Pulse Room

Created by Collin Cunningham

https://learn.adafruit.com/pulse-room

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Overview

Technology connects us to the outer world, but have we lost touch with our inner selves? Let's attempt to remedy this modern condition by controlling room lighting & sound with the beating of your own heart. Hey - it's worth a shot.

This project uses a Pulse Sensor Amped, Feather M0, MusicMaker FeatherWing, RGB LED strips, and power MOSFETs to turn any room into a thumping, flashing pulse room. For a more refined version of this idea in a gallery setting, see Sean Montgomery's excellent Emergence installation. (https://adafru.it/waO)

What you'll need

Basics:

- Soldering Iron (http://adafru.it/2163) & solder (http://adafru.it/1886)
- Hook-up Wire (http://adafru.it/1311) (for Perma-Proto)
- Stranded wire (http://adafru.it/805) or coaxial cable (http://adafru.it/2059) (for connecting LED drivers to Feather)
- Wire Strippers (http://adafru.it/527)
- Small flathead screwdriver (http://adafru.it/424) for terminal blocks
- Flush Diagonal Cutters (http://adafru.it/152)

- RGB LED Weatherproof flexi-strip 30 LED/m (http://adafru.it/285)

- Amplified speakers with a 3.5mm connection (living room stereo is fine)

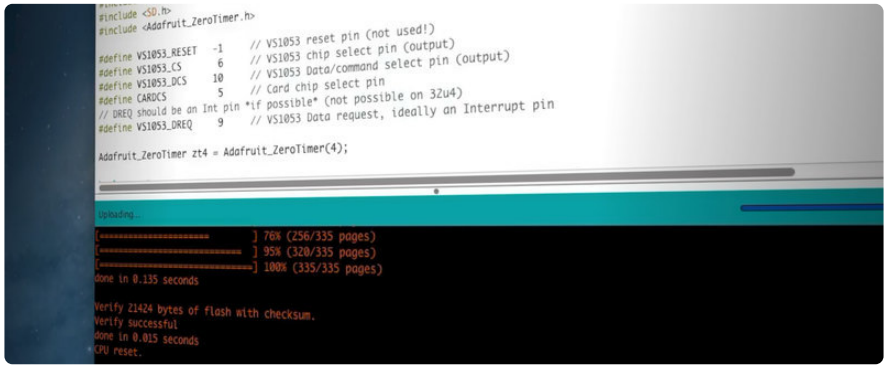
Feather Parts:

- Pulse Sensor Amped (http://adafru.it/1093)
- Feather M0 Basic Proto (http://adafru.it/2772)
- MusicMaker FeatherWing (http://adafru.it/3357)
- Feather Female Header Kit (http://adafru.it/2886)
- Feather Stacking Headers (http://adafru.it/2830)
- MicroSD Memory Card (http://adafru.it/102)
- Breadboard-friendly SPDT Slide Switch (http://adafru.it/805)
- Micro USB power supply (http://adafru.it/1995) or LiPo Battery w JST connector (https://adafru.it/waX)

LED Driver Parts:

- N-Channel Power MOSFET (IRLB8721) (http://adafru.it/355)
- 5-Pin 0.1" Pitch Terminal Block (http://adafru.it/2139)
- 6-Pin 0.1" Pitch Terminal Block (http://adafru.it/2135)
- Breadboard-friendly 2.1mm DC Barrel Jack (http://adafru.it/373)
- Perma-Proto Quarter-sized Breadboard PCB (http://adafru.it/1608)
- 12V Power Supply w 2.1mm plug (https://adafru.it/wb0)
- 10K Resistor

Software



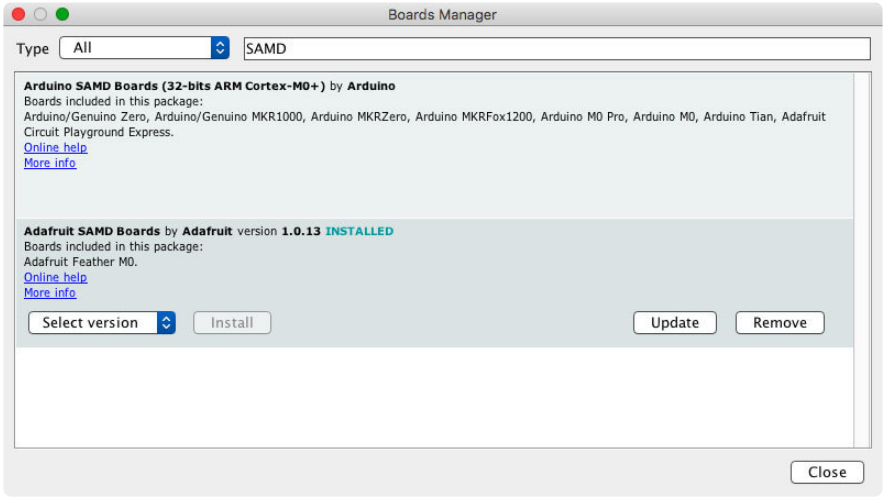
The code for this project is based off the Pulse Sensor Amped's Arduino (https://adafru.it/wbf) sketch. Modifications have been made to include audio file playback, timer interrupts on the Feather M0, and serial output has been removed to keep things simple.

First, install the latest version of the Arduino IDE, if you haven't already:

Download Arduino IDE

https://adafru.it/f1P

Install Adafruit SAMD Boards

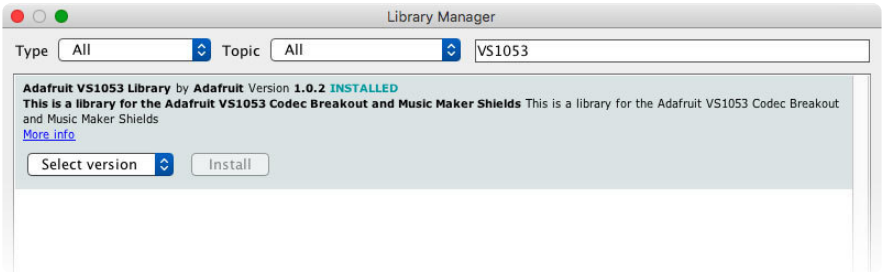


You'll need to install **two SAMD board libraries** - one from **Adafruit** & one from **Arduino**.

Open the Arduino IDE and go to **Tools->Board->Boards Manager**... and use the search box to find **SAMD**. Select **Adafruit SAMD Boards,** click the **Install** button and **wait for the process to complete**.

Once the process is complete, select **Arduino SAMD Boards (32-bits ARM Cortex M0+)**, click the **Install** button and **wait for the process to complete**.

Install Libraries

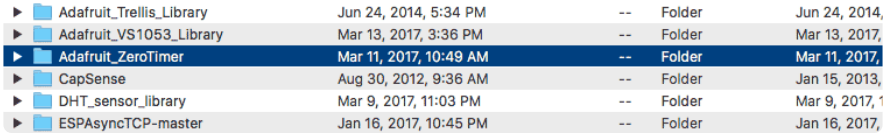


You'll need a couple of Arduino libraries to get things working. The first one can be installed via the Arduino IDE's library manager. Go to the **Sketch->Include Library->Manage Libraries...** Search for "VS1053" and install the **Adafruit VS1053 Library.**

Next, you'll need to install an **older version** of the **Adafruit ZeroTimer library** - specifically version **1.0.1**.

Be sure to install version 1.0.1 of the ZeroTimer Library, not the latest version

In the **Arduino Library Manager** search for **Adafruit ZeroTimer**, select it from the results and choose **Version 1.0.1** from the **Select Version** pulldown menu and click **Install**.



You'll also need the **Adafruit_ASFCore** library, which is available here:

Adafruit_ASFcore library

https://adafru.it/lnc

Unzip the downloaded archive, and rename the resulting folder to "**Adafruit_ASFcore**" (just remove the "-master" string). Once the folder is renamed, move it to your Arduino library folder (**Documents/Arduino/libraries**) and restart the Arduino IDE.

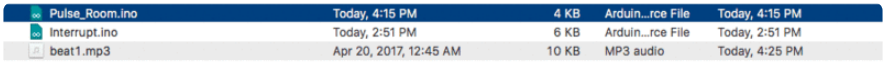
Download project code & upload to Feather

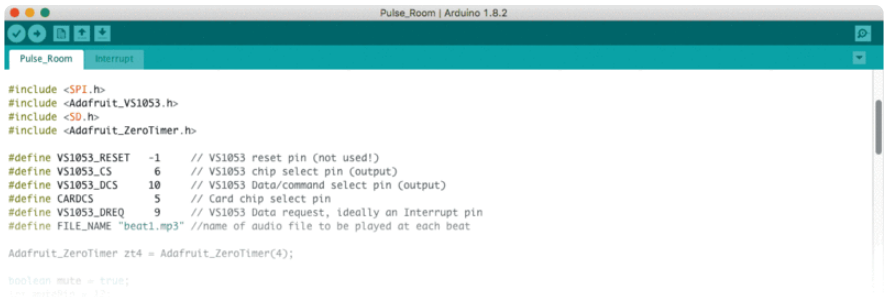
Grab the Pulse_Room (https://adafru.it/wbi) project code from GitHub:

Download Pulse Room code

https://adafru.it/wbj

Unzip the downloaded archive and rename the resulting folder to **Pulse_Room**. Inside the folder, you'll find the **Pulse_Room.ino** file - open it in the **Arduino IDE**.

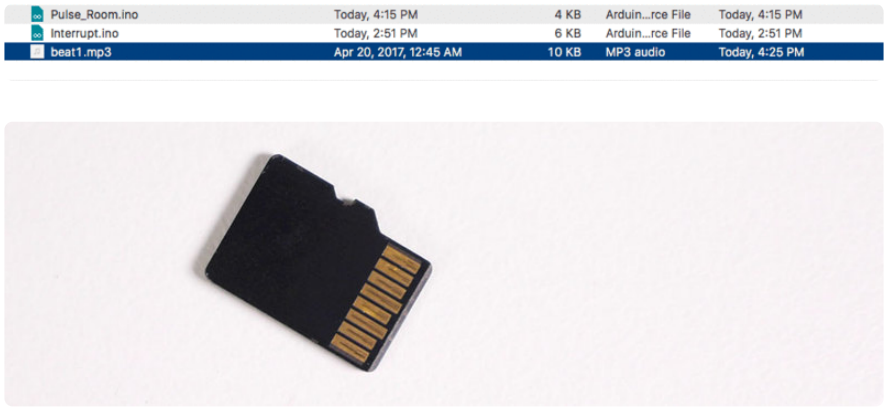




Connect your **Feather M0** board via USB. Go to **Tools->Board** and select **Adafruit Feather M0 (Native USB Port)** from the list. Then go to **Tools->Port** and select the port for your Feather M0. Click the **Upload** button and wait for the process to complete.

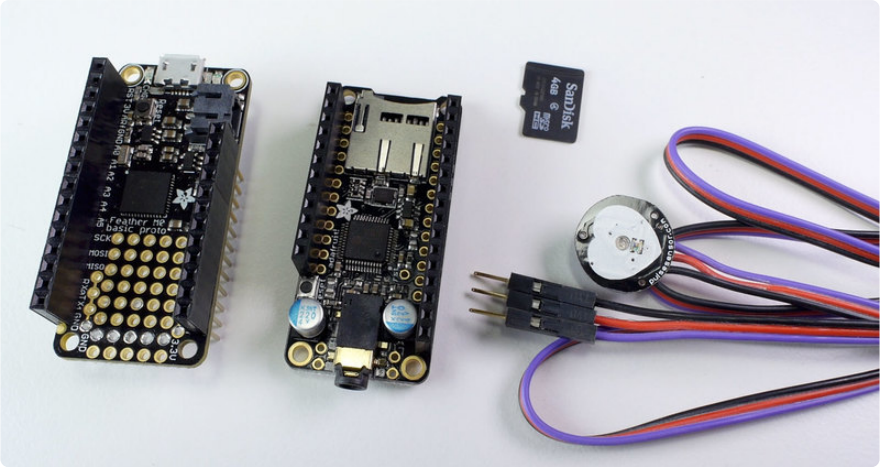
Sound File

Now that the Feather is programmed, we can put our sound file on an **SD Card** for playback. You could use your own sound file, or the one I used named **beat1.mp3**, which is included in the **Pulse_Room** zip file downloaded in the previous step. More info on compatible file formats can be found in the MusicMaker FeatherWing guide (https://adafru.it/wbk).



