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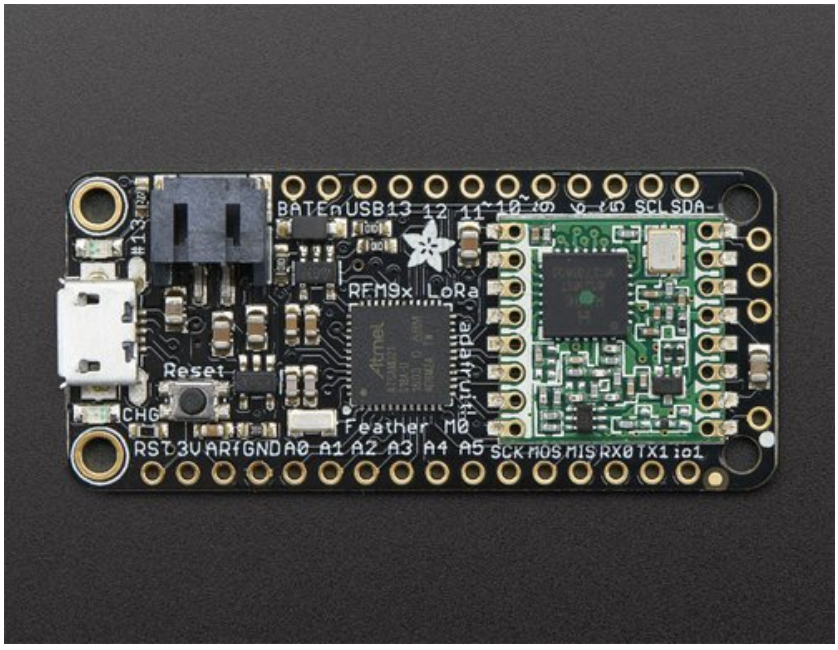
Adafruit Feather M0 Radio with LoRa Radio Module

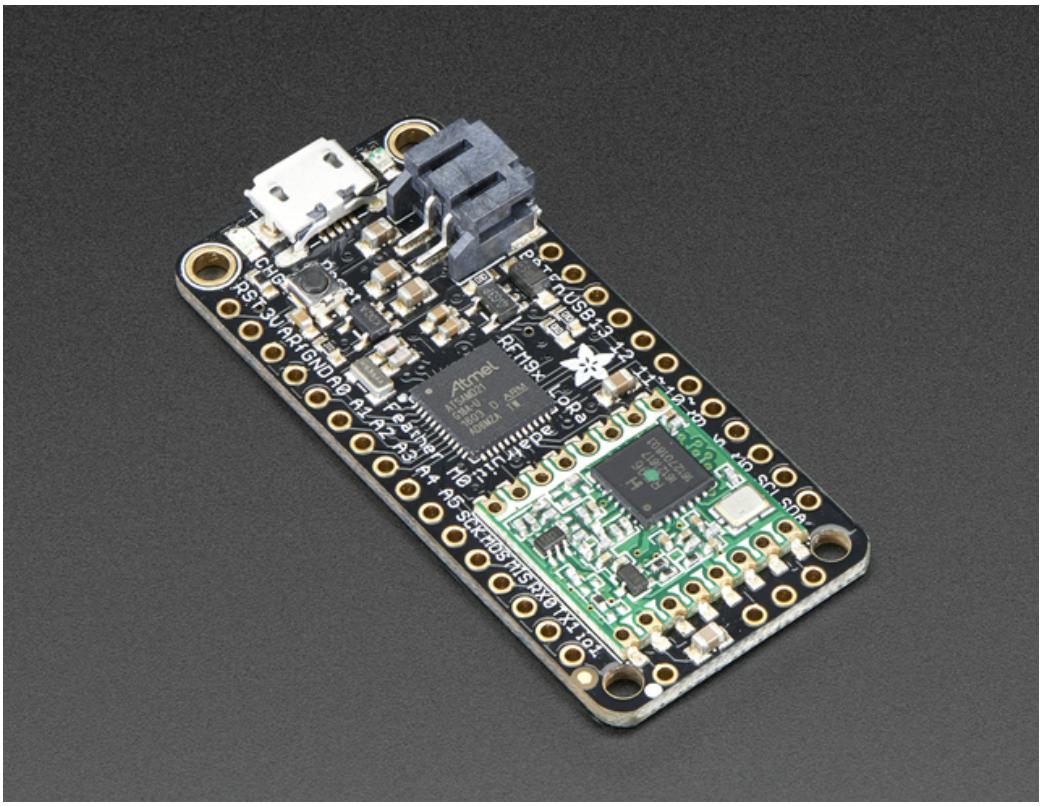
Created by lady ada



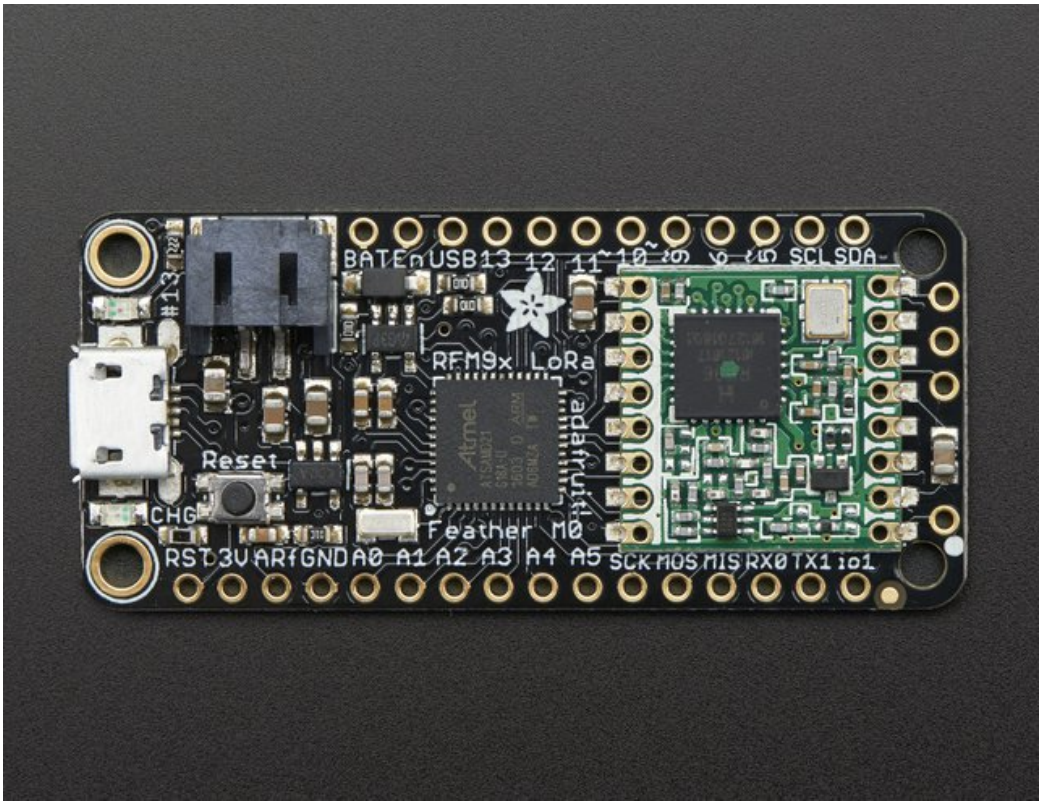
Last updated on 2017-04-27 07:31:08 PM UTC

