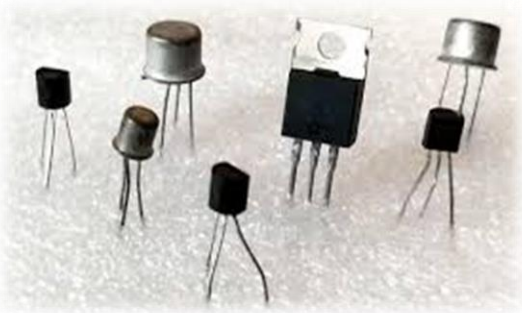
BIPOLAR JUNCTION TRANSISTORS (BJTs)



Er. J. Sravankumar

THE SURPRISING ACTION OF A TRANSISTOR

2 junctions

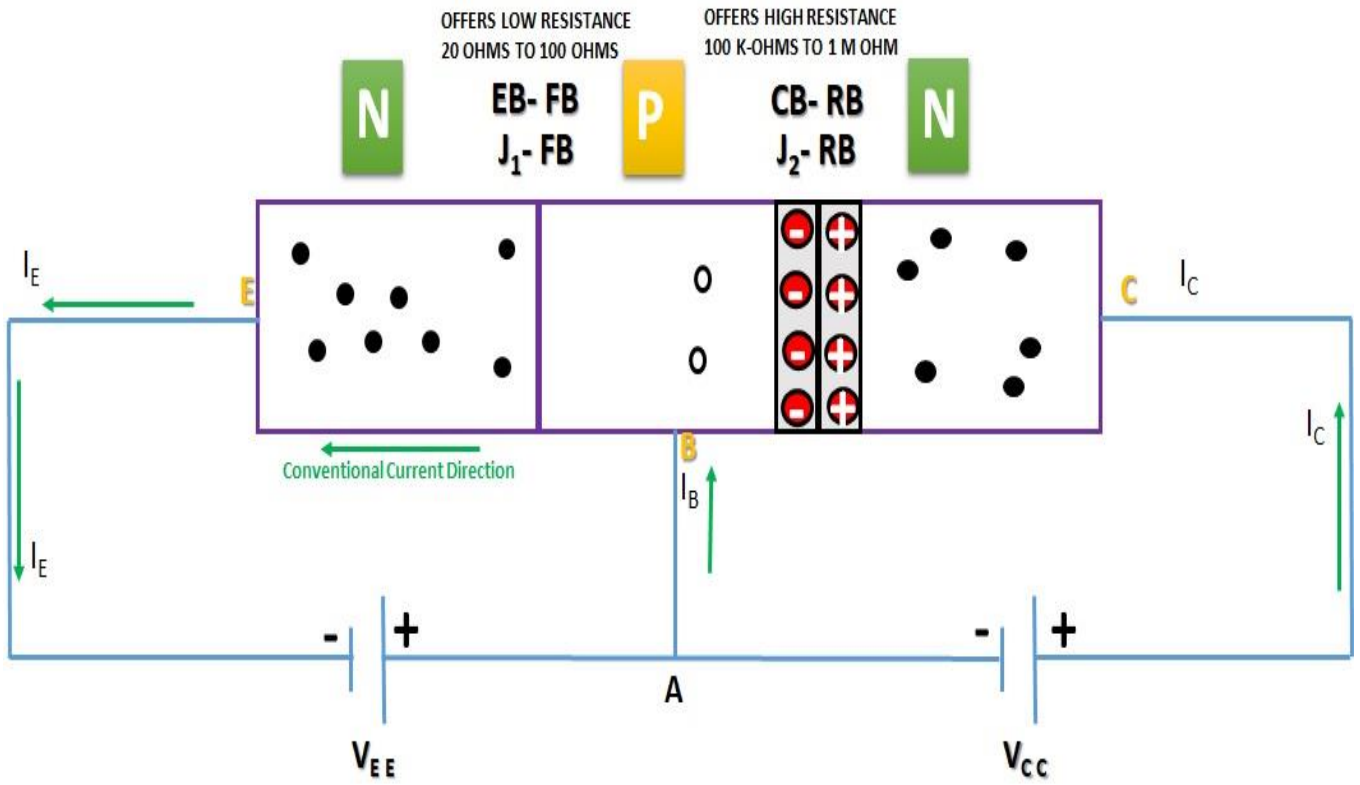
emitter junction and
a collector junction

