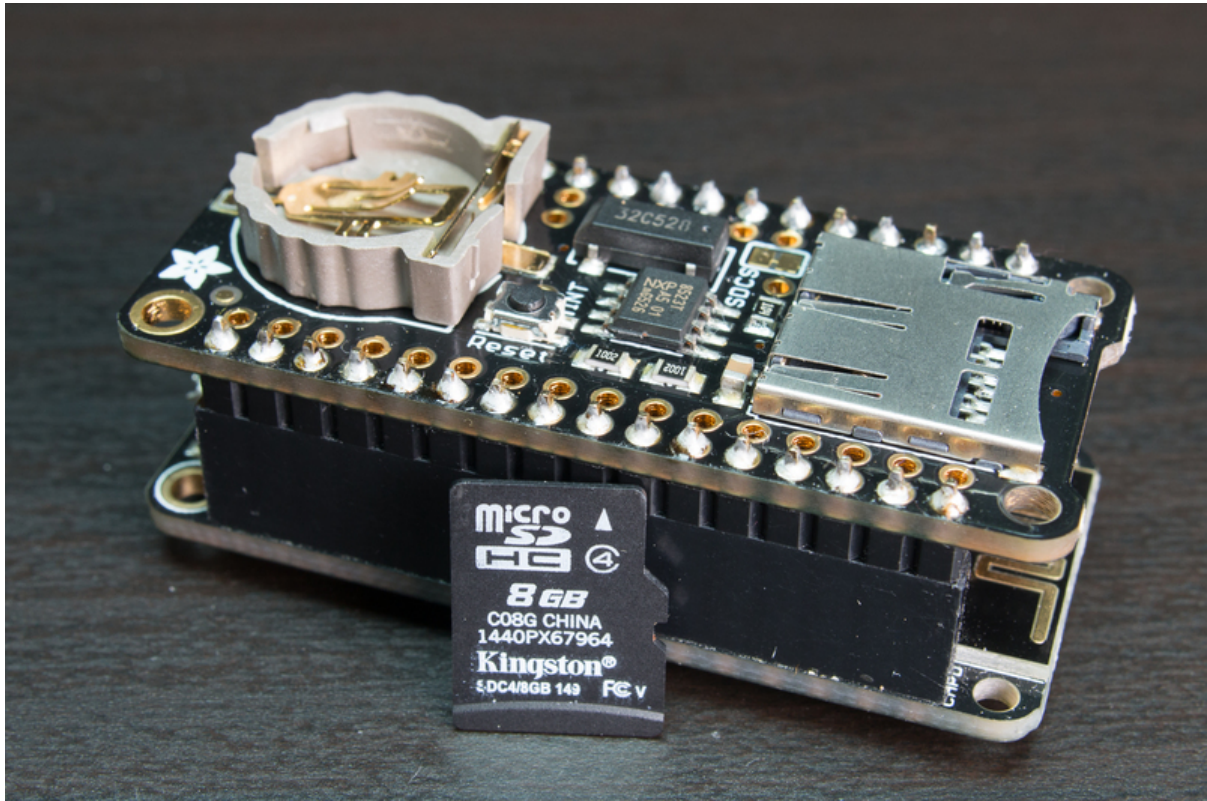




CircuitPython Hardware: SD Cards

Created by Tony DiCola



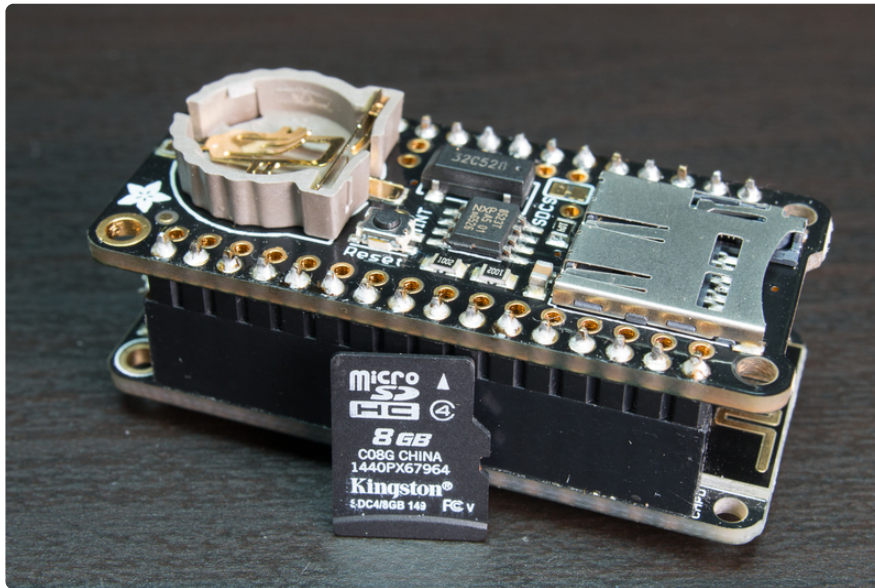
<https://learn.adafruit.com/micropython-hardware-sd-cards>

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Overview



Note the video above was made showing the MicroPython version of this library. Follow the guide to see both CircuitPython and MicroPython versions of using the SD card library.

[Secure Digital \(https://adafru.it/rye\)](https://adafru.it/rye), or SD, cards and tiny microSD cards are inexpensive and ubiquitous means of adding lots of storage to devices. For a few dollars you can have gigabytes of storage at your fingertips (smaller than your fingertips actually!).

With small boards, you typically have a very limited amount of flash memory to store code and data. Wouldn't it be nice if you could connect a microSD card to a CircuitPython board and expand its storage? It turns you can use microSD cards with CircuitPython and MicroPython!

In fact some boards come with microSD card support built-in, and for other boards like the M0 / SAMD21 family they can easily be connected to a microSD card that expands their storage.

