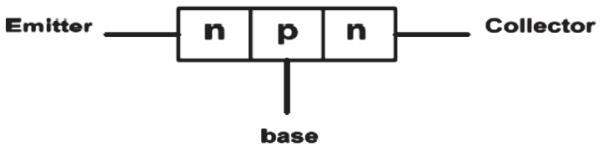
Bipolar junction transistor

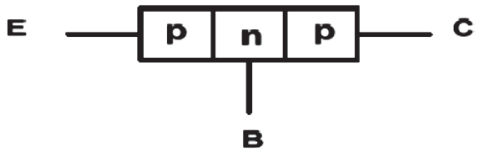
1. Construction of bipolar junction transistor .
2. Biasing of bipolar junction transistor

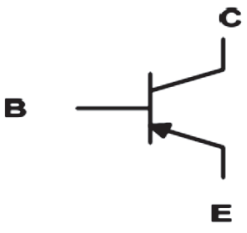
Bipolar junction transistor (BJT) :

The (BJT) is constructed with three doped semiconductor regions separated by two P-N junctions . The three regions are called emitter , base and collector .

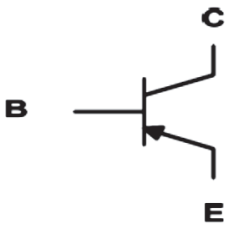
One type consists of two N regions separated by a P region (npn) , and the other type consists of two P regions separated by an N region (pnp) as shown in the Fig. below .



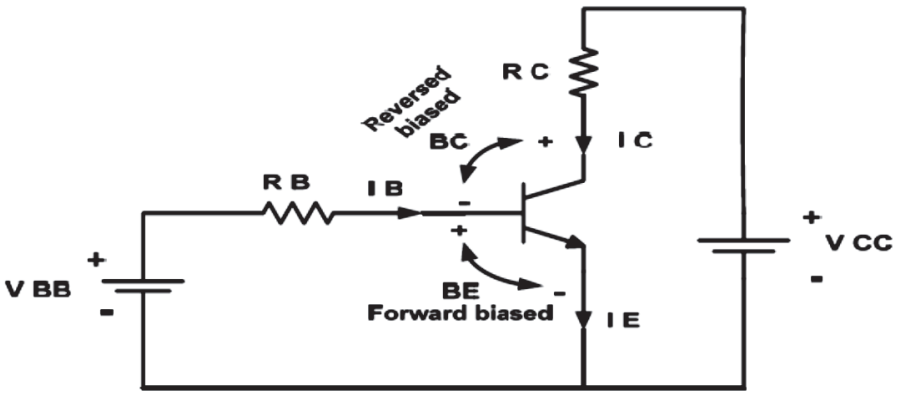




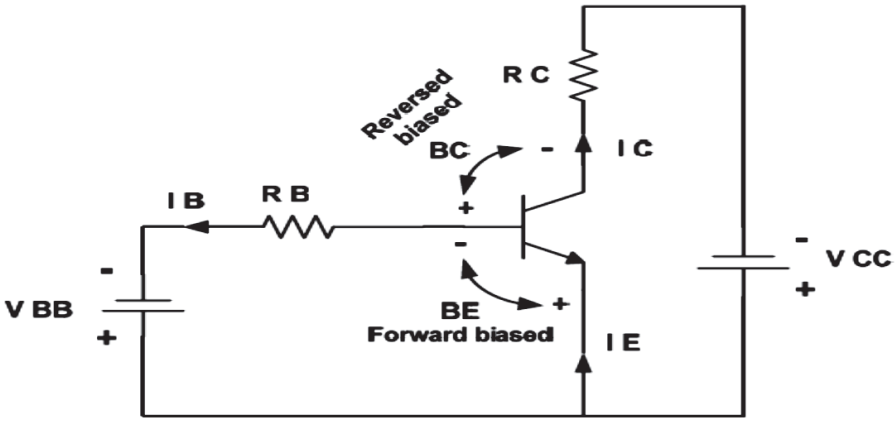
(npn)



(pnp)



V BB forward biased
V CC reversed biased
I E = I C – I B



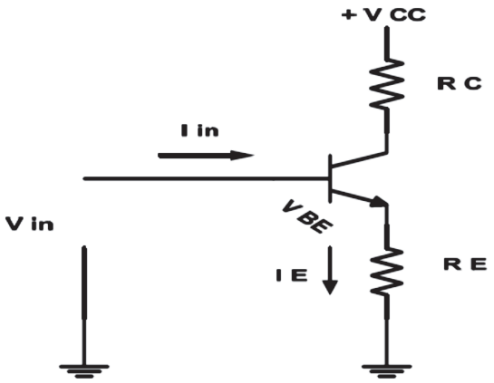
V BB forward biased
V CC reversed biased
I E = I C + I B

