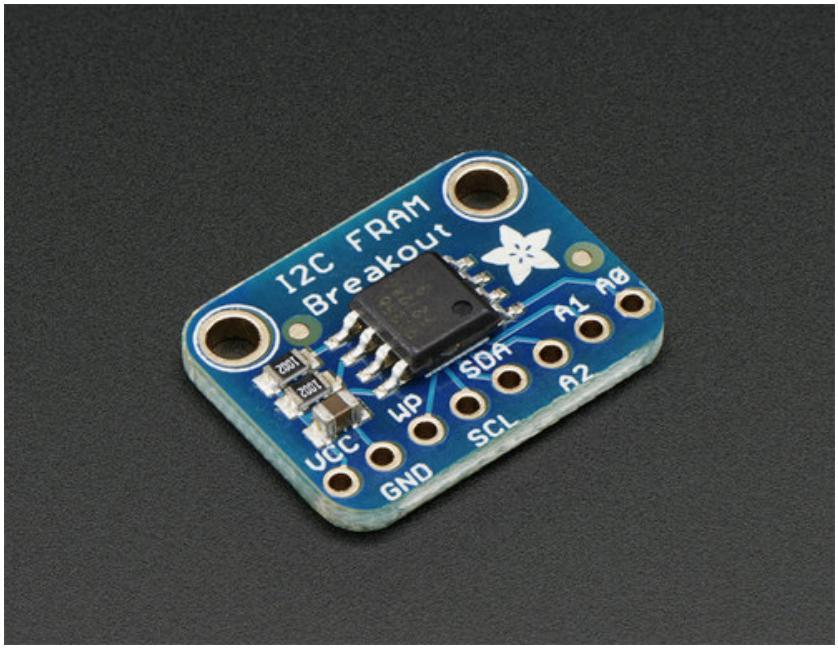
adafruit learning system

Adafruit I2C FRAM Breakout

Created by lady ada



