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Adafruit 7-Segment LED FeatherWings

Created by lady ada

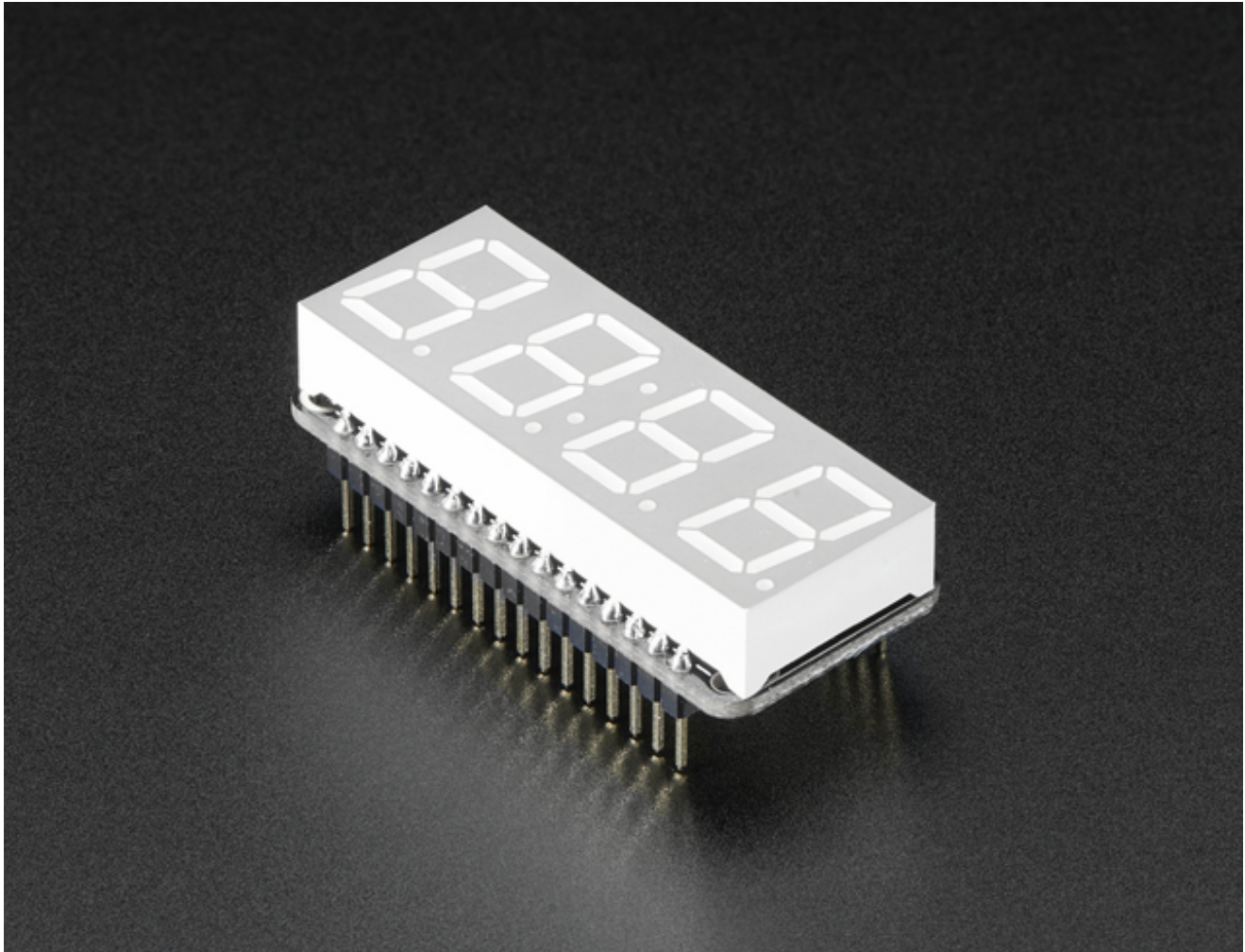


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Overview



One segment? No way dude! 7-Segments for life!

This is the **Adafruit 0.56" 4-Digit 7-Segment Display w/ FeatherWing Combo Pack** Available in Blue, [Green](http://adafru.it/3107) (<http://adafru.it/3107>), [Red](http://adafru.it/3108) (<http://adafru.it/3108>), [White](http://adafru.it/3109) (<http://adafru.it/3109>), and [Yellow](http://adafru.it/3110) (<http://adafru.it/3110>)!

7-Segment Matrices like these are 'multiplexed' - so to control all the seven-segment LEDs you need 14 pins. That's a lot of pins, and there are [driver chips like the MAX7219](http://adafru.it/453) (<http://adafru.it/453>) that can control a matrix for you but there's a lot of wiring to set up and they take up a ton of space. Here at Adafruit we feel your pain! After all, wouldn't it be awesome if you could control a matrix without tons of wiring? That's where these [LED Matrix FeatherWings](http://adafru.it/3088) (<http://adafru.it/3088>) come in!

The 7-segment FeatherWing backpack makes it really easy to add a 4-digit numeric display with decimal points and even 'second colon dots' for making a clock.