Guide Contents

Overview

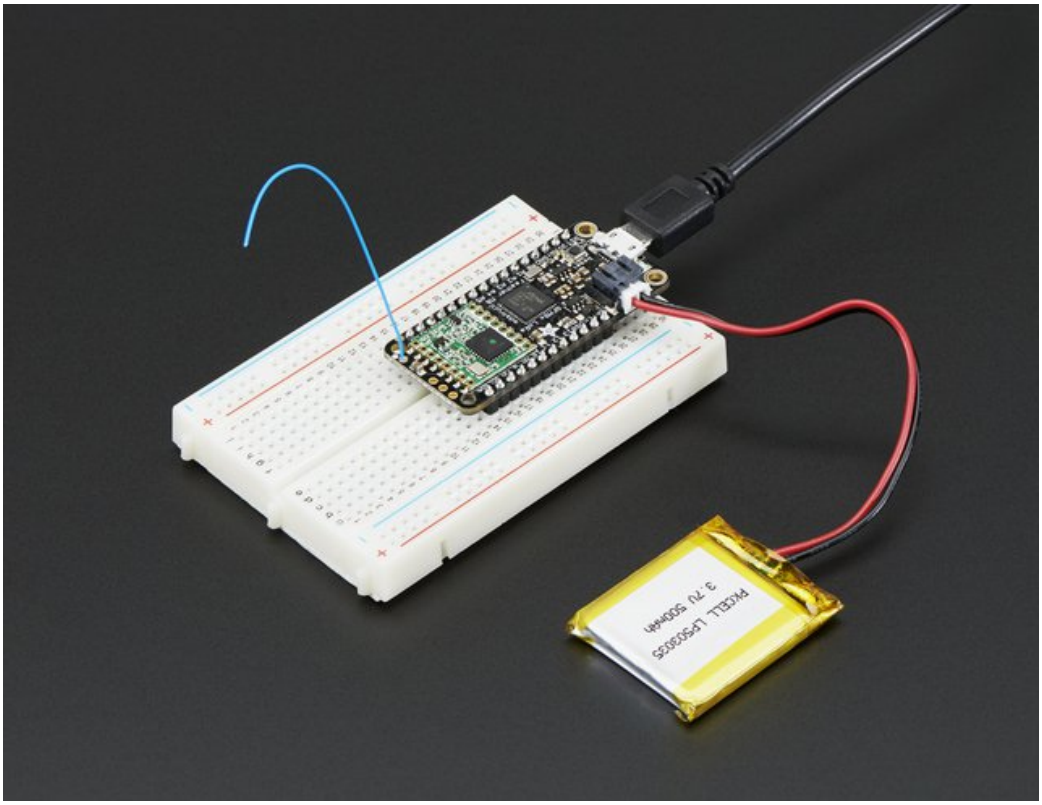


This is the **Adafruit Feather M0 RFM95 LoRa Radio (433 or 900 MHz)**- our take on an microcontroller with a "Long Range (LoRa) (http://adafru.it/mFZ)" packet radio transceiver with built in USB and battery charging. Its an Adafruit Feather M0 with a Long Range radio module cooked in! Great for making wireless networks that are more flexible than Bluetooth LE and without the high power requirements of WiFi. We have other boards in the Feather family, check'em out here (http://adafru.it/l7B).



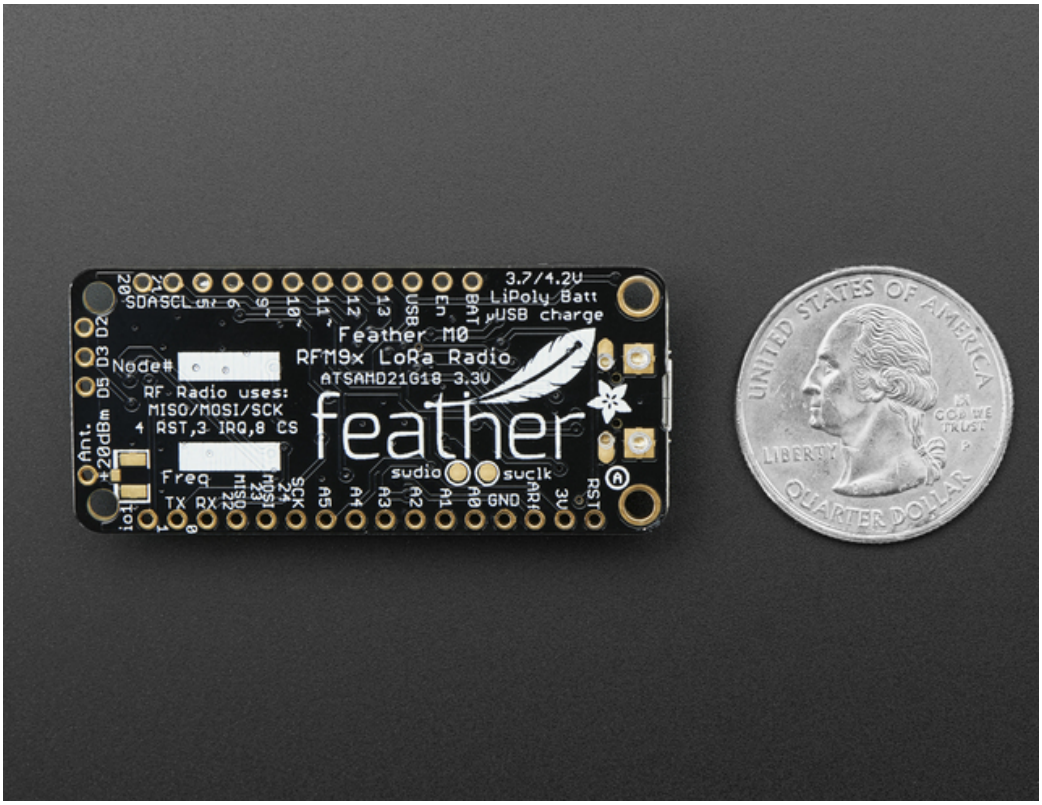
At the Feather M0's heart is an ATSAMD21G18 ARM Cortex M0 processor, clocked at 48 MHz and at 3.3V logic, the same one used in the new Arduino Zero (http://adafru.it/2843). This chip has a whopping 256K of FLASH (8x more than the Atmega328 or 32u4) and 32K of RAM (16x as much)! This chip comes with built in USB so it has USB-to-Serial program & debug capability built in with no need for an FTDI-like chip.

To make it easy to use for portable projects, we added a connector for any of our 3.7V Lithium polymer batteries and built in battery charging. You don't need a battery, it will run just fine straight from the micro USB connector. But, if you do have a battery, you can take it on the go, then plug in the USB to recharge. The Feather will automatically switch over to USB power when its available. We also tied the battery thru a divider to an analog pin, so you can measure and monitor the battery voltage to detect when you need a recharge.



