

# WEARABLE LIGHT TUTORIAL



## MATERIALS:

- Conductive Thread
- LEDs (Super Flux recommended) with a minimum 90° Viewing Angle
- 2 x 3V Batteries
- Two Cell Battery Holder
- 9" x 3" Thin Piece of Leather (or Ultra-Suede)
- 2 x 8.5" x 2.5" White Diffusing Fabric
- 9.5" x 3.5" Patterned Fabric For Bottom of Bracelet
- 2" of Conductive Velcro
- 6" of Regular Velcro
- 100-280 ohm 1/8 W Resistor

## TOOLS:

- Exacto Knife or Rotary Cutter
  - Needle
  - Sewing Machine
  - Alligator Clips
  - Pins
  - Scissors
  - Needle nose pliers
  - Iron (for Iron-on Seam option)
- You can use iron-on seams if you do not wish to sew the bracelet. Sewing is recommended.



Resistor



Alligator Clip



Pliers

Go to [www.sparklab.la/links.htm](http://www.sparklab.la/links.htm) for a list of online retailers and sources to purchase the electronic components.

## WHAT ARE LEDs?

LEDs are a bright light source which are low on power consumption and heat emission. There are several types of LEDs out on the market. The one recommended for this project is the Super Flux wide angle square LEDs with a minimum of a 90° viewing angle.

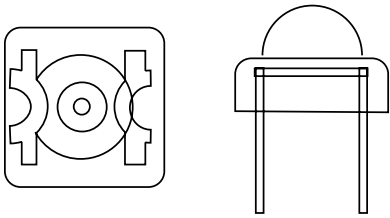
## WHY DO I NEED A RESISTOR?

Resistors are used to limit the current in the LED to a safe value so the LED will not burn out.

## 1. DESIGN

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- 1.1 | Design a pattern for the top leather (or ultra-suede) portion of your bracelet. Refer to [www.sparklab.la/patterns](http://www.sparklab.la/patterns) for pattern suggestions. Keep the design a minimum of 0.25" from the edges.
- 1.2 | Using an exacto knife or rotary cutter, cut out your pattern. Some decorative hole punches may also be used to create a pattern.
- 1.3 | You can either design a pattern for the bottom fabric of your bracelet, using an iron-on transfer to apply your image onto a piece of fabric or simply use a decorative fabric to your liking.



### SUPER FLUX LED

LEDs are polarized which means that the current from your battery can only run through them in one direction. Therefore, in order to “wire” (in our case, sew) the LEDs properly, we need to determine the positive (anode) legs from the negative (cathode) legs.

The Super Flux LEDs have four legs—two positive (anodes) and two negative (cathodes). Since there are several varieties of these LEDs, the best way to determine which are the positive and negative legs is to wire them temporarily using alligator clips. This will be explained in section 2 “Testing an Led.”