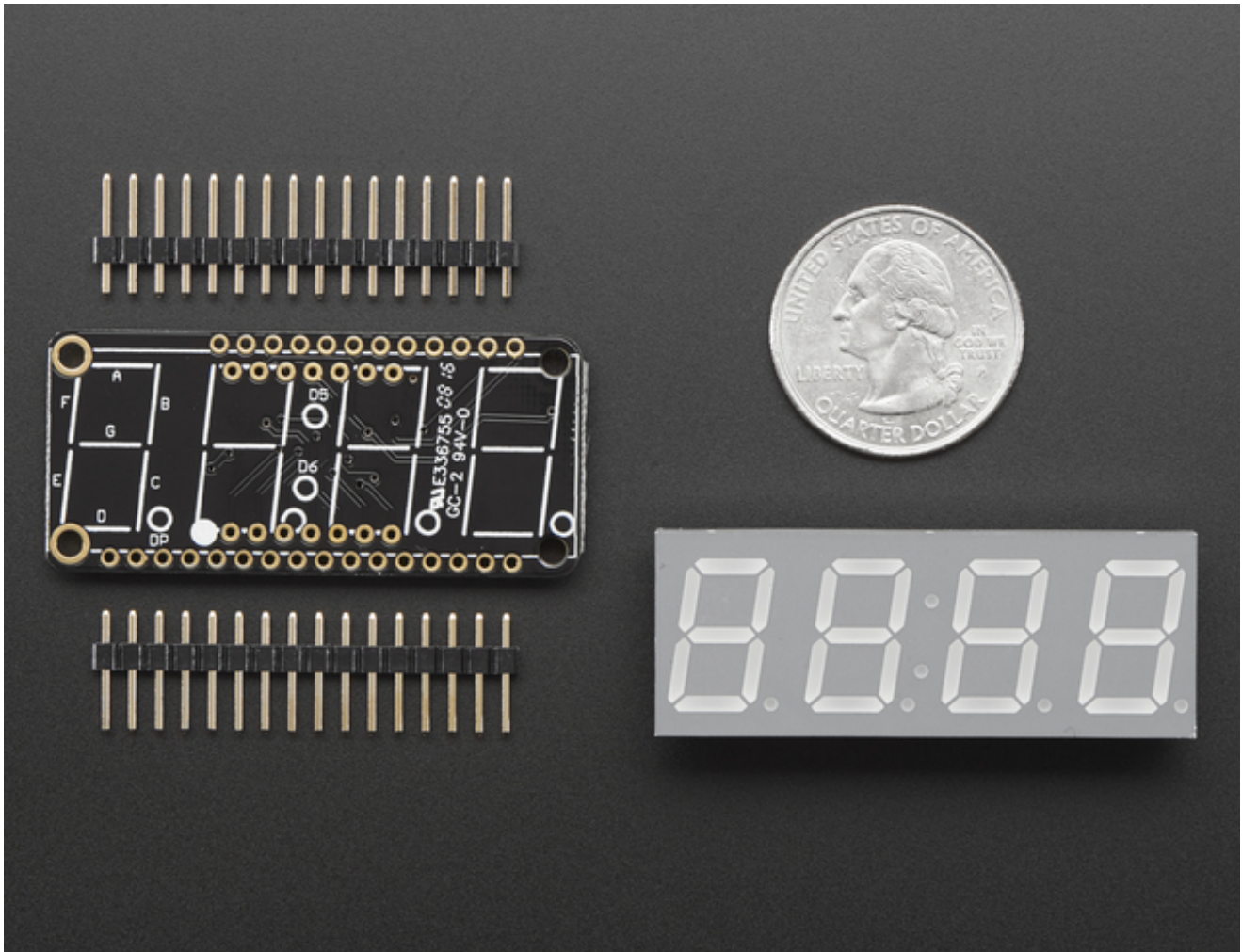


The LEDs themselves do not connect to the Feather. Instead, a matrix driver chip (HT16K33) does the multiplexing for you. The Feather simply sends i2c commands to the chip to tell it what LEDs to light up and it is handled for you. This takes a lot of the work and pin-requirements off the Feather. Since it uses only I2C for control, it works with any Feather and can share the I2C pins for other sensors or displays.

The product kit comes with:

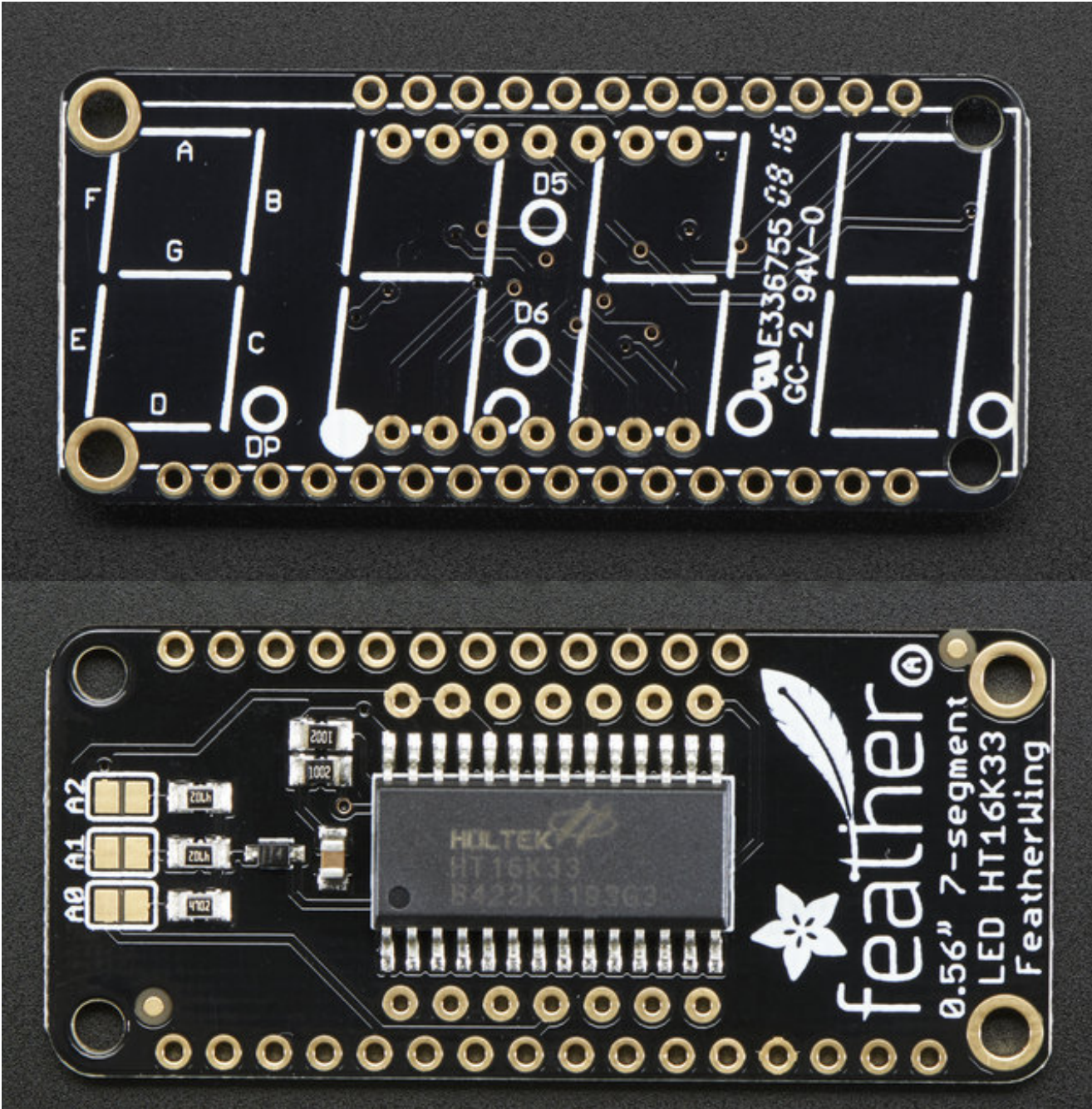
- A fully tested and assembled [Adafruit 4-Digit 7-Segment LED Matrix Display FeatherWing](http://adafru.it/3088) (<http://adafru.it/3088>)
- Ultra-bright 4-digit 0.56" tall seven-segment display
- Two sixteen pin headers

A bit of soldering is required to attach the matrix onto the FeatherWing but its very easy to do and only takes about 5 minutes!



Of course, in classic Adafruit fashion, [we also have a detailed tutorial showing you how to solder, wire and control the display](http://adafru.it/aW8). We even wrote [a very nice library for the backpacks so you can get running in under half an hour, displaying images on the matrix or numbers on the 7-segment](http://adafru.it/aLI). If you've been eyeing matrix displays but hesitated because of the complexity, this is the solution you've been looking for!

