

# **Transistor (BJT) Operating Modes**

**Elementrix Classes**

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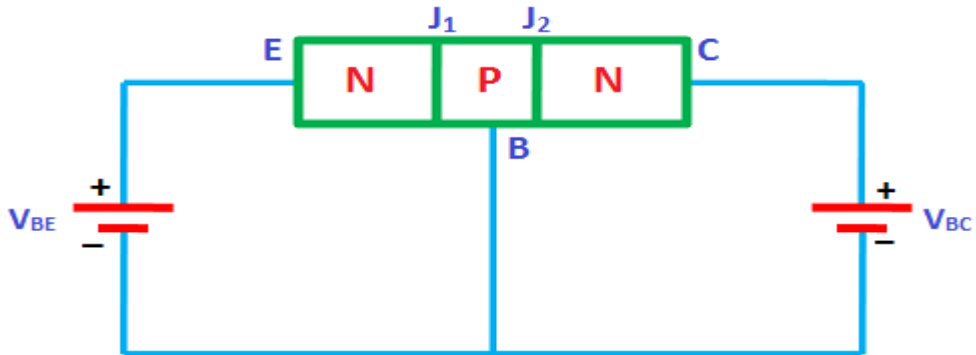
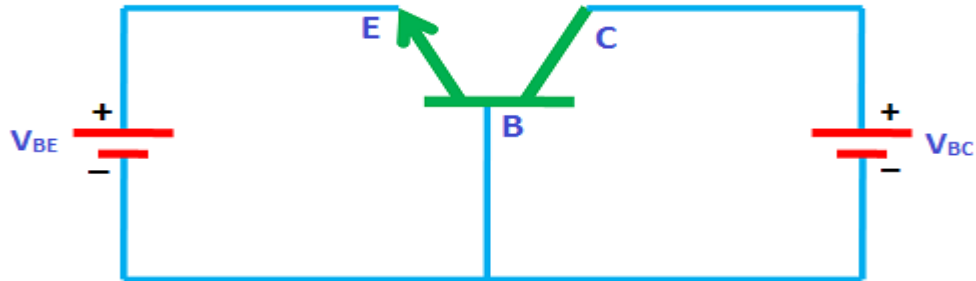
The transistor can be operated in three modes:

- Cut-off mode
- Saturation mode
- Active mode

In order to operate transistor in one of these regions, we have to supply dc voltage to the npn or pnp transistor. Based on the polarity of the applied dc voltage, the transistor operates in any one of these regions.

Applying dc voltage to the transistor is nothing but the biasing of transistor.

