Lab 1 – Miscellaneous Components

CSE 3323 – Electronics for Computer Engineering

In this lab, we will build a variety of simple circuits to help illustrate the basic functionality of common electronic components. This will include: Voltage Regulators, Photoresistors, mechanical switches, and proper power supply usage.

Students work in pairs (except one group of 3) during lab time.

Each student will submit a PDF lab report (due by one week) regarding the lab measurements and the circuits built.

What you specifically should include in your lab report is indicated in RED throughout this document. You should also elaborate to discuss the procedure of each individual circuit AND discuss your results/measurements/thoughts.

Lab reports are **individual work** but include your lab partner's name in your report.

Tools Used:

- **Digital Multimeters**
  - Thsinde 18B+ (yellow)
  - Mastech MS8268 (green)
- **Current-Limited Power Supplies**
  - DC Power Supply, Yihua YH-302D
  - DC Regulated Power Supply, Tekpower TP3005T
- **Digital Oscilloscope**
  - Siglent SDS 1202X-E, 200MHz
- **Signal Generator**
  - Siglent SDG1025, 25MHz, 125 MSa/s
- **IDL-800 Digital Lab**
- **Wire cutters/strippers, probes, banana connectors, alligator clips, jumper wires, solderless breadboards, etc.**

Components Used:

- Note: You can go to Mouser.com and search these part numbers (below) to find their specific specs and datasheets or just click their hyperlink to find their product page
- Resistors, potentiometers, capacitors, and LEDs (various values)
- Linear Voltage Regulator: 511-L7805CV
- Photoresistor: GM5539
- SPST Push Button Switch: 506-FSM4JH
- SPDT Slide Switch: 612-EG1218

NOTE: For all **Vout** (voltage output) mentions below, implies using your Multimeter to measure the **Vout** directly. We will not use the oscilloscope to measure any voltages today.

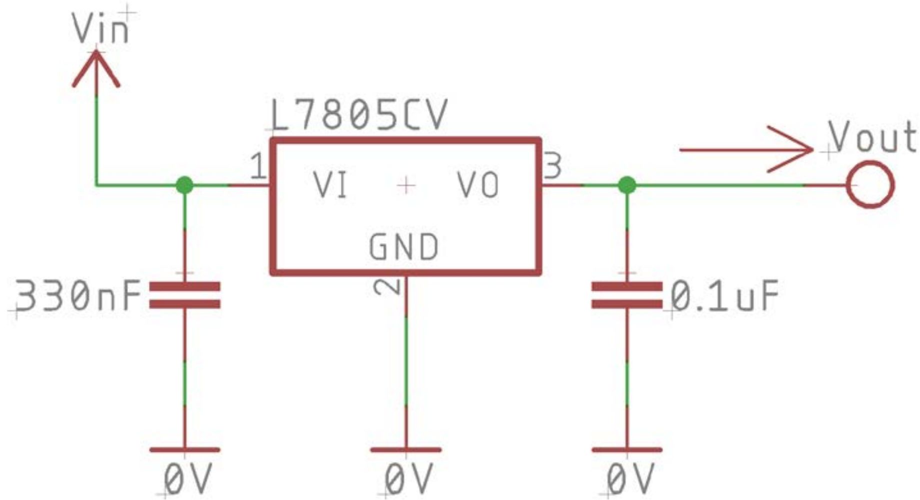
Directed Part of Lab:

1. **Linear Voltage Regulator (regulated 5.0V output)**

   NOTE: For this part, set your Power Supply's current limit to 50mA

   a. Build this circuit with the Linear Voltage Regulator, find the Voltage Regulator's datasheet with the part number/link above to learn its pinout

L7805CV
(TO-220 Package)



   b. After the circuit is fully built, incrementally increase the power supply voltage **Vin** from 1.0V to 8.0V (in 0.5V increments), stopping to measure both the **input voltage** and **output voltage** of the linear regulator (record all **Vin** and **Vout** values in a table)

   c. What is the minimum **Vin** value when the **Vout** "levels off" at the desired 5.0V output and remains constant? (make fine power supply voltage adjustments to find this value)

      i. How does this measured value compare to the datasheet's specs?

   d. Keeping your input at the minimum **Vin** you found, attach a resistive load (470Ω resistor) to the **Vout** and **GROUND**.

      i. Is the **Vout** still a steady 5.0V?

