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# EECS 16A    Designing Information Devices and Systems I

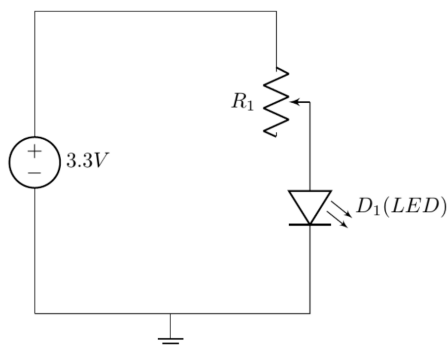
## Summer 2023    Pre-Lab Reading Touch 1

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### 1 Touch 1 Overview

You just completed a journey as expert photographers last week. You will now begin a new one to become expert designers in the touchscreen industry as we make a transition from linear algebra to circuits. We have all interacted with touchscreens in various ways. While most commonly through a mobile phone, you may have also interacted with tablets (like an iPad), smartwatches, and gaming devices like the PSP or the Game Boy (massive throwback!). All of these devices interact with its user using a touchscreen. In this module, you will learn how to build two different types of functional touchscreens - a resistive and a capacitive touchscreen. You will learn how to understand and build complex circuits, solder different circuit components to a circuit board and use code to detect touches on your touchscreen. Sit tight and prepare yourself as you begin the journey to becoming Berkeley's best electrical engineer!

Here is the circuit you will be building in lab during Touch 1 (07/18):



This circuit is known as an **LED Fader Circuit**. This circuit has three nodes and three circuit elements (a voltage source, a resistor, and an LED). The arrow on top of the resistor means that this is a **variable resistor**; *i.e.*, it does not have a fixed value. Let's look at a couple of the circuit elements you will be using in this lab:

- (a) **LED:** If you recall from Imaging 1, an LED is a device that converts electric current directly into light. It only emits light when the voltage across its two terminals is above a certain value, also known as the threshold voltage. The most common LED we use in the lab is red, and its threshold voltage is 1.6V. Its brightness also depends on the current flowing through the terminals which in turn depends on the voltage across it. Note that an LED is a polar device, so its orientation in the circuit makes a difference. The positive terminal, or anode (+), is the longer leg and triangular side of the LED symbol. The negative terminal, or cathode (-), is the shorter leg and the flat side of the LED symbol.
- (b) **Potentiometer:** A potentiometer is a variable resistor, whose resistance can be adjusted by turning its coils through a hole in the center. One end of the potentiometer is zero resistance and the other end is max resistance. A potentiometer has three terminals: two end terminals that are positive and ground and one middle terminal that acts as the output. The manufacturer specifies the maximum value. The potentiometers in our lab have a max of 10k.

## 1.1 Voltage Divider!

You might wonder why we're spending time on the LED Fader circuit. What does it have to do with building a touchscreen? While it does not have a direct correlation, the LED Fader allows us to look at an important theoretical circuit concept that we will make use of to build our touchscreen in the next lab: a voltage divider! Some uses of Voltage dividers are: adjusting the level of a signal and measurement of voltages. In the next lab, we will see how we can make use of the ability to adjust voltages using the voltage divider to identify touch locations on a touchscreen.

Please refer to Note 12 (pages 1-3) for a step-by-step overview of Voltage Dividers!

**Note:** An interesting fact about potentiometers is that they are essentially voltage dividers! When the coils are turned, the length of one resistor increases, and the other decreases, which changes the individual resistances and thus, the resistance ratio. If we connect the voltage source and the ground to end terminals and measure the voltage on the output terminal, we have a voltage divider!

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