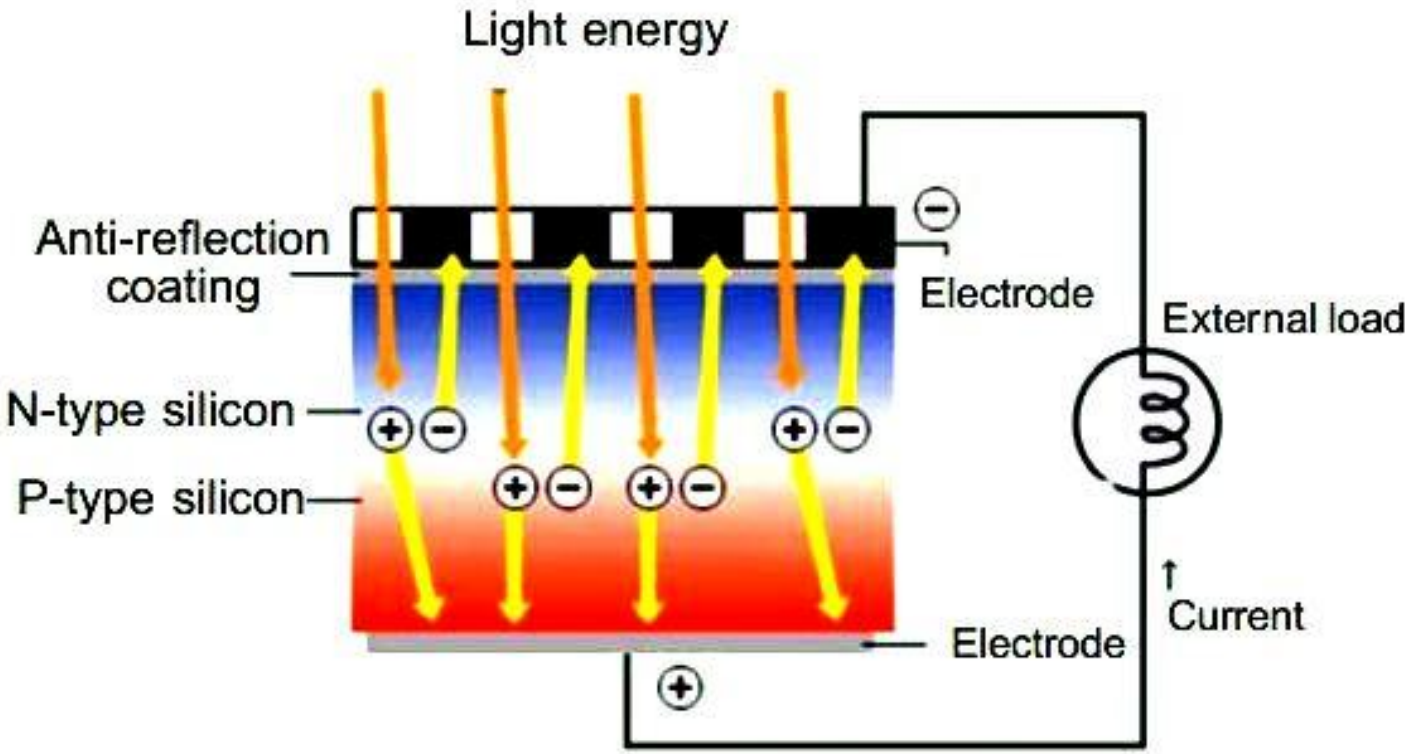
Photo Voltaic / Solar Cell



A photovoltaic cell generates electricity when irradiated by sunlight

