

ELEC ENG 2E15

Lab 4

Lab 2 explores the iv-characteristics of BJTs.

Objectives

1. Explore the iv-characteristics of BJTs.
2. Extract BJT parameters from measurement.

Safety

Be sure to check the ratings of any device before using it. Supplying current or applying voltage in excess of device ratings could destroy the device and/or cause minor burns if you touch a device that is “running hot.”

Resources

- Under Content->Resources on Avenue you will find the old lab manual used in this course. It contains all the information you need regarding PSpice.

Lab Requirements

Part 1: Refer to the [guided exploration of iv-characteristics](#) in Content Module 1. **Modify** those instructions **or any alternate experimental setup you identify through your own research** to measure the iv-characteristics of the NPN in your parts kit. You should plot:

- a. i_C as a function of v_{CE} for four different values of i_B (including $i_B = 0$);
- b. $\ln i_C$ and $\ln i_B$ (preferably on the same graph) as a function of v_{BE} for a reasonable range of v_{BE} for $v_{CE} = 4V$ and $v_{CE} = 5V$; and
- c. $\ln i_C$ and $\ln i_B$ (preferably on the same graph) as a function of v_{BE} for a reasonable range of v_{BE} for $v_{CE} = 0.1V$, $v_{CE} = 0.2V$, and $v_{CE} = 0.3V$.

In each case, discuss what you would expect from theory and how it compares with what you actually measure.

From the different curves that you obtain determine how best to extract β , $V_{BE(ON)}$ and $V_{CE(sat)}$.

Compare the values you extract with the values given in the data sheets.

Part 2: Repeat Part 1 for the PNP device. Remember to switch the polarities of applied voltage and measured current appropriately.

Part 3 (bonus): Figure out how to extract V_A from your measurements. Read about the full BJT model in your textbook and extract the value of I_S .

Report Requirements

You are expected to make one submission per report in the Avenue Dropbox for Lab 1. Your submission has to be a single pdf file containing:

1. A photograph of your hardware setup.
2. Your measurement results
 - a. This should include explanation of the specific steps you took in your measurements.
 - b. This should include screen capture of graphs that were generated by your measurement software or graphs that you generated manually. **Use your judgment: we only need enough graphs to answer the questions you are supposed to investigate.**
3. Screen capture of your simulations:
 - a. This should include circuit schematic, netlist, and simulation results.
4. A brief discussion of any discrepancies between measurement and simulation.
5. A brief discussion of any difficulties encountered in doing the lab and how you did troubleshooting.

I have not specified a particular page limit but you should make your report as brief as you can while meeting the above requirements. Excessive length will be penalized.

Marking

Your report will be marked on:

1. Experimental work
2. Calculations and discussion
3. Professional presentation and clarity

No simulations are required in this report. A detailed rubric will be posted prior to the deadline for submitting the report.

Deadline

All deadlines are listed on the course schedule and in the “Labs and Projects” page in the Handbook.