



# Digital LED Belt

Created by lady ada



<https://learn.adafruit.com/digital-led-belt>

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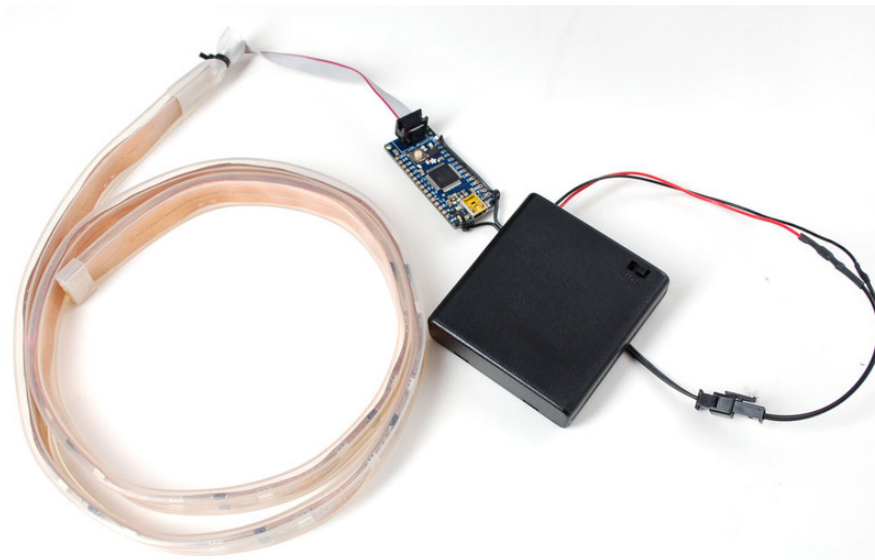
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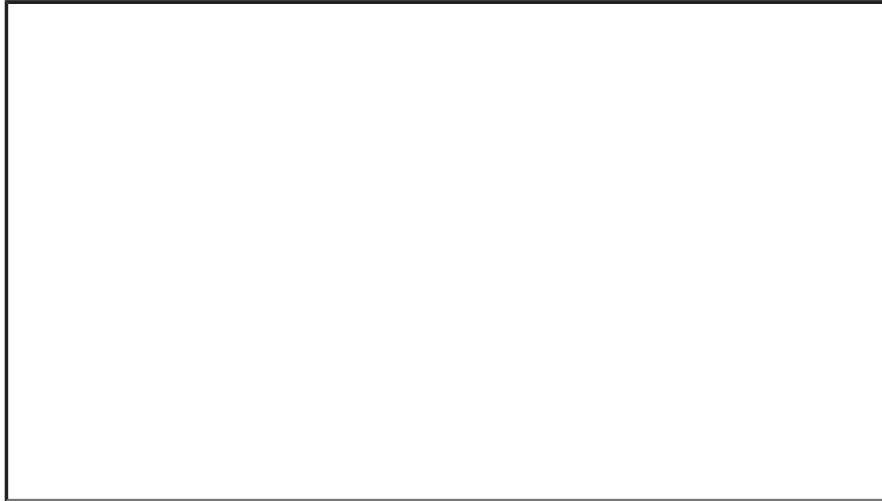
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# Overview

By popular demand, we now have a project tutorial for how to make your own programmable, ultra-blinky LED belt. Perfect for parties, raves, parades, weddings, funerals, and bar mitzvahs. Wear it with pride, wear it with blinky! Follow this tutorial to build your own heirloom LED belt, and hand it down to your grandkids.

We designed this project to demonstrate how to use the digital LED strip, how to use our Atmega32u4 breakout board with the Arduino IDE and how to make a portable battery powered project that runs off of AAs. This project is not too difficult, and can be finished in a day. Some soldering experience is good since 'free wire' soldering is a little more difficult than soldering to a PCB, but even beginners should be able to manage. We don't include a tutorial on using the Arduino IDE so its good if you've played around with the Arduino already.





## Tools

You'll need some very common electronics tools to make this project

- [A soldering iron \(https://adafru.it/aIH\)](https://adafru.it/aIH) and [solder \(https://adafru.it/aIH\)](https://adafru.it/aIH)
- [Wire cutters \(https://adafru.it/aIH\)](https://adafru.it/aIH) and [wire stripper \(https://adafru.it/aIH\)](https://adafru.it/aIH)(or a tool that does both)
- Heat source like a heat gun, hairdryer, or lighter
- [Any kind of pliers \(https://adafru.it/aIH\)](https://adafru.it/aIH)
- [A 3rd hand tool \(https://adafru.it/aIH\)](https://adafru.it/aIH) or [panavise \(https://adafru.it/aIH\)](https://adafru.it/aIH)or some other way to keep your work steady
- [A basic multimeter can be handy \(https://adafru.it/aIH\)](https://adafru.it/aIH)

## Parts List

We have this project available as a pack. You can of course, get the parts individually and adapt it for your own nefarious purposes

- [Atmega32u4 breakout board \(the brains!\) \(https://adafru.it/aIH\)](https://adafru.it/aIH)
- [Digital LED strip - 1 meter \(https://adafru.it/aIH\)](https://adafru.it/aIH)
- 6-pin IDC cable
- Inline cable pair ([male \(https://adafru.it/aIH\)](https://adafru.it/aIH)and [female \(https://adafru.it/aIH\)](https://adafru.it/aIH) )
- [4xAA battery holder with a switch \(https://adafru.it/cwD\)](https://adafru.it/cwD)
- [1N4001 diode \(https://adafru.it/cuU\)](https://adafru.it/cuU)
- 3" of 3/32" heatshrink
- 2" of 1" heatshrink
- Zip/cable tie

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# Install Driver

We'll start out easy, by plugging in the atmega32u4 board and installing the driver. For mac and linux users, you can skip this step! If you're using windows, however, you'll need to do this:

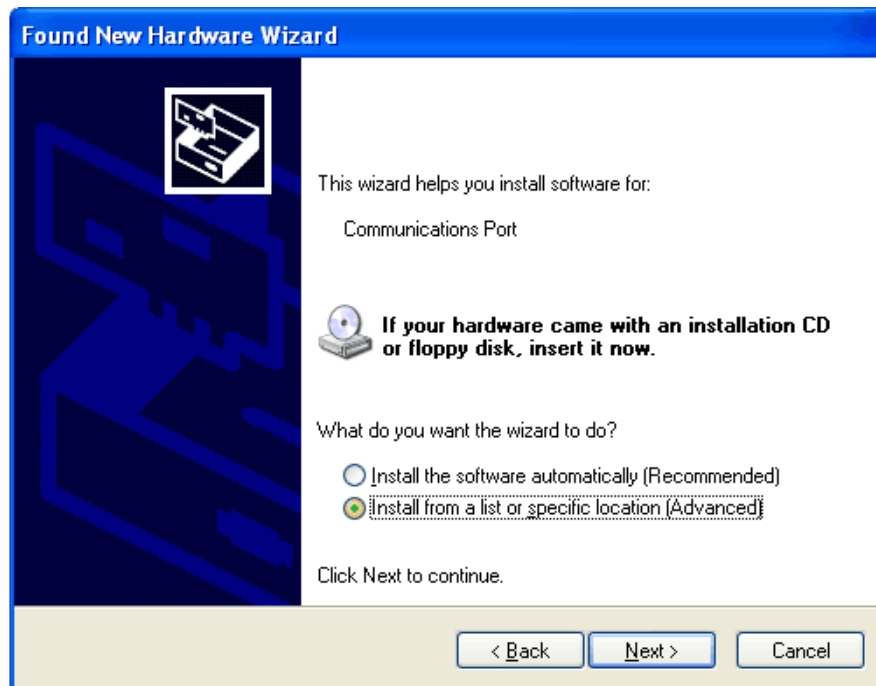
Download the **\*\*inf\*\*** by right-click saving this file and saving it to the Desktop (<https://adafru.it/aVa>)

Then plug a mini-B cable into the board and you should see the LED light up on it and you'll be asked to install the driver.

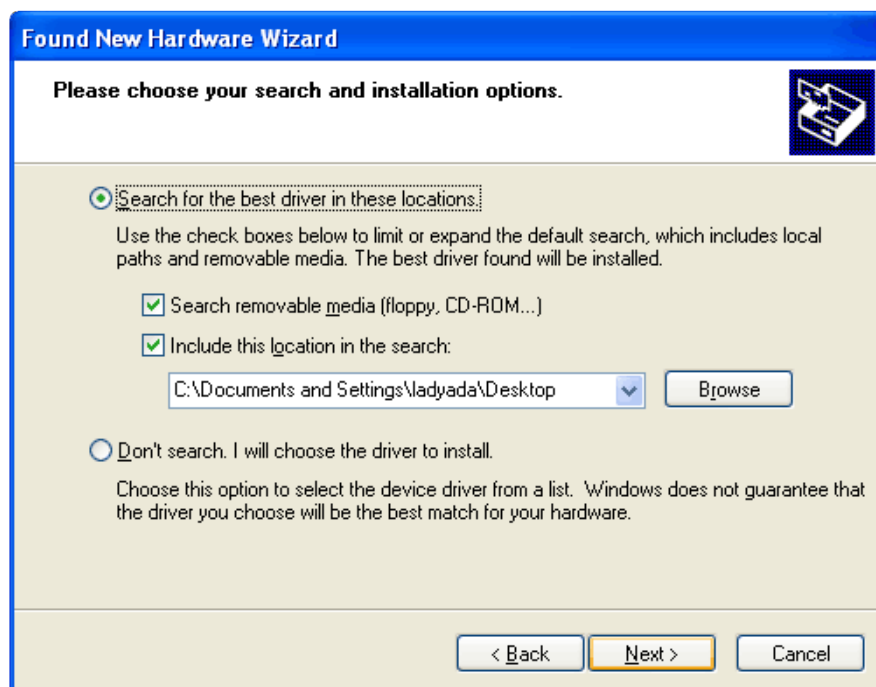
Select **No, not this time**:



Select **Install from a list or specific location**:



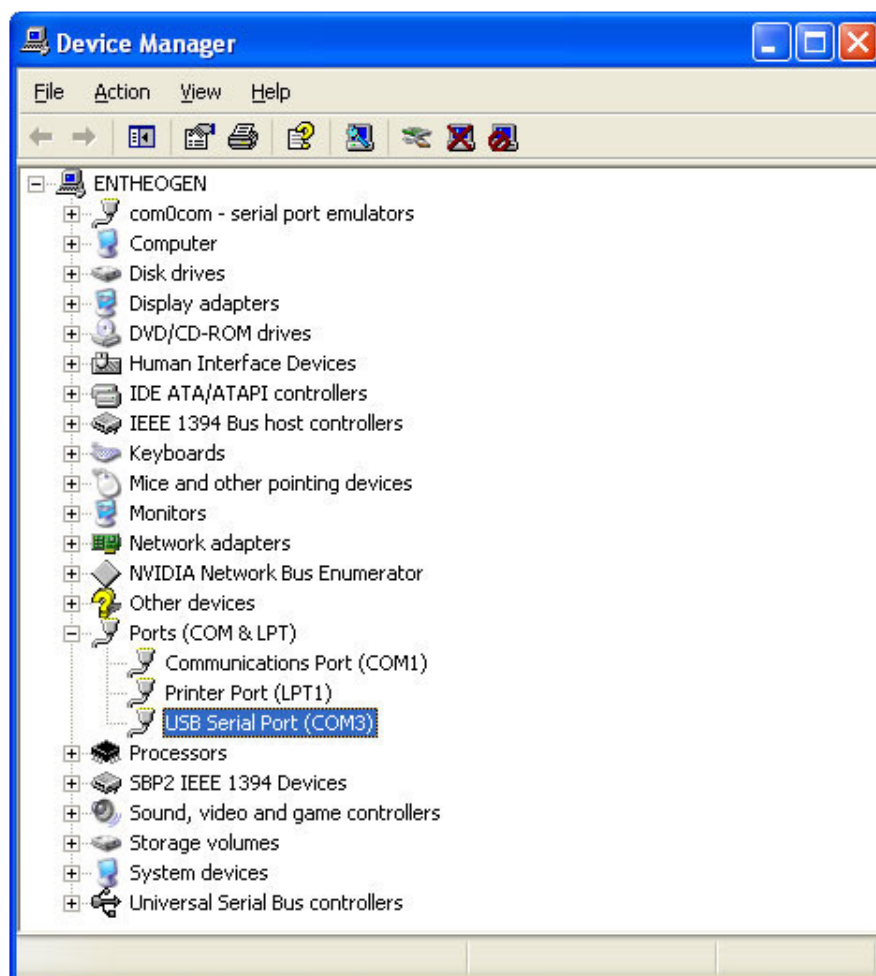
Browse to the desktop (or where-ever you saved the inf)



Click **Continue Anyways** (we didn't pay for Logo testing, but we're using the built in driver so its OK)



Thats it! The USB-serial port should now show up under the device manager. If you press the reset button it will 'disappear' and reappear.

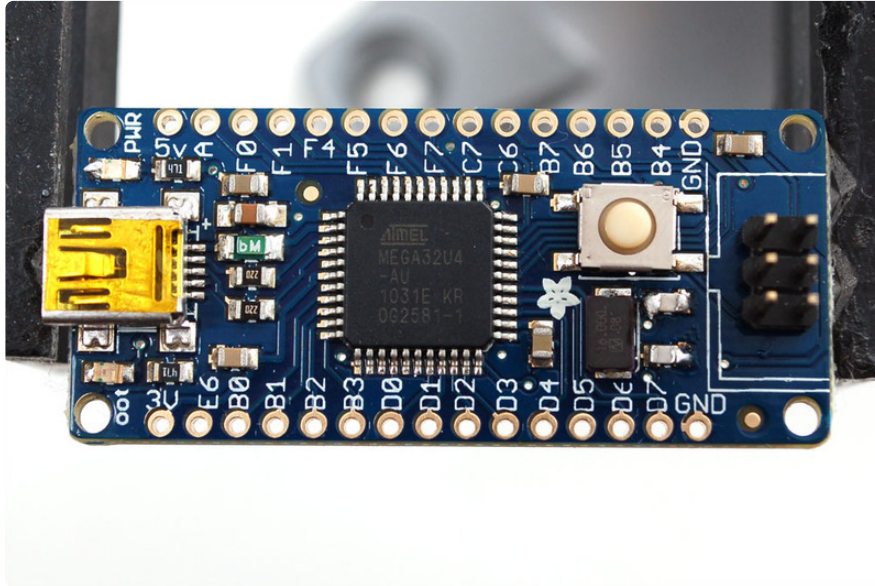




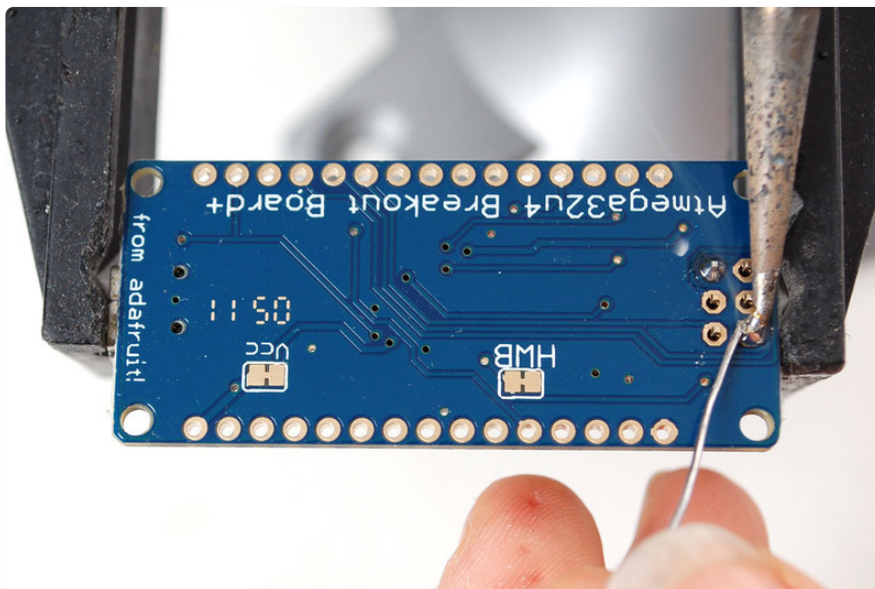
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# Solder Header

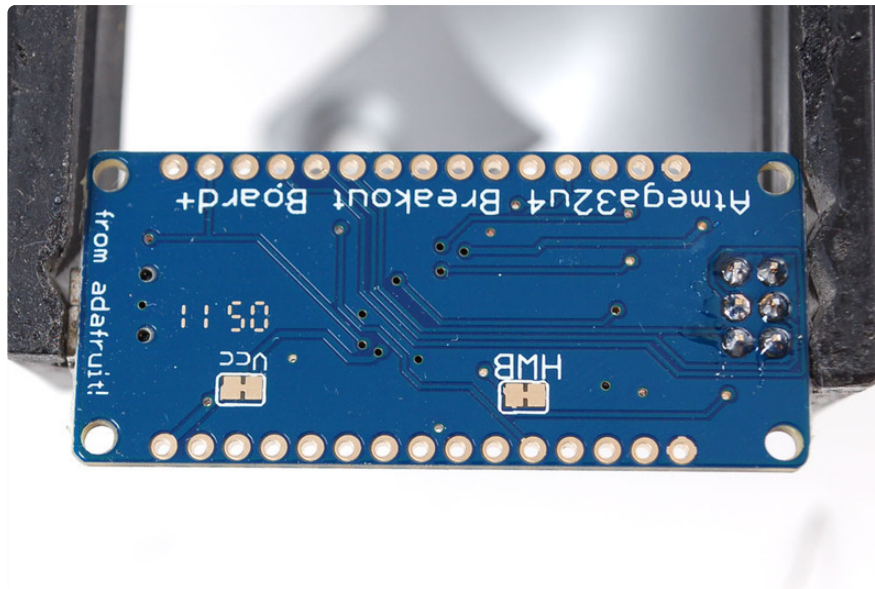
This step is pretty easy, find the small header piece in the package and solder it into the spot at the end of the Atmega32u4 breakout board. Make sure the short pins are going into the PCB and the long pins are facing up.



You may need to use a piece of tape to keep the header in place while soldering it. Solder all 6 pins.

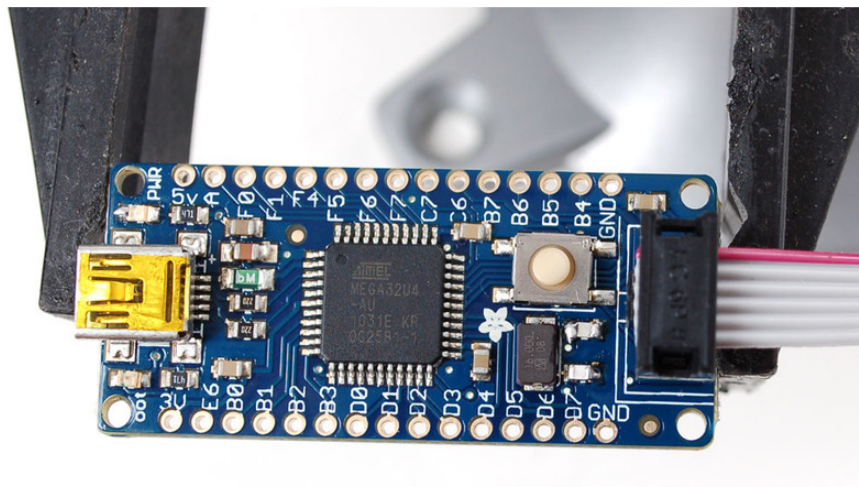






## Prepare Cable

Find the 6-pin IDC cable and plug one end in. it should look like the following. with the cable coming out onto the right side and the red wire up top.



Now cut the other end just before the connector (I'm cutting it about 1" away but don't cut any more off than that!

