Which CircuitPython Board is Right for You?

Created by Kattni Rembor

https://learn.adafruit.com/choose-your-circuitpython-board

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There are so many Adafruit microcontrollers that are compatible with CircuitPython, choosing a board can be overwhelming. Perhaps you have a feature in mind that you’re looking for. This helps narrow it down, but there may be multiple boards with that feature. So what can you do? Check out this guide!

This guide breaks down the CircuitPython compatible Adafruit microcontrollers into feature categories. Within those categories, each board has text explaining its other features to explain why you might choose it over another board.

For example, let's say you want a board that's WiFi enabled. Great! But which board do you choose? Maybe a built-in display would be ideal for your WiFi project. Check out the WiFi Enabled page, scan through the boards, and get a feel for their differences. You could find that PyPortal is perfect for you!
Perhaps you're new to electronics and programming. Maybe you're a pro, but you've never worked with CircuitPython. Working with CircuitPython is super simple, but requires that you have a CircuitPython compatible microcontroller. Some boards are better than others for getting started than others. So which one do you choose?

This page contains all of the beginner CircuitPython compatible boards and a bit about the features of each one. You're ready to get started, now to figure out what features will work best for you!

Circuit Playground Express

The Adafruit Circuit Playground Express, running the ATSAMD21 microcontroller, is the perfect board for beginners to electronics and programming. It has tons built in: ten RGB NeoPixel LEDs, an accelerometer, temperature, light and sound sensors, mini speaker, two buttons, a slide switch, IR transmitter and receiver, little red LED, and eight alligator-clip friendly GPIO pads, seven of which can act as touch pads.

This is an excellent beginner choice that does not require any soldering.
Circuit Playground Bluefruit

The Adafruit Circuit Playground Bluefruit, running the Bluetooth LE capable nRF52840, is an all-in-one board designed to get you started with programming an electronics. It's loaded with all kinds of LEDs, sensors and inputs, including an accelerometer, light, temperature, and sound sensors, touch pads, buttons, switch, NeoPixel LEDs, speaker, and more. Additional capabilities can be added via the alligator clip friendly pads.

This is an excellent beginner choice that does not require any soldering.

Circuit Playground Express or Bluefruit?

There are two great Circuit Playground options for using CircuitPython. So which one is better for you? You'll be fine with either, but here a few key differences that may drive you one way or the other.

- The Circuit Playground Express has more support in MakeCode (/) / Code.org and the SAMD21 is a more universal processor. There's a lot more example codes for it. However, it's an older chip so not as powerful and of course, does not have Bluetooth LE wireless
- The Circuit Playground Bluefruit does not have an IR transceiver (for remote control projects) because it has BLE instead. The processor is more powerful, has tons more memory which comes in handy with CircuitPython projects as they grow. However, it's a newer chip, and does not have full MakeCode support, Code.org CS Discoveries support, or as many projects. It also has Bluetooth LE connectivity so it can wirelessly connect to computers, phones, tablets and other devices.
The original ATmega 32u4 based Circuit Playground (Renamed the Circuit Playground Classic) is NOT CircuitPython compatible. Use the Express or Bluefruit versions.

QT Py RP2040

Easily interface to STEMMA QT / Qwiic sensors and breakouts.

Adafruit QT Py RP2040

What a cutie pie! Or is it... a QT Py? This diminutive dev board comes with one of our new favorite chip, the RP2040. It's been made famous in the new https://www.adafruit.com/product/4900

The Adafruit QT Py uses an RP2040 microcontroller, has 11 GPIO pins, a built in RGB NeoPixel LED, and a USB Type C connector, in the same size, form factor and pinout as the Seeed Xiao. There is 8MB of flash for CircuitPython and file storage. The built in STEMMA QT connector makes it super simple to use any of the available STEMMA QT sensors and breakouts () with no soldering required.

This is a good choice if you want an easy way to interface to STEMMA QT / Qwiic connected sensors without a lot of expense

Feather M4 Express

Adafruit Feather M4 Express - Featuring ATSAMD51

It's what you've been waiting for, the Feather M4 Express featuring ATSAMD51. This Feather is fast like a swift, smart like an owl, strong like a ox-bird (it's half ox,...

https://www.adafruit.com/product/3857
The Adafruit Feather M4 Express is running the ATSAMD51 microcontroller. With some light soldering, this board enables you to use the many FeatherWings available, which provides a ton of possibilities without a lot of wiring necessary. It has 21 GPIO pins, a little red LED and an RGB NeoPixel LED. You can power it with and charge a lipoly battery.

A good choice if you want access to Feather ecosystem and its many FeatherWing add on boards. The board is very powerful and runs CircuitPython very nicely.

**Metro M4**

The Adafruit Metro M4, featuring the ATSAMD51 microcontroller, is a development board in the Metro form factor. It boasts 25 GPIO pins, along with four indicator LEDs and an RGB NeoPixel LED. It can be powered via USB using the micro USB connector, or through the DC jack. The great thing about this board is that it's compatible with Arduino Shields, meaning there are a ton of possibilities available without a lot of wiring necessary.

