ECE112 - Lab 4

Purpose

- Measure KVL loops across circuit elements
- Measure power dissipated and physically experience it

Parts/tools needed:

- Assembled and properly working power supply
- Wall wart, jumper leads
- 100Ω, 2W resistor
- Digital Multimeter (DMM)

Finding and Measuring KVL loops

1. Using the annotated schematic in figure 1 (use *.pdf for color*) note the three colored KVL loops. Using your voltmeter on the 20V scale, trace around each loop, placing the voltmeter probes as indicated across each element, and sum the voltages around the loop. Note that the "+' and "-" signs show an assumed current direction just as in our hand calculations.

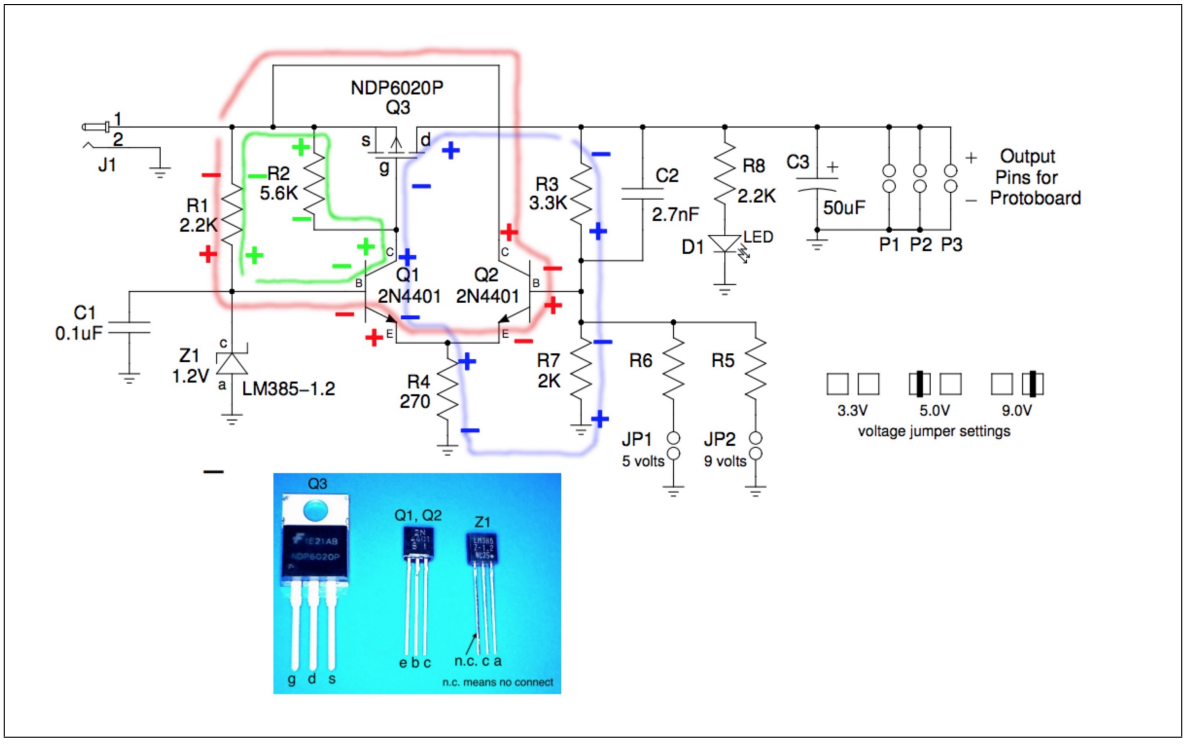

Figure 1: Three KVL Loops

For loop 1 (green), you should have three voltage readings; one across R1, one across R2, and then one across the C-B terminals of Q1 (clockwise path). According to KVL, the voltages across all elements in this closed loop should sum to zero. Write down each voltage you observe below and sum them. Your sum should be very close to zero volts.

R1: _____
R2: _____
C-B terminals at Q1: _____
Voltage sum : _____

For loop 2 (red), you would have four voltage readings; one across R1, one at the B-E terminals of Q1, and across the E-B and then B-C terminals of Q2. Record the voltages for loop two and sum as before.

R1: _____
B-E @ Q1: _____
E-B @ Q2: _____
B-C @ Q2: _____
Voltage sum : _____

For loop 3 (blue), there are five voltages. Record them and sum again as before and see that the result is zero.

D-G @ Q3: _____
C-E @ Q1: _____
R4: _____
R7:_____
R3:_____
Voltage sum : _____

In all three loops you should see that regardless of the closed loop taken, the sum of the voltages in that loop will equal zero. This is in agreement with Kirchhoff's voltage law:

$$\sum_{b=1}^{B} V_b = 0$$

Where B is the number of branches in the circuit and V_b is the voltage across each branch.

Measuring and Feeling Power Dissipation

1. Plug two female jumper wires into the power supply output pins. On the other end of the jumper wires, push the leads of a 1 watt, 100 ohm resistor into the connectors. Put your power supply in the 5 volt setting and plug the wall wart in.

Measure the voltage across the 100 ohm resistor. You will probably find that it has dropped somewhat. Then cut your power supply off to keep the resistor from getting too hot. Record the voltage here.

Voltage across 100 ohm resistor: _____

Now compute the power the resistor is dissipating. Show your calculations.

2. All the output current going through the 100 ohm resistor flows from Q3 via its s-d terminals. We can compute how much power Q3 is dissipating by measuring the voltage across it and knowing the current through the 100 ohm resistor. Knowing the voltage across the 100 ohm resistor allows computation of the current through it. Thus you do not need to break the circuit to find the current through Q3. Compute the power dissipated by Q3. Show your calculations.

3. Unplug your power supply. Set it for 9V operation. Plug in the wall wart again and feel how hot the 100 ohm resistor gets. (It gets hot very fast) Take quick measurements to determine how much power Q3 and the 100 ohm resistor are dissipating. Be careful not to get burned. Show your measurements and calculations below.

4. Have your TA check off your work.