**EECS Day Electrical Engineering Lab**

**Part 0: Introduction**

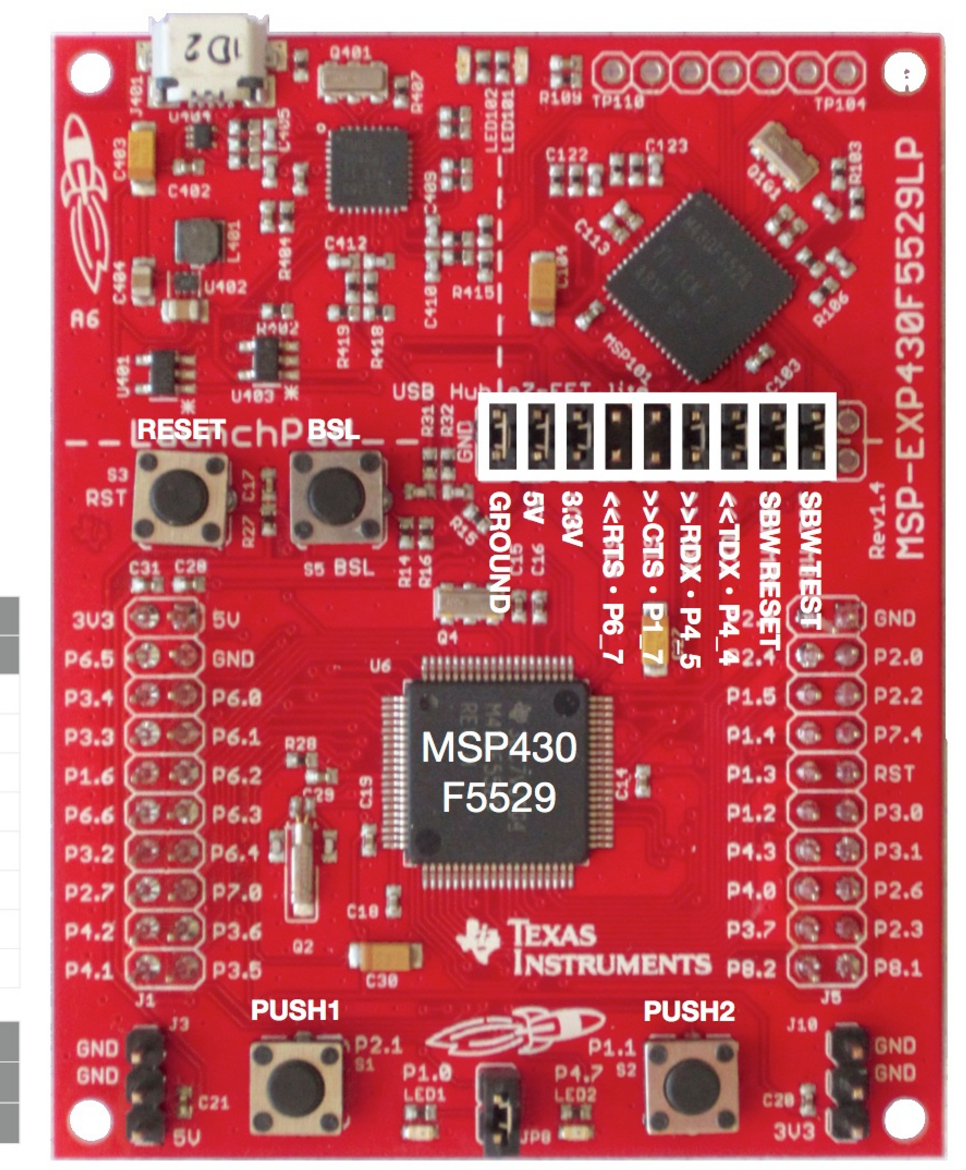
**General Overview:**

This will be a 5 part microcontroller, circuits, and coding lab. You will be: making a light blink, making a light fade, making a light fade based on your movement, making a buzzer sound at different tones, and making a buzzer sound at different tones based on your movement. Feel free to do as much or as little of the lab as you like. If you finish all 5 parts, you are welcome to create your own circuit with the help of your group mentor.