This guide explores how to use a microSD card to store files for a CircuitPython MicroPython board. Specifically adding a microSD card to CircuitPython boards like [Feather M0 adalogger \(http://adafru.it/2796\)](http://adafru.it/2796) and [Adalogger FeatherWing \(http://adafru.it/2922\)](http://adafru.it/2922) will be covered in this guide. You'll learn how to connect a microSD card to the board and mount it as a new filesystem that store code & data.

CircuitPython Boards with Built-In microSD Capability

The guide page below contains all the current Adafruit boards that have a microSD card slot built in on the page "[SD Card Capable \(https://adafru.it/19TA\)](https://adafru.it/19TA)":



Which CircuitPython Board is Right for You?

By Kattni Rembor

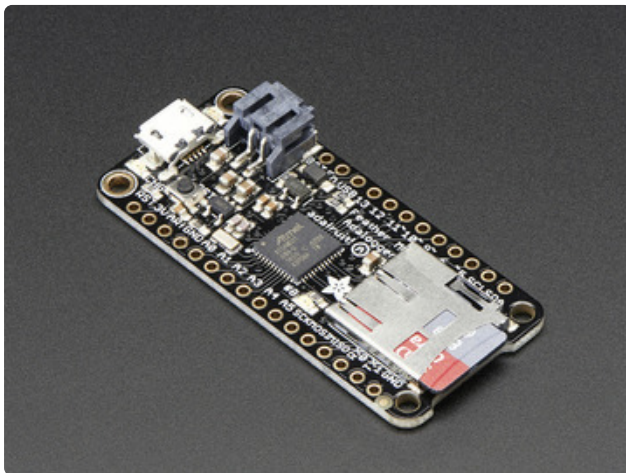
[SD Card Capable](#)

<https://learn.adafruit.com/choose-your-circuitpython-board/sd-card-capable>

Hardware

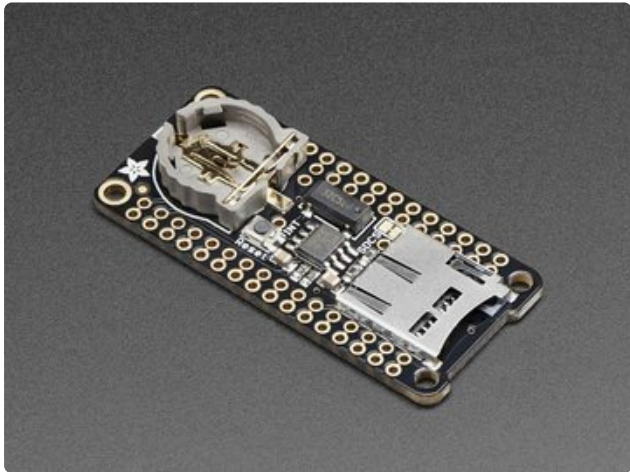
Parts

You'll need the following parts to follow this guide:



CircuitPython board. This guide focuses on the [ESP8266 \(http://adafru.it/2821\)](http://adafru.it/2821) and [Feather M0/SAMD21-based boards \(http://adafru.it/2772\)](http://adafru.it/2772), but any CircuitPython board that supports I2C should work. You'll find a board with a SD card holder built-in, like the [Feather M0 Adalogger \(http://adafru.it/2796\)](http://adafru.it/2796), the most simple and direct way to use an SD card.

If your board doesn't come with CircuitPython running on it already then check out your board's guide for how to load CircuitPython firmware. For example the [Feather M0 express guide \(https://adafru.it/wbv\)](https://adafru.it/wbv) is a good reference.



MicroSD card holder. If your board doesn't have one already you'll need to get a microSD card holder that exposes the card as a SPI device. For Feathers the [Adalogger FeatherWing \(http://adafru.it/2796\)](http://adafru.it/2796) is an easy plug-in adapter that adds microSD card (and more) to your board. For other boards a [microSD breakout \(http://adafru.it/254\)](http://adafru.it/254) is what you want.



[MicroSD card. \(http://adafru.it/1294\)](http://adafru.it/1294) You'll need a card to use to store data. Any microSD card should work, but be aware the very cheap / generic cards can sometimes be more unreliable or cause problems compared to known-good cards. If a card works well for Raspberry Pi and other boards it should work well for CircuitPython and MicroPython.

Be careful to avoid extremely large (128+ gigabyte) cards as they require special filesystems and block sizes that might not be compatible with the code in this guide. Stick with a typical 4 - 16 gigabyte card.



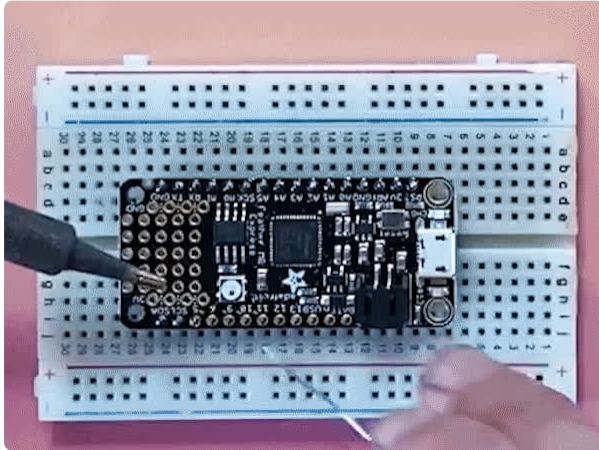
[Breadboard \(http://adafru.it/64\)](http://adafru.it/64) and [jumper wires \(http://adafru.it/153\)](http://adafru.it/153). If you aren't using a Feather and FeatherWing you'll need a breadboard and jumper wires to connect the components.

[Soldering tools \(http://adafru.it/136\)](http://adafru.it/136). You'll need to solder headers to the boards. Check out the [guide to excellent soldering \(https://adafru.it/dxy\)](https://adafru.it/dxy) if you're new to soldering.

