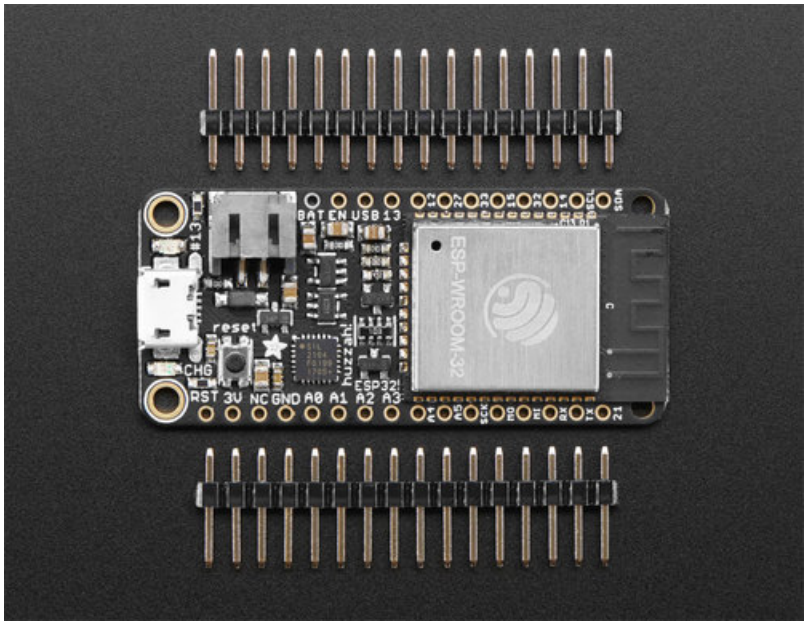
adafruit learning system

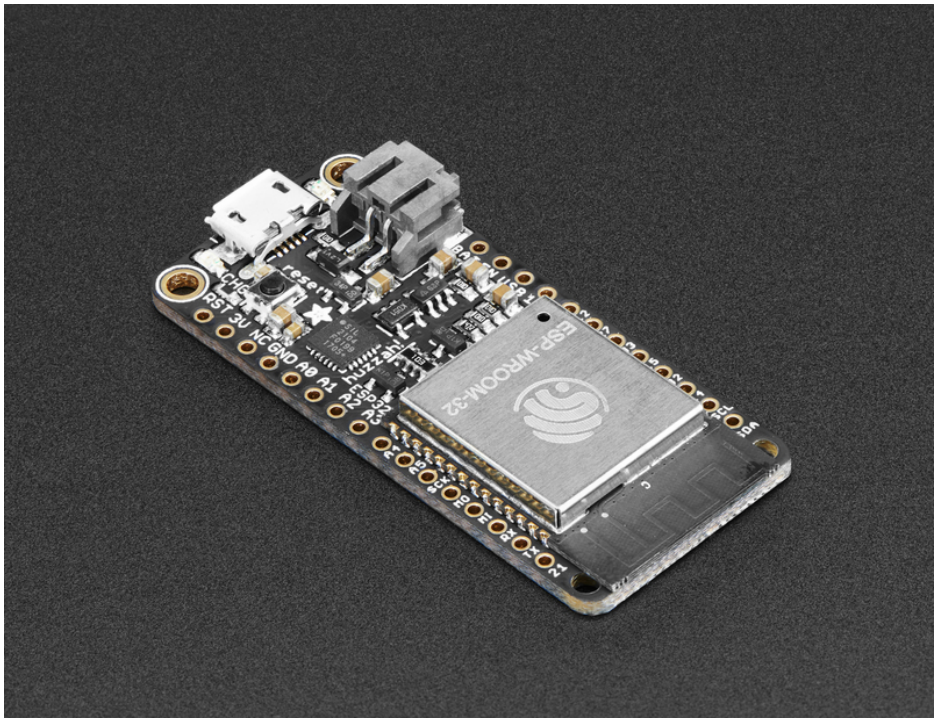
Adafruit HUZZAH32 - ESP32 Feather

Created by lady ada



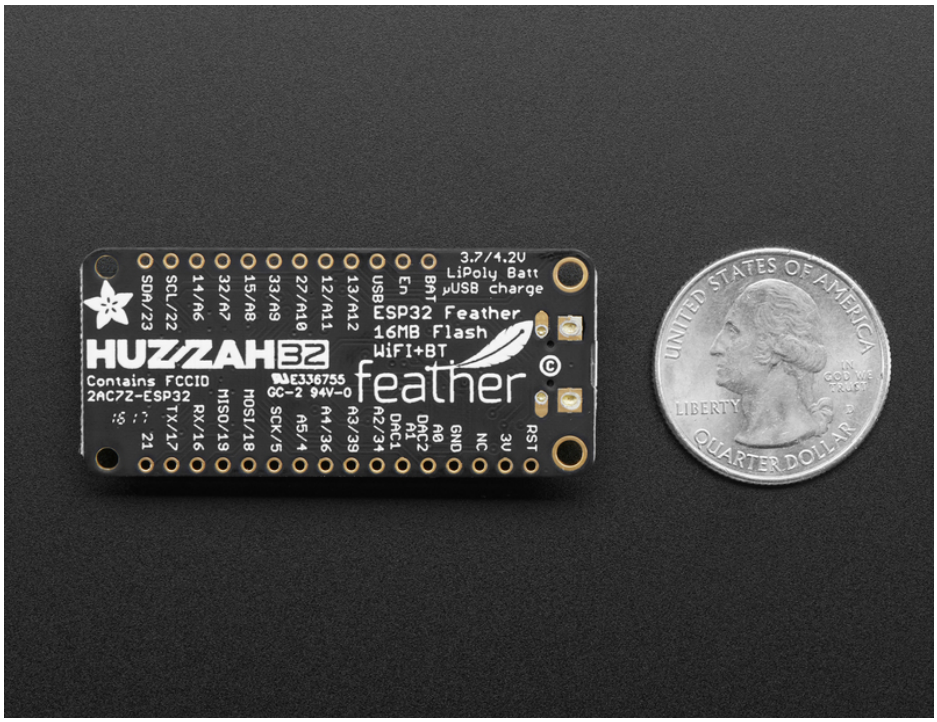
Last updated on 2019-05-27 02:07:23 AM UTC

Overview



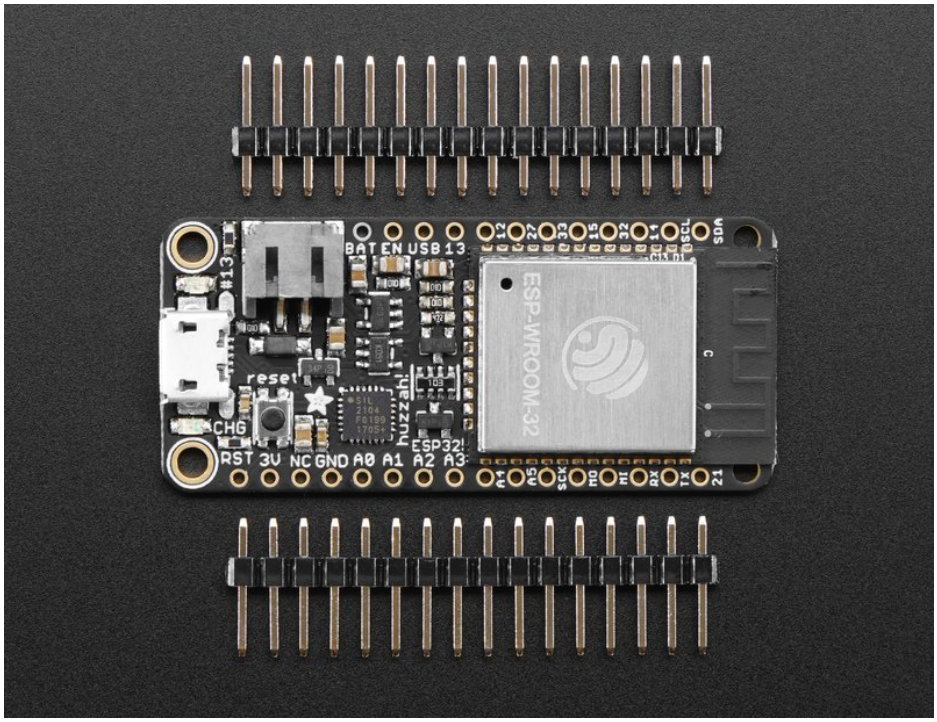
Aww yeah, it's the Feather you have been waiting for! The HUZZAH32 is our ESP32-based Feather, made with the official WROOM32 module. We packed everything you love about Feathers: built in USB-to-Serial converter, automatic bootloader reset, Lithium Ion/Polymer charger, and all the GPIO brought out so you can use it with any of our Feather Wings.