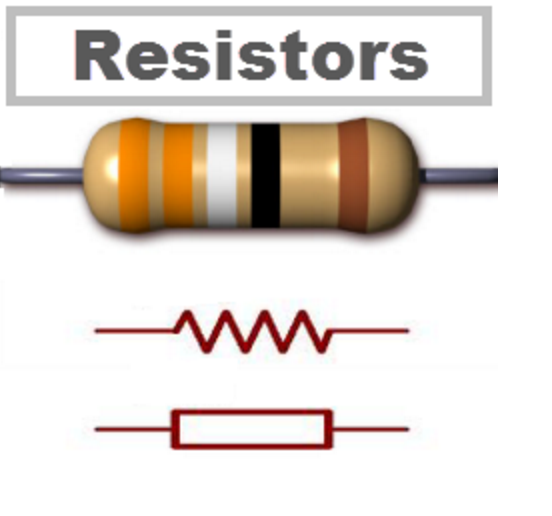
The code for all parts is written so that there is a brief description of what we would like you to do. We highly encourage that you try to fill in the code yourself. If you get stuck, or do not have any coding experience, feel free to see the solutions that are commented out in the code or ask your group mentor for help.

**Brief Overview of Parts:**

1) TI Launchpad MSP430 (we will refer to it as an MSP430)

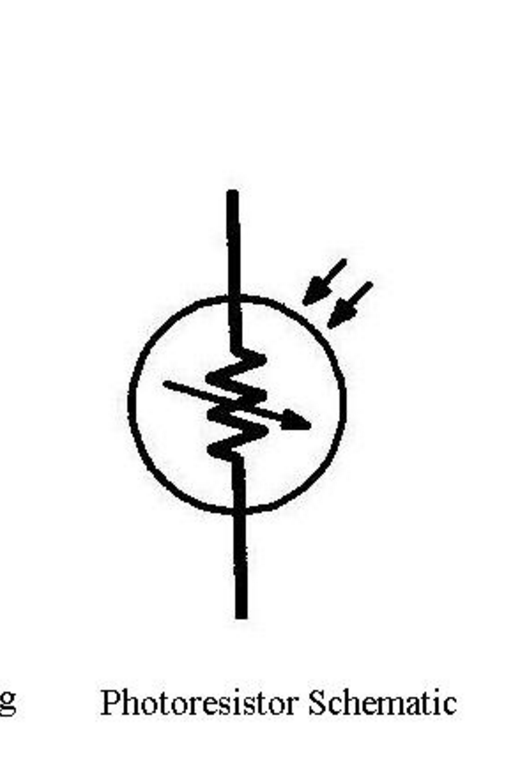
This is a microcontroller, essentially a small computer on a chip, that will be powering our circuit and performing most of the functionality. The MSP looks like this:

It has about 40 pins. When we refer to a pin during this lab we will call it “Pin PX.X of the MSP” where the ‘X’ will be filled in with numbers. Additionally, we will be plugging wires into the holes on the back of the board with the breadboard placed in the middle. The MSP will be connected to the computer through the given USB cord.



