

# EEEE BJT introduction

Basics

- : BJT operation, CE, CB, CC configuration of BJTs
- BJT as a switch, current amplifier & voltage amplifier

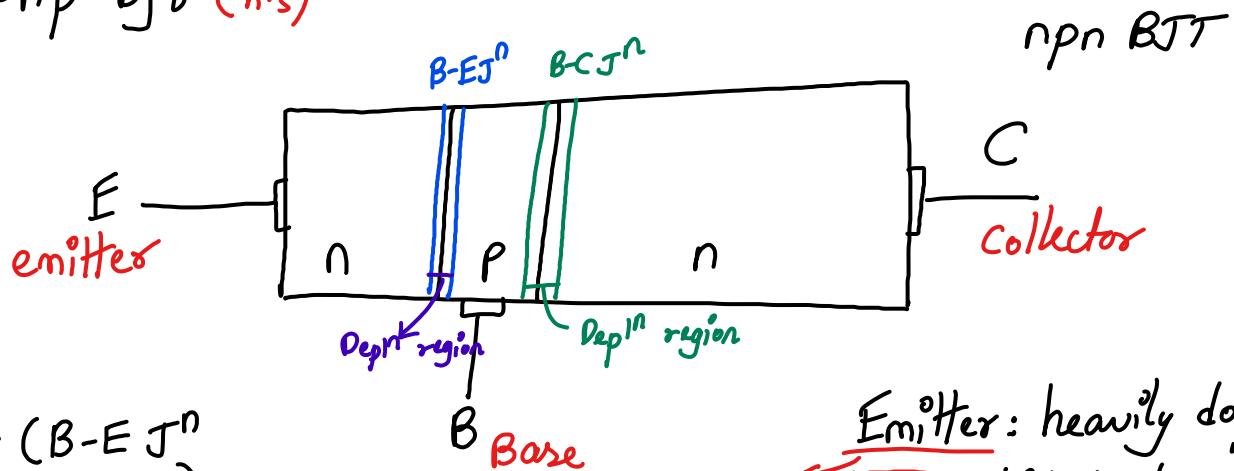
## Applications

BJT : Bipolar junction transistor (1948, Bell labs)

Types : npn bjt (e's)

pnp b<sup>o</sup>t (hts)

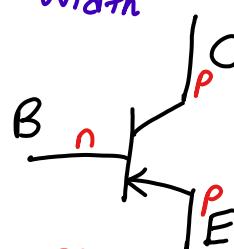
PN J<sup>n</sup> → FB → W↓ → I↑  
 → RB → W↑ → μA



3 terminals

two junctions ( $B-E J^n$ )

Emitter: heavily doped  
Base: lightly doped  
Collector: Moderately doped



PNP BJT symbol

**Different regions of operation**

② Cut-off region (OFF)

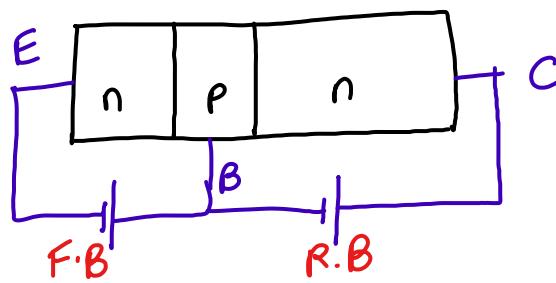
**Switch** ③ Saturation region (ON) F.B

④ Inverse-active region R.B  
→ Avoided (not used)

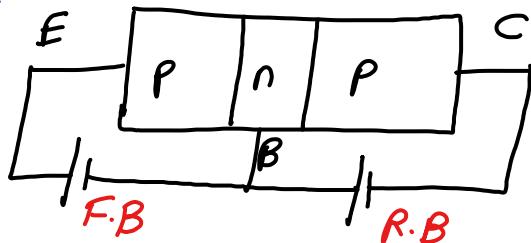
$\beta C J^n$  R.B  $\checkmark$   $(\beta) \text{fars}$   $(\text{amplir})$  F.B  $\rightarrow$  forward bias