Pinouts

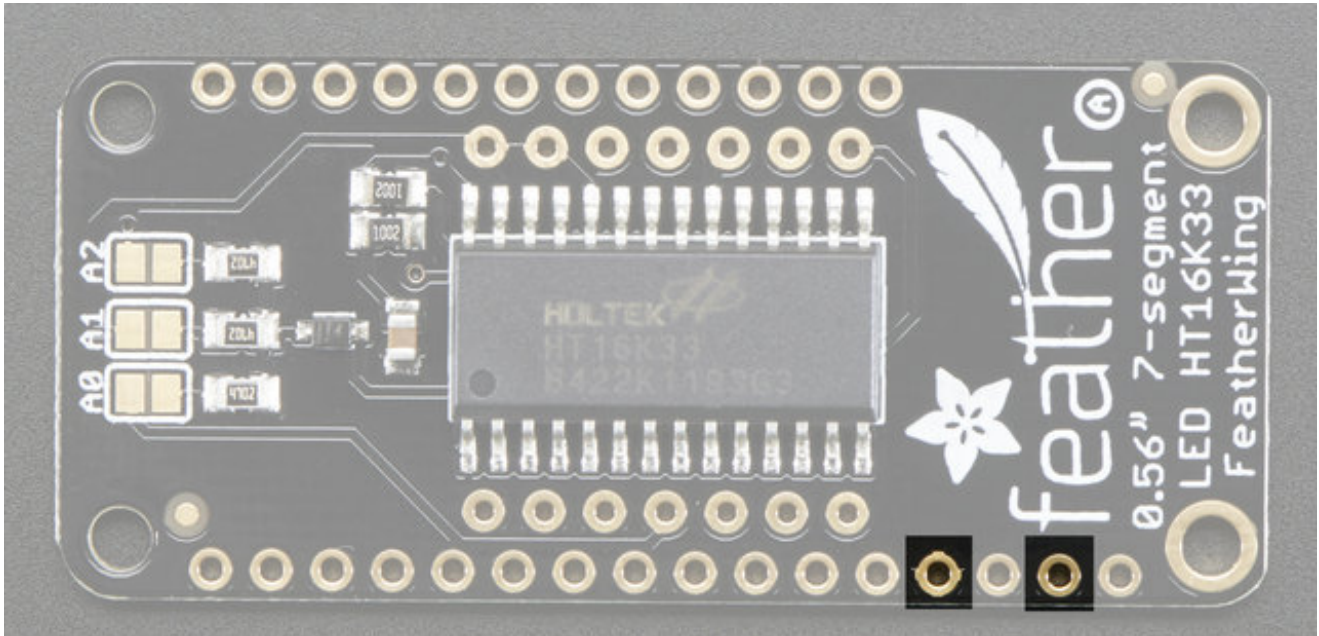


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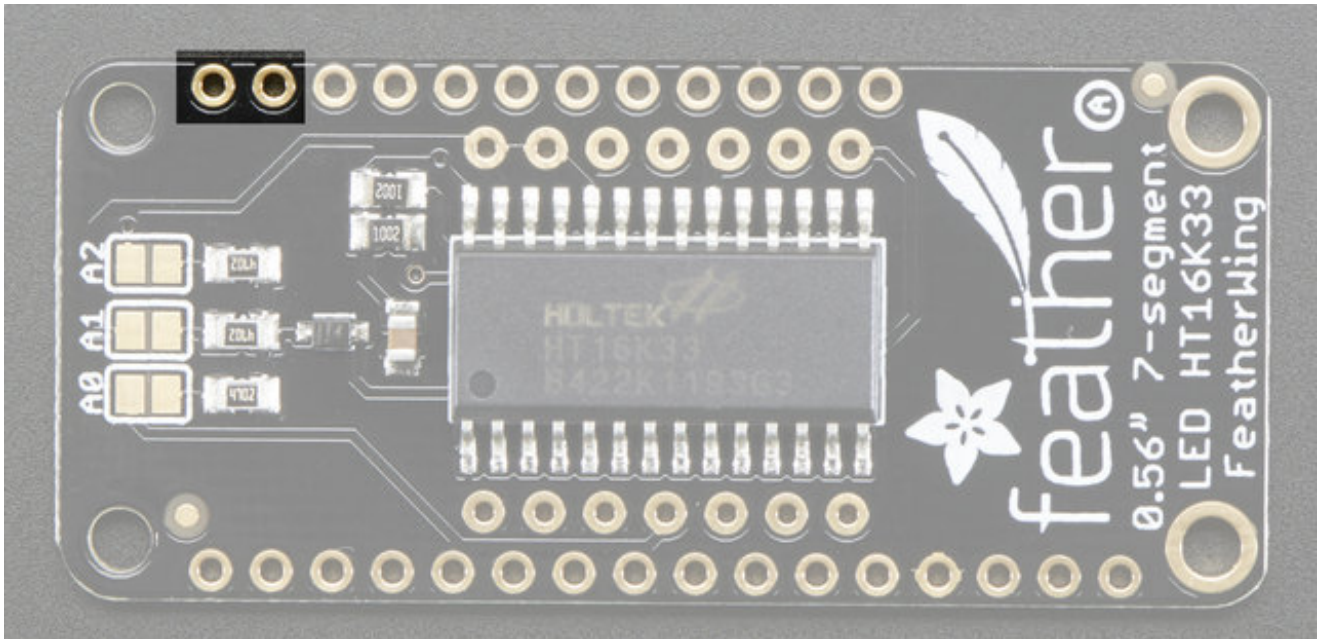
Power Pins



The LED matrix uses only the **3V** and **GND** pins for power and logic. Current draw depends on how many LEDs are lit but you can approximate it as about 40mA for most uses. Check the PCB file/schematic to verify which pin is ground!

Note that the 3.3V power supply is a tiny bit lower than the forward voltage for the pure green, blue and white LED matrices but we didn't find any significant degradation in brightness. Really, they're still very bright.

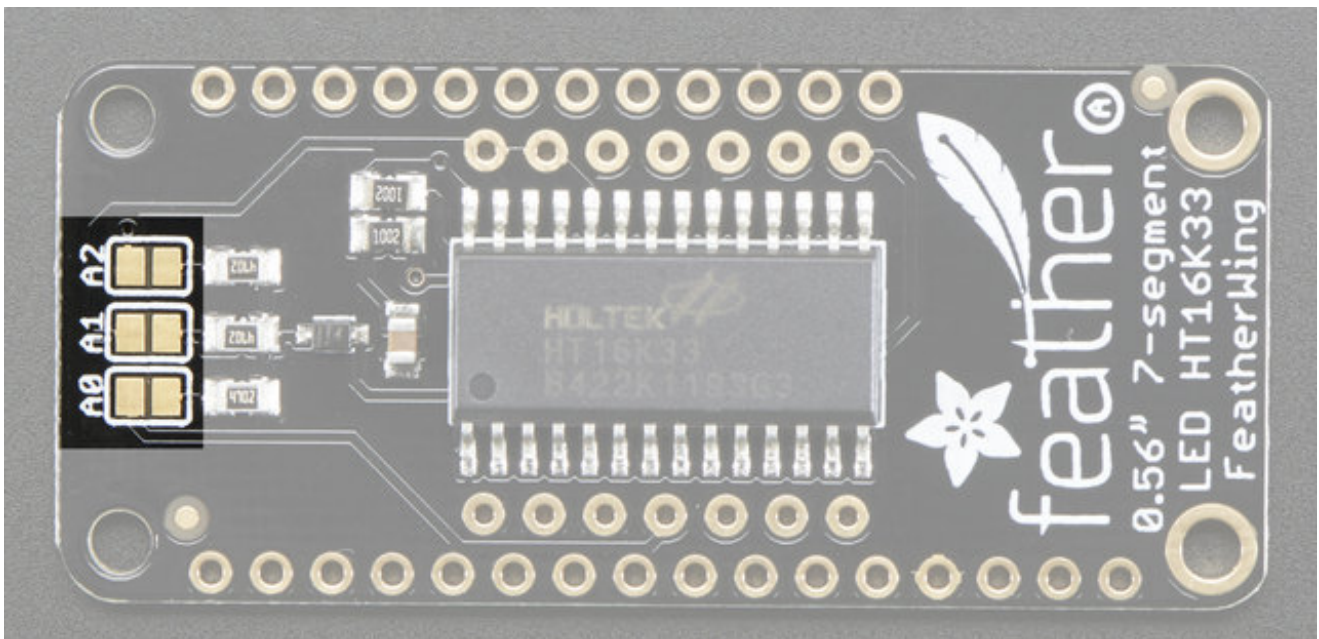
I2C pins



All LED control is done over I2C using the HT16K33 interface library. This means SDA and SCL must be connected, see above for those pins.

The default address is **0x70** but you can change the address to **0x71-0x77** by bridging solder onto the address pins.