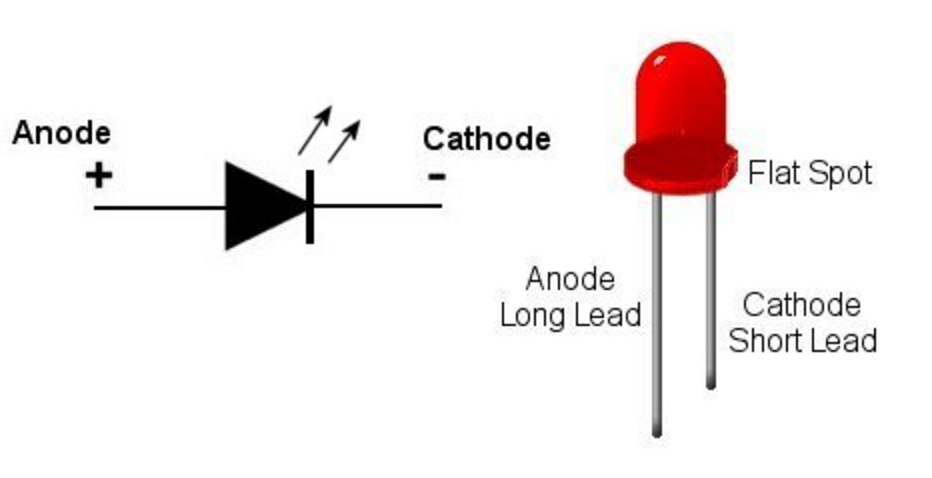
2) Resistors

A resistor “resists” or limits the current across it. These are electrical components that will be used in this lab for dividing voltages and limiting currents. They have resistance values which are noted as color bands on the physical resistor itself. The middle symbol on the right is a circuit schematic symbol for a resistor

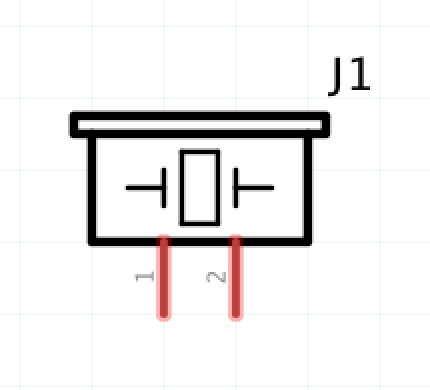
5) Photoresistors

These are resistors that vary their resistance based on the amount of light they sense. The rightmost symbol is a circuit schematic symbol for a photoresistor.

4) LEDs



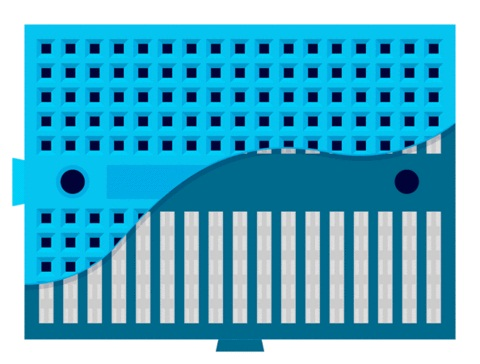
When current flows through an LED in the right direction, it generates light!

5) Piezo Buzzer

Piezo Buzzers are like speakers. They have a small piezo-electric element inside of them, which “Bends” when there is a voltage across it. This forms a basic speaker

6) Breadboards

Breadboards are what we build our circuit on. Internally, all the holes in a column of the breadboard. The breadboards are perfectly sized to fit in between the header of the MSP. **PLEASE DO NOT STICK YOUR BREADBOARD TO THE MSP.** We need to reuse the MSPs between lab sections.