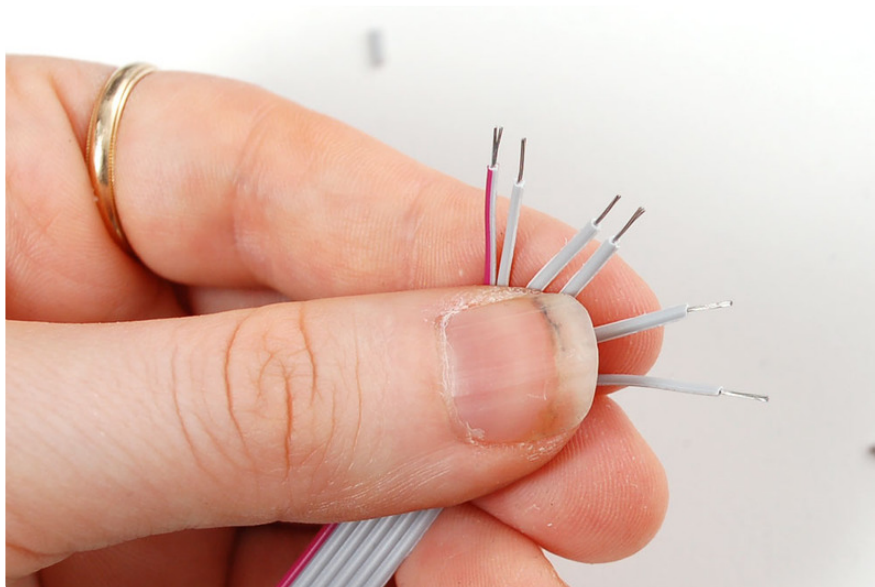


Disconnect the cable from the board (now that its cut)

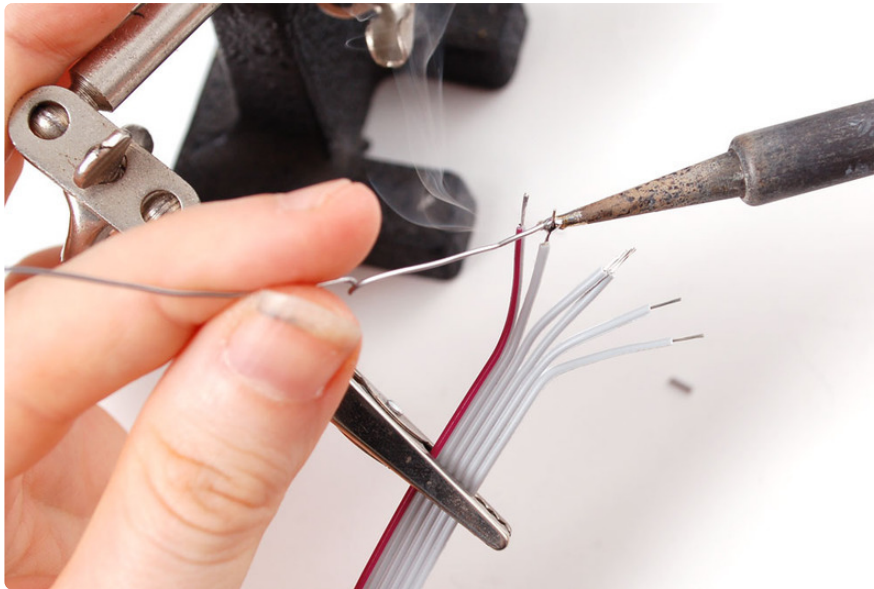
Separate the wires of the cable, you can use fingernails to start, or use the tips of the diagonal cutters to nip into the edges and then pull. Pull them so they are about 1" separated.



Strip the ends of each of the wires to remove the plastic coating.



Place the cable in a vise or holder like this third hand tool, and 'tin' the ends by melting solder into the wires while heating with the tip of your soldering iron until they are coated with solder.



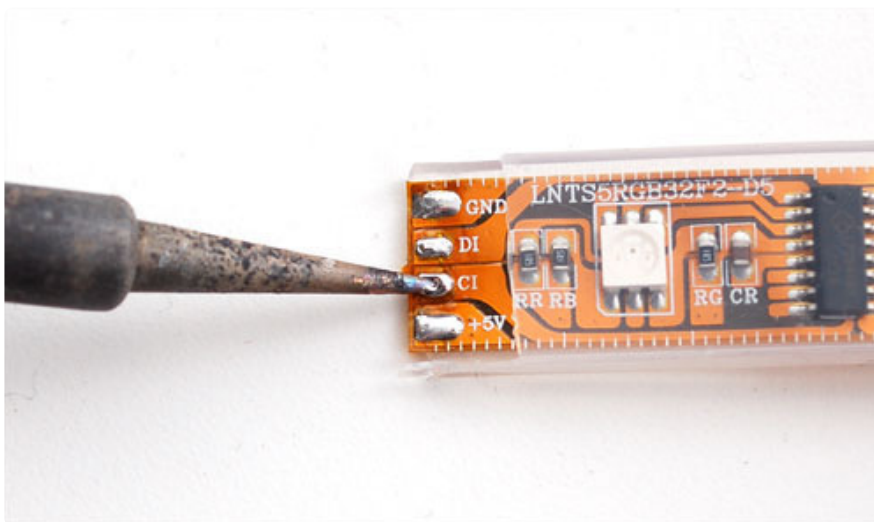
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## Connect the LED Strip

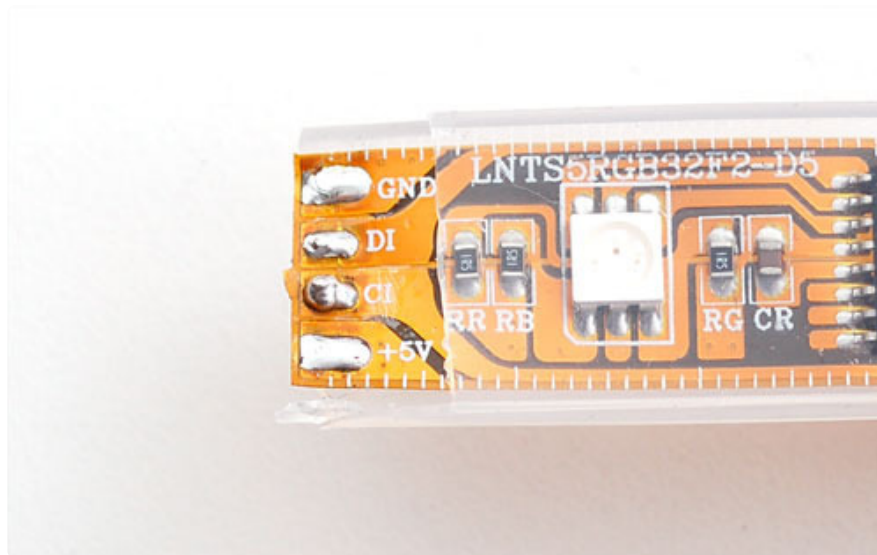
We have a lot more details on the digital LED strip and how it works here (<https://adafruit.it/aHG>) so you may want to also read that stuff.

The most important part is that you'll be soldering to one end of the LED strip, and to make sure you are soldering to the **INPUT** end. To determine which is the input, check the writing on the flexible PCB. If it says **CI DI** then that's the (correct) input end. If it says **CO DO** then that's the (wrong) output. You can only connect to the input end so double check.

Tin the pads by carefully melting a little solder onto the pads.

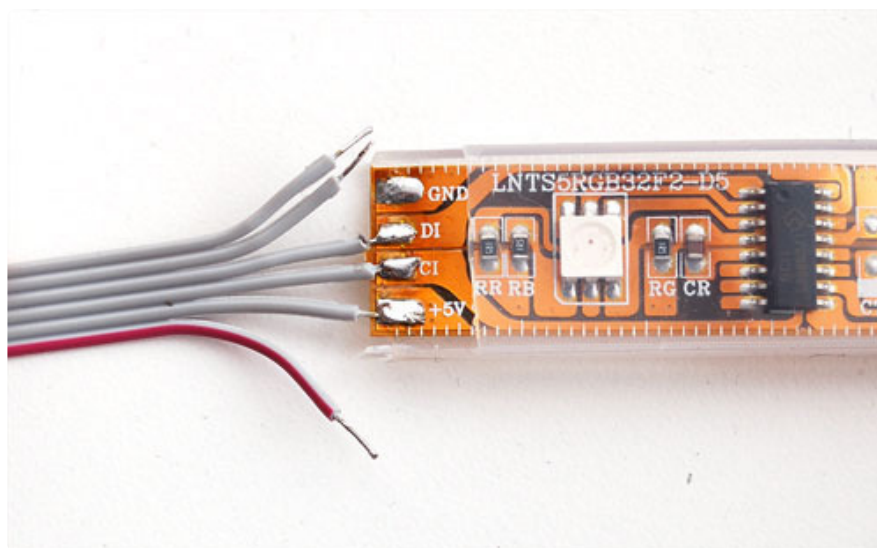






We'll skip first wire, which is the red-striped one. Go to the wire next to that (#2), that wire will connect to the **+5V** pad. Carefully solder the tinned pad to the tinned wire.

The next two wires go in line to **CI** and **DI**.



The unused fifth (5th) wire gets skipped as well.

The sixth wire connects to **GND**.



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# Upload the Test Sketch

Now its time to get BLINKY!

We'll have to install a version of the Arduino IDE called Teensyduino and our LED strip library, so we can program the controller chip.