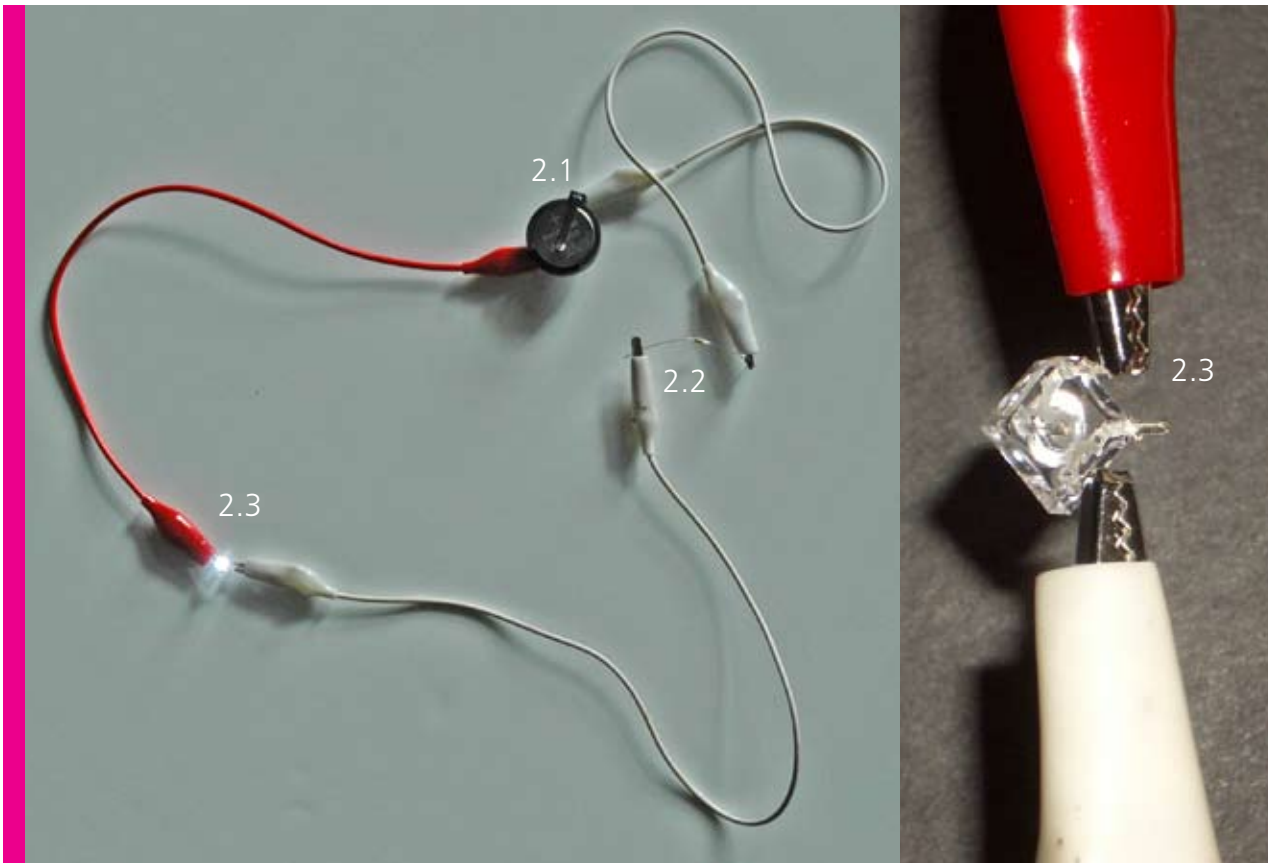
NOTE: If you are using typical 3 mm or 5 mm LEDs, typically the longer leg is the positive (anode) leg and the shorter, the negative (cathode). You can bypass the following section.



## 2. TESTING AN LED

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- 2.1 | Connect an alligator clip to the positive and negative terminal of your battery pack.
- 2.2 | Connect one end of the resistor to the alligator clip attached to the positive terminal of the battery. Connect another alligator clip to the other end of the resistor.
- 2.3 | Now connect one alligator clip to one leg of the LED and the other alligator clip attached to the negative terminal of the battery to another leg of the LED. **MAKE CERTAIN THE ALLIGATOR CLIPS DO NOT TOUCH EACH OTHER OR ELSE YOU WILL CREATE A SHORT AND YOUR LED WILL NOT TURN ON.**
- 2.4 | If your LED does not turn on, switch the two alligator clips on the LED.
- 2.5 | Once your LED turns on, take a red marker and mark the positive legs of the LED for future reference. The positive legs of the LED will be connected via the alligator clip to the positive battery terminal.



LED CIRCUIT

3. SEWING THE LEDS

- 3.1 | Once you have determined and marked the positive and negative legs of the LED, you need to determine the placement of the LEDs.
- 3.2 | Place a 8.5" x 2.5" piece of White Diffusing Fabric over your cutout leather or suede piece. Mark the placement of the LEDs on the fabric with a pen so you can sew the LEDs in your desired location.
- 3.3 | We are going to sew the LEDs in parallel, meaning that all the positive legs of the LED will be sewn to each other and all the negative legs to each other.
- 3.4 | Place the LEDs on the fabric with the positive legs (marked RED) facing in the same direction.