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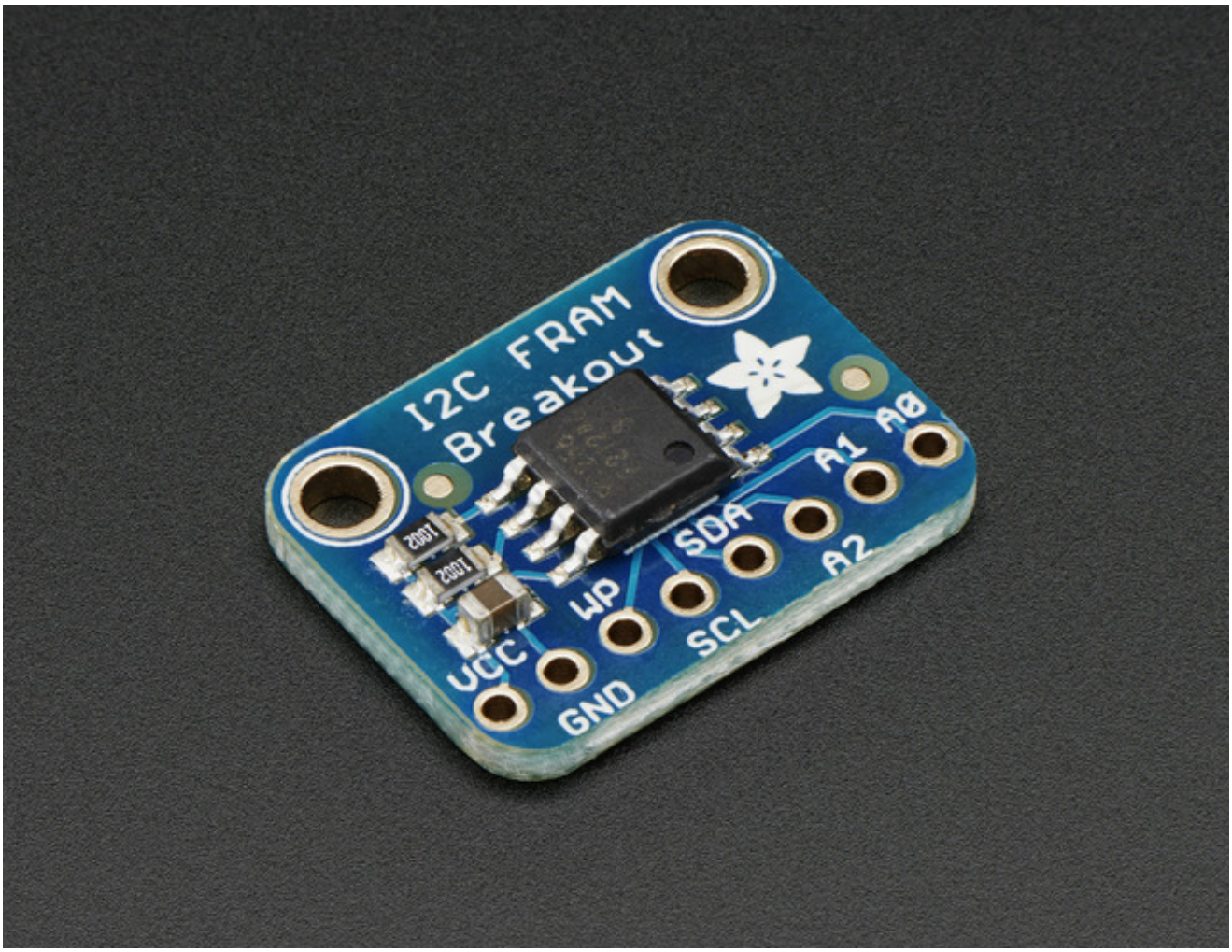
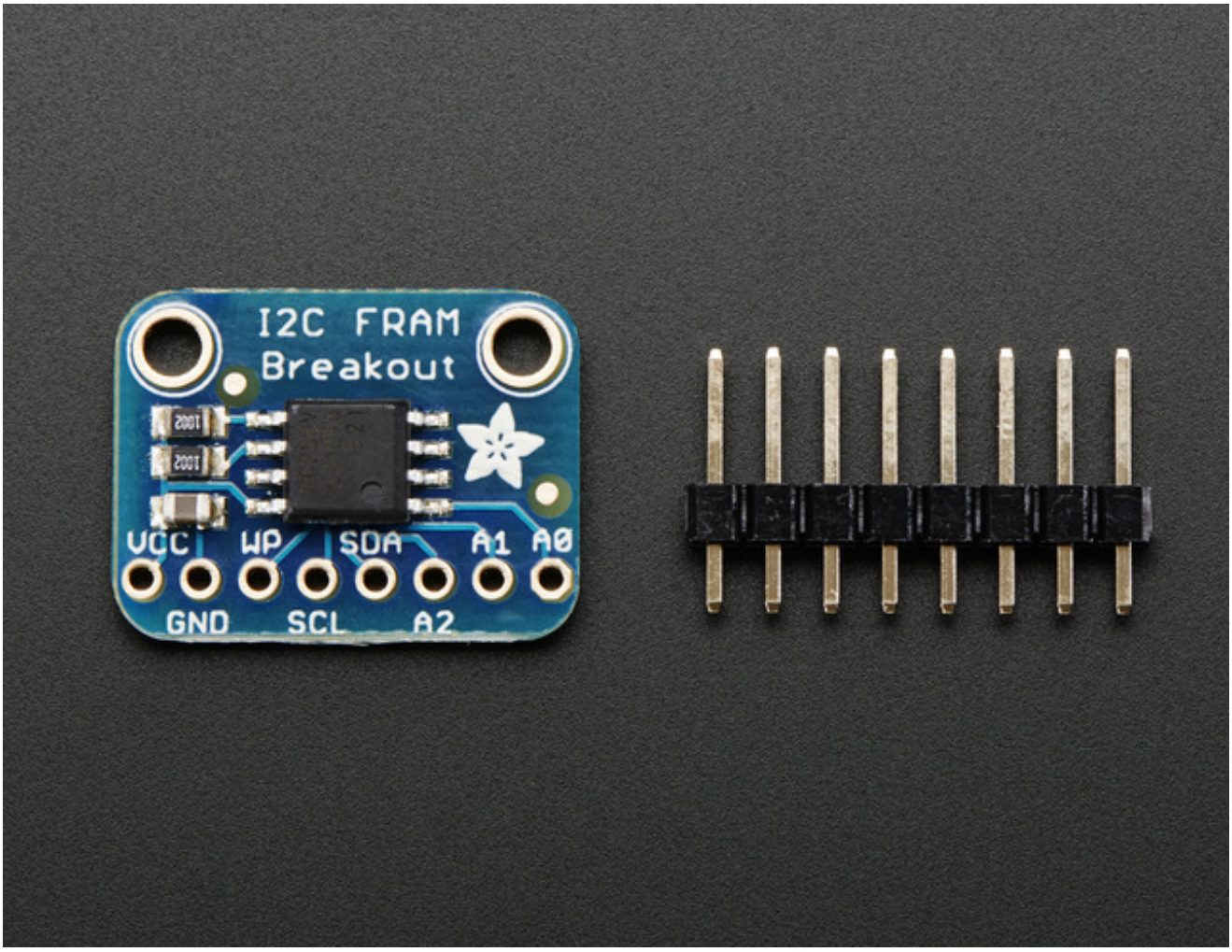
Guide Contents