Here's some handy specs! Like all Feather M0's you get:

- Measures 2.0" x 0.9" x 0.3" (51mm x 23mm x 8mm) without headers soldered in
- Light as a (large?) feather - 5.8 grams
- ATSAMD21G18 @ 48MHz with 3.3V logic/power
- No EEPROM
- 3.3V regulator with 500mA peak current output
- USB native support, comes with USB bootloader and serial port debugging
- You also get tons of pins - 20 GPIO pins
- Hardware Serial, hardware I2C, hardware SPI support
- 8 x PWM pins
- 10 x analog inputs
- 1 x analog output
- Built in 100mA lipoly charger with charging status indicator LED
- Pin #13 red LED for general purpose blinking
- Power/enable pin
- 4 mounting holes
- Reset button



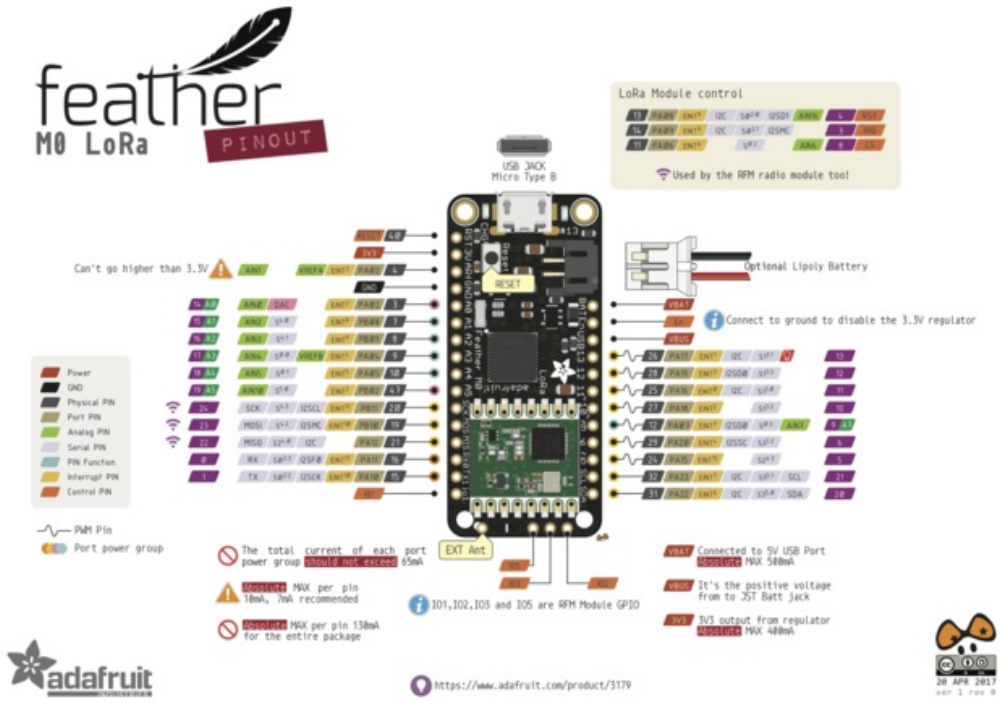
This **Feather M0 LoRa Radio** uses the extra space left over to add an RFM9x LoRa 868/915 MHz radio module. These radios are not good for transmitting audio or video, but they do work quite well for small data packet transmission when you need more range than 2.4 GHz (BT, BLE, WiFi, ZigBee).

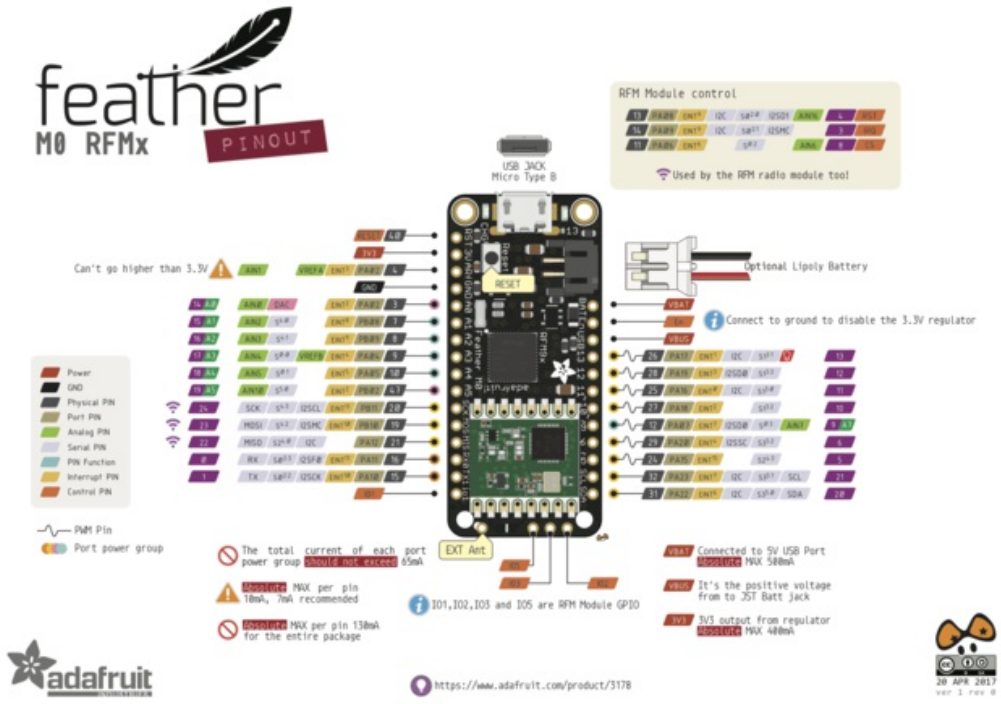
- SX1276 LoRa® based module with SPI interface
- Packet radio with ready-to-go Arduino libraries
- Uses the license-free ISM bands (ITU "Europe" @ 433MHz and ITU "Americas" @ 900MHz)
- +5 to +20 dBm up to 100 mW Power Output Capability (power output selectable in software)
- ~300uA during full sleep, ~120mA peak during +20dBm transmit, ~40mA during active radio listening.
- Simple wire antenna or spot for uFL connector

Our initial tests with default library settings: over 1.2mi/2Km line-of-sight with wire quarter-wave antennas. With setting tweaking and directional antennas, 20Km is possible (http://adafru.it/mGa).

Comes fully assembled and tested, with a USB bootloader that lets you quickly use it with the Arduino IDE. We also toss in some headers so you can solder it in and plug into a solderless breadboard. You will need to cut and solder on a small piece of wire (any solid or stranded core is fine) in order to create your antenna. **Lipoly battery and USB cable not included** but we do have lots of options in the shop if you'd like!

Pinouts



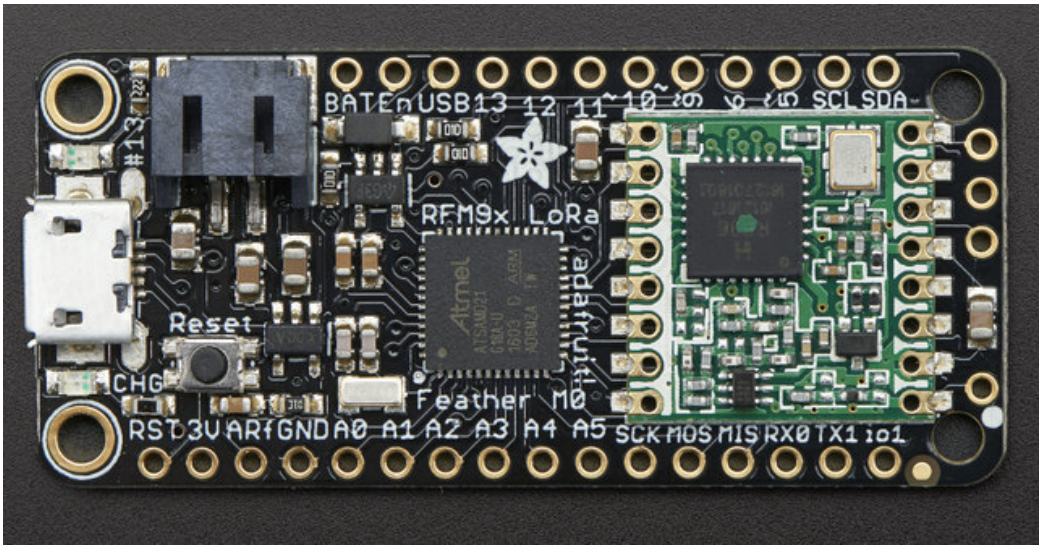


The Feather M0 Radio is chock-full of microcontroller goodness. There's also a lot of pins and ports. We'll take you a tour of them now!