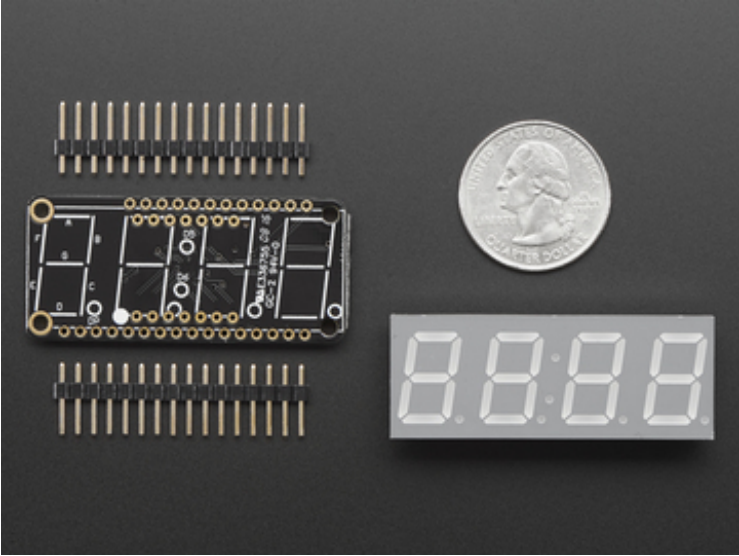
Address Jumpers



Changing Addresses

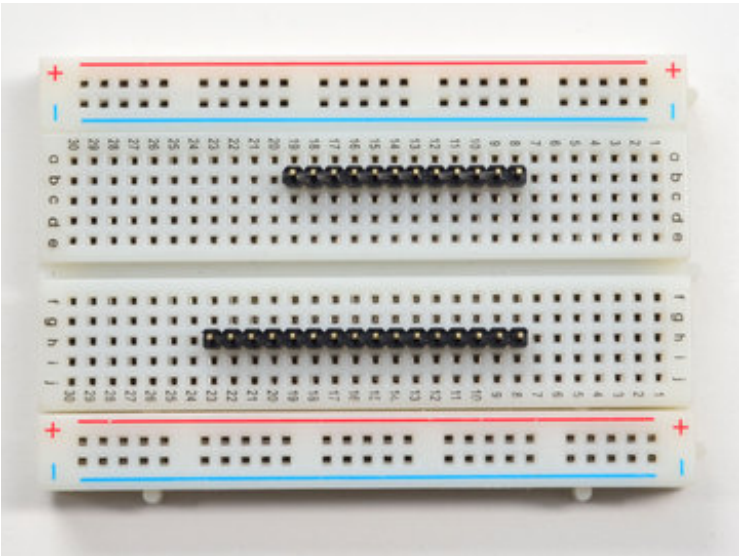
You can change the address of a backpack very easily. Look on the back to find the two or three **A0, A1 or A2** solder jumpers. Each one of these is used to hardcode in the address. If a jumper is shorted with solder, that sets the address. **A0** sets the lowest bit with a value of **1**, **A1** sets the middle bit with a value of **2** and **A2** sets the high bit with a value of **4**. The final address is **$0x70 + A2 + A1 + A0$** So for example if **A2** is shorted and **A0** is shorted, the address is **$0x70 + 4 + 1 = 0x75$** . If only A1 is shorted, the address is **$0x70 + 2 = 0x72$**

Assembly



When you buy a pack from Adafruit, it comes with the fully tested and assembled backpack as well as a 7-segment display in one of the colors we provide (say, red, yellow, blue or green). You'll need to solder the matrix onto the backpack but it's an easy task.

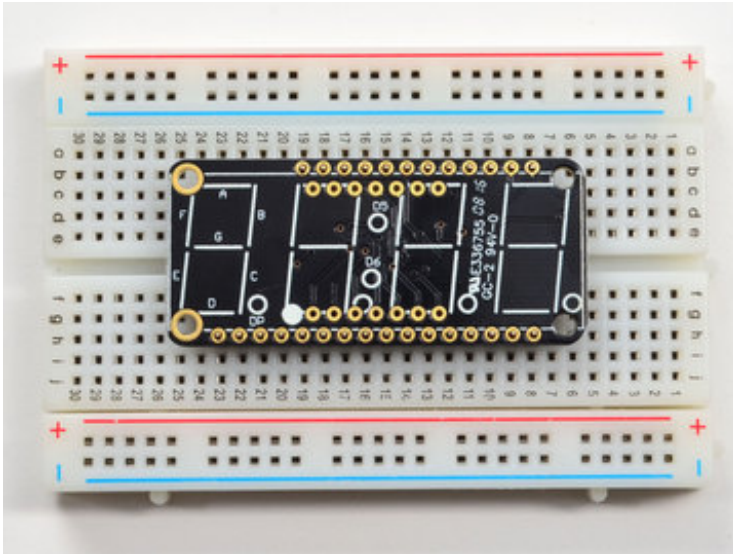
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Prepare the header strips:

You'll need a 16-pin and a 12-pin strip of header to attach the Featherwing to your Feather. Cut the header strip to length if necessary. It will be easier to solder if you insert it into a breadboard - **long pins down**

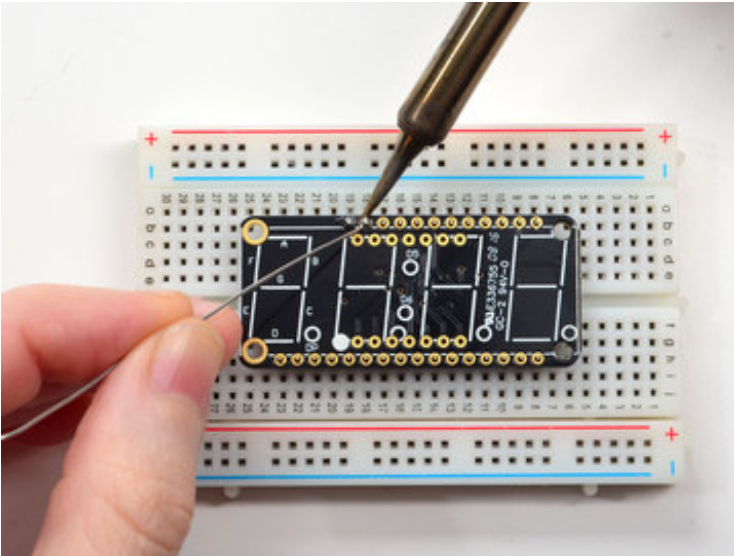
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Add the FeatherWing PCB:

Place the circuit board over the pins so that the short pins poke through the breakout pads

