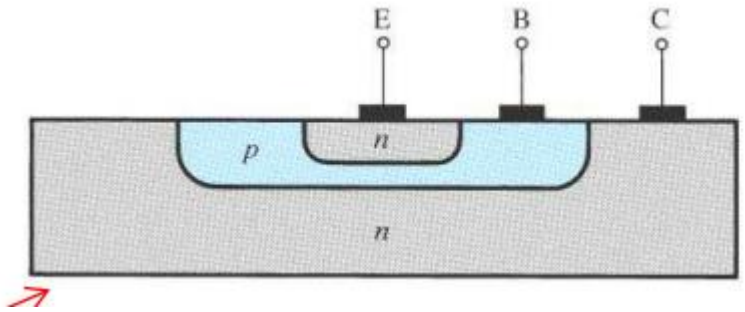
PH231 Session 3

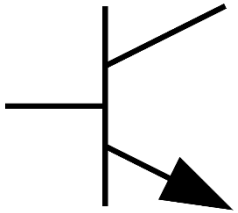
Introduction to Lab 3 – BJT's!

The BJT's Silicon device structure

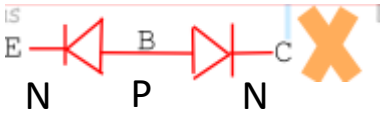
IN FORWARD ACTIVE MODE

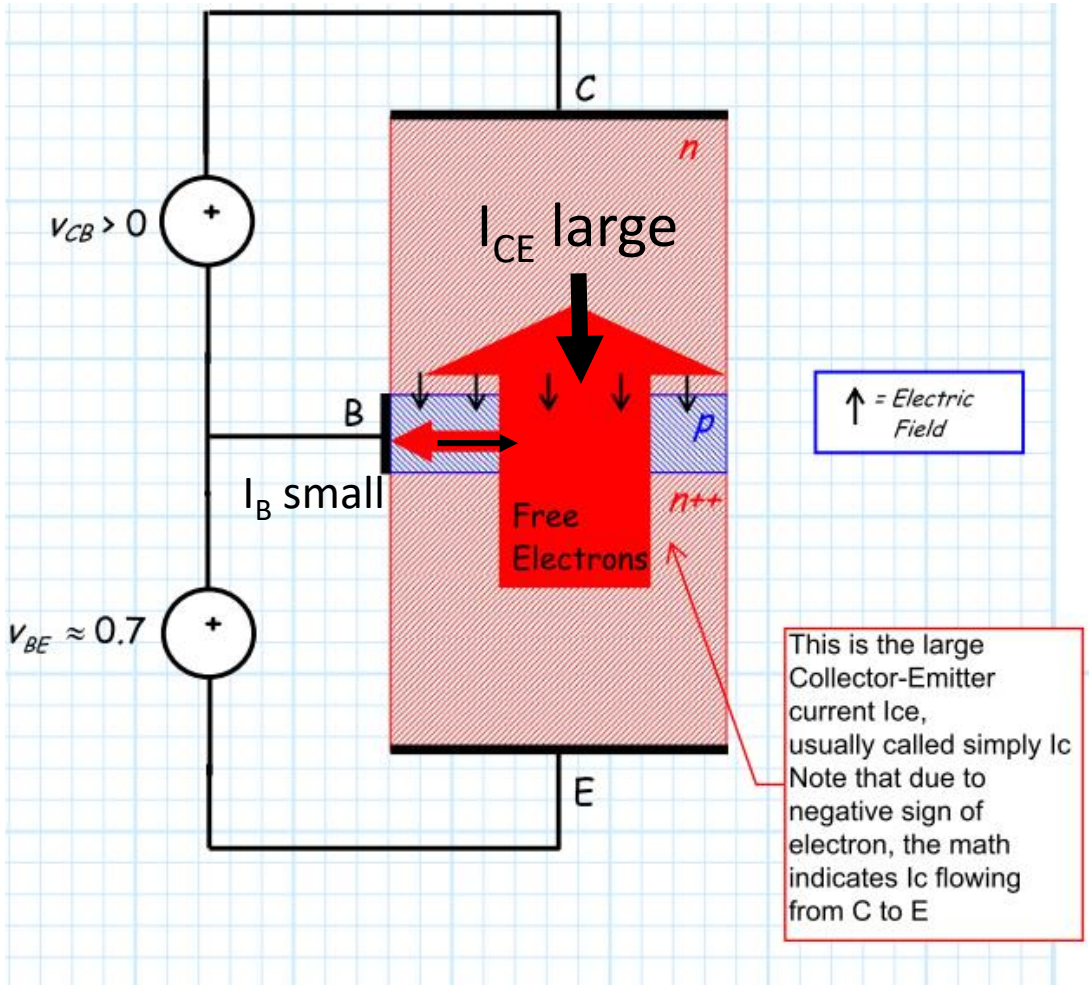


NOTE: Although an NPN BJT schematically appears to be two diode junctions NP (CB) and PN(BE), it is NOT ACTUALLY two diodes connected back to back!!
The thickness of N, P, N regions inside the silicon determines the characteristics as explained below



