BJT BASICS

BY VIGNESH.D EEE

GCE , ERODE

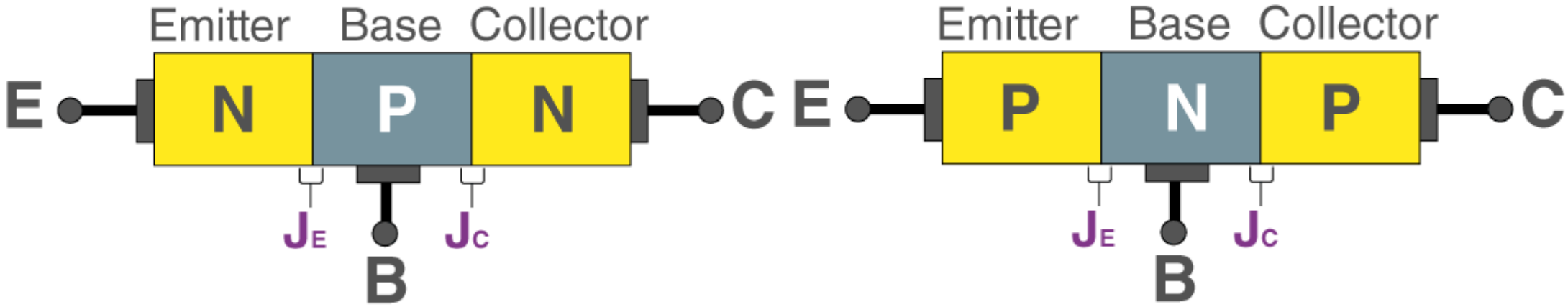
BJT

- BJT is a three-terminal semiconductor device that consists of two p-n junctions which are able to amplify or magnify a signal or act as a switch.
- It is a current controlled device.
- The three terminals of the BJT are the base, the collector, and the emitter
- Bipolar transistors are two types, **PNP** and **NPN**