Soldering Header Pins

If you're using a Feather board and FeatherWing you probably want a [Feather female header set](http://adafru.it/2886) (<http://adafru.it/2886>) or [Feather stacking female header set](http://adafru.it/2830) (<http://adafru.it/2830>).

[Check out the guide](https://adafru.it/19TB) (<https://adafru.it/19TB>) below on how to do the soldering.



How To Solder Headers

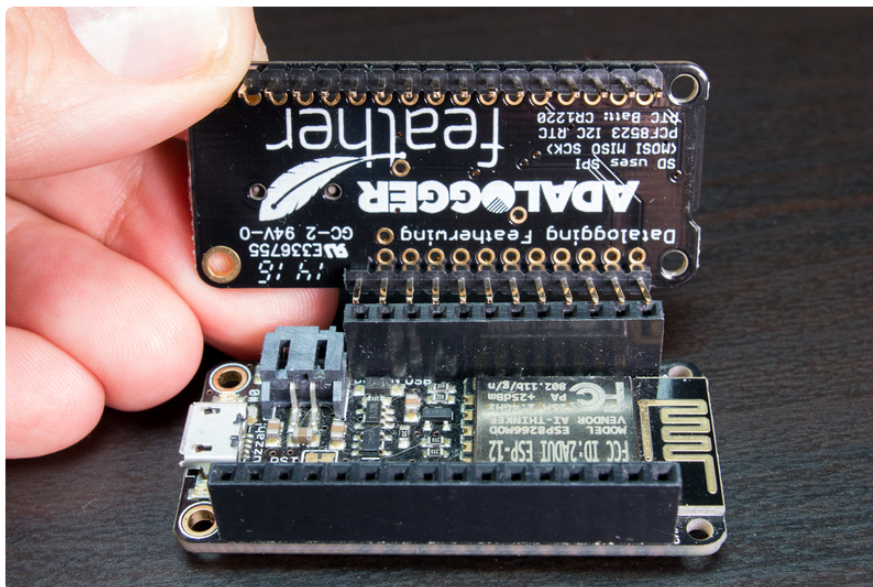
By Erin St Blaine

[Feathers and FeatherWings](#)

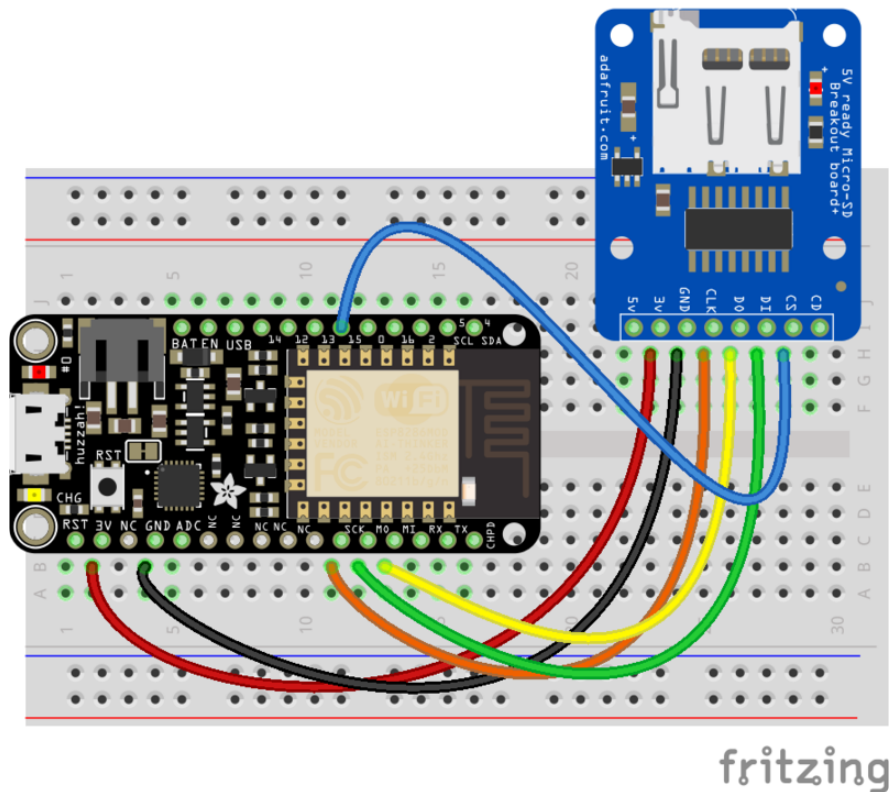
<https://learn.adafruit.com/how-to-solder-headers/feathers-and-featherwings>

Wiring

If you're using a Feather and FeatherWing just plug the FeatherWing into your board and be sure to note which pin on the FeatherWing is used for the microSD card chip select line (for the Adalogger FeatherWing this is GPIO 10 on M0 boards and GPIO 15 on the ESP8266).



If you're wiring up a microSD card breakout you'll need to connect it to your board's hardware SPI bus, for example with the ESP8266 you might wire it as follows:



Fritzing Source

<https://adafru.it/zwB>

- Board ground (GND) to microSD breakout ground (GND).
- Board 3.3V power to microSD breakout 3.3V power.
- Board SPI CLK (ESP8266 GPIO 14) to microSD breakout clock (CLK).
- Board SPI MOSI (ESP8266 GPIO 13) to microSD breakout data input (DI).
- Board SPI MISO (ESP8266 GPIO 12) to microSD breakout data output (DO).
- Board GPIO 15 (or any other free digital IO pin) to microSD breakout chip select (CS).

Formatting your SD Card

Finally make sure your microSD card is formatted with the FAT or FAT32 filesystem. Most cards come pre-formatted with this filesystem, but if yours does not or you'd like to erase it look for a disk utility in your operating system. On **macOS** the **Disk Utility** program can format cards, and on **Windows** right-click the drive and select **Format**.

The [official SD memory card formatter](https://adafru.it/FKd) (<https://adafru.it/FKd>) (Windows/Mac) is highly recommended. Use settings for FAT32.

