

ENGR-356

Lab # 6

Current-Voltage (I-V) Characteristics of Semiconductor Devices

Goals

The principle goal is to investigate and to understand the voltage-current relationships of transistors. Another goal is to gain further ability to use electronic test and measurement equipment.

Design

Create a way of using an oscilloscope, a function generator, a DC power supply, and other components to display the I-V characteristics of the transistors listed below. The curves displayed on the screen will look similar to those in your textbook (for one base current at a time)

Components to test

- 1) An NPN transistor. 2N2222 is suggested.
- 2) A PNP transistor. 2N2907 or MPQ2907 suggested.

Measurements

For the transistors, determine their Beta (the DC current gain). Also, use the Tektronix curve tracer to check the same parts, determine Beta, and compare your measurements with the Tektronix unit. Let V_{ce} range up to 10 volts and I_c up to 20ma or so.

Documentation

Take careful notes in your lab notebook. Be sure to include a circuit diagram and details of how you set up the oscilloscope, etc. Sketch the I-V curves from the oscilloscope and the curve tracer.

Lab Report

There is no formal lab report for this lab but your work needs to be neatly and thoroughly documented in your notebook. There should be a summary, i.e. results, section in your lab notes created after completing your measurements. Turn in a Xerox copy of your work.

In your summary you need to clearly state the following:

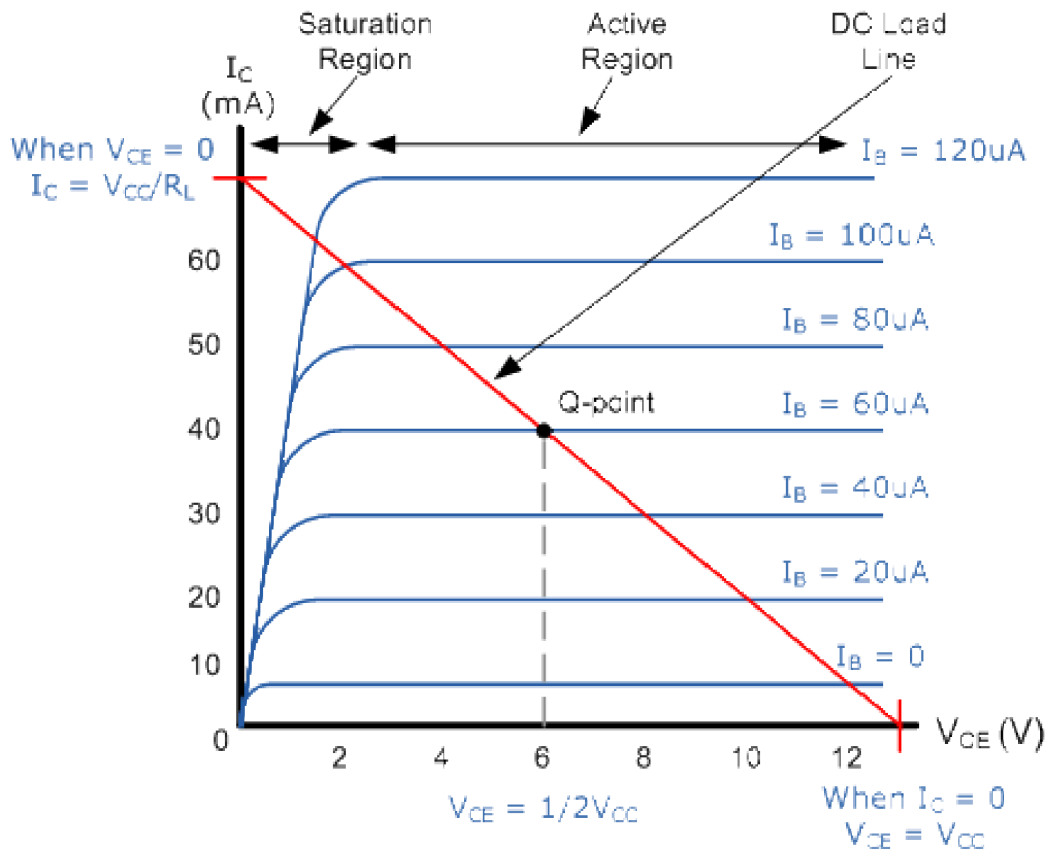
Beta and V_{be} of the 2N2222 and 2N2907 with an I_c of 10ma at V_{ce} of 5 volts

Additional information that may be helpful.

2N2222 Max collector current = 600ma
 Max collector to emitter voltage = 40 volts
 Max base to emitter voltage = 6 volts

2N2907 Max collector current = -600ma
 Max collector to emitter voltage = -60 volts
 Max base to emitter voltage = -5 volts

Example transistor curves. The current ranges you test at may be different than those shown in this graph. You don't need to take data over the full voltage range of the transistor. Attempting to have V_{CE} go from 0 to 12 volts is reasonable.



Before creating a circuit that will produce a curve, set up the transistor with a power supply to create the base current, another supply to create V_{CE} . You will have a base resistor with a value that limits the base current to a desired value. Measure its resistance. Also measure the actual value of a 10 ohm resistor and place it in series with the collector supply source. You can then measure the voltage across these 2 resistors to determine I_B and I_C values.