4 ways of biasing

Condition		Emitter Junction	Collector Junction	Region of operation
I	FR	Forward biased	Reverse biased	Active
II	FF	Forward biased	Forward biased	Saturation
III	RR	Reverse biased	Reverse biased	Cutoff
IV	RF	Reverse biased	Forward biased	Inverted

- Electrons
- Holes

Condition		Emitter Junction	Collector Junction	Region of operation
I	FR	Forward biased	Reverse biased	Active



@ A: Applying KCL: $I_E = I_B + I_C$

Also : $I_c = \alpha_{dc} I_E + I_{CO}$

Where reverse leakage current, I_{co}=very small and can be neglected

$$I_c = \alpha_{dc} I_E$$

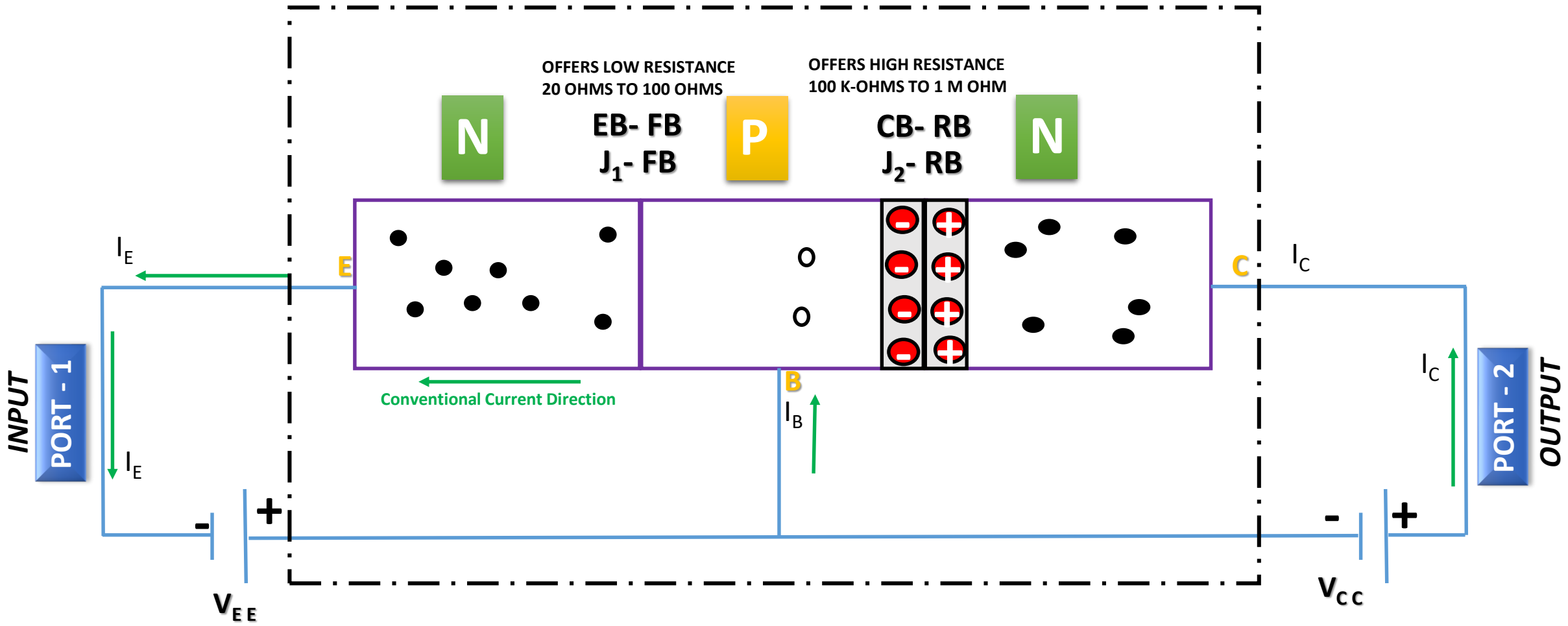
$$\alpha_{dc} = \frac{I_c}{I_E}$$

$$0.95(always) < \alpha_{dc} = \frac{I_c}{I_E} < 1(always)$$

- Electrons
- Holes

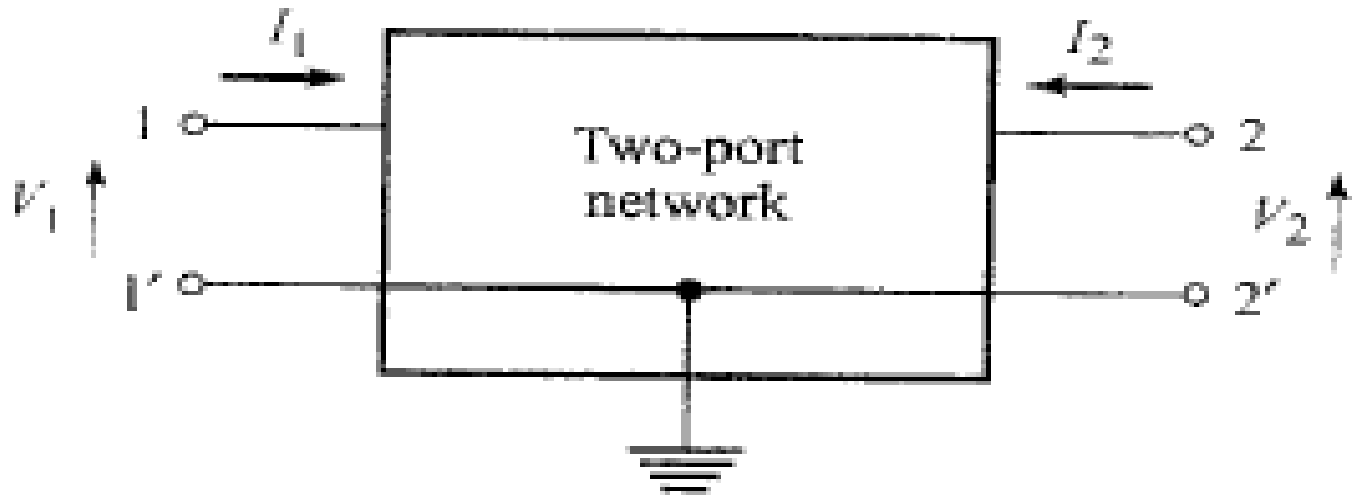
Two port network

Condition		Emitter Junction	Collector Junction	Region of operation
I	FR	Forward biased	Reverse biased	Active