This board can also be used with the examples from the Metro Experimenter’s Guide.

A good choice if you want something in the classic Arduino UNO form factor for use with the many available Arduino shields. The board is very powerful and runs CircuitPython very nicely.

**Itsy Bitsy M4 Starter Kit**

A more hands on approach with some light soldering required.
CircuitPython Starter Kit with Adafruit Itsy Bitsy M4

You've heard about CircuitPython and maybe you want to get started fast with a breadboard-friendly microcontroller board! We recommend the ItsyBitsy M4 - a super fast chip...

https://www.adafruit.com/product/4028

This kit does require some soldering to attach the header pins to the Itsy Bitsy M4. It also requires building up each circuit to use the various components. However, this does allow you to gain more experience by being more hands on with the hardware.

This a good choice if you are comfortable soldering and building circuits and want a more hands on experience. The board is very powerful and runs CircuitPython very nicely.

WiFi Enabled

WiFi allows you to connect to your local network and access the Internet. This lets you do things like send/receive data to services like Adafruit IO. Or, you can grab some information from the Internet, like weather, sports scores, etc. and display it locally.

This page contains all of the WiFi enabled CircuitPython compatible boards and a bit about the features of each one. You know you want WiFi, now to figure out what other features will work best for you!
Metro ESP32-S2

Provides native WiFi support via ESP32-S2 processor.

The Adafruit Metro ESP32-S2 brings native WiFi to the Metro form factor. Unlike other metro boards, this board can be powered by a LiPo battery, as well as USB C and a DC jack.

Since it's a single chip compared to the Metro Airlift, it is less expensive - but it isn't going to be as fast because the one processor has to handle both running Python and managing WiFi. It's a great value with a good number of pins. Unlike the ESP32, the ESP32-S2 does not have bluetooth.

This is a good option if you want something general purpose you can use with Arduino Shields.

Metro M4 AirLift Lite

Provides WiFi support using an ESP32 as a WiFi co-processor.

The Adafruit Metro M4 AirLift Lite gives your next project a lift with AirLift - our witty name for the ESP32 co-processor that graces this Metro M4. You already know about the Adafruit Metro...
The Adafruit Metro M4 AirLift Lite combines the ATSAMD51 with an ESP32 WiFi co-processor in the Metro form factor. Easily add WiFi to projects using any compatible shields. The SAMD51 is powerful, the ESP32 is wireless - the combination of the two is what gives this fast board a solid chip for Python (M4) and offloading the Wireless work to a friend (ESP32). It won't be as cheap as an all-in-one but if you need a well documented processor, the SAMD M4 is very well supported by many languages and IDEs.

This is a good option if you want something general purpose you can use with Arduino Shields.

Matrix Portal

Provides WiFi support using an ESP32 as a WiFi co-processor.

The Adafruit Matrix Portal is basically a Metro Airlift in a different shape. It combines an ATSAMD51 M4 main processor with an ESP32 WiFi co-processor and can be used to easily add WiFi to RGB LED matrices. It plugs directly into the back of any HUB-75 compatible display (all the ones we stock will work) from 16x32 up to 64x64, and adds three buttons, a STEMMA QT connector and a digital/analog 3-pin JST connector.

This is a good option if you want to easily display things on a RGB matrix, whether that something comes from the Internet or not.

MagTag 2.9"

Provides native WiFi support via ESP32-S2 processor.
Adafruit MagTag - 2.9" Grayscale E-Ink WiFi Display
The Adafruit MagTag combines the new ESP32-S2 wireless module and a 2.9" grayscale E-Ink display to make a low-power IoT display that can show data on its screen even when power...
https://www.adafruit.com/product/4800

The Adafruit MagTag 2.9" uses the ESP32-S2 wireless module and has a built-in 2.9" grayscale eInk display. It also has an accelerometer, four buttons, four RGB NeoPixel LEDs and a speaker. It's designed to be low power, so it can run off of a battery connected to the port on the back, for many weeks.

This is a good option if you want a low power option for displaying things from the Internet.

PyPortal

Provides WiFi support using an ESP32 as a WiFi co-processor.

Adafruit PyPortal - CircuitPython Powered Internet Display
PyPortal, our easy-to-use IoT device that allows you to create all the things for the “Internet of Things” in minutes. Make custom touch screen interface...
https://www.adafruit.com/product/4116

The Adafruit PyPortal is a WiFi enabled board with a built in display. Like the Metro AirLift, it has two processors - a SAMD51 main processor + the ESP32 is a WiFi co-processor. It also comes with a 3.2” 320 x 240 color TFT with resistive touch screen, a speaker, light sensor, temperature sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors. It has a lot of projects and is very very easy to get going to display data from the Internet.
This is a good option if you want to display something from the Internet on a TFT display especially if you want a touch screen (the Matrix Portal and MagTag do not have touch screen overlays)

**PyPortal Pynt**

Provides WiFi support using an ESP32 as a WiFi co-processor.

