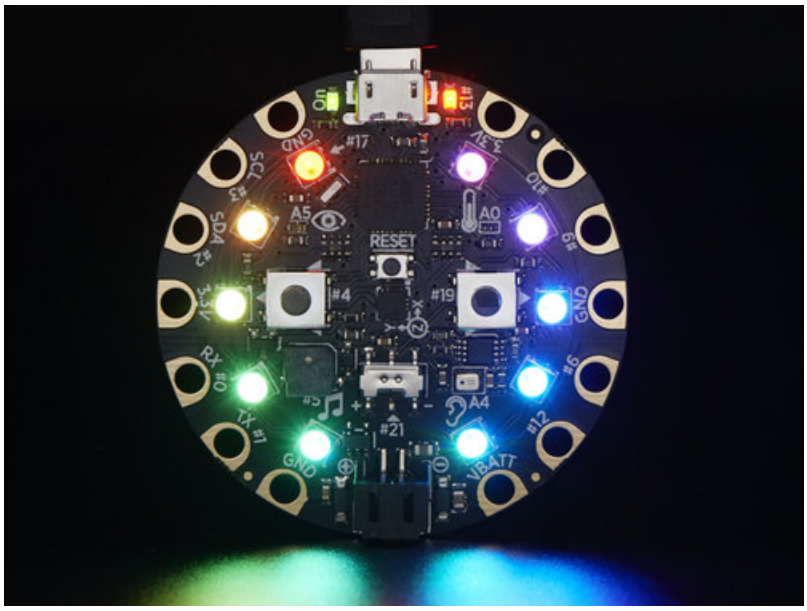
adafruit learning system

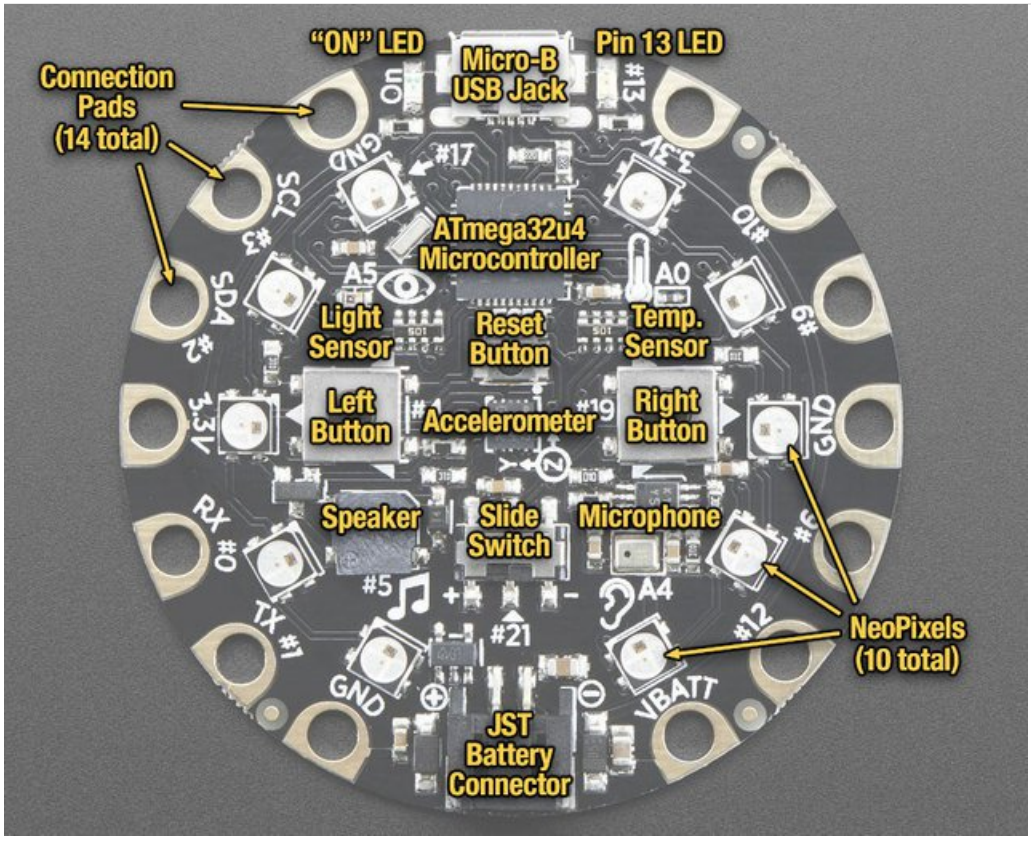
Introducing Circuit Playground

Created by lady ada



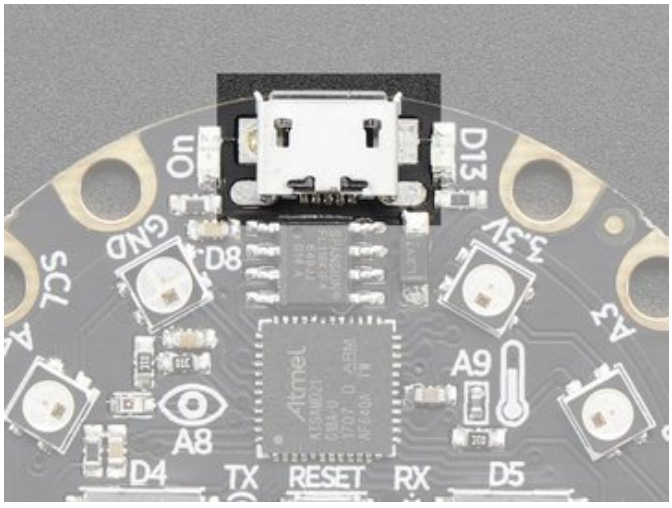
Last updated on 2017-10-22 10:36:23 PM UTC

Guided Tour



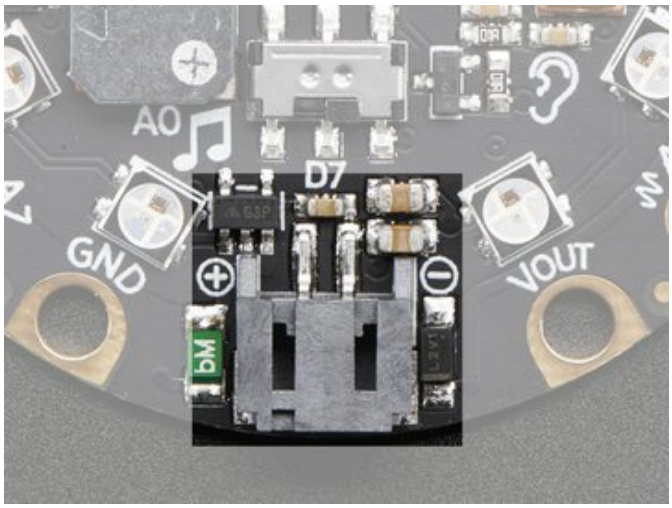
Let me take you on a tour of your Circuit Playground Classic (we'll shorten that to **CPC**). Each CPC comes chock-full of good design to make it a joy to use.

Power and Data



Micro B USB connector

This is at the top of the board. We went with the tried and true micro-B USB connector for power and/or USB communication (bootloader, serial, HID, etc). Use with any computer with a standard data/sync cable.

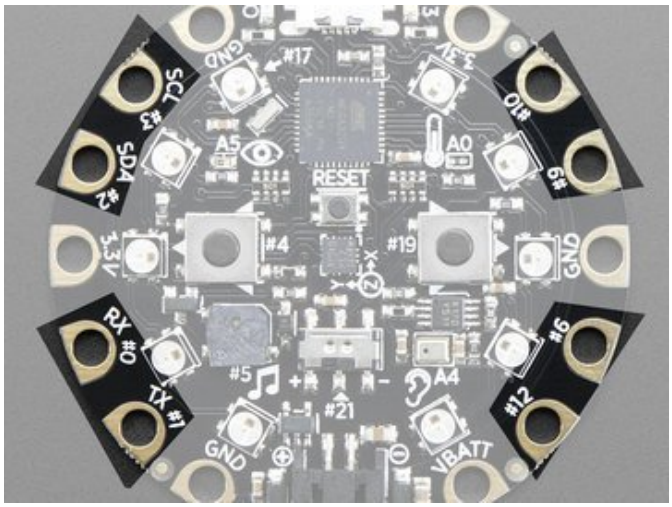


JST Battery Input

This is at the bottom of the board. You can take your CPC anywhere and power it from an external battery. This pin can take up 6V DC input, and has reverse-polarity, over-current and thermal protections. The circuitry inside will use either the battery input power or USB power, safely switching from one to the other. If both are connected, it will use whichever has the higher voltage. Works great with a Lithium Polymer battery or our 3xAAA battery packs with a JST connector on the end. There is no built in battery charging (so that you can use Alkaline *or* Lithium batteries safely)

Alligator/Croc Clip Pads

To make it super-easy to connect to the microcontroller, we have 14 connection pads. You can solder to them, use alligator/croc clips, sew with conductive thread, even use small metal screws!