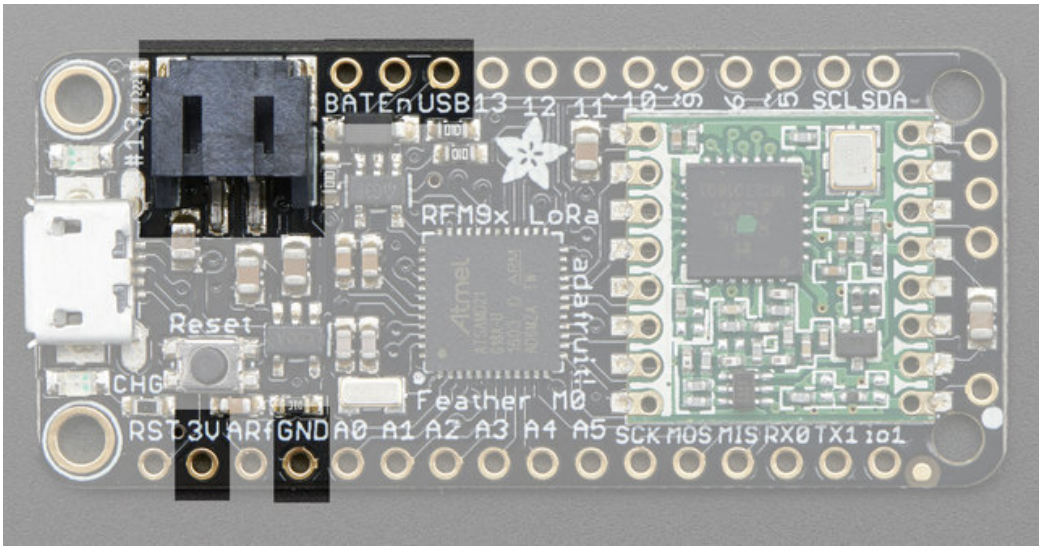
Note that the pinouts are identical for both the Feather M0 RFM69 and LoRa radios - you can look at the silkscreen

of the Feather to see it says "RFM69" or "LoRa"

Pinouts are also the same for both 433MHz and 900Mhz. You can tell the difference by looking for a colored dot on the chip or crystal of the radio, green/blue is 900MHz & red is 433MHz

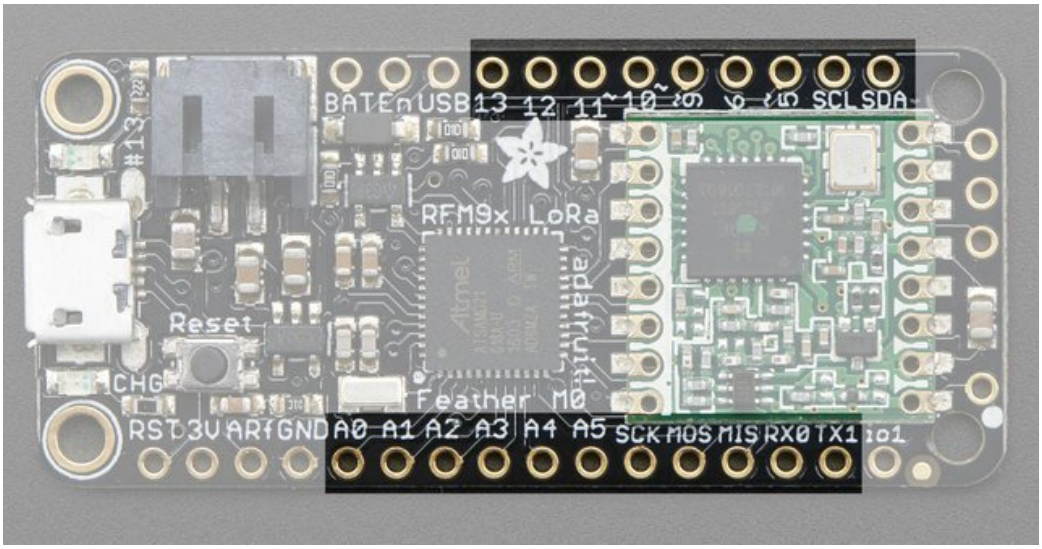


Power Pins



- **GND** - this is the common ground for all power and logic
- **BAT** - this is the positive voltage to/from the JST jack for the optional Lipoly battery
- **USB** - this is the positive voltage to/from the micro USB jack if connected
- **EN** - this is the 3.3V regulator's enable pin. It's pulled up, so connect to ground to disable the 3.3V regulator
- **3V** - this is the output from the 3.3V regulator, it can supply 500mA peak

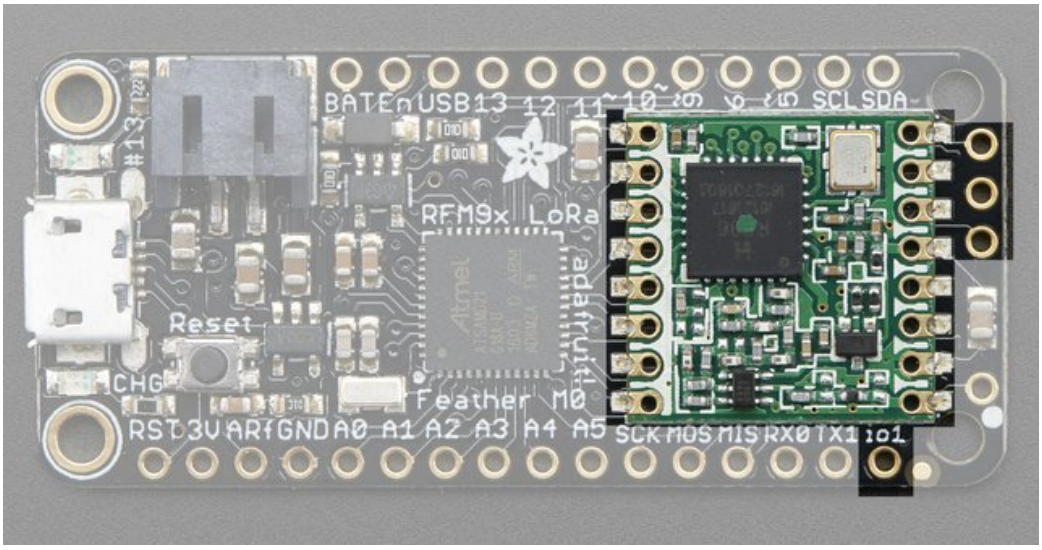
Logic pins



This is the general purpose I/O pin set for the microcontroller.
All logic is 3.3V
All pins can do PWM output
All pins can be interrupt inputs

- **#0** / **RX** - GPIO #0, also receive (input) pin for **Serial1** (hardware UART), also can be analog input
- **#1** / **TX** - GPIO #1, also transmit (output) pin for **Serial1**, also can be analog input
- **#20** / **SDA** - GPIO #20, also the I2C (Wire) data pin. There's no pull up on this pin by default so when using with I2C, you may need a 2.2K-10K pullup.
- **#21** / **SCL** - GPIO #21, also the I2C (Wire) clock pin. There's no pull up on this pin by default so when using with I2C, you may need a 2.2K-10K pullup.
- **#5** - GPIO #5
- **#6** - GPIO #6
- **#9** - GPIO #9, also analog input **A7**. This analog input is connected to a voltage divider for the lipoly battery so be aware that this pin naturally 'sits' at around 2VDC due to the resistor divider
- **#10** - GPIO #10
- **#11** - GPIO #11
- **#12** - GPIO #12
- **#13** - GPIO #13 and is connected to the **red LED** next to the USB jack
- **A0** - This pin is analog *input* **A0** but is also an analog *output* due to having a DAC (digital-to-analog converter). You can set the raw voltage to anything from 0 to 3.3V, unlike PWM outputs this is a true analog output
- **A1 thru A5** - These are each analog input as well as digital I/O pins.
- **SCK**/**MOSI**/**MISO** (GPIO **24**/**23**/**22**)- These are the hardware SPI pins, you can use them as everyday GPIO pins (but recommend keeping them free as they are best used for hardware SPI connections for high speed.