R.B ] ✓ (switch) BJT tag RB → reverse bias

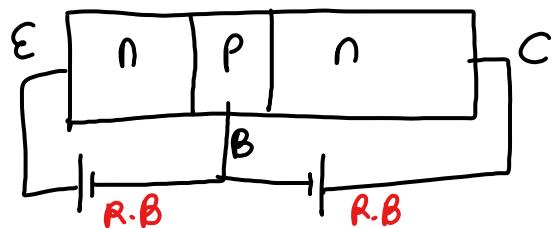
F.B



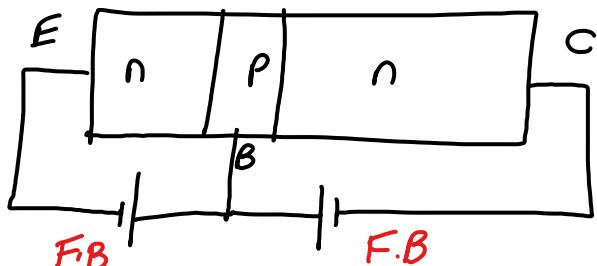
Active region



Cut-off region



Saturation region



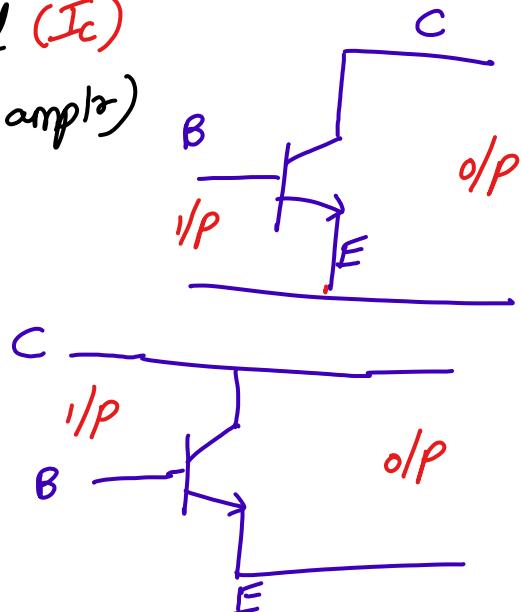
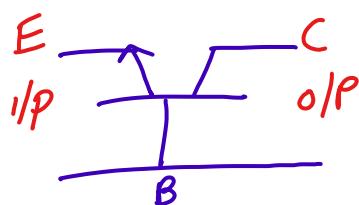
"  
Bipolar"

charge carriers of both polarities  
(e<sup>-</sup>s & holes) → take part in current conduction process

Principle of BJT : It involves the use of two terminals to control the current flowing in the 3rd terminal ( $I_c$ )

BJT configuration (BJT as ampl)

- ① Common emitter (CE)
- ② Common base (CB)
- ③ Common collector (CC)