CircuitPython

As of CircuitPython 9, a mount point (folder) named `/sd` is required on the **CIRCUITPY** drive. Make sure to create that directory after upgrading CircuitPython.

Follow these steps to create the `/sd` directory

<https://adafru.it/19ei>

Adafruit CircuitPython Module Install

To use a microSD card with your Adafruit CircuitPython board you'll need to install the [Adafruit_CircuitPython_SD](https://adafru.it/zwC) (<https://adafru.it/zwC>) module on your board.

First make sure you are running the [latest version of Adafruit CircuitPython](https://adafru.it/Amd) (<https://adafru.it/Amd>) for your board.

Next you'll need to install the necessary libraries to use the hardware--carefully follow the steps to find and install these libraries from [Adafruit's CircuitPython library bundle](https://adafru.it/zdx) (<https://adafru.it/zdx>). Our introduction guide has [a great page on how to install the library bundle](https://adafru.it/ABU) (<https://adafru.it/ABU>) for both express and non-express boards. **Be sure to use the latest CircuitPython Bundle** as it includes an updated version of the SD card module with a few necessary fixes!

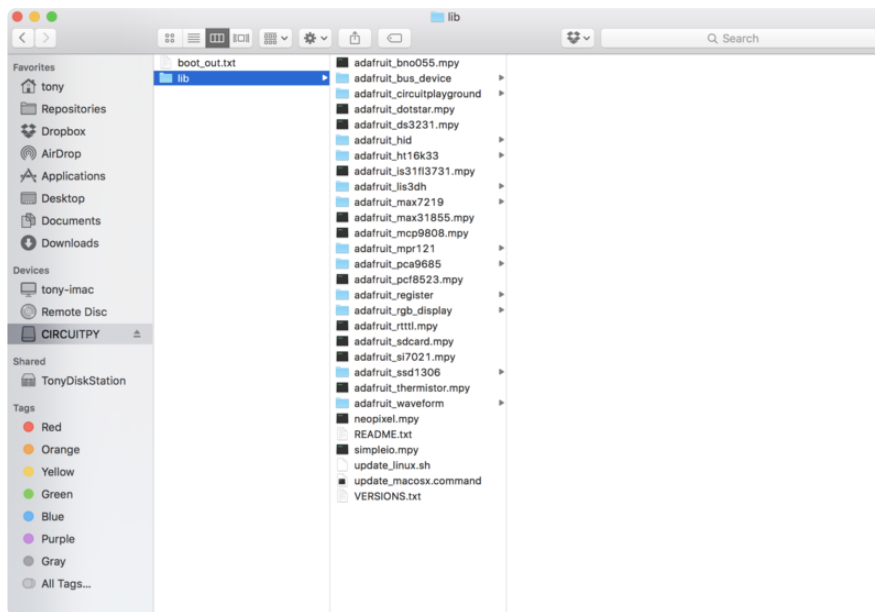
[If your board supports sdcardio](https://adafru.it/-Cy) (<https://adafru.it/-Cy>), then this is the preferred method to do things. **sdcardio** is a built-in module on boards that support it, so you don't have to copy it over.

Remember for non-express boards like the Feather M0 Basic, you'll need to manually install the necessary libraries from the bundle:

- `adafruit_sdcard.mpy`
- `adafruit_bus_device`

If your board doesn't support USB mass storage, like the ESP8266, then [use a tool like ampy to copy the file to the board](https://adafru.it/s1f) (<https://adafru.it/s1f>). You can use the latest version of ampy and its [new directory copy command](https://adafru.it/q2A) (<https://adafru.it/q2A>) to easily move module directories to the board.

Before continuing make sure your board's lib folder or root filesystem has the `adafruit_sdcard.mpy` and `adafruit_bus_device` modules copied over.



Usage

The following section will show how to initialize the SD card and read & write data to it from the board's Python prompt / REPL.

Next [connect to the board's serial REPL \(https://adafru.it/Awz\)](https://adafru.it/Awz) so you are at the CircuitPython >>> prompt.

sdcardio is an SPI interface SD card library in CircuitPython 6.0 that is optimized in C to be much faster than the original `adafruit_sdcard` library. Some boards don't have enough memory for this module, in which case you will have to use `adafruit_sdcard`

Initialize & Mount SD Card Filesystem Using `sdcardio`

Before using this method, verify that your board supports `sdcardio` using the [support matrix \(https://adafru.it/-Cy\)](https://adafru.it/-Cy). If it does not, try using `adafruit_sdcard` instead.

Before you can use the microSD card you need to initialize its SPI connection and mount its filesystem. First import all the modules we'll need:

```
import board
import busio
import sdcardio
import storage
```

Next create the SPI bus and a digital output for the microSD card's chip select line (be sure to select the right pin names for your wiring):

```
# Use the board's primary SPI bus
spi = board.SPI()
# Or, use an SPI bus on specific pins:
#spi = busio.SPI(board.SD_SCK, MOSI=board.SD_MOSI, MISO=board.SD_MISO)

# For breakout boards, you can choose any GPIO pin that's convenient:
cs = board.D10
# Boards with built in SPI SD card slots will generally have a
# pin called SD_CS:
#cs = board.SD_CS
```

If you are using some non-standard CircuitPython board, you may need to use specific GPIO pins for MISO and MOSI to get the SPI recognized appropriately

If your SPI chip select pin is different or not defined like SD_CS, put the appropriate pin number in the code, like board.D5.

Note that when you use `sdcardio`, `cs` is a `Pin` object, not a `DigitalInOut` object. If you change your code to use `adafruit_sdcard`, you need to use a `DigitalInOut` object instead.

At this point you're ready to create the microSD card object and the filesystem object:

```
sdcard = sdcardio.SDCard(spi, cs)
vfs = storage.VfsFat(sdcard)
```

Notice the `sdcardio` module has a `SDCard` class which contains all the logic for talking to the microSD card at a low level. This class needs to be told the SPI bus and chip select pin in its constructor.

