

## Sew What?!

Use special conductive thread made with stainless steel to connect electronics with stitching instead of soldering! This tutorial will get you started creating an e-textile (that's short for electronic textile) pin that lights up.



## SKILL REQUIREMENTS

ELECTRICAL PROTOTYPING



ROBOTICS



SOLDERING



PROGRAMMING



DIY



## MATERIALS LIST

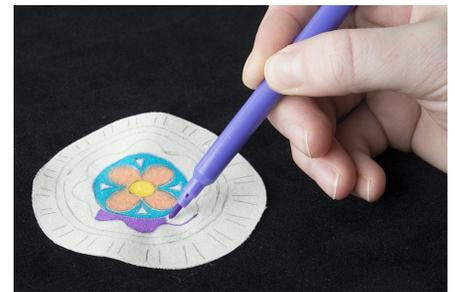
- Conductive Thread
- Needle
- LilyPad Switched Coin Cell Battery Holder
- CR2032 Coin Cell Battery
- LilyPad LED
- Felt
- Thin Fabric
- Scissors
- Glue Gun
- Markers
- Adhesive Pin Back

### STEP 1: Cut Out Template

Cut a 2.75" circle of felt (or use the template) for the backing of your pin and 3" circle out of thin fabric for the front/top of your pin. If your fabric is fraying along the edges, use fray check or clear nail polish to seal after you finish your project.

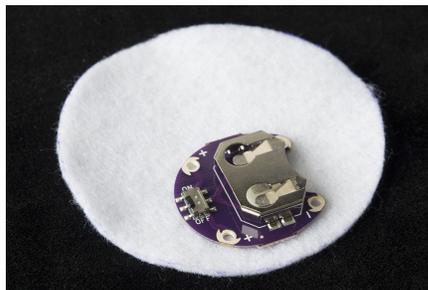
### STEP 2: Design Your Pin Art

Use markers or pens to draw a design on the thin fabric circle. Here's where you can be creative and decide where in your design you would like the light from your **LilyPad LED (Light Emitting Diode)** to shine through. The fabric is thin enough that we can hide the LED underneath and still see the light. *Note: the battery holder will take up some of your circle, so placing the LED board in the center or near the top half of the design is recommended.*



### STEP 3: Place Components

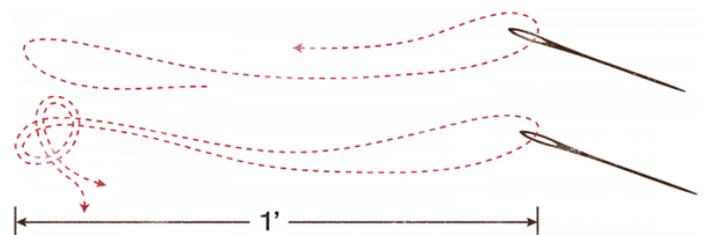
Take a look at your LED and battery holder and see where the holes are labeled either **positive** or **negative**. Place a small dot of hot glue in the center of the back of your **LilyPad Battery Holder** and glue it on one side of the felt circle - keeping the on/off switch upright. Flip the circle over and glue your LED on the other side of the felt near, but



not on top of the battery holder. Make sure the + and - symbols line up with the symbols on the battery holder. Be careful not to cover the holes with glue - we'll need those to sew through later. *Do not put your battery in yet.*

### STEP 4: Thread the Needle

After you've arranged your components, it's time to sew them together! We'll be sewing paths for the electricity, called **traces**, with conductive thread, connecting the positive (+) sides of the components together and then the same for the negative (-) sides. Unwind about 1 ft of **conductive thread** to work with and carefully thread the needle and tie a knot at the end. A needle threader or needle with a larger eye will help if you are having trouble getting the thread through. Just be careful not to use a needle too big for the holes in your LilyPad components.



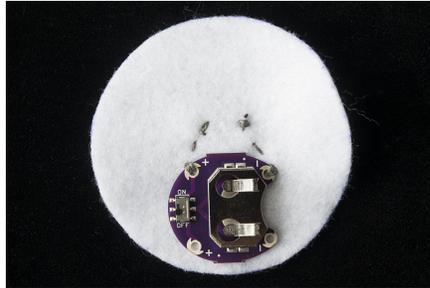
### STEP 5: Sew Positive Traces

On your battery holder, find the hole marked with a + symbol closest to your LED board. Push your needle up through hole and felt, then to the outside of the hole and felt - creating a stitch that holds the battery holder down and makes an electrical connection with the metal around the hole. Repeat 3 more times to make a secure connection, then using a straight stitch, follow your path to the next positive hole on your LED. Don't forget to loop 3-4 times on each hole to secure. Once you have finished at the LED, tie a knot in your thread and trim any excess. Congratulations, you've just sewn the first part half of your circuit!



### STEP 6: Sew Negative Traces

Tie a knot in your remaining thread (or a new piece if needed) then connect the negative side of your LED board to the negative holes of the battery holder using the same technique. Be careful not to let your stitches touch the path you used for your positive connections. Now your circuit is complete!

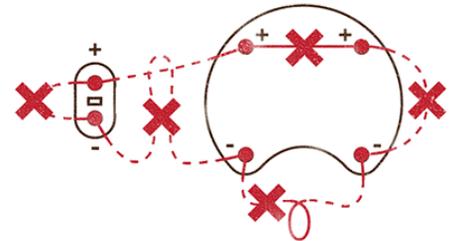


### STEP 7: Test Your Circuit

Insert your **coin cell battery** with the positive side facing up (marked with a +), into your battery holder. The battery slides in the opening only one way (the side opposite of the on/off switch). Turn on the switch and see if your LED shines bright!

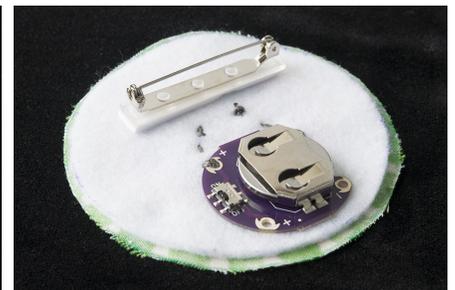
### STEP 8: Troubleshooting

If your circuit isn't lighting up, try a new battery or checking that your project is switched on. Check your sewing for any loose threads or ends that may be touching other threads or electronic components, causing a **short circuit**. See the picture for examples of conductive thread short circuits – practice tidy stitching to keep your thread from going where it shouldn't.



### STEP 9: Finishing Touches

Once your circuit is working, use a hot glue gun to attach your decorated muslin/fabric design over your felt circle so the LED shines through. Turn the project over and attach an adhesive pin back to finish up your wearable art pin!



## TAKING IT FURTHER

- What are some other fabric projects you could sew an LED into?
- Can you figure out how to use multiple LEDs in a project?
- [Sewing with Conductive Thread](#)
- [LilyPad Design Kit Experiment 1: Lighting Up a Basic Circuit](#)