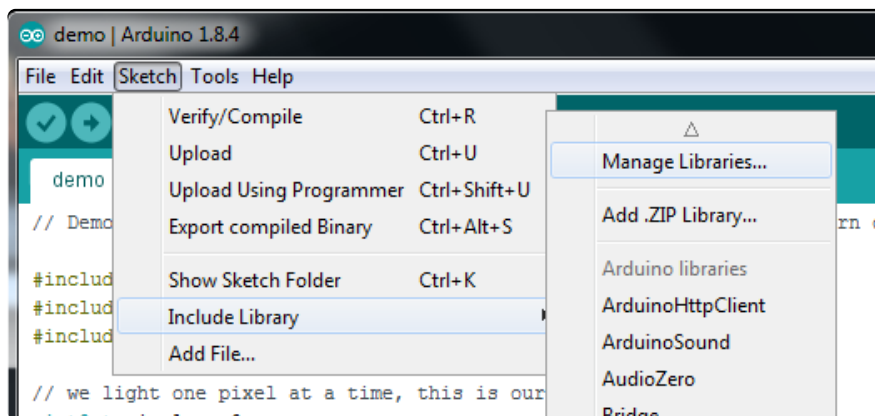
If you're running Windows, you can just download this ready-to-go zip package. Uncompress it and inside will be an Arduino IDE (<https://adafru.it/cmA>)

If you're running Mac OS X, you can just download this ready-to-go dmg package. Uncompress it and inside will be an Arduino IDE (<https://adafru.it/cmB>)

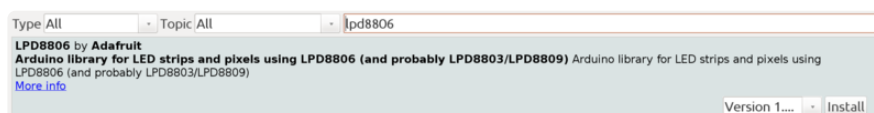
Download and install whichever matches your setup. Uncompress it onto your desktop or where ever you want to store the IDE folder. This will take a while so we'll wait here for you.

OK welcome back! Now you will install the 'library' for the Digital LED strip.

Open up the Arduino library manager:



Search for the **LPD8806** library and install it



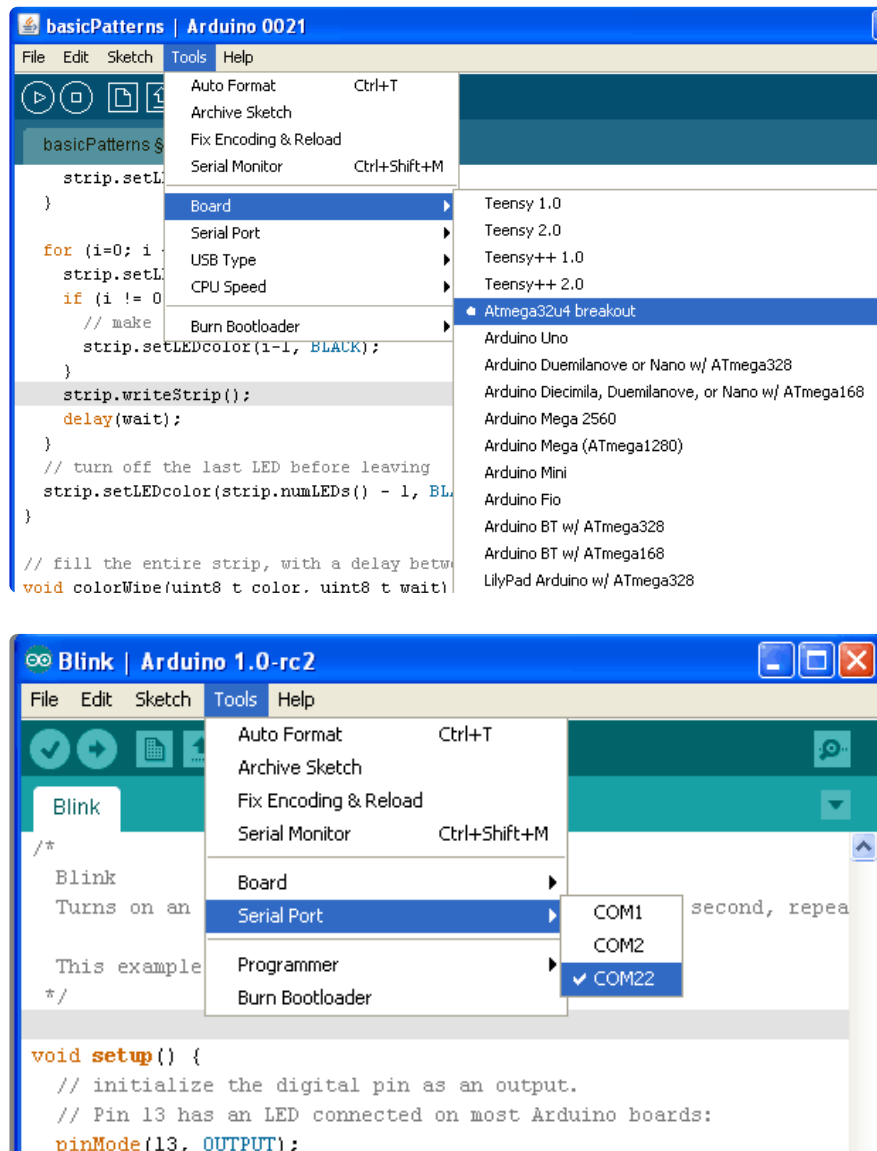
We also have a great tutorial on Arduino library installation at:

<http://learn.adafruit.com/adafruit-all-about-arduino-libraries-install-use> (<https://adafru.it/aYM>)

You should now see a new **example** folder called **LPD8806** and inside, an example called **LEDbeltKit**. Open up the LEDbeltKit example.

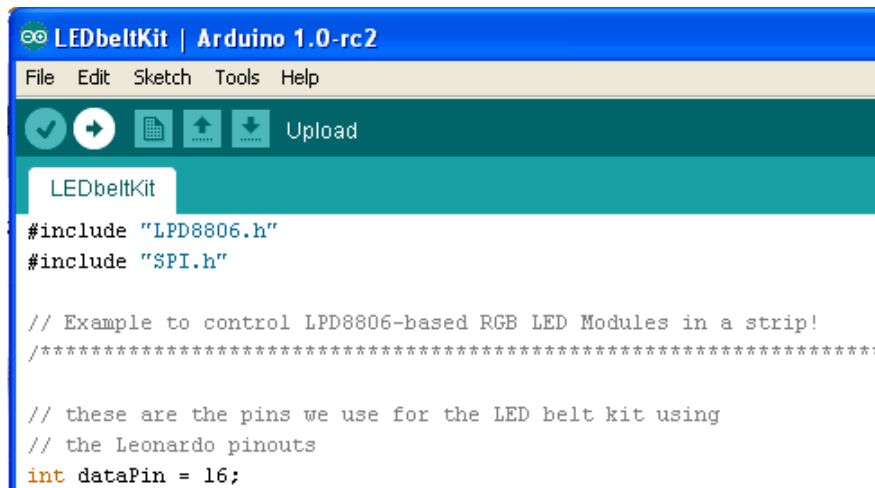


Be sure to select **Atmega32u4 breakout** in the **Board** menu. Also select the Serial Port that is made when you plug in the Atmega32u4 board to USB.



To upload the LEDbeltKit sketch, simply have the board plugged in, click the Upload button in the IDE and press the **RESET** button on the breakout board.

Don't forget to press the reset button on the blue 32u4 PCB right after clicking upload to launch the bootloader and get it ready for programming!



```
#include "LPD8806.h"
#include "SPI.h"

// Example to control LPD8806-based RGB LED Modules in a strip!
/*****

// these are the pins we use for the LED belt kit using
// the Leonardo pinouts
int dataPin = 16;
```

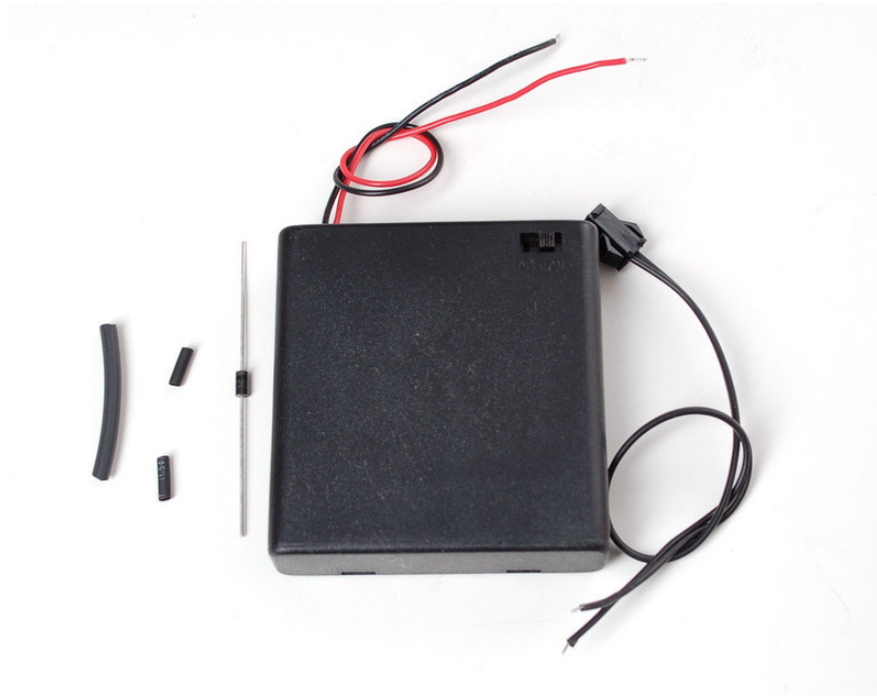
Once you've uploaded you should see the LED belt perform the blinky test! It will look a little similar to this:



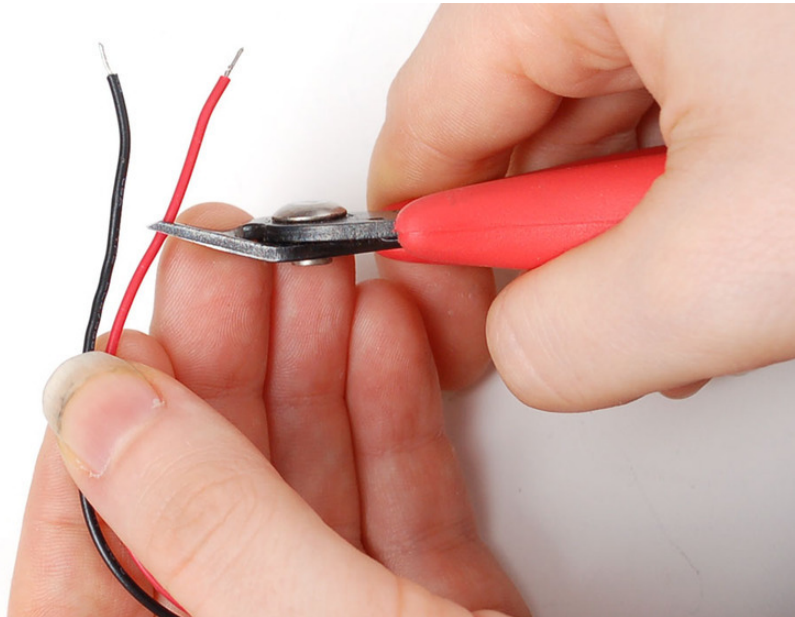
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## Battery Protection Diode