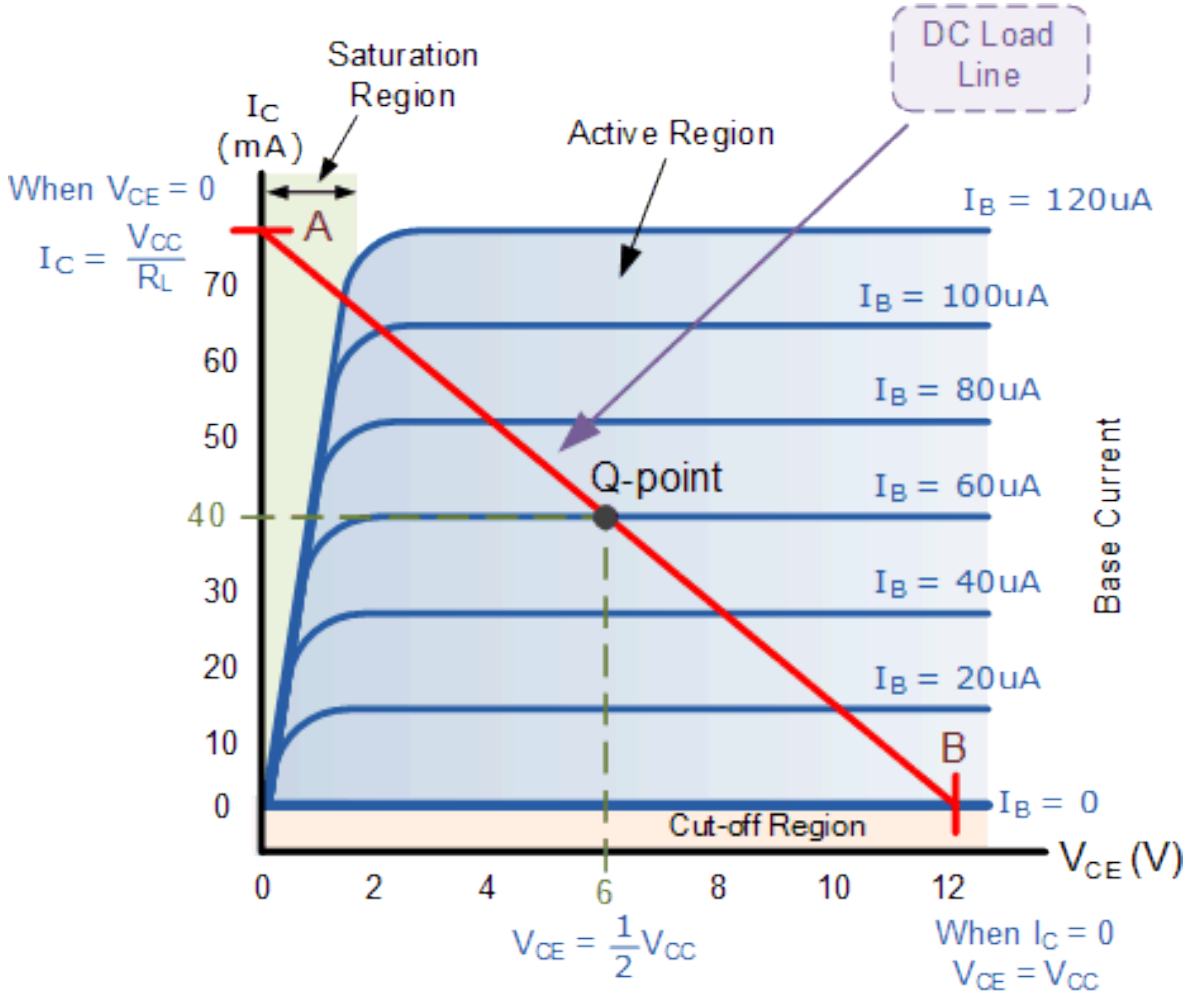
IS NOT:





PRACTICALLY, BJT AMPLIFIES CURRENT

Send small Base current IN. Get LARGE current out



Necessary conditions to be in the blue:

$$V_{BE} > 0.7V \ (= 0.7V)$$
$$V_C > V_B$$

BJT in a circuit:

