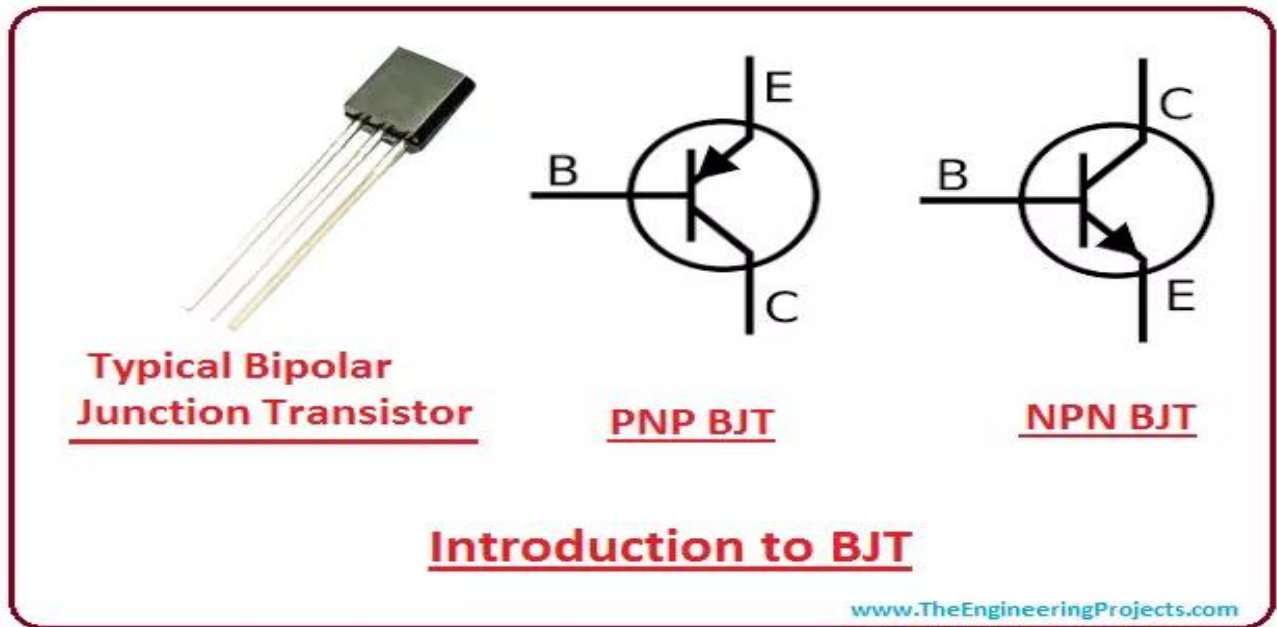


BJT (Bipolar Junction Transistor)



BJT (Bipolar Junction Transistor) is an electronic component mainly used for amplification and switching purpose. As the name suggests, it is composed of two junctions called emitter-base junction and collector-base junction. Don't be confuse BJT with regular transistors.

A transistor is a semiconductor device, comes with three terminals that are used for external connection with electronic circuits. A transistor is termed as a trans resistor which is used as switch or gate for electronic signals. Small signals applied between one pair of its terminals are used to control much larger signals at the other pair of terminals. Actually, transistors are divided into two categories called unipolar transistor and a bipolar transistor. Bipolar junction transistor uses two charge carries i.e. electrons and holes while unipolar

transistor like FETs (Field Effect Transistors) uses only one charge carrier. I hope you are aware of another type of transistors called MOSFET. I'll try to cover each and everything related to this bipolar junction transistor, so you find all information at one place. Let's get started.

