Electronic Components & Textiles

Electronics + Textiles ≠ E-Textiles

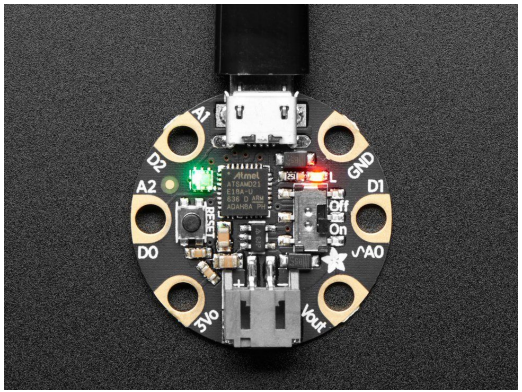
Both systems must be carefully designed simultaneously in order to succeed. This includes planning ahead of time to determine:

1) How the electronic system will be attached to the fabric
2) Where the power system and circuit boards will be stored
3) Whether the fabric is strong enough to support this extra weight
4) How is the circuitry affected when interacting with the body

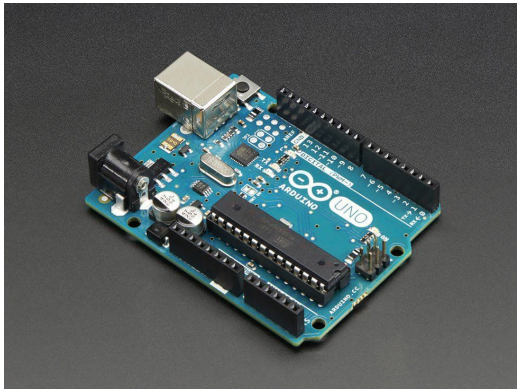
Fabrics stretch, Circuits don't (currently).

The constant struggle with E-Textiles is figuring out methods to ensure that the circuits integrate well with the fabric. If the circuitry does not have enough support then the circuitry will break; at the same time, if the fabric is too structured to support the circuitry, then it will be uncomfortable to use.

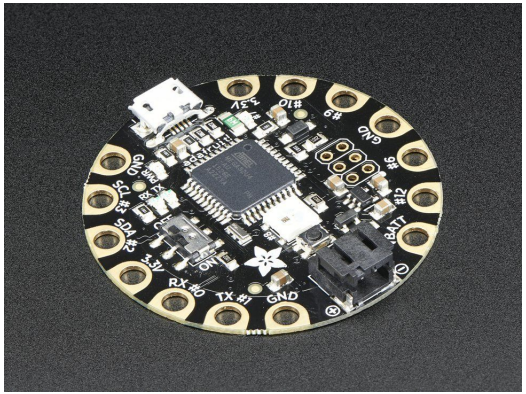
Some Wearable Microcontrollers!