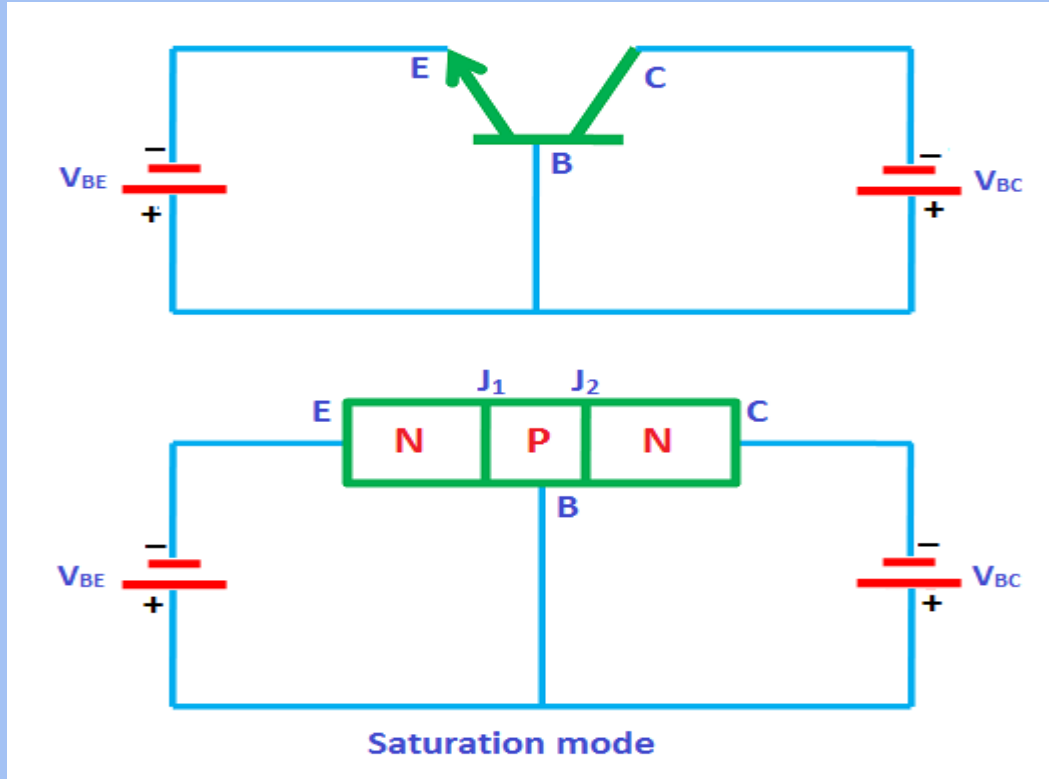
# Cut-off Mode



Cutoff mode

- ❑ In the cutoff mode, both the junctions of the transistor (emitter to base and collector to base) are reverse biased. In other words, if we assume two p-n junctions as two p-n junction diodes, both the diodes are reverse biased in cutoff mode. We know that in reverse bias condition, no current flows through the device. Hence, no current flows through the transistor. Therefore, the transistor is in off state and acts like an open switch.
- ❑ The cutoff mode of the transistor is used in switching operation for switch OFF application.

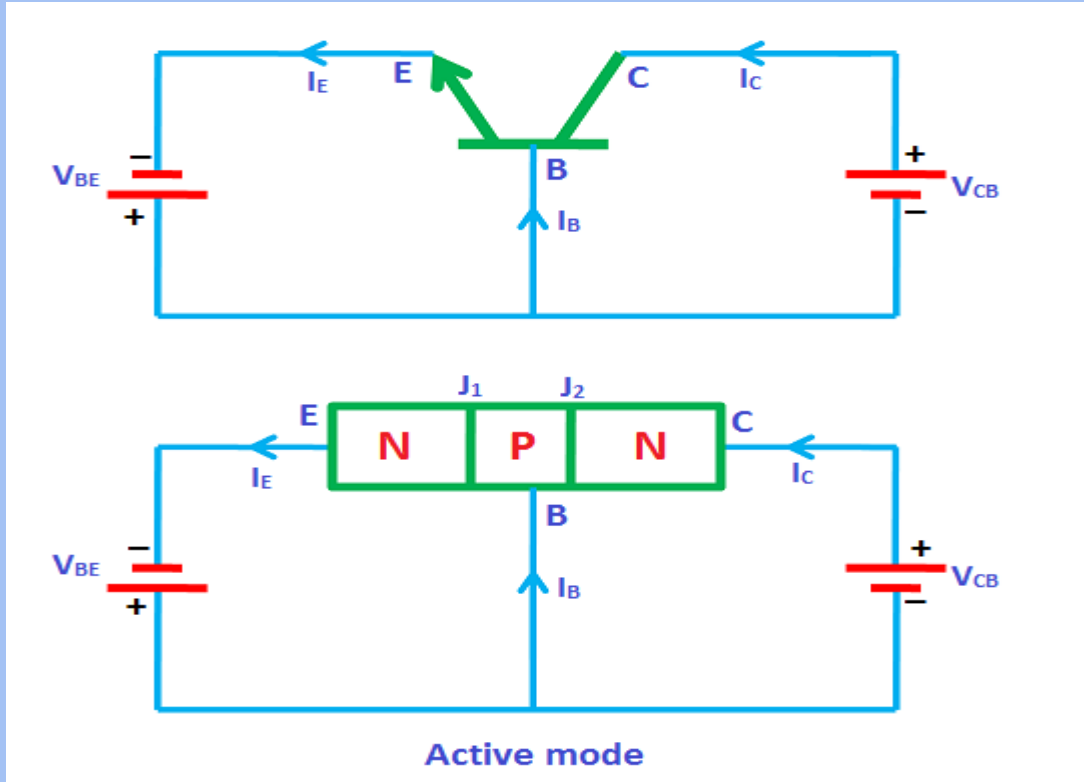
# Saturation Mode



- ❑ In the saturation mode, both the junctions of the transistor (emitter to base and collector to base) are forward biased. In other words, if we assume two p-n junctions as two p-n junction diodes, both the diodes are forward biased in saturation mode. We know that in forward bias condition, current flows through the device. Hence, electric current flows through the transistor.
- ❑ In saturation mode, free electrons (charge carriers) flows from emitter to base as well as from collector to base. As a result, a huge current will flow to the base of transistor.

- ❑ Therefore, the transistor in saturation mode will be in on state and acts like a closed switch.
- ❑ The saturation mode of the transistor is used in switching operation for switch ON application.
- ❑ From the above discussion, we can say that by operating the transistor in saturation and cutoff region, we can use the transistor as an ON/OFF switch.

# Active Mode





- ❑ In the active mode, one junction (emitter to base) is forward biased and another junction (collector to base) is reverse biased. In other words, if we assume two p-n junctions as two p-n junction diodes, one diode will be forward biased and another diode will be reverse biased.
  
- ❑ The active mode of operation is used for the amplification of current.

From the above discussion, we can say that the transistor works as an ON/OFF switch in saturation and cutoff modes whereas it works as an amplifier of current in active mode.

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