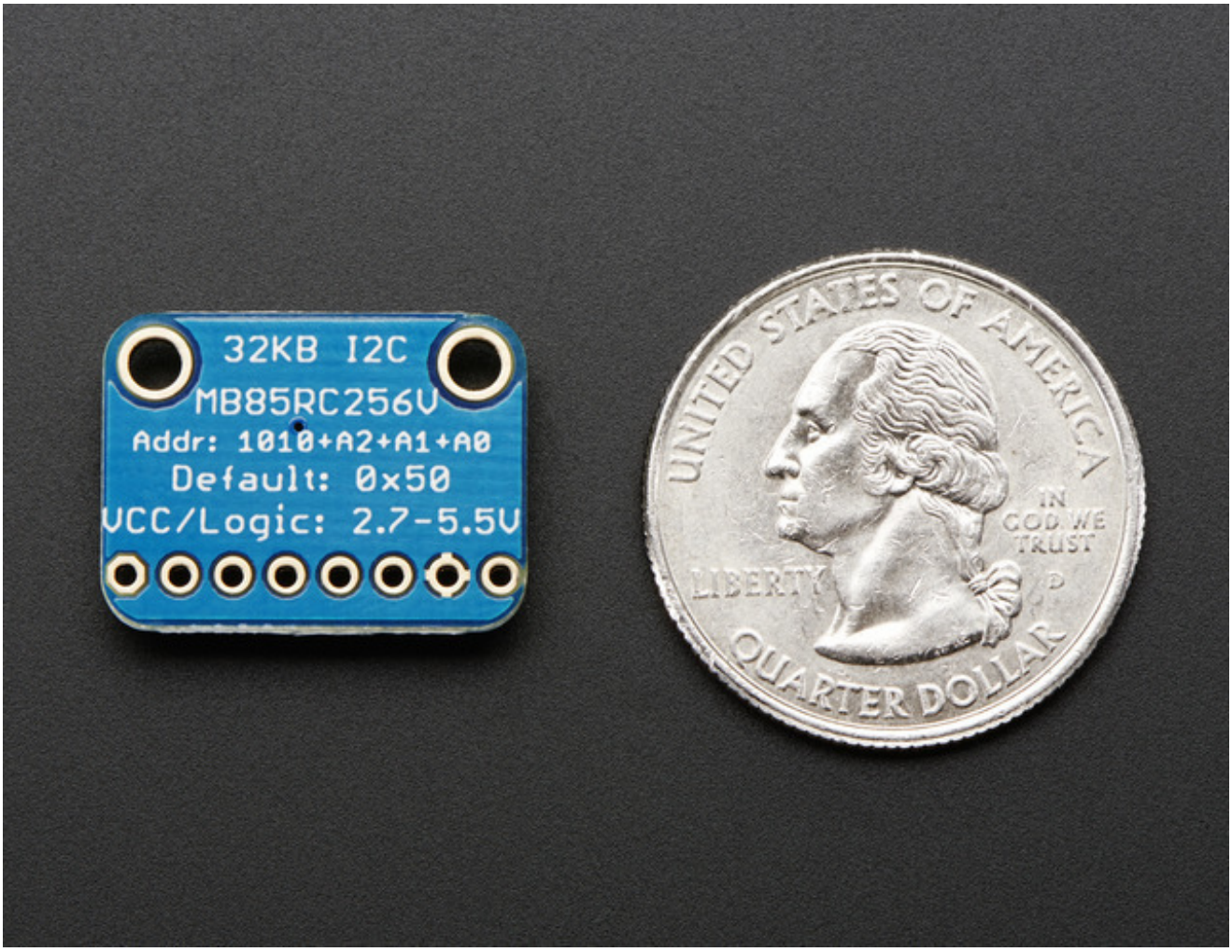
Overview



You're probably familiar with SRAM, DRAM, EEPROM and Flash but what about FRAM? FRAM is 'ferroelectric' RAM, which has some very interesting and useful properties. Unlike SRAM, FRAM does not lose the data when power is lost. In that sense it's a durable storage memory chip like Flash. However, it is much faster than Flash - and you don't have to deal with writing or erasing pages.

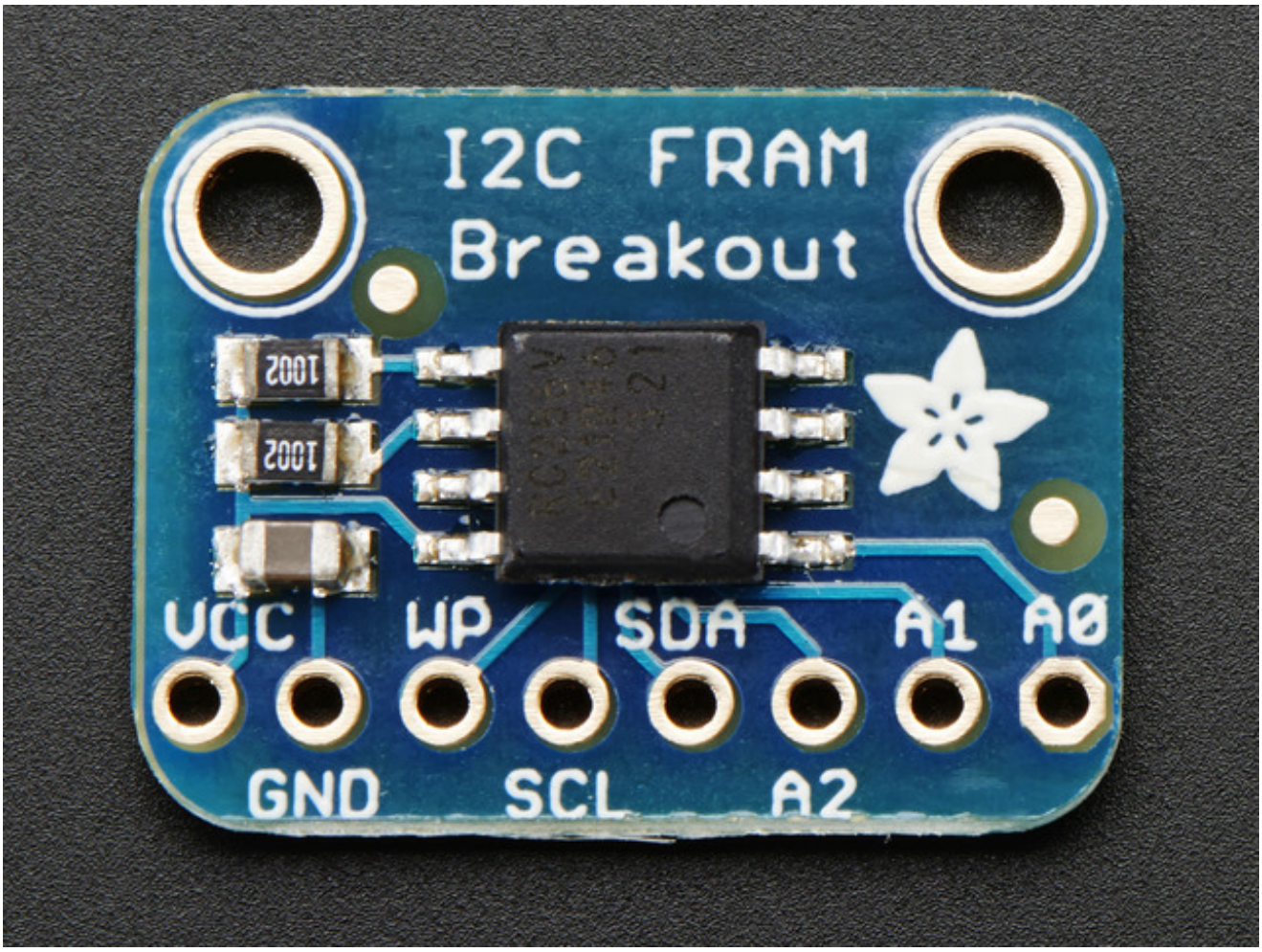


This particular FRAM chip has 256 Kbits (32 KBytes) of storage, interfaces using I2C, and can run at up to 1MHz I2C rates. Each byte can be read and written instantaneously (like SRAM) but will keep the memory for 95 years at room temperature. Each byte can be read/written 10,000,000,000,000 times so you don't have to worry too much about wear leveling.



With the best of SRAM and Flash combined, this chip can let you buffer fairly-high speed data without worrying about data-loss.