Gemma

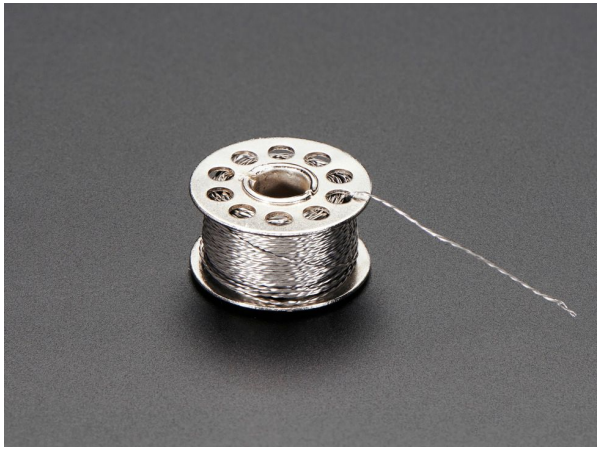


Arduino



Flora

Some Path Making Connections

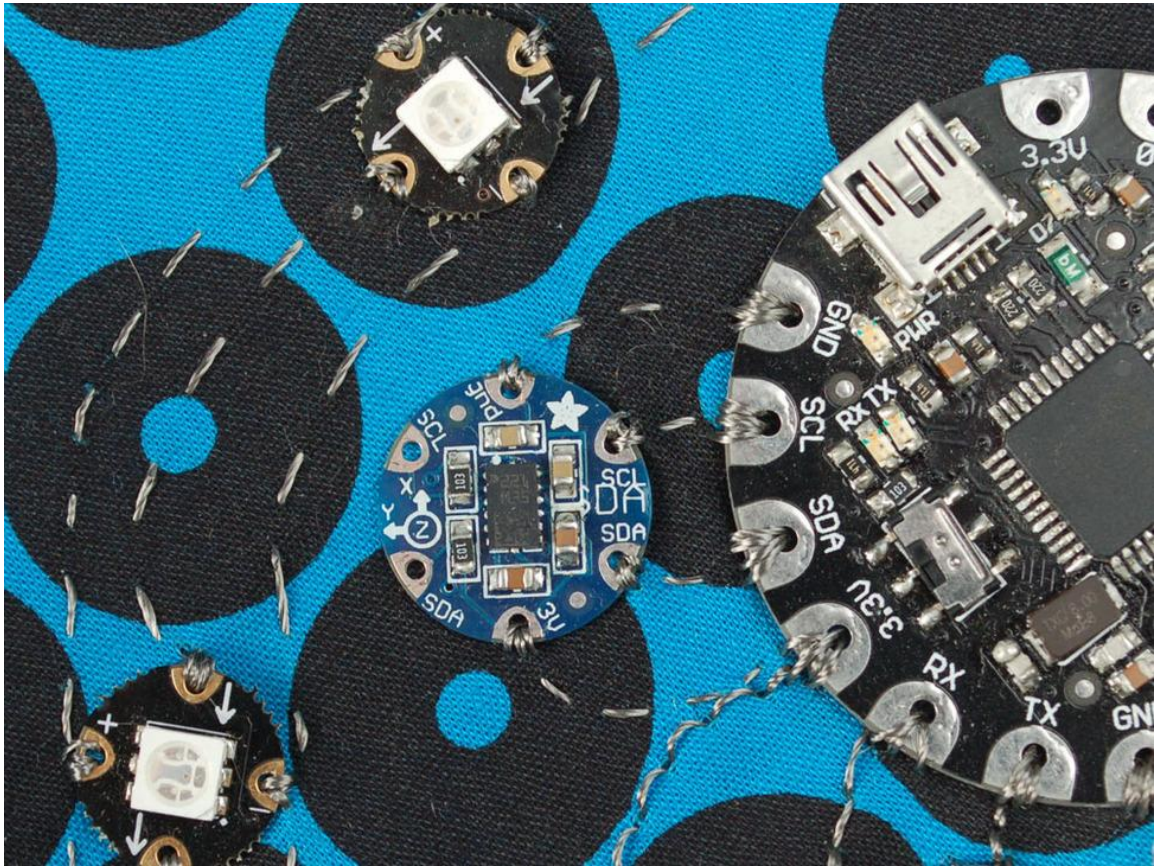


conductive thread
(stainless steel / silver)

conductive fabric
(wide variety!)

conductive ink
(drawing/printing)

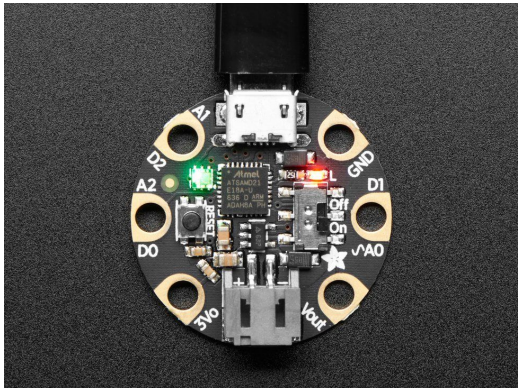
Sewn Connections



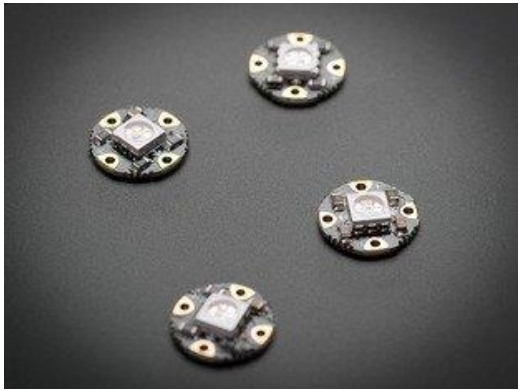
Great for basic circuitry.