RFM/SemTech Radio Module



Since not all pins can be brought out to breakouts, due to the small size of the Feather, we use these to control the radio module

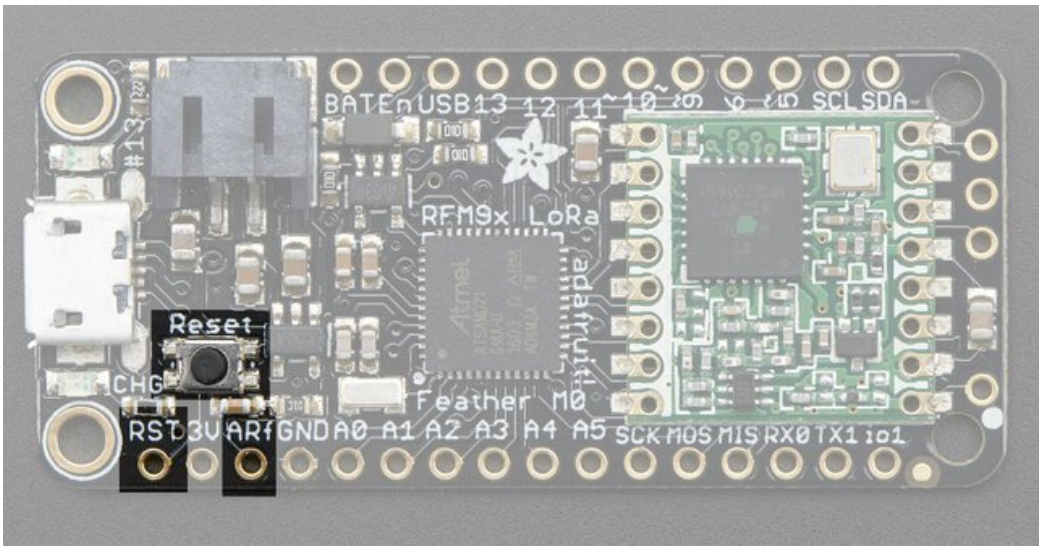
- **#8** - used as the radio **CS** (chip select) pin
- **#3** - used as the radio **GPIO0** / **IRQ** (interrupt request) pin.
- **#4** - used as the radio **Reset** pin

Since these are not brought out there should be no risk of using them by accident!

There are also breakouts for 3 of the RFM's GPIO pins **IO1, IO2, IO3** and **IO5**). You probably wont need these for most uses of the Feather but they are available in case you need 'em!

The CS pin (#8) does not have a pullup built in so be sure to set this pin HIGH when not using the radio!

Other Pins!



- **RST** - this is the Reset pin, tie to ground to manually reset the AVR, as well as launch the bootloader manually
- **ARef** - the analog reference pin. Normally the reference voltage is the same as the chip logic voltage (3.3V) but if you need an alternative analog reference, connect it to this pin and select the external AREF in your

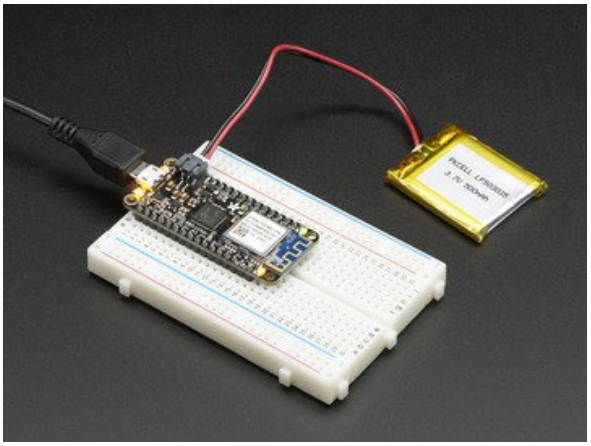
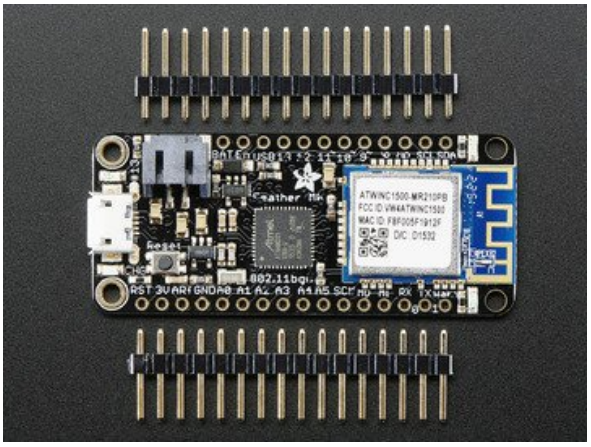
firmware. Can't go higher than 3.3V!

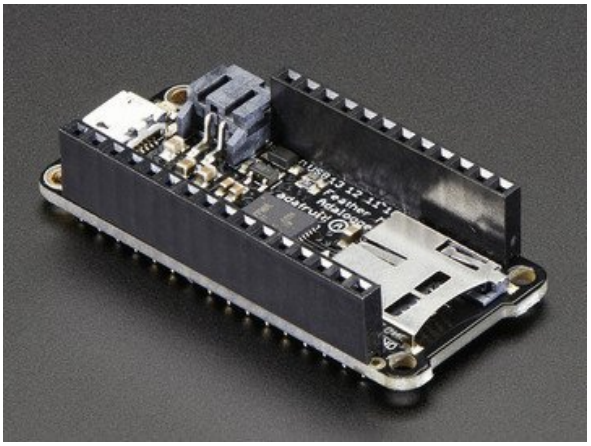
Assembly

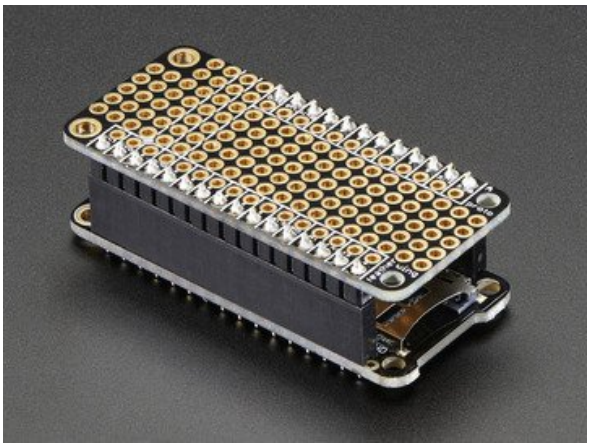
We ship Feathers fully tested but without headers attached - this gives you the most flexibility on choosing how to use and configure your Feather

Header Options!

Before you go gung-ho on soldering, there's a few options to consider!