pnp type

Bipolar junction transistor

1. **Input resistance at the transistor base.**

2. **Voltage – divider base circuit .**



$$R_{in(base)} = \frac{V_{in}}{I_{in}}$$

$$V_{in} = V_{BE} + I_E R_E$$

With the assumption that $V_{BE} << I_E R_E$

$$V_{in} = I_E R_E$$

Now since $I_E \approx I_C = \beta_{DC} I_B$

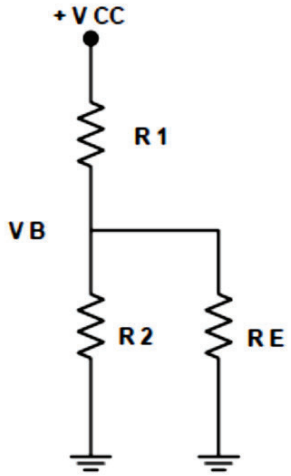
$$V_{in} = \beta_{DC} I_B R_E$$

The input current is the base current

$$R_{in(base)} = \frac{V_{in}}{I_{in}} = \frac{\beta_{DC} I_B R_E}{I_B}$$

$$R_{in(base)} = \beta_{D.C} R_E$$

Analysis of a voltage – divider base circuit

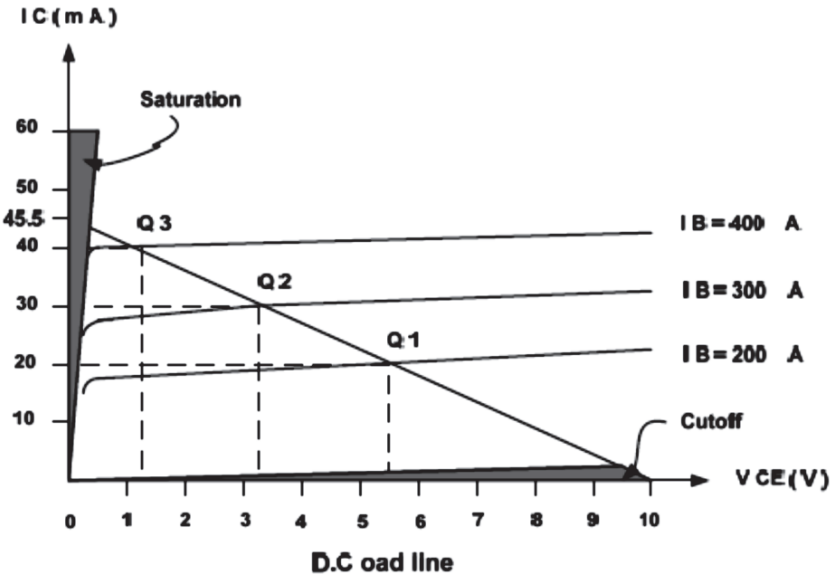


From figure above , the total resistance from base to ground is:

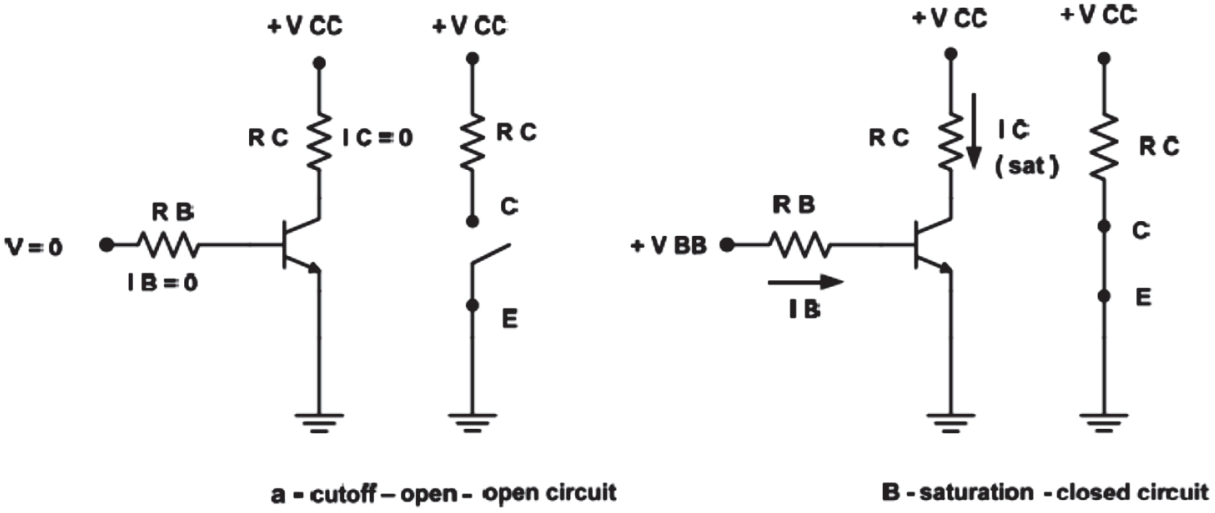
R2 // βD.C RE

D.C load line and transistor as switch

1. **D.C load line.**
2. **Transistor as switch**



Transistor as switch



a - cutoff – open - open circuit

B - saturation - closed circuit