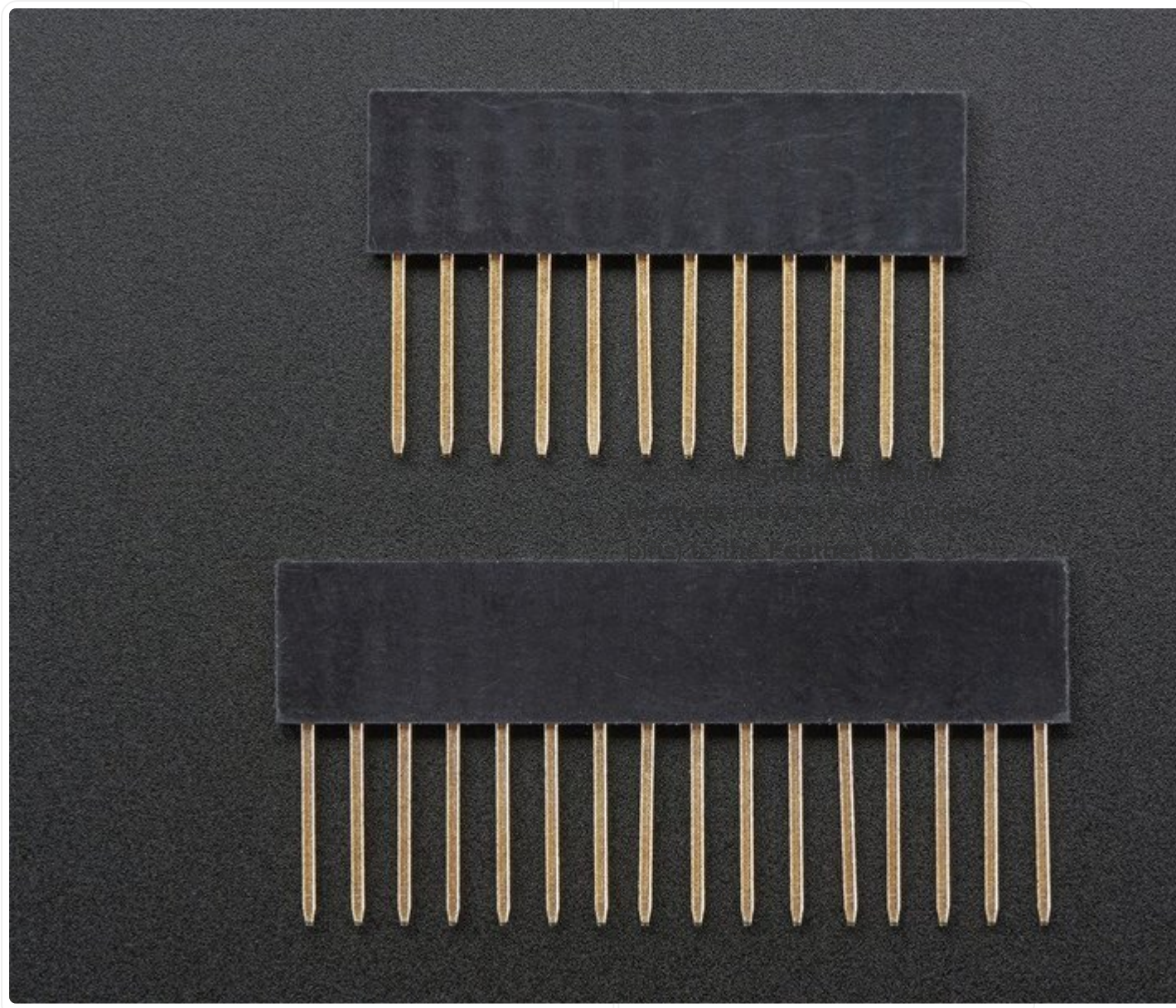
Copy the file to the root level of your **Micro SD card**. Note that your SD card should be formatted for **FAT16** or **FAT32** and have a capacity greater than 64MB.

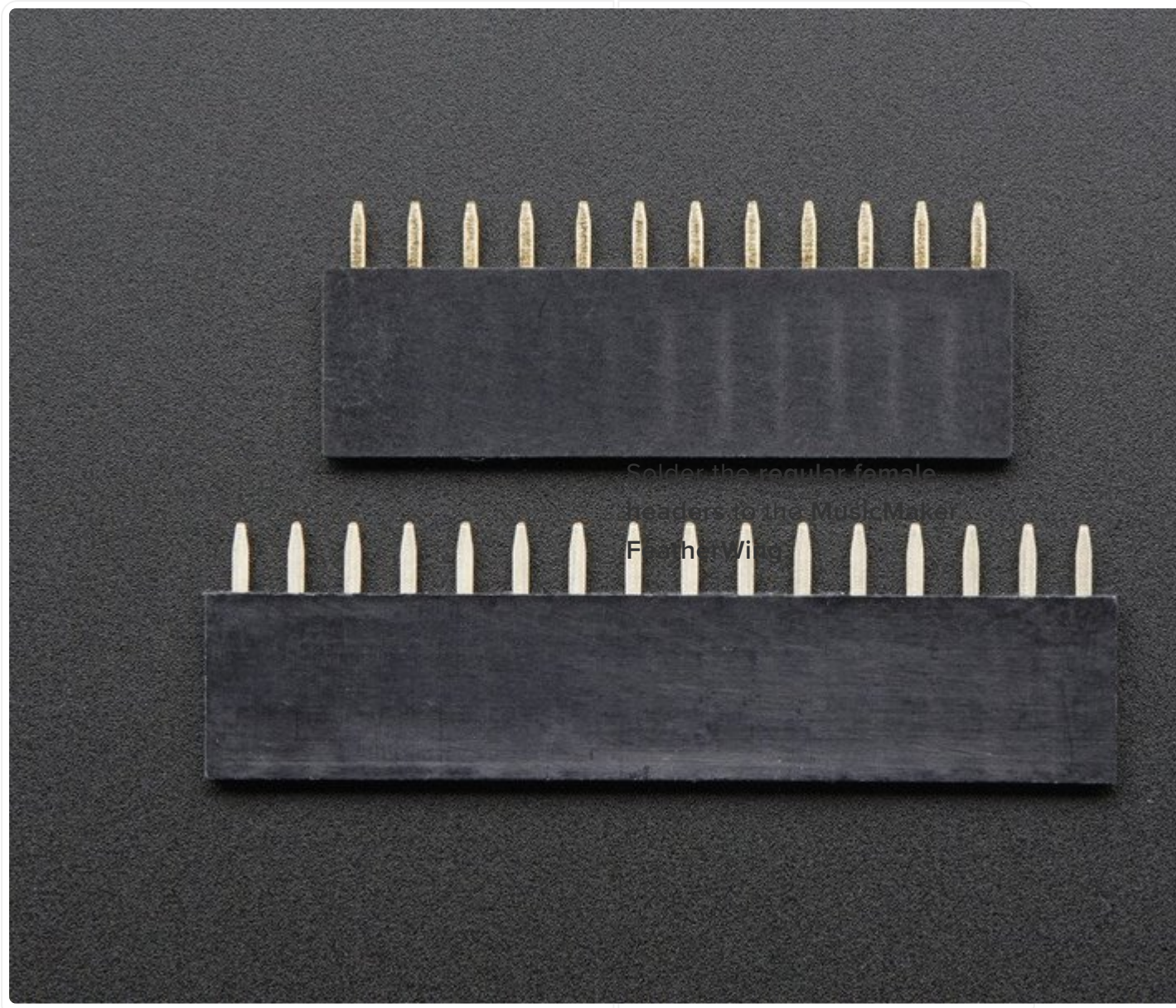
Feather Connections



About those headers ...

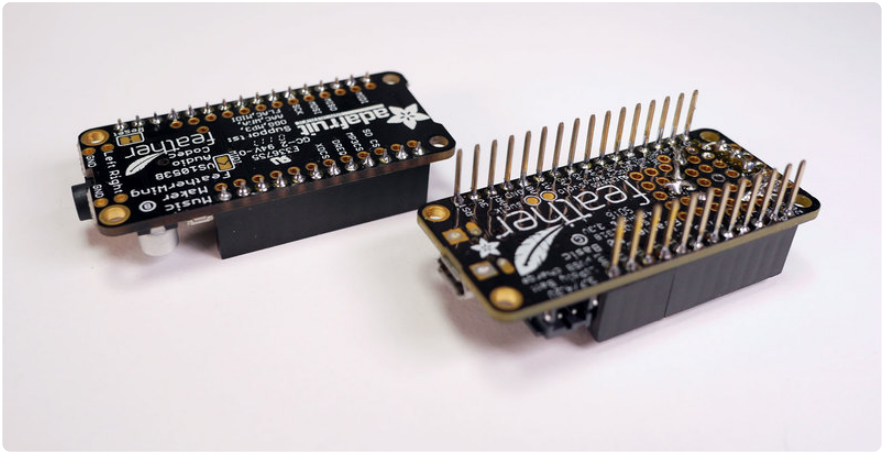
In order to have access to the Feather M0's prototyping area, I decided to mount the MusicMaker Wing underneath the Feather. I also wanted to easily connect & disconnect the Pulse Sensor - so this means we'll need female headers on both the M0 & MusicMaker Wing.





Solder the regular female headers to the MusicMaker FeatherWing

Once complete, your boards should look something like this ...

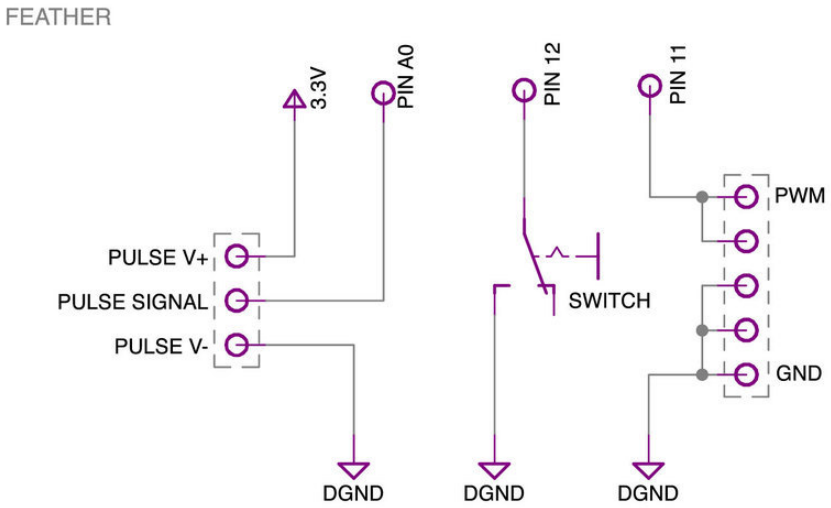


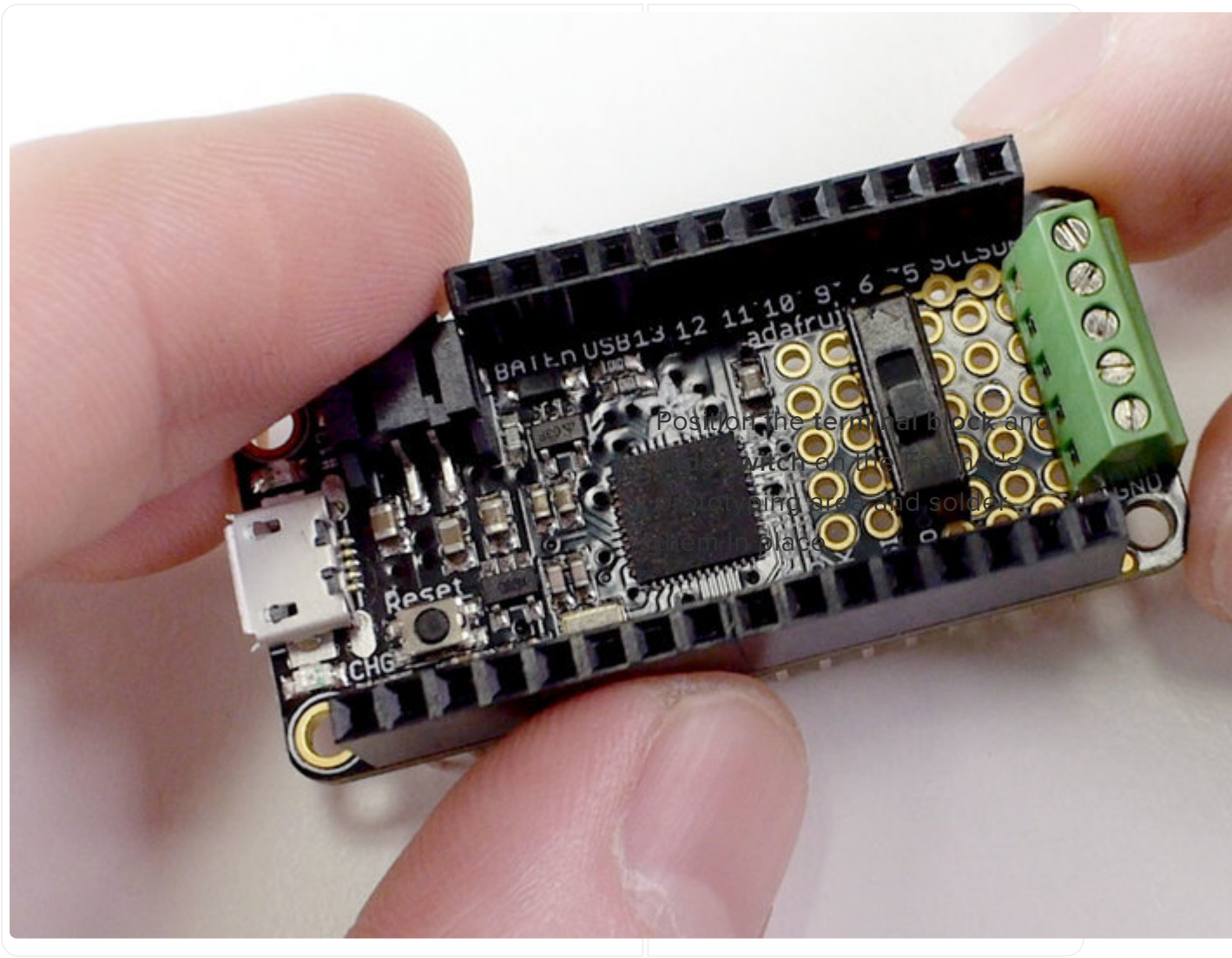
Mount components on Feather M0

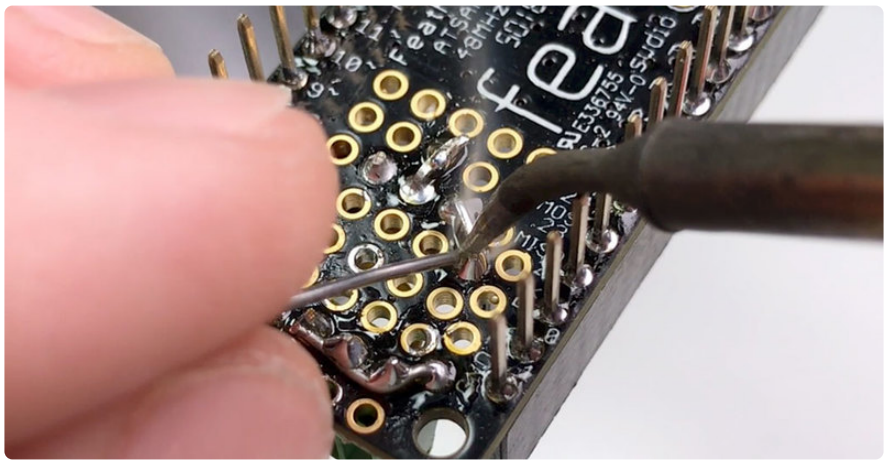
We'll be adding two components to the Feather M0's prototyping area:

