

Introductions to Electronics Laboratory

*By
Dr. Basim Al-Qargholi*

Resistor:

The resistor is a two-terminal component which is denoted by R. Symbol of the resistor is represented by Zig-Zag lines between two terminals. It is a common and widely used symbol in schematics. It can also be represented by another symbol that has an unfilled rectangle between two terminals instead of Zig-Zag lines. There are various types of resistors like a variable resistor, LDR, Thermistor, MOV, etc.

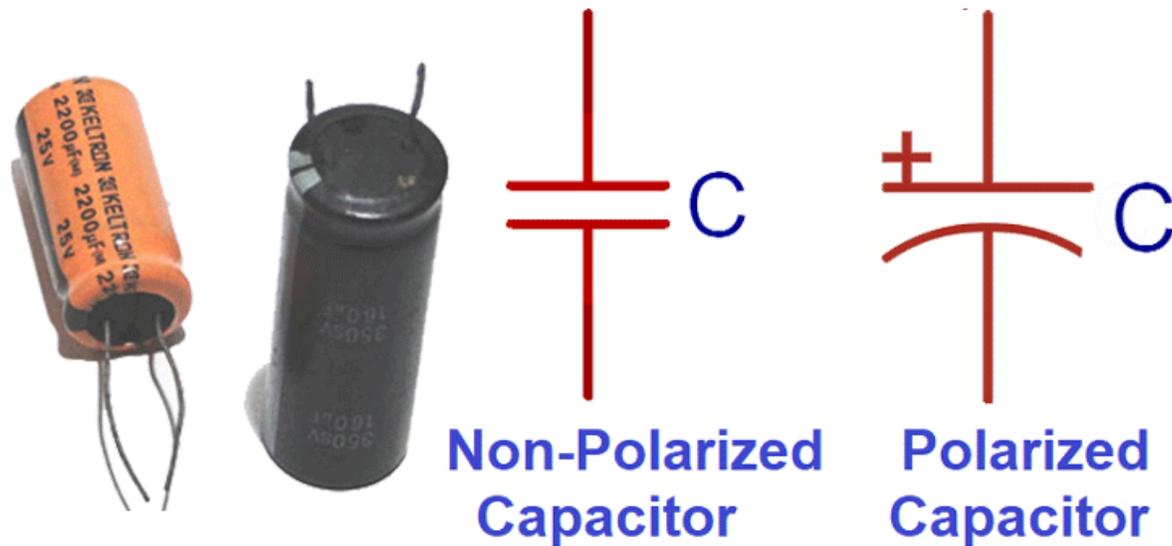


Capacitor:

The capacitor is a two-terminal component denoted by C. Symbol of the capacitor looks like the two parallel plates are placed in between two terminals. In the schematic, two types of capacitor symbols are available. One is for a polarized capacitor and the other one is for the non-polarized capacitor.

The difference between both the symbols is that in the polarized capacitor symbol, one parallel plate has a curved shape. The curved plate represents the cathode of the capacitor and should be at a lower voltage than the anode pin (plane-parallel plate). The plane-parallel plate is the anode of the capacitor and is marked by plus (+) sign.

As the name indicates, a non-polarized capacitor can be connected in two ways but for polarized capacitor only specified one-way Connection is possible. The value of the capacitor is measured in farads (F).



