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ECe 3200-01 Lab 1

Four Resistor Biasing of NPN & PNP BJTs in the Active Region

**Objective:**

Student will measure the biasing stability of an NPN & PNP transistor circuits and will validate the results by calculation and simulation. The learning outcome will be a foundation for the design of small signal amplifiers later in the course.

**Parts:**

1. ​​2 general purpose NPN transistors (2N2222)
2. ​​2 general purpose PNP transistors (2N3906)
3. ​​Resistors: 2x 2.7k, 2x 3.3k, 2x 10k, 2x 22k

**Procedure:**

1. Set up the NPN and PNP transistor circuits, one at a time, according to the diagram shown in fig.1.
2. Adjust the power supply to Vcc = 15 V. If the power supply has a current limiter set it to 100 mA as a measure of safety.
3. Measure ICq and VCEq of the transistors each time as the transistors are changed.
4. Determine the % of variation in the bias quantities due to changing of the transistor.

**MEASUREMENT 1 (B = 100)**

ICq (meas.) = ...1.44mA.. VCEq (meas.) = ....6.315v... NPN

ICq (meas.) = …1.42mA.. VECq (meas.) = ....6.42v.... PNP

**MEASUREMENT 2 (B = 125)**

1. Now replace both transistor with another one from the same batch and repeat step 3. Measure the quiescent values again:

ICq (meas.) = ...1.449mA.. VCEq (meas) = ...6.268v.... NPN

ICq (meas.) = ..-1.433mA.. VECq (meas) = ...6.371v.... PNP

1. What is the % variation of the results between the two measurements?

ICq (% change) = ..0.625...% VCEq (% change)= ....0.744..... % NPN

ICq (% change) = ..0.618...% VECq (% change)= ....0.763..... % PNP

Diagram, schematic

Description automatically generated

**Postlab:**

1. Data based calculations from device theory deriving the Q-point.
2. Circuit simulation diagrams showing the circuit voltage and current.
3. Conclusion.

**Analysis & Results:**

1. **Calculations:**

**MEASUREMENT 1**

(NPN)

= 1.440 mA

= 6.315 V

(PNP)

1.4242 mA

= 6.42 V

**MEASUREMENT 2**

(NPN)

= 1.440 mA

= 6.315 V

(PNP)

1.4242 mA

= 6.42 V

1. **Simulation:**

Diagram, schematic

Description automatically generated

Figure 2: Voltage measurements using 2N2222 and 2N3906 transistor with

Graphical user interface

Description automatically generated

Figure 3: Current measurements using 2N2222 and 2N3906 transistor with

Diagram, schematic

Description automatically generated

Figure 4: Voltage measurements using 2N2222 and 2N3906 transistor with

**Conclusion:**

This lab was conducted to examine the differences in biasing of an NPN and PNP. As a result of this lab, I was able to better understand making measurements on the biasing stability of an NPN and PNP transistor circuits, as well as how the biasing of these transistors produces certain current values. Although I was not able perform the lab physically, I was still able to visualize the circuit with the help of pSpice, and the zoom meeting provided. Having pSpice also allowed me to adjust the β value for each transistor and, from there, compare the percent variation between the quiescent values across the NPN and PNP. I thought this lab was relatively simple yet informative as it will become a foundation for small signal amplifiers for future labs from here on out.