![PyPortal Pynt](https://www.adafruit.com/product/4465)

The Adafruit PyPortal Pynt has everything the PyPortal does but in a smaller package. The display is a 2.4” diagonal 320 x 240 color TFT with resistive touch screen. It also includes a speaker, light sensor, temperature sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good option if you want to display something from the Internet on a TFT display with a touch screen

**PyPortal Titano**

Provides WiFi support using an ESP32 as a WiFi co-processor.

![PyPortal Titano](https://www.adafruit.com/product/4444)

The PyPortal Titano is the big sister to our popular PyPortal now with twice as many pixels! The PyPortal...

[https://www.adafruit.com/product/4444](https://www.adafruit.com/product/4444)
The Adafruit PyPortal Titano is nearly the same as the PyPortal with a bigger display and no temperature sensor. The display is a higher resolution 3.5” diagonal 320 x 480 color TFT with resistive touch screen. It also includes a speaker, light sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good option if you want to display something from the Internet on a TFT display with a higher resolution and touch screen.

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Bluetooth Enabled

Bluetooth allows for short range wireless connectivity between other Bluetooth devices. You can even use your BLE enabled smart phone with the free BLE Connect App to connect and control your board.

This page contains all of the Bluetooth enabled CircuitPython compatible boards and a bit about the features of each one. You know you want Bluetooth, now to figure out what other features will work best for you!

All of these are BLUETOOTH LOW ENERGY only! Not Bluetooth Classic!

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Circuit Playground Bluefruit

Provides BLE connectivity via the nRF52840 processor.
Circuit Playground Bluefruit - Bluetooth Low Energy

Circuit Playground Bluefruit is our third board in the Circuit Playground series, another step towards a perfect introduction to electronics and programming. We've...

https://www.adafruit.com/product/4333

The Circuit Playground Bluefruit, running an nRF52840, is an all-in-one board designed to get you started with programming an electronics. It's loaded with all kinds of LEDs, sensors and inputs, including an accelerometer, light, temperature, and sound sensors, touch pads, buttons, switch, NeoPixel LEDs, speaker, and more. Additional capabilities can be added via the alligator clip friendly pads.

This is an excellent beginner choice that does not require any soldering. In addition to Arduino there is some MakeCode support as well.

CLUE

Provides BLE connectivity via the nRF52840 processor.

Adafruit CLUE - nRF52840 Express with Bluetooth LE

Do you feel like you just don't have a CLUE? Well, we can help with that - get a CLUE here at Adafruit by picking up this sensor-packed development board. We wanted to build some...

https://www.adafruit.com/product/4500

The Adafruit CLUE is a Bluetooth Low Energy enabled board in the micro:bit form factor with a built-in 1.3” 240×240 Color IPS TFT display. It includes two buttons, and light/proximity/color, 9-DoF motion, sound, humidity, and pressure/temperature sensors. There is a STEMMA QT connector to make it super simple to connect many other sensors and breakouts to your project with no soldering necessary.
It’s perfect when you want all the sensors and a screen + two buttons built in. The micro:bit formfactor is excellent when you want to plug in various accessories.

This is an excellent beginner choice that does not require any soldering, and has just about every sensor.

**Feather nRF52840**

Provides BLE connectivity via the nRF52840 processor.

The Adafruit Feather nRF52840 Express is the new Feather family member with Bluetooth Low Energy and native USB support featuring the nRF52840! It’s... [https://www.adafruit.com/product/4062](https://www.adafruit.com/product/4062)

The Adafruit Feather nRF52840 is a Bluetooth Low Energy enabled board in the Feather form-factor. This means you can add Bluetooth to any of the many FeatherWings available. You can power it with and charge a lipoly battery.

This is a good choice if you want BLE connectivity in the Feather form factor.

**Feather nRF52840 Sense**

Provides BLE connectivity via the nRF52840 processor.

The Adafruit Feather Bluefruit Sense takes our popular Feather nRF52840 Express and adds a smorgasbord of sensors... [https://www.adafruit.com/product/4516](https://www.adafruit.com/product/4516)
The Adafruit Feather nRF52840 Sense is a BLE enabled board packed with sensors including light/proximity/color, 9-DoF motion, sound, humidity, and pressure/temperature sensors. Since it's a Feather, you can add BLE and these sensors to any of the many FeatherWings available. You can power it with and charge a lipoly battery.

It's kind of like a CLUE but without the screen, buttons, buzzer or micro:bit connector. On the other hand, it's a lot smaller and has lipoly charging built in.

This is a good choice if you want BLE connectivity in the Feather form factor - plus some built in sensors.

**ItsyBitsy nRF52840**

Provides BLE connectivity via the nRF52840 processor.