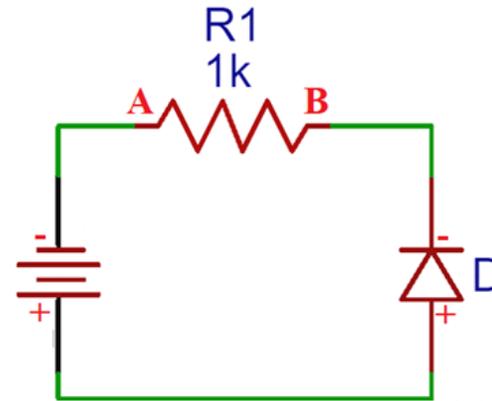
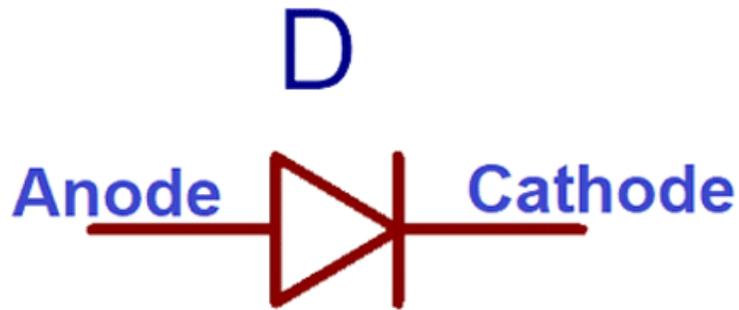
Inductor:

An inductor is a non-polarized two-terminal component. Inductor's Symbol contains loopy coils or curved bumps in between two terminals. The international symbol of an inductor considers a filled-in rectangle instead of loopy coils. An inductor is denoted by 'L' and the unit is Henry (H). Here are few Inductors with their pinouts and working.

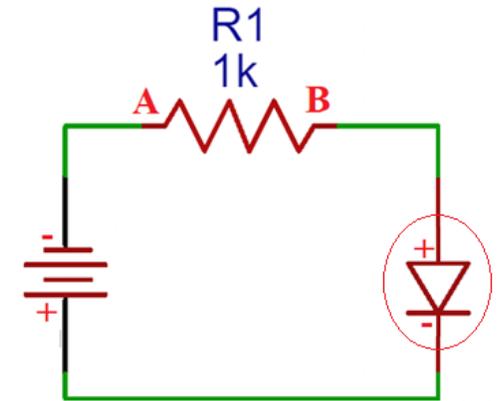


Diode:

The diode is a polarized device with two terminals and denoted by D. In a diode, one terminal is positive (anode) and another one is negative (cathode). The closed side of a triangle is the cathode, and the base of a triangle is an anode. The symbol of a diode looks like a horizontal isosceles triangle pressed up against a line between two terminals. The diode works in the forward bias or we can say that the diode will let the current flow in the forward bias condition. Therefore, it is important to note that the positive terminal (anode) of the diode is connected to the positive pole of the battery and negative pole (cathode) of the diode is connected to the negative terminal of the battery.



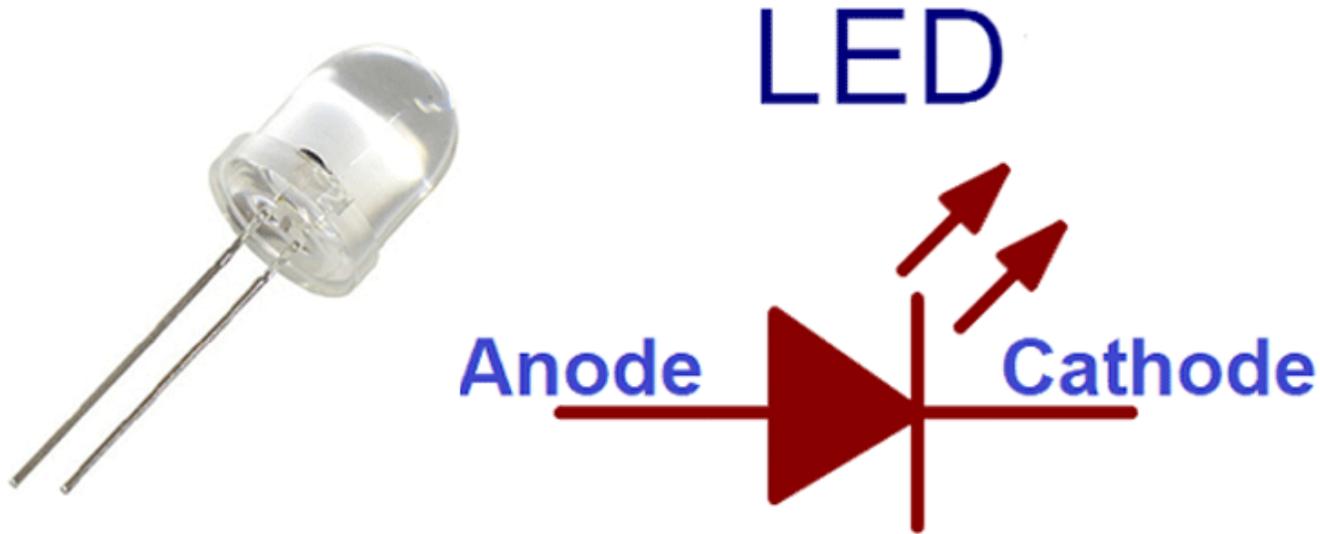
Right Connection
Forward-Bias Connection