Of the 14 pads, you get a wide range of power pins, I2C, UART, Analog In, Digital In/Out and PWMt.

Some of them can even sense the touch of your finger!

See the next pinouts page for more details!

All 8 non-power pads around the circuit playground have the ability to act as capacitive touch pads. Each pad has a 1Mohm resistor between it and digital pin #30. You can toggle this pin to control whether the resistor is a pullup or pulldown or floating. Note that this means that all the pads have a 2Mohm resistance between them.

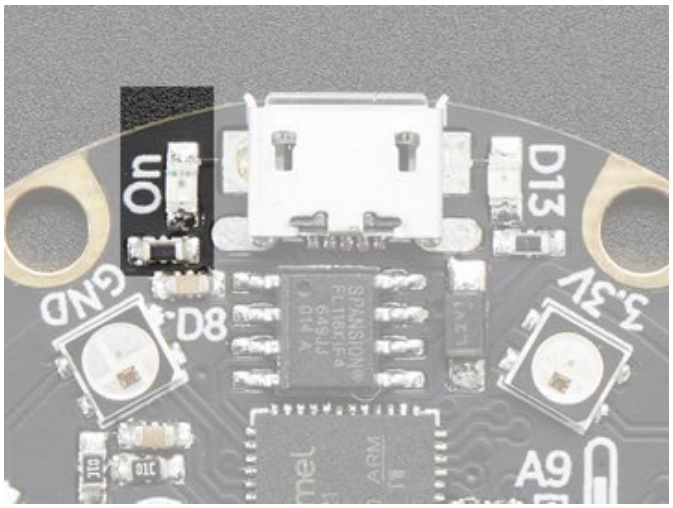
You can also of course just use those pads for GPIO, we expose the hardware Serial (TX + RX), hardware I2C (SDA + SCL) and 4 gpio pins that can also do analog readings. They are the same exact pins as those on the Flora

Microchip

The **brains** of the operation here is the **ATMEGA32u4** an 8-bit AVR microcontroller. It sits in the top center, and is what

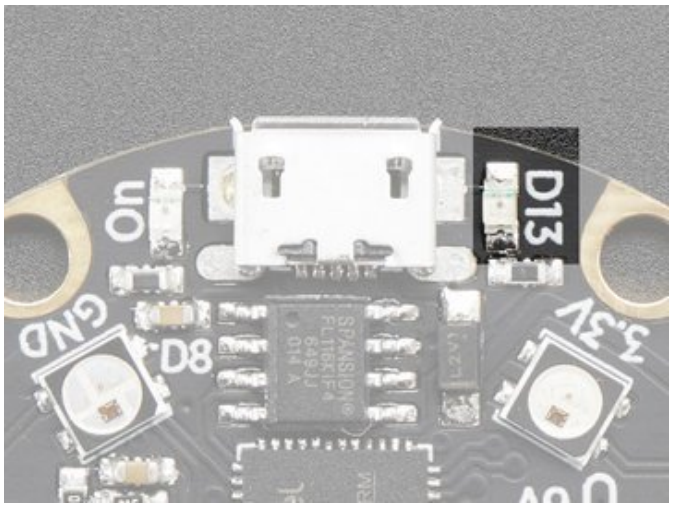
you use to run Arduino!

LEDs



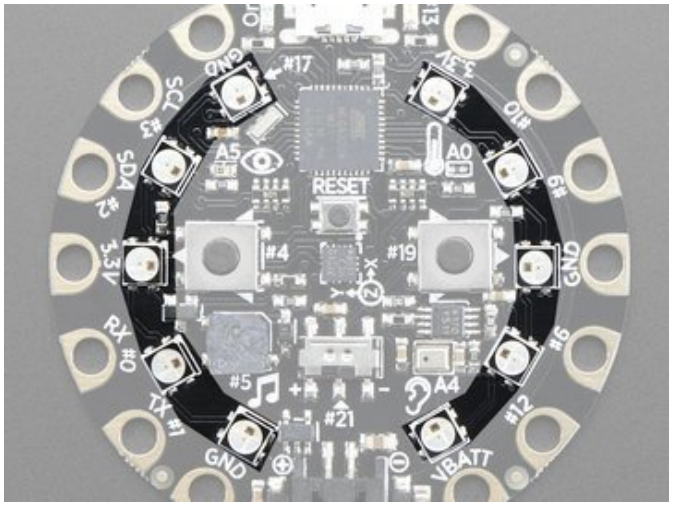
Green ON LED

To the left of the USB connector. This LED lets you know that the CPC is powered on. If it's lit, power is good! If it's dim, flickering or off, there's a power problem and you will have problems. You can't disable this light, but you *can* cover it with electrical tape if you want to make it black.