After a `SDCard` instance is created it can be passed to the `storage` module's `VfsFat` class. This class has all the logic for translating CircuitPython filesystem calls into low level microSD card access. Both the `SDCard` and `VfsFat` class instances are required to mount the card as a new filesystem.

Finally you can mount the microSD card's filesystem into the CircuitPython filesystem. For example to make the path `/sd` on the CircuitPython filesystem read and write from the card run this command:

```
storage.mount(vfs, "/sd")
```

At this point, you can read and write to the SD card using common Python functions like `open`, `read`, and `write`. The filenames will all begin with `"/sd/"` to differentiate them from the files on the **CIRCUITPY** drive. If you're not familiar, and all this worked, skip ahead to the section labeled **Reading & Writing Data**.

If the same SPI bus is shared with other peripherals, it is important that the SD card be initialized before accessing any other peripheral on the bus. Failure to do so can prevent the SD card from being recognized until it is powered off or re-inserted.

Initialize & Mount SD Card Filesystem Using `adafruit_sdcard`

Before you can use the microSD card you need to initialize its SPI connection and mount its filesystem. First import the necessary modules to initialize the SPI and CS line physical connections:

```
import board
import busio
import digitalio
```

Next create the SPI bus and a digital output for the microSD card's chip select line (be sure to select the right pin name or number for your wiring):

```
spi = busio.SPI(board.SCK, MOSI=board.MOSI, MISO=board.MISO)
# Use board.SD_CS for Feather M0 Adalogger
cs = digitalio.DigitalInOut(board.SD_CS)
# Or use a digitalio pin like 5 for breakout wiring:
#cs = digitalio.DigitalInOut(board.D5)
```

Now import modules to access the SD card and filesystem:

```
import adafruit_sdcard
import storage
```

At this point you're ready to create the microSD card object and the filesystem object:

```
sdcard = adafruit_sdcard.SDCard(spi, cs)
vfs = storage.VfsFat(sdcard)
```

Notice the `adafruit_sdcard` module has a `SDCard` class which contains all the logic for talking to the microSD card at a low level. This class needs to be told the SPI bus and chip select digital IO pin in its initializer.

After a `SDCard` class is created it can be passed to the `storage` module's `VfsFat` class. This class has all the logic for translating CircuitPython filesystem calls into low level microSD card access. Both the `SDCard` and `VfsFat` class instances are required to mount the card as a new filesystem.

Finally you can mount the microSD card's filesystem into the CircuitPython filesystem. For example to make the path `/sd` on the CircuitPython filesystem read and write from the card run this command:

```
storage.mount(vfs, "/sd")
```

The first parameter to the `storage.mount` command is the `VfsFat` class instance that was created above, and the second parameter is the location within the CircuitPython filesystem that you'd like to 'place' the microSD card. Remember the mount location as you'll need it to read and write files on the card!

If the same SPI bus is shared with other peripherals, it is important that the SD card be initialized before accessing any other peripheral on the bus. Failure to do so can prevent the SD card from being recognized until it is powered off or re-inserted.

Reading & Writing Data

Once the microSD card is mounted inside CircuitPython's filesystem you're ready to read and write data from it. Reading and writing data is simple using Python's file operations like [open](https://adafru.it/reL) (<https://adafru.it/reL>), [close](https://adafru.it/ryE) (<https://adafru.it/ryE>), [read](https://adafru.it/ryE) (<https://adafru.it/ryE>), and [write](https://adafru.it/ryE) (<https://adafru.it/ryE>). The beauty of CircuitPython and MicroPython is that they try to be as similar to desktop Python as possible, including access to files.

For example to create a file and write a line of text to it you can run:

```
with open("/sd/test.txt", "w") as f:  
    f.write("Hello world!\r\n")
```

Notice the `with` statement is used to create a context manager that opens and automatically closes the file. This is handy because with file access you Python you must close the file when you're done or else all the data you thought was written might be lost!

The `open` function is used to open the file by telling it the path to it, and the mode (w for writing). Notice the path is under `/sd`, `/sd/test.txt`. This means the file will be created on the microSD card that was mounted as that path.

Starting with CircuitPython 9, the SD card MUST be mapped to `/sd` on the CircuitPython file system. Create an empty `sd` directory in the root directory of the CIRCUITPY drive, especially if you get messages complaining of a missing mount point.

Inside the context manager you can access the `f` variable to operate on the file while it's open. The `write` function is called to write a line of text to the file. Notice that unlike a print statement you need to end the string passed to write with explicit carriage returns and new lines.

You can also open a file and read a line from it with similar code:

```
with open("/sd/test.txt", "r") as f:
    print("Read line from file:")
    print(f.readline())
```

If you wanted to read and print all of the lines from a file you could call `readline` in a loop. Once `readline` reaches the end of the file it will return an empty string so you know when to stop:

```
with open("/sd/test.txt", "r") as f:
    print("Printing lines in file:")
    line = f.readline()
    while line != '':
        print(line)
        line = f.readline()
```

There's even a `readlines` function that will read all of the lines in the file and return them in an array of lines. Be careful though as this means the entire file must be loaded into memory, so if the file is very large you might run out of memory. If you know your file is very small you can use it though:

```
with open("/sd/test.txt", "r") as f:
    lines = f.readlines()
    print("Printing lines in file:")
    for line in lines:
        print(line)
```

Finally one other very common file scenario is opening a file to add new data at the end, or append data. This works exactly the same as in Python and the `open` function can be told you'd like to append instead of erase and write new data (what normally happens with the `w` option for `open`). For example to add a line to the file:

```
with open("/sd/test.txt", "a") as f:
    f.write("This is another line!\r\n")
```

Notice the **a** option in the open function--this tells Python to add data at the end of the file instead of erasing it and starting over at the top. Try reading the file with the code above to see the new line that was added!