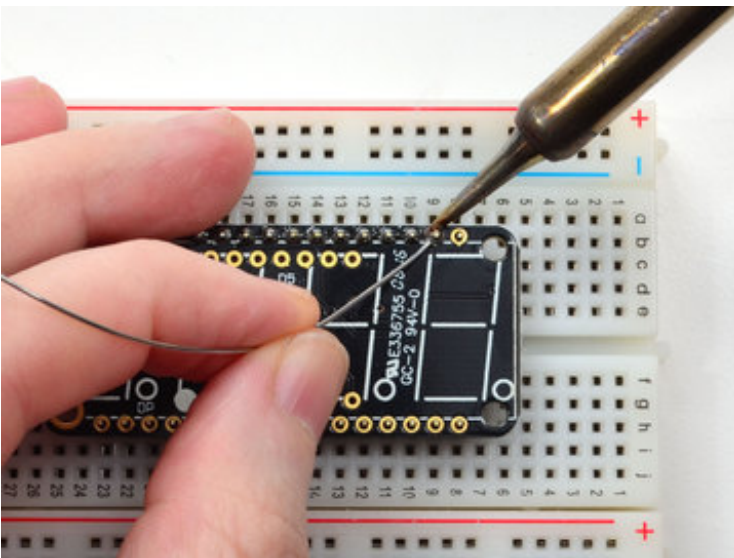
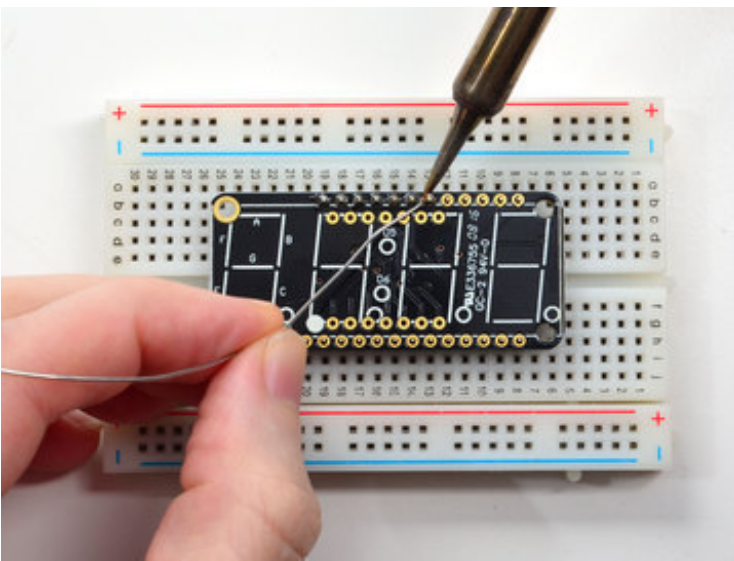
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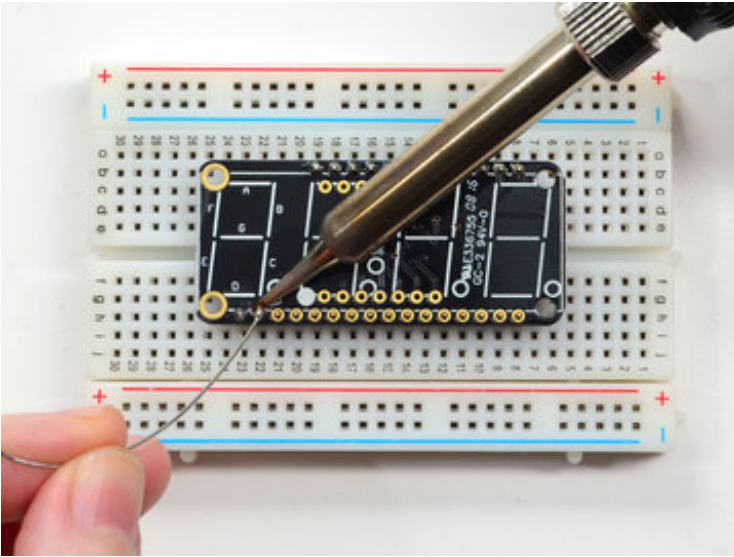


And Solder!

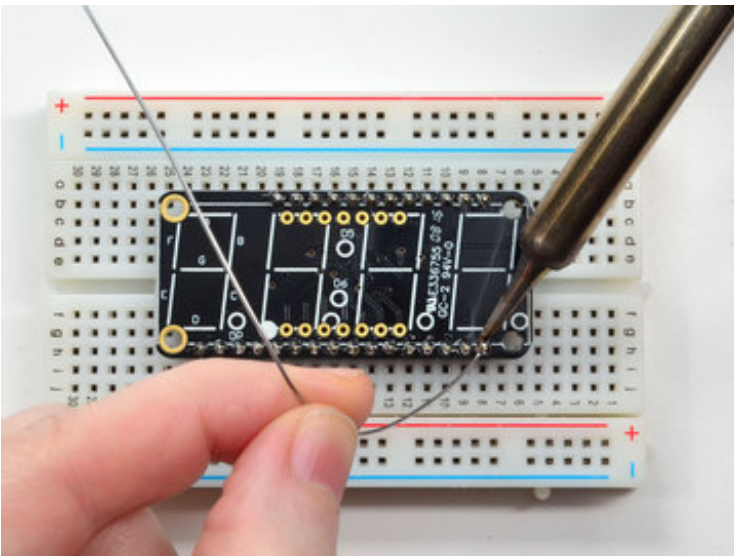
Be sure to solder all pins for reliable electrical contact.

(For tips on soldering, be sure to check out our [Guide to Excellent Soldering](http://adafruit.it/aTk) (<http://adafruit.it/aTk>)).



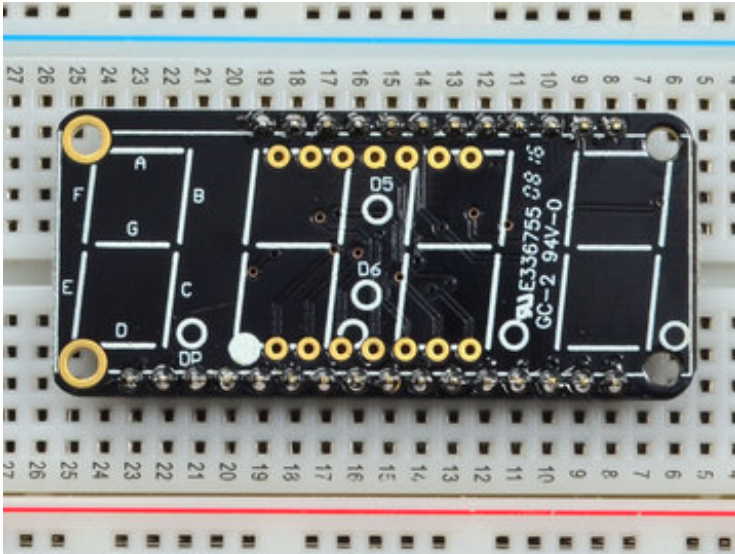


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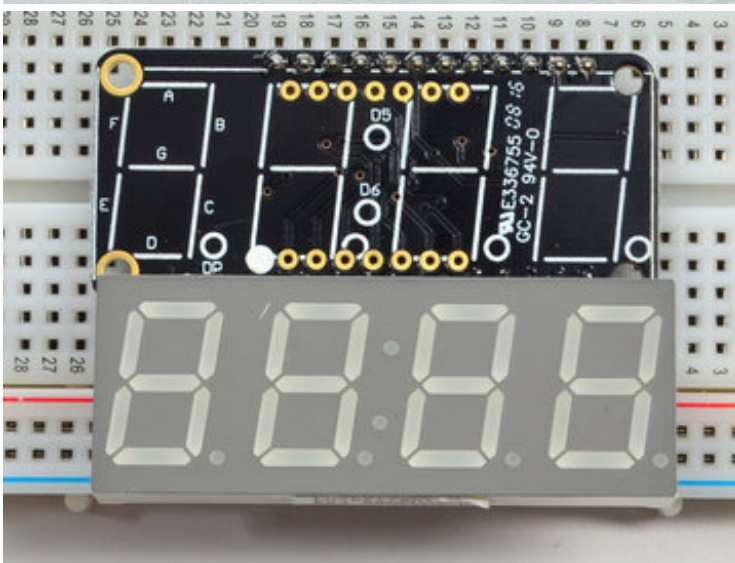


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Do both strips completely!