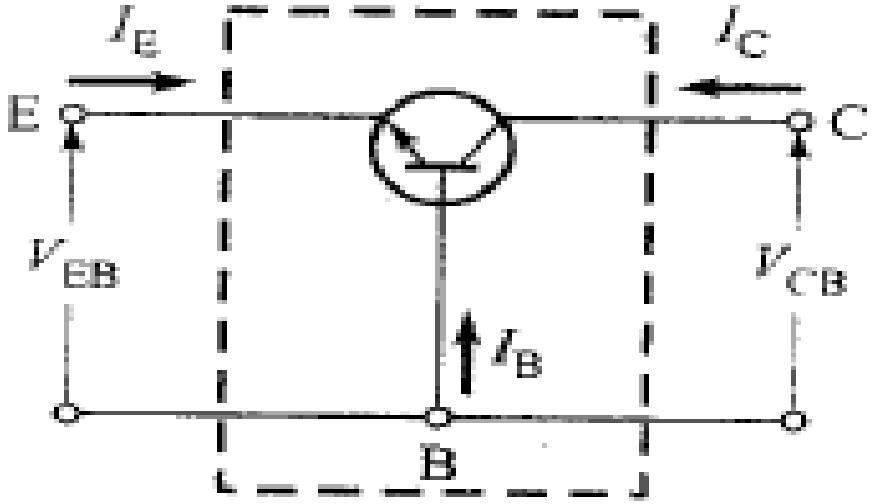


Transfers current signal from low resistance to high resistance

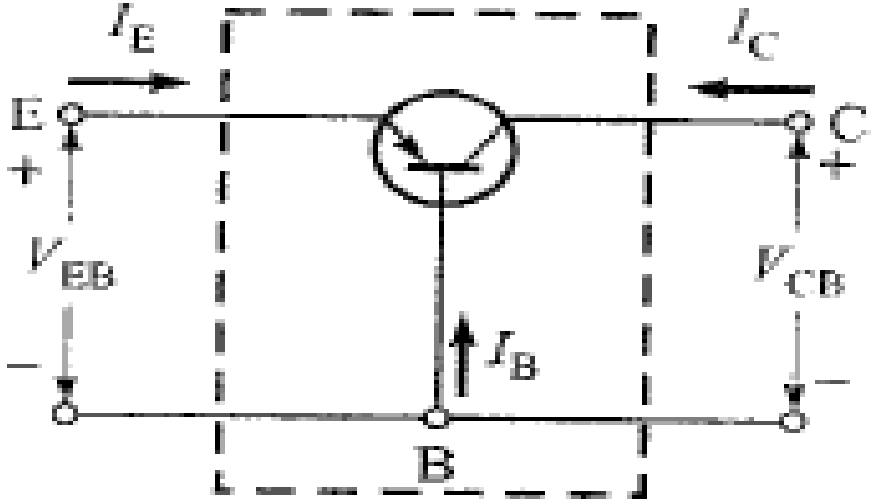
TRANS**FER + RESI**STOR** = **TRANSISTOR



(*a*) Two-port network

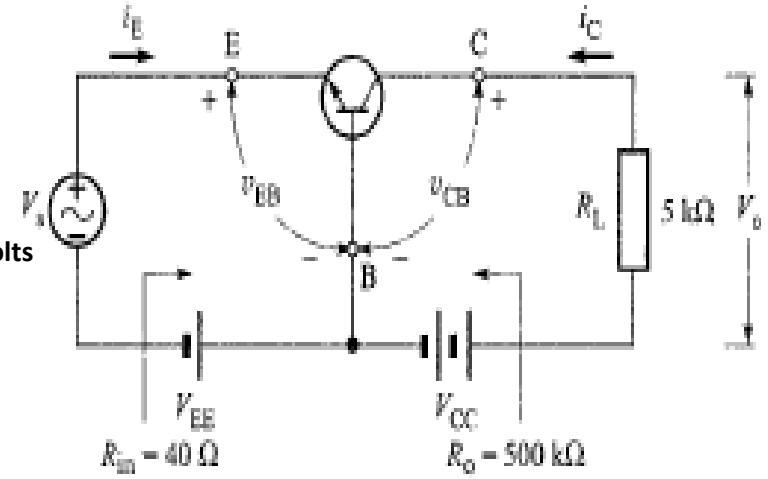


(*b*) NPN transistor



(*c*) PNP transistor

AMPLIFYING ACTION OF A TRANSISTOR



V_s=20 milli volts

Condition		Emitter Junction	Collector Junction	Region of operation
I	FR	Forward biased	Reverse biased	Active

Input signal, V_s = 20 m Volts

$$Emitter\ current, I_e = \frac{V_s}{R_{in}} = \frac{20X10^{-3}}{40} = 0.5mA$$

Collector Current, $I_c \cong I_E = 0.5mA$

The effective value of the output signal voltage,

$$V_0 = I_c . R_L$$
$$= (0.5x10^{-3})(5x10^3) = 2.5\ volts$$

Voltage Amplification or voltage gain(A_v) $= \frac{V_0}{V_S} = \frac{2.5}{20x10^{-3}} = 125$