That's all there is to manipulating files on microSD cards with CircuitPython!

Here are a few more complete examples of using a SD card from the [Trinket MO CircuitPython guides](https://adafru.it/Bvi) (<https://adafru.it/Bvi>). These are great as a reference for more SD card usage.

List Files

Load this into **code.py** (CircuitPython) or **main.py** (MicroPython):

```
# SPDX-FileCopyrightText: 2017 Limor Fried for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import os

import adafruit_sdcard
import board
import busio
import digitalio
import storage

# Use any pin that is not taken by SPI
SD_CS = board.D0

# Connect to the card and mount the filesystem.
spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
cs = digitalio.DigitalInOut(SD_CS)
sdcard = adafruit_sdcard.SDCard(spi, cs)
vfs = storage.VfsFat(sdcard)
storage.mount(vfs, "/sd")

# Use the filesystem as normal! Our files are under /sd

# This helper function will print the contents of the SD

def print_directory(path, tabs=0):
    for file in os.listdir(path):
        if file == "?":
            continue # Issue noted in Learn
        stats = os.stat(path + "/" + file)
        filesize = stats[6]
        isdir = stats[0] & 0x4000

        if filesize < 1000:
            sizestr = str(filesize) + " by"
        elif filesize < 1000000:
            sizestr = "%0.1f KB" % (filesize / 1000)
        else:
            sizestr = "%0.1f MB" % (filesize / 1000000)
```

```

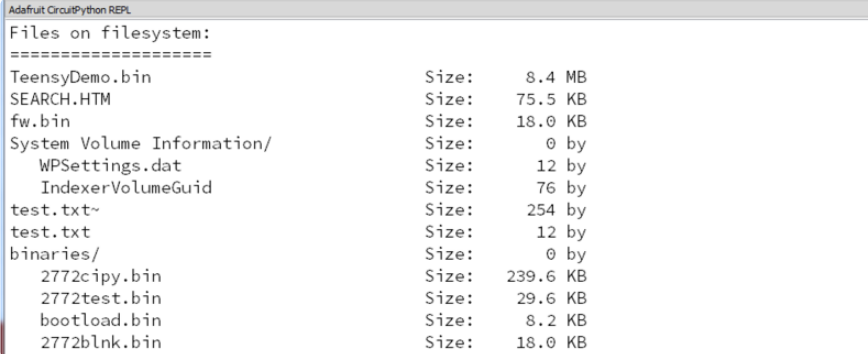
prettyprintname = ""
for _ in range(tabs):
    prettyprintname += "  "
prettyprintname += file
if isdir:
    prettyprintname += "/"
print('{0:<40} Size: {1:>10}'.format(prettyprintname, sizestr))

# recursively print directory contents
if isdir:
    print_directory(path + "/" + file, tabs + 1)

print("Files on filesystem:")
print("=====")
print_directory("/sd")

```

Once it's loaded up, open up the REPL (and restart it with ^D if necessary) to get a printout of all the files included. We recursively print out all files and also the filesize. This is a good demo to start with because you can at least tell if your files exist!



```

Adafruit CircuitPython REPL
Files on filesystem:
=====
TeensyDemo.bin           Size:    8.4 MB
SEARCH.HTM              Size:   75.5 KB
fw.bin                  Size:   18.0 KB
System Volume Information/
  WPSettings.dat        Size:    12 by
  IndexerVolumeGuid     Size:    76 by
test.txt~               Size:   254 by
test.txt                Size:    12 by
binaries/               Size:     0 by
  2772cipy.bin          Size:  239.6 KB
  2772test.bin          Size:   29.6 KB
  bootloader.bin       Size:    8.2 KB
  2772blnk.bin          Size:   18.0 KB

```

Logging Temperature

But you probably want to do a little more, lets log the temperature from the chip to a file.

Here's the new script

```

# SPDX-FileCopyrightText: 2017 Limor Fried for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import time

import adafruit_sdcard
import board
import busio
import digitalio
import microcontroller
import storage

# Use any pin that is not taken by SPI
SD_CS = board.D0

led = digitalio.DigitalInOut(board.D13)
led.direction = digitalio.Direction.OUTPUT

# Connect to the card and mount the filesystem.

```

```

spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
cs = digitalio.DigitalInOut(SD_CS)
sdcard = adafruit_sdcard.SDCard(spi, cs)
vfs = storage.VfsFat(sdcard)
storage.mount(vfs, "/sd")

# Use the filesystem as normal! Our files are under /sd

print("Logging temperature to filesystem")
# append to the file!
while True:
    # open file for append
    with open("/sd/temperature.txt", "a") as f:
        led.value = True # turn on LED to indicate we're writing to the file
        t = microcontroller.cpu.temperature
        print("Temperature = %0.1f" % t)
        f.write("%0.1f\n" % t)
        led.value = False # turn off LED to indicate we're done
    # file is saved
    time.sleep(1)

```

When saved, the Trinket will start saving the temperature once per second to the SD card under the file **temperature.txt**

The key part of this demo is in these lines:

```

print("Logging temperature to filesystem")
# append to the file!
while True:
    # open file for append
    with open("/sd/temperature.txt", "a") as f:
        led.value = True # turn on LED to indicate we're writing to the file
        t = microcontroller.cpu.temperature
        print("Temperature = %0.1f" % t)
        f.write("%0.1f\n" % t)
        led.value = False # turn off LED to indicate we're done
    # file is saved
    time.sleep(1)

```

This is a slightly complex demo but it's for a good reason. We use **with** (a 'context') to open the file for **appending**, that way the file is only opened for the very short time its written to. This is safer because then if the SD card is removed or the board turned off, all the data will be safe(r).

The LED is used to let the person using this know that the temperature is being written, it turns on just before the write and then off right after.

After the LED is turned off the **with** ends and the context closes, the file is safely stored.