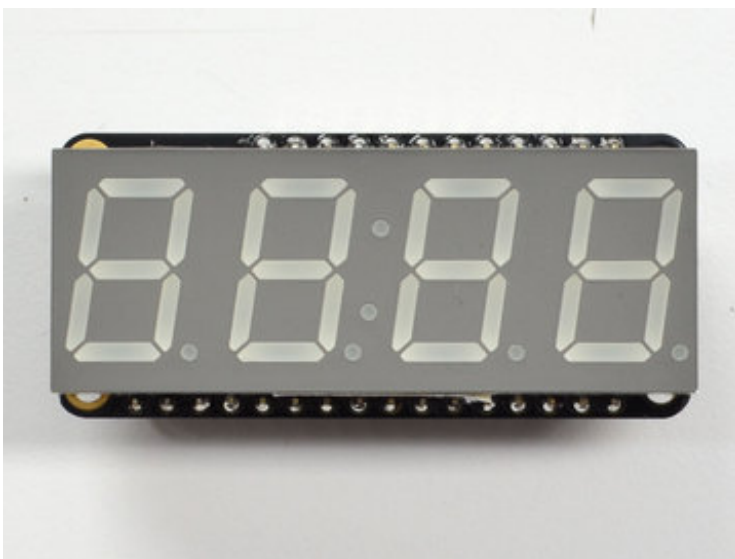


Check your solder joints visually and continue onto the next step

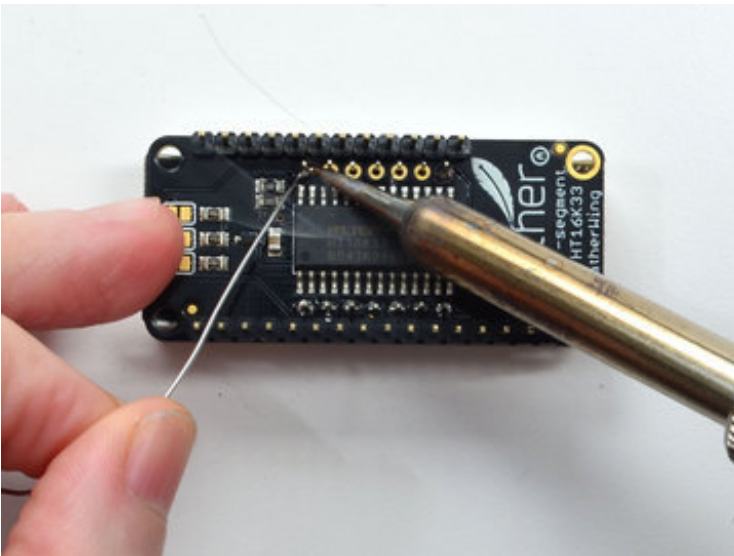
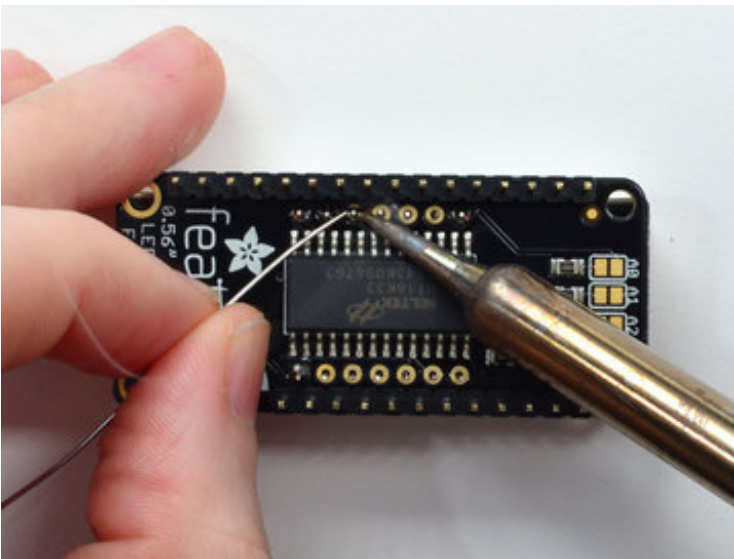
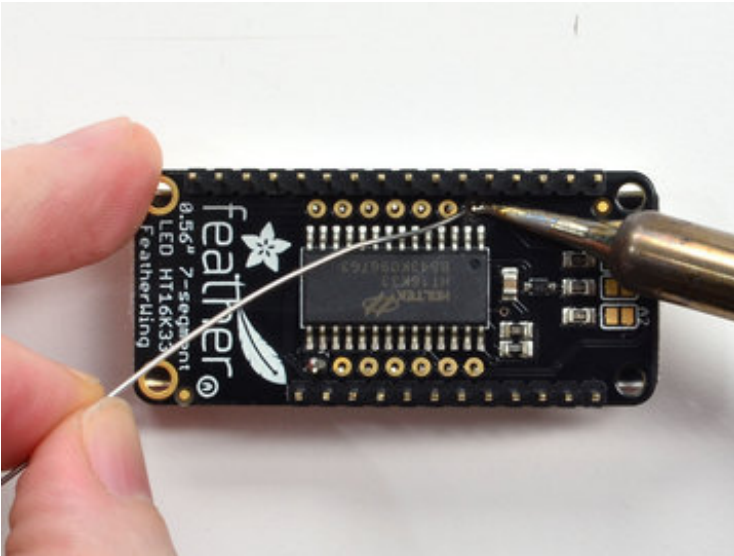


Next we'll attach the LED matrix
Check the Matrix and line it up
next to the FeatherWing

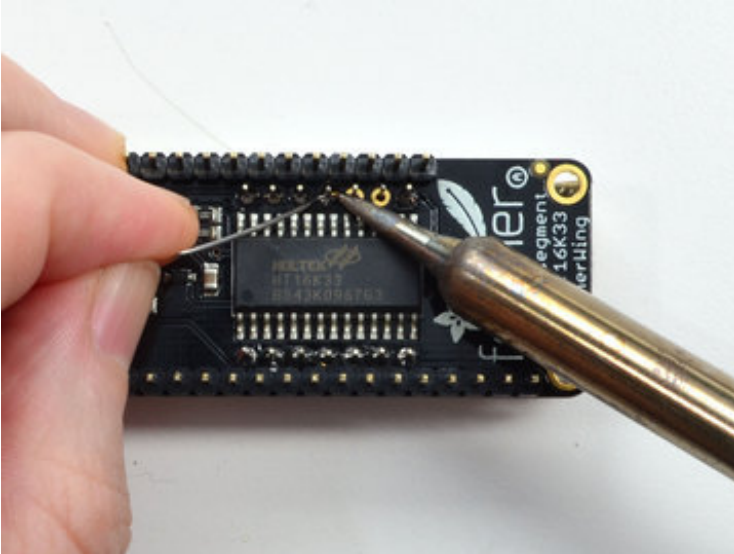
Be careful to NOT PUT THE
DISPLAY ON UPSIDE DOWN
OR IT WONT WORK!! Check the
image to make sure the 'decimal
point' dots are on the bottom,
matching the silkscreen.



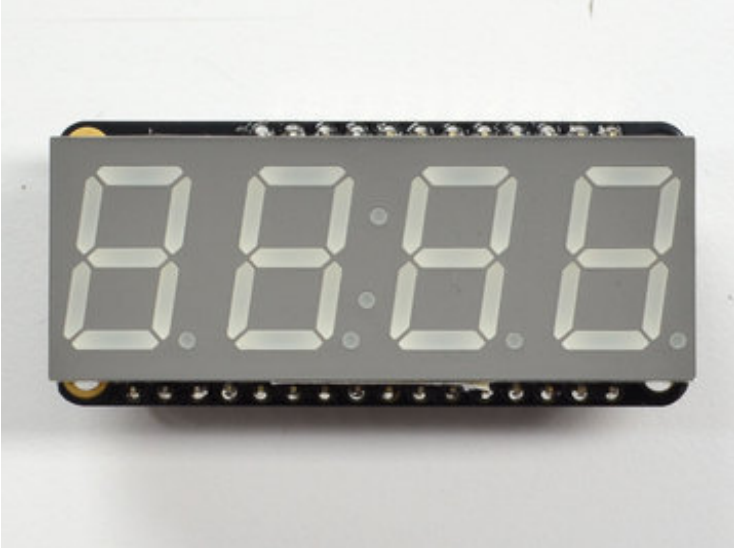
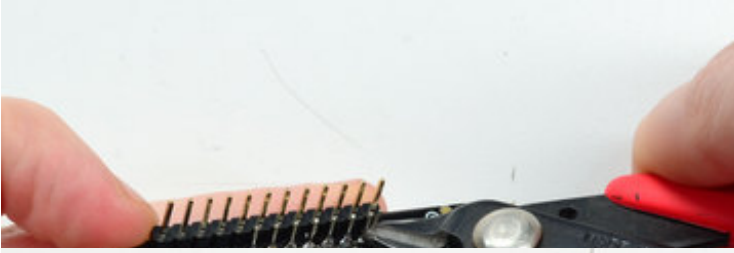
Slot the LED module on top,
check again that you have it right
way up!