LED POSITIONING ON FABRIC

- 3.5 | Pierce the legs of the LEDs through the fabric.

3.6| Turn the fabric over.

3.7| Using the needle nose pliers, gently bend legs of the LEDs flush to the fabric.



#### BENDING LED LEGS

3.8| Using the conductive thread and needle, sew one of the positive legs of the LED to the fabric firmly.

3.9| Sew a straight line from one positive leg of the LED to the other.



#### CONNECTING POSITIVE AND NEGATIVE LEGS OF LEDS TOGETHER

3.10| Repeat for the negative legs.

NOTE: MAKE SURE THAT THE CONDUCTIVE THREAD FROM THE POSITIVE AND NEGATIVE LEGS DO NOT TOUCH AT ANY POINT. THIS WILL CAUSE A SHORT AND YOUR LEDS WILL NOT LIGHT UP.

3.11| Test your connection. Using your Battery and Resistor Set-up (see "Testing an LED" Fig 2.1 & 2.2), connect the positive end of the battery terminal using an alligator clip to one of the positive legs of the LED (use one that you have not sewn too). Connect the negative end of the battery terminal to the negative leg of the LED.

- 3.12 | Your LEDs should light up. If they don't, check to make sure that the conductive thread from the positive and negative leg is not touching at any point.
- 3.13 | Place the fabric that will be your bottom layer of the bracelet right side down.
- 3.14 | Lay the LED fabric right side up on top of the bottom fabric. The negative legs of the LEDs should be on top.
- 3.15 | Fold over 0.25" hem along the width of the bottom fabric. Pin.
- 3.16 | Pin the loop (soft) pieces of the conductive Velcro on the left side of the bottom fabric at least 0.15" from the edge.



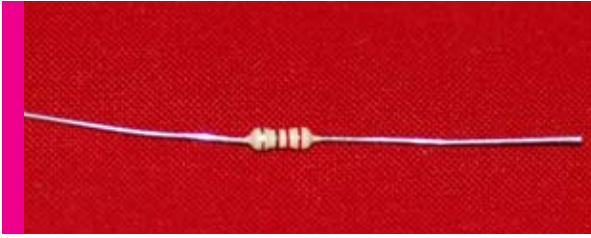
#### CONNECTING THE LEDS TO THE CONDUCTIVE VELCRO

- 3.17 | With the conductive thread, sew a line from the positive leg of the LED to the conductive Velcro, securing the conductive Velcro onto to the bottom fabric.
- 3.18 | Repeat for the negative leg of the LED.

#### 4. SEWING THE BATTERY PACK

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- 4.1 | Place the leather cover right side down on a table.
- 4.2 | Place a 8.5" x 2.5" White Diffusing Fabric right side down over the leather cover.
- 4.3 | Place the battery pack with the positive terminal on top about 0.5" away from the right edge of leather cover.
- 4.4 | Pierce the legs of the battery pack through the fabric.
- 4.5 | Turn the fabric over.
- 4.6 | Using the needle nose pliers, gently bend legs of the battery pack flush to the fabric. Mark the positive battery terminal on the other side of the fabric for quick reference.
- 4.7 | Pin the hook pieces (prickly pieces) of the conductive Velcro on the right side of the leather cover a little before the edge.
- 4.8 | Lay the Battery fabric right side up on top of the leather cover. The positive battery terminal should be on top.
- 4.9 | Using the conductive thread and needle, sew the positive battery terminal to the fabric firmly.
- 4.10 | Using the needle nose pliers, create a loop to both ends of the resistor.