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**Part 1: LED Blinker**

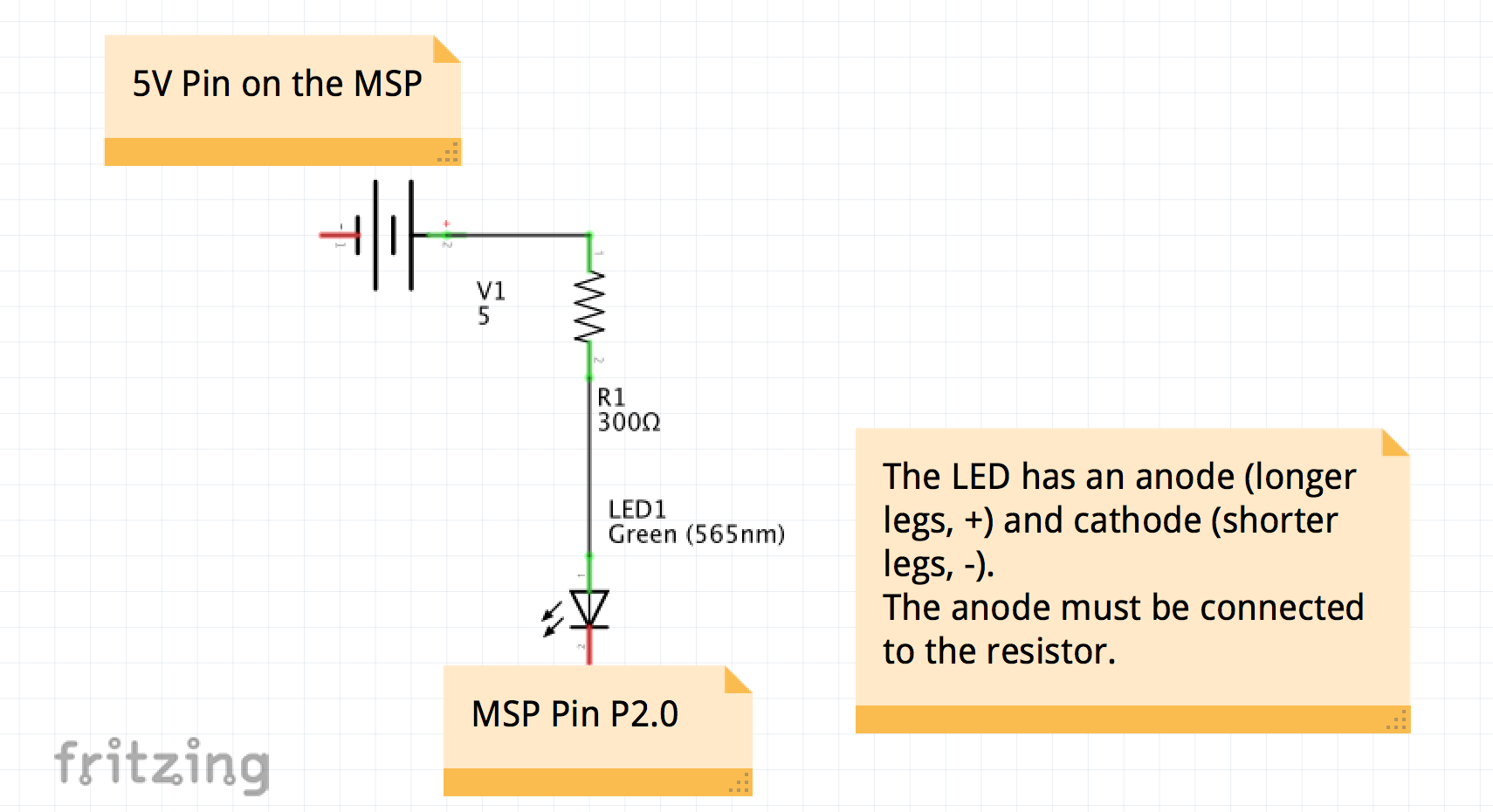
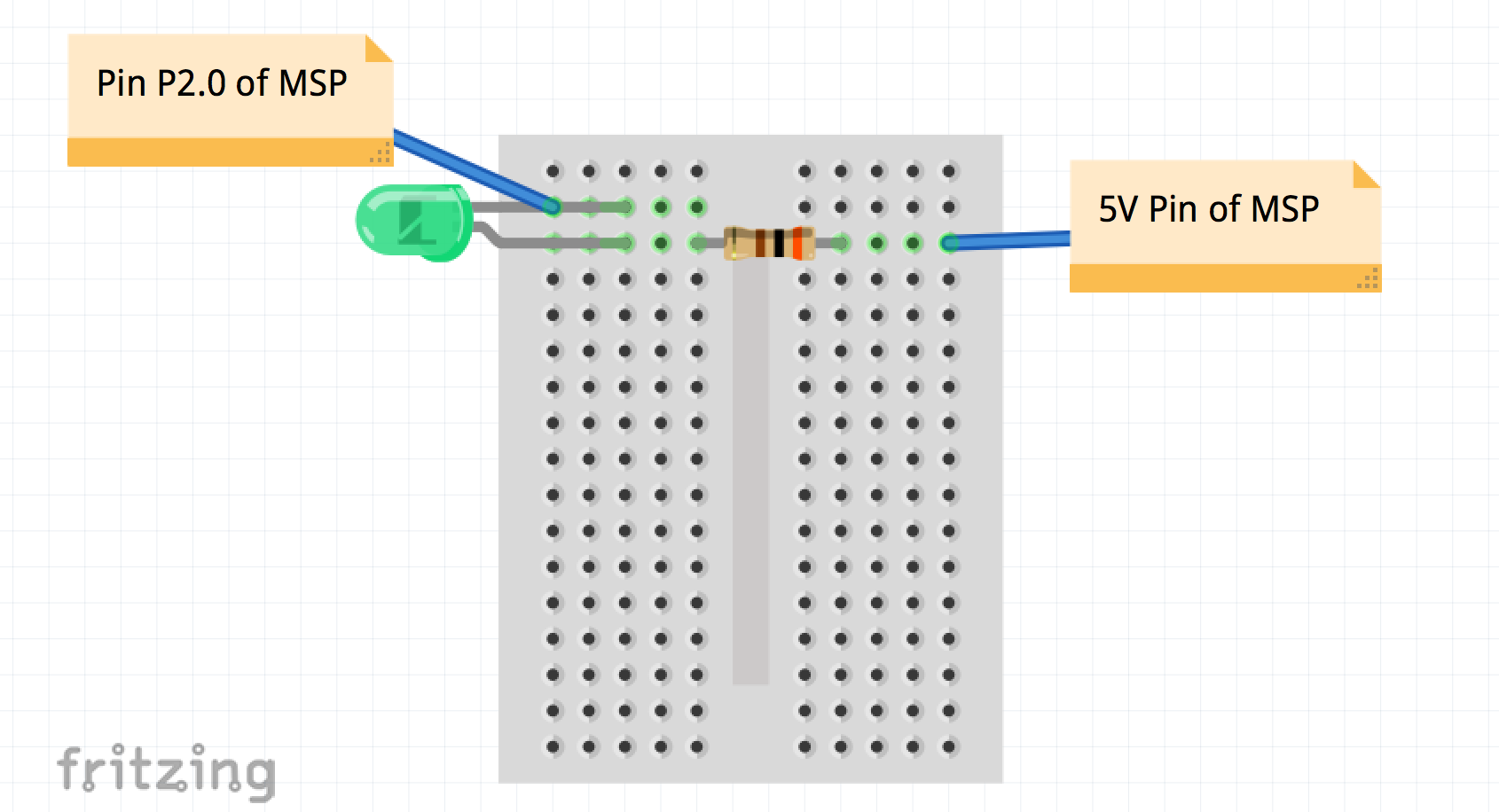
**Materials:**