- **SPDT slide switch** for muting sound & light output until we have a steady pulse
- **5-pin terminal block** for easy connections to the LED driver boards

Here's a schematic showing all the connections we'll make to the Feather (including the **Pulse Sensor Amped**).

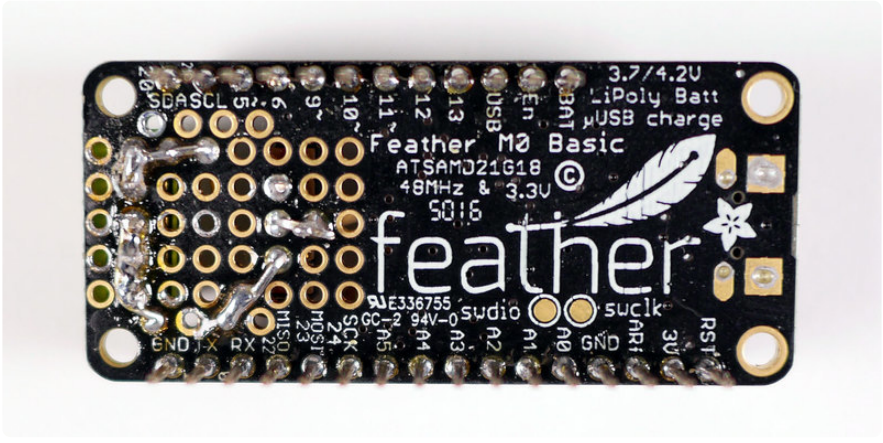




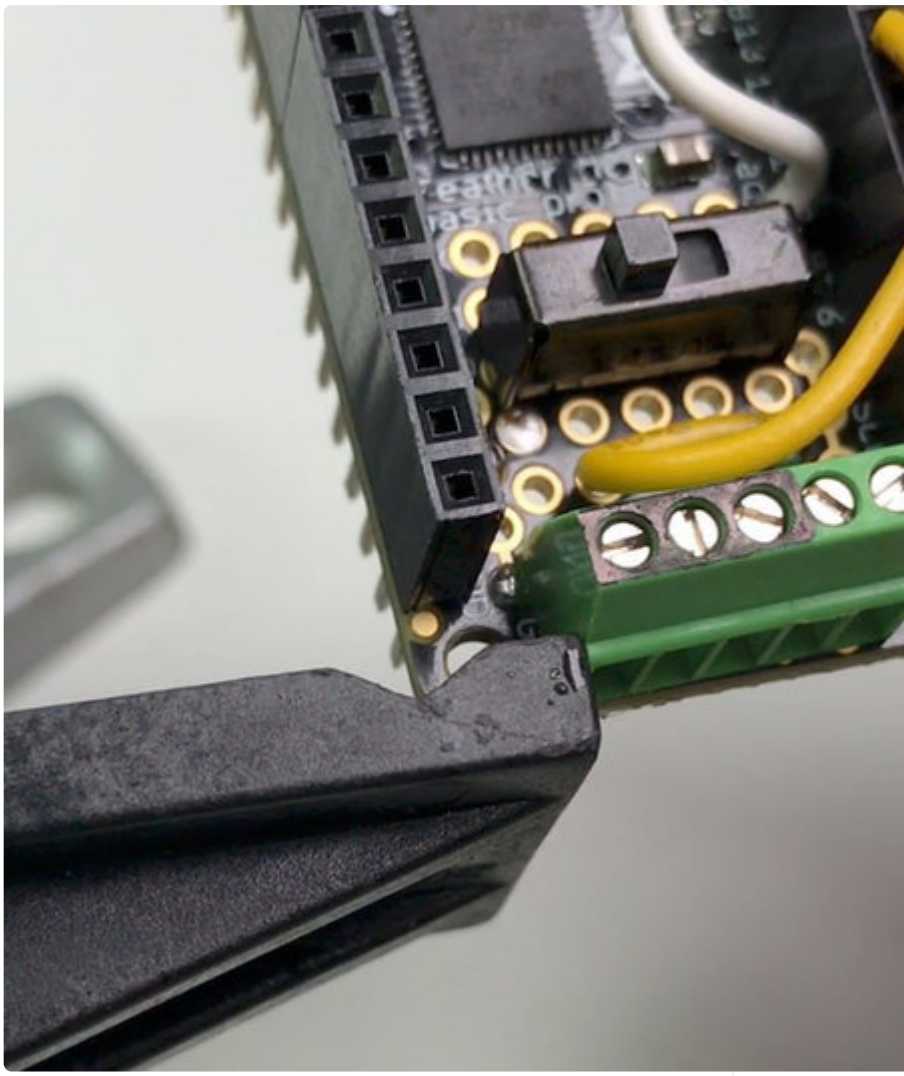


Solder the bottom 3 pins of the terminal block to **GND** and solder the top 2 pins together (we'll connect these to **pin 11**).

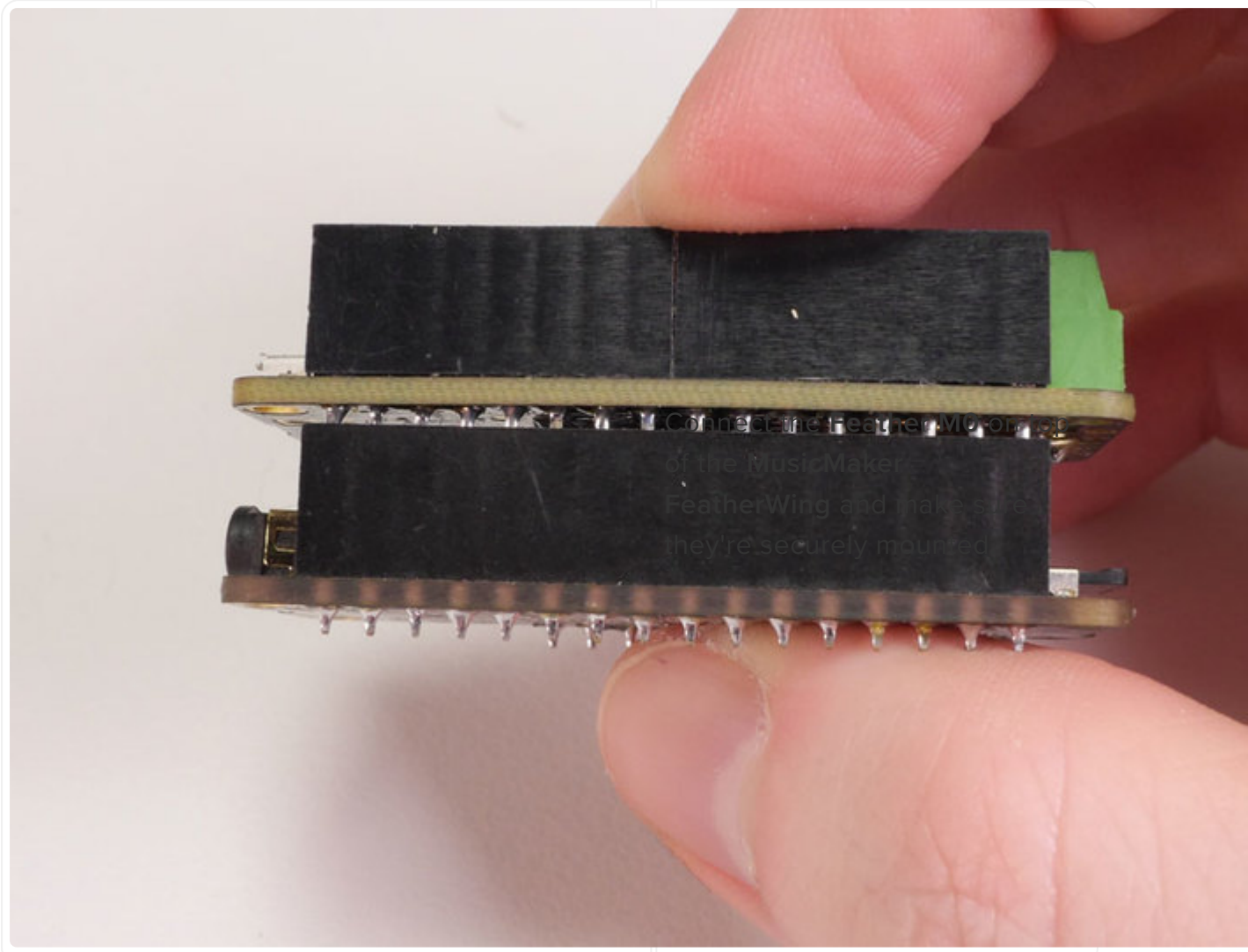
For reference - below is a shot of the feather after soldering is complete. Note the use of the GND bus conveniently located in the Feather's prototyping area:

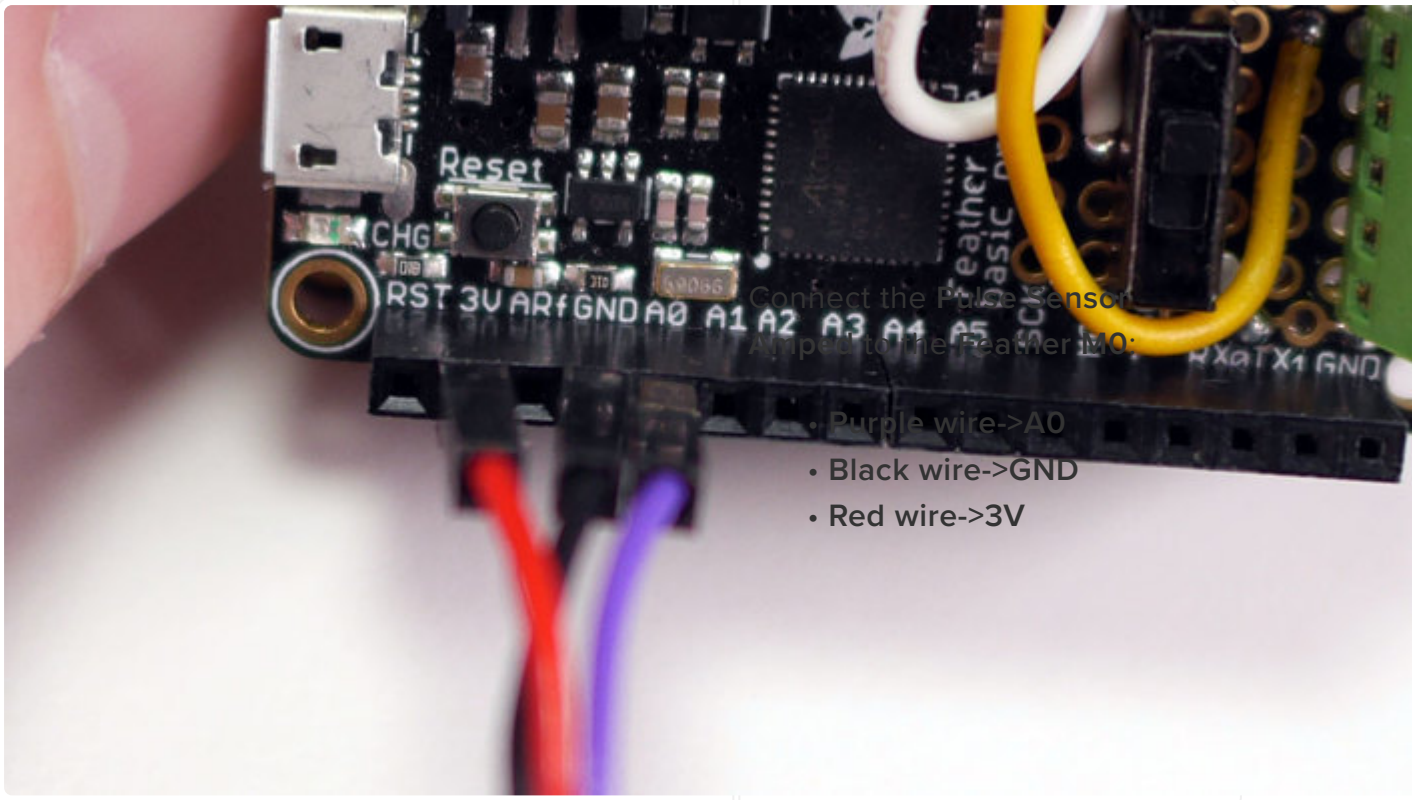


To avoid mistakes later, use a marker or paint to label the terminal block's ground connections.