That module nestled in at the end of this Feather contains a dual-core ESP32 chip, 4 MB of SPI Flash, tuned antenna, and all the passives you need to take advantage of this powerful new processor. The ESP32 has both WiFi *and* Bluetooth Classic/LE support. That means it's perfect for just about any wireless or Internet-connected project.



Because it is part of our Feather eco-system you can take advantage of the 50+ Wings (https://adafru.it/wev) that we've designed, to add all sorts of cool accessories

The ESP32 is a perfect upgrade from the ESP8266 that has been so popular. In comparison, the ESP32 has way more GPIO, plenty of analog inputs, two analog outputs, multiple extra peripherals (like a spare UART), two cores so you don't have to yield to the WiFi manager, much higher-speed processor, etc. etc! We think that as the ESP32 gets traction, we'll see more people move to this chip exclusively, as it is so full-featured.

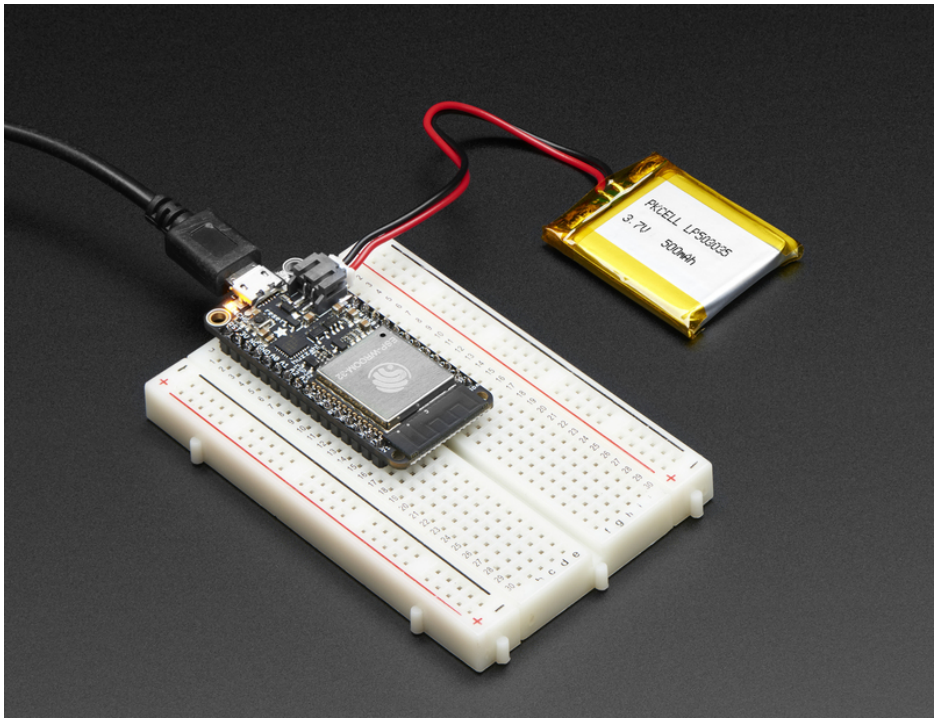


Please note: The ESP32 is still targeted to developers. Not all of the peripherals are fully documented with example

code, and there are some bugs still being found and fixed. We got all of our Featherwings working under Arduino IDE, so you can expect things like I2C and SPI and analog reads to work. But other elements are still under development. For that reason, we recommend this Feather for makers who have some experience with microcontroller programming, and not as a first dev board.

Here are specifications from Espressif about the ESP32 (https://adafru.it/wew)

- 240 MHz dual core Tensilica LX6 microcontroller with 600 DMIPS
- Integrated 520 KB SRAM
- Integrated 802.11b/g/n HT40 Wi-Fi transceiver, baseband, stack and LWIP
- Integrated dual mode Bluetooth (classic and BLE)
- 4 MByte flash
- On-board PCB antenna
- Ultra-low noise analog amplifier
- Hall sensor
- 10x capacitive touch interface
- 32 kHz crystal oscillator
- 3 x UARTs (only two are configured by default in the Feather Arduino IDE support, one UART is used for bootloading/debug)
- 3 x SPI (only one is configured by default in the Feather Arduino IDE support)
- 2 x I2C (only one is configured by default in the Feather Arduino IDE support)
- 12 x ADC input channels
- 2 x I2S Audio
- 2 x DAC
- PWM/timer input/output available on every GPIO pin
- OpenOCD debug interface with 32 kB TRAX buffer
- SDIO master/slave 50 MHz
- SD-card interface support

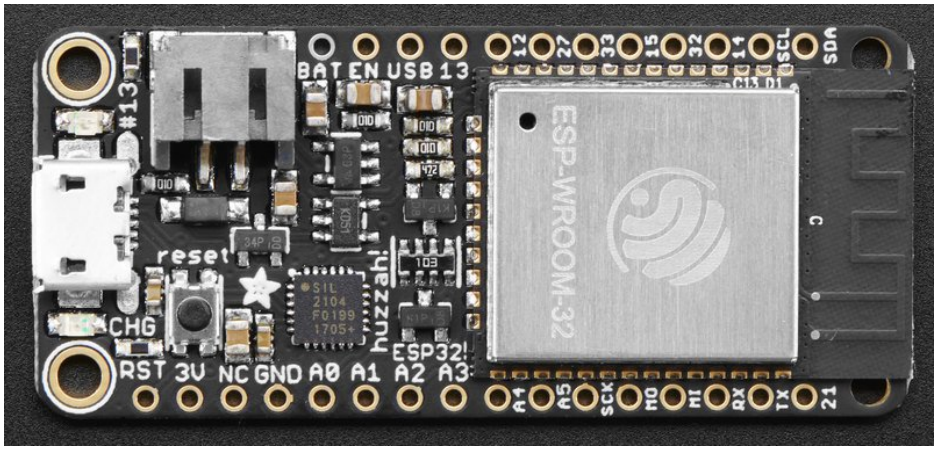


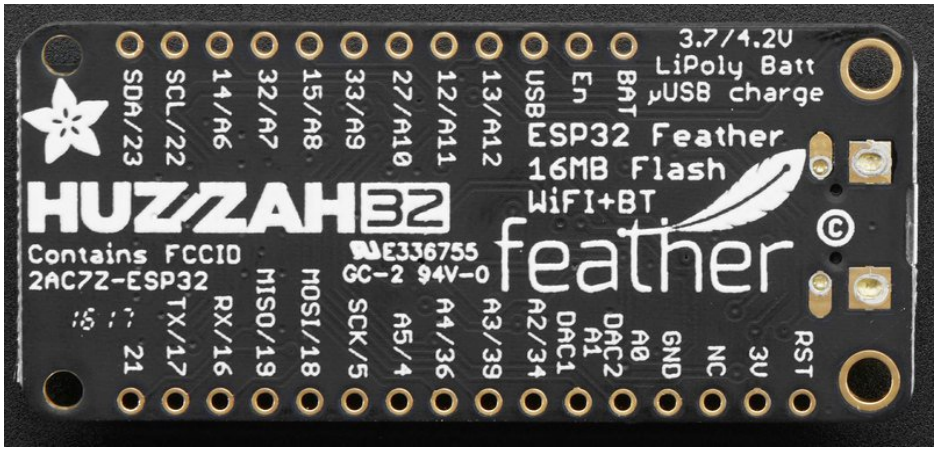
Comes fully assembled and tested, with a USB interface that lets you quickly use it with the Arduino IDE or the low-

level ESP32 IDF. We also toss in some header so you can solder it in and plug into a solderless breadboard. **Lipoly battery and USB cable not included** (but we do have lots of options in the shop if you'd like!)