1. 1 TI Launchpad MSP430
2. 1 Green LED
3. 1 300 Ohm Resistor

**Description:**

We will first build a circuit that turns on an LED when the MSP430 is connected to it. Then we will write code to make the LED blink on and off.

**Circuit:**

1. Schematic
2. Breadboard 

**Code:**

The unfilled code can be found in the eecs\_day\_lab1\_skeleton folder. All instructions and descriptions are commented directly into the code. The solutions are in the eecs\_day\_lab1 folder.

**Part 2: LED Fader**

**Materials:**

1. 1 TI Launchpad MSP430
2. 1 Green LED
3. 1 300 Ohm Resistor

**Description:**

Now let’s make the LED fade. We’re going to change the brightness of the LED through something known as PWM. Basically, we turn the LED on for a short amount of time, and turn it off for a short amount of time. Do this fast enough, and persistence of vision makes humans think the LED is continuously on. As you increase the ratio of on time to off time, the LED gets brighter.

**Circuit:**

Same as in part 1.

**Code:**

The unfilled code can be found in the eecs\_day\_lab2\_skeleton folder. All instructions and descriptions are commented directly into the code. The solutions are in the eecs\_day\_lab2 folder.

**Part 3: Photoresistor Output Graph**

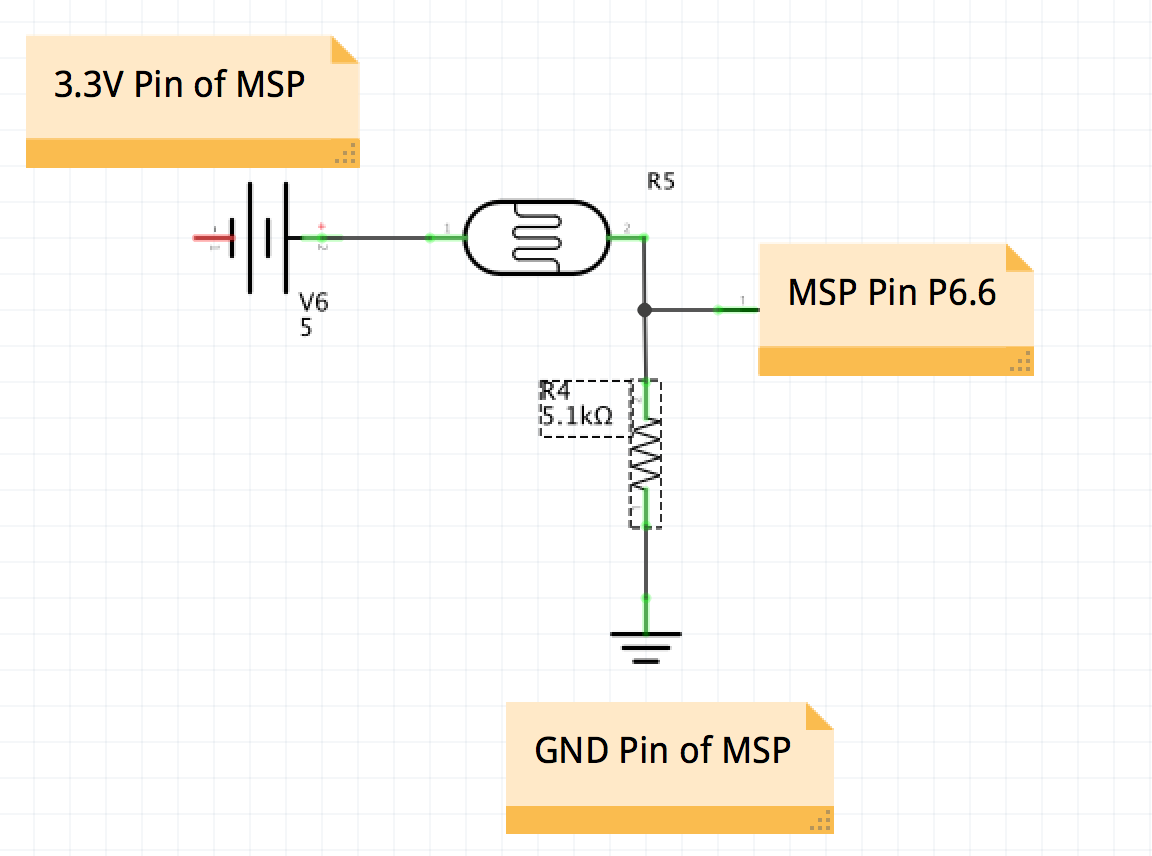
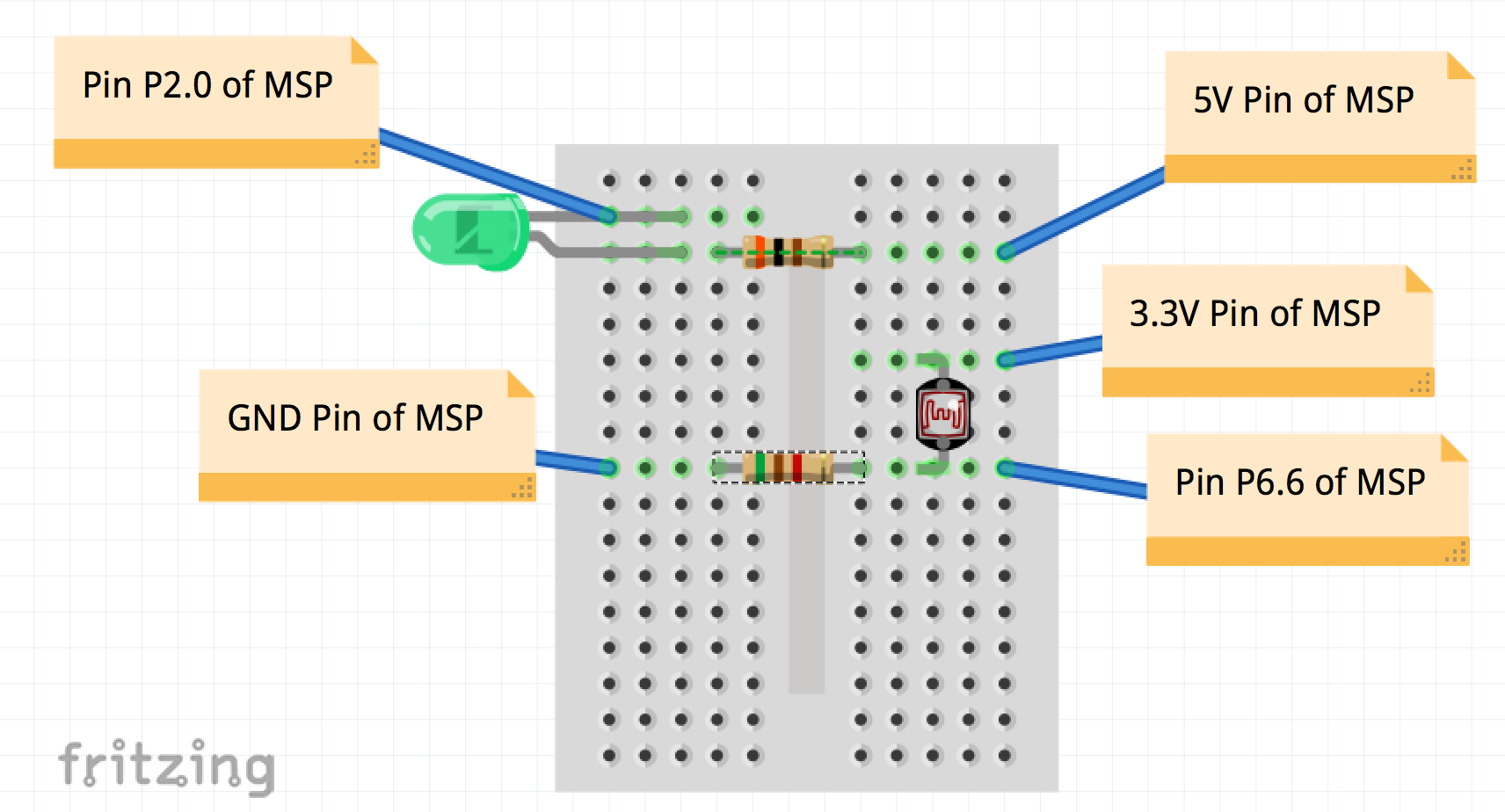
**Materials:**

