Conductive Thread

Created by Becky Stern

https://learn.adafruit.com/conductive-thread
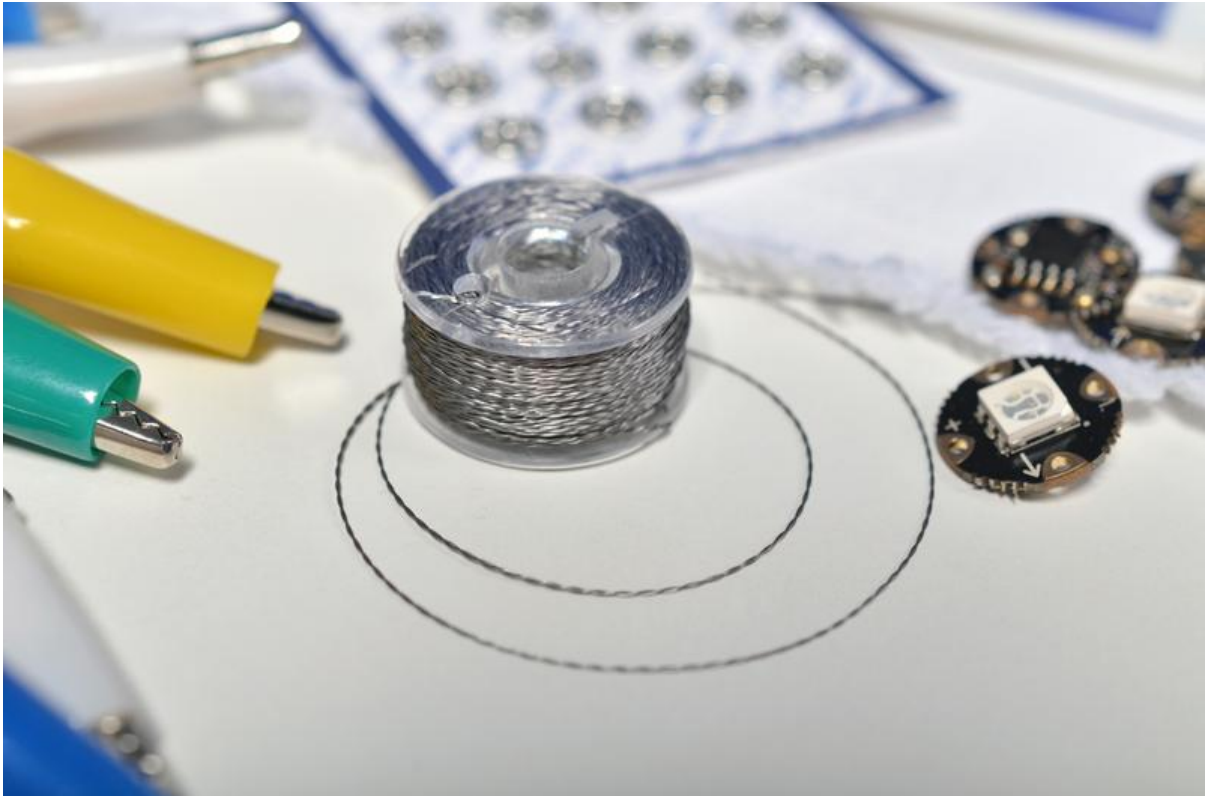
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Overview

After months of searching, we finally have what we consider to be the ultimate conductive thread. It's thin, strong, smooth, and made completely of 316L stainless steel. Once you start working with this thread you'll quickly agree its optimal for any wearables work!

We carry this thread in 2 and 3 ply. 2 ply (http://adafru.it/640) is a little thicker than every day polyester or cotton thread but still thin enough to be sewn by hand in medium-eye needles or with a sewing machine that can handle 'heavy' thread. Because it is strong and smooth, its ideal for any wearable/e-textile project. It also has fairly low resistivity, 16 ohms per foot so you can use it to drive LEDs and other electronic components that use under ~50mA.

Our 3 ply thread (http://adafru.it/641) has a resistance of 10 ohms per foot for components that use under ~100mA. It is thicker than standard cotton/poly thread and can be used by hand or in industrial sewing machines.

Because it is made of stainless steel fibers, it will not oxidize like silver does: your projects will not 'stop working' because of oxidation after a few months and its safe to wash. However, this thread is a little 'stiff', it feels a little like 'waxed thread' and is not ideal for making iPhone-compatible gloves. If you want to sew conductive thread into the pads of gloves, check out our thin conductive yarn! (http://adafru.it/603)