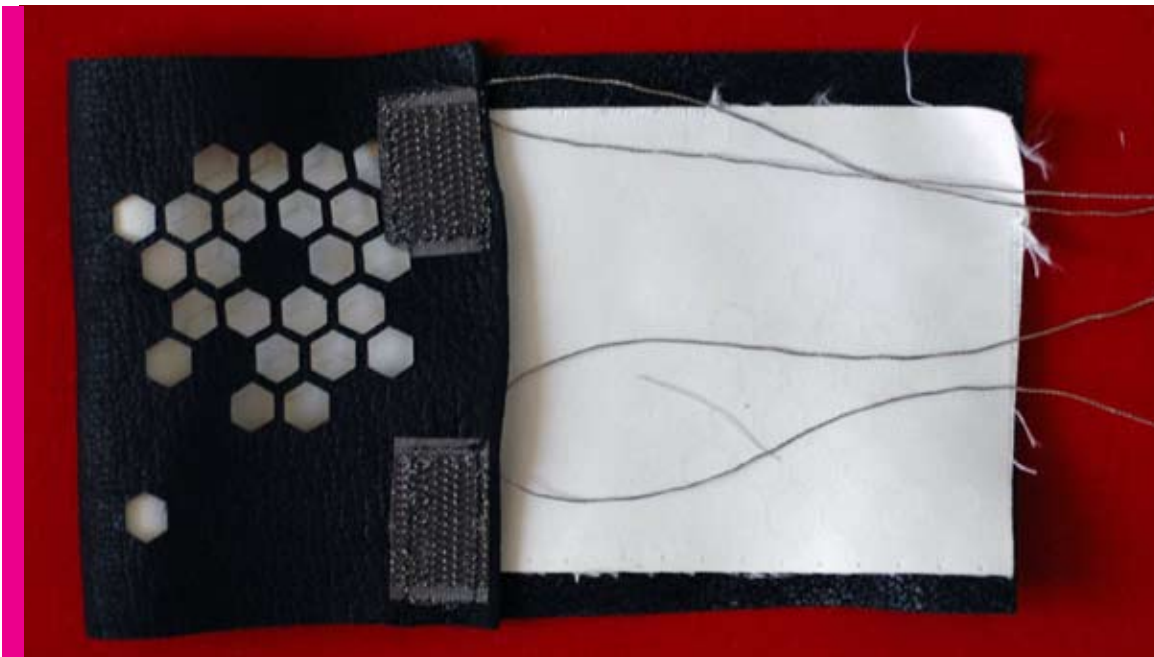


RESISTOR

- 4.11 | Sew a line from the positive battery terminal to one end of the resistor.
- 4.12 | Sew another line from the other end of the resistor to the hook conductive Velcro, securing the conductive Velcro onto the leather cover.
- 4.13 | Sew a line from the negative battery terminal to the prickly conductive Velcro, securing the conductive Velcro onto the leather cover.



CONNECTING THE BATTERY AND RESISTOR



CONDUCTIVE VELCRO

## 5. FINAL ASSEMBLY

- 5.1 | Lay the leather cover and battery piece right side down with the positive battery terminal on top.
- 5.2 | Lay the bottom fabric and LED assembly (negative LED legs on top) on top of the leather cover right side up.
- 5.3 | Fold the hems on all sides and pin down to leather cover.
- 5.4 | Test your bracelet. When the two sides of the conductive Velcro touch, your LEDs should light up.
- 5.5 | Once you've determined that you have assembled everything properly and your connections work, with the bracelet right side down, you can now sew the top and bottom of the bracelet together.
- 5.5 | It is recommended that you use regular Velcro on the right side of the bracelet and 3" of Velcro on the bottom so you can access your battery pack later to change your batteries.

## VISUAL ASSEMBLY GUIDE

Although the visual guide is not necessary, it is a helpful tool to guide you along the construction process. Cut along the solid black line of the bottom and top layer guide. Fold both guides along the center dashed lines. Use it alongside the tutorial as a visual reference.