Red #13 LED

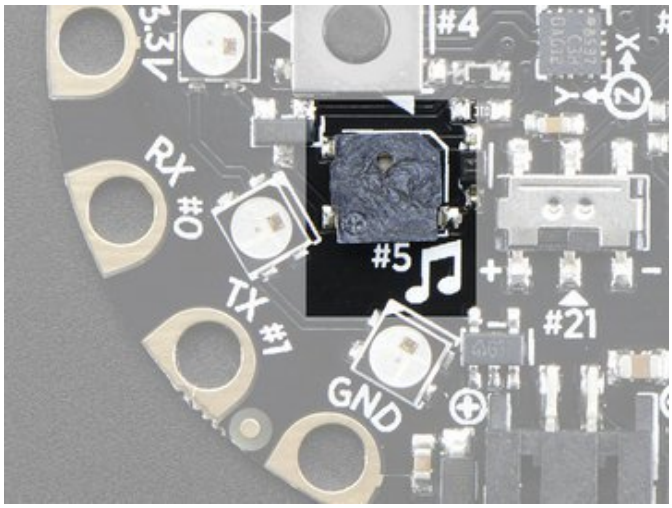
To the right of the USB connector. This LED does double duty. Its connected with a series resistor to the digital #13 GPIO pin. It pulses nicely when the CPC is in bootloader mode, and its also handy for when you want an indicator LED. Many first projects blink this LED to prove that programming worked.



10 x Color NeoPixel LED

The ten LEDs surrounding the outer edge of the boards are all full color, RGB LEDs, each one can be set to any color in the rainbow. Great for beautiful lighting effects! The NeoPixels will also help you know when the bootloader is running (they will turn green) or if it failed to initialize USB when connected to a computer (they will turn red).

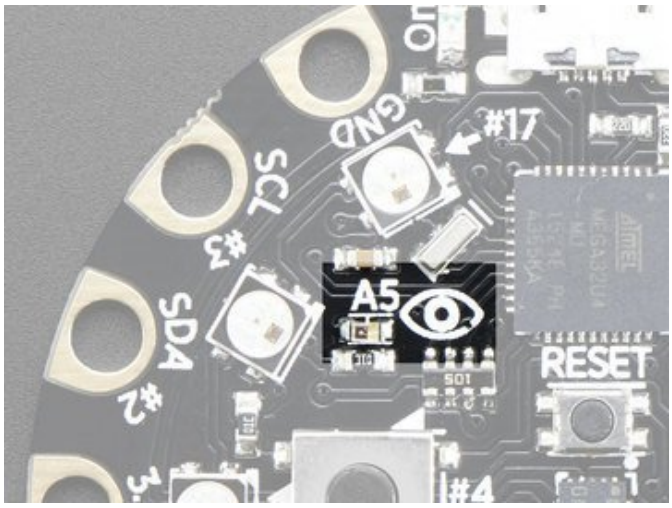
Speaker



You can make your circuit playground sing with the built in buzzer. This is a miniature magnetic speaker connected to digital pin **#5** with a transistor driver. You can use PWM at varying frequencies to make basic tones.

Sensors

The Circuit Playground Classic has a large number of sensor **inputs** that let you add all sorts of interactivity to your project.

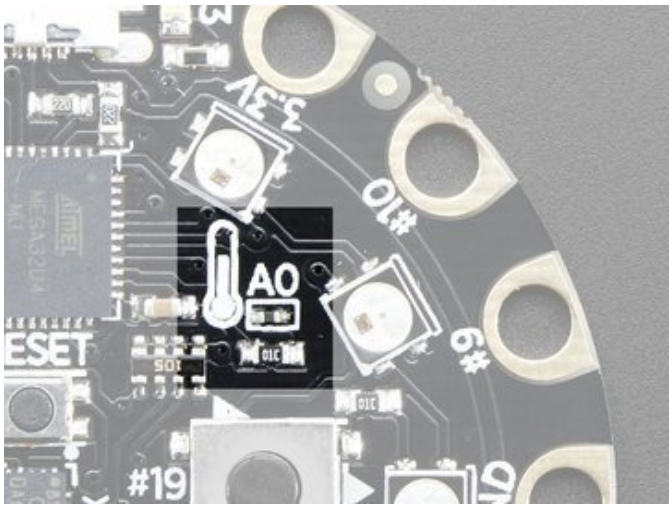


Light Sensor

There is an analog light sensor, part number ALS-PT19 (https://adafru.it/tC2), in the top left part of the board. This can be used to detect ambient light, with similar spectral response to the human eye.