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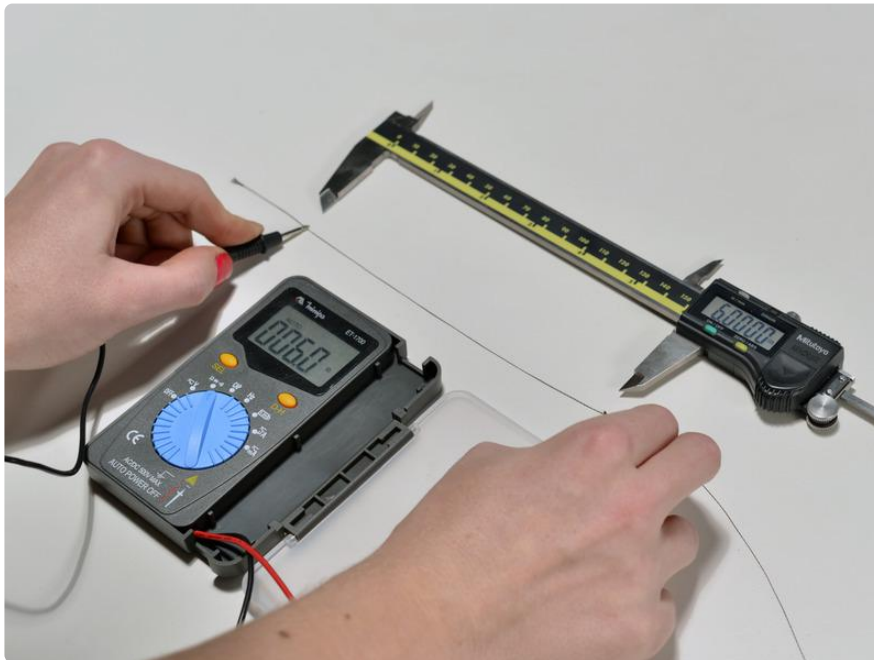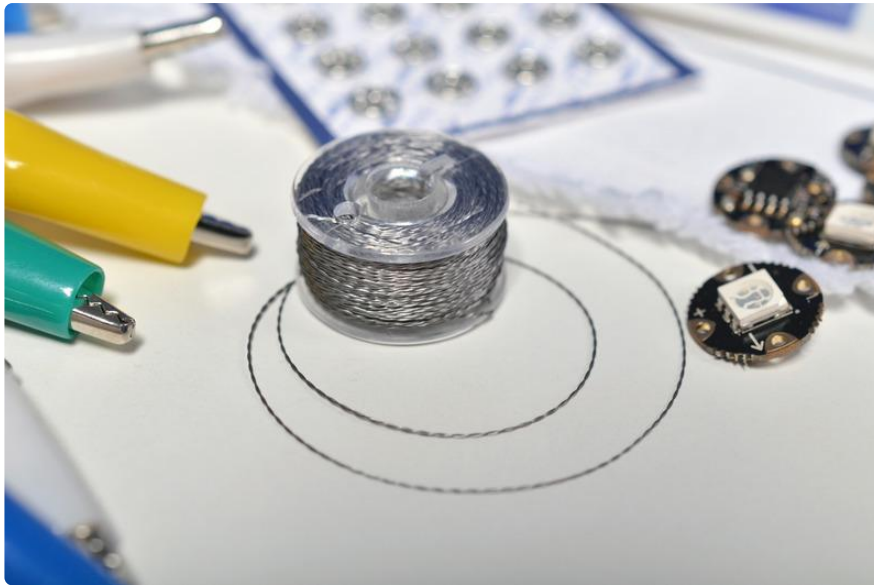
2 ply
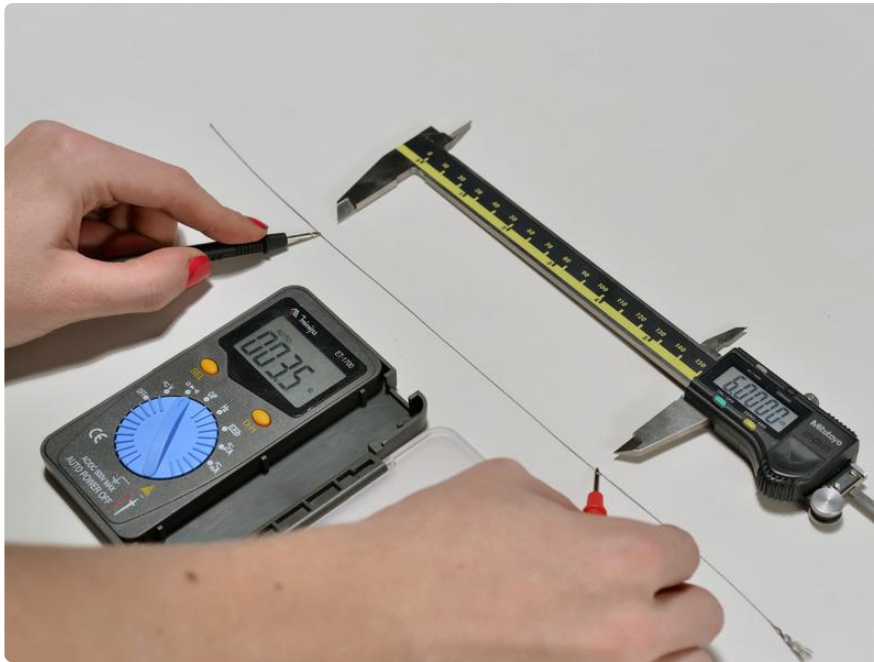
3 ply

Tools & supplies

You'll need some conductive thread, scissors, needles, fabric or a garment, a battery pack, and the following:

Multimeter

You will need a good quality basic multimeter that can measure voltage and continuity.

Click here to buy a basic multimeter. (http://adafru.it/71)

Click here to buy a top of the line multimeter. (http://adafru.it/308)

Click here to buy a pocket multimeter. (http://adafru.it/850)

Don't forget to learn how to use your multimeter too! (https://adafru.it/aOy)


Embroidery Hoop

We recommend beginners use an embroidery hoop to stabilize the circuit-supporting fabric during sewing. It makes things a lot easier and results in a better-looking finished project. For more information on using an embroidery hoop correctly, check out our Cross Stitch tutorial (https://adafru.it/aUT).

Alligator Clips

Great for testing out your circuit or mocking up designs, alligator clips can connect different components or clip to conductive threads and your multimeter for measuring continuity and resistance.

Click here to buy a set of small alligator clip test leads. (http://adafru.it/1008)
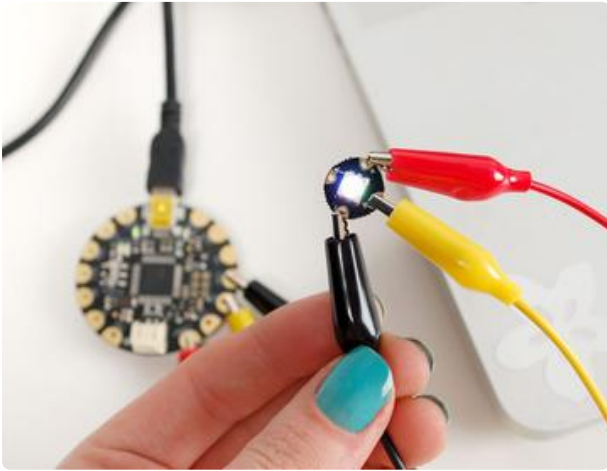
Snaps and other metal fasteners

Snaps can be used for quick-connecting circuit boards and also as switches. You can sew them with conductive thread and/or solder them to circuit boards.