Python Docs

[Python Docs \(https://adafru.it/C5z\)](https://adafru.it/C5z)

Code Storage on SD Card

In addition to storing data files on the SD Card, you may also want to store Python scripts or libraries. This is especially useful for the "non-Express" boards that have a very limited file system.

In order to execute code from the SD Card, you have to tell the system where to look for the executable files. The search path is set and viewed via the **sys.path** command. The default path looks on the processor file system in "/" then **/lib** then in the modules contained in **.frozen** as part of the board's CircuitPython build. Here is an example:

```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with sand21g18
>>> import sys
>>> sys.path
[('/', '/lib', '.frozen')]
>>>
```

As of CircuitPython 9, the SD mount point must be **/sd** on drive **CIRCUITPY**. If you get errors about a bad mount point, ensure you have a directory named **sd** on your **CIRCUITPY** drive.

The search path may be extended via the **sys.path.append** command. If you have followed the previous [example for mounting an SD Card \(https://adafru.it/C5A\)](https://adafru.it/C5A) as **/sd** then you can extend the search path using the **sys.path.append("/sd")** command as shown:

```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with sand21g18
>>> import sys
>>> sys.path
[('/', '/lib', '.frozen')]
>>> sys.path.append("/sd")
>>> sys.path
[('/', '/lib', '.frozen', '/sd')]
>>>
```

If you want mount the SD card and extend the search path via a script, place the following code in a file named **sdmount.py** and then copy it onto the file system of your processor board (not the SD card).

In this example the script **sdmount.py** will mount the SD card as **"/sd"** and then extend the **sys.path** to use **"/sd"**.

This example is written for the Feather M0 Adalogger so the "chip select" is set to **SD_CS**. For other boards, use the pin that is connected to the Chip Select line of your SD card (e.g. **board.D5**).

```
# SPDX-FileCopyrightText: 2018 Jerry Needell for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import sys

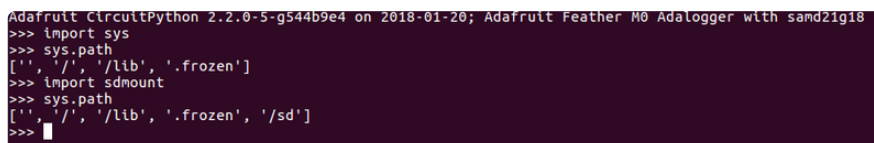
import adafruit_sdcard
import board
import busio
import digitalio
import storage

# Connect to the card and mount the filesystem.
spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
cs = digitalio.DigitalInOut(board.SD_CS)
sdcard = adafruit_sdcard.SDCard(spi, cs)
vfs = storage.VfsFat(sdcard)
storage.mount(vfs, "/sd")
sys.path.append("/sd")
```

The file **sdmount.py** must be placed on the processor file system, not on the SD card. For a non-express board like the Feather M0 Adalogger used in this example, use **ampy**.

```
ampy -p /dev/ttyUSB0 put sdmount.py
```

From the REPL you can now reboot (by typing Control-D) then mount the SD card and verify the path:



```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with samd21g18
>>> import sys
>>> sys.path
['', '/', '/lib', '.frozen']
>>> import sdmount
>>> sys.path
['', '/', '/lib', '.frozen', '/sd']
>>>
```

hello.py Example

The following walks through a simple example of how to execute a script from the SD Card.

First, store the following code as **hello.py** on the SD Card using your computer. Typically this would be done by removing the SD Card from your device and attaching

it to your computer where it will be mounted as a USB drive. You can save the **hello.py** file directly on the drive or save it locally on your computer and drag/drop it to the USB drive.

```
# SPDX-FileCopyrightText: 2018 Jerry Needell for Adafruit Industries
#
# SPDX-License-Identifier: MIT

print('Hello, World!')
```

After copying the file to your SD Card, and reinserting and remounting the SD Card on your device, you can verify that the file is there:

```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with samd21g18
>>> import sdmount
>>> import os
>>> os.listdir("/sd")
['.Spotlight-V100', '.fsevents', 'hello.py', 'lib', 'test.txt']
>>>
```

As you can see, there are some additional files on my SD Card.

You can now execute the code from the SD Card like any stored file as shown:

```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with samd21g18
>>>
>>>
>>> import sdmount
>>> import hello
Hello, World!
>>>
```

If you want to have access to the entire Adafruit CircuitPython Bundle, you can copy the `lib/` subdirectory to your SD Card then make it available with an additional append. Here is a revised script `sdmount_lib.py` file that also appends `"/sd/lib"` to the path.

```
# SPDX-FileCopyrightText: 2018 Jerry Needell for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import sys

import adafruit_sdcard
import board
import busio
import digitalio
import storage

# Connect to the card and mount the filesystem.
spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
cs = digitalio.DigitalInOut(board.SD_CS)
sdcard = adafruit_sdcard.SDCard(spi, cs)
vfs = storage.VfsFat(sdcard)
storage.mount(vfs, "/sd")
sys.path.append("/sd")
sys.path.append("/sd/lib")
```

Copy `sdmount_lib.py` to your processor's File system (not the SD Card).

```
ampy -p /dev/ttyUSB0 put sdmount_lib.py
```

You now have access to the entire Bundle! You can see that '/lib' shows up first in the path. When searching for a library the system will first look in /lib then in /sd and /sd/lib.

```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with sand21g18
>>>
>>> import sys
>>> sys.path
['', '/', '/lib', '.frozen']
>>> import sdmount_lib
>>> sys.path
['', '/', '/lib', '.frozen', '/sd', '/sd/lib']
>>>
```

For example, you can load the NeoPixel driver with:

```
import neopixel
```

and it will be loaded from the SD Card.

```
Adafruit CircuitPython 2.2.0-5-g544b9e4 on 2018-01-20; Adafruit Feather M0 Adalogger with sand21g18
>>>
>>> import sdmount_lib
>>> import sys
>>> sys.path
['', '/', '/lib', '.frozen', '/sd', '/sd/lib']
>>> import neopixel
>>>
```