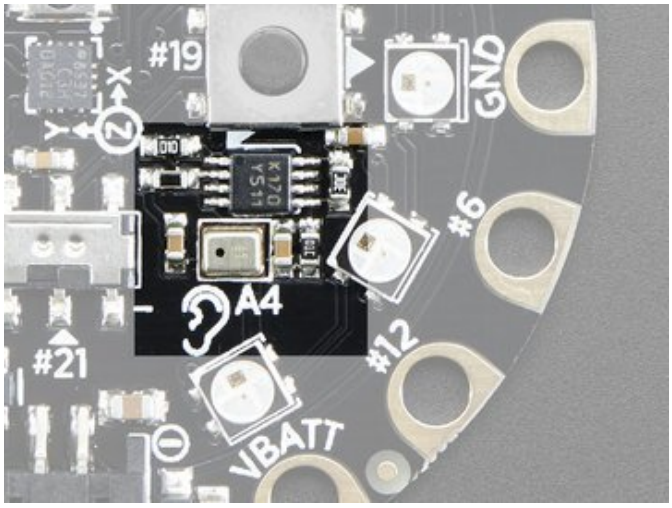
This sensor is connect to analog pin **A5** and will read between 0 and 1023 with higher values corresponding to higher light levels. A reading of about 300 is common for most indoor light levels.

With some clever code, you can use this as a color sensor or even a pulse sensor!



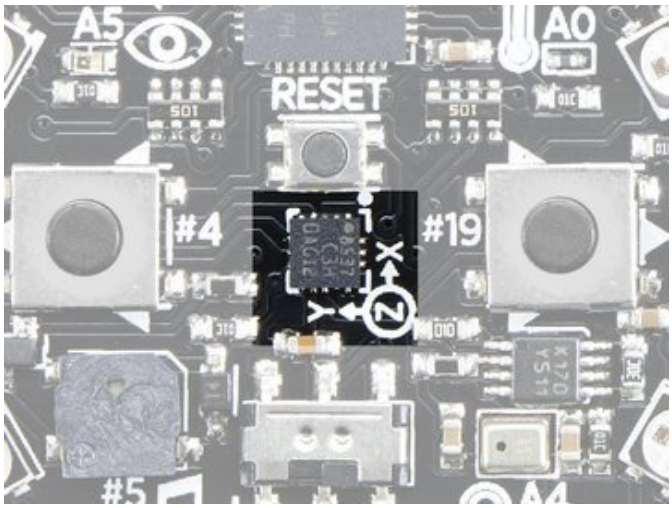
Temperature Sensor

There is an NTC thermistor (Murata NCP15XH103F03RC) that we use for temperature sensing. While it isn't an all-in-one temperature sensor, with linear output, it's easy to calculate the temperature based on the analog voltage on analog pin **#A0**. There's a 10K resistor connected to it as a pull down.



Microphone Audio Sensor

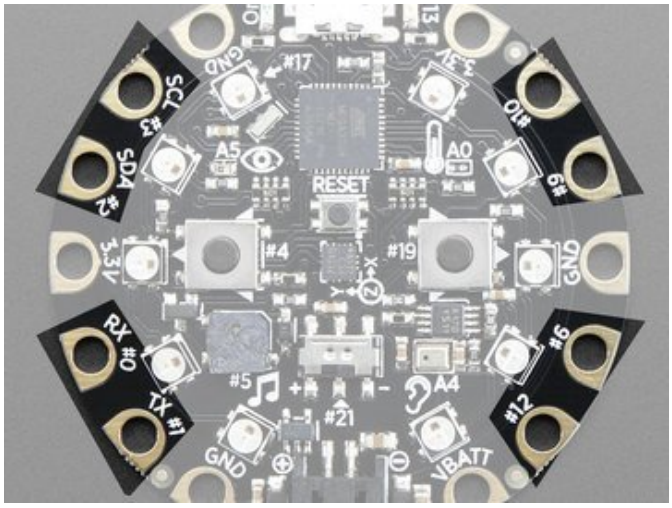
A MEMS microphone can be used to detect audio levels and even perform basic FFT functions. You can read the analog voltage corresponding to the audio on analog pin **#A4**. Note that this is the raw analog audio waveform! When it's silent there will be a reading of ~330 and when loud the audio will read between 0 and 800 or so. Averaging and smoothing must be done to convert this to sound-pressure-level.