Click here to buy 5mm tin-plated brass snaps. (http://adafru.it/1126)

You can also use hooks and eyes, metal zippers, and other metal sewing notions. Experiment!
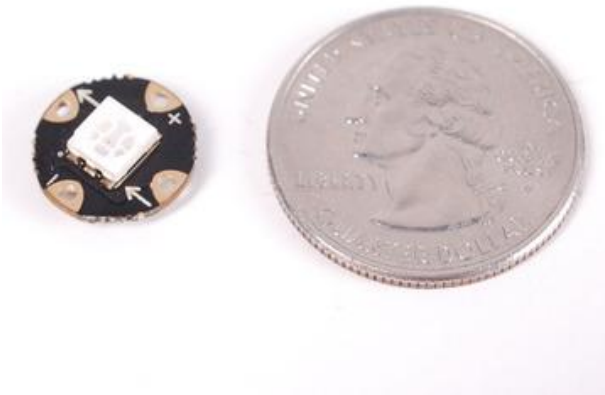
Circuit board components

Circuit boards specifically designed for sewing with conductive thread have large pads and through-plated holes large enough for a medium sized needle to pass through.

Getting Started with FLORA (https://adafru.it/aSZ)

Flora Wearable Ultimate GPS Module (https://adafru.it/aUU)

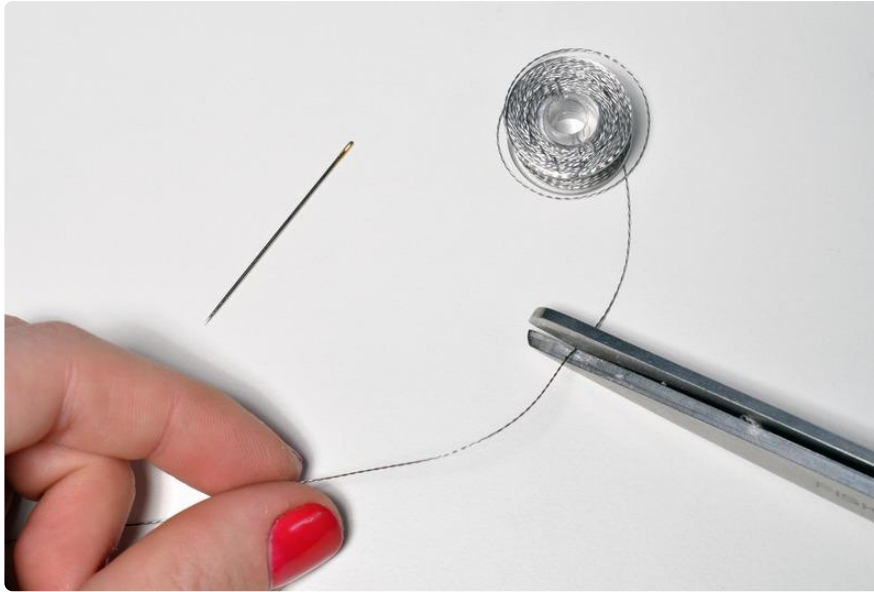Flora RGB Smart Pixel (https://adafru.it/aRT)

Clear nail polish or fray check to seal knots

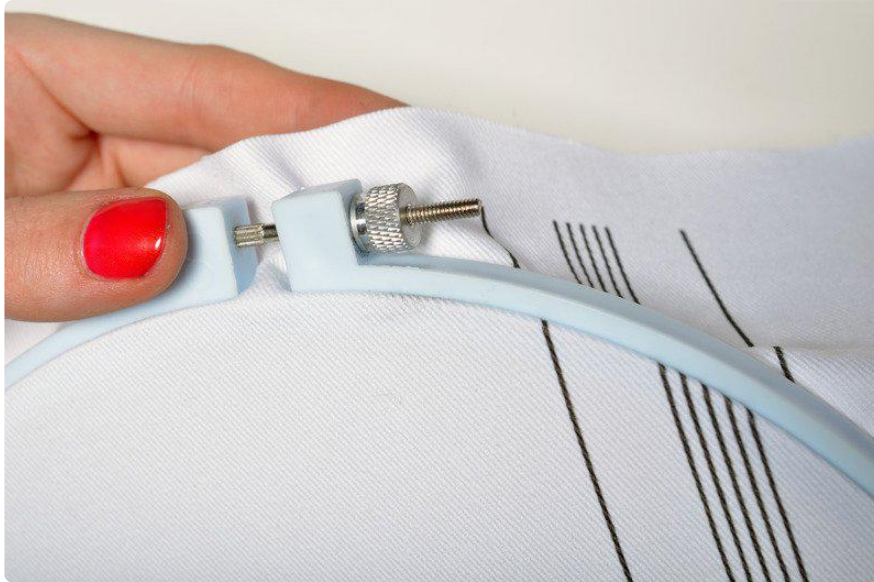To mark out your circuit use a water-soluble embroidery marker or tailor's chalk.

Prep thread and fabric

Cut a length of thread roughly the length of one arm. Much longer and the thread will start to be unwieldy and twisted.


Thread a medium size needle with the conductive thread. You may need to moisten the thread end to help it stay pointy for threading.