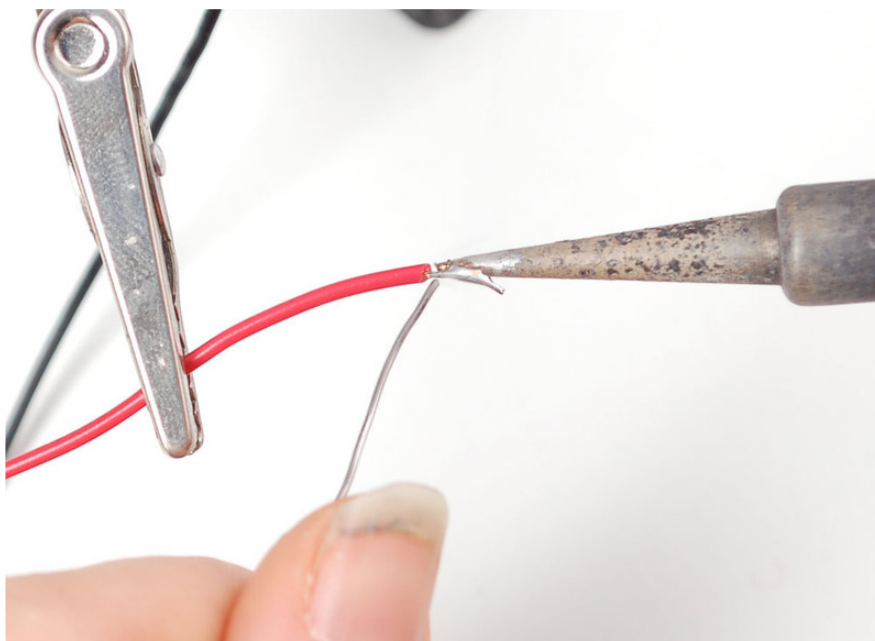
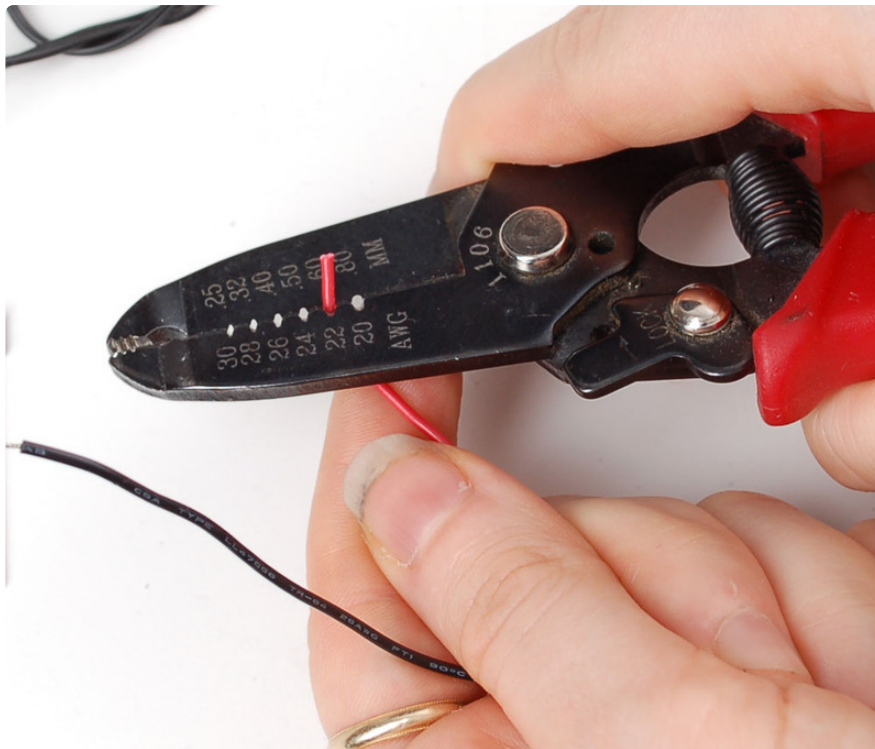
Now we can work on making the battery pack to give us portable power. Grab the remaining parts you'll need, the battery holder, diode, long battery connection cable, and small heatshrink.



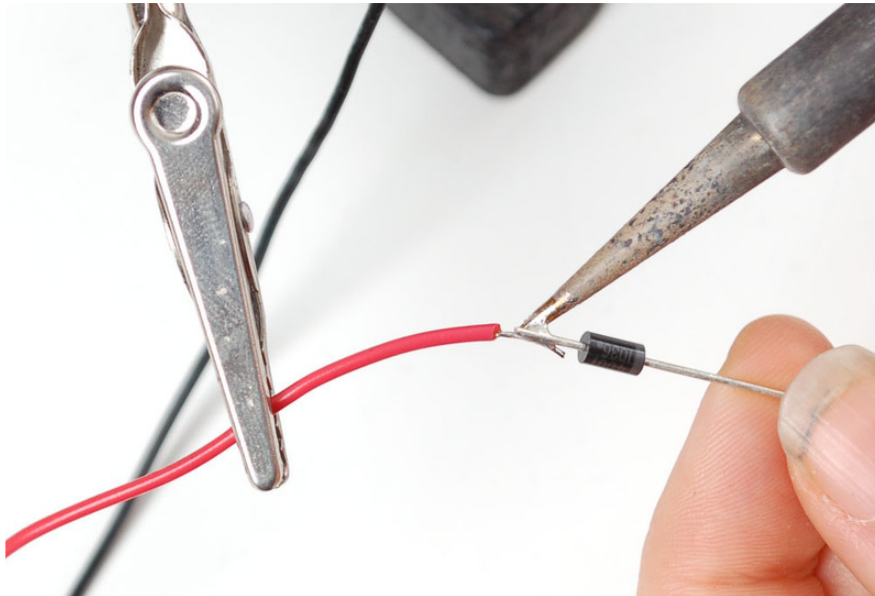
Cut the red wire of the battery pack short by about an inch.



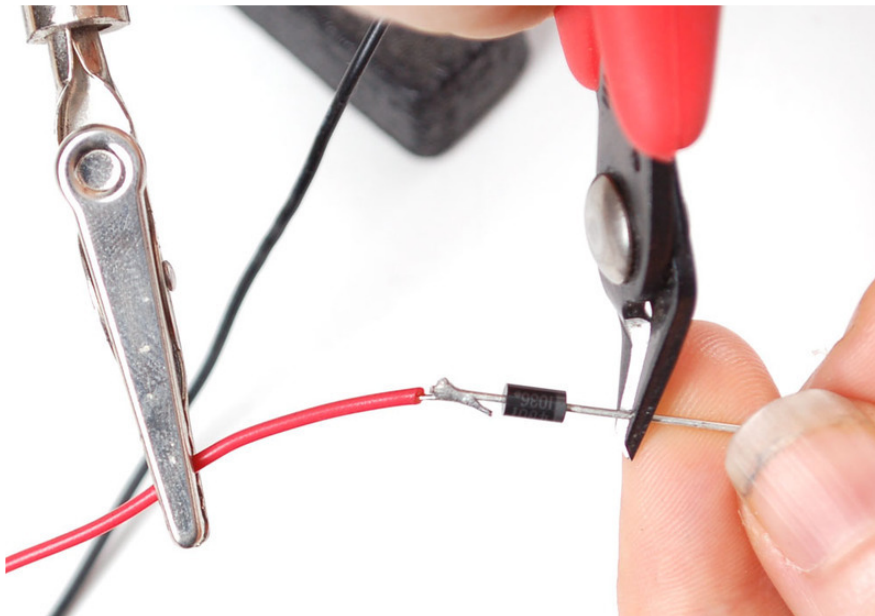
Then strip and tin the wire.



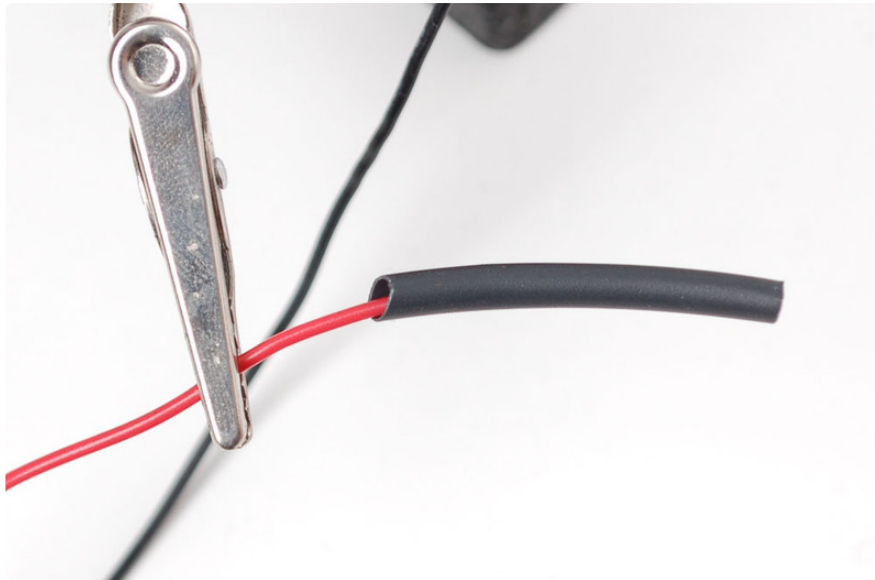
Find the diode, this part will protect the board in case you put the batteries in backwards, it also lowers the voltage a little so if you have fresh alkaline batteries, the voltage won't be too high. Diodes are directional so make sure you're working with the right end. Find the end that **doesn't** have a white strip and cut it short. Solder that end to the red wire.