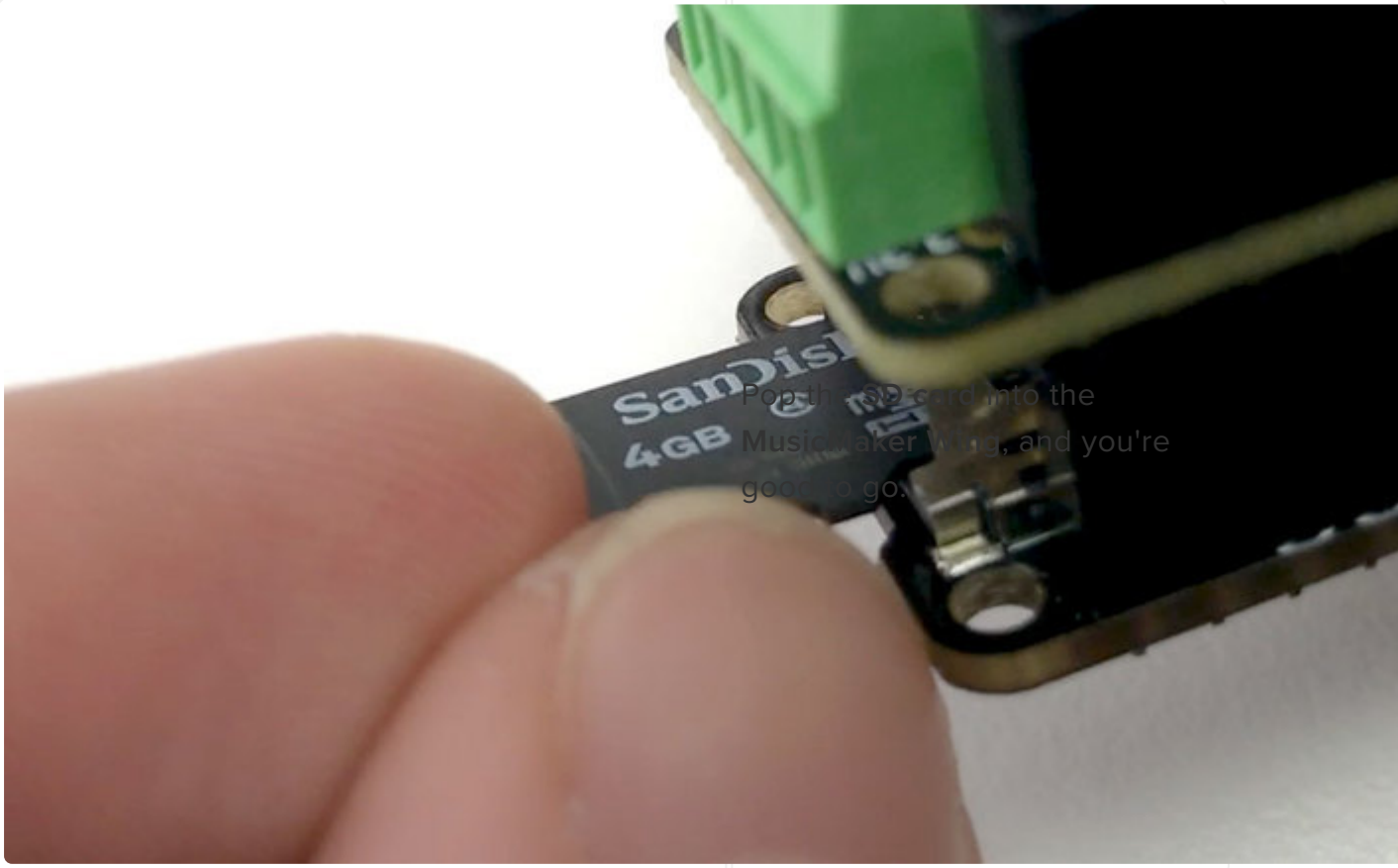
Connect it all





Connect the Pulse Sensor Amped to the Feather M0:

- Purple wire->A0
- Black wire->GND
- Red wire->3V

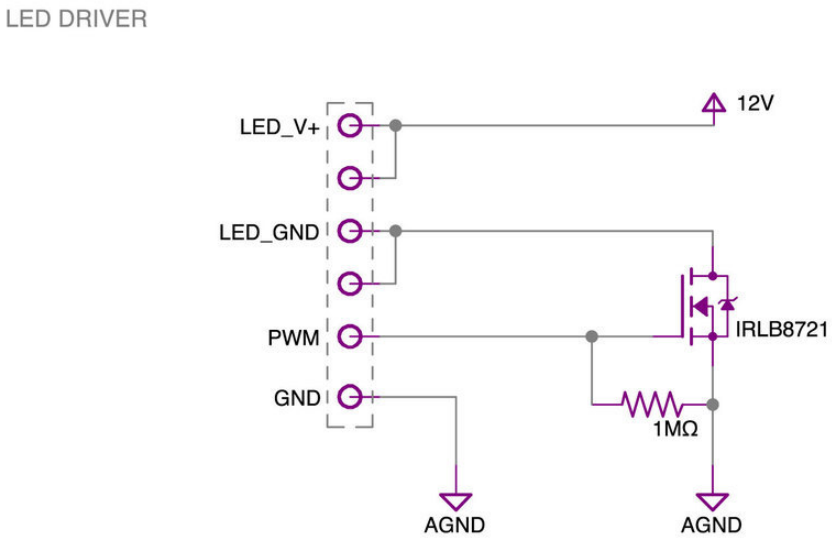


Pop the SD card into the Music Maker wing, and you're good to go!

LED Driver

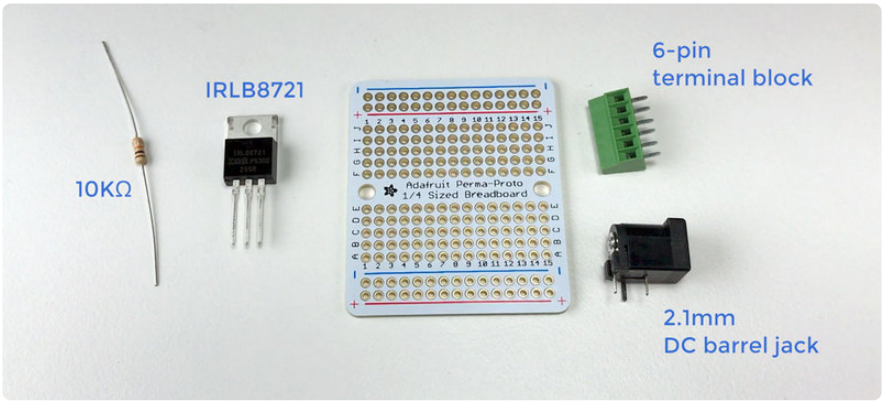
The **LED driver board** will take the 3.3V PWM signal from the Feather M0 and use it to control 12V power needed for the LED strips. One board connected to a 12V 1A power supply is capable of pulsing the red channel of two 5-meter LED strips without the need for a heatsink.

The board itself is quite simple. Check out the schematic below:

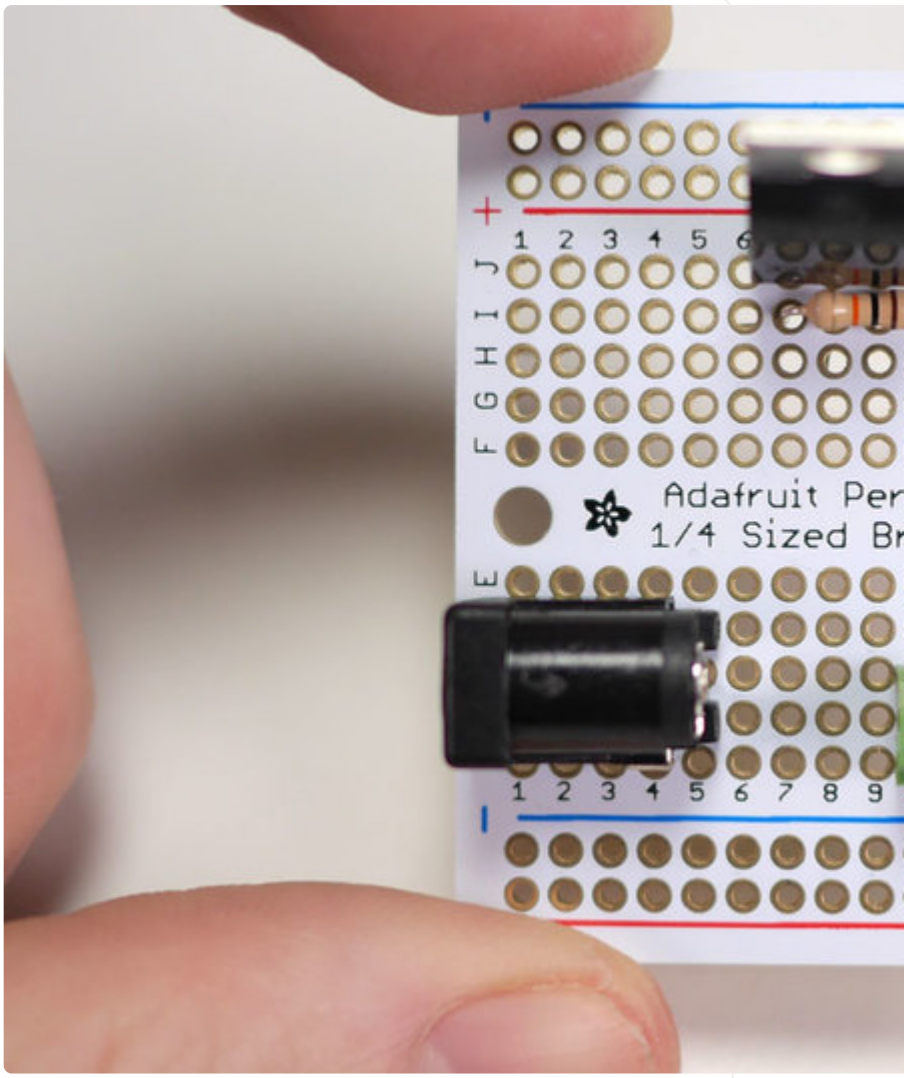


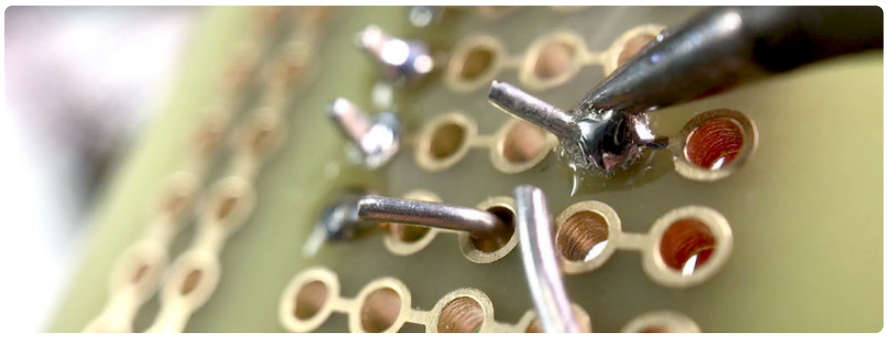
We put down a 1 Megaohm resistor for the pulldown resistor but later found 10Kohm works better!