Place your fabric in an embroidery hoop. Beginners will find this helps a TON when learning. For more information on using an embroidery hoop correctly, check out our Cross Stitch tutorial (https://adafru.it/aUT). More advanced folks may wish to stitch directly to a stiff garment.
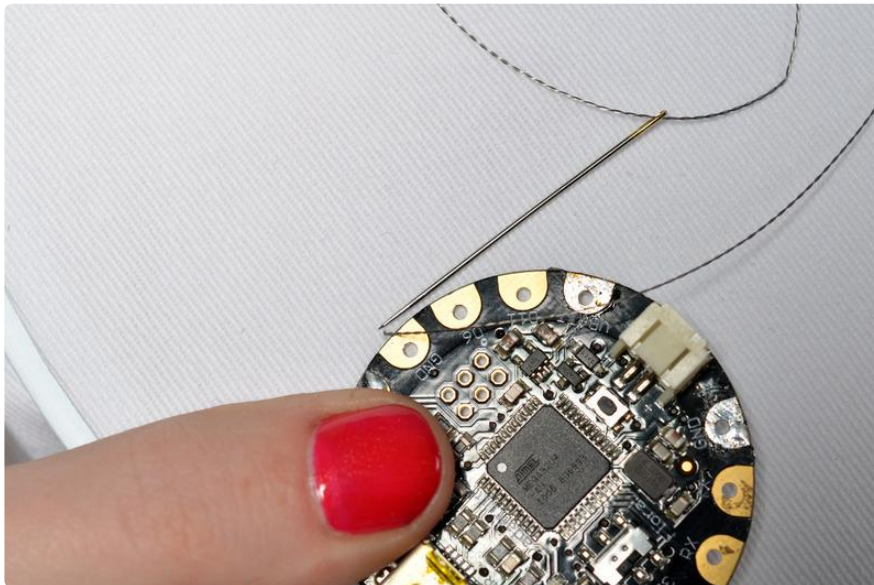
Stitching around circuit boards
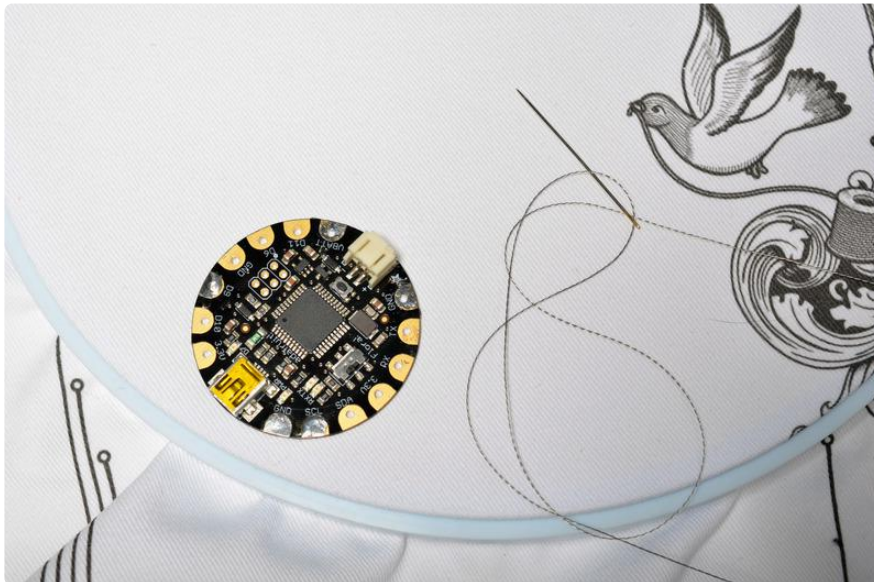
Get an idea of where your circuit will go. You may wish to mark traces with tailor's chalk or a water-soluable embroidery marker, or just freehand it! Get your circuit board onto your taut fabric and pick up your threaded needle.
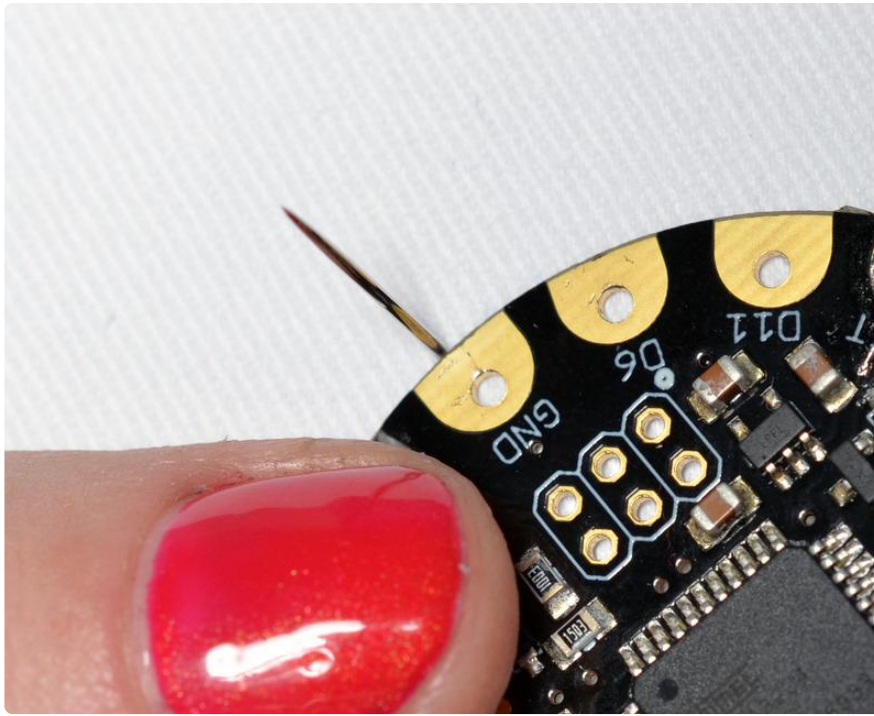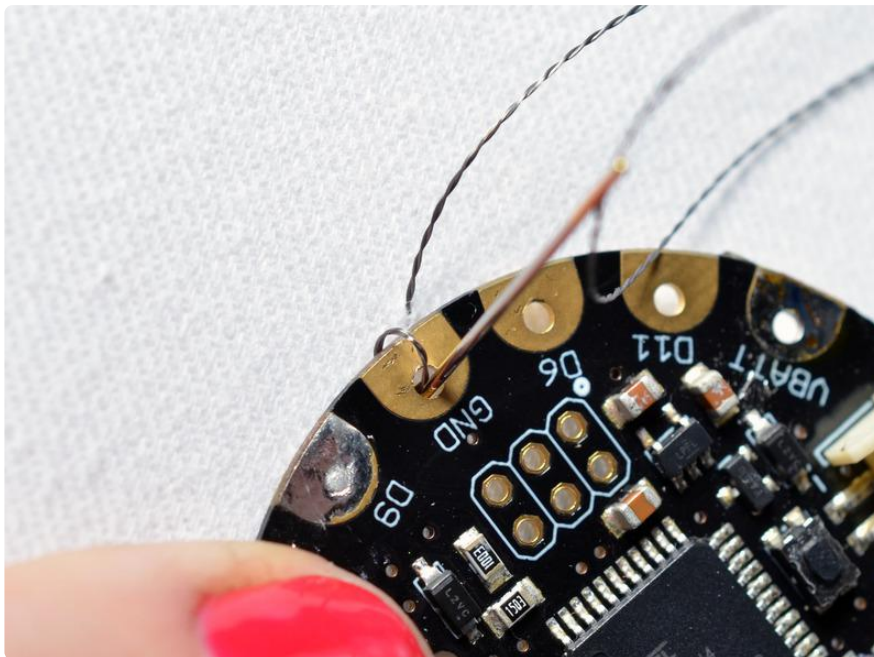
Bring the needle through the fabric from back to front, right next to the circuit board.