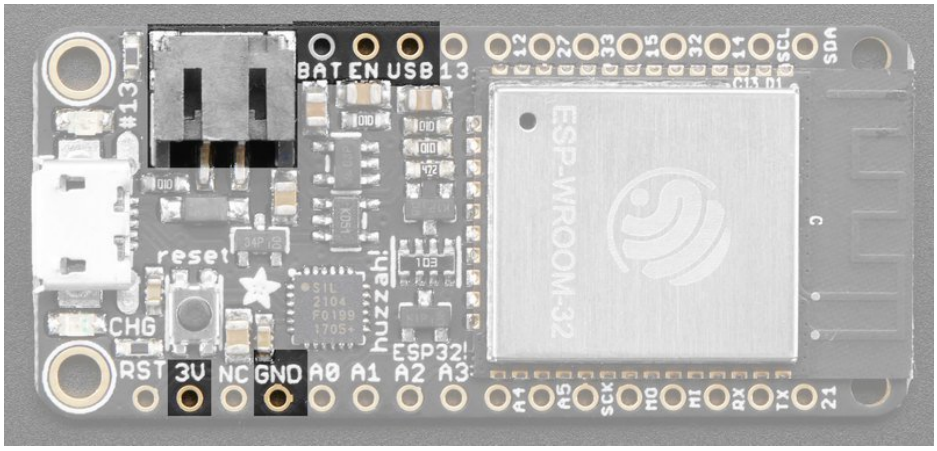
Pinouts

One of the great things about the ESP32 is that it has tons more GPIO than the ESP8266. You *won't* have to juggle or multiplex your IO pins! There's a few things to watch out for so please read through the pinouts carefully





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. The regulator can supply 500mA peak but half of that is drawn by the ESP32, and it's a fairly power-hungry chip. So if you need a ton of power for stuff like LEDs, motors, etc. Use the **USB** or **BAT** pins, and an additional regulator

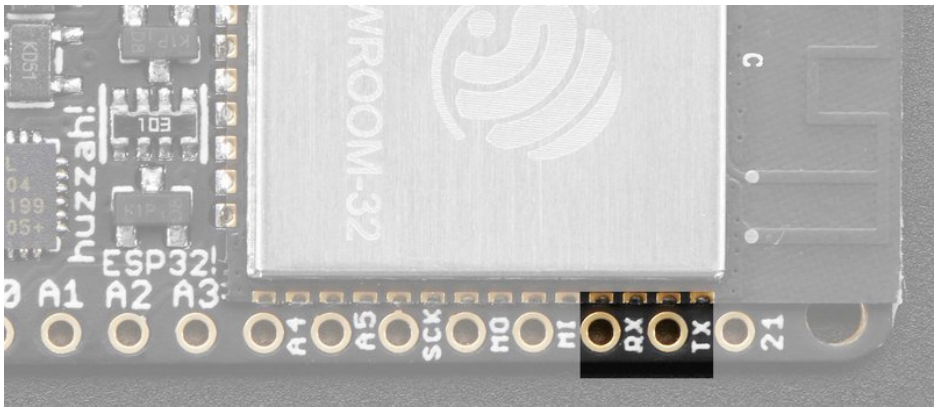
Logic pins

This is the general purpose I/O pin set for the microcontroller. All logic is 3.3V

The ESP32 runs on 3.3V power and logic, and unless otherwise specified, GPIO pins are not 5V safe!

Serial pins

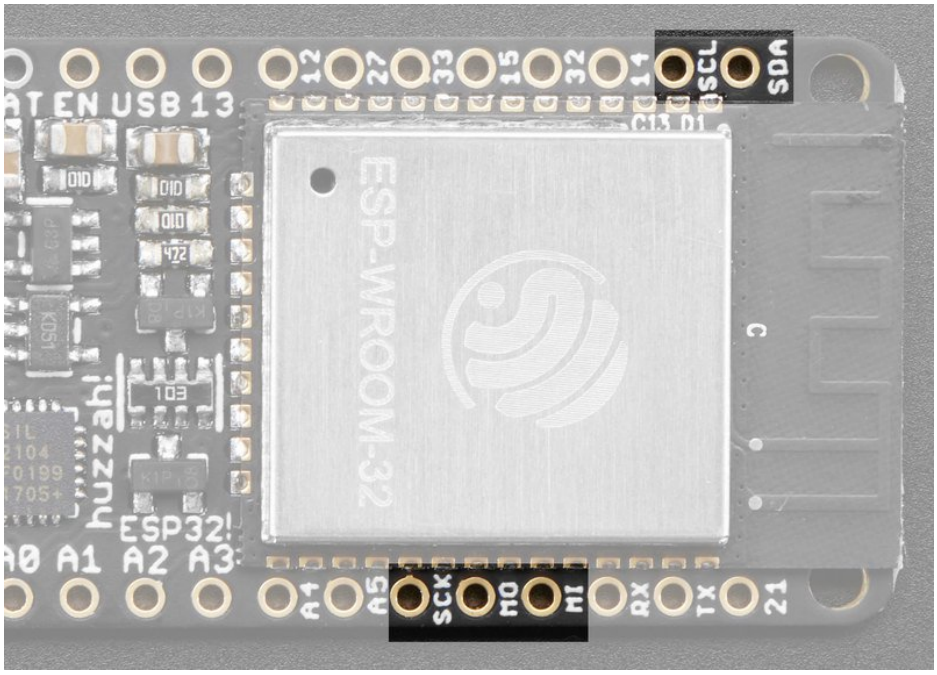
RX and **TX** are the additional Serial1 pins, and are *not* connected to the USB/Serial converter. That means you can use them to connect to UART-devices like GPS's, fingerprint sensors, etc.



The **TX** pin is the output *from* the module. The **RX** pin is the input *into* the module. Both are 3.3V logic

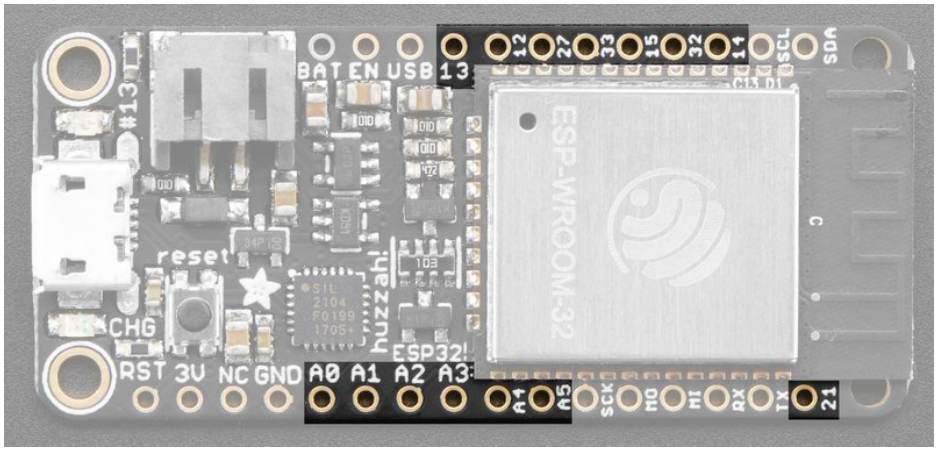
I2C & SPI pins

You can use the ESP32 to control I2C and SPI devices, sensors, outputs, etc. If using with Arduino, the standard **Wire** and **SPI** devices work as you'd expect!



Note that the I2C pins **do not have pullup resistors** already! You must add them if you want to communicate with an I2C device

GPIO & Analog Pins



There are tons of GPIO and analog inputs available to you for connecting LEDs, buttons, switches, sensors, etc. Here's the remaining pins available.