Adafruit ItsyBitsy nRF52840 Express - Bluetooth LE
What's smaller than a Feather but larger than a Trinket? It's an Adafruit ItsyBitsy nRF52840 Express featuring the Nordic nRF52840 Bluetooth LE...
https://www.adafruit.com/product/4481

The Adafruit ItsyBitsy nRF52840 makes it easy to add Bluetooth to smaller projects or projects with smaller spaces. It includes special Vhigh output pin to give you the higher voltage from power, for driving NeoPixels, servos, and other 5V-logic devices directly.

This is a good choice if you want BLE connectivity in a small form factor.
A display allows you to show all kinds of information from your project, including sensor data, directly on your microcontroller board. You can add external displays to other boards if you want, but boards with built-in displays provide ready-to-go options.

This page contains all of the CircuitPython compatible boards with a built-in display and a bit about the features of each one. You know you want a display, now to figure out what other features will work best for you!

**MagTag 2.9"**

Comes with a 2.9" grayscale E-Ink display.

The Adafruit MagTag combines the new ESP32-S2 wireless module and a 2.9" grayscale E-Ink display to make a low-power IoT display that can show data on its screen even when power...  
[https://www.adafruit.com/product/4800](https://www.adafruit.com/product/4800)

The Adafruit MagTag 2.9" uses an ESP32-S2 wireless module and has a built-in 2.9" grayscale eInk display. It also has an accelerometer, four buttons, four RGB NeoPixel
LEDs and a speaker. It's designed to be low power, so it can run off of a battery connected to the port on the back.

This is a good option if you want low power or just want eInk.

**Note - the eInk display is retained even when power is removed.**

## PyPortal

Comes with 3.2” 320 x 240 color TFT LCD display.

The Adafruit PyPortal is a WiFi enabled board with a built in display. It uses an ESP32 as a WiFi co-processor. It also comes with a 3.2” 320 x 240 color TFT LCD with resistive touch screen, a speaker, light sensor, temperature sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good general purpose option with WiFi capability.

## PyPortal Pynt

Comes with a 2.4” 320 x 240 color TFT LCD display.
Adafruit PyPortal Pynt - CircuitPython Powered Internet Display
The PyPortal Pynt is the little sister to our popular PyPortal - zapped with a shrink ray to take the design...
https://www.adafruit.com/product/4465

The PyPortal Pynt has everything the PyPortal does, but in a smaller package. The display is a 2.4” diagonal 320 x 240 color TFT LCD with resistive touch screen. It also includes a speaker, light sensor, temperature sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good general purpose option with WiFi capability.

PyPortal Titano

Comes with a 3.5” 320 x 480 color TFT LCD display.

The Adafruit PyPortal Titano is nearly the same as the PyPortal with a bigger display and no temperature sensor. The display is a higher resolution 3.5” diagonal 320 x 480 color TFT LCD with resistive touch screen. It also includes a speaker, light sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good general purpose option with WiFi capability.
CLUE

Comes with a 1.3" 240 x 240 color IPS TFT LCD display.

Adafruit CLUE - nRF52840 Express with Bluetooth LE
Do you feel like you just don't have a CLUE? Well, we can help with that - get a CLUE here at Adafruit by picking up this sensor-packed development board. We wanted to build some...
https://www.adafruit.com/product/4500

The Adafruit CLUE is a Bluetooth Low Energy enabled board in the micro:bit form factor with a built-in 1.3” 240×240 Color IPS TFT LCD display. It includes two buttons, and light/proximity/color, 9-DoF motion, sound, humidity, and pressure/temperature sensors. There is a STEMMA QT connector to make it super simple to connect many other sensors and breakouts () to your project with no soldering necessary.

This is a good option beginner option with Bluetooth BLE capability.

PyGamer

Comes with a 1.8" 160 x 128 color TFT LCD display.

Adafruit PyGamer for MakeCode Arcade, CircuitPython or Arduino
What fits in your pocket, is fully Open Source, and can run CircuitPython, MakeCode Arcade or Arduino games you write yourself? That's right, it's the Adafruit...
https://www.adafruit.com/product/4242

The Adafruit PyGamer is designed for open source game design, with a 1.8" 160x128 color TFT LCD display, analog thumbstick, 4 buttons, RGB NeoPixel LEDs, accelerometer, light sensor, stereo headphone jack, external speaker connector, STEMMA connectors, and lipoly battery connector. It also has FeatherWing-
compatible headers on the back to enable easy use of the many FeatherWings available(). The holes in the corners allow for connecting a lanyard to wear the PyGamer as a conference badge.

This is a good choice if you want to play with small game development.

**PyBadge**

Comes with a 1.8" 160 x 128 color TFT LCD display.