Pull the needle all the way through and continue pulling the thread tail until only 6 inches remains at the back of the fabric.

Leave this tail dangling for now-- we'll tie it in a knot later.

Bring your needle from front to back through the hole in the circuit board. Pull the needle and slack thread all the way through until the thread snugly hugs the conductive pad ad the edge of the board.
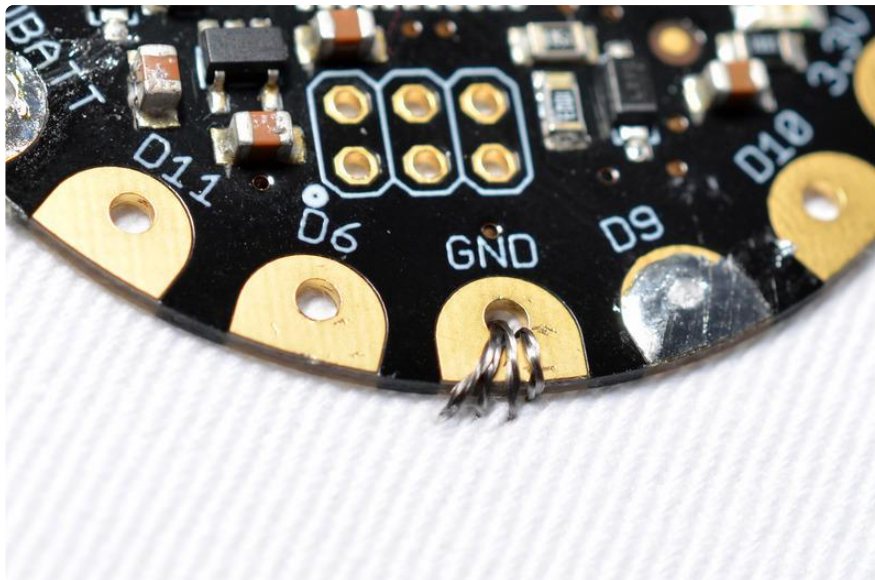
Repeat with a few more stitches to make a secure mechanical and electrical connection.

End with both ends at the back of the fabric and get ready to tie a knot.

Tying knots

Before cutting anything, tie the threads in a tight square knot at the back of the fabric.
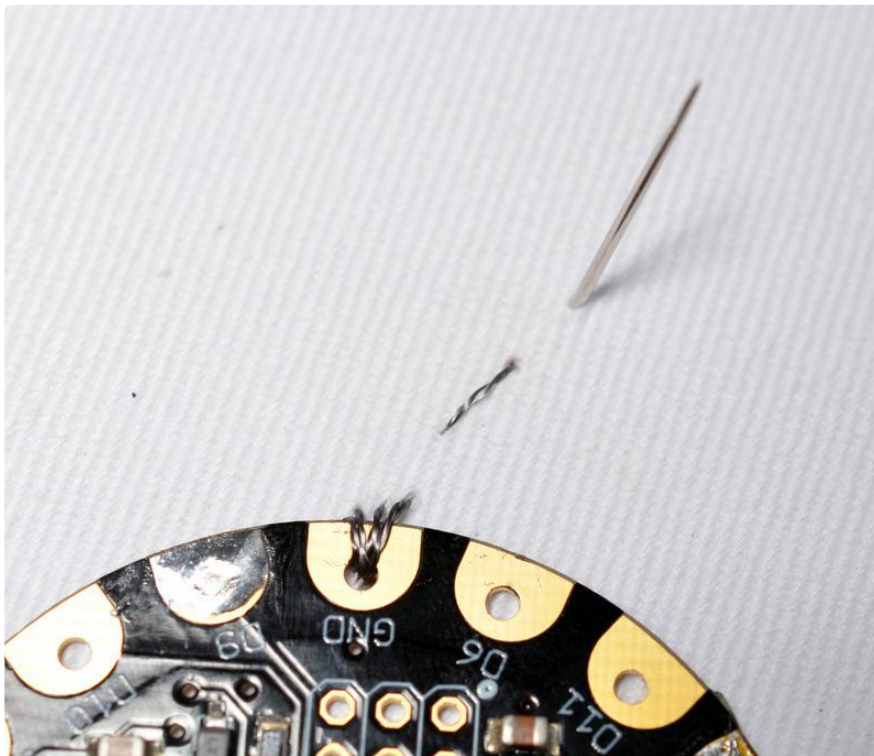

Seal this knot by applying a drop of clear nail polish or Fray Check.