Wrong Connection
Reverse-Bias Connection

Light Emitting Diode (LED):

LED stands for light-emitting diode. The LED symbol is similar to the diode symbol with additional arrows. These arrows appear to point in the opposite direction of the triangle and seem to radiate from the triangle. LED is a polarized component with anode and cathode terminals.



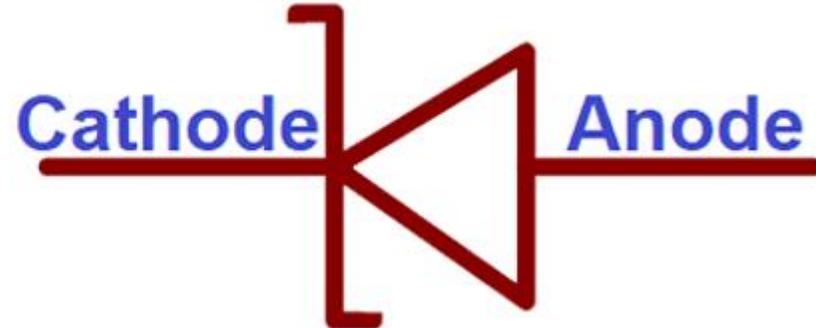
Photodiode:

The symbol of the photodiode is similar to the LED Symbol except that it contains arrows striking the diode. Arrows striking the diode represent photons or light. The photodiode has two terminals named anode and cathode. A photodiode is used to convert light into electrical current.



Zener Diode:

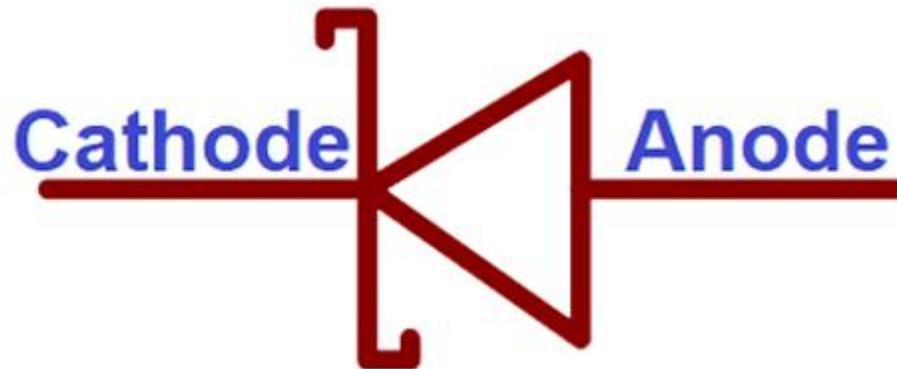
It is similar to the normal forward diode; it also allows reverse current when the applied voltage reaches the breakdown voltage. The diode has a special, heavily doped P-N junction, which is designed to operate in the reverse direction when a certain specified voltage is reached.



Schottky Diode:

The Schottky diode has a lower forward voltage drop than the PN junction diode, and it is a metal-semiconductor diode. It can be used in high-speed switching applications. The Schottky diode is a unipolar device because it has electrons as majority carriers on both sides of the junction.

