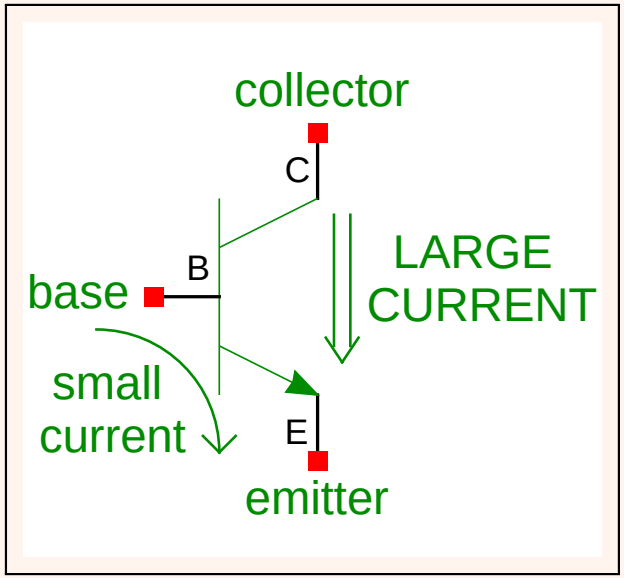
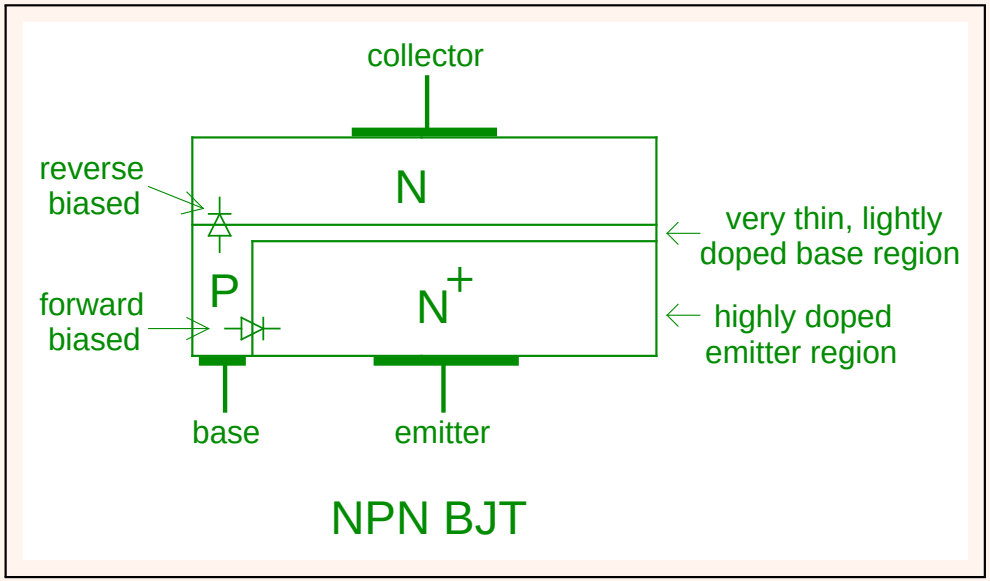
How a BJT Works

- An NPN BJT is roughly configured as shown below.
- The emitter region is highly doped and has a large number of free electrons. It is the *emitter* of electrons.
- The collector region is less doped than the emitter but far more than the base. It is the *collector* of electrons.
- The base region is a thin region ($\approx 100nm$) that is very lightly doped. It has a only a small number of holes present so that recombination of minority carriers from the emitter is reduced.



(a) BJT Current Flow



(b) Rough Physical Structure

How a BJT Works

- The base is so named because of the physical configuration of the first transistors. Mechanical necessities utilized the base region as a substrate or "base" to which the other regions were applied.
- The emitter-base junction forms a forward biased diode when the transistor is in the forward active region. The collector-base junction forms a reverse biased diode under forward active conditions.
- For the transistor to be "on", the base-emitter junction must be forward biased. This diode generally acts like most other diodes and follows the diode equation.
- We want a minimum base current and a maximum collector to emitter current. This is a figure of merit for a BJT called β. The base current is actually an nuisance current but is required for the BJT to operate.

How a BJT Works

- With the collector being very close to the emitter, many of the electrons which cross the emitter-base junction will be swept into the collector region by the relatively high V_{ce} potential before they can recombine in the base region. They are collected by the collector.