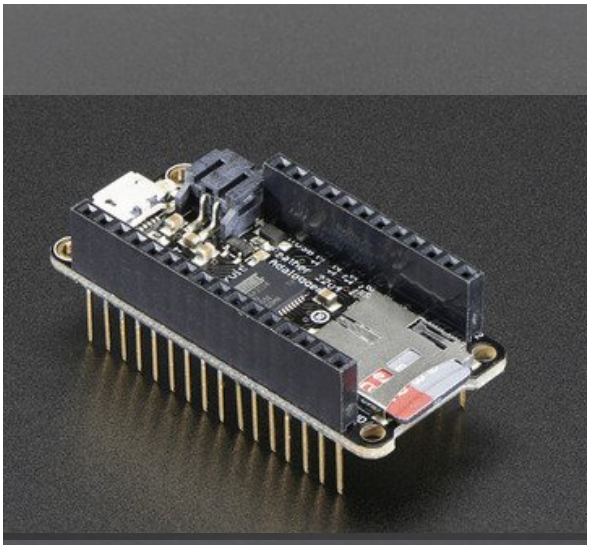
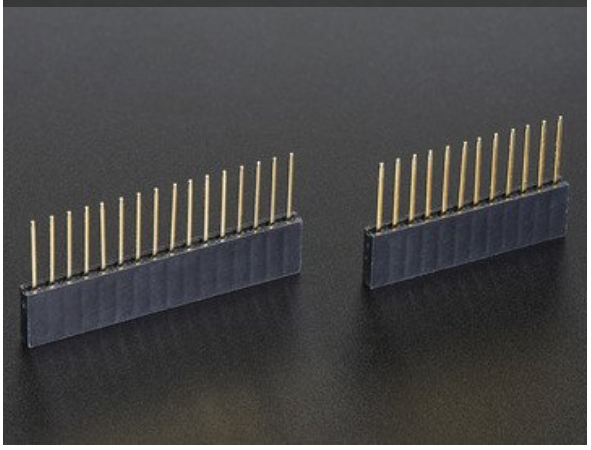
-  The first option is soldering in plain male headers, this lets you plug in the Feather into a solderless breadboard
- 

- 

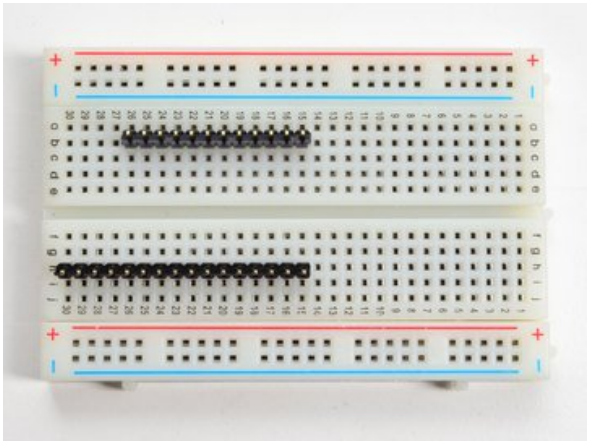
- 

Another option is to go with socket female headers. This won't let you plug the Feather into a breadboard but it will let you attach featherwings very easily

We also have 'slim' versions of the female headers, that are a little shorter and give a more compact shape

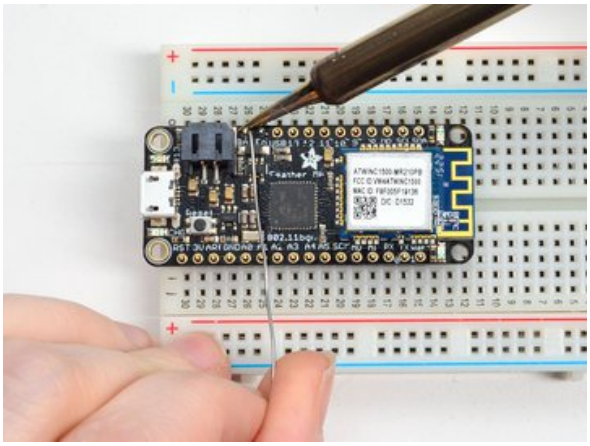
- 
- Finally, there's the "Stacking Header" option. This one is sort of the best-of-both-worlds. You get the ability to plug into a solderless breadboard *and* plug a featherwing on top. But its a little bulky
- 

Soldering in Plain Headers

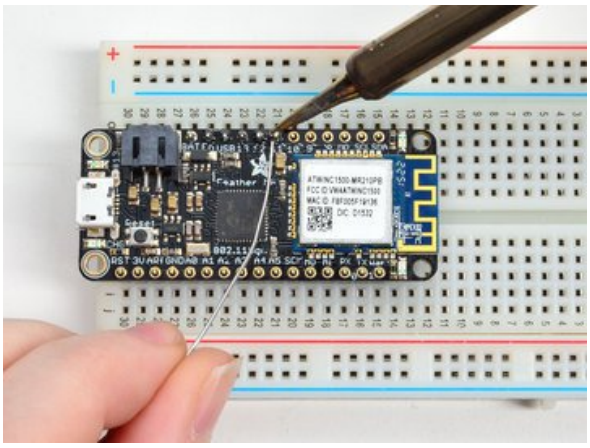
- 

Prepare the header strip:

Cut the strip to length if necessary. It will be easier to solder if you insert it into a breadboard - **long pins down**

- 

Add the breakout board:

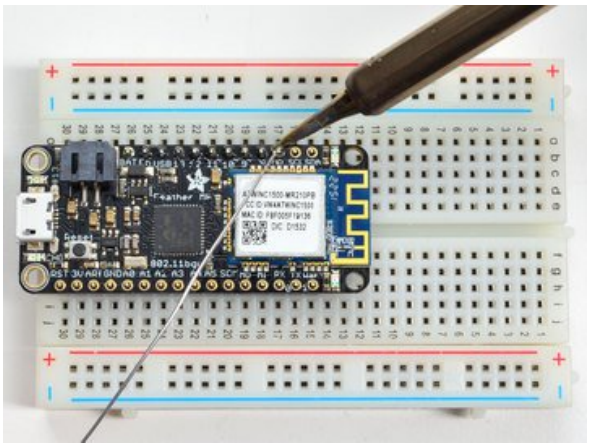
- 

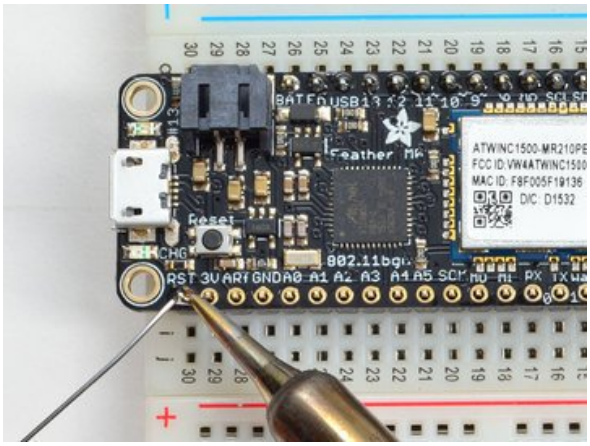
Place the breakout board over the pins so that the short pins poke through the breakout pads