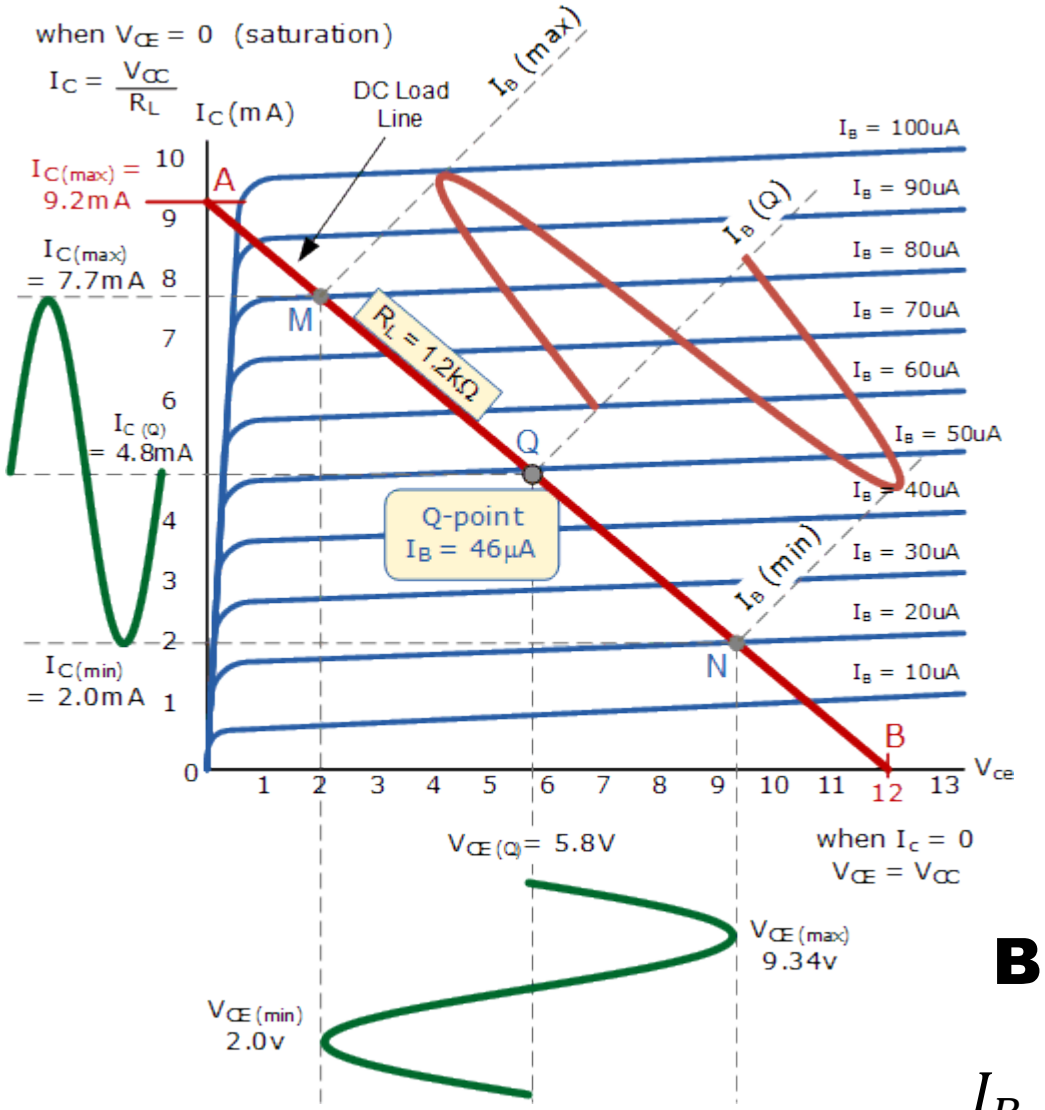
some source is injecting I_B , some load is taking I_C
I_B & I_C may change as a function of *t*

Q – point "quiet" DC operating point:
When I_B *and* $I_C = \beta I_B$ constant in *t*
V_{CE} is restricted to < V_{CC}
$\frac{V_{CC}}{R_L} = I_C$: constrains the BJT's node voltages and currents: **"load line"**
setup the circuit so that V_{CE} is at $0.5V_{CC}$ – then V_{CE} can swing between V_{CC} and 0

BJT AMPLIFICATION "ACTION"

Base current changes in time: how does Collector current respond?

Lab 3



Lab 4

Node voltages and currents restricted to be on Load Line

I_{BQ} and hence $I_{CQ} = \beta I_{BQ}$ have been set at the Q-point

Time variation: $I_{BQ} \pm i_B \rightarrow I_{CQ} \pm i_C$

But notice difference in scale!

$$I_B = 50 \pm 30\ \boldsymbol{\mu A} \rightarrow I_C = 5 \pm 3mA$$

SCRATCH-PAD

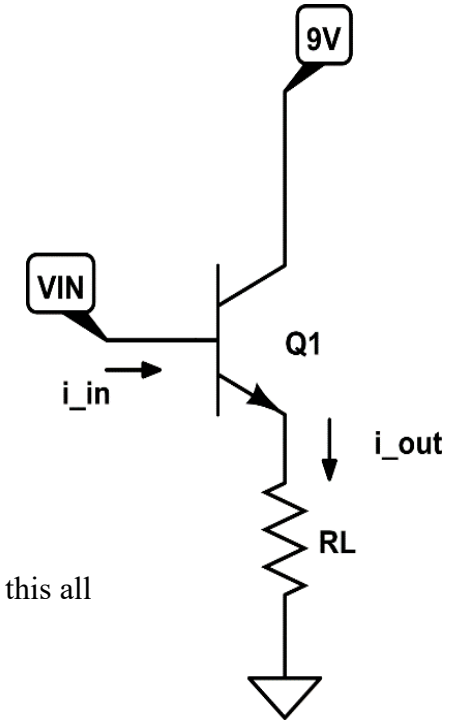


Fig 1:
The BJT current amplifier… is this all there is to it?