MINISTRY OF HIGHER EDUCATION AND SIENTIFIC RESEARCH - SAWA UNIVERSITY - ENGINEERING COLLEGE -PHYSICS DEPT. SECOND STAGE 2.nd COURSE

جامعة ساوة الاهلية

كلية التقنيات الهندسية

القسم: الفيزياء الطبية والعلاج الاشعاعي

المرحلة الثانية /الفصل الثاني

عنوان المحا ضرة:

Bipolar Junction transistor (BJT)

اسم المحاضر: عطاالله باني حمود

رقم المحا ضرة (7)

The Seventh lecture/ twelveth week

بسم الله الرحمن الرحيم

IN THE NAME OF GOD, THE MOST GRACIOUS, THE MOST MERCIFUL

Department of Physics and Radiotherapy

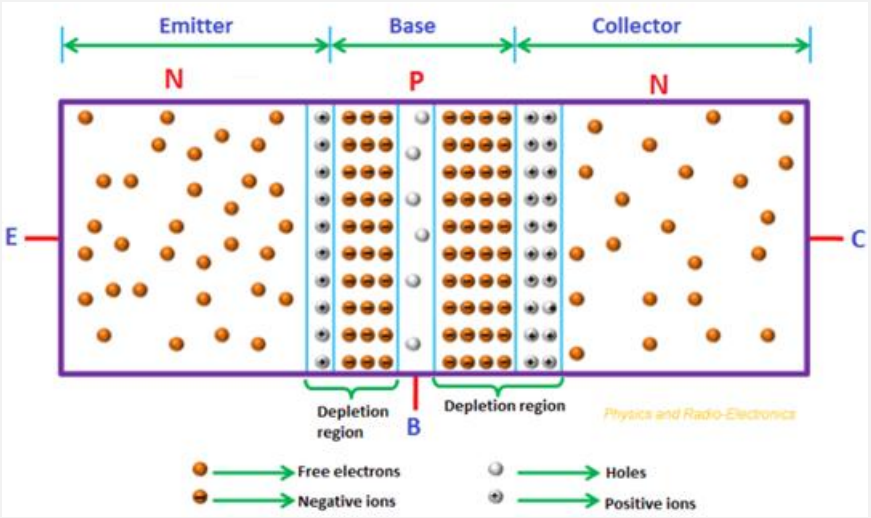
Bipolar Junction transistor (BJT)

Transistor Definition

A transistor is a semiconductor device used to amplify or switch electrical signals and power. It is one of the basic building blocks of modern electronics.[1] It is composed of semiconductor material, usually with at least three terminals for connection to an electronic circuit.

(a) collector : It is the largest part and dissipates heat.
(b) emitter :It is emiting electrons through the base to the collector.
(c) base : It is thinner and smaller in size and located between the collector and emitter

UNBIASED TRANSISTOR



Transistor symbol:

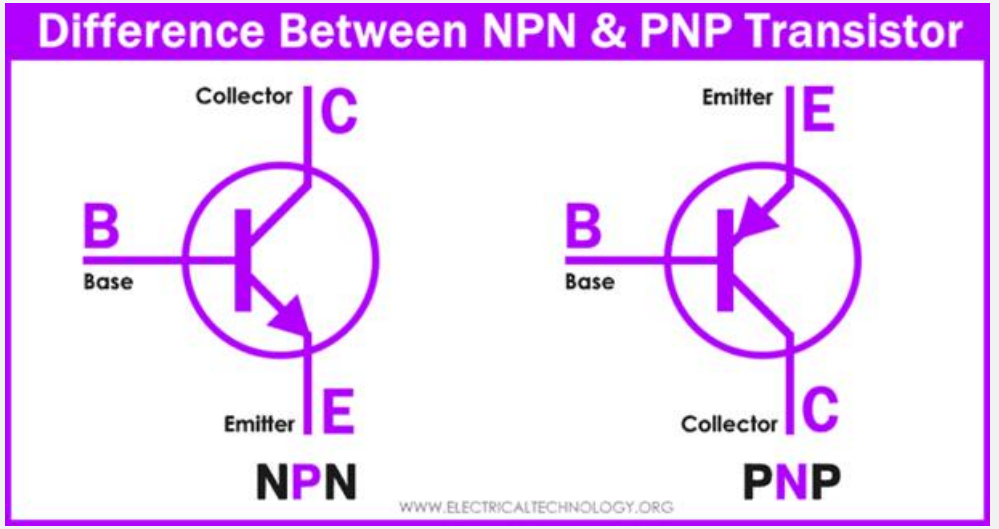


Fig. (30)Tansistor Types

Configuration of Transistor

The three types of configurations are
(a) **Common Base configuration**
(b) Common Collector configuration
(c) Common Emitter configuration

In every configuration, the emitter junction is forward biased and the collector junction is reverse biased.