Not great for circuitry that needs to send data.

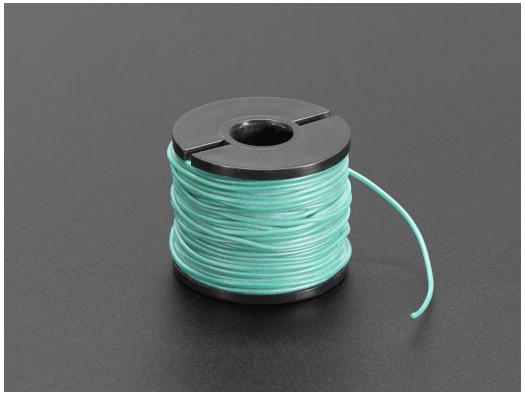
What we will use Today!



Gemma

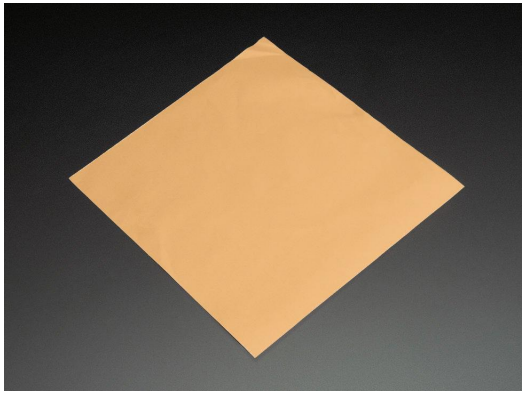


Neopixels



Silicone Wire

USB Battery Pack



Copper Fabric

Other items:
Regular thread, hand sewing needle, hot glue

Soldering Equipment

Soldering Station

Soldering Iron

Solder

Helping Hands

Soldering Stand

Tip Cleaner

Solder Pump

Desoldering Braid

Safety

- Never leave a hot soldering iron unsupervised.
- Put soldering iron in stand when not in use.
- Use “helping hands” to hold components and wires when soldering.
- Work in a well ventilated space and/or use a fume extractor.
- Always wash your hands after handling solder and electronic components.
- Keep workspace clean and clutter free.
- Wear eye protection as an extra precautionary measure.

Technique

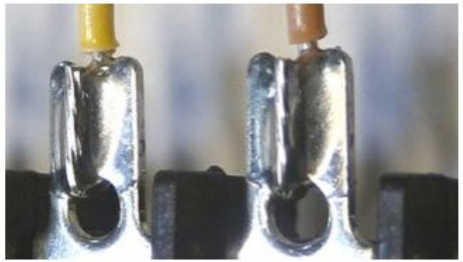
Temperature: Around 600 degrees+ for leaded solder. 700 degrees+ for lead-free solder.

A good solder joint should take no longer than 2-3 seconds to form. If it takes longer, raise the soldering iron temperature.

Keep the soldering iron tip clean and coated with a thin layer of solder (“tinned”).

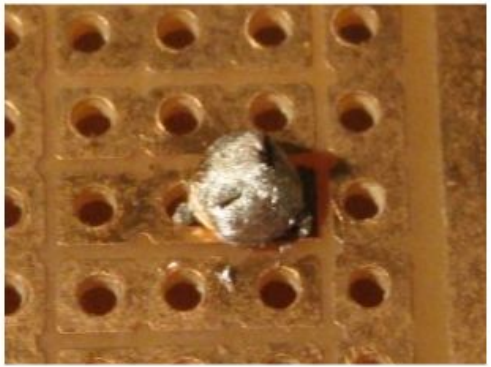
Apply heat to the joint to be soldered and allow solder to flow over it.

A good solder joint



A good solder joint will be bright and silver (unless you use lead-free solder) and not use too much solder.

A bad solder joint



A bad solder joint will be grey and gritty and/or use too much or too little solder.
These are often referred to as "cold" solder joints.