When dry, trim the tail end of the thread very closely to the sealed knot. Now you can continue stitching with the long tail to connect up different parts of your circuit!

Connecting components

The thread must travel between components to connect them, while avoiding other paths of conductive thread in the circuit. The thread acts like uninsulated wire or traces on a circuit board, but this circuit board is made out of fabric!
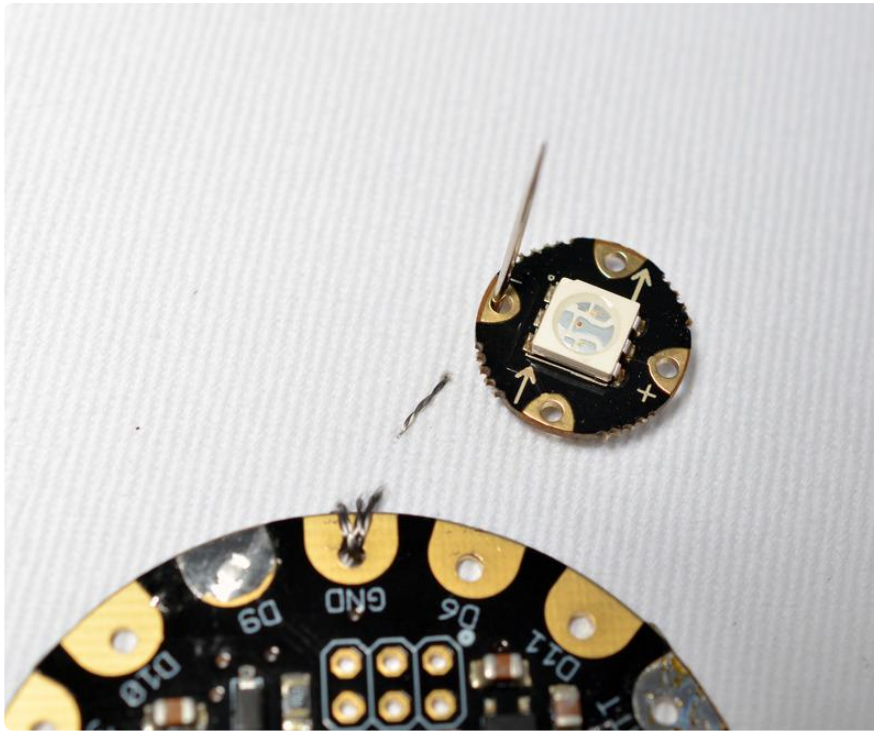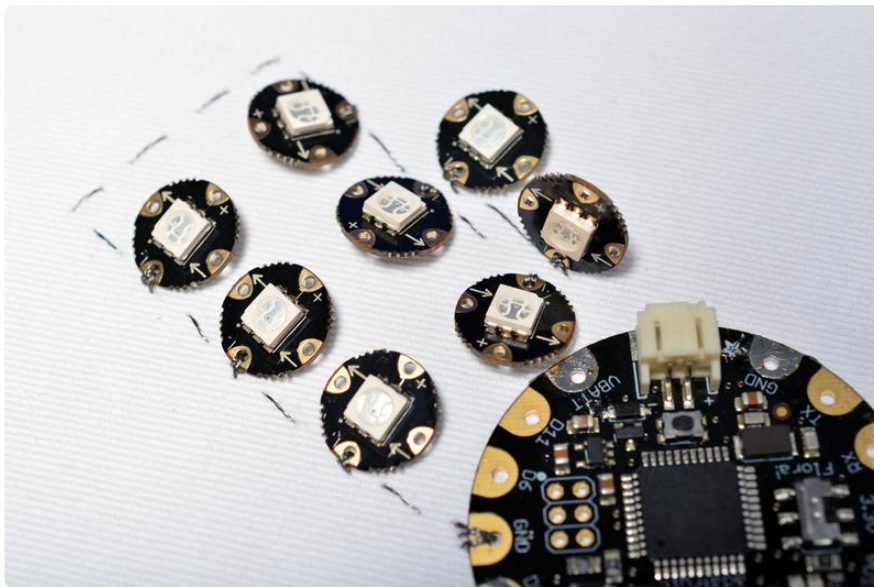
The most straightforward connection is a running stitch. You can also learn many more hand embroidery stitches (https://adafru.it/aV8) which can have decorative or functional appeal in your project.
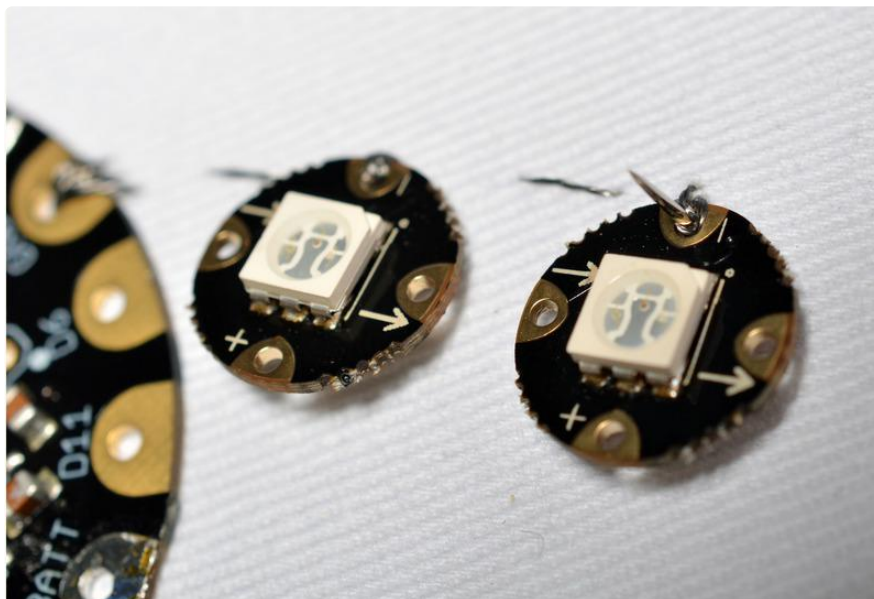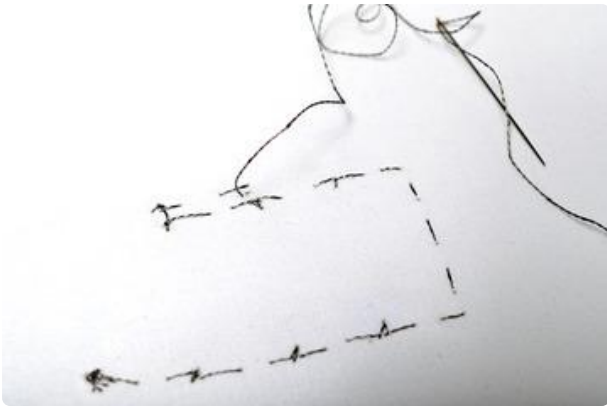