Motion Sensor

We can sense motion with an accelerometer. This sensor detects *acceleration* which means it can be used to detect when its being moved around, as well as gravitational pull in order to detect orientation.

A LIS3DH 3-axis XYZ accelerometer is in the dead center of the board and you can use it to detect tilt, gravity, motion, as well as 'tap' and 'double tap' strikes on the board. The LIS3DH is connected to the hardware SPI pins (to leave the I2C pins free) and has the CS pin on digital pin **#8** and an optional interrupt output on digital pin **#7** (also known as IRQ #4)

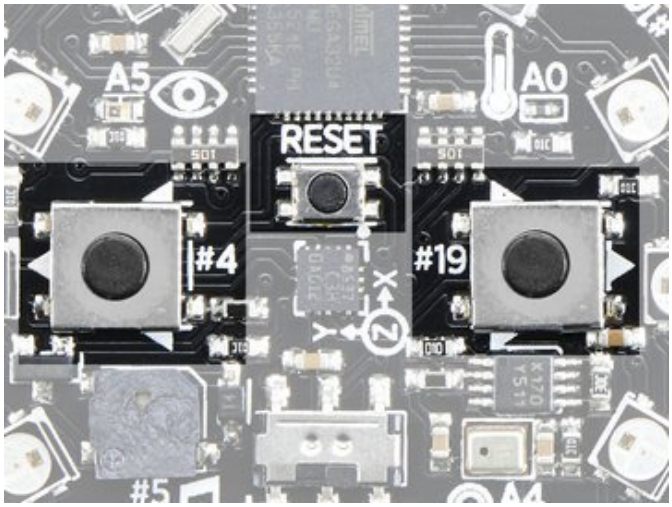


Capacitive Touch

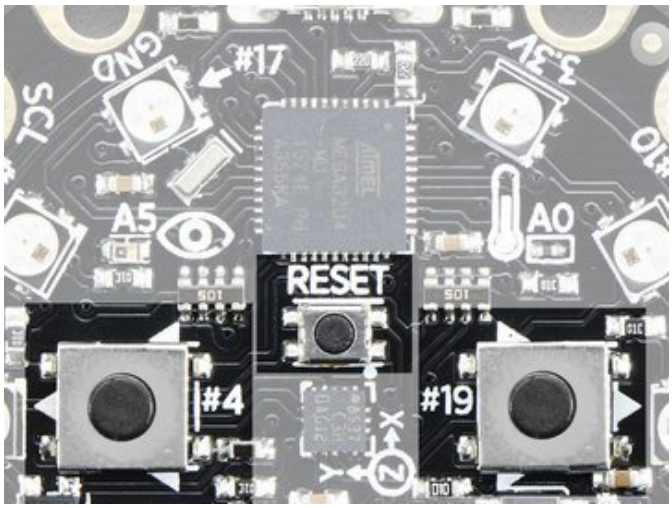
The CPC has some resistor pullups and an extra pin that gives it the ability to perform capacitive touch readings. This is a great way to sense human touch without additional components. Even animals will work if its directly touching their skin!

On the Classic you get **eight** capacitive touch pads (all GPIO pads)

Switches & Buttons

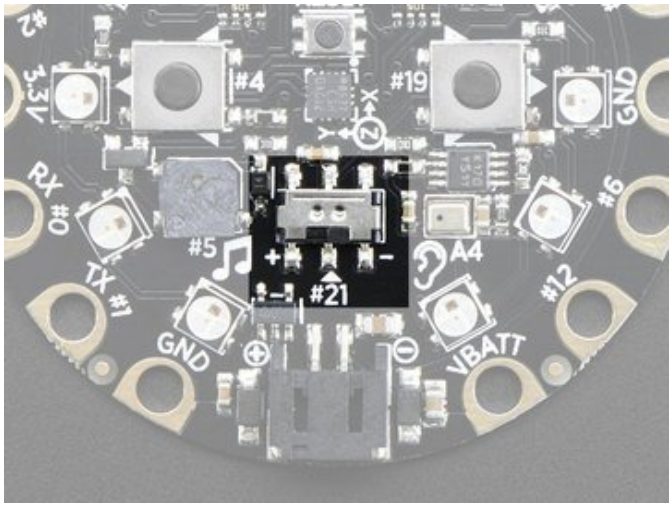


There are two large buttons, connected to digital **#19** (Left) and **#5** (Right) each. These are pulled to ground when not pressed, and connected to 3.3V when pressed, so they read HIGH.