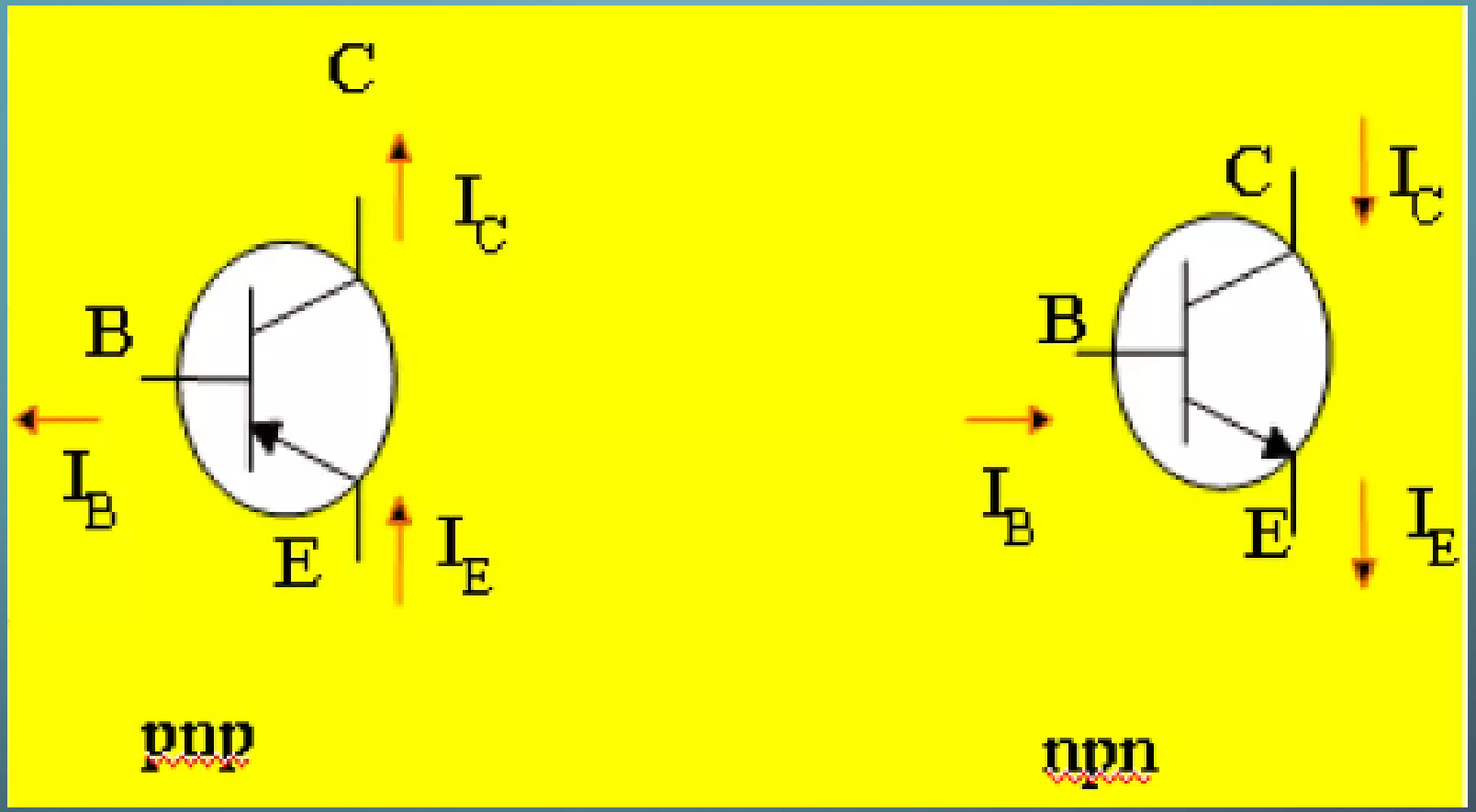
BJT

- There is a back to back PN junctions present in the PNP transistors. **Potential barriers** are increased because of the depletion layer present in these two junctions. The batteries supply external power. Because of the forward biasing lots of holes pass the terminal and enter the base. Some electrons are enter into emitter from the base. These electrons reunite with holes in the emitter. **Emitter current I_E** increases when the drift of electrons increses from the emitter to the base. Likewise, Base current and, Collector current flow was calculated. These is the functions of the Bipolar Junction Transistor.

BJT


Emitter
Base
Collector
E
N
P
N
C
J_E
J_C
B
Emitter
Base
Collector
E
P
N
P
C
J_E
J_C
B