Bottom row:

- **A0** - this is an analog input A0 and also an analog output DAC2. It can also be used as a GPIO #26. It uses ADC #2
- **A1** - this is an analog input A1 and also an analog output DAC1. It can also be used as a GPIO #25. It uses ADC #2
- **A2** - this is an analog input A2 and also GPI #34. Note it is *not* an output-capable pin! It uses ADC #1
- **A3** - this is an analog input A3 and also GPI #39. Note it is *not* an output-capable pin! It uses ADC #1
- **A4** - this is an analog input A4 and also GPI #36. Note it is *not* an output-capable pin! It uses ADC #1
- **A5** - this is an analog input A5 and also GPIO #4. It uses ADC #2

- **21** - General purpose IO pin #21

Top row:

- **13** - This is GPIO #13 and also an analog input A12 on ADC #2. It's also connected to the red LED next to the USB port
- **12** - This is GPIO #12 and also an analog input A11 on ADC #2. This pin has a pull-down resistor built into it, we recommend using it as an output only, or making sure that the pull-down is not affected during boot.
- **27** - This is GPIO #27 and also an analog input A10 on ADC #2
- **33** - This is GPIO #33 and also an analog input A9 on ADC #1. It can also be used to connect a 32 KHz crystal.
- **15** - This is GPIO #15 and also an analog input A8 on ADC #2
- **32** - This is GPIO #32 and also an analog input A7 on ADC #1. It can also be used to connect a 32 KHz crystal.
- **14** - This is GPIO #14 and also an analog input A6 on ADC #2

There's also an external analog input

- **A13** - This is general purpose input #35 and also an analog input A13, which is a resistor divider connected to the **VBAT** line

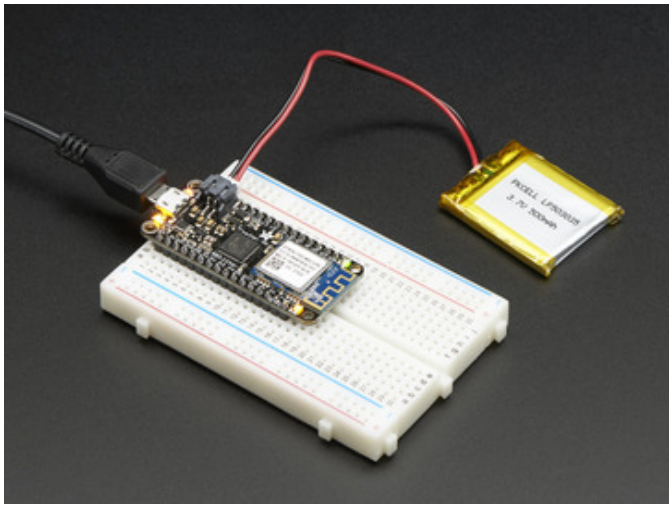
Note you can only read analog inputs on **ADC #1** once WiFi has started

Assembly

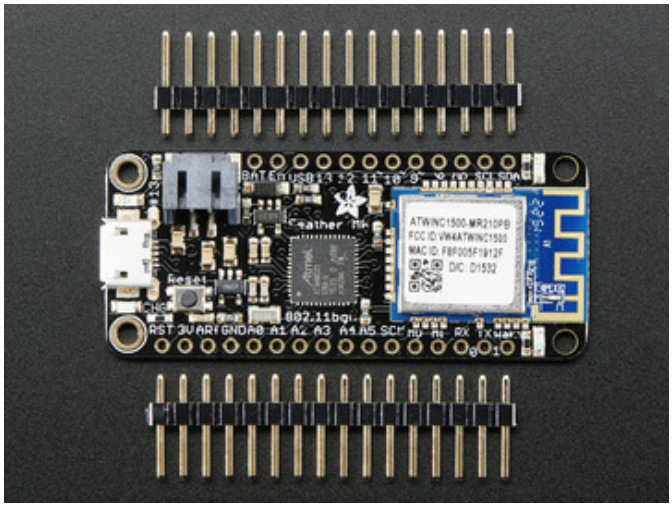
We ship Feathers fully tested but without headers attached - this gives you the most flexibility on choosing how to use and configure your Feather

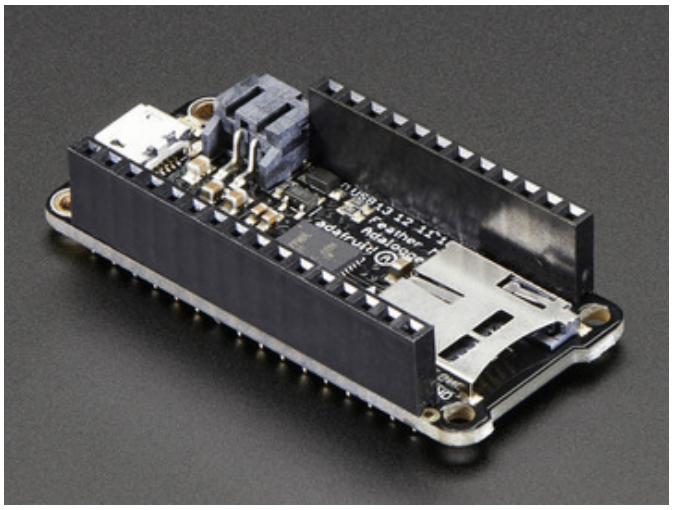
Header Options!

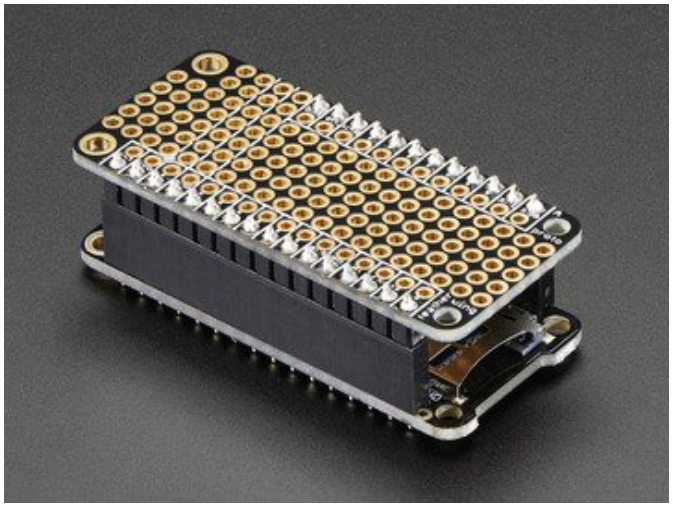
Before you go gung-ho on soldering, there's a few options to consider!



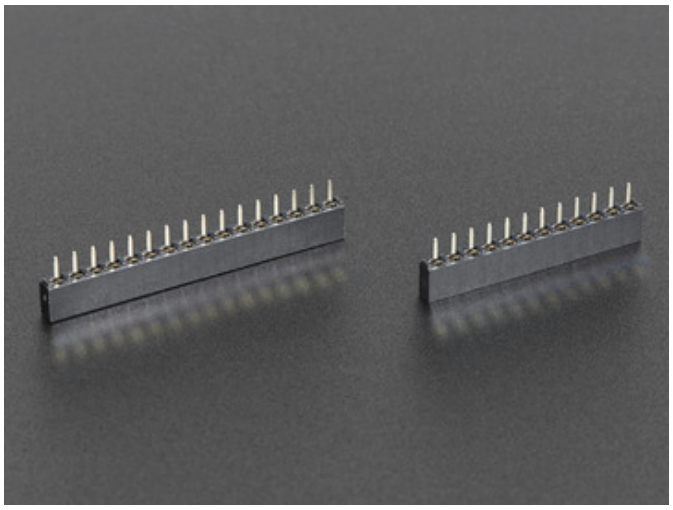
The first option is soldering in plain male headers, this lets you plug in the Feather into a solderless breadboard