This small button in the center of the board is for **Resetting** the board. You can use this button to restart or reset the CPC.

Press this button **once** to reset, **double-click** to enter the bootloader manually.



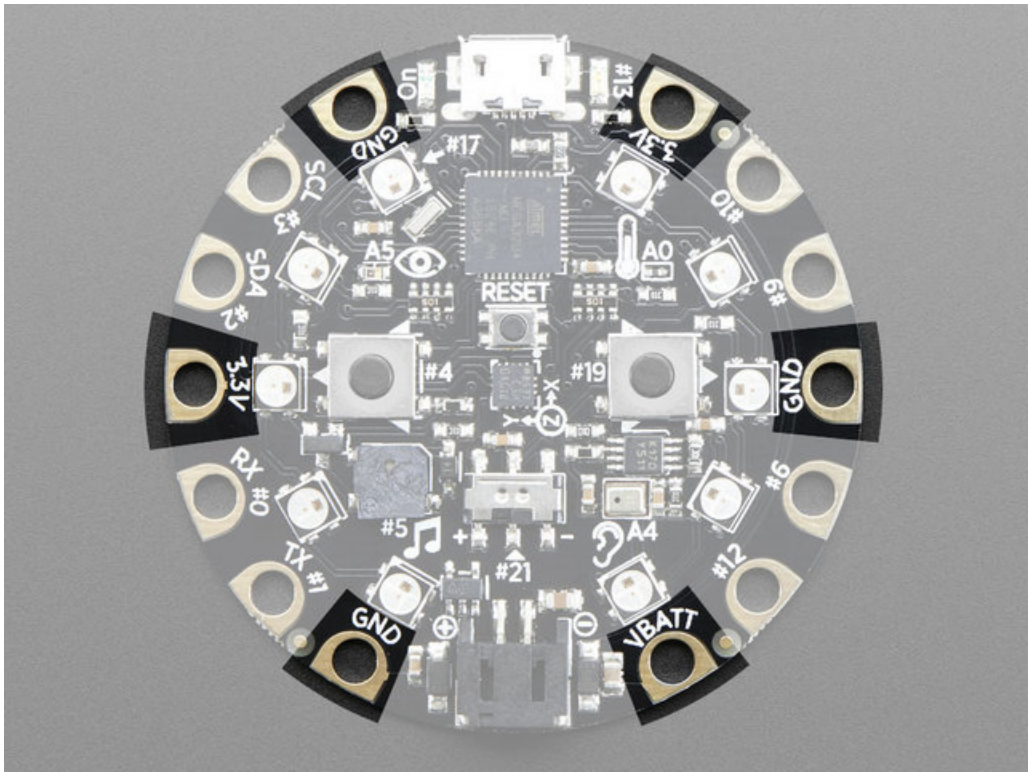
There is a single slide switch near the center of the Circuit Playground. It is connected to digital **#21** and will read LOW when slid to the left, and HIGH when in the right hand position

Pinouts

Despite having only 14 pads with 8 general purpose I/O pins available, there are a *lot* of possibilities with Circuit Playground Classic. We went over all the internals in the last page. On this page we'll go through each pin/pad to explain what you can do with it.

No external I/O pads are shared with internal sensors/devices, so you do not need to worry about 'conflicting' pins or interactions!