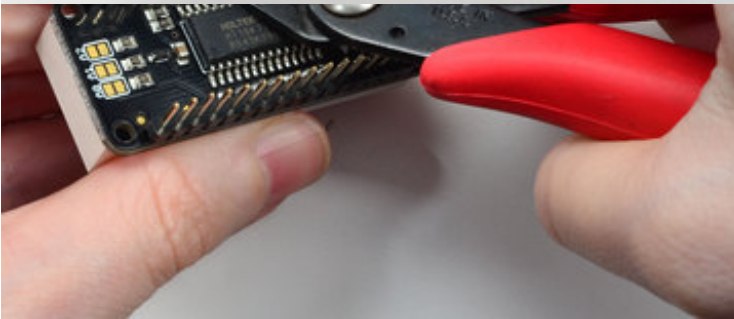
Solder the matrix in place. Note this will be a little tougher because there's not as much space. Go slow, do one pin at a time and you can clip it after each point if you need!



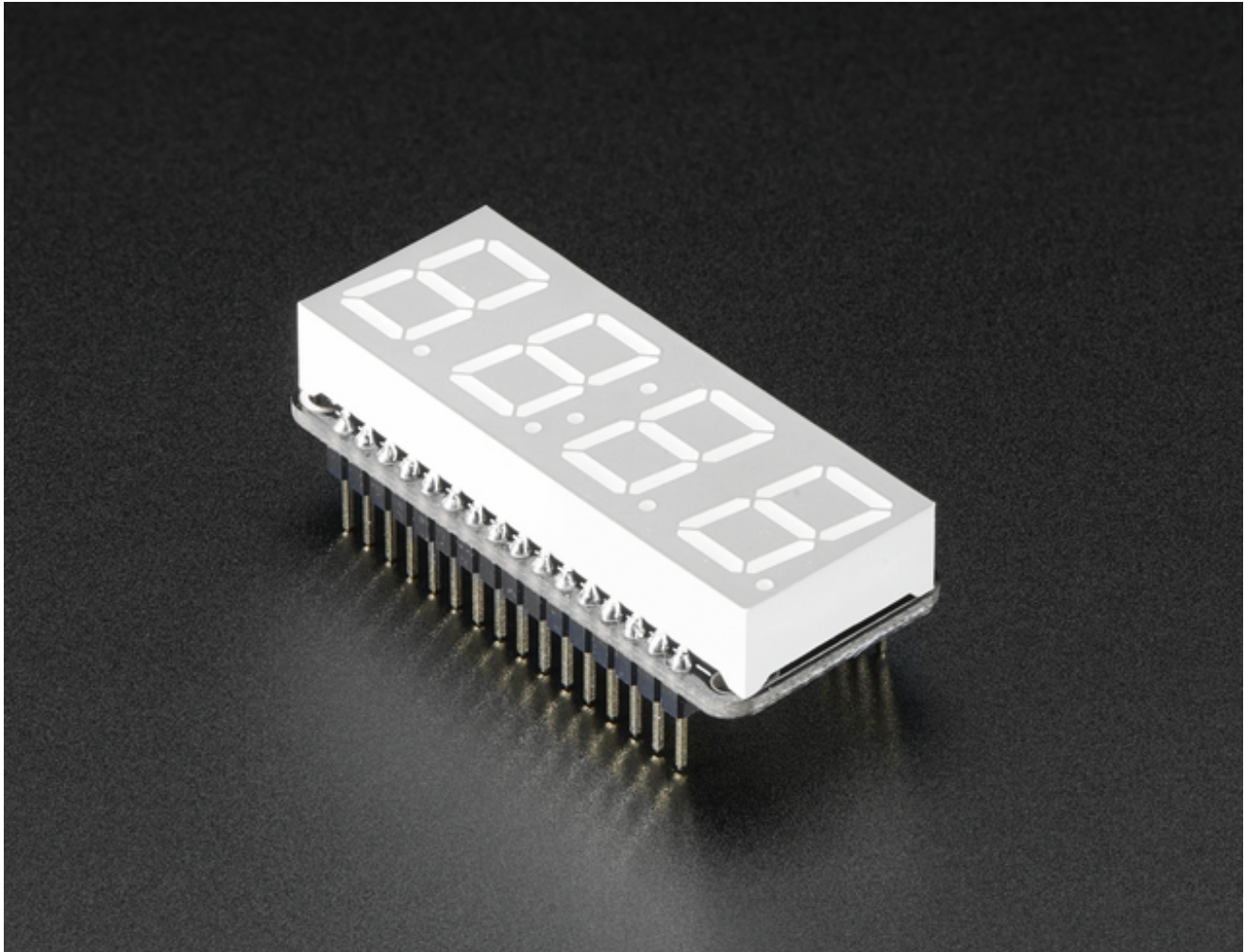
Once soldered, clip each wire short



You're done! You can now install software and get blinking



Usage



To talk to the LED helper chip you'll need to use our Arduino [Adafruit LED Backpack library from github](http://adafru.it/aLI) (<http://adafru.it/aLI>).

To download you can visit the repository, or simply click on this button:

[Download Adafruit LED Backpack Library](http://adafru.it/ncm)
<http://adafru.it/ncm>

Rename the uncompressed folder **Adafruit_LEDBackpack**. Check that the **Adafruit_LEDBackpack** folder contains **Adafruit_LEDBackpack.cpp** and **Adafruit_LEDBackpack.h** Place the **Adafruit_LEDBackpack** library folder your *arduinofolder/libraries/* folder.

You may need to create the *libraries* subfolder if it's your first library. We also have a great tutorial on Arduino library installation at:

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

Install Adafruit GFX

[You will need to do the same for the Adafruit_GFX library available here \(http://adafru.it/aJa\)](http://adafru.it/aJa)

[Download Adafruit GFX Library](http://adafru.it/cBB)