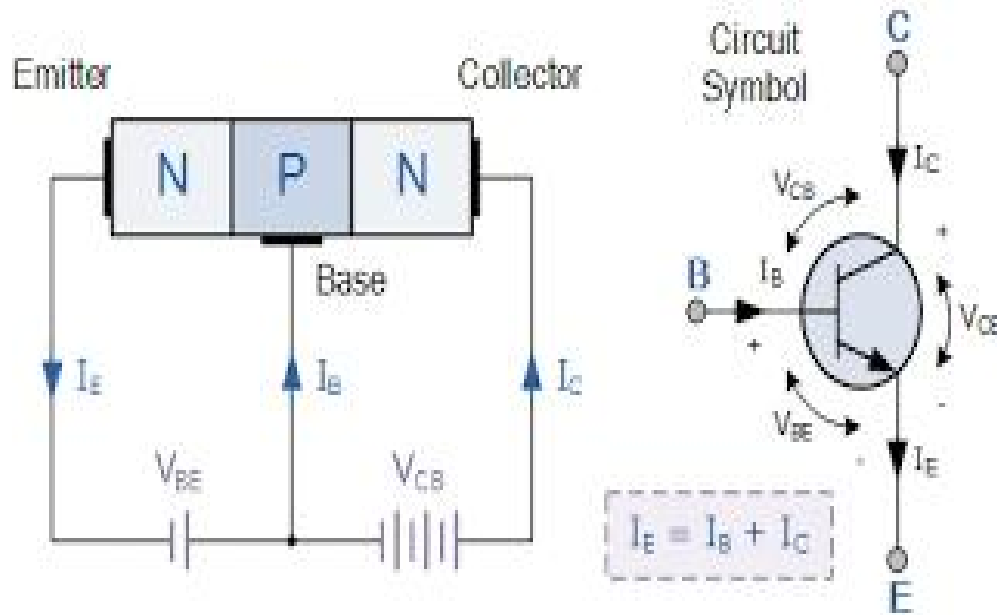


(William Bradford Shockley 1910-1989)

Types of BJT

BJTs are divided into two types based on the nature and construction of the transistor. Following are two main types of the BJT.

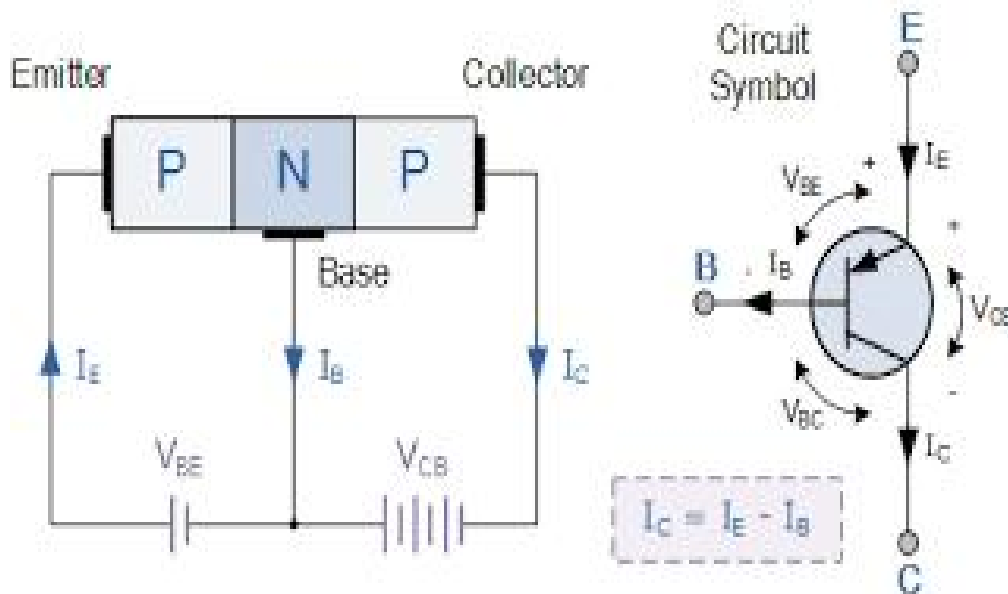
NPN :-



- NPN (negative-positive-negative) is a type of BJT where a P-doped layer of semiconductor exists between the two layers of N doped material.
- The P doped region represents the base of the transistors while other two layers represent emitter and collector respectively.
- NPN transistors are also called minority carrier devices because minority charge carriers at the base side are used to control large current at other terminals of the transistor.

- The current moves from an emitter to the collector where electrons act as a minority carrier at the base side.

PNP :-



- PNP (positive-negative-positive) transistor is a type of BJT where N doped semiconductor layer which acts as a base, is housed between the two layers of P doped material.
- The base uses small base current and negative base voltage to control large current at the emitter and collector side and voltage at the collector side is larger than the voltage at the base side.
- In PNP transistor current direction and voltage polarities are reversed as compared to NPN transistors.
- PNP transistors work in a similar way like NPN transistor with some exception i.e. holes are diffused through the base from an emitter and are collected by the collector.

- This transistor is rarely used for applications as conduction carried out by the movement of electrons is considered fast and holds more value as conduction by movement of holes.