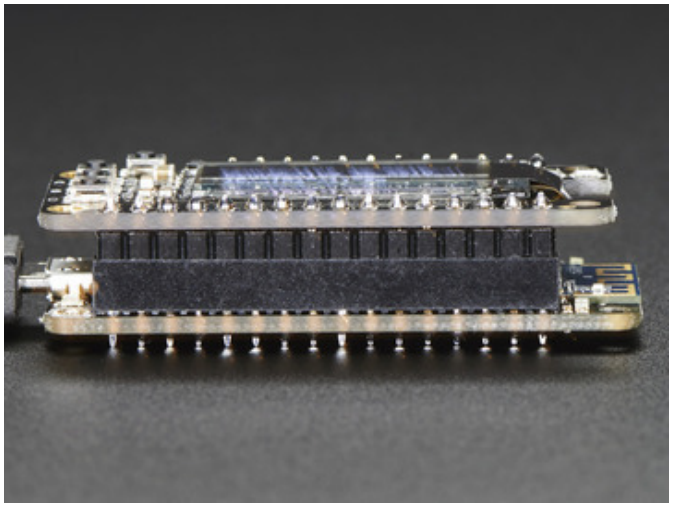


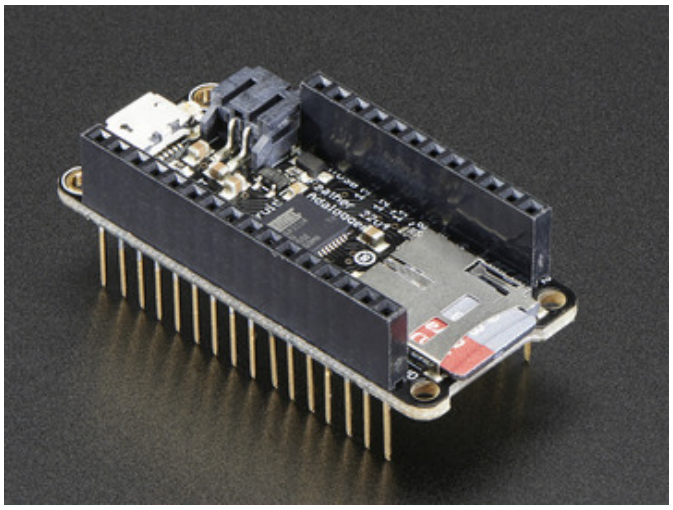


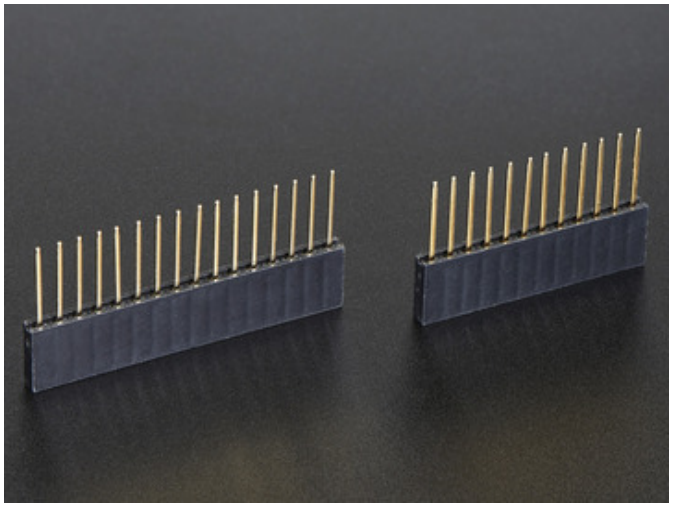
Another option is to go with socket female headers. This won't let you plug the Feather into a breadboard but it will let you attach featherwings very easily



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

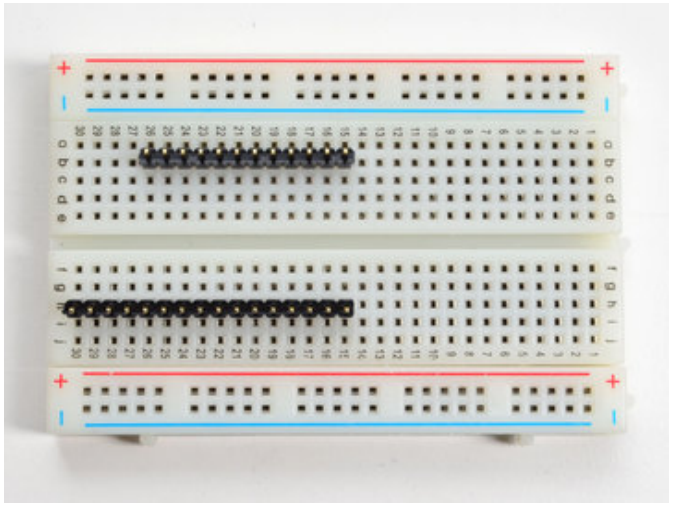






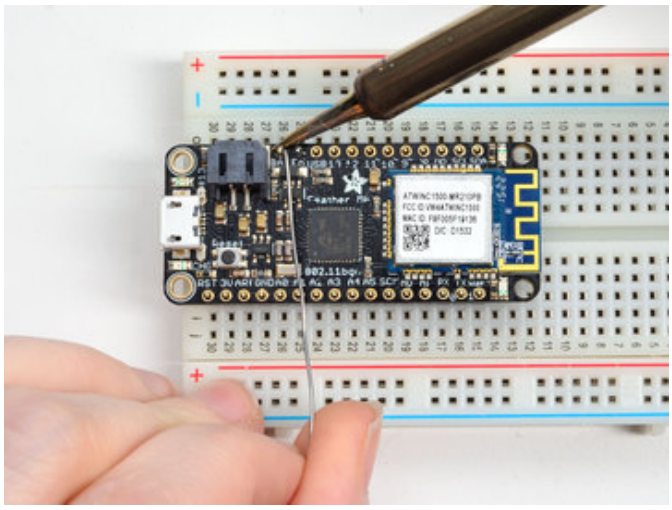
Finally, there's the "Stacking Header" option. This one is sort of the best-of-both-worlds. You get the ability to plug into a solderless breadboard *and* plug a featherwing on top. But its a little bulky

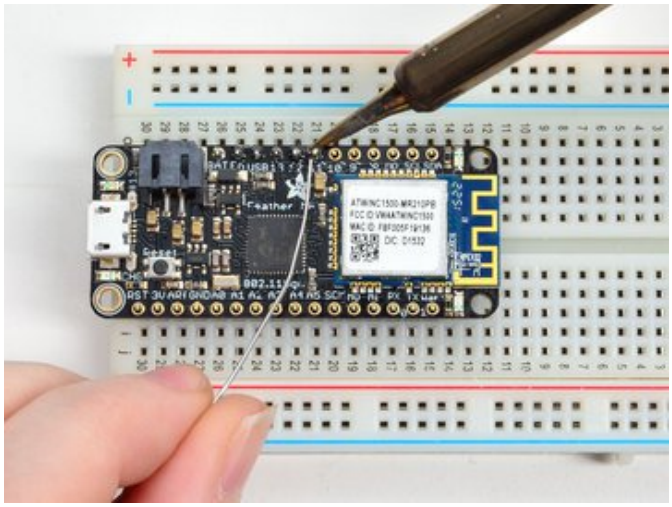
Soldering in Plain Headers

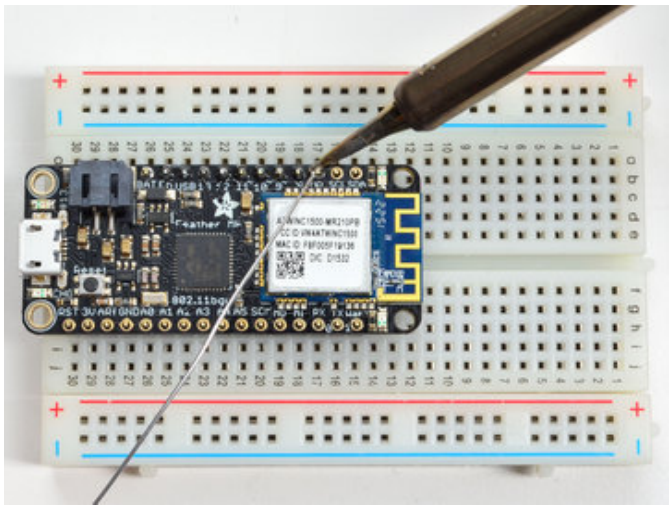


Prepare the header strip:

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







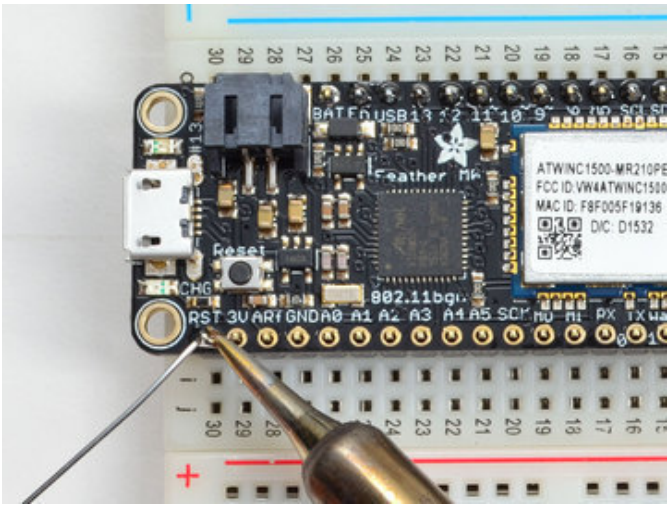
Add the breakout board:

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

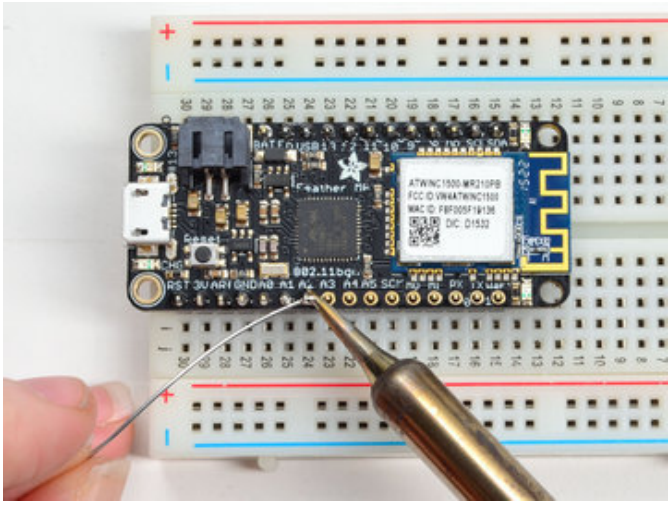
And Solder!

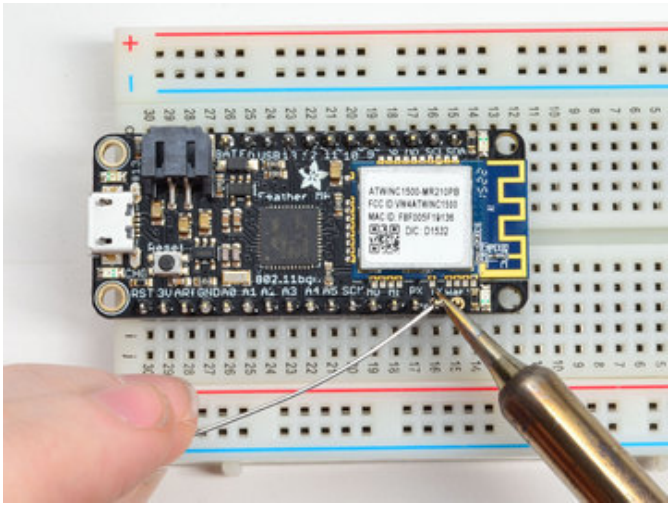
Be sure to solder all pins for reliable electrical contact.

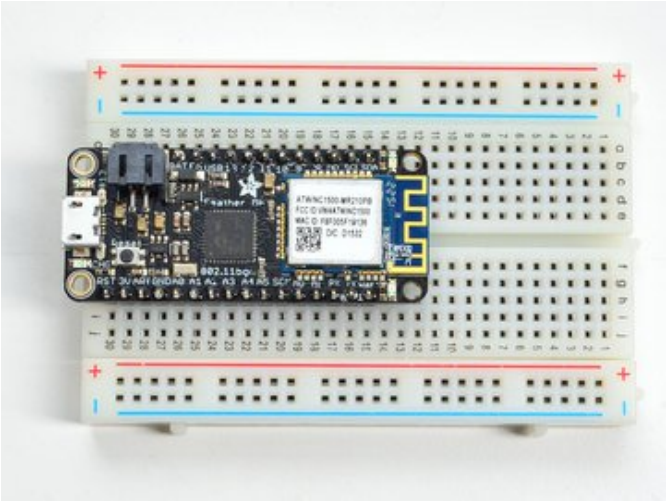
(For tips on soldering, be sure to check out our Guide to Excellent Soldering (https://adafru.it/aTk).



Solder the other strip as well.





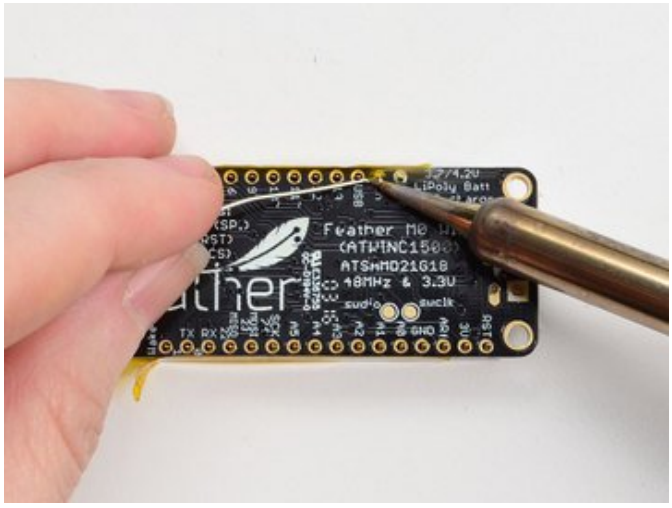


You're done! Check your solder joints visually and continue onto the next steps

Soldering on Female Header

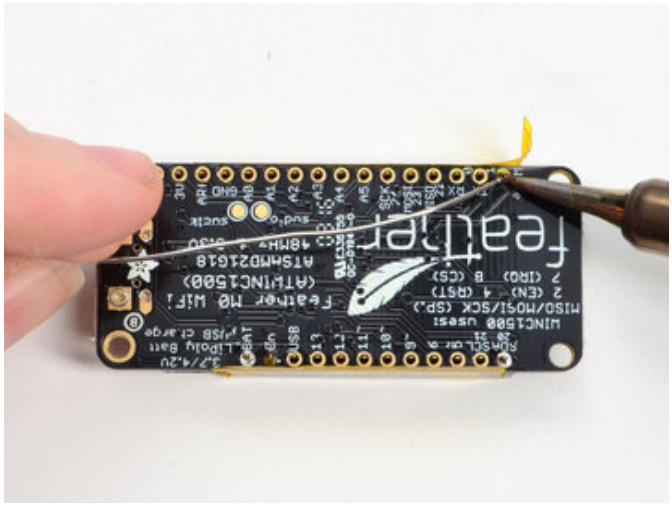
Tape In Place

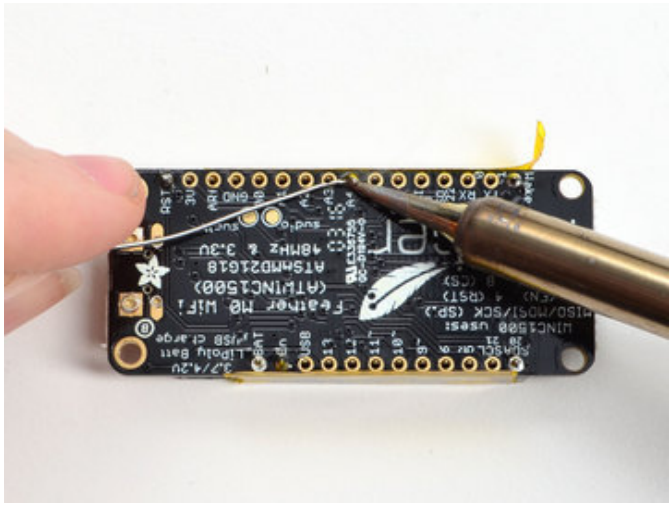
For sockets you'll want to tape them in place so when you flip over the board they don't fall out