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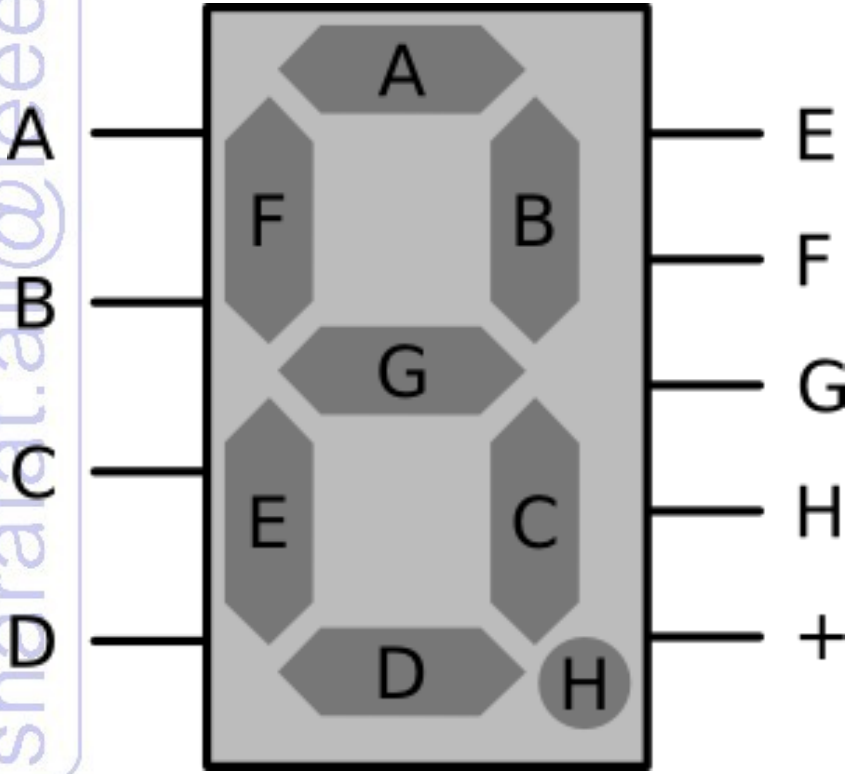
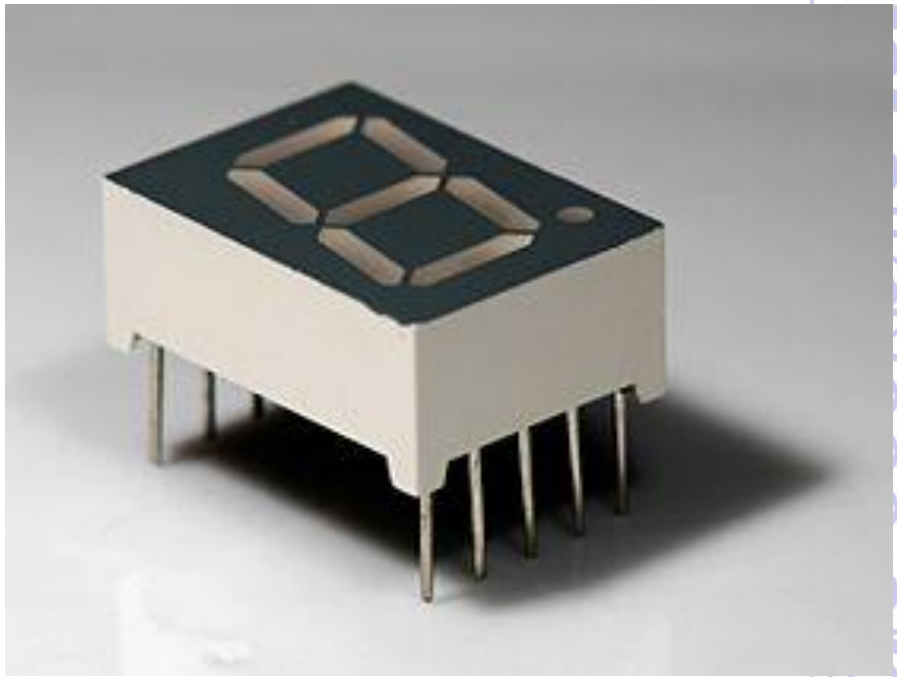
Ref: Theraja: Article 53.10: page 2097