![Adafruit PyBadge for MakeCode Arcade, CircuitPython, or Arduino](https://www.adafruit.com/product/4200)

What's the size of a credit card and can run CircuitPython, MakeCode Arcade or Arduino? That's right, it's the Adafruit PyBadge! We wanted to see how much we...

https://www.adafruit.com/product/4200

The Adafruit PyBadge is the size of a credit card and uses an ATSAMD51 microcontroller. It has a 1.8" 160x128 color TFT LCD display, 8 user-controllable buttons, accelerometer, RGB NeoPixel LEDs, light sensor, built in speaker and external speaker connector, STEMMA connectors, and lipoly battery connector. The PyBadge also has FeatherWing-compatible headers on the back to enable easy use of the many FeatherWings available(). The holes in the corners allow for connecting a lanyard to wear the PyBadge as a conference badge.

This is a good choice if you want something you can wear like a badge.

**PyBadge LC**

Comes with a 1.8" 160 x 128 color TFT LCD display.
Adafruit PyBadge LC - MakeCode Arcade, CircuitPython, or Arduino

What's the size of a credit card and can run CircuitPython, MakeCode Arcade or Arduino even when you're on a budget? That's right, it's the Adafruit...

https://www.adafruit.com/product/3939

The Adafruit PyBadge LC is a PyBadge on a budget - it's the size of a credit card, uses an ATSAMD51 microcontroller, has a 1.8" 160x128 color TFT LCD display, 8 user-controllable buttons, an RGB NeoPixel LED, light sensor, built in speaker, and lipoly battery connector. The holes in the corners allow for connecting a lanyard to wear the PyBadge LC as a conference badge.

This is a good choice if you want something you can wear like a badge - on a budget.

EdgeBadge

Comes with a 1.8" 160 x 128 color TFT LCD display.

Adafruit EdgeBadge - TensorFlow Lite for Microcontrollers

Machine learning has come to the 'edge' - small microcontrollers that can run a very miniature version of TensorFlow Lite to do ML computations. But you don't...

https://www.adafruit.com/product/4400

The Adafruit EdgeBadge does everything the PyBadge does, but includes a microphone for machine learning projects. It's the size of a credit card, uses an ATSAMD51 microcontroller, has a 1.8" 160x128 color TFT LCD display, 8 user-controllable buttons, accelerometer, RGB NeoPixel LEDs, light sensor, built in speaker and external speaker connector, STEMMA connectors, and lipoly battery connector. It also has FeatherWing-compatible headers on the back to enable easy use of the many FeatherWings available (). The holes in the corners allow for connecting a lanyard to wear the PyBadge as a conference badge.
This is a good choice if you want something you can wear like a badge - and do machine learning.

Hallowing M4 Express

Comes with a 1.54" 240 x 240 color IPS TFT LCD display.

Adafruit HalloWing M4 Express - Goth
Adafruit Black Edition
This is Hallowing..this is Hallowing...
Hallowing! Hallowing! Following up on 2018's
https://www.adafruit.com/product/4300

The Adafruit Hallowing M4 Express runs an ATSAMD51 microcontroller, has 8 MB of SPI flash for storing animations, sounds, images, and so on, four side-lit RGB NeoPixel LEDs, four touch pads, an accelerometer, light sensor, speaker driver, JST ports for NeoPixels, servos, and I2C (Grove compatible), lipoly battery port with charging capability, on/off switch, female feather headers for use of the many FeatherWings available (), and has a 1.54" sized 240x240 full color IPS TFT LCD. The display has 4x the pixels of the Hallowing M0 Express and is IPS for great color and brightness. This board is great for an adorable wearable, badge, development kit, or the engine for your next cosplay or prop.

This is a good choice if you want something you can use in costumes or props.

Hallowing M0 Express

Comes with a 1.44" 128 x 128 color TFT LCD display.
Adafruit HalloWing M0 Express
This is Hallowing..this is Hallowing...
Hallowing! Hallowing! Are you the kind of person who doesn't...
https://www.adafruit.com/product/3900

The Adafruit HalloWing M0 Express runs an ATSAMD21 microcontroller, has 8 MB of SPI flash for storing animations, sounds, images, and so on, status RGB NeoPixel LEDs, four touch pads, an accelerometer, light sensor, speaker driver, JST ports for NeoPixels, servos, and I2C (Grove compatible), lipoly battery port with charging capability, on/off switch, female feather headers for use of the many FeatherWings available [], and a 1.44" sized 128x128 full color TFT LCD display. This board is great for an adorable wearable, badge, development kit, or the engine for your next cosplay or prop.

This is a good choice if you want something you can use in costumes or props.

MONSTER M4SK

Comes with two (2) 1.54" 240 x 240 color IPS TFT LCD displays.

Adafruit MONSTER M4SK - DIY Electronic Eyes Mask
Peep dis! Have you always wanted to have another pair of eyes on the back of your head? Or outfit your costume with big beautiful orbs? The MONSTER M4SK https://www.adafruit.com/product/4343

The Adafruit MONSTER M4SK runs an ATSAMD51 microcontroller, has 8 MB of SPI flash for storing animations, sounds, images, and so on, a touch pad nose, lipoly battery port with charging capability, stereo headphone jack, speaker driver, a 4-pin STEMMA JST connector for I2C (Grove compatible), two 3-pin STEMMA JST connectors with digital/analog/PWM for LEDs or servos, a 4-pin JST SH port for
connecting an optional PDM microphone, three buttons, a light sensor, on/off switch, and two 240x240 pixel IPS TFT LCD displays. The displays can be separated with pliers/cutters and then wired together with a 9-pin JST SH cable up to 100mm long so the eyes can be re-positioned or freely attached.

