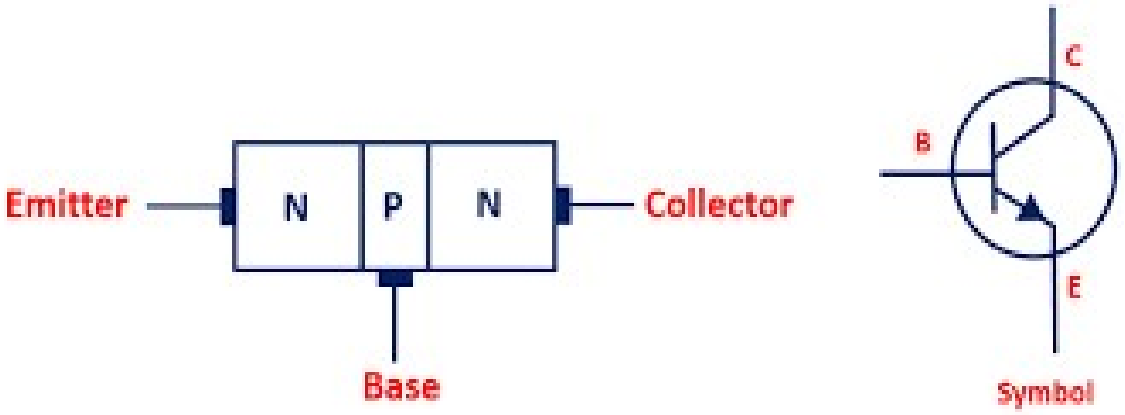
BIPOLAR JUNCTION TRANSISTOR

A bipolar junction transistor (BJT) is a three-terminal device that is widely used in electronic circuits. It is a type of transistor that consists of three layers of semiconductor materials, two of which are doped to form a p-n junction. The BJT is used in amplifying signals, in switch circuits, and performing other important functions. BJTs use two p–n junctions between two semiconductor types, n-type and p-type, which are regions in a single crystal of material.



Working of BJT:

A BJT has three layers:

- Emitter
- Base
- Collector

The emitter is heavily doped with impurities that donate free electrons, making it an n-type material.

The base is lightly doped compared to the emitter and collector.

The collector is heavily doped with impurities that accept free electrons, making it a p-type material.

When a small voltage is applied between the base and emitter, it creates a current flow from the emitter to the base because the base-emitter junction is forward-biased which makes current flow easily. However, this current is small as the base is lightly doped.

If a larger voltage is applied between the collector and emitter, a much larger current will flow from the collector to the emitter. This is because the collector-emitter junction is reverse-biased, which normally prevents current from flowing and widens the depletion region making a larger region for combining electrons and holes. This results in a much larger current flowing from the collector to the emitter.

This makes the BJT an "amplifier" of current since a small change in the current flowing into the base can make a larger change in the current flowing through the collector.

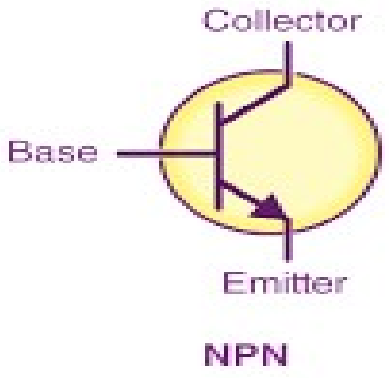
Types of BJT:

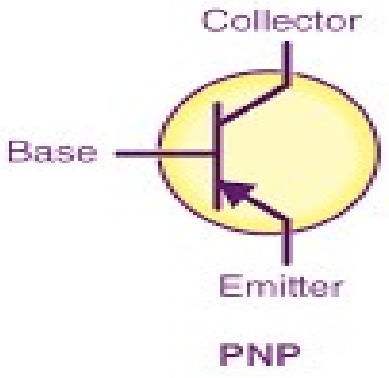
There are two types of BJT:

(a) **NPN:** In an NPN transistor, the majority of charge carriers in the emitter and collector region are electrons, and the base is doped with a p-type material. When current is applied to the base, electrons flow from the emitter to the collector, resulting in the amplification of signals.

(b) **PNP:** In a PNP transistor, the majority of charge carriers in the emitter and collector region are holes, and the base region is doped with n-type material. When current is applied to the base, holes flow from the emitter to the collector, resulting in the amplification of signals.

The operation of the NPN and PNP transistors is similar, but the polarity of the voltage applied to the terminals is different.





Applications of BJT:

1. **Amplifiers**: The BJT is commonly used as an amplifier. It is used to amplify both analog and digital signals. The BJT can amplify signals with frequencies ranging from a few hertz to several gigahertz. The BJT is used in various applications such as audio amplifiers, power amplifiers, and radio frequency amplifiers.

2. **Switches**The BJT can be used for switching on and off by applying a small voltage to the base. The BJT is used as a switch in various applications such as motor control, power supplies, and digital circuits.

3. **Oscillators**: The BJT can also be used to generate oscillations. The BJT is used in various oscillator circuits such as the Colpitts oscillator, Hartley oscillator, and the Pierce oscillator. These oscillators are used in various applications such as radio transmitters, signal generators, and clocks.

4. **Temperature sensors**: The BJT is used in various temperature sensor circuits such as the diode temperature

sensor and the thermistor temperature sensor. These temperature sensors are used in various applications such as temperature controllers, thermostats, and climate control systems.

5. **Current regulators:** The BJT is used in various current regulator circuits such as the current source and the current sink. These current regulators are used in various applications such as LED drivers, battery chargers, and power supplies.

CONCLUSION:

The BJT is a widely used transistor that has several applications in various fields. The BJT is used as an amplifier, switch, oscillator, temperature sensor, and current regulator. The BJT is a versatile device that can perform various functions and is an essential component of modern electronic circuits.