Seven Segment Display





Alphanumeric Display

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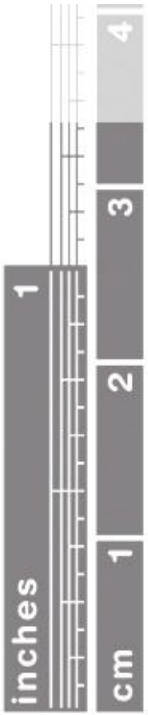
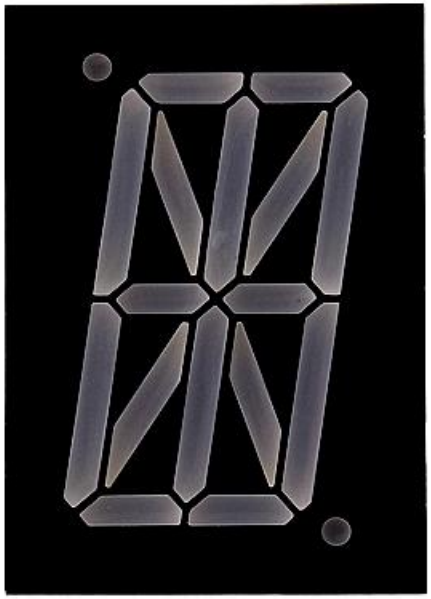
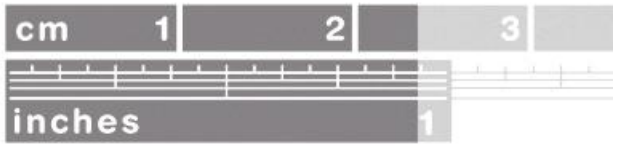
Alphanumeric Display







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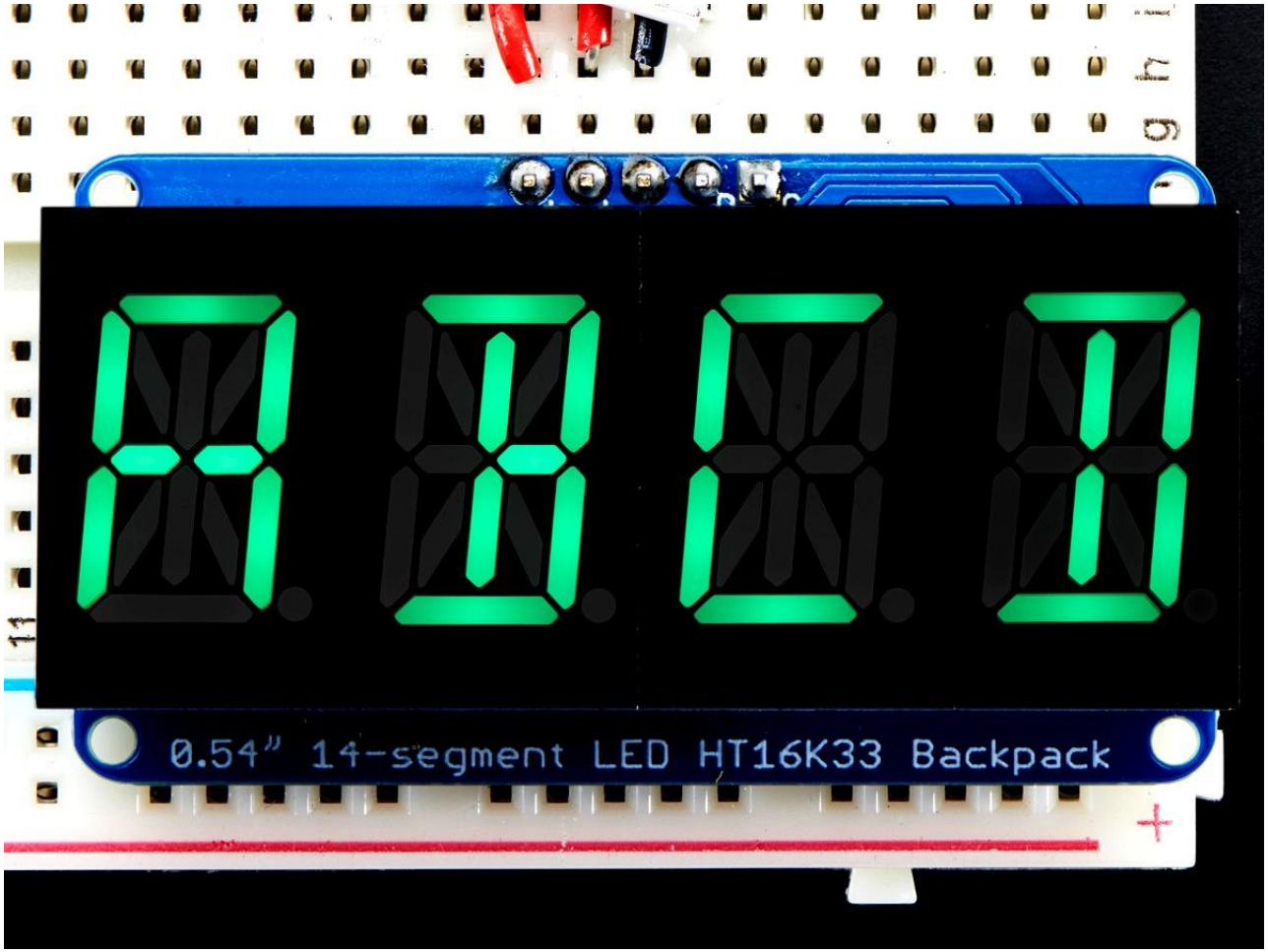