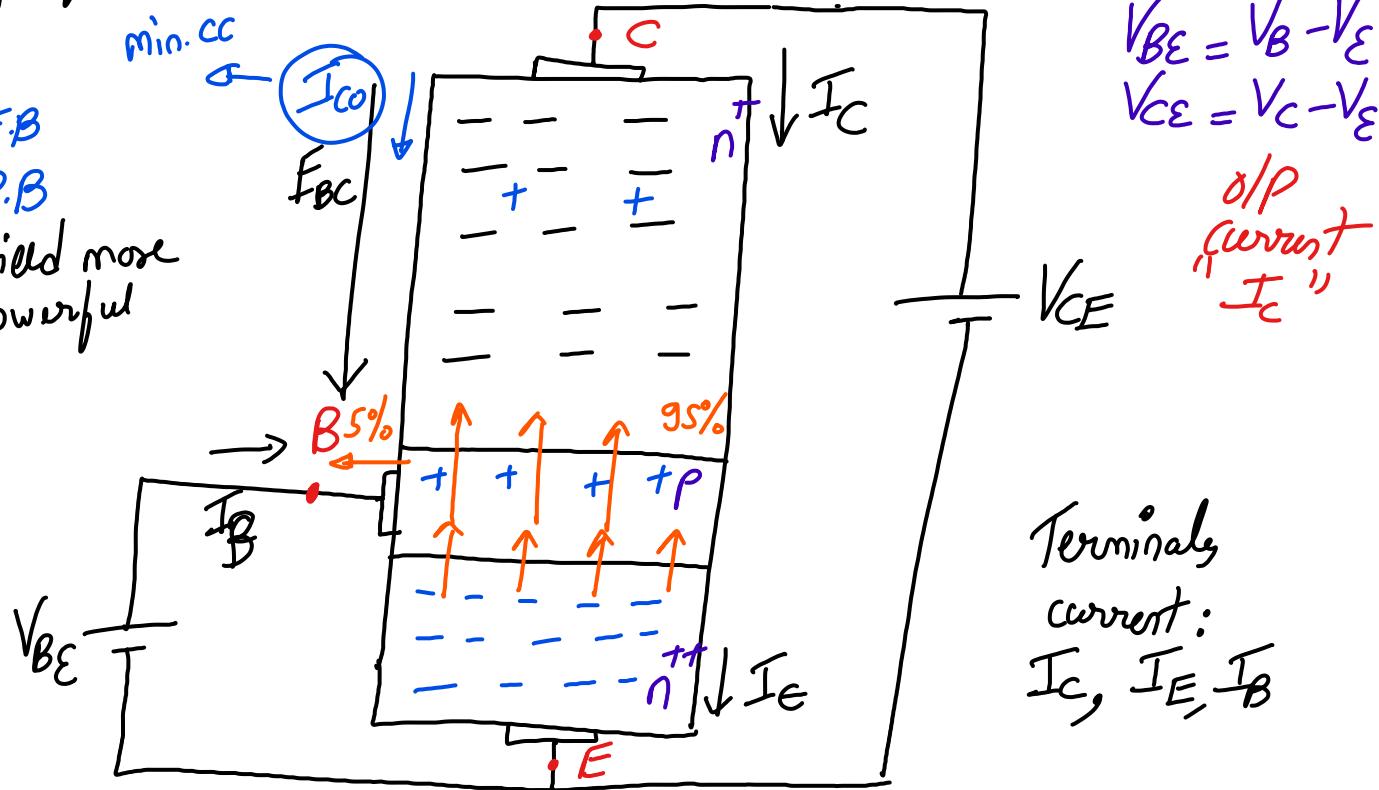
# Working of npn BJT in active region (CE configuration)

Active:  
region

$B_E J^0 \rightarrow F.B$

$B_C J^2 \rightarrow R.B$

$\hookrightarrow E\text{-field more powerful}$



$$V_{BE} = V_B - V_E$$

$$V_{CE} = V_C - V_E$$

d/p current  $I_C$

Terminal current:  
 $I_C, I_E, I_B$

↓ control  $I_B$   
↓ control "I\_C"

$$I_E = I_C + I_B$$

$\downarrow mA$        $\downarrow mA$        $\rightarrow \mu A$

$$\alpha < 1$$

$$I_E \approx I_C ; I_C = \alpha I_E$$

$$I_E = \beta I_B + I_B$$

$$I_E = (1+\beta) I_B$$

BJT: current controlled device

$$I_B + \alpha I_E = I_E$$

$$I_B = I_E (1-\alpha)$$

$$I_B = \frac{I_C}{\alpha} (1-\alpha)$$

$$\rightarrow I_C = \left( \frac{\alpha}{1-\alpha} \right) I_B$$

$$I_C = \beta I_B$$

→ Current gain  
(50-400)

— x —

