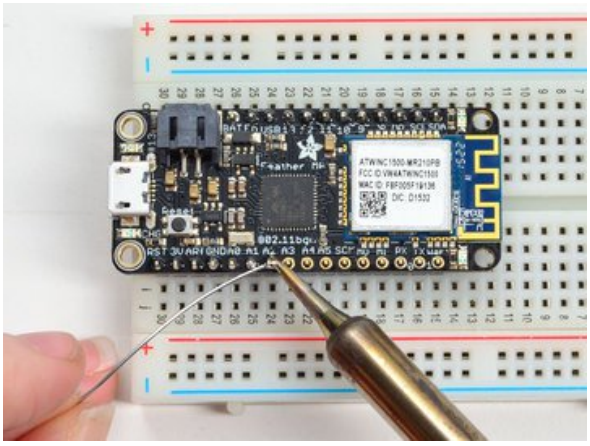
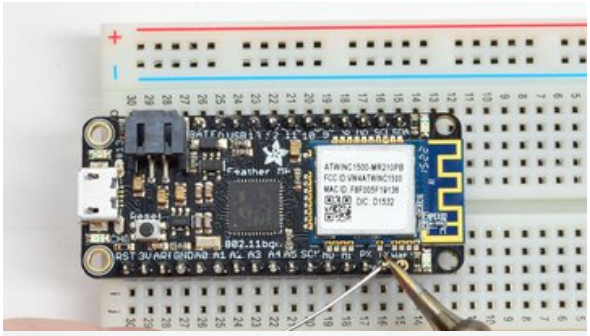
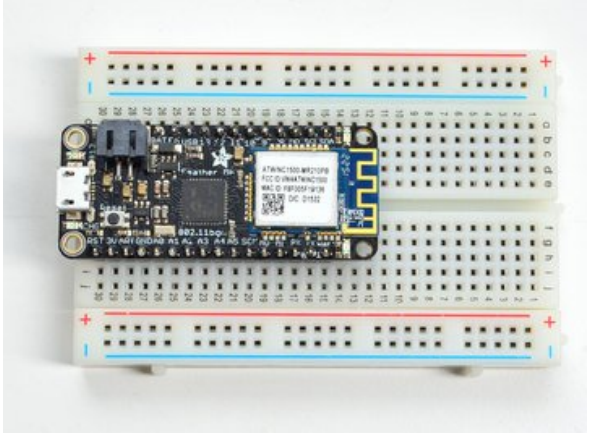
And Solder!

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://adafru.it/aTk)).

- 

- 

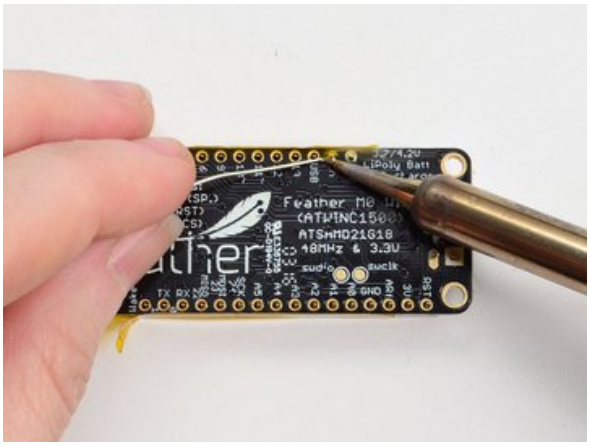
Solder the other strip as well.
- 
- 
- 
You're done! Check your solder joints visually and continue onto the next steps

Soldering on Female Header

- 

Tape In Place

For sockets you'll want to tape them in place so when you flip over the board they don't fall out

- 
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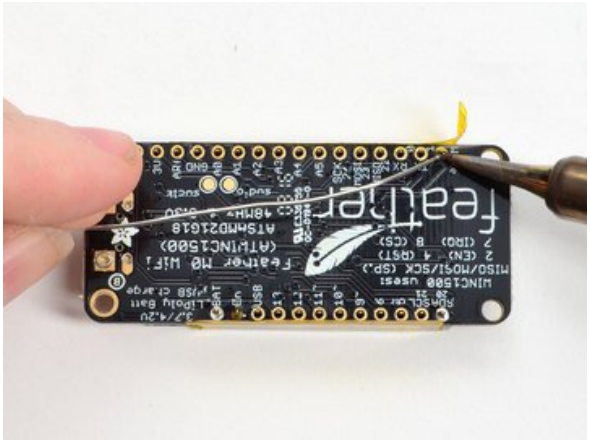
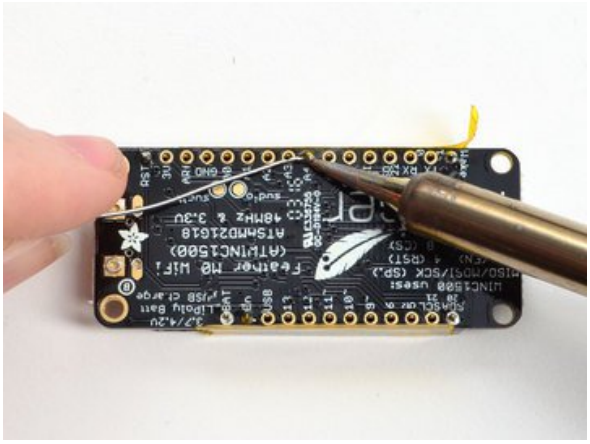
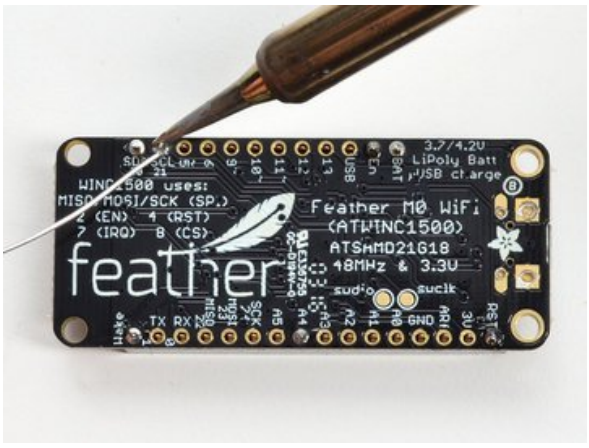
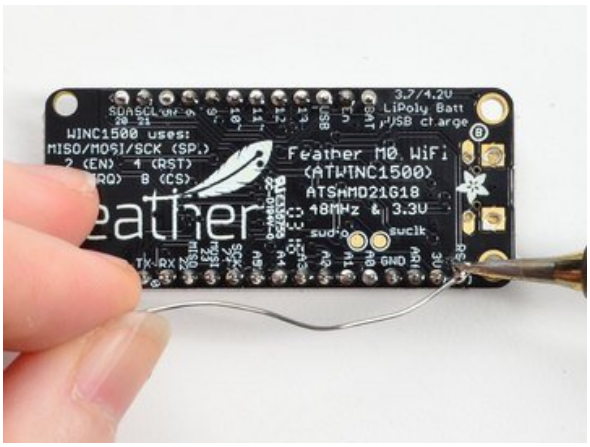
- 

Flip & Tack Solder

After flipping over, solder one or two points on each strip, to 'tack' the header in place

- 
- 
- 

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://adafru.it/aTk) (http://adafru.it/aTk)).