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Photo Couplers

In electronics, an **opto-isolator**, also called an **opto-coupler**, **photo-coupler**, or **optical isolator**, is a component that transfers electrical signals between two isolated circuits by using light. Opto-isolators prevent high voltages from affecting the system receiving the signal. Commercially available opto-isolators withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 10 kV/µs.

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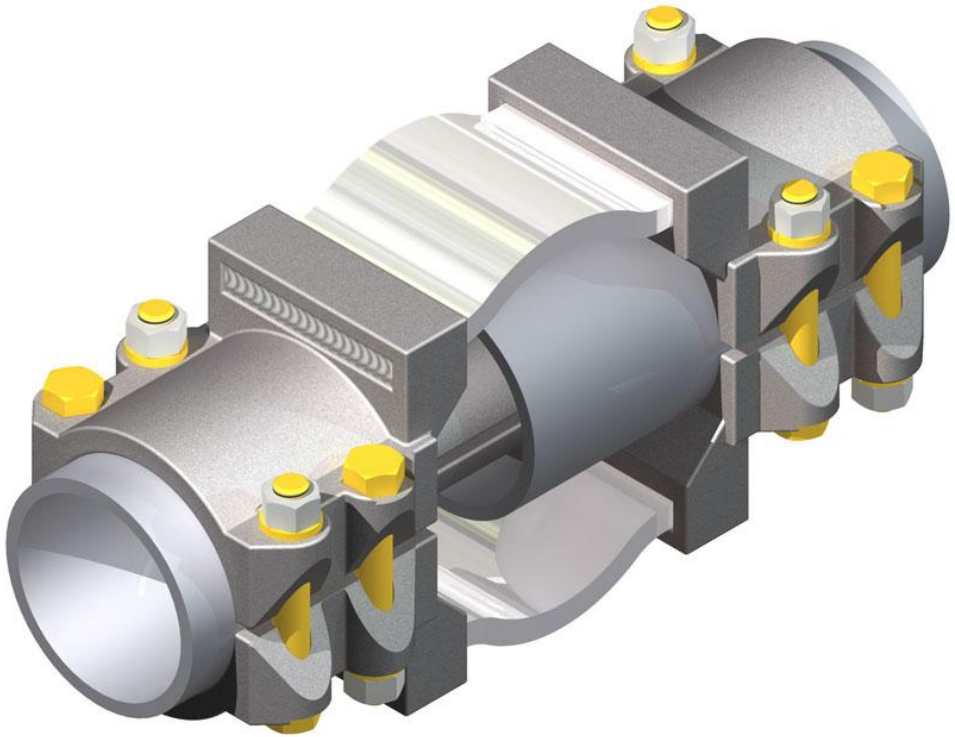
Photo Couplers