Hands On

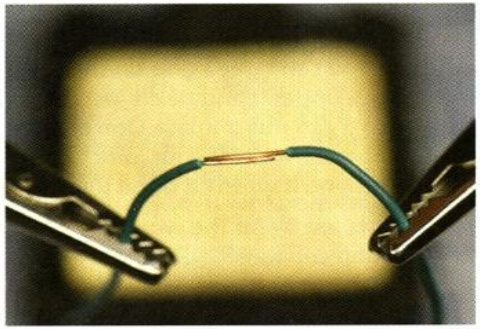


Figure 3-40

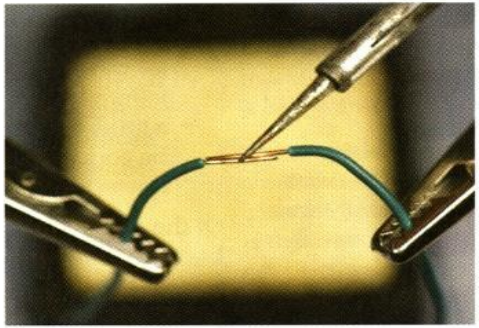


Figure 3-41

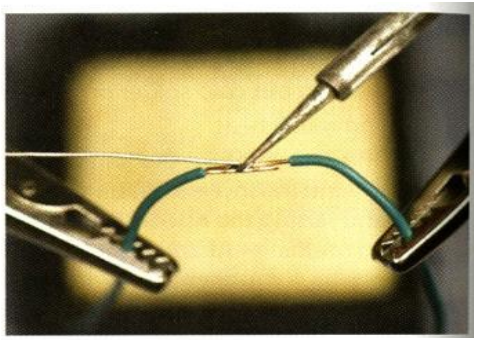
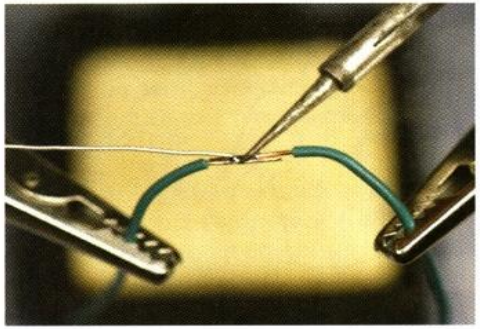
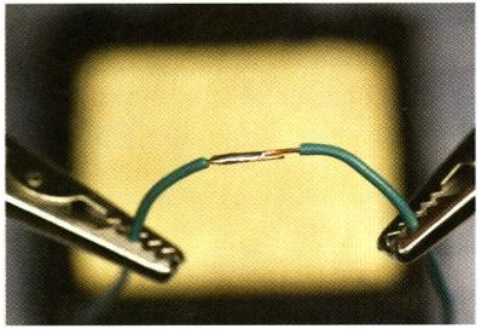
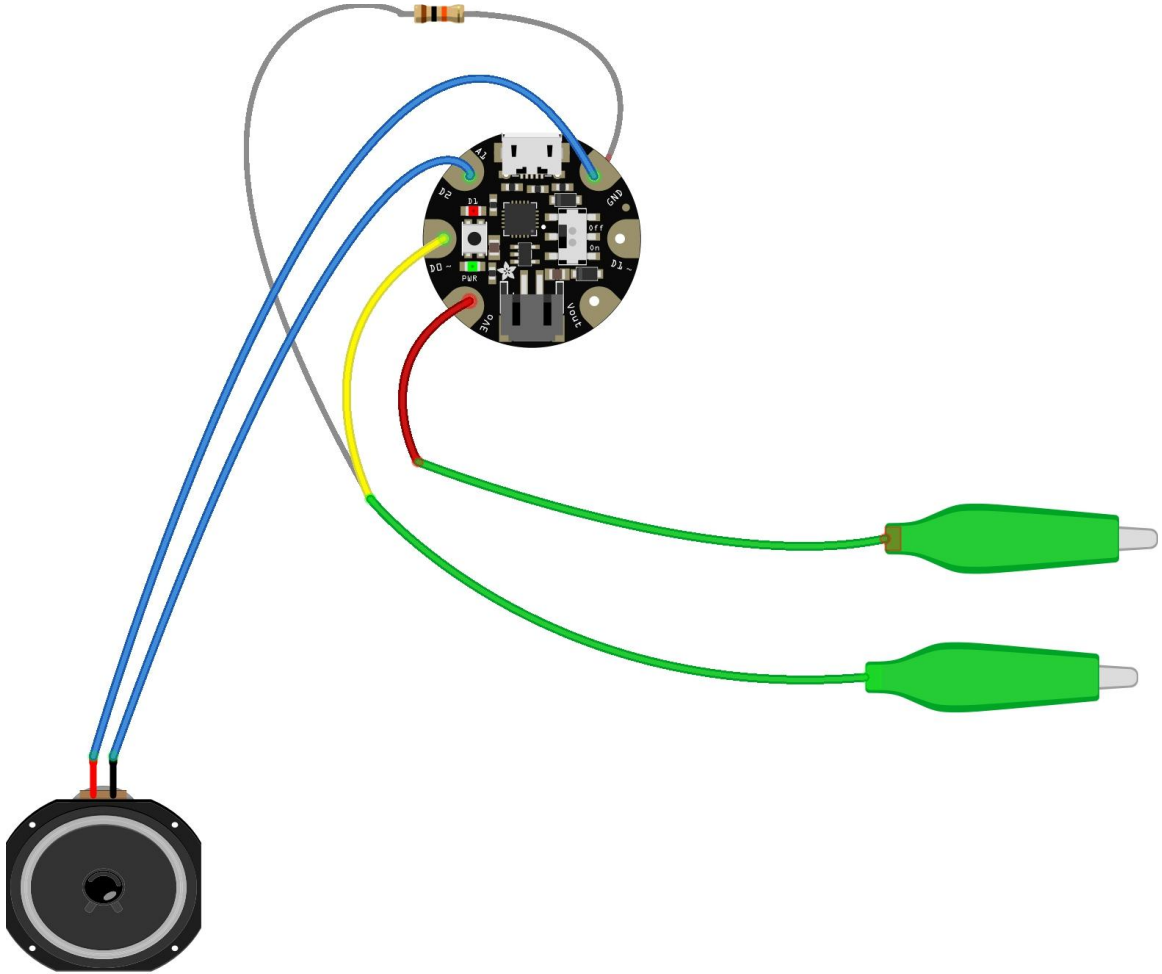