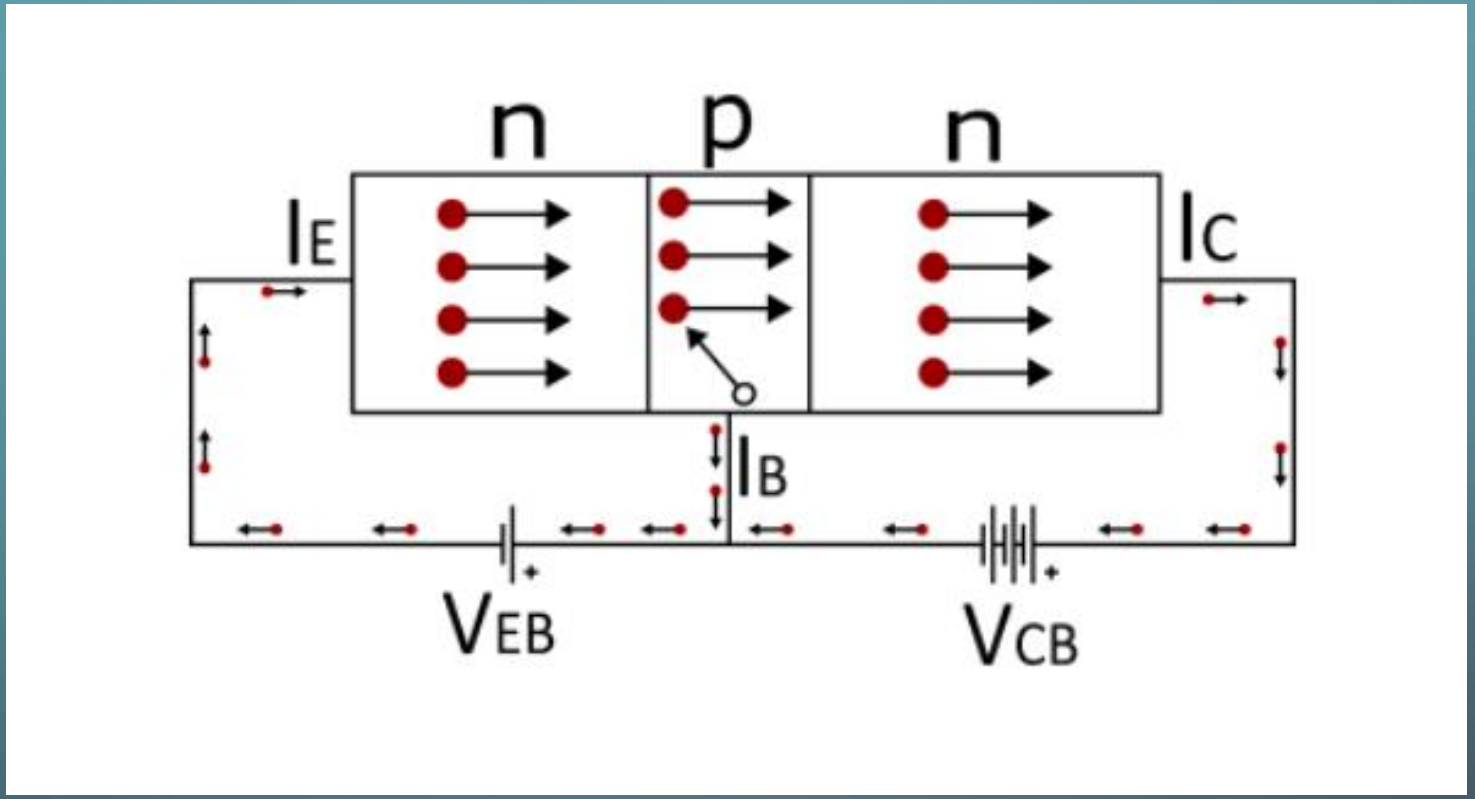
BJT



WORKING OF NPN TRANSISTOR

- With the forward-biased emitter-base junction and reverse-biased collector-base junction, it can be seen that the forward bias causes the flow of electrons from the n-type emitter into the p-type base. As these electrons flow through the p-type base, they tend to combine with the holes.
- Since the base is lightly doped and very thin, hence, only a small number electrons (less than 5%) combine with the holes to constitute the base current (). The remaining (more than 95%) electrons cross over the base region and reach to the collector region to constitute the collector current (). In this manner, the entire emitter current flows in the collector circuit.