(a) Common Base CB Configuration

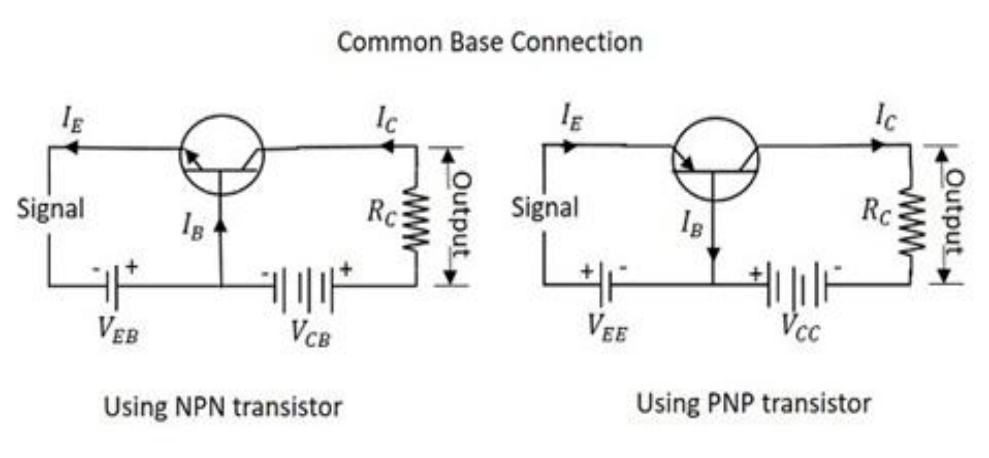


Fig. (32) Common Base con.

(b) Common Collector CC Configuration

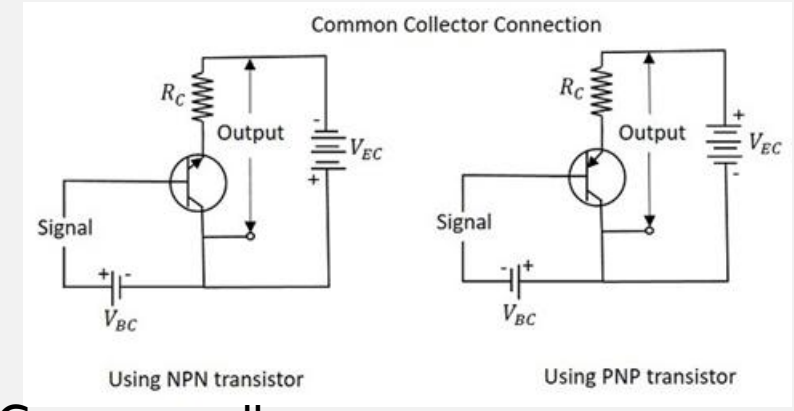


Fig. (33) Common collector con.

(c) Common Emitter configuration

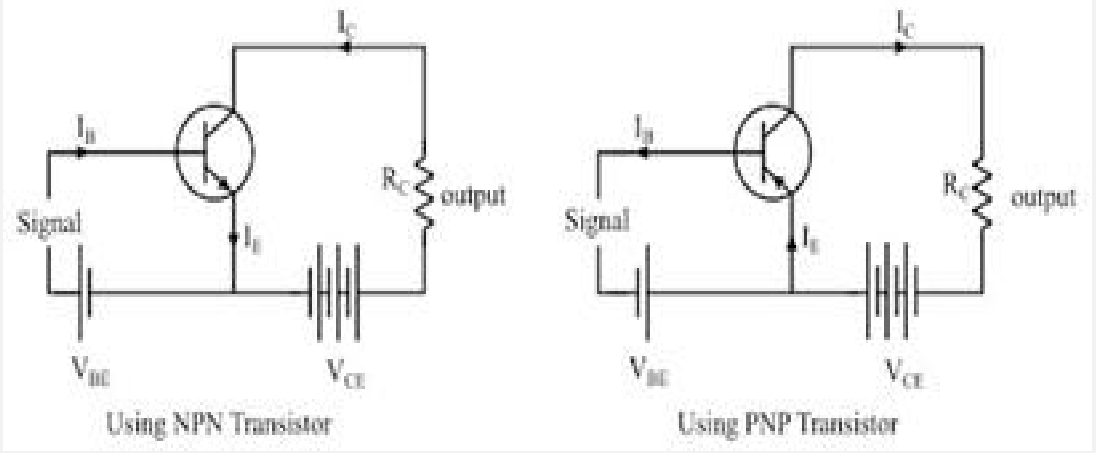


Fig. (34) Common Emitter

Type equation here.**Base Current Amplification factor** β

$$\beta = \frac{\triangle I_c}{\triangle I_B} \quad \text{or} \quad \beta = \frac{I_c}{I_B} \text{ ----------(38)}$$