Figure 3-42







Steps for speaker & sensor circuit:

1. Solder a 10K resistor and one blue wire to GND.
2. Solder another blue wire to A1/D2.
3. Solder a black wire to the other end of the 10K resistor.
4. Solder a yellow wire to A2/D0.
5. Solder a red wire to 3v.
6. Solder the open ends of the black wire and the yellow wire to one alligator clip wire.
7. Solder the other alligator clip wire to the red wire.
8. Solder one blue wire to one pin of the piezo speaker.
9. Solder the other blue wire to the pin on the piezo speaker.
10. TEST YOUR CIRCUIT
11. If the circuit works, then gently cover the places where the wires meet the hardware with Sugru or hot glue.
12. TEST YOUR CIRCUIT AGAIN!
13. On your canvas, draw where the battery pocket and circuit should go.
14. Sew the circuit to the canvas.

Demo Time

Steps for Neopixel Gemma Circuit:

1. Lay your items out & draw a to scale drawing of your plan
2. Cut wires to the appropriate size to go between components
3. Solder wires onto 1 of the neopixels.
   a. Solder two black wires to GND.
   b. Solder two red wires to +5VDC
   c. Solder one yellow, green or blue wire to Din (arrow pointing inward) and one to Dout (arrow pointing outward).
4. Solder this neopixel to your Gemma.
   a. Connect the black wire to GND
   b. Connect the red wire to Vout
   c. Connect the Din wire on the neopixel to D1 on the Gemma.
5. TEST to make sure it works! Test after adding each neopixel.
6. Solder on another neopixel to the string you have already started. If you will be adding more neopixels eventually, also solder on an extra black wire to GND, an extra red wire to +5VDC, and a wire to Dout. Test!
7. Solder on the wire that will go to Gemma's A2 (your capacitance pin).
8. TEST everything again!
9. Hot glue or sugru the areas where the wires connect to the boards.

Neopixel Layout