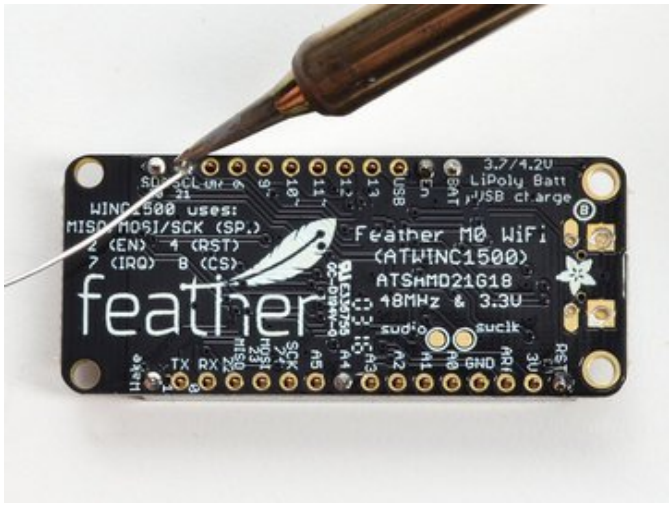


Flip & Tack Solder

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







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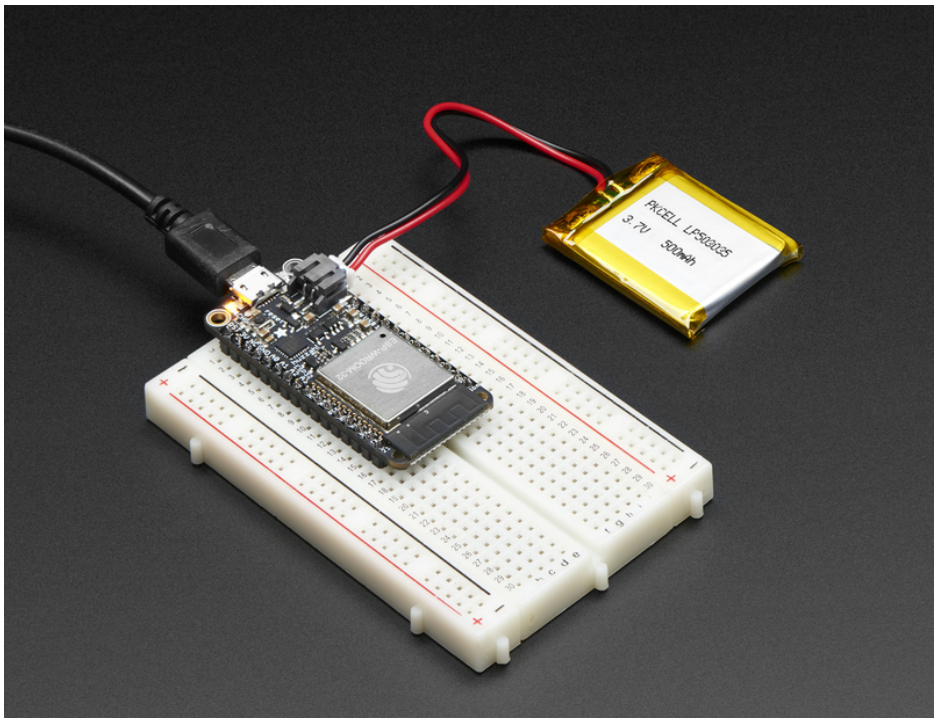
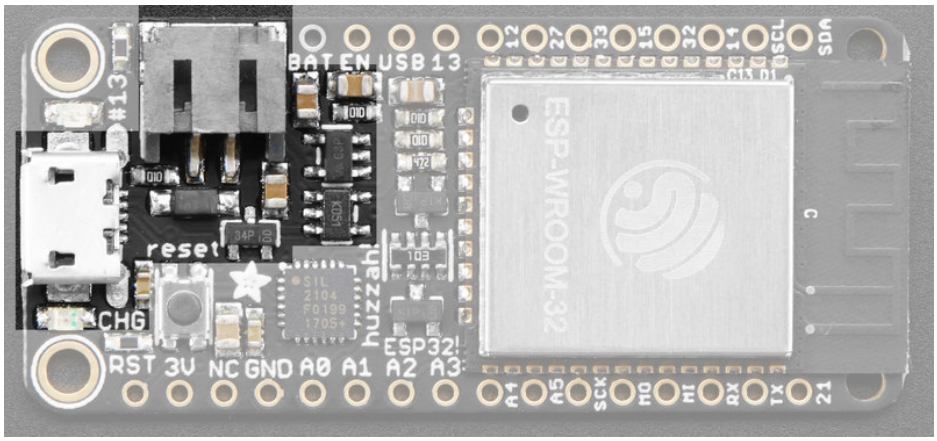


Battery + USB Power

We wanted to make the Feather HUZZAH32 easy to power both when connected to a computer as well as via battery. There's **two ways to power** a Feather. You can connect with a Micro USB cable (just plug into the jack) and the Feather will regulate the 5V USB down to 3.3V. You can also connect a 4.2/3.7V Lithium Polymer (Lipo/Lipoly) or Lithium Ion (Lilon) battery to the JST jack. This will let the Feather run on a rechargeable battery. **When the USB power is powered, it will automatically switch over to USB for power, as well as start charging the battery (if attached) at 200mA.** This happens 'hot-swap' style so you can always keep the LiPoly connected as a 'backup' power that will only get used when USB power is lost.

The JST connector polarity is matched to Adafruit LiPoly batteries. Using wrong polarity batteries can destroy your Feather

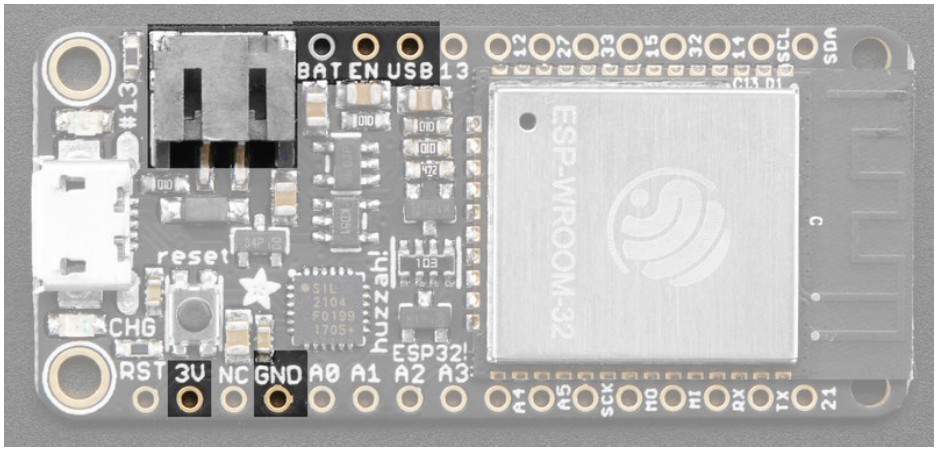


The above shows the Micro USB jack (left), Lipoly JST jack (top left), as well as the 3.3V regulator (to the right of the JST jack), changeover diode+transistor (below the JST jack) and the Lipoly charging circuitry (right below the regulator).

There's also a **CHG** LED next to the USB jack, which will light up while the battery is charging. This LED might also flicker if the battery is not connected, it's normal.

Power supplies

You have a lot of power supply options here! We bring out the **BAT** pin, which is tied to the lipoly JST connector, as well as **USB** which is the +5V from USB if connected. We also have the **3V** pin which has the output from the 3.3V regulator. We use a 500mA peak low-dropout regulator. Please budget 250mA for the WROOM32 module. While you can get 500mA total from it, you can't do it continuously from 5V as it will overheat the regulator. We use this to power the ESP32 which draws about 200mA continuous. The good news is you can put the ESP32 into sleep and low-power modes much easier.