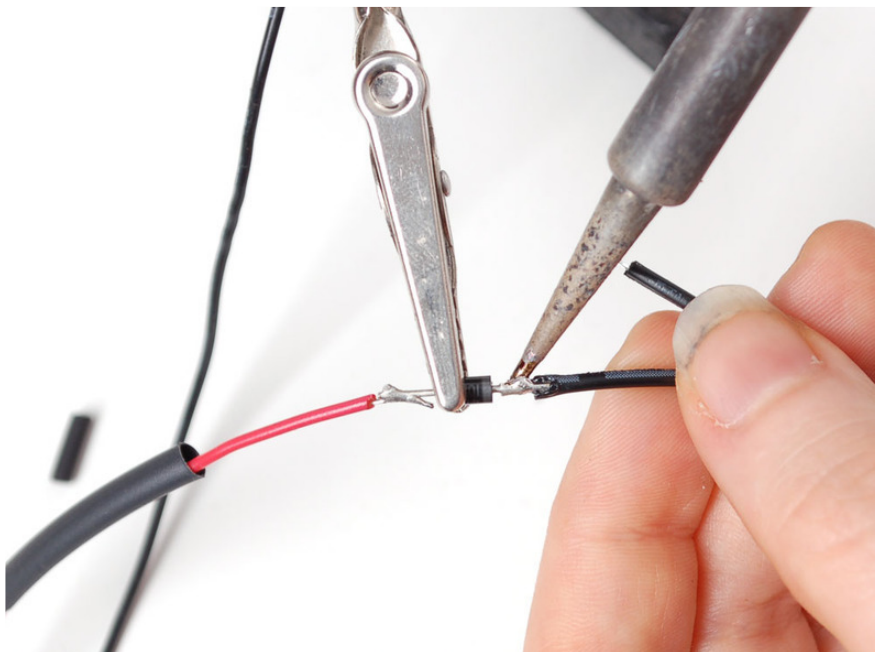
Clip the other side (the side with a white stripe).



Cut off and slide a ~2" piece of black heatshrink onto the red wire past the diode.

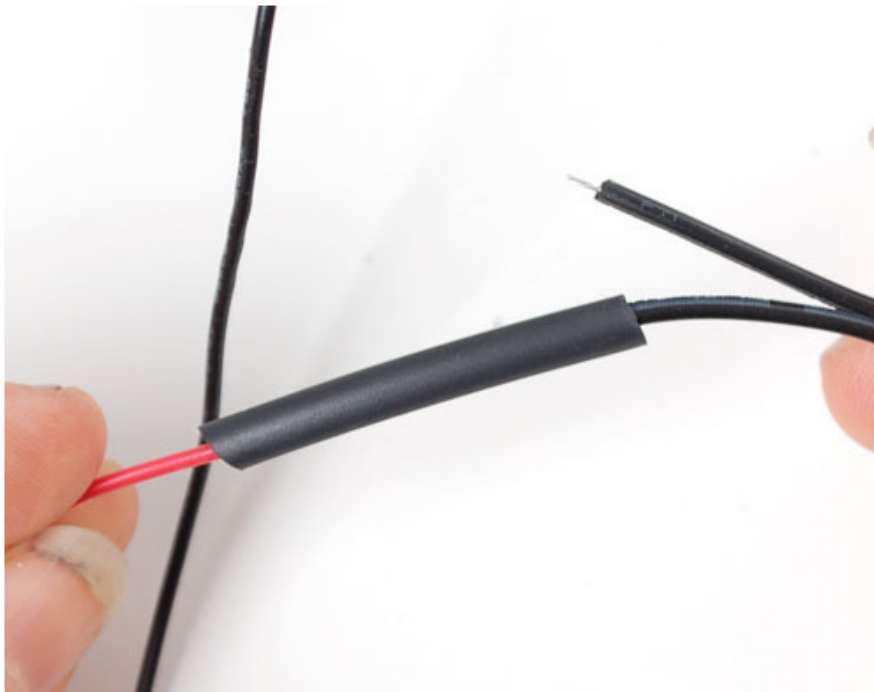
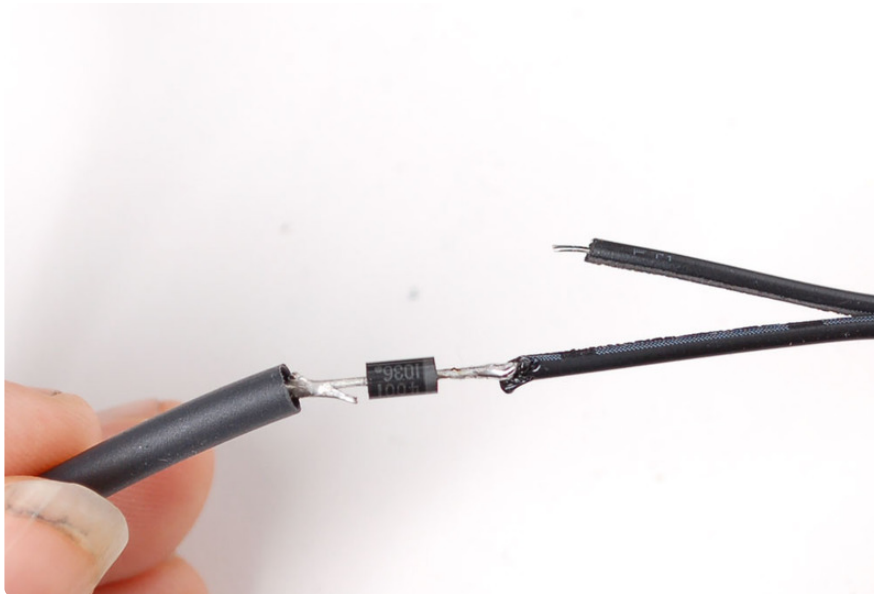


Now solder one wire from the battery connection cable onto the other end of the diode, you may need to tin both if you are having trouble getting a good joint. It doesn't matter which wire you choose so just pick one!



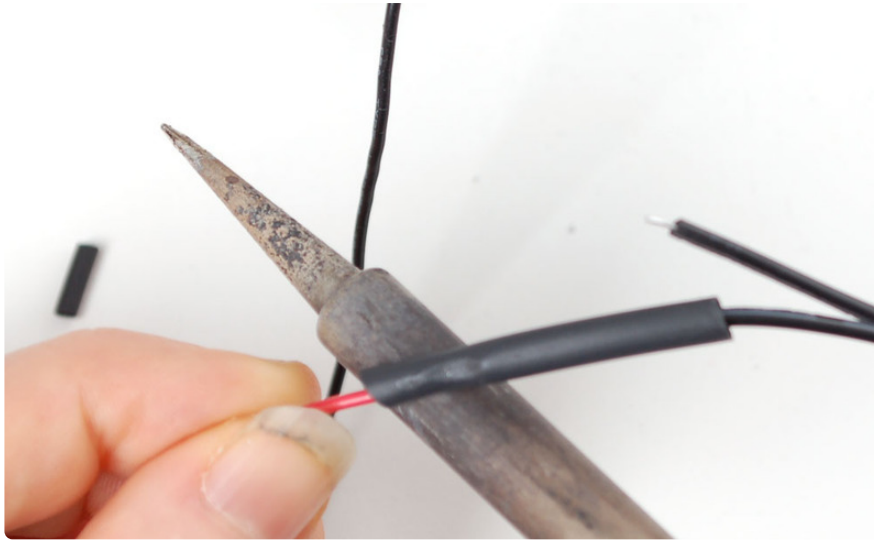
Slide the heatshrink back over the diode and solder joints.



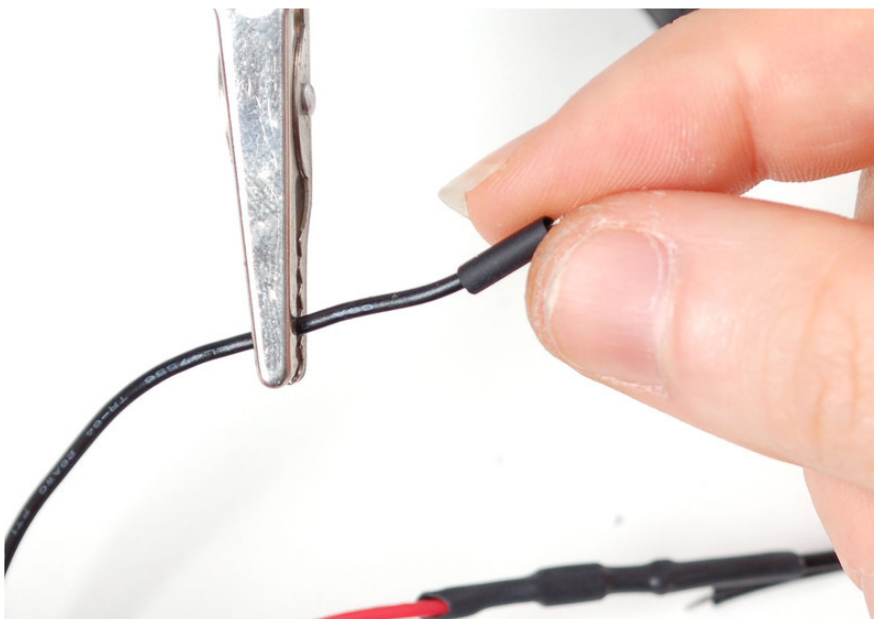


Now shrink the tubing to protect the diode, you can use a hair dryer, heat gun, lighter or the edge of your soldering iron.