Component layout



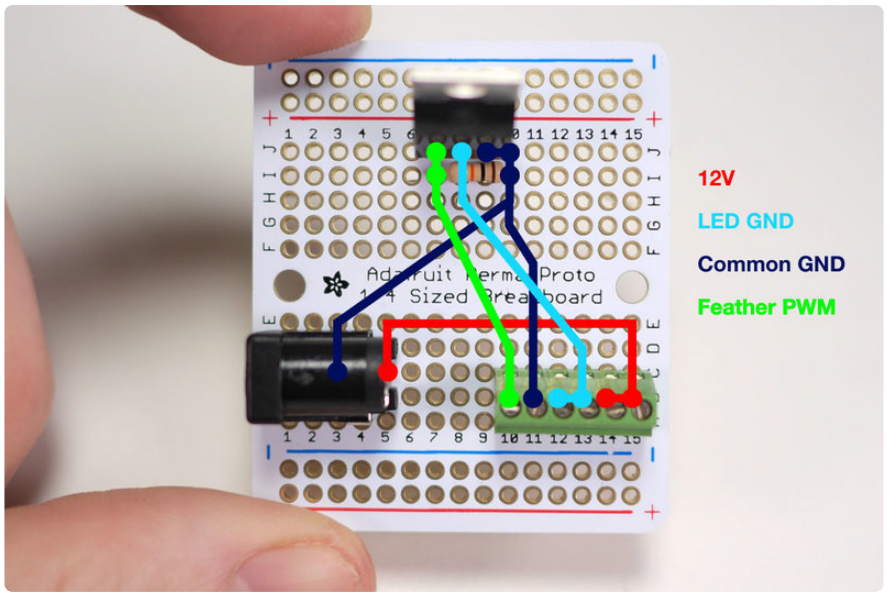
Place the components on the Perma-Proto board, solder, and trim any protruding leads.



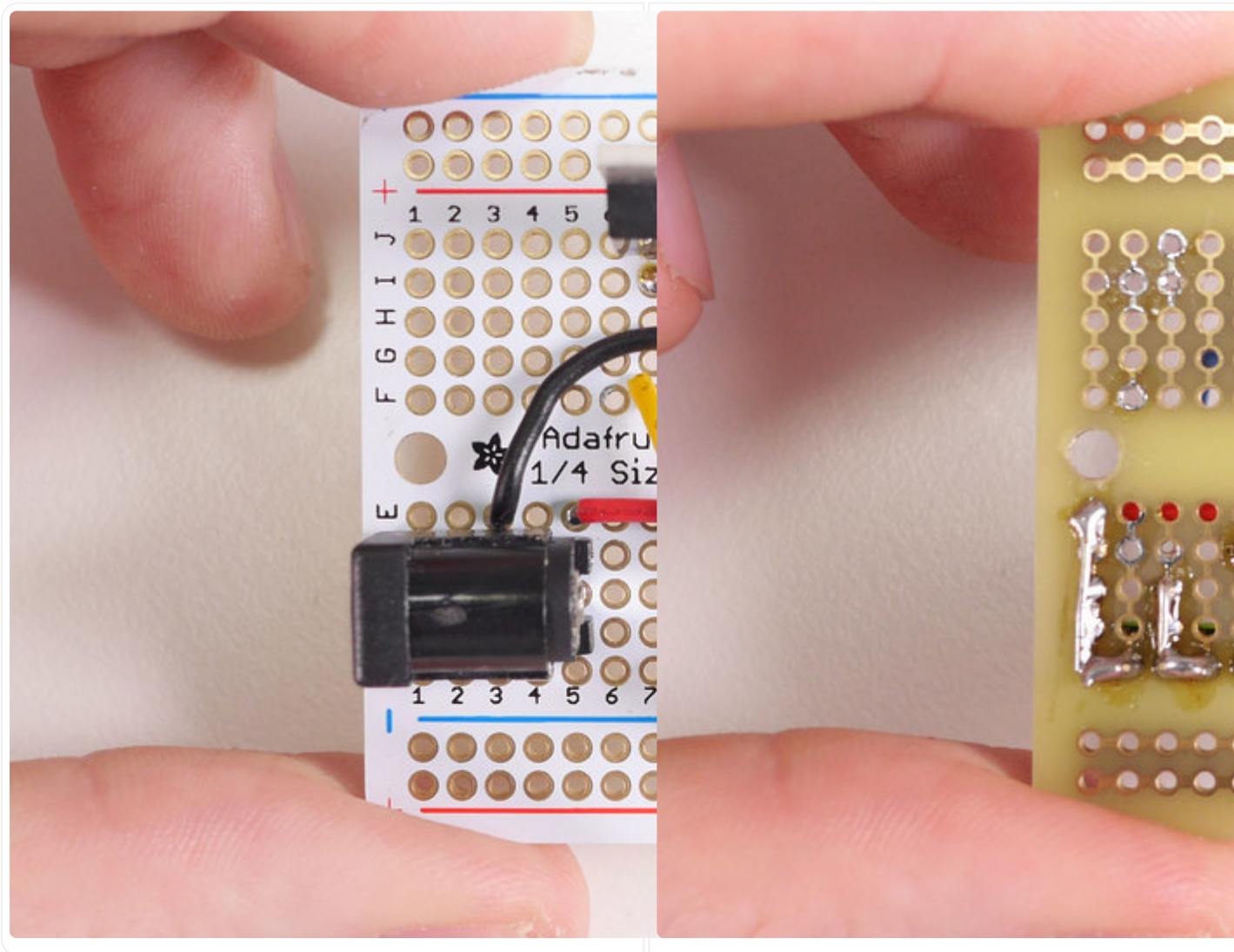


Solder wire jumpers

Solder the necessary connections between components using solid core hookup/ jumper wire. Check the image below to reference what connections need to be made:

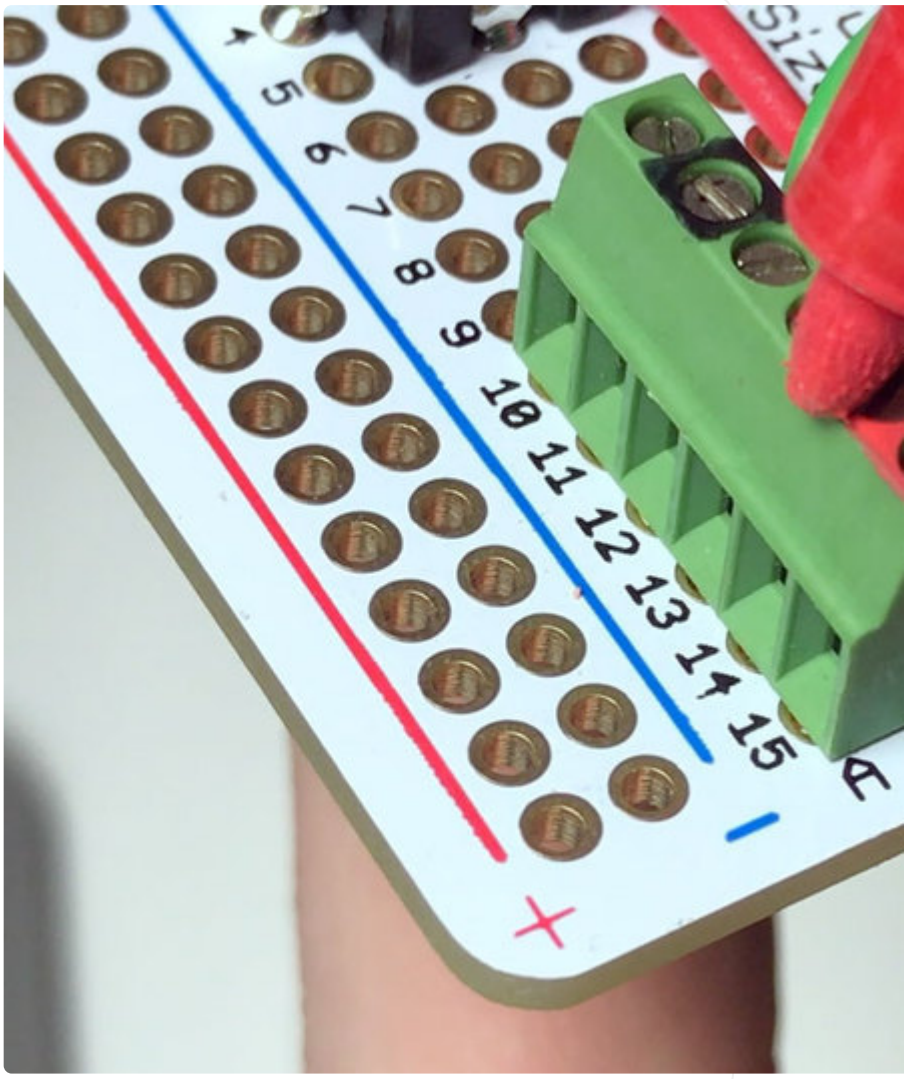


The finished board should look something like this:

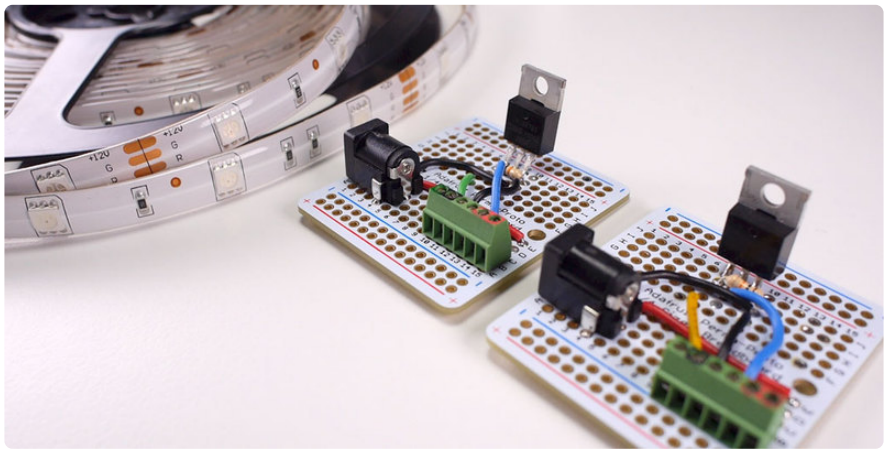


Label the terminal block

Label the terminal block to avoid incorrect connections. You can use a marker, paint, or the best of both worlds - a paint marker.



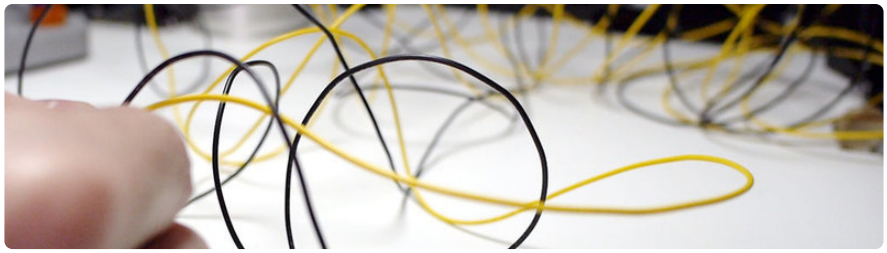
Since we're only using the red channel of the LED strips, each 12V LED Driver board will be able to power 2 x 5-meter strips. Build additional boards as needed ...



Wiring

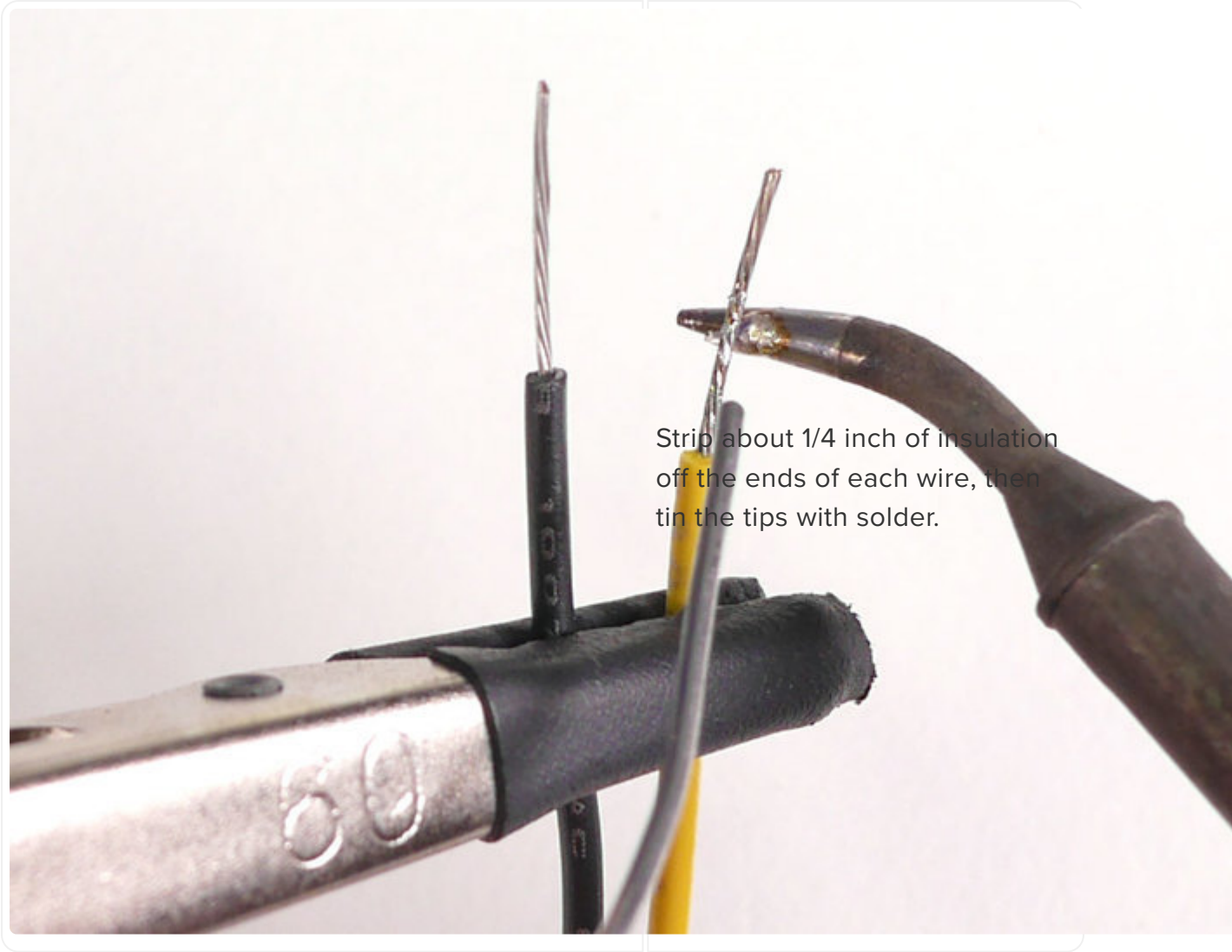
A whole lotta wire ...