As you stitch along, pause periodically to whip-stitch a chainable pixel's ground pad (-).
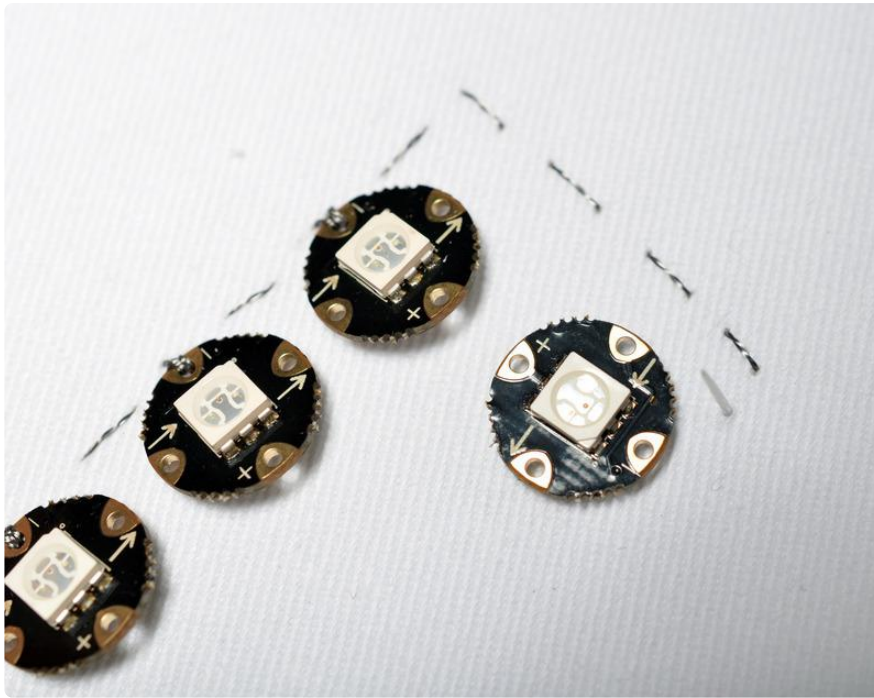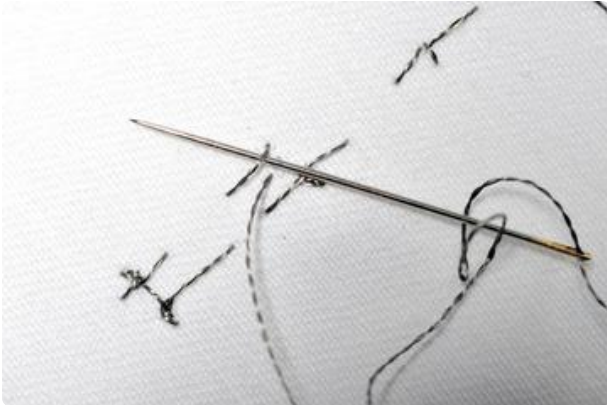
Turning 180 degrees

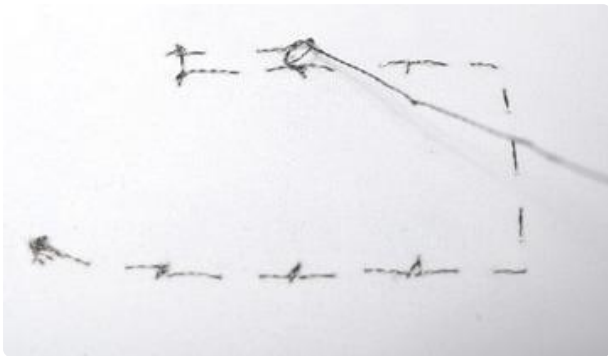Now that all the pixels are anchored by one pad, clean up any stray threads on the back.