<http://adafru.it/cBB>

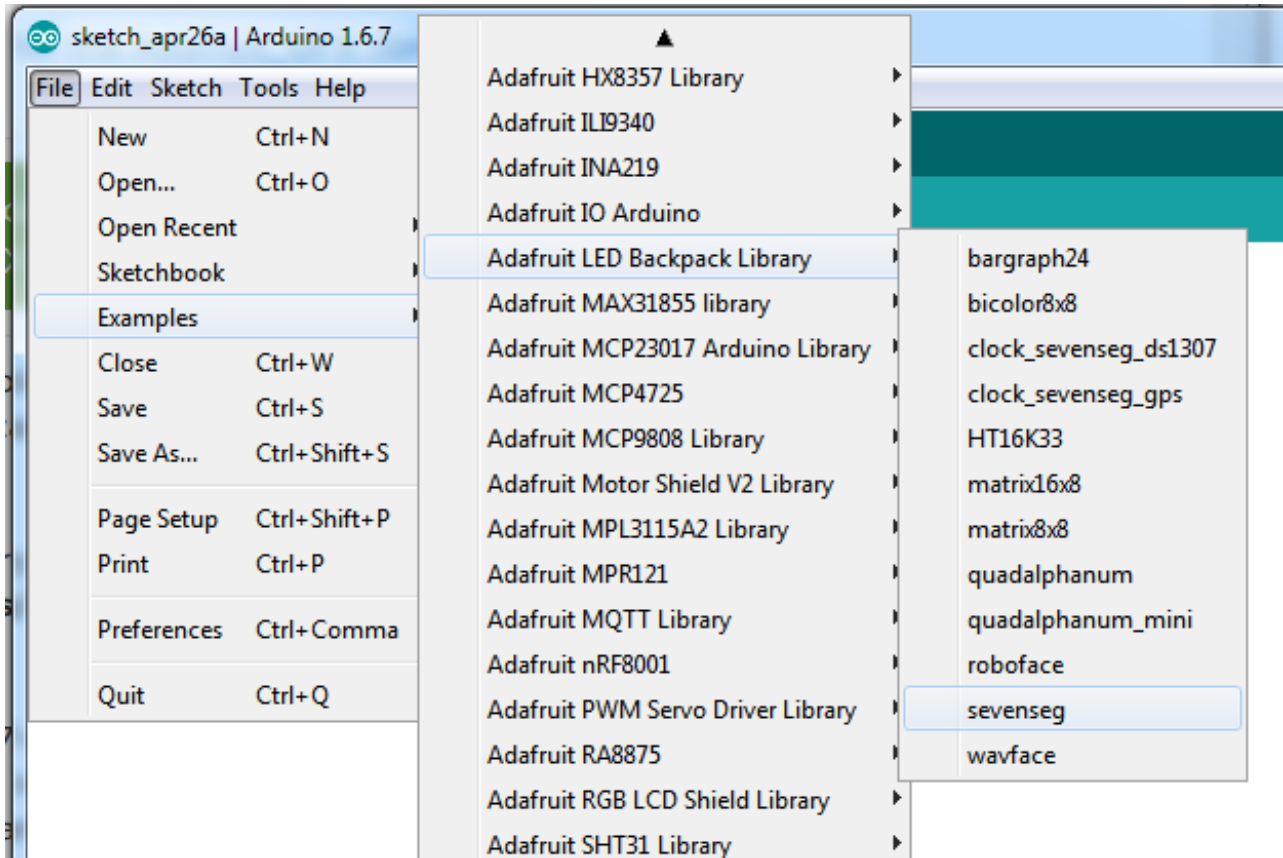
Rename the uncompressed folder **Adafruit_GFX** and check that the **Adafruit_GFX** folder contains **Adafruit_GFX.cpp** and **Adafruit_GFX.h**

Place the **Adafruit_GFX** library folder your *arduinorsketchfolder/libraries/* folder like you did with the LED Backpack library

It's not actually used for the 7-segment display, it's only for the matrix backpacks but it's still required by the library so please install it to avoid errors! Restart the IDE.

Run Test!

Once you've restarted you should be able to select the **File->Examples->Adafruit_LEDBackpack->sevenseg** example sketch. Upload it to your Feather as usual. You should see a basic test program that goes through a bunch of different routines.





Library Reference

Once you're happy that the matrix works, you can write your own sketches.

There's a few ways you can draw to the display. The easiest is to just call **print** - just like you do with **Serial**

- **print(variable,HEX)** - this will print a hexadecimal number, from 0000 up to FFFF
- **print(variable,DEC)** or **print(variable)** - this will print a decimal integer, from 0000 up to 9999

If you need more control, you can call **writeDigitNum(location, number)** - this will write the *number* (0-9) to a single location. Location #0 is all the way to the left, location #2 is the colon dots so you probably want to skip it, location #4 is all the way to the right.

If you want a decimal point, call **writeDigitNum(location, number, true)** which will paint the decimal point. To draw the colon, use **drawColon(true or false)**

If you want even more control, you can call **writeDigitRaw(*location*,*bitmask*)** to draw a raw 8-bit mask (as stored in a `uint8_t`) to that location.

All the drawing routines only change the display memory kept by the Arduino. Don't forget to call **writeDisplay()** after drawing to 'save' the memory out to the matrix via I2C.

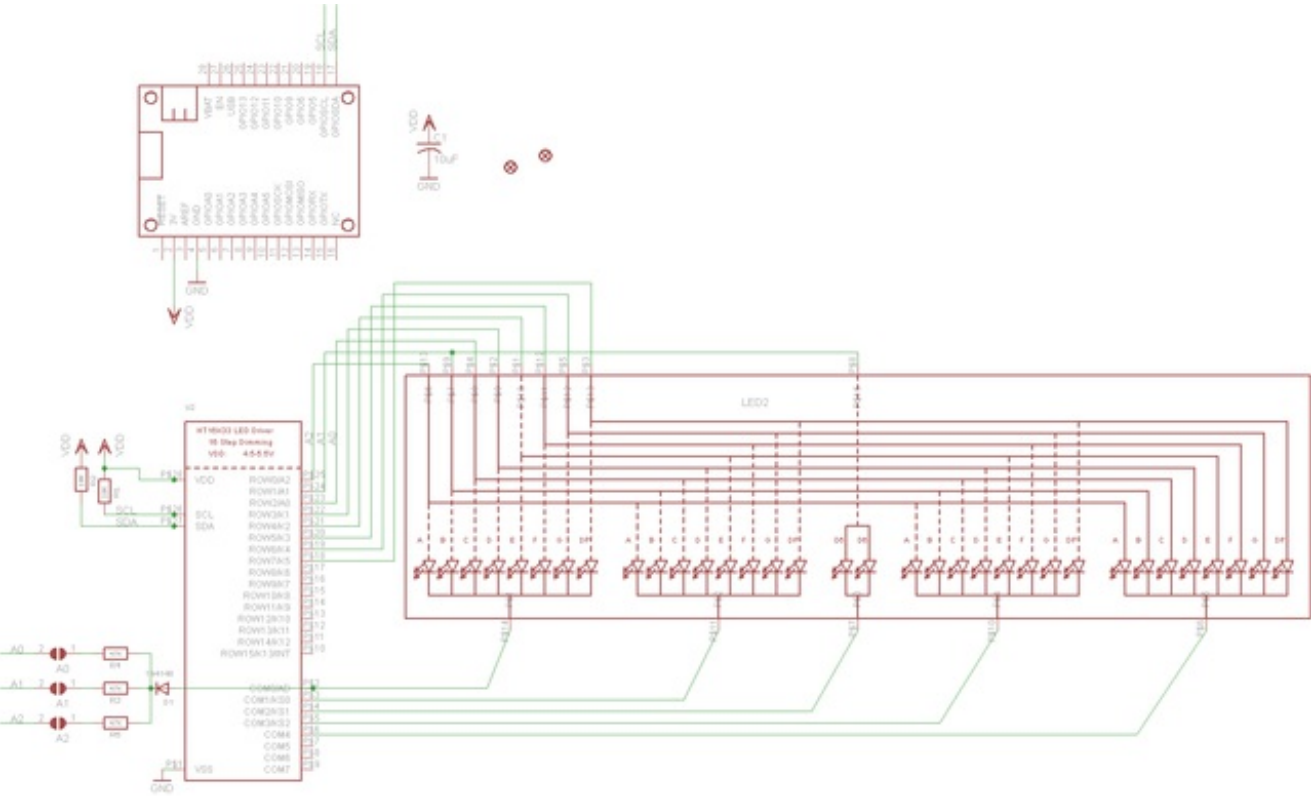
There are also a few small routines that are special to the backpack:

- **setBrightness(*brightness*)**- will let you change the overall brightness of the entire display. 0 is least bright, 15 is brightest and is what is initialized by the display when you start
- **blinkRate(*rate*)** - You can blink the entire display. 0 is no blinking. 1, 2 or 3 is for display blinking.

Downloads

- [Arduino LED Backpack Library \(http://adafru.it/mau\)](http://adafru.it/mau)
- [EagleCAD Featherwing PCB files \(http://adafru.it/nco\)](http://adafru.it/nco)
- [Fritzing objects in Adafruit Fritzing library \(http://adafru.it/aP3\)](http://adafru.it/aP3)

Schematic



Fabrication Print

Dimensions in inches