Pinouts



The FRAM chip is the little guy in the middle. On the bottom we have the power and interface pins

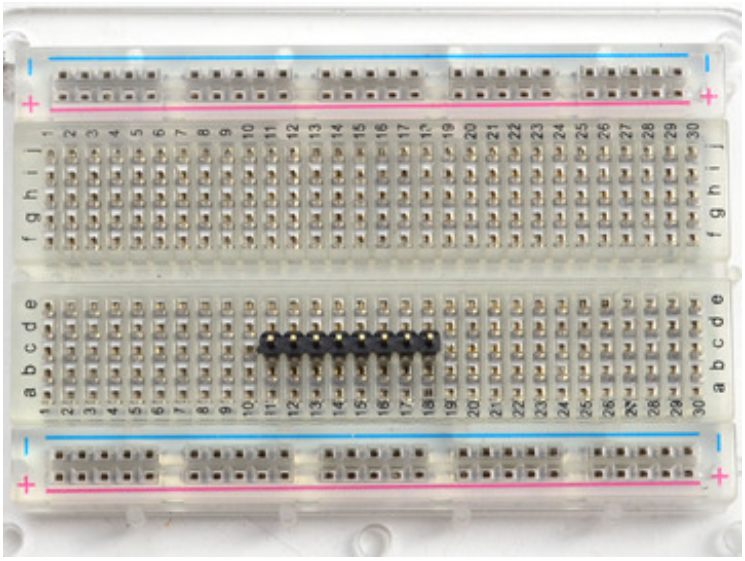
Power Pins:

- **VCC** - this is the power pin. Since the chip uses 3-5VDC you should pick whatever the logic voltage you're using. For most Arduino's that's 5V.
- **GND** - common ground for power and logic

I2C Logic pins:

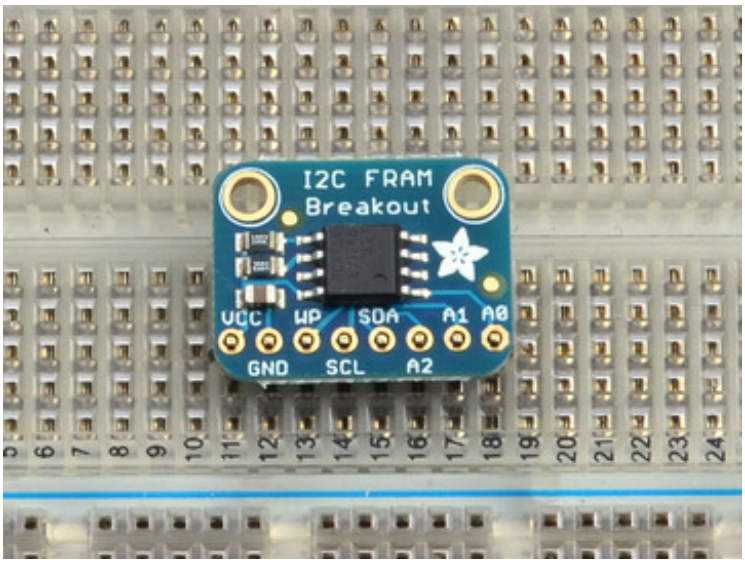
- **WP** - Write Protect pin. This is used to force write protection so you cannot write to the FRAM. It has an internal pulldown. Bring to a high voltage (VCC) to turn on WP
- **SCL** - I2C clock pin, connect to your microcontrollers I2C clock line.
- **SDA** - I2C data pin, connect to your microcontrollers I2C data line.
- **A2, A1, A0** - These are the I2C address selection pins. By default the I2C address is 0x50. Connecting these pins to VCC and power cycling the chip will adjust the lower three bits of the address. For example, if A0 is high, the address is 0x51. If A1 and A2 are high, the address is 0x56

Assembly

- 

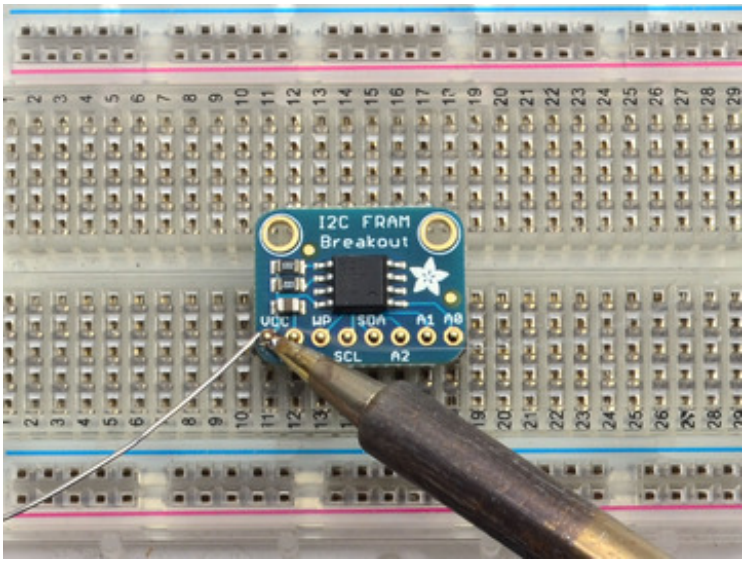
Prepare the header strip:

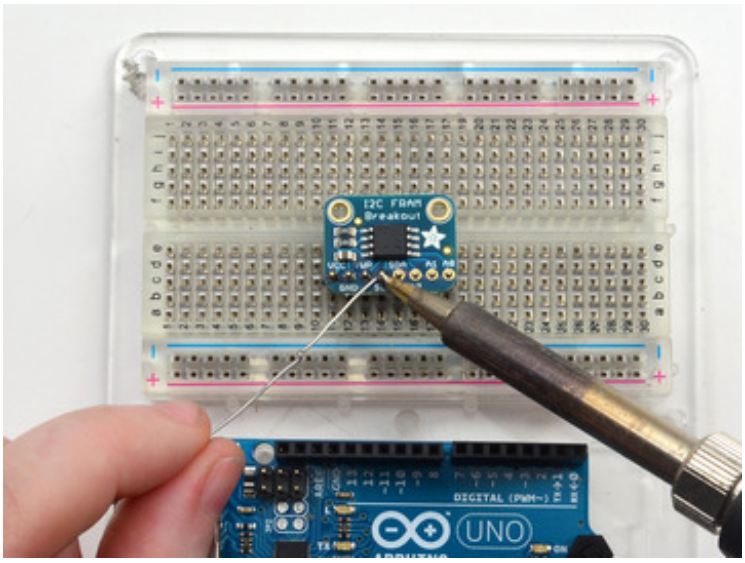
Cut the strip to length if necessary. It will be easier to solder if you insert it into a breadboard - **long pins down**

- 

Add the breakout board:

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

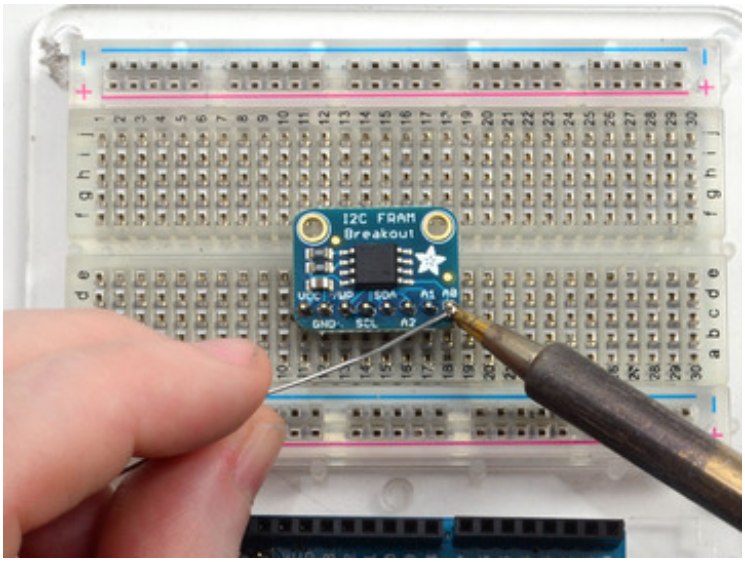
- 

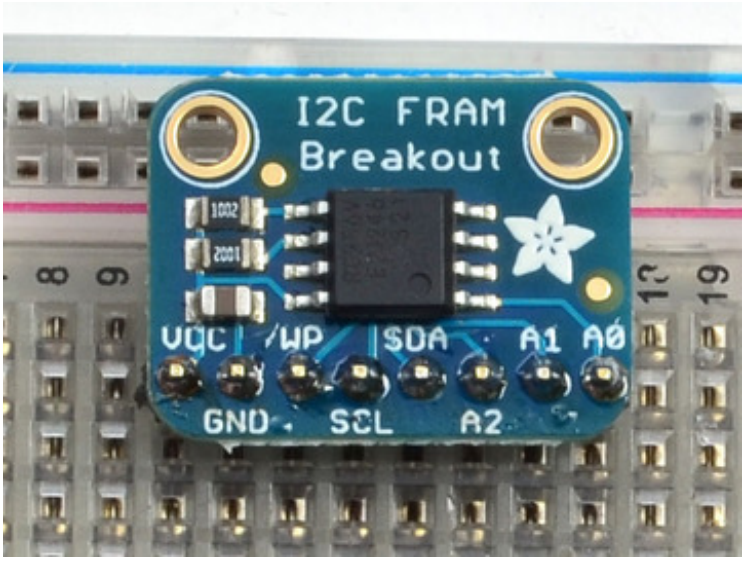
- 

And Solder!

Be sure to solder all pins for reliable electrical contact.