MicroPython

Note this page describes how to use a MicroPython.org version of this library with MicroPython boards. Skip back to the previous page if you're using a CircuitPython board like the Feather M0 express or Adalogger! This tutorial page is not maintained and may be out of date

Before you get started you'll want to be familiar with the basics of using MicroPython by reading these guides:

- [MicroPython Basics: What is MicroPython? \(https://adafru.it/pMb\)](https://adafru.it/pMb)
- [MicroPython Basics: How to Load MicroPython on a Board \(https://adafru.it/pNB\)](https://adafru.it/pNB)
- [MicroPython Basics: Load Files & Run Code \(https://adafru.it/r2B\)](https://adafru.it/r2B)
- [MicroPython Basics: Loading Modules \(https://adafru.it/ryf\)](https://adafru.it/ryf)

Note that SD card support varies greatly for MicroPython boards. A few boards have good native support built-in:

pyboard

The pyboard is one of the easiest MicroPython boards to use with a microSD card.

The board is built with a small microSD card slot and its firmware will automatically load the card as the root filesystem for the board. Plug in the card, power up the pyboard and it should automatically use the card as a filesystem to run scripts, store data, etc. You don't need to buy extra hardware or run any commands!

[Check out the pyboard SD card documentation \(https://adafru.it/qyB\)](https://adafru.it/qyB) for more details.

WiPy

The WiPy also makes it easy to use a microSD card with its [WiPy expansion board \(http://adafru.it/2960\)](http://adafru.it/2960). The expansion board includes a microSD card slot so you can easily plug in a card. With a few lines of code you can mount the microSD card on the board's filesystem to read and write data, just like with the pyboard.

[Check out the WiPy SD card documentation \(https://adafru.it/qyC\)](https://adafru.it/qyC) for more details.

Other MicroPython boards like the ESP8266 need to use a little more code to work with microSD cards. Follow the steps below to use MicroPython ESP8266 with a microSD card.

MicroPython ESP8266 SD Card Setup

Before you can use a microSD card with MicroPython on the ESP8266 you'll need to make sure you're using **at least firmware version 1.8.4 or higher**. If you aren't familiar with loading MicroPython firmware on the ESP8266 [check out this handy guide for all the details \(https://adafru.it/pNB\)](https://adafru.it/pNB). **Be sure to get MicroPython ESP8266 stable firmware version 1.8.4 or higher from its download page!**

Once your board is running MicroPython 1.8.4 or higher there's one more step to enable microSD card access. You need to manually install a Python module to talk to the SD card. This module is not included in the MicroPython ESP8266 firmware by default, but it's easy to copy to the board's internal filesystem. [Be sure to read this guide on loading modules \(https://adafru.it/ryf\)](https://adafru.it/ryf) to understand more about how you can copy modules and load them.

The quickest way to load the module is to copy its source to the board. This isn't the most memory efficient way to load the module (it will use a bit more RAM), but it's good to quickly get started. Once you have SD card access working you can [freeze the module into a custom build of MicroPython firmware \(https://adafru.it/ryA\)](https://adafru.it/ryA) to reduce its memory usage.

First download the [SD card driver module \(https://adafru.it/ryB\)](https://adafru.it/ryB) from the [MicroPython GitHub repository \(https://adafru.it/ryC\)](https://adafru.it/ryC) by clicking the button below:

[Download MicroPython sdcard.py](https://adafru.it/19en)

<https://adafru.it/19en>

Next [use a tool like ampy \(https://adafru.it/q9C\)](https://adafru.it/q9C) to copy the `sdcard.py` file to the root of the board's filesystem:

```
ampy --port /board/serial/port put sdcard.py
```

At this point the `sdcard.py` file should be on the root of the MicroPython board's filesystem. You're ready to run code that can import the SD card and make it the new root filesystem.

Mount SD Card

To mount the SD card as the MicroPython ESP8266 board's filesystem you'll need to run a few commands. Connect to the board's serial or other REPL and first run this import command:

```
import machine, sdcard, os
```

If you see an error like the `sdcard` module couldn't be found or imported double check that you copied the module's `.py` file to the board (or that you froze it into the firmware if you're building a custom MicroPython firmware).

Once the necessary modules are imported you can initialize access to the SD card with this command:

```
sd = sdcard.SDCard(machine.SPI(1), machine.Pin(15))
```

Make sure you're using MicroPython ESP8266 version 1.8.4 or higher! If you're using an older firmware version this command will fail because the `machine.SPI` object doesn't use interface number 1.

This command will create a SD card object that's initialized using the hardware SPI interface (interface 1 for the ESP8266) and the specified chip select pin (GPIO 15, but you can use other GPIO pins if you wire them accordingly).

Next to make the SD card the new root filesystem run the following command:

```
vfs = os.VfsFat(sd, "")
```

This line will create a new virtual FAT filesystem using the SD card as a backing store instead of the internal flash memory on the board. The filesystem is assigned to a global `vfs` object that MicroPython ESP8266 internally uses for its filesystem.

It actually isn't that important that the `vfs` object be assigned since the `VfsFat` object initializer does all the work to mount the filesystem. However as a best practice it's good to assign the new `VfsFat` object to a variable so it never gets garbage collected.

The second parameter to the `VfsFat` object initializer is the path on the filesystem to mount the card. For now only the empty string is allowed as it specifies to load the filesystem as the new root (i.e. under `/`).

At this point the microSD card should be the new root filesystem for the board. You can interact with the files just like interacting with files on the internal filesystem. See the [CircuitPython file usage page \(https://adafru.it/zwE\)](https://adafru.it/zwE) for details on file reading and writing with the **open**, **read**, and **write** functions. Remember since the card is mounted as the root filesystem you access files directly under the `/` path and not `/sd` or other deeper paths!