Measuring Battery

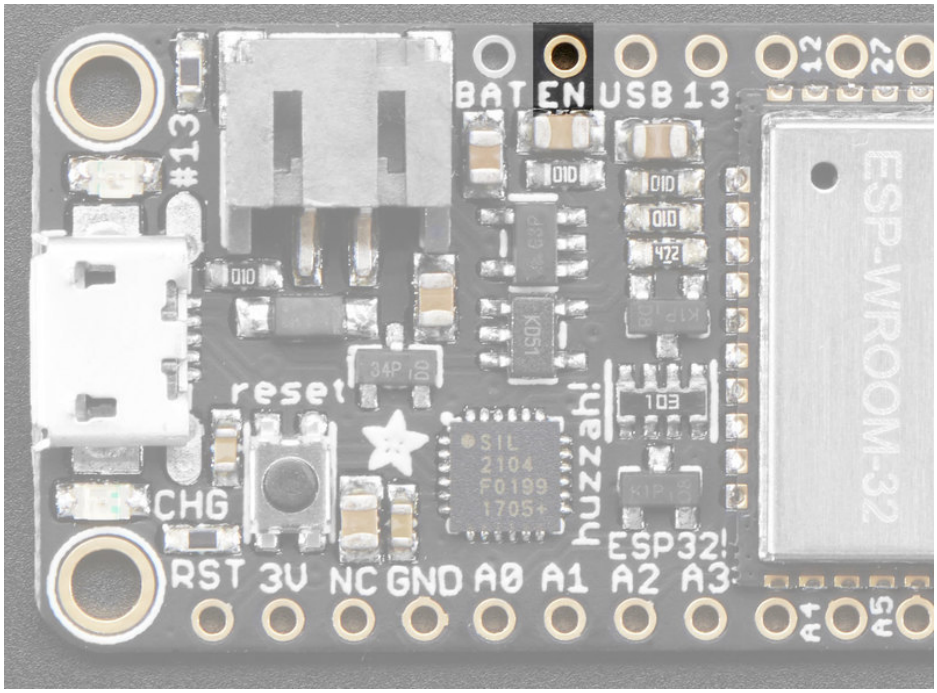
If you're running off of a battery, chances are you wanna know what the voltage is at! That way you can tell when the battery needs recharging. Lipoly batteries are 'maxed out' at 4.2V and stick around 3.7V for much of the battery life, then slowly sink down to 3.2V or so before the protection circuitry cuts it off. By measuring the voltage you can quickly tell when you're heading below 3.7V

Since the ESP32 has tons of ADC pins, we 'sacrifice' one for Lipoly battery monitoring. You can read half of the battery voltage off of **A13**. Don't forget to double the voltage you read, since there is a divider.

ENable pin

If you'd like to turn off the 3.3V regulator, you can do that with the **EN**(able) pin. Simply tie this pin to **Ground** and it will disable the 3V regulator. The **BAT** and **USB** pins will still be powered.

This will turn off the ESP32 processor as well as all onboard circuitry except the USB-Serial converter



Alternative Power Options

The two primary ways for powering a feather are a 3.7/4.2V LiPo battery plugged into the JST port *or* a USB power cable.

If you need other ways to power the Feather, here's what we recommend:

- For permanent installations, a 5V 1A USB wall adapter (https://adafru.it/duP) will let you plug in a USB cable for reliable power
- For mobile use, where you don't want a LiPoly, use a USB battery pack! (https://adafru.it/e2q)
- If you have a higher voltage power supply, use a 5V buck converter (https://adafru.it/DHs) and wire it to a USB cable's 5V and GND input (https://adafru.it/DHu)

Here's what you cannot do:

- **Do not use alkaline or NiMH batteries** and connect to the battery port - this will destroy the LiPoly charger and there's no way to disable the charger
- **Do not use 7.4V RC batteries on the battery port** - this will destroy the board

The Feather *is not designed for external power supplies* - this is a design decision to make the board compact and low cost. It is not recommended, but technically possible:

- **Connect an external 3.3V power supply to the 3V and GND pins.** Not recommended, this may cause unexpected

behavior and the **EN** pin will no longer. Also this doesn't provide power on **BAT** or **USB** and some Feathers/Wings use those pins for high current usages. You may end up damaging your Feather.

- **Connect an external 5V power supply to the USB and GND pins.** Not recommended, this may cause unexpected behavior when plugging in the USB port because you will be back-powering the USB port, which *could* confuse or damage your computer.

Using with Arduino IDE

We primarily recommend using the ESP32 Feather with Arduino.

Check out the Espressif Arduino repository for details on how to install it (https://adafru.it/weF)

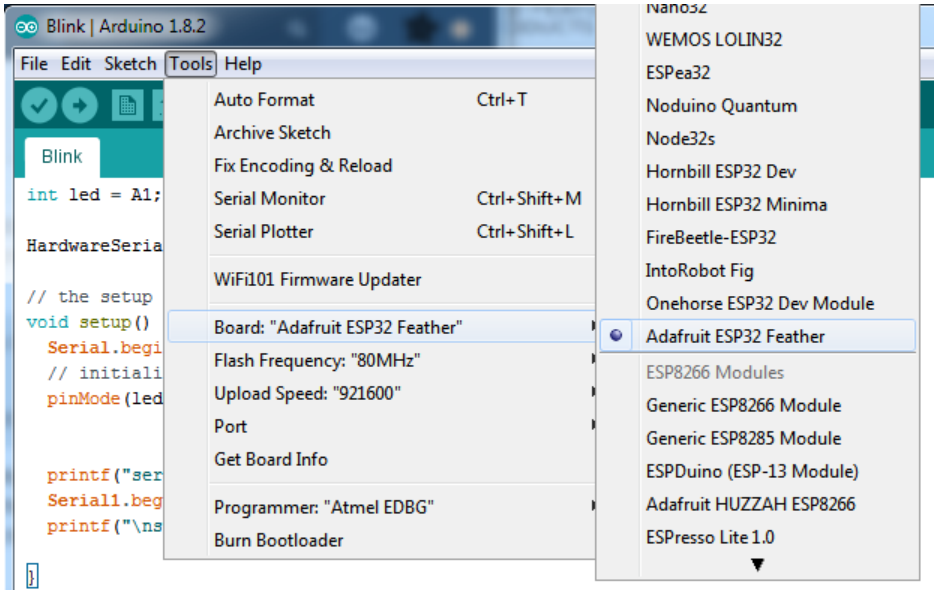
Don't forget you will also need to install the SiLabs CP2104 Driver

https://adafru.it/vrf

https://adafru.it/vrf

Once installed, use the **Adafruit ESP32 Feather** board in the dropdown

For **Upload speed** we've found **921600** baud works great.



Some pins are special about the ESP32 - here's a list of 'notorious' pins to watch for!

- **A2 / I34** - this pin is an *input only!* You can use it as an analog input so we suggest keeping it for that purpose
- **A3 / I39** - this pin is an *input only!* You can use it as an analog input so we suggest keeping it for that purpose
- **IO12** - this pin has an internal pulldown, and is used for booting up. We recommend not using it or if you do use it, as an output only so that nothing interferes with the pulldown when the board resets
- **A13 / I35** - this pin is not exposed, it is used only for measuring the voltage on the battery. The voltage is divided by 2 so be sure to double it once you've done the analog reading

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Why does the yellow CHARGE LED blink while USB powered?

The charging circuit will flash when there is no LiPoly battery plugged in. It's harmless and doesn't mean anything. When a LiPoly battery is connect it will stabilize the charger and will stop flashing

Why can I not read analog inputs once WiFi is initialized?

Due to the design of the ESP32, you can only read analog inputs on **ADC #1** once WiFi has started. That means pins on **ADC 2** (check the pinouts page) can't be used as analog inputs

Downloads

Files

- ESP32 WROOM32 Datasheet (https://adafru.it/BAL)
- ESP32 Technical Manual (https://adafru.it/weC)
- *Don't forget to visit esp32.com for the latest and greatest in ESP32 news, software and gossip!* (https://adafru.it/weD)
- EagleCAD PCB files on github (https://adafru.it/weE)
- Fritzing object in the Adafruit Fritzing library (https://adafru.it/aP3)

Schematic and Fabrication print