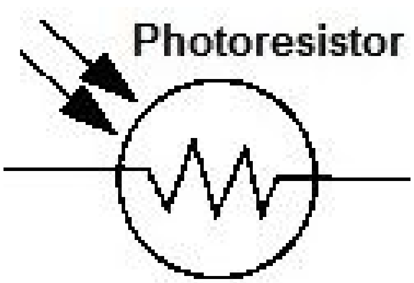
      ii. With the load still attached, find the new **Vin** minimum

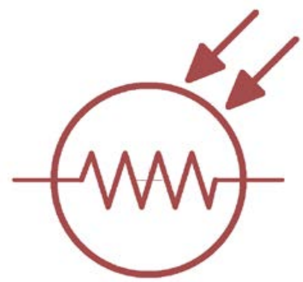
      iii. How does this measured value compare to the datasheet's specs?

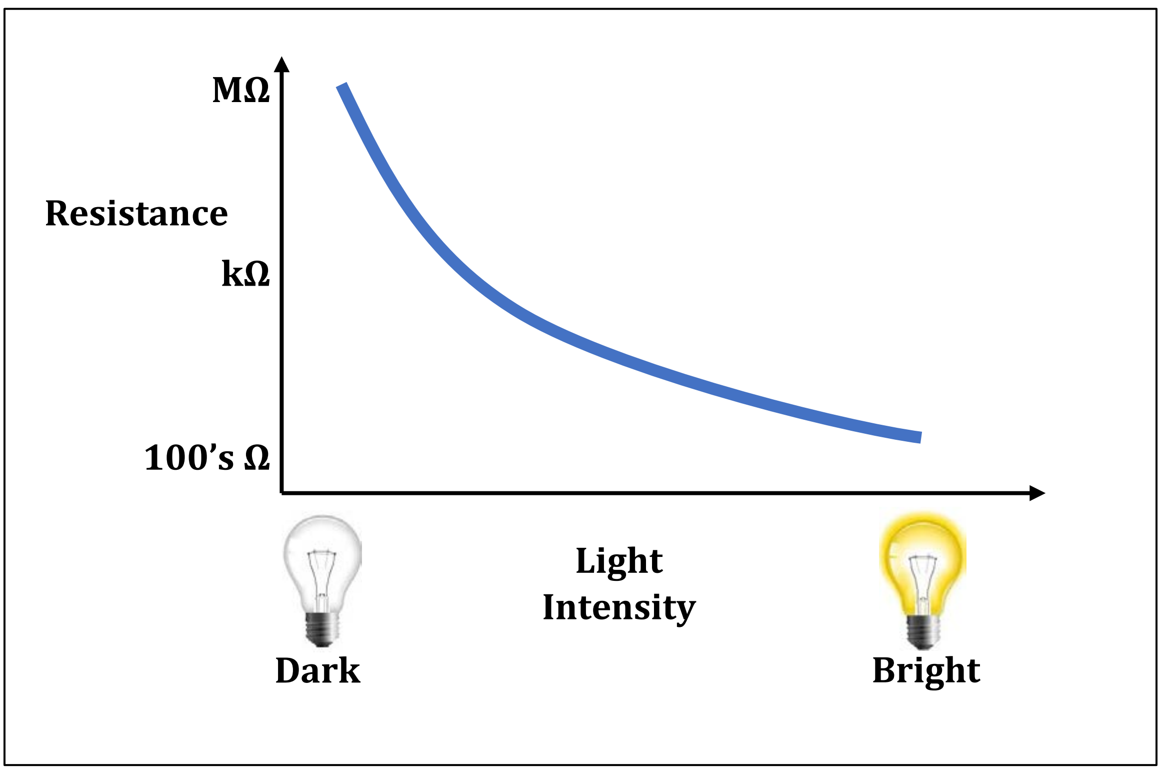
2. **Photoresistor (or Light-Dependent Resistor, LDR, or Photo-Conductive Cell)**