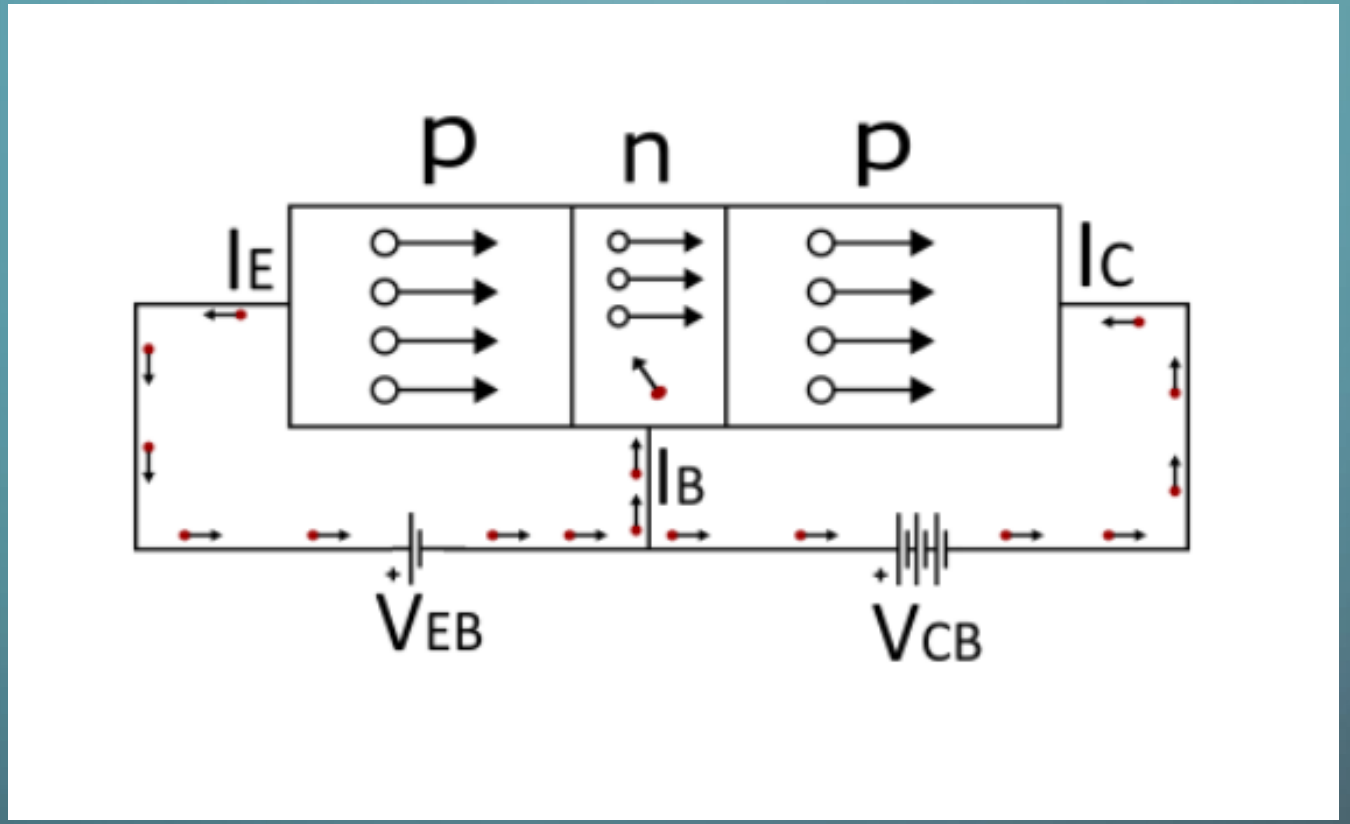
BJT



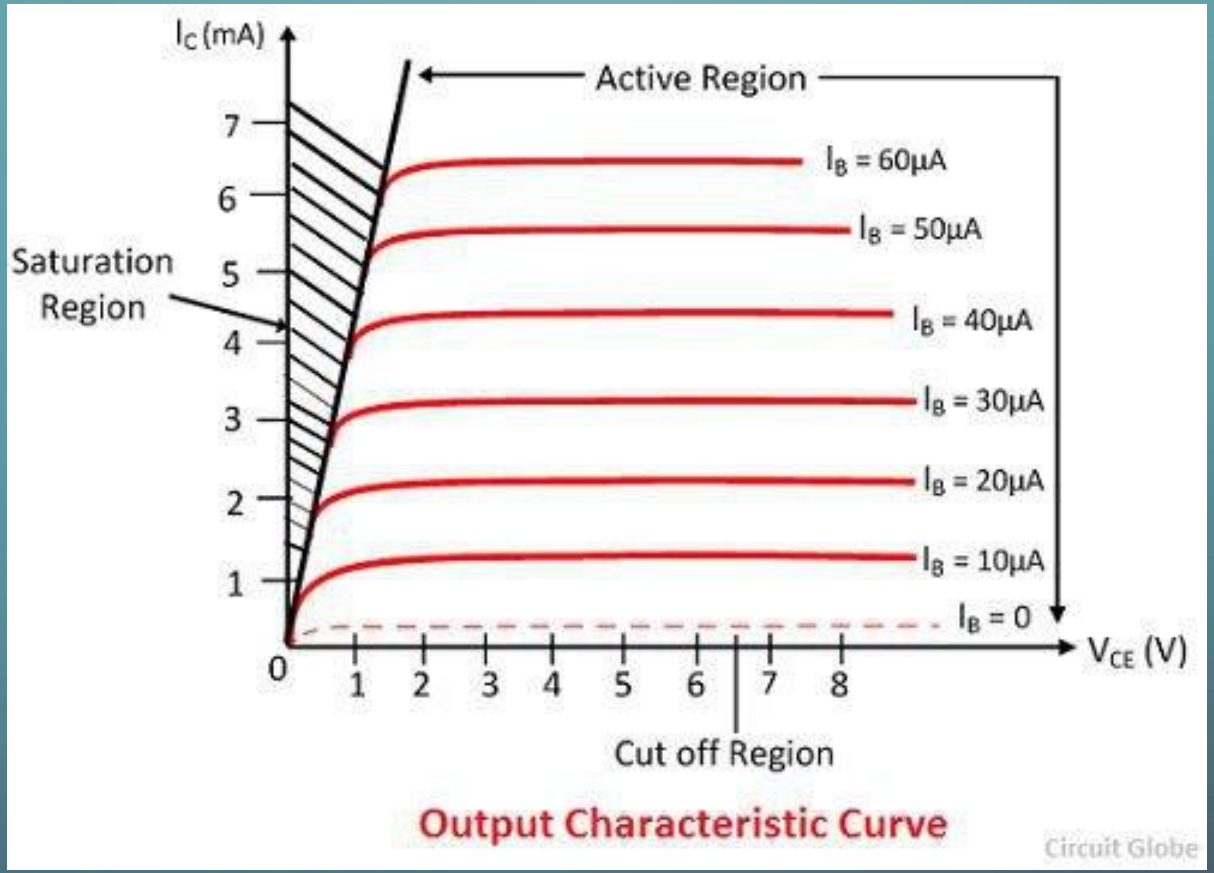
WORKING OF PNP TRANSISTOR

- For the pnp-transistor, the forward bias of emitter-base junction causes the flow of holes in the p-type emitter region towards the n-type base and constitutes the emitter current . As these holes cross into the n-type base region, they tend to combine with the electrons. Since the base is lightly doped and very thin, hence only a small number of holes (less than 5%) combine with the electrons. The remaining (more than 95%) cross the base and reach into the collector region to constitute the collector current.
- In this manner, the entire emitter current flows into the collector circuit. It may be noted that the current conduction inside the pnp-transistor is due to the movement of holes. However, in the external connecting wires, the current is still due to the flow of electrons.

BJT



BJT MODES OF OPERATIONS



ACTIVE MODE

- Configuration: In the active mode, the BJT is biased such that the base-emitter junction is forward-biased, and the base-collector junction is reverse-biased.
- Operation: In this mode, the transistor amplifies signals. A small change in the base current causes a much larger change in the collector current. This mode is often used in amplifier circuits.

SATURATION MODE

- Configuration: In saturation mode, both the base-emitter and base-collector junctions are forward-biased.
- Operation: In this mode, the BJT acts like a closed switch. It allows a significant current to flow from collector to emitter, irrespective of the base current. Saturation mode is commonly used in digital circuits as a "fully on" state for switching purposes.

CUT-OFF MODE:

- Configuration: In the cut-off mode, both the base-emitter and base-collector junctions are reverse-biased.
- Operation: In this mode, the BJT acts like an open switch. There is no significant current flow from collector to emitter, even if there is a small base current. Cut-off mode is used to turn off the transistor completely.

BJT MODE OF OPERATIONS

Emitter-Base Junction	Collector-Base Junction	Operating Region
Forward Biased	Reverse Biased	Active Region
Forward Biased	Forward Biased	Saturation Region
Reverse Biased	Reverse Biased	Cutt off region

CONFIGURATION

Common Emitter (CE)	Common Base (CB):	Common Collector (CC):
• The emitter is common between input and output. Provides voltage and current gain. Inverts the input signal.	• The base is common between input and output. Provides current gain. No inversion of the input signal.	• The collector is common between input and output. Also known as an emitter follower. Provides voltage gain. No inversion of the input signal.

BJT MODE OF OPERATIONS