Determine where you'd like to place the **Feather** + **Pulse Sensor** in your room and then decide where you to place the **LED driver boards** + **LED strips**. I placed the Feather near the middle of the room on a coffee table and the driver boards on opposite walls – so I needed a lot of wire to connect the Feather to each driver (~20ft to allow for routing around furniture/etc).

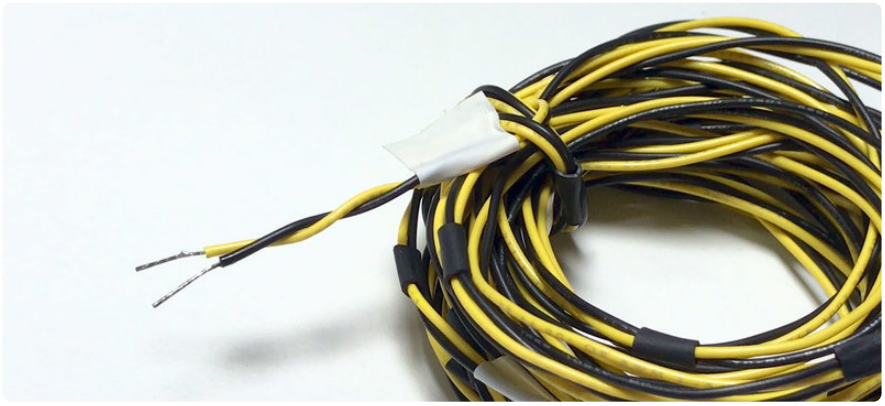


Each board needs 2 connections - **one for PWM** signal, and **one for ground**. 2-conductor cable, such as a thin coaxial type, would be ideal for this situation. I had 26AWG stranded wire on hand, so that's what's used in this guide.

Figure out the length you'll need, then cut two matching lengths of different colored wire (I used black for ground & yellow for PWM)

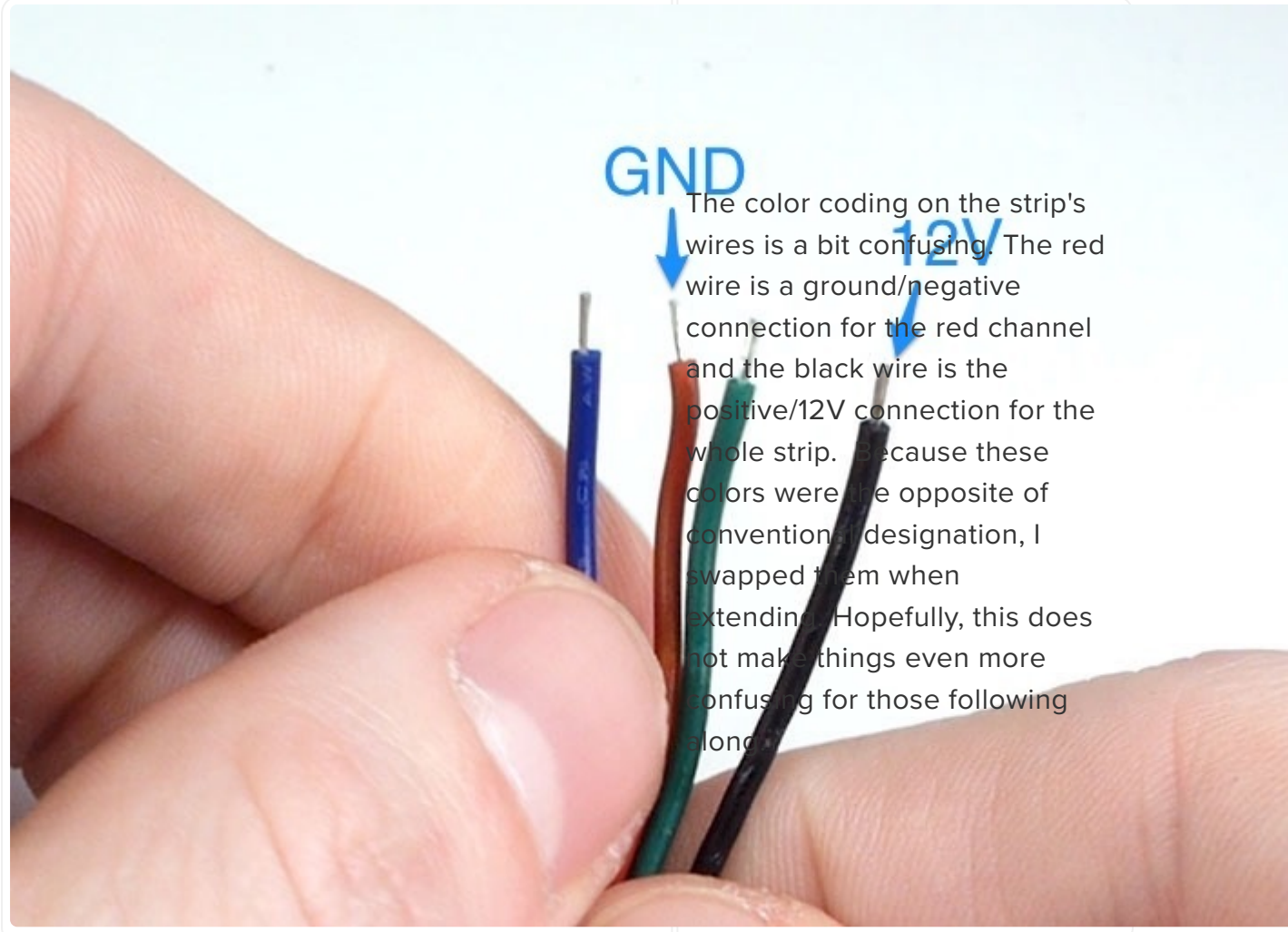


Optionally, to keep the wires from getting too unruly, you can twist the pairs together and bind them at regular intervals with tape or heat shrink tubing ...

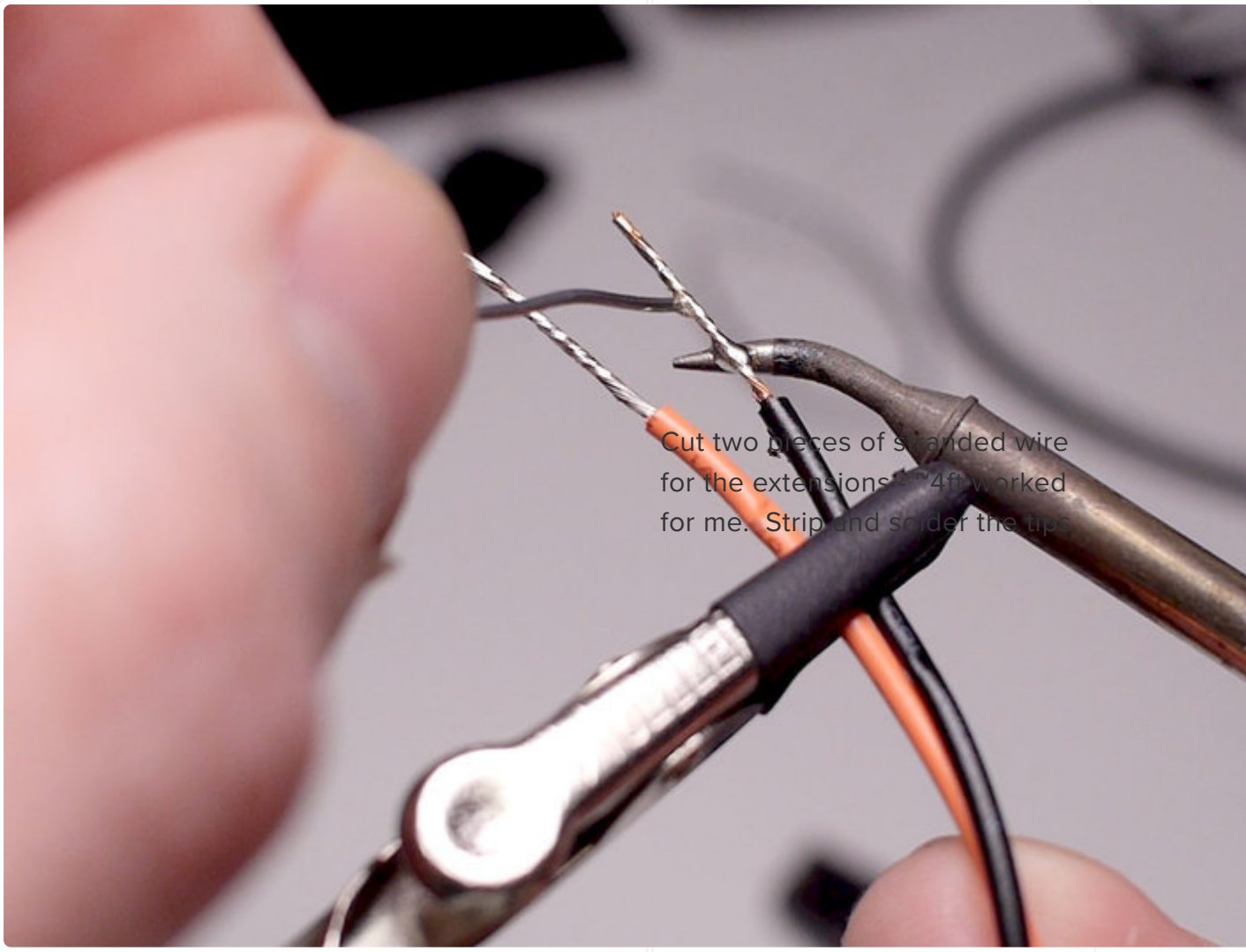


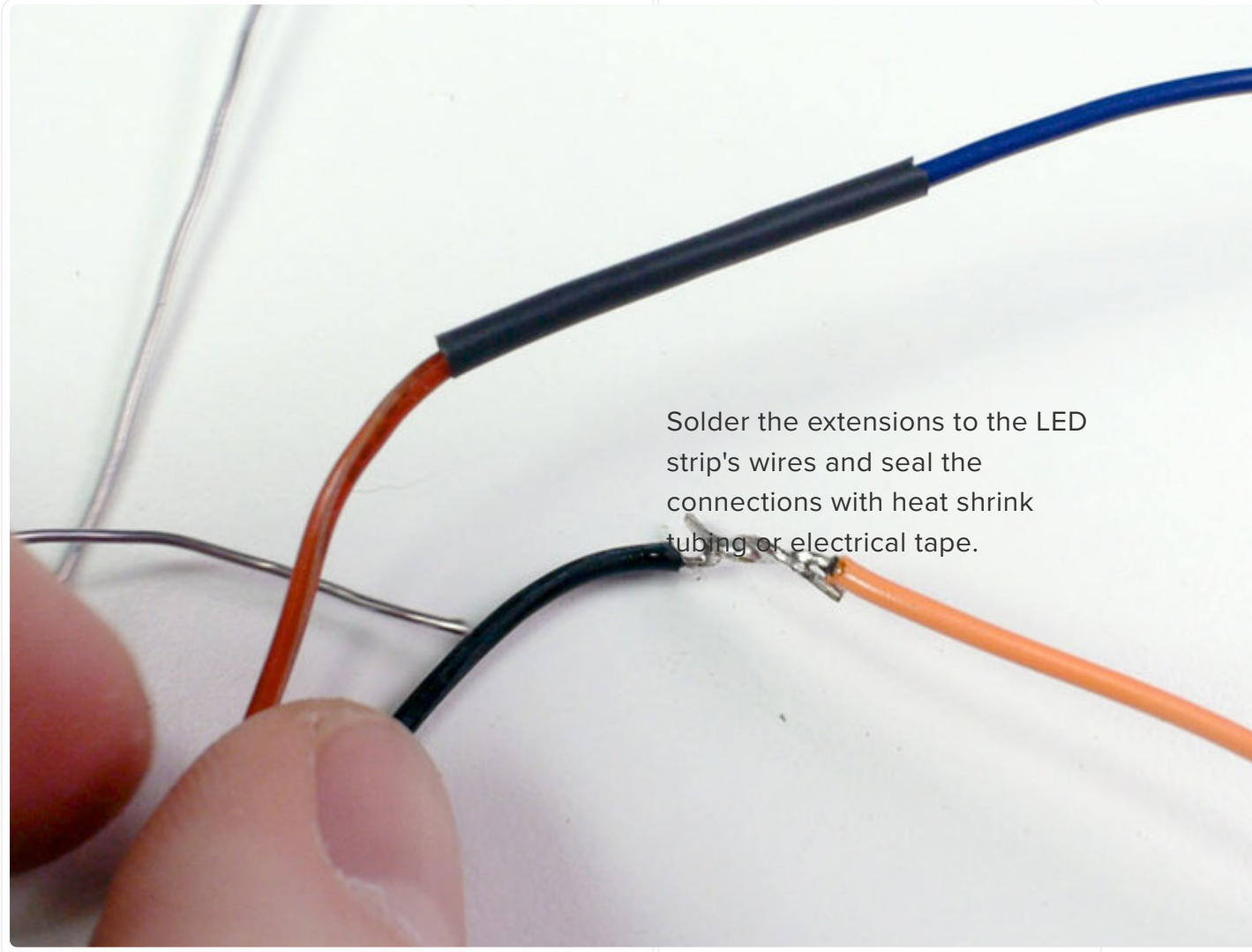
Extend the LED Strip Wires

The wires coming off the LED strips aren't very long, so you'll likely need to solder extensions to them. Since we're only using the red channel, we only need to extend the red & black wires.