NOTE: For this part, no power supply is needed, only your Multimeter

  a. A Photoresistor is a 2-lead component that acts as a light-controlled variable resistor
  b. Normally behaves as such:
     i. More Light (less dark) → Smaller Resistance
     ii. More Dark (less light) → Higher Resistance
  c. Measure and record the resistance of the Photoresistor in 3 situations:
     i. Complete Darkness
     ii. Normal Lab Light
     iii. Bright Flashlight Pointed Directly at the Photoresistor







Individual Part of Lab:

3. **Photoresistor continued**

   NOTE: For this part, set your Power Supply's current limit to 20mA

   a. Use a 5V supply, 1 Photoresistor, and 1 normal resistor (you decide upon the most appropriate Ω value to give you the widest range of voltage output) to construct two simple circuits to accomplish the following:

      i. More light input → More voltage output (**Vout**)

      ii. More light input → Less voltage output (**Vout**)

      iii. Draw both of these circuits in your reports and record some of your **Vout** readings under different lighting conditions

   b. Replace the normal resistor with a 100kΩ Potentiometer. Use it as a variable resistor to "set" the **Vout** to 2.5V under "normal lab light" conditions. So now if the circuit is darkened, the **Vout** drops below 2.5V. If the circuit is illuminated more brightly, the **Vout** goes above 2.5V.

      i. Draw this circuit in your report and record some of your **Vout** readings under different light conditions

      ii. Also record what Ω value the POT was set to in order to achieve the "normal" 2.5V output

      iii. Demo to the TA or Instructor

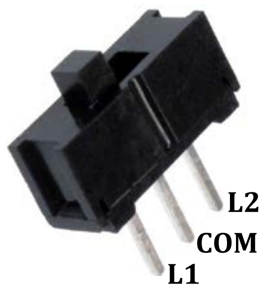
4. **Switch Basics**

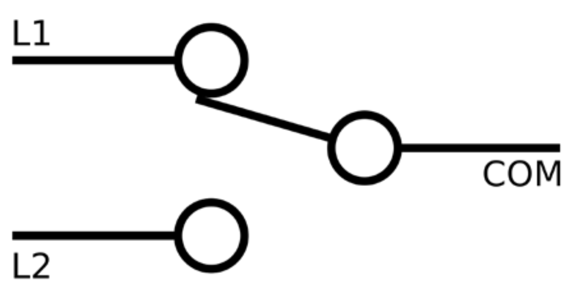
   a. **SPDT** (Single Pole, Double Throw)

      i. A SPDT mechanical switch has 3 leads, the middle lead is always connected to one of the other two outer leads. But it can only be connected to either once at a time. It can "throw" itself to two possible connections (double throw). It holds its state, not momentary.

      ii. Only two possible states:

         1. **L1** is connected to **COM**, and **L2** is floating (not connected)
         2. **L2** is connected to **COM**, and **L1** is floating (not connected)





      iii. Use a 5V supply with a current limit of 20mA. Use two resistors, two LEDs, and one SPDT Slide Switch to make a circuit that only turns ON one LED at a time. Moving the switch alternates between the two. Pick resistor values so only about ~5mA are flowing through any one LED.

      iv. Draw the circuit in your lab report and demo to the TA or Instructor

b. **SPST** (Single Pole, Single Throw)

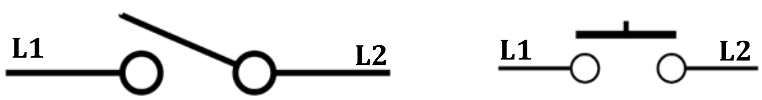
i. A SPST mechanical switch has 2 ***true*** leads but the packaging might come with 4 lead connections available. Pressing or releasing the button simply connects or disconnects the 2 leads.

ii. The specific switch we are using is a “Momentary Tactile” switch, which means it does not hold the state once you release the button. It returns to its normal default state. This specific switch is a N.O. switch (Normally Open). Some are available as N.C. switches (Normally Closed).