Power Pads

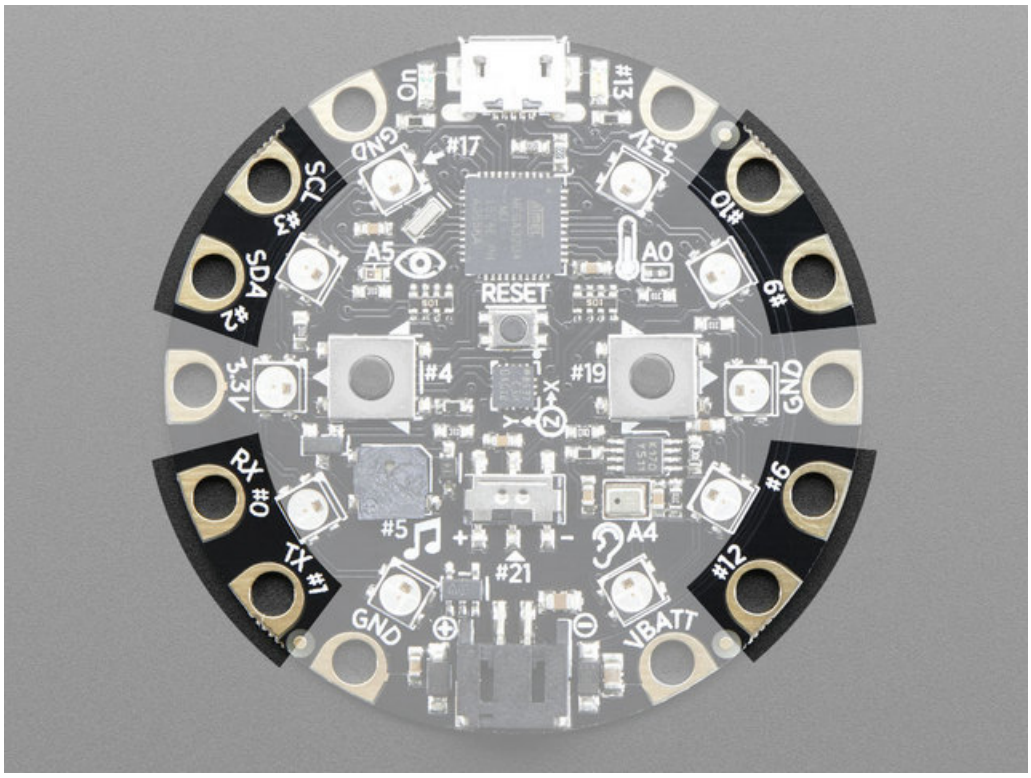


There are 6 power pads available, equally spaced around the perimeter.

- **GND** - there are 3 x **Ground** pads. They are all connected together, and are all the signal/power ground connections
- **3.3V** - there are two **3.3 Volt output** pads. They are connected to the output of the onboard regulator. The regulator can provide about 500mA max, but that includes all the built in parts too! So you should roughly budget about 300mA available for your usage (450mA if you are not using the onboard NeoPixels)
- **VBATT** - there is one **Voltage Output** pad. This is a special power pad,it will be connected to *either* the USB power or the battery input, whichever has the higher voltage. This output does not connect to the regulator so you can draw as much current as your USB port / Battery can provide.

Input/Output Pads

Next we will cover the 8 GPIO (General Purpose Input Ouput) pins! For reference you may want to also check out the datasheet-reference in the downloads section for the core ATMEGA32U4 pin. We picked pins that have *a lot* of capabilities.



Common to all pads

All the GPIO pads can be used as digital inputs, digital outputs, for LEDs, buttons and switches. In addition, all can be used as analog inputs (10-bit ADC). All pads can be used for hardware capacitive touch.

Each pad can provide up to ~20mA of current. Don't connect a motor or other high-power component directly to the pins! Instead, use a transistor to power the DC motor on/off

All of the GPIO pads are 3.3V output level, and should not be used with 5V inputs. In general, most 5V devices are OK with 3.3V output though.

All of the pads are completely 'free' pins, they are not used by the USB connection, LEDs, sensors, etc so you never have to worry about interfering with them when programming.

- D6, D9, D10 and D11 can be **analog inputs**
- D3, D6, D9 and D10 can be **PWM outputs**
- D0, D1, D2 and D3 can be **hardware interrupt input**

Each Pin!

Let's start with **#10** which is in the top right corner, and work our way clockwise

- **D10 / A10** - This pin can be digital I/O, or Analog Input. This pin has PWM output
- **D9 / A9** - This pin can be digital I/O, or Analog Input. This pin has PWM output.
- **D6 / A7** - This pin can be digital I/O, or Analog Input. This pin has PWM output.
- **D12 / A11** - This pin can be digital I/O, or Analog Input.
- **D1** - This pin can be digital I/O, it is also used for **Hardware Serial Transmit,** and can be an interrupt input.
- **D0** - This pin can be digital I/O, it is also used for **Hardware Serial Receive,** and can be an interrupt input.

- **D2** - This pin can be digital I/O, it is also the **I2C SDA** pin, and can be an interrupt input
- **D3** - This pin can be digital I/O or PWM output, it is also the **I2C SCL** pin, and can be an interrupt input

Internally Used Pins!

These are the names of the pins that are used for built in sensors and such!

- **D4** - Left Button A
- **D5** - Speaker PWM output
- **D7** - Accelerometer interrupt
- **D13** - Red LED
- **D17** - Built-in 10 NeoPixels
- **D19** - Right Button B
- **D21** - Slide Switch
- **A0** - Temperature Sensor
- **A4 -** Microphone sound sensor
- **A5** - Light Sensor