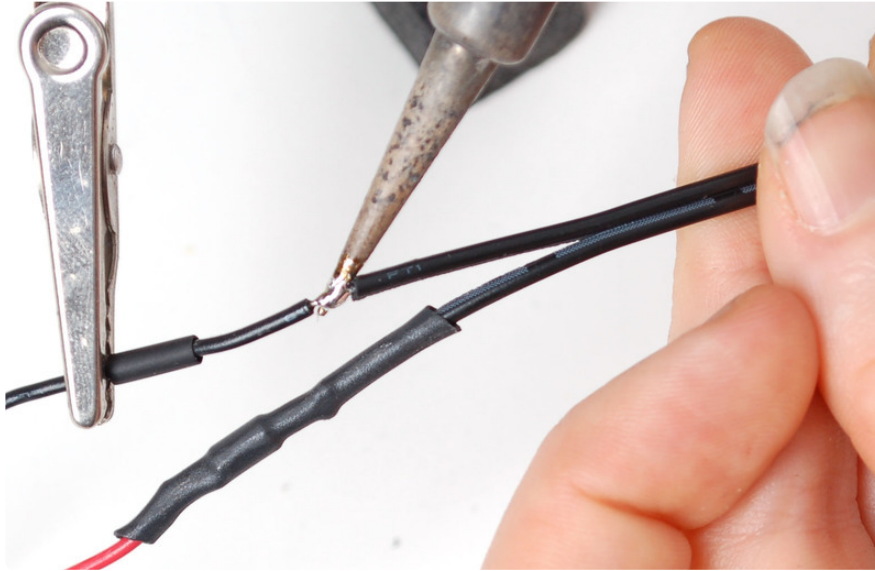




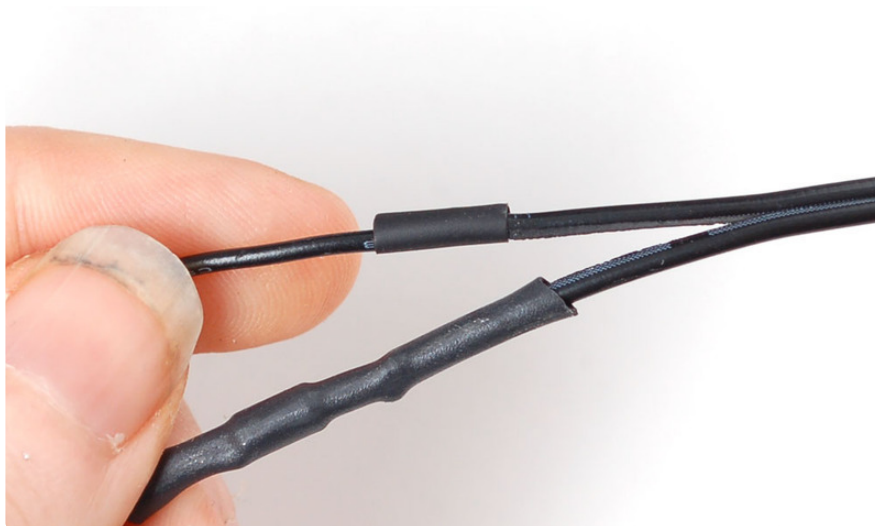
Now we'll connect the other side of the long power cable to the black wire. Slide a small 1" piece of heat shrink onto the black wire (this image shows a much shorter piece, but its too short so go a little longer).



...and solder together the wires



Then heatshrink like you did before!



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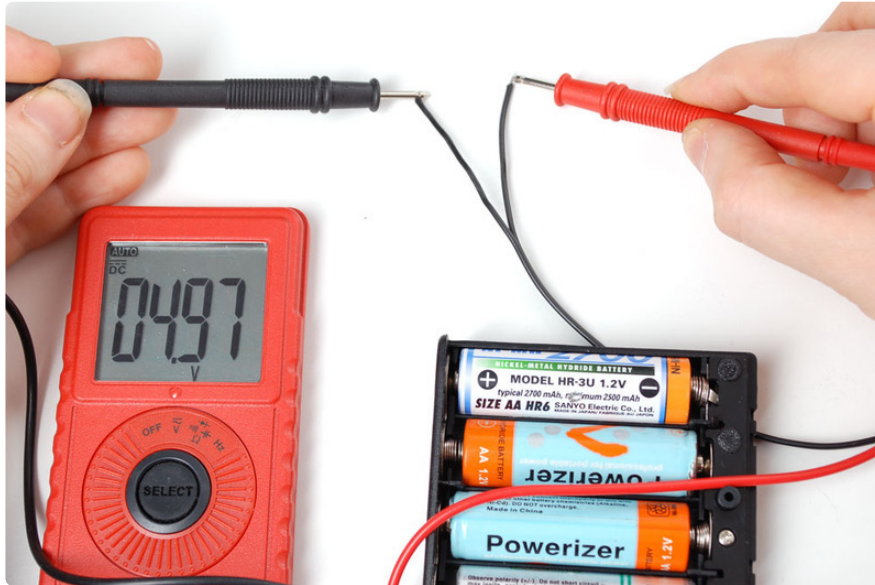
## Power Connection

Now we will do the other half of the power connection, the side that connects to the board.

Plug the matching shorter power cable into the longer one so they snap together (they can only go one way).

Now you'll want to trace the **red** power wire back through the connectors. We suggest using a multimeter to be sure. Put 4 AA's in the holder and turn it on. Then use a multimeter to measure the voltage between the cable wires. One way will be about -5V and the other will be +5V. When it's reading +5V the red handle is touching the

positive wire. In this example, its the one on the right:

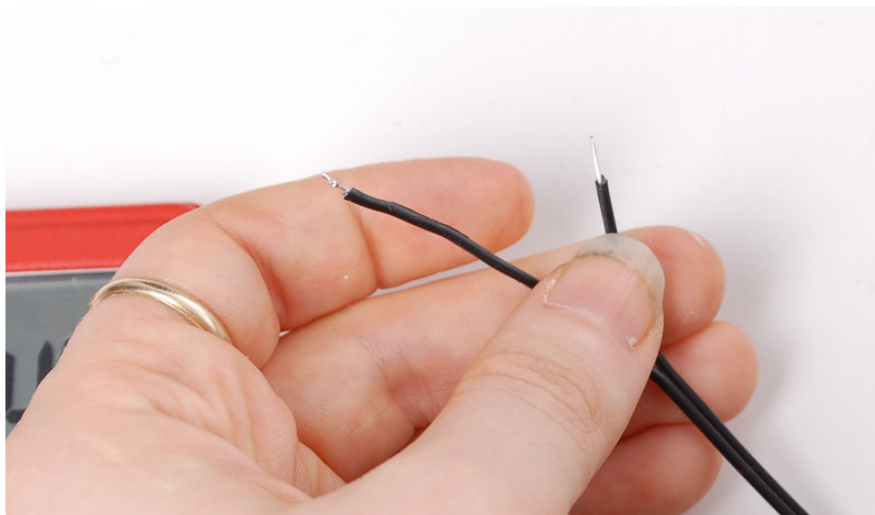


Turn off the power pack (or remove the batteries).

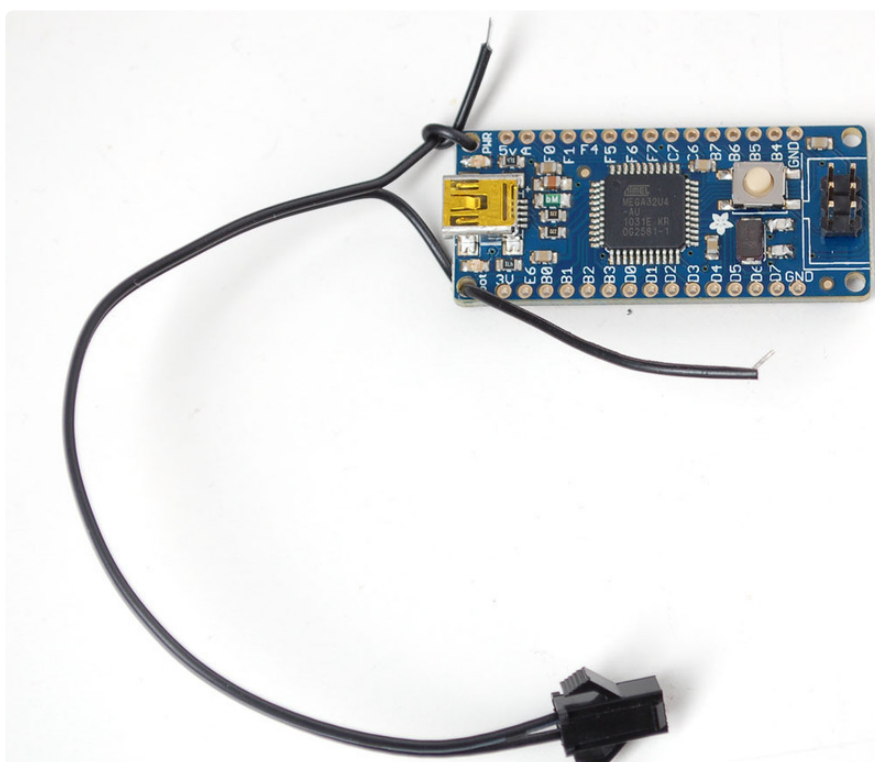
Cut the positive wire short by about 1"



Strip and tin the wire.