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

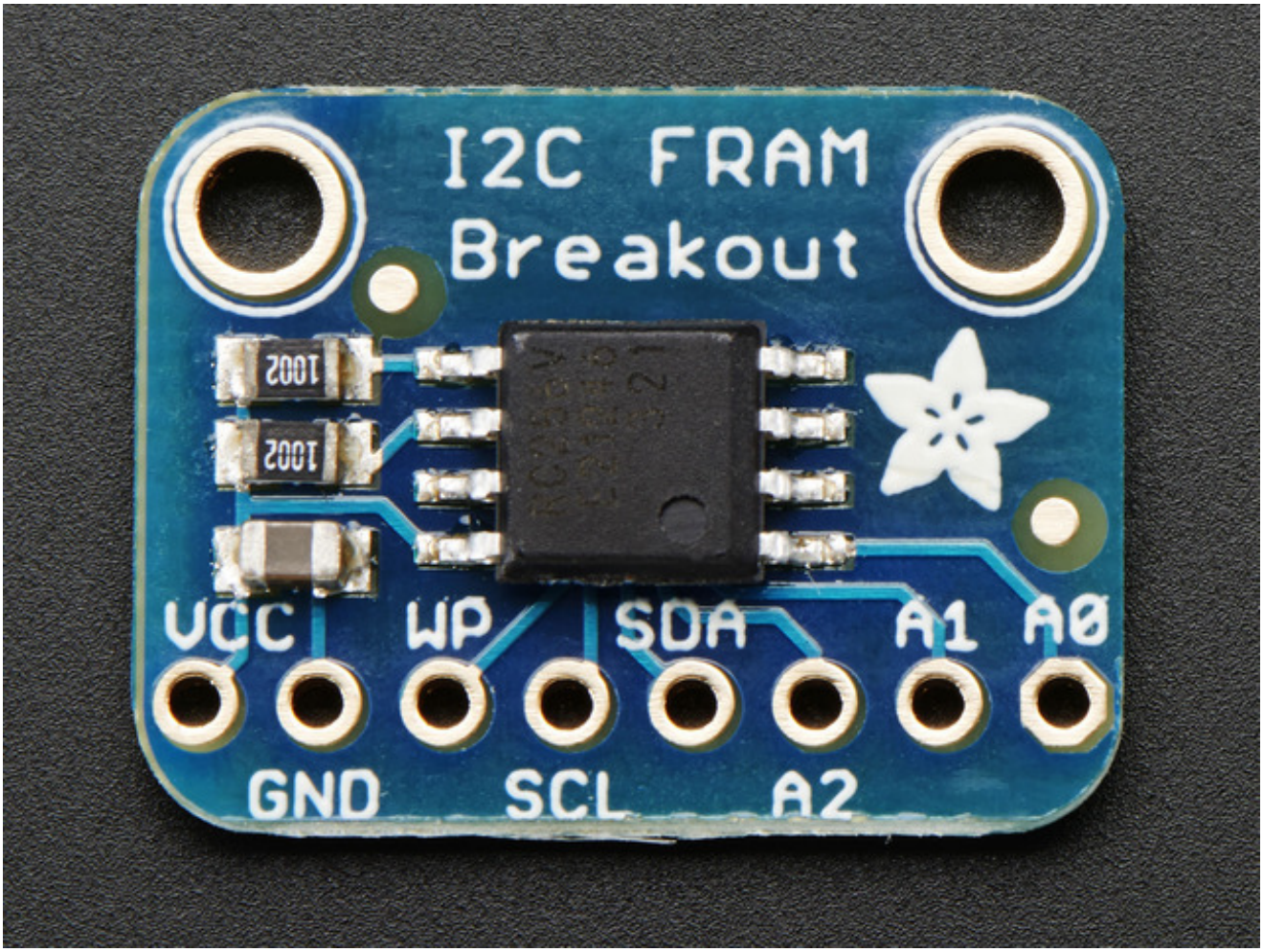
- 

- 

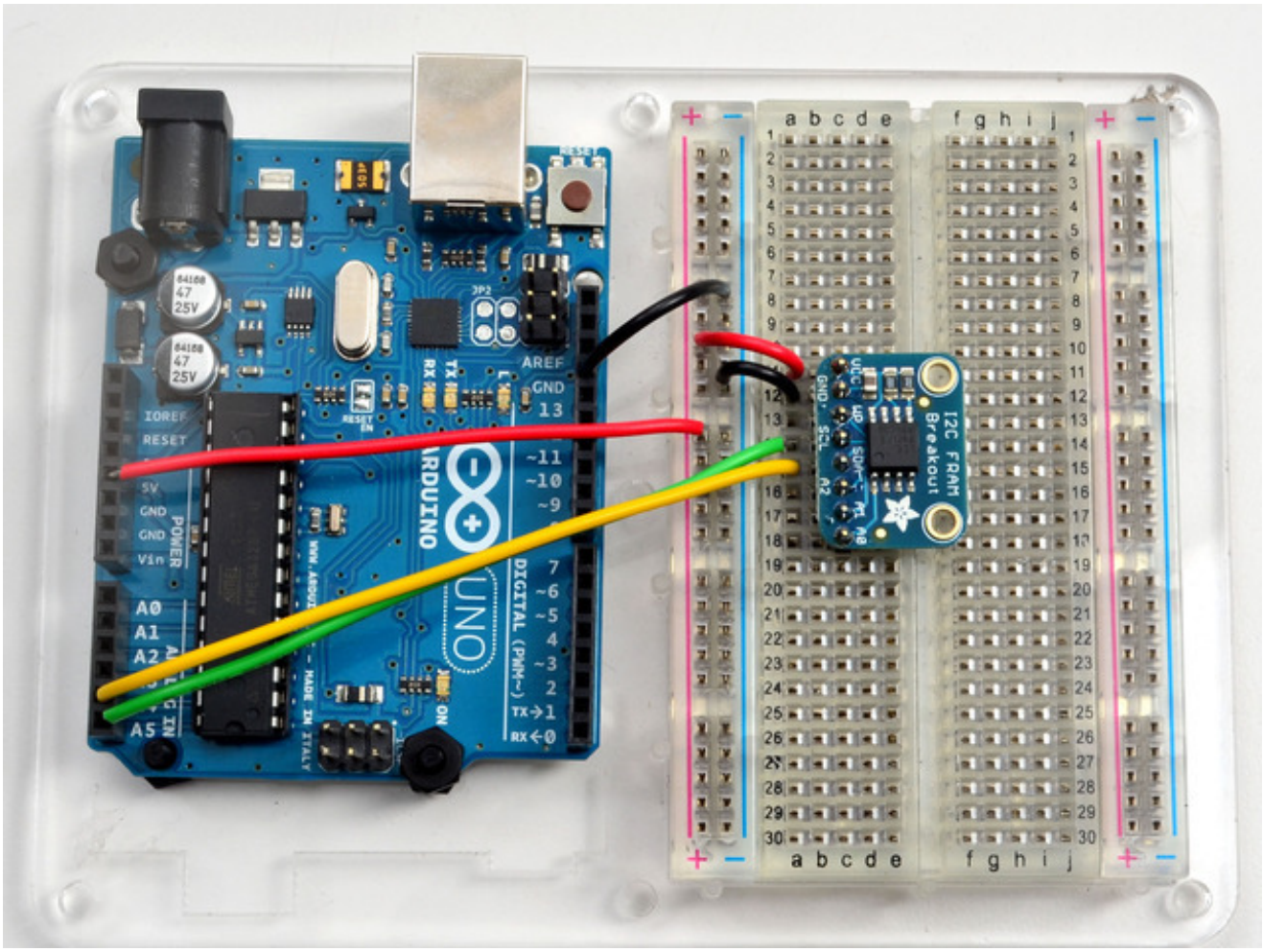
You're done! Check your solder joints visually and continue onto the next steps

Wiring and Test

Arduino Wiring



You can easily wire this breakout to any microcontroller, we'll be using an Arduino



- Connect **Vcc** to the power supply, 3V or 5V is fine. Use the same voltage that the microcontroller logic is based off of. For most Arduinos, that is 5V
- Connect **GND** to common power/data ground
- Connect the **SCL** pin to the I2C clock**SCL** pin on your Arduino. On an UNO & '328 based Arduino, this is also known as **A5**, on a Mega it is also known as **digital 21** and on a Leonardo/Micro, **digital 3**
- Connect the **SDA** pin to the I2C data**SDA** pin on your Arduino. On an UNO & '328 based Arduino, this is also known as **A4**, on a Mega it is also known as **digital 20** and on a Leonardo/Micro, **digital 2**

The I2C FRAM has a default I2C address of**0x50** but you can set the address to any of 8 values between 0x50 and 0x57 so you can have up to 8 of these chips all sharing the same SCL/SDA pins. We suggest just connecting up the power and SDA/SCL pins for now. Once you have things working, change up the address as desired.