Working of BJT

The word “transistor” is the combination of two words, “Trans” (Transform) and “istor” (Varistor). So, it means the transistor can transform its resistance. The resistance varies in such way that it can either act as an insulator or conductor by applying small signal voltage. This changing ability makes it able to perform both as an “Amplifier” or a “Switch”. It can be used either as a switch or an amplifier at a single time. Therefore, BJT can operate in three different regions to perform the said operation.

Forward Active Mode

- BJT comes with two junctions called emitter-base junction and collector-base junction. Emitter-base junction is forward biased and the collector-base junction is reverse biased.
- For amplification purpose, most of the transistors come with high common emitter current gain which shows the exact current and power gain required for amplification purpose.

- The collector-emitter current is largely dependent on the base current where small current at the base side is used to control the large current at the emitter and collector side.

Reverse Active Mode

- By interchanging the emitter and collector, transistor goes from active mode to reverse active mode.
- Most of the transistors are designed to afford high current gain, but reversing the role of emitter and collector makes the current gain very small as compared to forward biased region. This type of mode is rarely used unless a failsafe condition is required.

Saturation Region

BJT exhibits saturation mode when both junctions are forward biased. This mode of operation is referred as a closed circuit which

allows a large amount of current flowing from emitter to collector side.

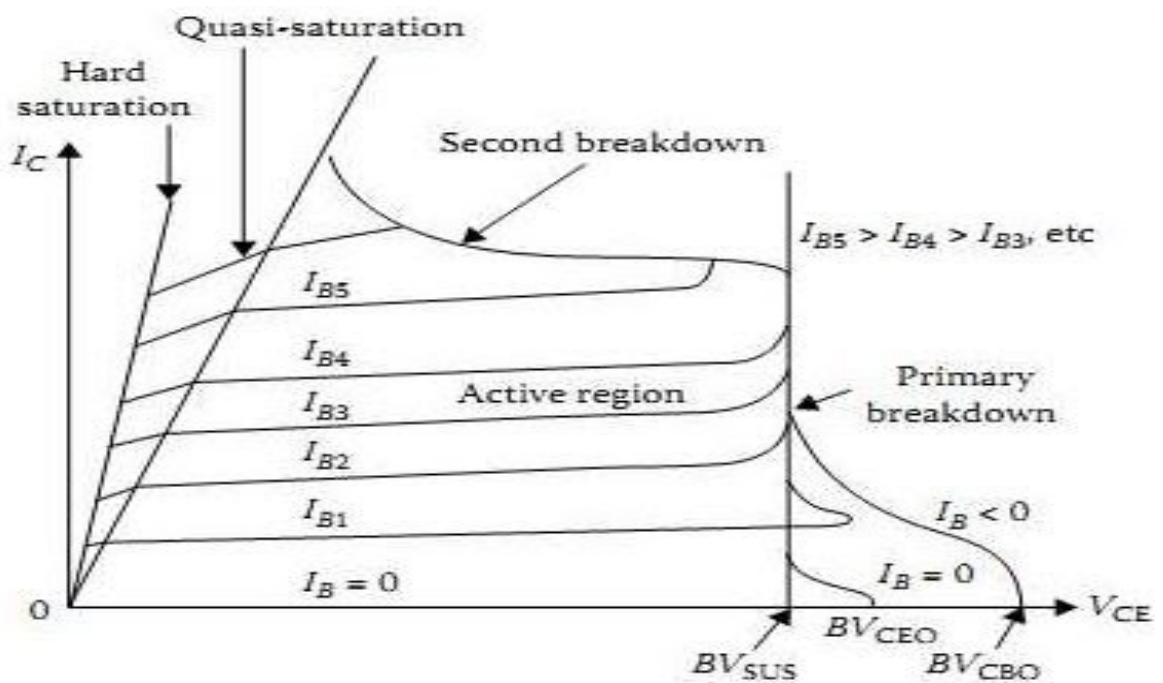
Cut Off Region

When the emitter-base junction is not forward biased, the transistor is said to have in the cut-off region where collector current and base current will be zero, no matter how much voltage is applied at the base terminal.

I-V Characteristics of Bipolar Junction Transistor

The I-V characteristic of Power BJT divides into four regions.

