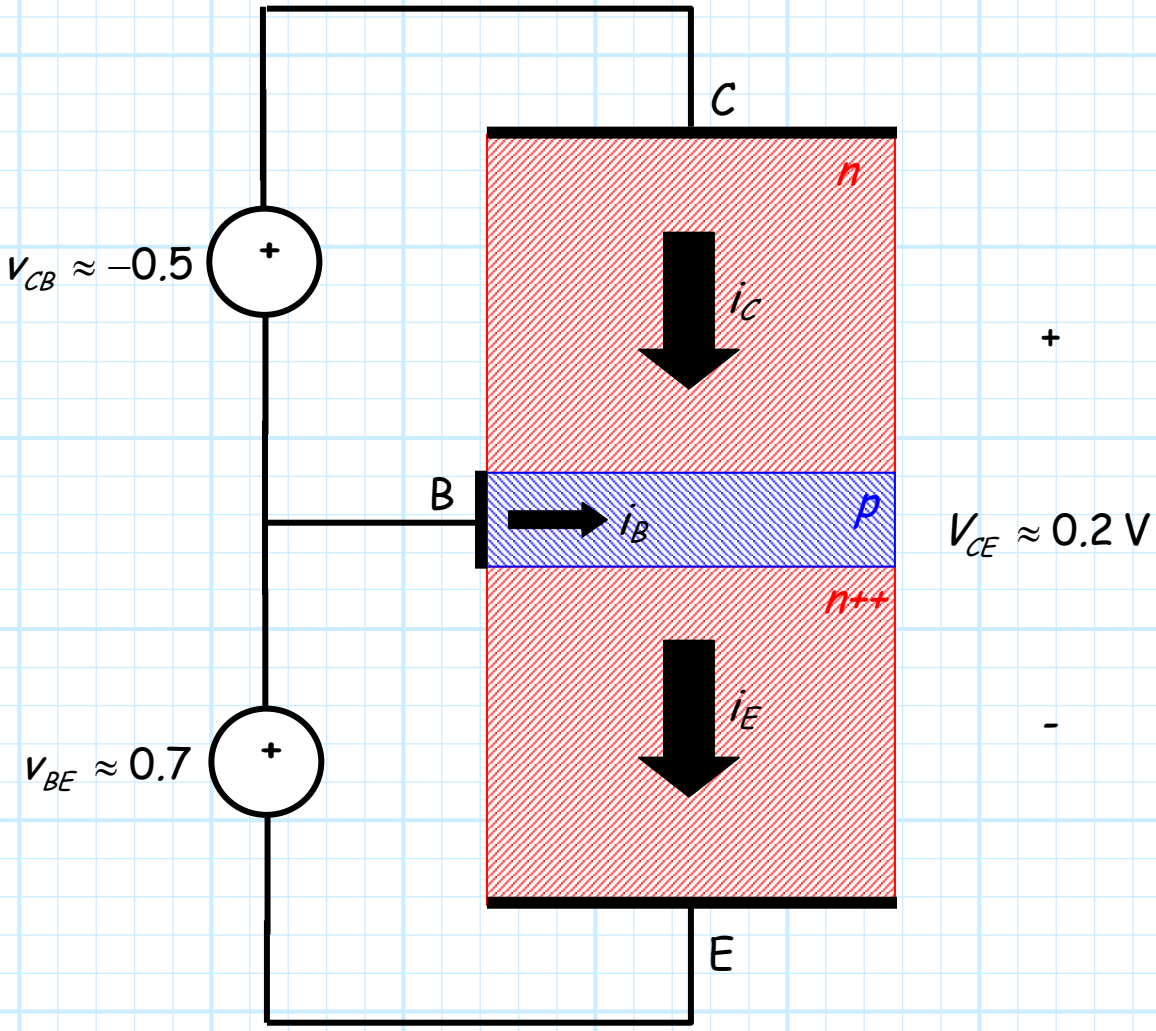
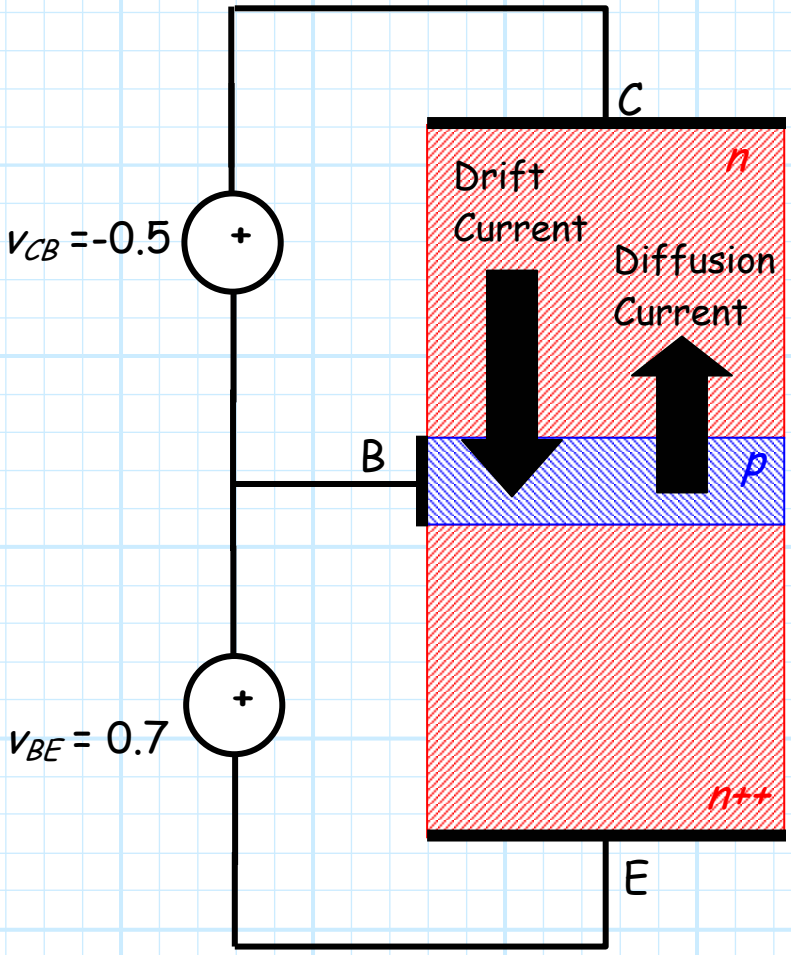
# The *npn* Transistor in Saturation

We know that for an *npn* BJT in **saturation**, **both** the BEJ and CBJ will be **forward biased**. In other words:

$$v_B - v_E \doteq v_{BE} \approx 0.7\ V \quad \text{and} \quad v_C - v_B \doteq v_{CB} \approx -0.5\ V$$






* In **active** mode, the collector current consists mainly of free-electrons that **drift** from the emitter into the collector.

* Since in **active** mode the CBJ is **reverse biased**, there is **no diffusion** of free electrons and holes.

* But in **saturation**, the CBJ is **forward biased** therefore there is also a large amount **diffusion current**!

Recall that **diffusion** current flows in the **opposite** direction of **drift** current.

As a result, diffusion and drift current tend to **cancel** each other.

Therefore in **saturation**, the **total collector current** (i.e., drift **minus** diffusion) is **less** than that of drift alone.