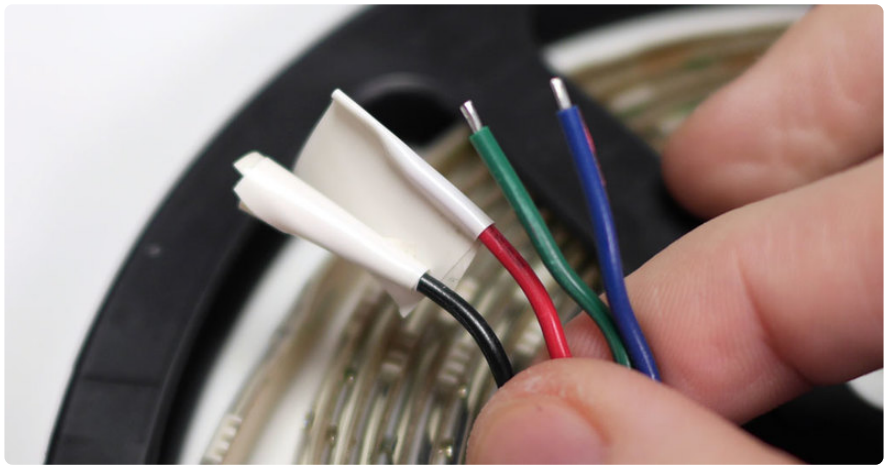


The color coding on the strip's wires is a bit confusing. The red wire is a ground/negative connection for the red channel and the black wire is the positive/12V connection for the whole strip. Because these colors were the opposite of conventional designation, I swapped them when extending. Hopefully, this does not make things even more confusing for those following along.


Cut two pieces of stranded wire
for the extensions (~4ft worked
for me). Strip and solder the tips

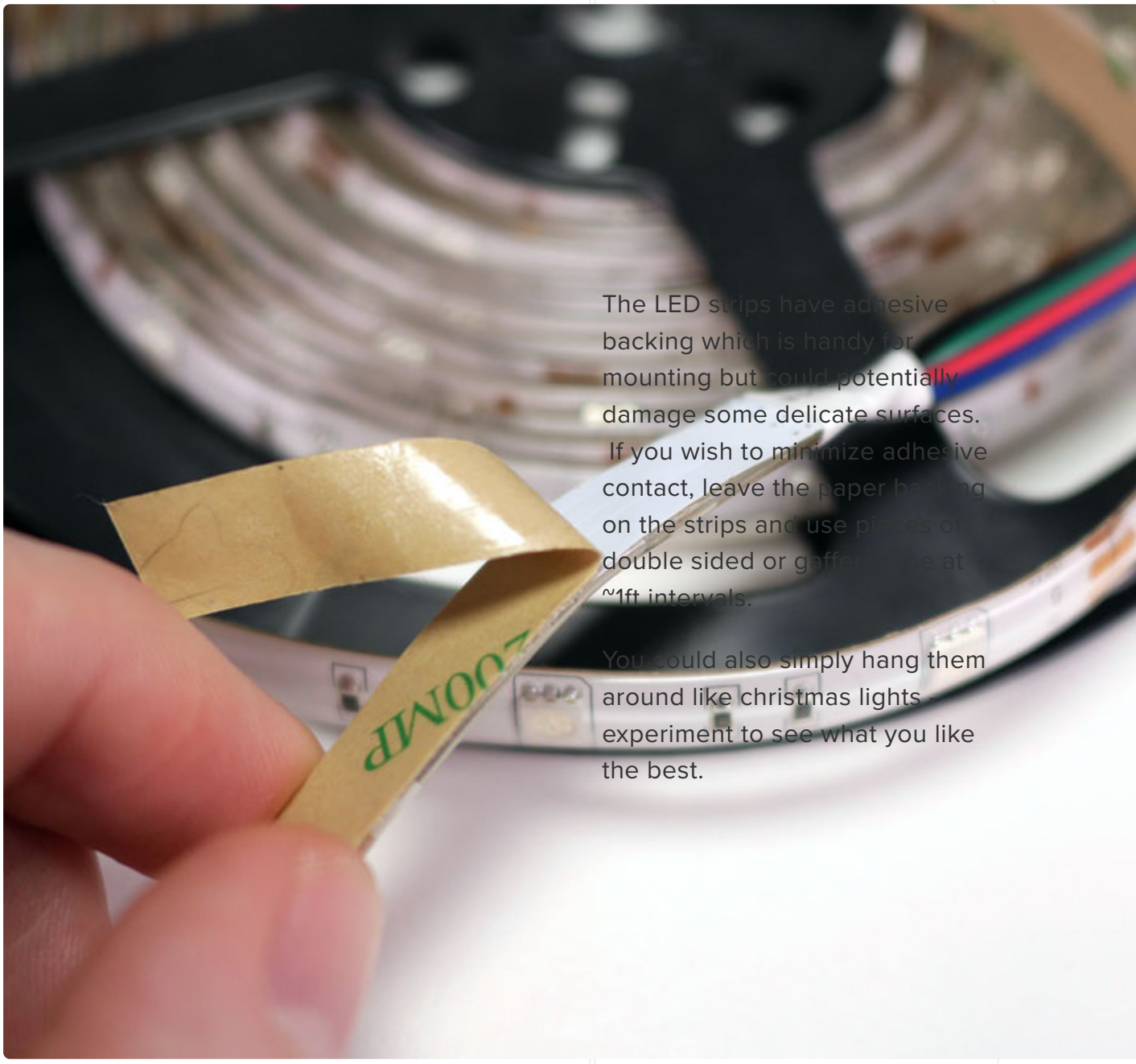


The tail end of the LED strip also has wire leads for chaining strips (an option I did not explore). To avoid shorts, wrap the red and black wires on that end with a couple layers of electrical tape ...



Installation & Usage

Mount LED strips & drivers

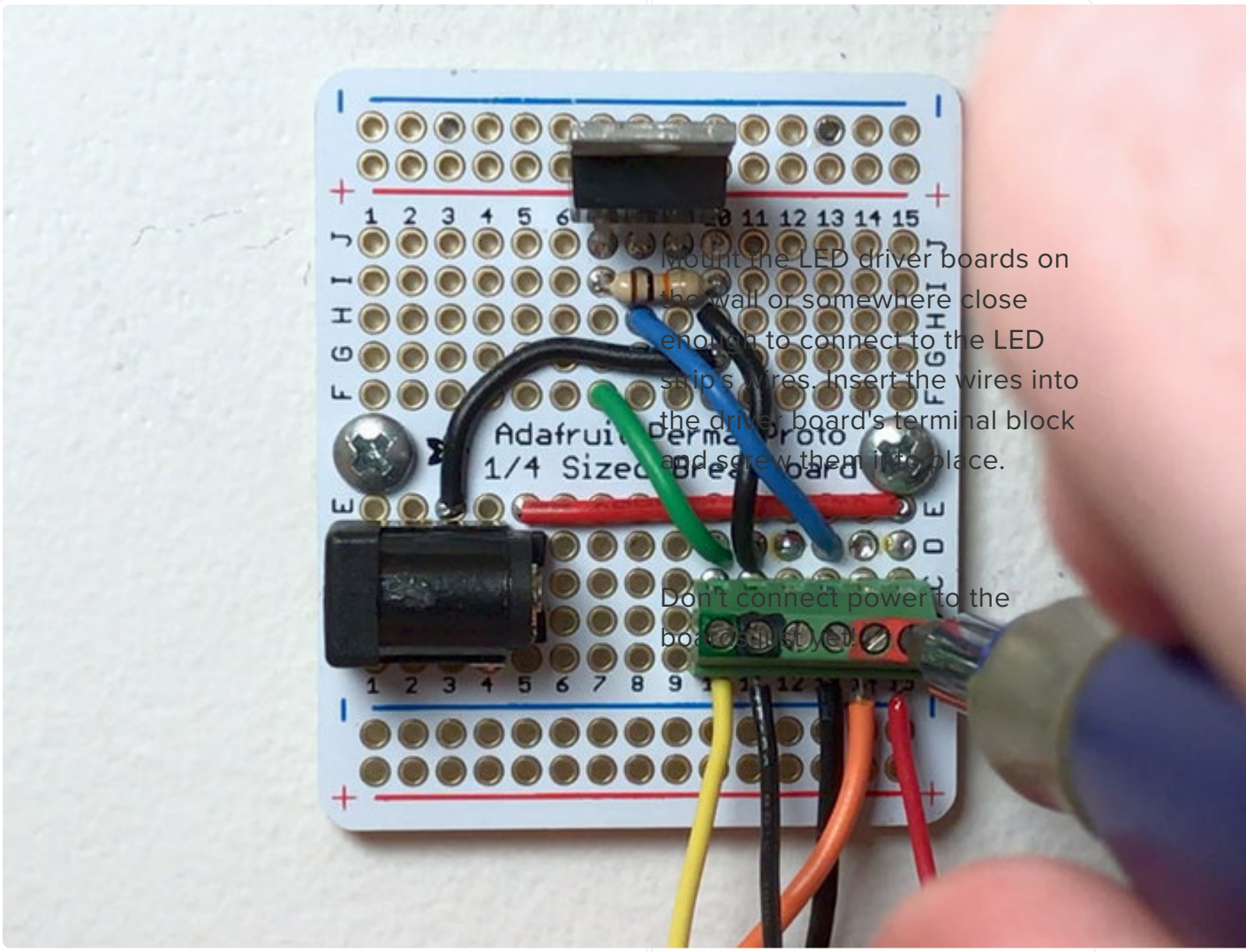


The LED strips have adhesive backing which is handy for mounting but could potentially damage some delicate surfaces. If you wish to minimize adhesive contact, leave the paper backing on the strips and use pieces of double sided or gaffers tape at ~1ft intervals.

You could also simply hang them around like christmas lights - experiment to see what you like the best.

These LEDs are quite bright and looking at them directly can be a rough on the eyes.

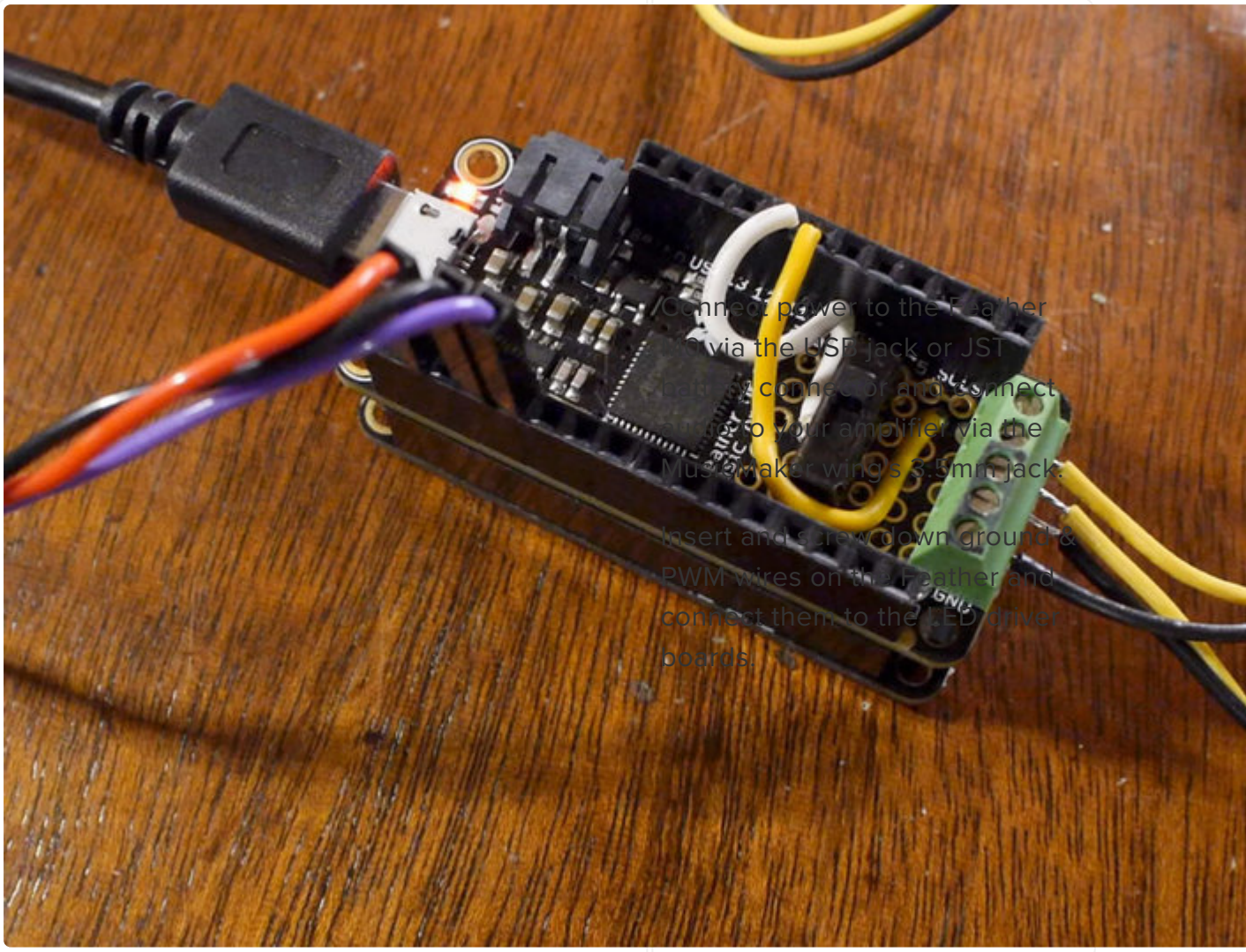
To minimize harshness, mount the LEDs around molding, behind furniture, or facing upward above eye level - this will create a pleasantly diffused and ambient effect.