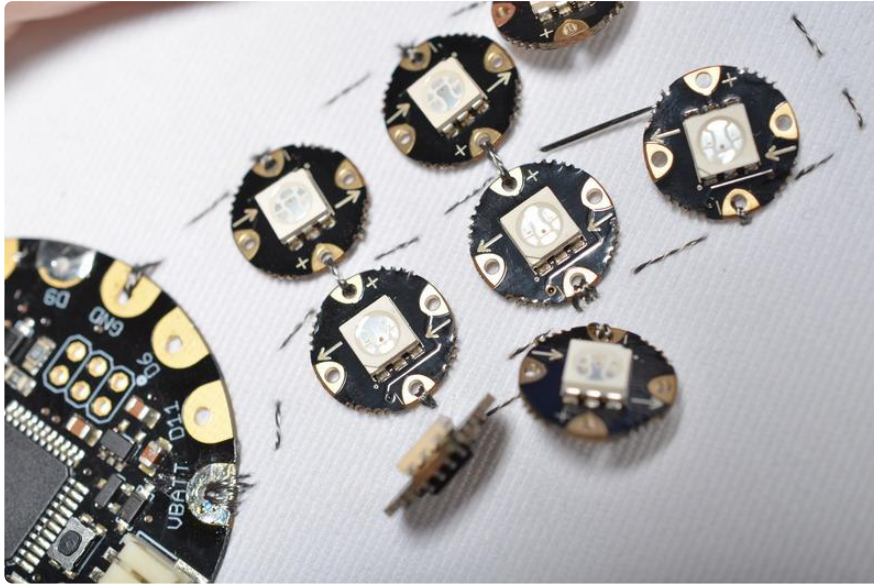Tie a knot with a sewing needle! Insert the needle under a previous stitch.

Pull the thread almost all the way through, leaving a small loop. Put your needle through this loop and pull the thread through, creating a tight knot.

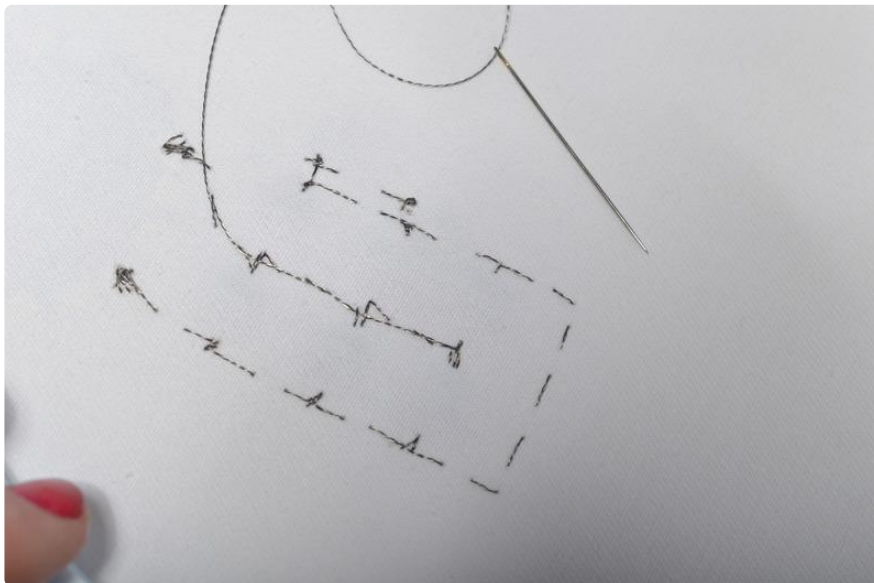Don't forget to seal the knot with Fray Check or clear nail polish before trimming the tail closely.

Preventing short circuits

Keep your stitches small and snug throughout your circuit. An embroidery hoop comes in handy to keep the fabric flat.


Keep power and ground lines far apart from each other. A short between power and ground will prevent your project from working and may even cause your battery to heat up.

Use a multimeter's continuity tester to check your circuit for shorts. The meter will beep any time the two probes are electrically connected.

Put one probe on power and one probe on ground. There should be no beep!
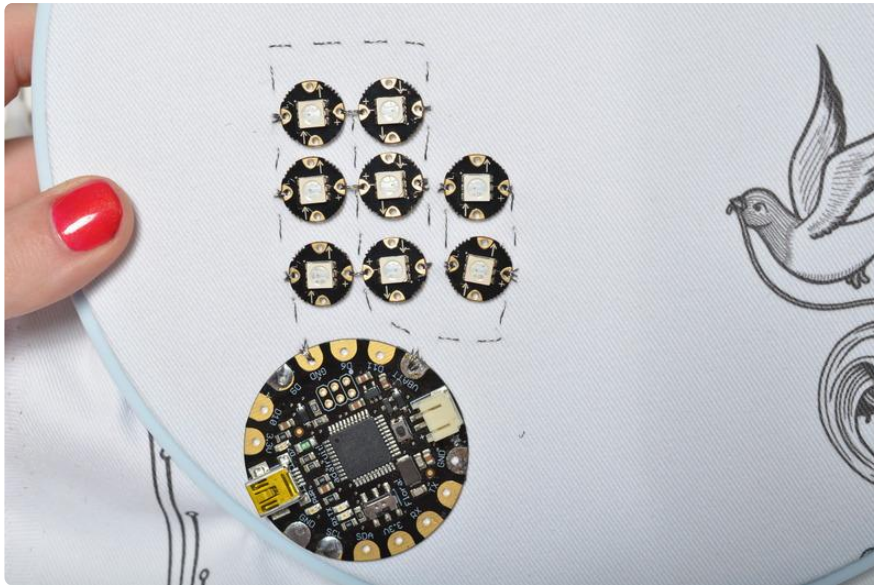
Check your circuit for shorts after finishing each path in your circuit. This way if you do discover a problem, you will know the likely location of the stray thread/short circuit.

Machine sewing

You can use our 2 ply conductive thread in the bobbin of a sewing machine. Thread the machine's needle with plain thread.

Use a water-disolvable marker to plan out your circuit traces.

You may need to adjust the tension on your machine. Experiment on a scrap piece of fabric and examine the balance between the conductive and regular thread. Adjust the tension and experiment again until you are satisfied.

Machine stitch your circuit.

Leave long tails of conductive thread at the ends of your stitching lines in case you need to pick them up with a hand sewing needle and connect to other components.

Spritz away the markings with water. Be sure to let the fabric completely dry before powering up your circuit.

Projects

Sewable LED Sequins (https://adafru.it/sequins) (2 or 3 ply)

Flora Snaps (https://adafru.it/aUQ)

iPhone Gloves (https://adafru.it/aUR) (conductive yarn)

TV-B-Gone Jacket (https://adafru.it/aVm)

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