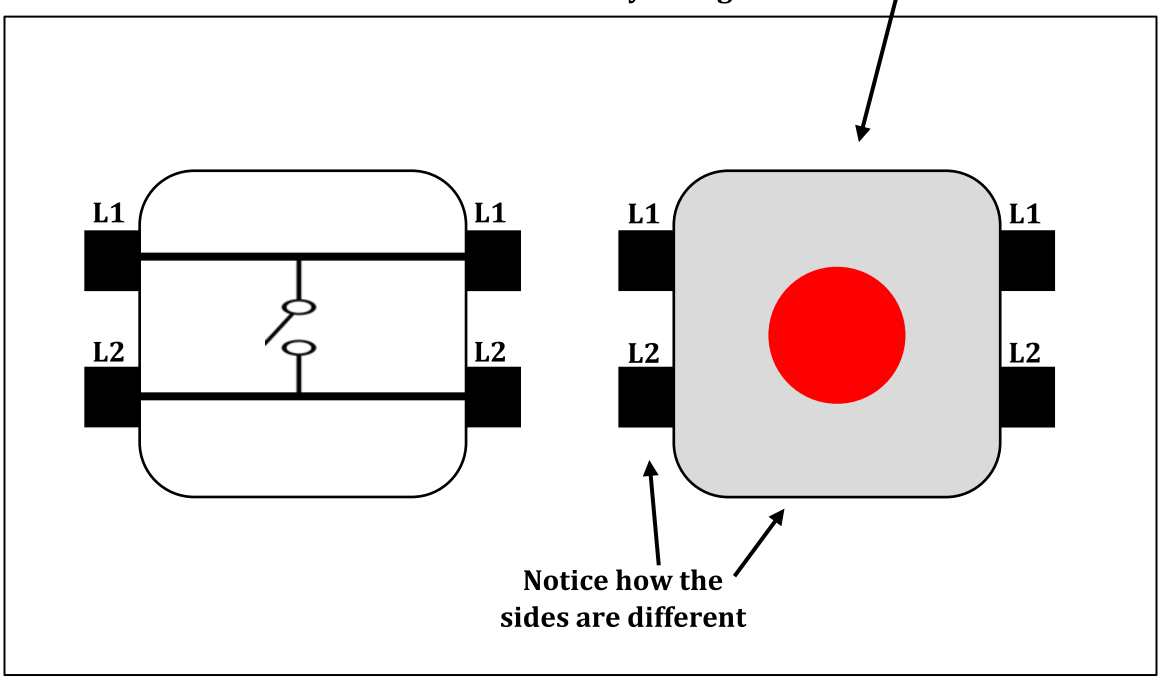
iii. Only two possible states for our N.O. example:

1. **Not Pressing Button:** L1 and L2 are NOT connected (open)
2. **Press Button:** L1 and L2 are DIRECTLY connected (closed)

Two most common symbols for a N.O. SPST switch



Here are diagrams to help understand how a 4-lead SPST switch is internally configured



iv. Use a 5V supply with a current limit of 10mA. Use 1 Push Button Switch, and 1 10kΩ resistor to construct two simple circuits to accomplish the following:
   1. **"Pull-Up Configuration"**
      a. Not Pressing Button → Vout = ~5V
      b. Pressing Button → Vout = 0V
   2. **"Pull-Down Configuration"**
      a. Not Pressing Button → Vout = 0V
      b. Pressing Button → Vout = ~5V
   3. DOUBLE CHECK THAT YOU ARE NOT SHORT-CIRCUITING ANYTHING, MAKE SURE YOU HAVE A 10mA CURRENT LIMIT
   4. Draw both of these circuits in your reports and record all of your **Vout** readings
   5. Demo both circuits to the TA or Instructor

More information regarding all types of switches: SparkFun Tutorial