This is a good choice if you really like animated eyes projects.

Tiny Boards

Sometimes projects call for a wee small microcontroller board. These products are cost effective solutions when you just want to do a few things, like read a few buttons and drive some NeoPixels, or in using them for wearable projects.

This page contains all of the diminutive CircuitPython compatible boards and a bit about the features of each one. You know you want a tiny board, now to figure out what other features will work best for you!

QT Py

Easily interface to STEMMA QT / Qwiic sensors and breakouts.
Adafruit QT Py - SAMD21 Dev Board with STEMMA QT
What a cutie pie! Or is it... a QT Py? This diminutive dev board comes with our favorite lil chip, the SAMD21 (as made famous in our GEMMA M0 and Trinket M0 boards). This time it...
https://www.adafruit.com/product/4600

The Adafruit QT Py uses an ATSAMD21 microcontroller, has 11 GPIO pins, a built in RGB NeoPixel LED, and a USB Type C connector, in the same size, form factor and pinout as the Seeed Xiao. There is an optional SOIC-8 SPI Flash chip footprint on the bottom. The built in STEMMA QT connector makes it super simple to use any of the available STEMMA QT sensors and breakouts with no soldering required.

This is a good choice if you want an easy way to interface to STEMMA QT / Qwiic connected sensors.

Trinket M0

A very minimalist board with only 5 GPIOs.

Adafruit Trinket M0 - for use with CircuitPython & Arduino IDE
The Adafruit Trinket M0 may be small, but do not be fooled by its size! It's a tiny microcontroller board, built around the Atmel ATSAMD21, a little chip with a lot...
https://www.adafruit.com/product/3500

The Adafruit Trinket M0 runs the ATSAMD21 microprocessor, has 5 GPIO pins, a little red LED and an RGB DotStar LED. This is a low cost option when you're looking to get started, or want to put together a project on a budget. It is pin compatible with the earlier (non-M0) Trinket, and a lot of projects can be upgraded with this board.

This is a good choice if you want the most minimal option.
GEMMA M0

Think of this as a wearable version of the Trinket M0.

Adafruit GEMMA M0 - Miniature wearable electronic platform
The Adafruit Gemma M0 is a super small microcontroller board, with just enough built-in to create many simple projects. It may look small and cute: round, about the...

https://www.adafruit.com/product/3501

Looking to add NeoPixels to your wearables or cosplay outfits? This board is the easiest way to do so.

The Adafruit GEMMA M0 run the ATSAMD21 microcontroller, an on/off switch, and a RGB DotStar LED. It has three input/output big-hole sew-pads that can be used for conductive thread, or alligator clips for fast prototyping. It can be powered via USB or through the JST battery connector (though it doesn't have charging capability).

It is pin compatible with the earlier (non-M0) Gemma, and a lot of projects can be upgraded with this board

This is a good choice if you want the most minimal wearable option.

ItsyBitsy M0 Express

A nice step up from the Trinket M0 with tons more GPIO pins.

Adafruit ItsyBitsy M0 Express - for CircuitPython & Arduino IDE
What's smaller than a Feather but larger than a Trinket? It's an Adafruit ItsyBitsy M0 Express! Small, powerful, with a rockin' ATSAMD21 Cortex M0...

https://www.adafruit.com/product/3727
The Adafruit ItsyBitsy M0 Express uses an ATSAMD21 microprocessor. It has 2 MB of SPI flash, a little red LED, a RGB DotStar LED, and 23 GPIO pins. It includes special Vhigh output pin to give you the higher voltage for driving NeoPixels, servos, and other 5V-logic devices directly.

This is an excellent choice for getting started with soldering and breadboarding.

**ItsyBitsy M4 Express**

The ItsyBitsy M0's big sister.

The Adafruit ItsyBitsy M4 Express uses a more powerful ATSAMD51 microprocessor. It has 2 MB of SPI flash, a little red LED, a RGB DotStar LED, and 23 GPIO pins. It includes special Vhigh output pin to give you the higher voltage for driving NeoPixels, servos, and other 5V-logic devices directly.

This is an excellent choice for getting started with soldering and breadboarding.

**ItsyBitsy nRF52840 Express**

The ItsyBitsy M0 and M4's cool cousin with Bluetooth.
The Adafruit ItsyBitsy nRF52840 makes it easy to add Bluetooth to smaller projects or projects with smaller spaces. It includes special Vhigh output pin to give you the higher voltage for driving NeoPixels, servos, and other 5V-logic devices directly.

This is an excellent choice for getting started with soldering and breadboarding - with bonus Bluetooth capability.