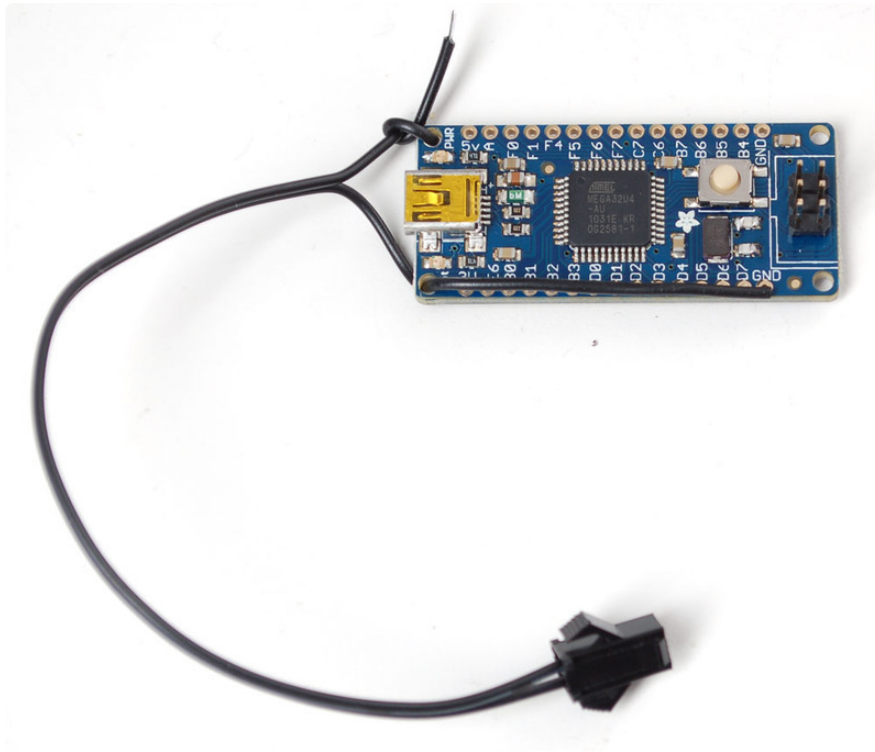


Thread the shorter positive wire into the top left hole and knot it. The longer negative wire goes through the opposite (bottom left) hole.



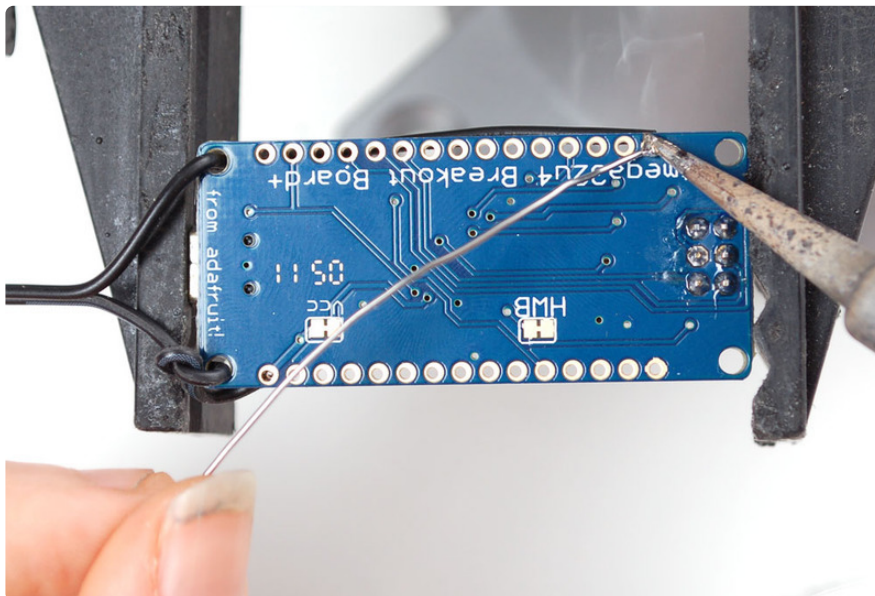
Pull the wires through so that you can push the negative wire into the **GND** pad all the way to the right.



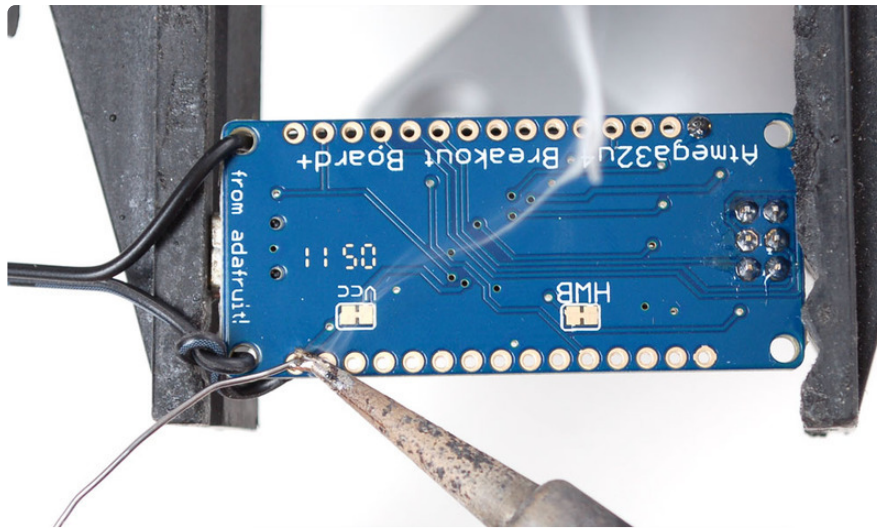


The positive wire goes to the first **5V** pad right next to the hole, all the way to the top left in the image above.

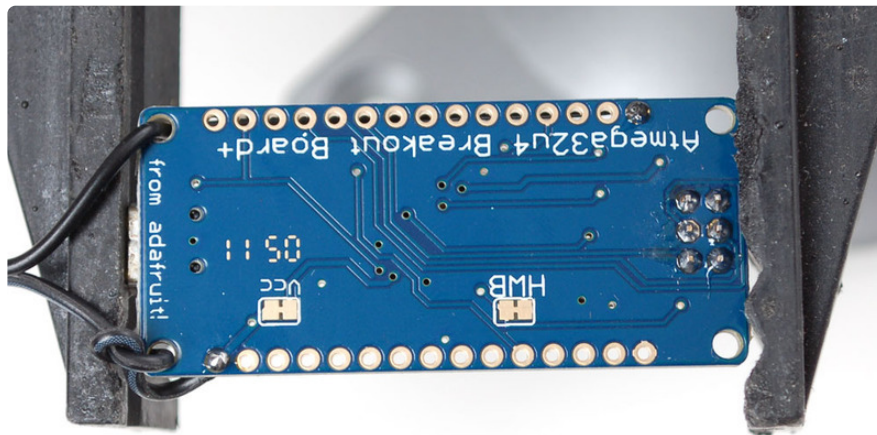
Turn the board over, and solder the ground wire.



...and the +5V wire.



Check your work before we finish up!



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## Finishing Up

Connect the LED strip back to the microcontroller board, and place the batteries back into the pack.

Turn on the pack and wait a few seconds, you should see the LED pattern again!



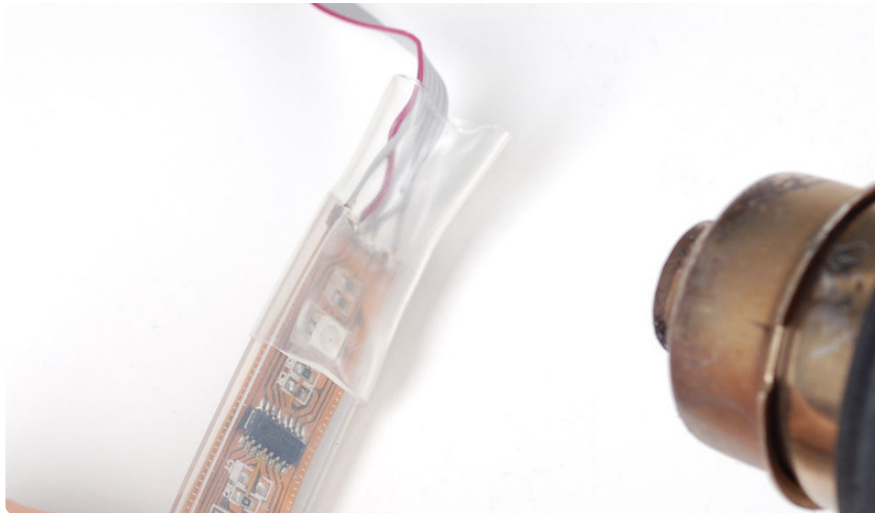
Now we'll wrap it up by protecting the cable that goes to the end of the strip.

Cut the large piece of heat shrink so you have two ~2" pieces. Slide one piece of the large heatshrink onto the end of the LED strip.

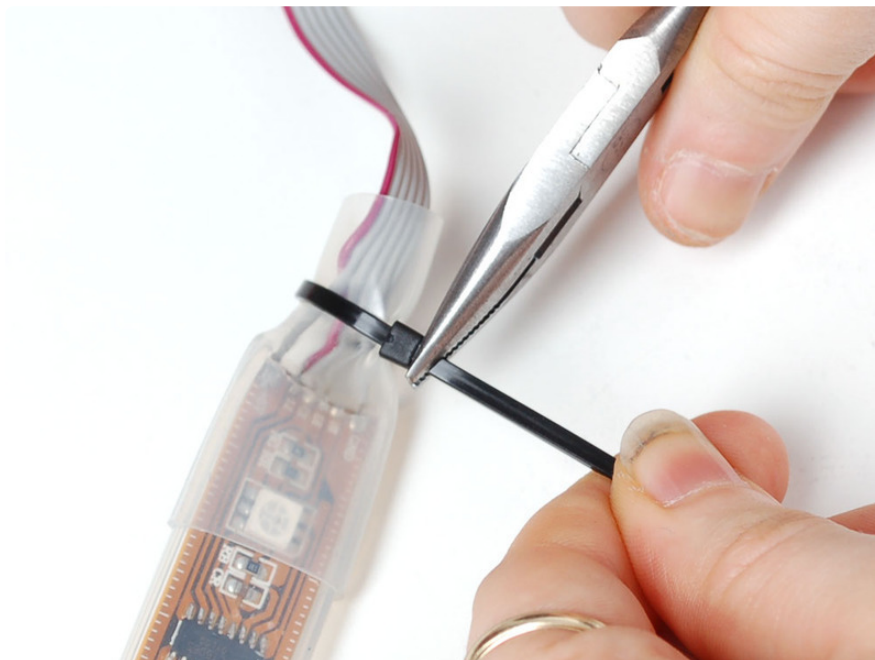


Use a heat gun, hair drier or lighter to shrink it down.





While its warm (but not too hot, be careful!) wrap the cable tie around the end of the heatshrink.



Tighten it over the IDC cable, and cut the end.



You can then use the other piece of heatshrink on the other end of the belt, to protect it.

That's it! Now the project is done. You can keep the battery pack and microcontroller board in your pocket and wrap the belt around you.