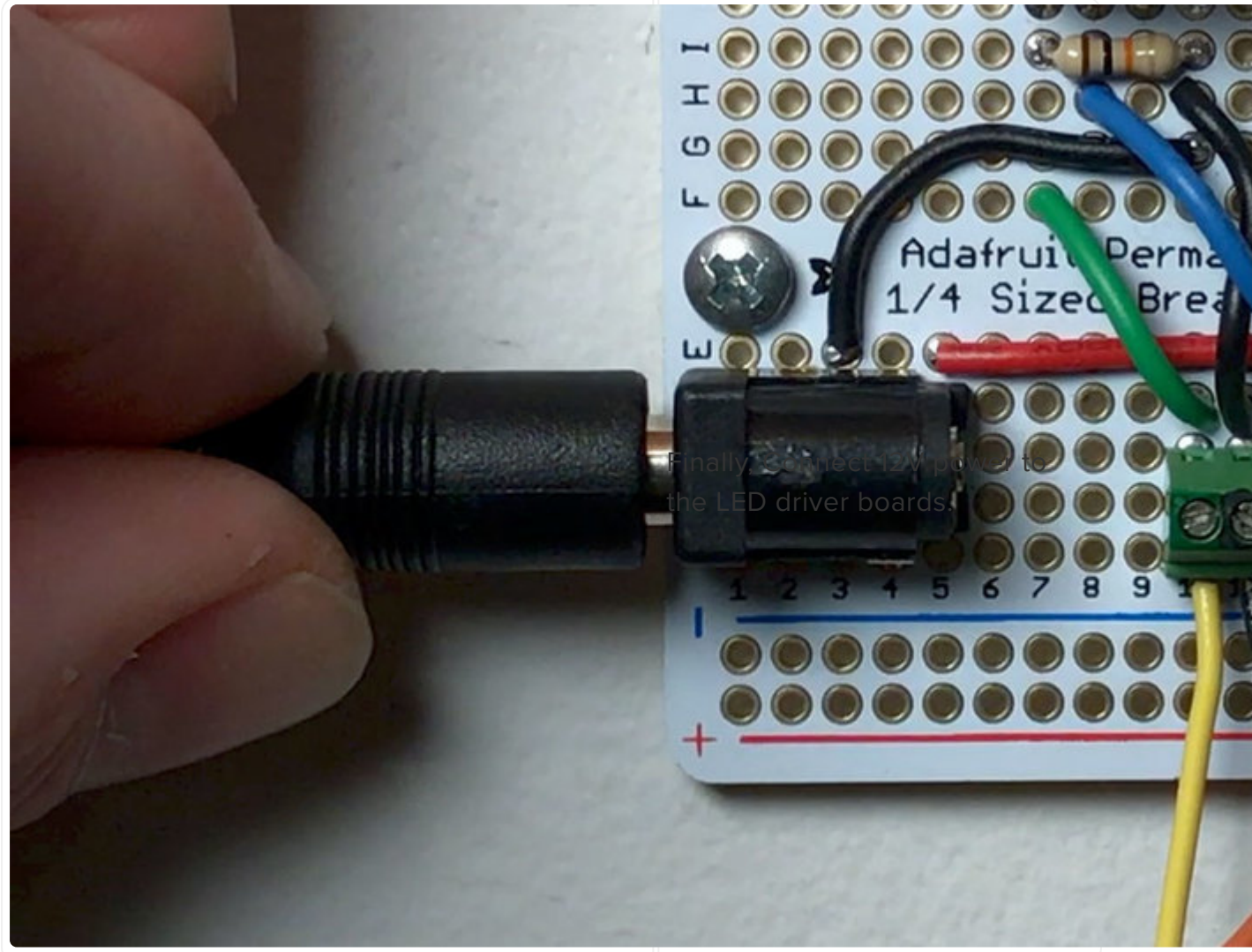


Mount the LED driver boards on the wall or somewhere close enough to connect to the LED strip's wires. Insert the wires into the driver board's terminal block and screw them into place.

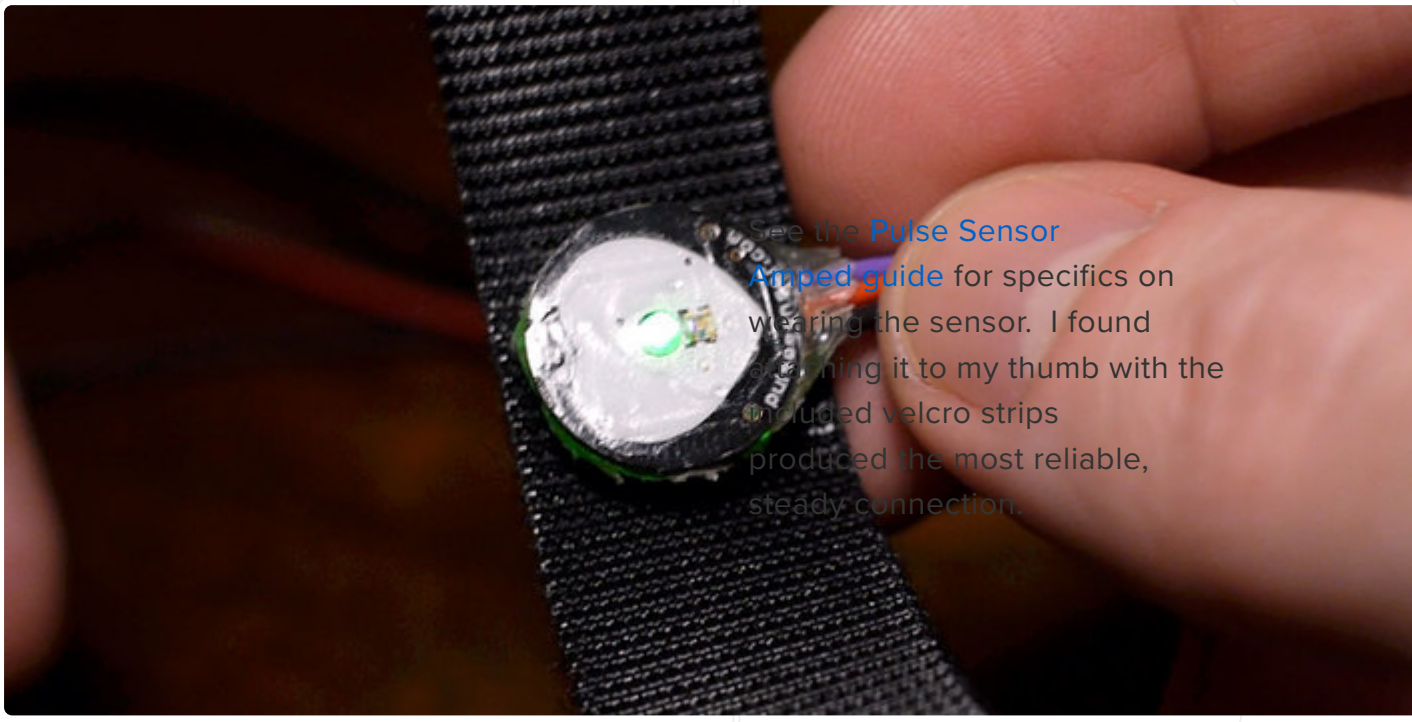
Don't connect power to the boards just yet!

Final Connections

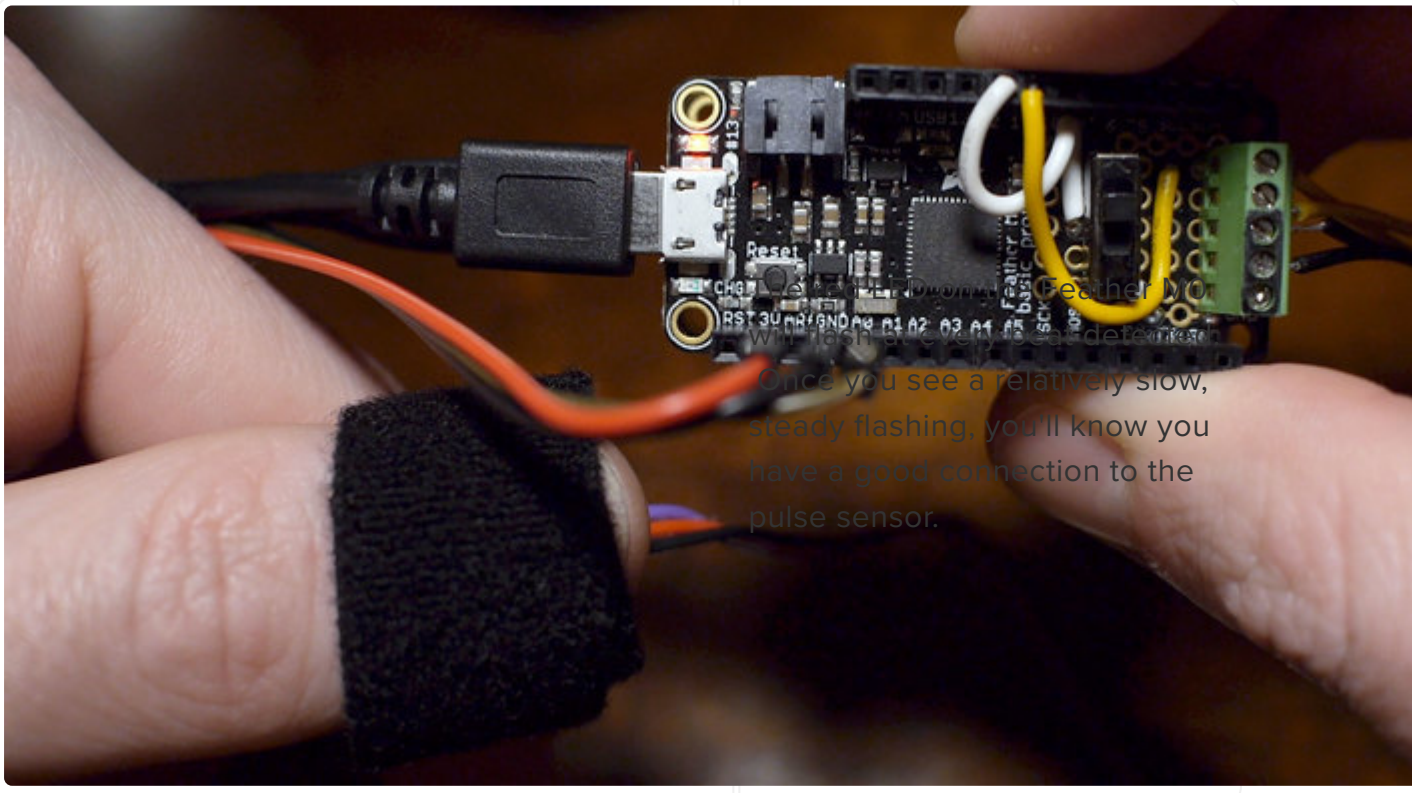



E F G H I
1 2 3 4 5 6 7 8 9
Finally, connect 12V power to
the LED driver boards.

Use it.



See the Pulse Sensor Amped guide for specifics on wearing the sensor. I found attaching it to my thumb with the included velcro strips produced the most reliable, steady connection.



Once you see a relatively slow, steady flashing, you'll know you have a good connection to the pulse sensor.

Once you have a steady pulse shown on the Feather's LED, go ahead and flick the switch on the Feather and witness your pulse displayed at room scale ...

Now sit and ask yourself, "Why did I do this?" and suddenly remember – art serves no practical purpose. It's just cool.