**SD Card Capable**

A microSD card can add a significant amount of storage to your project for datalogging, or for things like images, animations, MP3s, WAV files and more.

This page includes all of the SD card capable CircuitPython compatible boards and a bit about the features of each one. You know you need increased storage, now to figure out what other features will work for you!
Grand Central M4 Express

A beast of a board, with tons of GPIO.

The Adafruit Grand Central M4 Express uses an ATSAMD51 microcontroller. It has 8 MB of SPI flash, 62 GPIO pins, an on/off switch, a little red LED, two RX/TX LEDs for data being sent over USB, and an RGB NeoPixel LED. This board can be powered via USB or via a DC jack. The built in microSD Card slot is connected to a SPI SERCOM (SDIO is not supported).

This is a good option if you want access to everything including the kitchen sink.

Feather STM32F405 Express

A Feather main board that also has an SD card slot.

The Adafruit Feather STM32F405 Express uses a STM32F405 microcontroller. It has 2MB of SPI flash, a USB type C connector for data and power, a JST connector for a lipoly battery with charging capabilities, one STEMMA QT connector for use with many other sensors and breakouts (not included) with no soldering required, an RGB NeoPixel LED,
and works with the many FeatherWings available. The built in microSD Card slot on the bottom of the board is connected to SDIO for potentially faster card read capability.

This is a good option if you want the SD card as part of a Feather main board-based project.

**Adalogger FeatherWing**

Add SD card capability to a Feather main board.

The Adafruit Adalogger FeatherWing makes it super simple to add a microSD card to any CircuitPython compatible Feather board (Note: this is an add-on card that must be connected/plugged onto another card which contains a microcontroller). Solder on headers and plug it directly into any Feather. The microSD card slot uses SPI (it is not SDIO fast access capable). It also includes an I2C real time clock and coin cell battery slot for using the RTC battery-backup capabilities.

This is a good option if you want to add SD card capability to a Feather main board.

**PyPortal**

An Internet connected display plus SD card capability!
Adafruit PyPortal - CircuitPython Powered Internet Display
PyPortal, our easy-to-use IoT device that allows you to create all the things for the “Internet of Things” in minutes. Make custom touch screen interface...
https://www.adafruit.com/product/4116

The Adafruit PyPortal is a WiFi enabled board with a built in display. It uses the ESP32 is a WiFi co-processor. It also comes with a 3.2” 320 x 240 color TFT LCD with a resistive touch screen, a speaker, light sensor, temperature sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good choice if you want to show many image files or store lots of data from the Internet.

PyPortal Pynt

An Internet connected display plus SD card capability!

Adafruit PyPortal Pynt - CircuitPython Powered Internet Display
The PyPortal Pynt is the little sister to our popular PyPortal - zapped with a shrink ray to take the design...
https://www.adafruit.com/product/4465

The Adafruit PyPortal Pynt has everything the PyPortal does but in a smaller package. The display is a 2.4” diagonal 320 x 240 color TFT with resistive touch screen. It also includes a speaker, light sensor, temperature sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good choice if you want to show many image files or store lots of data from the Internet.
PyPortal Titano

An Internet connected display plus SD card capability!

The Adafruit PyPortal Titano is nearly the same as the PyPortal with a bigger display and no temperature sensor. The display is a higher resolution 3.5” diagonal 320 x 480 color TFT LCD with a resistive touch screen. It also includes a speaker, light sensor, NeoPixel, microSD card slot, 8MB flash, plug-in ports for I2C and 2 analog/digital connectors.

This is a good choice if you want to show many image files or store lots of data from the Internet.

Chipsets

There are many CircuitPython compatible microcontroller boards, with several different processor chips. Each microcontroller has different qualities that make it good for different types of situations. This page discusses the different microcontrollers to help you understand the differences, and why you might choose one over another.

ATSAMD21 M0

The Microchip ATSAMD21 Cortex M0 is the only Cortex M0+ based chip that CircuitPython supports. It does not have native Bluetooth or WiFi.

• SPEED: 48 MHz
• FLASH: 32 to 256 kB
• RAM: 4 to 32 kB
• BLE: NO
The SAMD21 can run CircuitPython, but it has limitations. It is clocked at 48MHz and has no built in floating point functionality, meaning it generally runs slower. There are memory limitations - it caps out at 256KB of flash and 32KB of RAM. Flash is important for multiple reasons, including determining the number of built-in CircuitPython modules supportable in builds for SAMD21 boards. If the board doesn't have a separate SPI flash chip, as in the case of the non-Express boards (e.g. Trinket, Gemma, QT Py, etc.), the flash limitations become even more critical. Flash space impacts how complex your code can be and how many libraries you can import, which determines things like how many sensors you can use at the same time.

The benefit is that it's small and lower cost than many of the other microcontrollers mentioned on this page.

**ATSAMD51 M4**

The Microchip [ATSAMD51 Cortex M4](https://www.microchip.com) microcontroller is powerful. It does not have native Bluetooth or WiFi.