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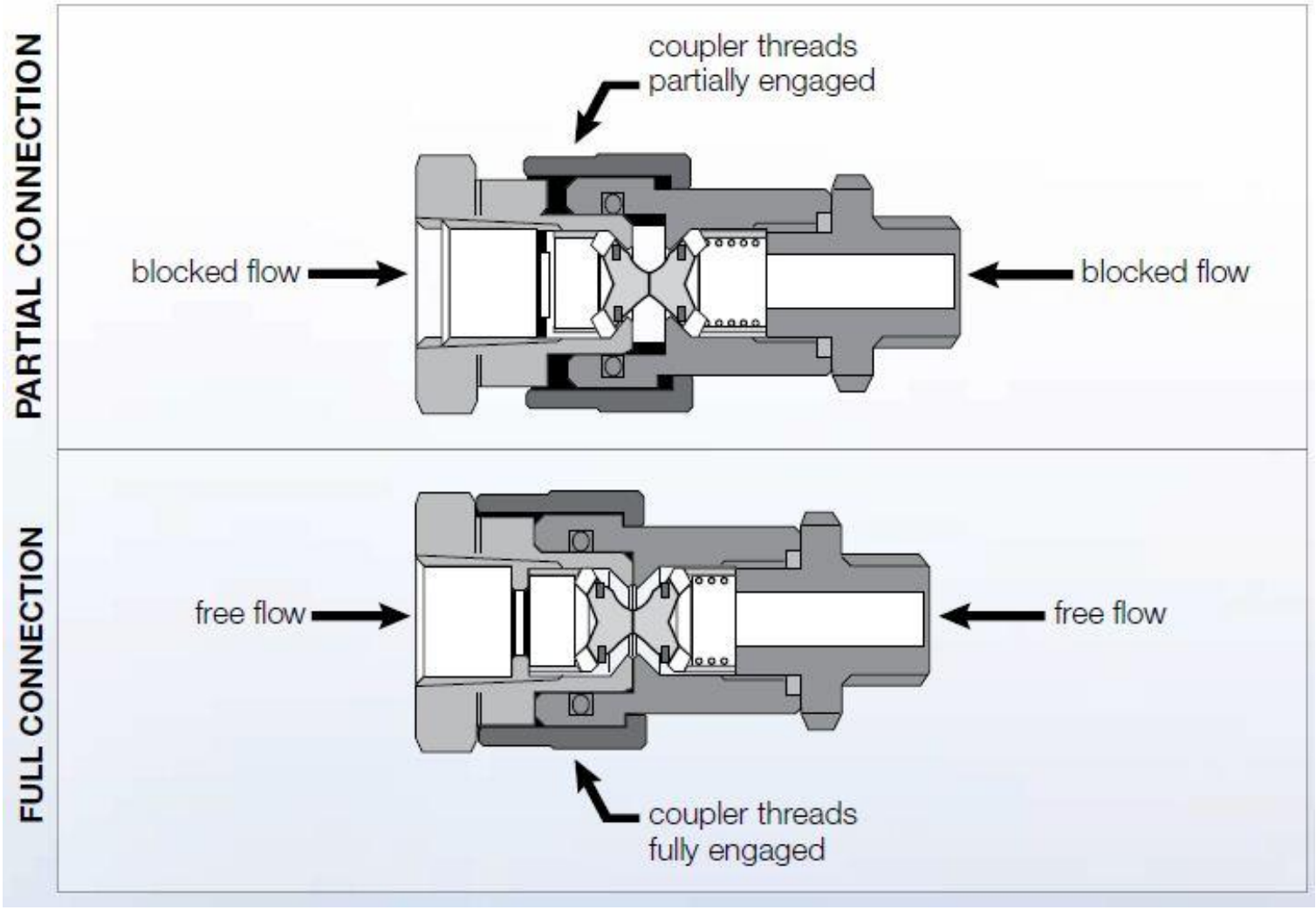

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