Download Adafruit_FRAM_I2C

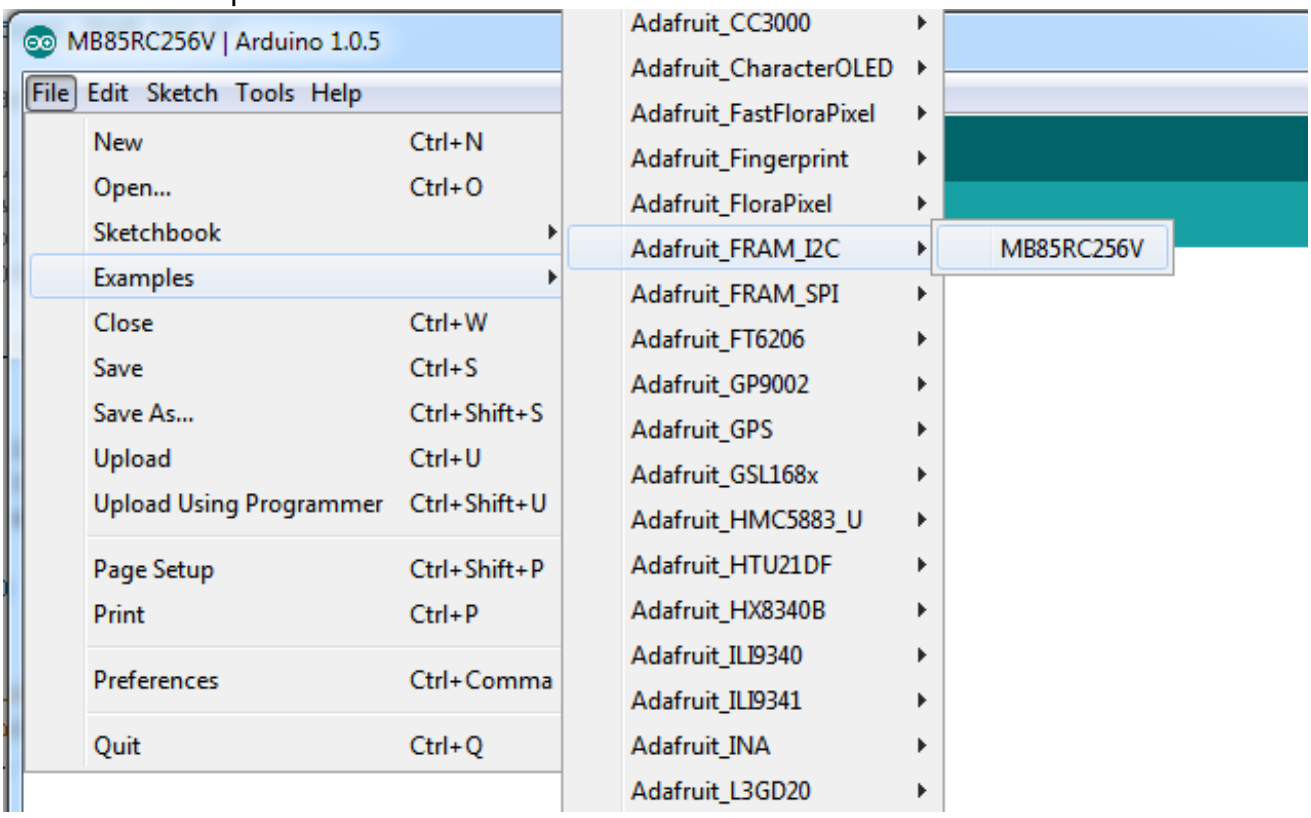
To begin reading and writing data to the chip, you will need todownload Adafruit_FRAM_I2C from our github repository (http://adafru.it/dtq). You can do that by visiting the github repo and manually downloading or, easier, just click this button to download the zip
Download Adafruit FRAM i2c Library
http://adafru.it/dtr
Rename the uncompressed folder **Adafruit_FRAM_I2C** and check that the **Adafruit_FRAM_I2C** folder contains **Adafruit_FRAM_I2C.cpp** and **Adafruit_FRAM_I2C.h**

Place the **Adafruit_FRAM_I2C** library folder your **arduinosketchfolder/libraries/** folder. You may need to create the**libraries** subfolder if its your first library. Restart the IDE.

We also have a great tutorial on Arduino library installation at:
http://learn.adafruit.com/adafruit-all-about-arduino-libraries-install-use (http://adafru.it/aYM)

Load Demo

Open up **File->Examples->Adafruit_FRAM_I2C->MB85RC256V** and upload to your Arduino wired up to the sensor