- SPEED: 120 MHz
- FLASH: 256 to 1024 kB
- RAM: 128 to 256 kB
- BLE: NO
- WIFI: NO

The Cortex M4 means it can do faster floating point math, so all division will be faster. It generally executes faster than the SAMD21, as the SAMD51 is clocked at 120mhz by default. It’s a good option in that it has a lot more RAM - up to 256KB RAM - which means you can do more things all at once in your code. Most of the SAMD51 chips have more built in flash as well, meaning less limitations on the built-in CircuitPython modules.

It's a great all around chip, as long as you're not looking for WiFi or Bluetooth connectivity.
nRF52840

The Nordic Semiconductor nRF52840 is not as fast as the ATSAMD51, but it does have native Bluetooth capabilities.

- SPEED: 64 MHz
- FLASH: 1024 kB
- RAM: 256 kB
- BLE: YES
- WIFI: NO

An nRF52840 like a SAMD51, is also a Cortex M4 based chip, so it's faster than the SAMD21. However, it's clocked slower than SAMD51, and therefore the nRF52840 is not as speedy as SAMD51. It has 1MB of flash, and 256KB of RAM. It is important to note that both the flash and the RAM are shared with the Bluetooth code - those numbers are the built in flash and RAM, so, the amount available to the user is less because it is sharing with Bluetooth stack. The chip does not do WiFi.

The important feature of this chip is the native Bluetooth capabilities - if you want Bluetooth in CircuitPython, this chip is the way to go.

STM32F405

The ST Microelectronics STM32F405 is an all-around faster microcontroller than many of the other microcontrollers covered here.

- SPEED: 168 MHz
- FLASH: 1024 kB
- RAM: 192 kB
- BLE: NO
- WIFI: NO

The STM32F405 is also a Cortex M4 based chip. It does not support native WiFi or Bluetooth. The Adafruit STM32F405 boards do not currently ship with a UF2 bootloader, so installing and updating CircuitPython requires more steps than simply dragging and dropping a UF2 file onto a BOOT drive. Note that only 128kB of RAM is available in CircuitPython. It's easier and cheaper to connect a debugger to this board than an ATSAMD board, it can be programmed without an external programmer using DFU, and it is very difficult to brick (render inoperable). However, it isn't as well supported in Arduino.
This microcontroller is great for folks looking to take extra steps with their project or learning process.

ESP32

The Espressif ESP32 has both Bluetooth and WiFi capabilities, but does not run CircuitPython natively. Instead, CircuitPython boards use the ESP32 as a co-processor for WiFi and Bluetooth capabilities. Note that it cannot do WiFi and Bluetooth at the same time.

The ESP32 is not directly supported by CircuitPython because it does not have native USB connectivity.

**NOTE:** The ESP32 and the ESP32-S2 are different microcontrollers with differing capabilities.

ESP32-S2

The Espressif ESP32-S2 has native WiFi capabilities like the ESP32, but does not have Bluetooth. However, it does have native USB support, and thus is the first all-in-one WiFi chip with CircuitPython support.

The ESP32-S2 typically has 4MB of external flash, but only 1MB is available to the user. The way it works is that the flash space is shared between the native CircuitPython core code and the user filesystem. In this way, it is unlike the SAMD21 Express and SAMD51 Express boards, where CircuitPython lives on the chip and the code is separate.

The ESP32-S2 WROVER module has 2MB of external RAM, all of which is allocated to CircuitPython, which means it has more CircuitPython-dedicated RAM than any of the other microprocessors. There are ESP32-S2 modules that do not have the external RAM chip, and in the case of those, memory when using CircuitPython will be limited. It is a relatively low-cost option as well.

iMX RT

The NXP iMX RT family of chips are fast. The minimum clock speed you'll see is around 500MHz. They're a Cortex M7 based microcontroller family, which means they're more efficient at code execution than an M4 as well. In terms of flash, there is always an external flash chip that is shared between the native CircuitPython code.
and the user filesystem. In most cases, you'll have more RAM than a SAMD51, but not in all cases for this chip line. The low end of the line will have less RAM than the SAMD51, but the code will run faster. It also has native high speed USB connectivity.

**Raspberry Pi**

The [Raspberry Pi](https://www.raspberrypi.org/) does not run CircuitPython natively. It is capable of running CircuitPython libraries using the [Blinka](https://github.com/adafruit/Adafruit_Blinka) CircuitPython library compatibility layer. This means it's compatible with your current CircuitPython code, with no changes needed. However, it is not low power or battery-friendly, as the boards are running a full Linux operating system. But, because it's running CPython (standard Python), you can also use all of the normal Python libraries along side, such as numpy, etc. that are not in CircuitPython.

**ATMEGA**

ATMEGA boards are not compatible with CircuitPython. This is because CircuitPython is designed for 32- or 64-bit machines, and ATMEGA based chips are 8-bit. For CircuitPython, please consider one of the options above.