1. 1 TI Launchpad MSP430
2. 1 Photoresistor
3. 1 5.1 kOhm Resistor
4. 1 Wire

**Description:**

We will be graphing the voltage across a resistor on the computer and see how the photoresistor changes resistance and voltage as you cover it up.

**Circuit:**

1. Schematic 
2. Breadboard 

**Code:**

The unfilled code can be found in the eecs\_day\_lab3\_skeleton folder. All instructions and descriptions are commented directly into the code. The solutions are in the eecs\_day\_lab3 folder. For this part of the lab after the code is uploaded, you should open Serial Monitor using the magnifying glass button in the upper right hand corner of Energia. Set the baud rate in the lower right hand corner to 56700.

**Part 4: Buzzer Tone Shifter**

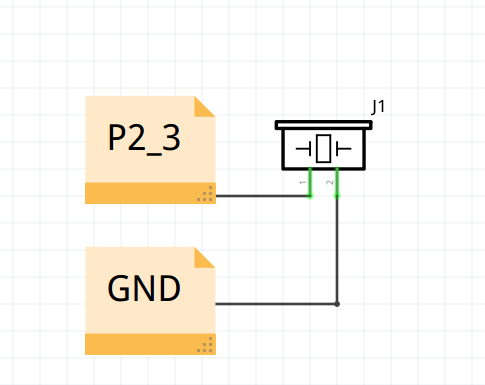
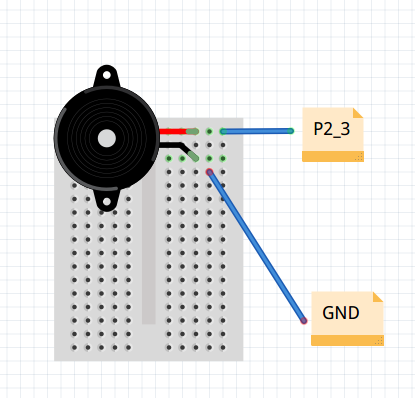
**Materials:**

1. 1 TI Launchpad MSP430
2. 1 Photoresistor
3. 1 5.1 kOhm Resistor
4. 1 Wire

**Description:**

We will build a circuit that outputs a changing tone. In order to produce a tone, we send a square wave to the buzzer. As the frequency of the wave changes, the frequency of sound the buzzer outputs changes.

**Circuit:**

1. Schematic 
2. Breadboard 

**Code:**

The unfilled code can be found in the eecs\_day\_lab4\_skeleton folder. All instructions and descriptions are commented directly into the code. The solutions are in the eecs\_day\_lab4 folder.

**Part 5: Buzzer Tone Shifter w/ Input**

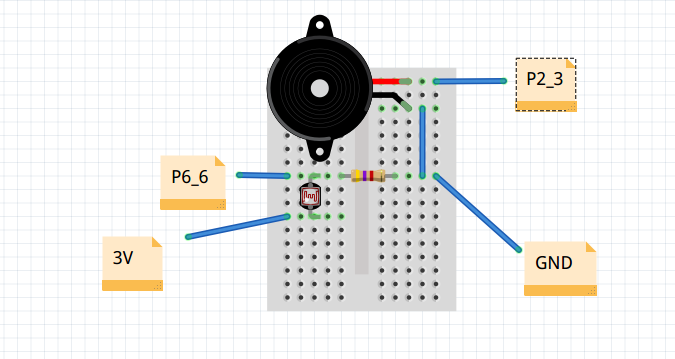
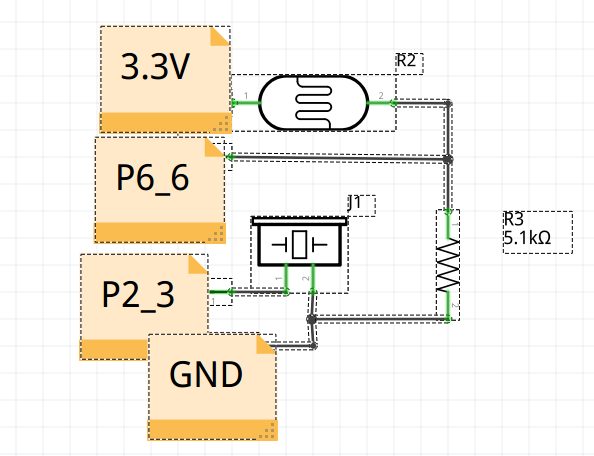
**Materials:**

1. 1 TI Launchpad MSP430
2. 1 Photoresistor
3. 1 5.1 kOhm Resistor
4. 1 Wire

**Description:**

Here we will build a circuit that measures the light coming in. Based on the input light, it outputs a tone. This is a basic “Music Player”.

**Circuit**



**Code:**

The unfilled code can be found in the eecs\_day\_lab5\_skeleton folder. All instructions and descriptions are commented directly into the code. The solutions are in the eecs\_day\_lab5 folder.

**Part 5 Extension: Adding a Fading LED**

As a challenge try to make both the LED fade and the buzzer change pitch as you move your hand above the photoresistor.