California State University, Fresno
Department of Electrical and Computer Engineering

ECE 1L – Introduction to Electrical and Computer Engineering Laboratory

Laboratory 2: Light Emitting Diodes and Push Buttons

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1. Background Information

"A light-emitting diode (LED) is a semiconductor diode that emits incoherent narrow-spectrum light when electrically biased in the forward direction of the p-n junction. This effect is a form of electroluminescence.

Figure 1: Red, Green, and Blue LEDs

"An LED is usually a small area source, often with extra optics added to the chip that shapes its radiation pattern.[1] The color of the emitted light depends on the composition and condition of the semiconducting material used, and can be infrared, visible, or near-ultraviolet.

"Unlike incandescent light bulbs, which light up regardless of the electrical polarity, LEDs will only light with positive electrical polarity. When the voltage across the *p-n junction* is in the correct direction, a significant current flows and the device is said to be *forward-biased*. If the voltage is of the wrong polarity, the device is said to be *reverse biased*, very little current flows, and no light is emitted. LEDs can be operated on an alternating current voltage, but they will only light with positive voltage, causing the LED to turn on and off at the frequency of the AC supply.

"While the only 100% accurate way to determine the polarity of an LED is to examine its

datasheet, these methods are usually reliable:

Sign:	**+**	**–**
Polarity:	Positive	Negative
Terminal:	Anode (A)	Cathode (K)
Leads:	Long	Short
Exterior:	Round	Flat
Interior:	Small	Large
Wiring:	Red	Black

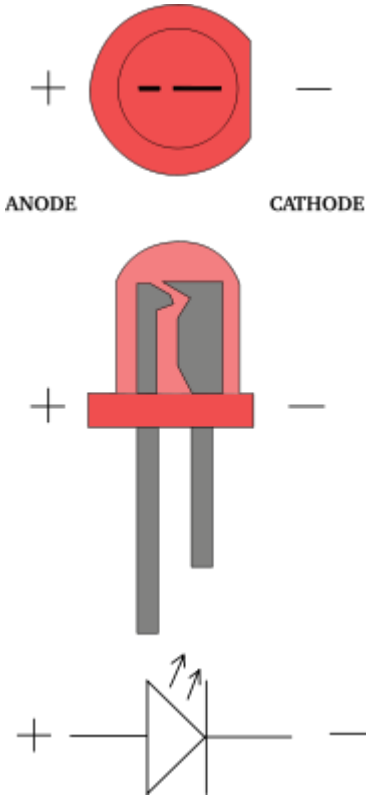

Figure 2: Polarity Determination of and LED

“Because the voltage versus current characteristics of an LED are much like any diode (that is, current approximately an exponential function of voltage), a small voltage change results in a huge change in current. Added to deviations in the process this means that a voltage source may barely make one LED light while taking another of the same type beyond its maximum ratings and potentially destroying it.

“Since the voltage is logarithmically related to the current it can be considered to remain largely constant over the LEDs operating range. Thus the power can be considered to be almost proportional to the current. In order to keep power nearly constant with variations in supply and LED characteristics, the power supply should be a "current source", that is, it should supply an almost constant current. If high efficiency is not required (e.g., in most indicator applications), an approximation to a current source made by connecting the LED in series with a current limiting resistor to a constant voltage source is generally used.”

Reference: http://en.wikipedia.org/wiki/Light-emitting_diode

2. Light Emitting Diodes (LEDs)

Go to http://optics.csufresno.edu/ and click on the ECE 1 link. From there, scroll down to the second link under “Documentation”, and click on it (http://www.parallax.com/dl/docs/books/edu/wamv2_2.pdf). This will bring up the “What's a Microcontroller?” manual. Skip over to Chapter 2 on Page 37 and perform the first 3 activities (you should end on Page 56). Be sure do document your work, code that you tested, and explain what is happening in your lab book.

3. Digital Inputs – Push Buttons

Skip the rest of Chapter 2 and move on to Chapter 3 in the “What's a Microcontroller?” manual. Again, perform the first 3 activities (you should end on Page 83) and document your progress.

4. Design Problem

Over the remainder of the lab, design a program that will turn on an LED with a Push Button and cause it to blink 10 times at a rate of 1/s, with the LED on for 0.5 s and off for 0.5 s during each cycle. However, if the button is pressed again before the LED blinks 10 times, the LED should automatically turn itself off.

To successfully get your circuit to function properly, you will have to learn about IF THEN statements. Use the Help function in the BASIC Stamp Editor to learn about them.

Be sure to demonstrate your circuit once it is working.