You're done! Check your solder joints visually and continue onto the next steps

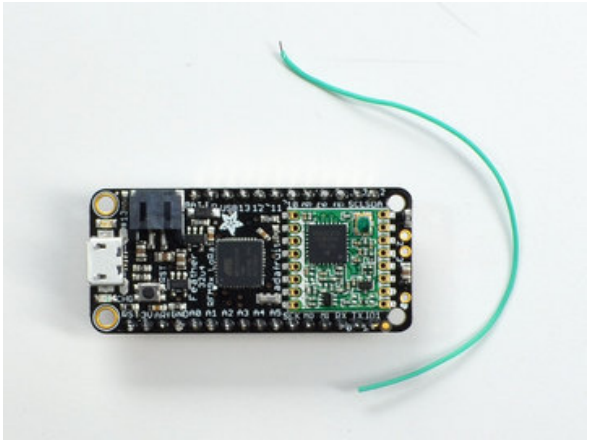
- 
WINC1500 uses:
MISO/MOSI/SCK (SPI)
2 (EN) 4 (RST)
7 (IRQ) 8 (CS)
Feather M0 WiFi
(ATWINC1500)
ATSAMD21G18
48MHz & 3.3V
3.7/4.2V
LiPoly Batt
USB charge
feather
- 

Antenna Options

Your Feather Radio does not have a built-in antenna. Instead, you have two options for attaching an antenna. For most low cost radio nodes, a wire works great. If you need to put the Feather into an enclosure, soldering in uFL and using a uFL to SMA adapter will let you attach an external antenna

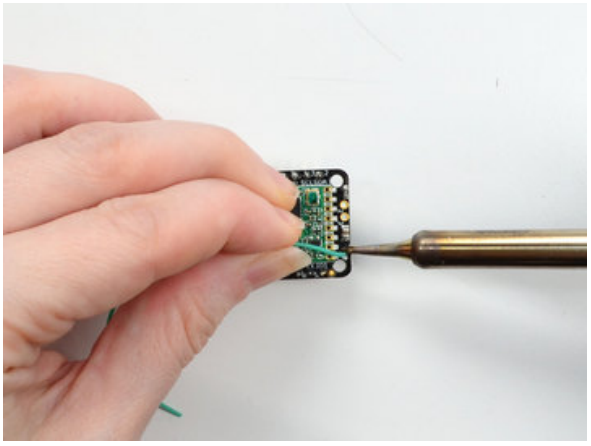
Wire Antenna

A wire antenna, aka "quarter wave whip antenna" is low cost and works very well! You just have to cut the wire down to the right length.

- 

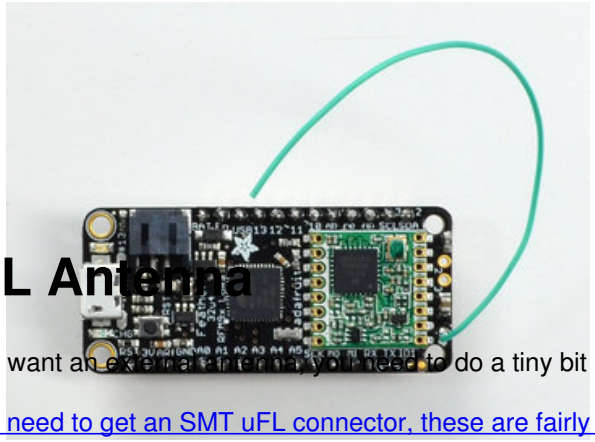
Cut a stranded or solid core wire the the proper length for the module/frequency

- **433 MHz** - 6.5 inches, or 16.5 cm
- **868 MHz** - 3.25 inches or 8.2 cm
- **915 MHz** - 3 inches or 7.8 cm

- 

Strip a mm or two off the end of the wire, tin and solder into the **ANT** pad on the very right hand edge of the Feather

That's pretty much it, you're done!



uFL Antenna

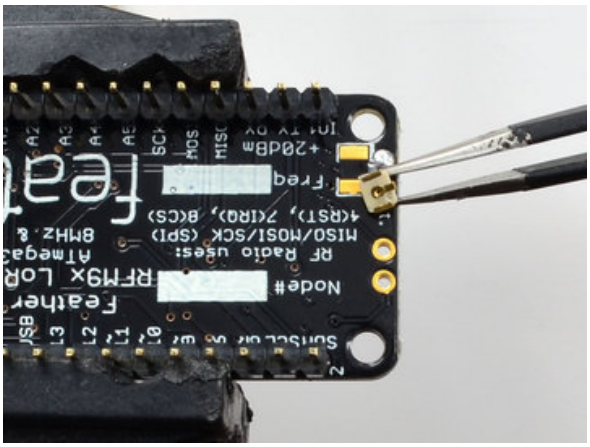
If you want an external antenna you'll need to do a tiny bit more work but its not too difficult.

- You'll need to get an SMT uFL connector, these are fairly standard (http://adafru.it/1661)

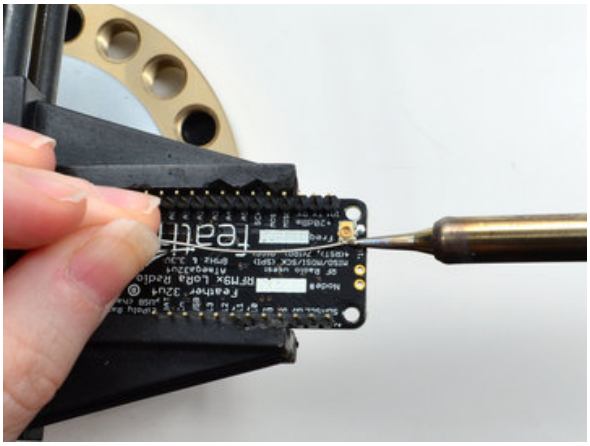
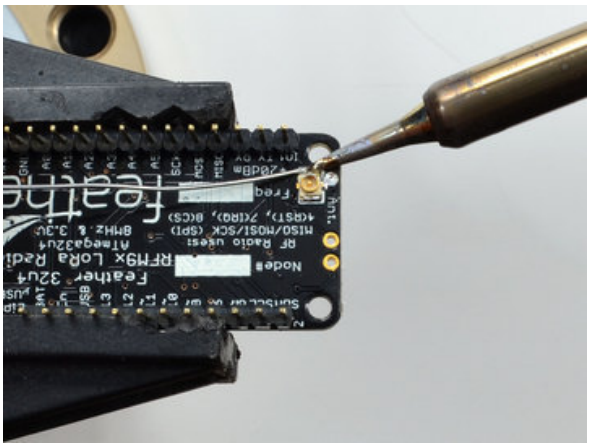
You'll also need a uFL to SMA adapter (http://adafru.it/851) (or whatever adapter you need for the antenna you'll be using, SMA is the most common

Of course, you will also need an antenna of some sort, that matches your radio frequency

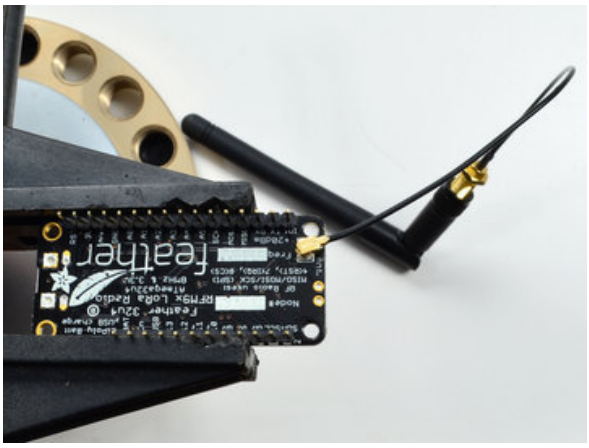
uFL connectors are rated for 30 connection cycles, but be careful when connecting/disconnecting to not rip the pads off the PCB. Once a uFL/SMA adapter is connected, use strain relief!

- 

Check the bottom of the uFL connector, note that there's two large side pads (ground) and a little inlet pad. The other small pad is not used!

- 
- 

Solder all three pads to the bottom of the Feather

- 

Once done attach your uFL adapter and antenna!