For this reason, electrons cannot flow across the Schottky barrier. Under the forward biased condition, an electron present on the N side receives more energy to cross the barrier and enter into the metal. Therefore, the diode is called a hot carrier diode. Due to this, the electrons are also called hot charge carriers.



Transistors:

In schematics, various transistors are available, either BJTs or MOSFETs. The transistor is a three-terminal device that amplifies or switches electronic signals and electrical power. We have previously covered various Transistors with their symbols, pinouts, and specifications.

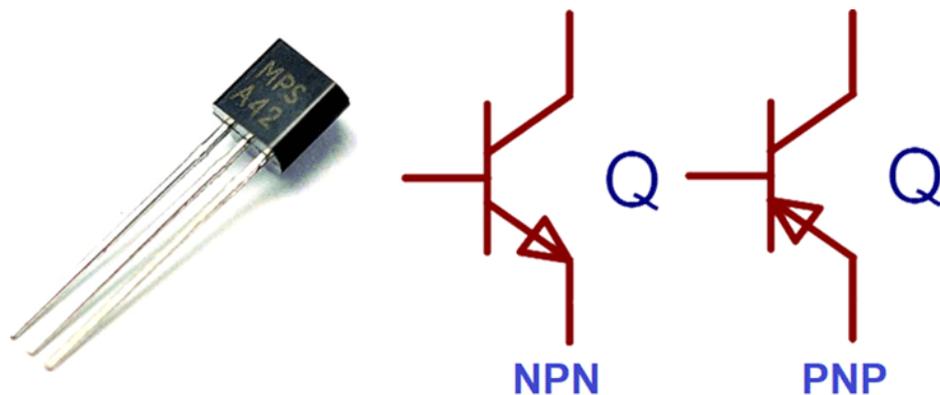
Bipolar Junction Transistor (BJT):

BJT is a bipolar transistor with three terminals: emitter (E), base (B) and collector (C). For the BJT symbol, emitter and collector are arranged in a line and the base is arranged vertically. There are two types of BJTs: NPN and PNP.

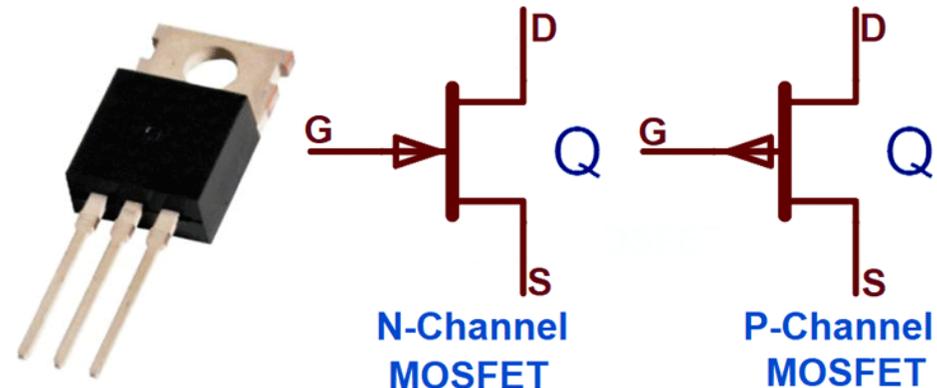
MOSFET:

MOSFET stands for Metal Oxide Field Effect Transistor, and it has three terminals named Source (S), Drain (D), and Gate (G). MOSFET has two types of symbols for n-channel or p-channel MOSFET. Here you can learn about various types of MOSFETs.

Just like BJT, in MOSFET, the direction of the arrow is used to distinguish between n-channel and p-channel MOSFET. If the arrow at the center of the symbol is pointing IN, it is an n-channel MOSFET and if the arrow is pointing OUT, it is a p-channel MOSFET.



Bipolar Junction Transistor (BJT)



MOSFET: