

ST 589-01 Lab 5

Operation of the transistor

The objective of this lab is to understand the operation and characteristics of the bipolar junction transistor (BJT). The BJT has 3 separately doped regions and contains two pn junctions. With three separately doped regions, the bipolar transistor is a three-terminal device. Current in the transistor is due to the flow of both electrons and holes, hence the name bipolar.

The basic transistor principle of operation is that the *voltage between two terminals controls the current through the third terminal*. However, the two pn junctions are sufficiently close together to be called interacting pn junctions. The operation of the transistor is therefore totally different from that of two back-to-back diodes.

We are using a transistor to turn a LED on and off. We need to calculate the resistances R and R_b , and the power dissipated in the transistor for the bipolar inverter switch shown in Figure 1. The required LED current is $I_c \approx 15$ mA to produce some specified output light. Look up transistor parameters β , $V_{BE(on)}$, and $V_{CE(sat)}$, and LED cut-in voltage [Note: LEDs are fabricated with compound semiconductor materials and have a larger cut-in voltage compared to silicon diodes.]

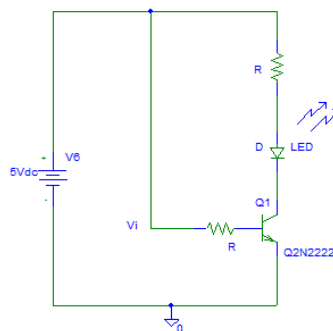


Figure 1. A circuit used to switch an LED on and off

Comments

You may assume values for β , $V_{BE(on)}$, and $V_{CE(sat)}$, to compute an estimate for the value of the resistors, however to know exactly the value of the current flowing through the LED, we need to look up the specs for this particular transistor on the internet.