- Cut-off region
- Active region
- Quasi-saturation region
- Hard saturation

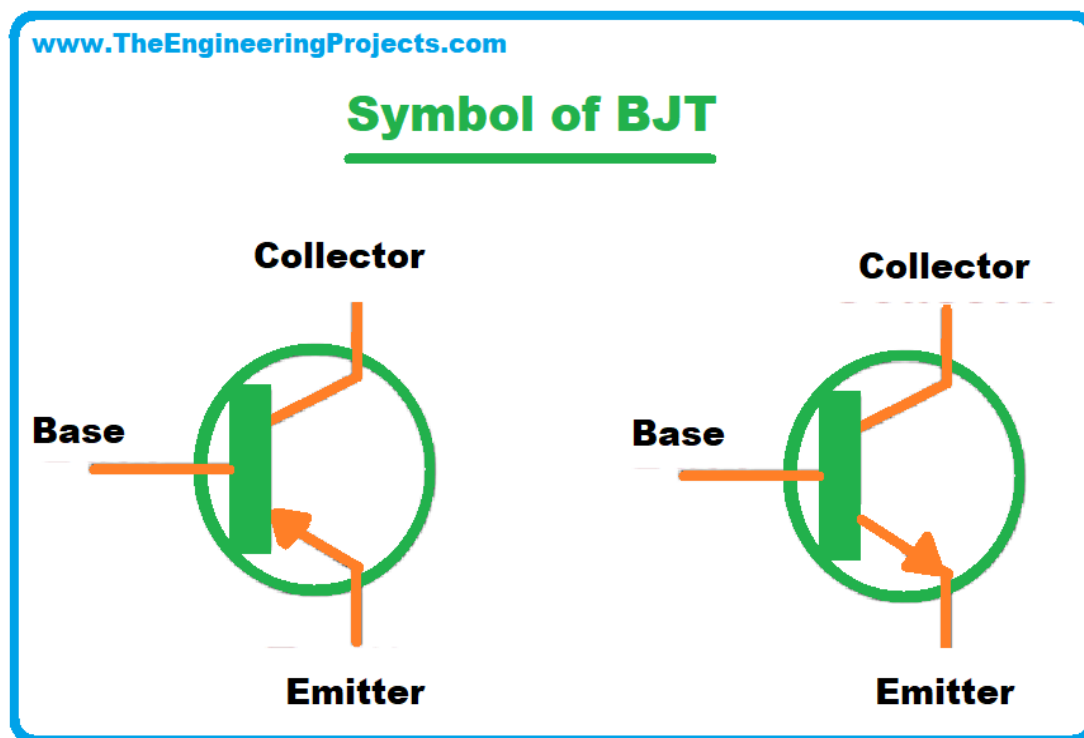


Symbol of BJT

Bipolar junction Transistor shortly known as BJT has the following three components;

- Base
- Emitter
- Collector
- All of the three components are represented in the symbol given below as B, E, and C.

Refer to the diagram given below showing the symbol of NPN and PNP Bipolar Junction Transistors;



- The direction of flow of current is indicated by the direction of Arrowhead.

Applications of the BJT

- BJT can be used in clipping circuits, for a detailed outlook on this you can read our article on transistors.
- Bipolar Junction Transistors are used for signal demodulation.
- We use BJT for amplifying current due to its current gain characteristics.
- High-frequency applications such as radio frequency also involve Bipolar Junction Transistors.
- Bipolar Junction Transistors are used for discrete circuit designs because of their easy availability and low-cost manufacturing.
- Bipolar Junction Transistors are frequently used in analog circuits.

PLAGIARISM REPORT

1.

bjt bipolar junction transistor is an electronic component mainly used for amplification and switching purpose as the name suggests it is composed of two junctions called emitter-base

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Viva-Voce

Q1: Define what is the significance of the arrow-head in the transistor symbol?

Answer: Arrow head is always marked on the emitter. The direction indicated the conventional direction of current flow(from emitter-to-base in case of p-n-p transistor and from base- to-emitter in case of n-p-n transistor). Generally no arrow head is marked for collector since its reverse leakage current is always opposite to the direction of emitter current.

Q2: Define what do you understand by collector reverse saturation? In which configuration does it have a greater value?

Answer: When input current (I_E in case of CB configuration and I_B in case of CE configuration) is zero, collector current I_C is not zero although it is very small. In fact this is the reverse leakage current or collector reverse saturation current (I_{CBO} or simply I_{CO} in CB configuration and I_{CEO} in CE configuration). In case of CE configuration it is much more than that in case of CB configuration.