Type equation here.**Emitter Current Amplification factor** α

$$\alpha = \frac{\triangle I_c}{\triangle I_E} \text{ ----------(39)}$$

$$I_E = I_c + I_B \text{ ----------(40)}$$

$$\triangle I_E = \triangle I_c + \triangle I_B \text{ ----------(41)}$$

Relation between β and α

When we divide equation (41) by $(\triangle I_C)$ we obtain :

$\triangle I_E = \triangle I_C + \triangle I_B$ ----------(41)

$\frac{\triangle IE}{\triangle I_C} = \frac{\triangle I_C}{\triangle I_C} + \frac{\triangle I_B}{\triangle I_C}$ from equation (39) and (38) we obtain :

$\frac{1}{\alpha} = 1 + \frac{1}{\beta}$

$\frac{1}{\alpha} - 1 = \frac{1}{\beta}$

$\frac{1-\alpha}{\alpha} = \frac{1}{\beta}$ ----------*(42)*

When we reverse the equation (42) :

$\beta = \frac{\alpha}{1-\alpha}$ ----------*(43)*

$\alpha = \frac{\beta}{1+\beta}$ (Home Work)

Different Regions of BJT Operation

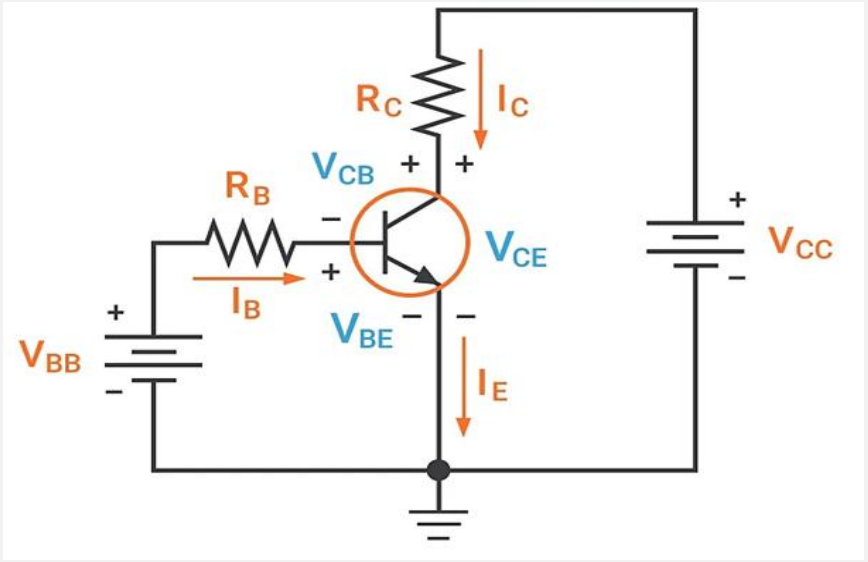


Fig.(35) (CE-Configuration of BJT)

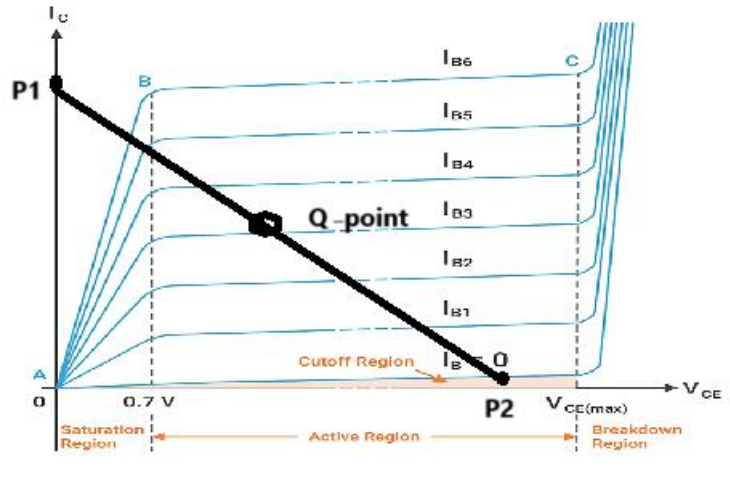


Fig.(36) BJT Operation region

(a) Cut- off region:

In this region

1- (I_B $^{=0\,A}$) see equation (38) ,Hence

2- (Ic $^{=0\,A}$)

3- $V_{CE} = V_{CC}$

(b) Saturatiion region:

In this region

1- (I_B $^{=Maximum\,Value}$) see equation (38) ,Hence

2- (Ic $^{=I\ saturation\ current\,A}$)

3- $V_{CE} = 0$ v

(c) Operation Region:

In this region, The emitter diode is forword Baise, while the collector diode is reverse baise

Here, all variables(I_B , Ic .$V_{CE)}$ have specific values

انتهى .... شكرا لاستماعكم