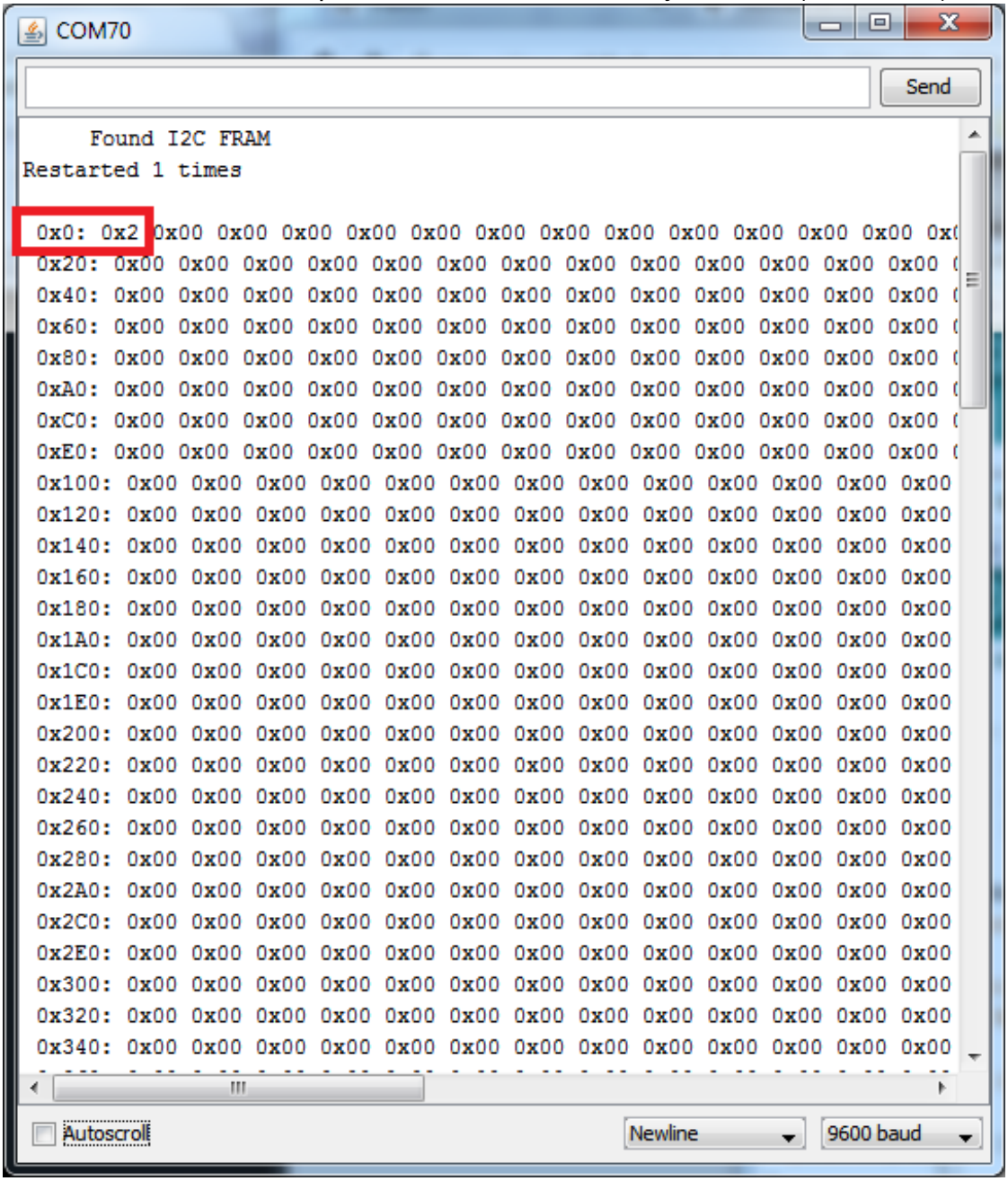


Thats it! Now open up the serial terminal window at 9600 speed to begin the test.

The test is fairly simple - It first verifies that the chip has been found. Then it reads the

value written to location #0 in the memory, prints that out and write that value + 1 back to location #0. This acts like a restart-meter: every time the board is reset the value goes up one so you can keep track of how many times its been restarted.

Afterwards, the Arduino prints out the value in every location (all 256KB!)



Library Reference

The library we have is simple and easy to use

You can create the FRAM object with

Adafruit_FRAM_I2C fram = Adafruit_FRAM_I2C();

Then when you **begin**(), pass in the i2c address. The default is 0x50 so if you don't put any value in the default is used.
If you have different addresses, call something like

fram.begin(0x53)

for example.

Then to write a value, call

fram.write8(address, byte-value);

to write an 8-bit value to the address location
Later on of course you can also read with

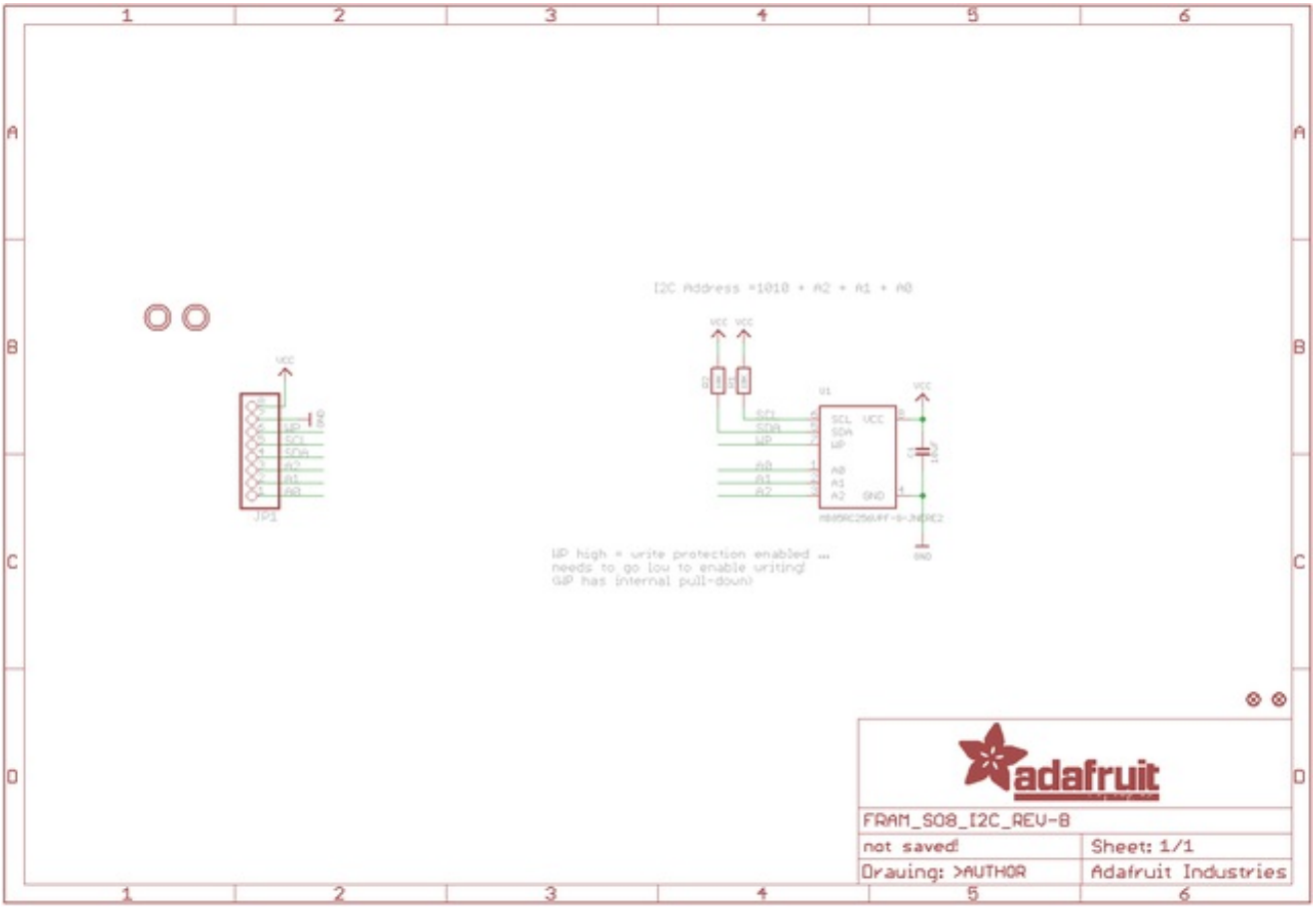
fram.read8(address);

which returns a byte reading.

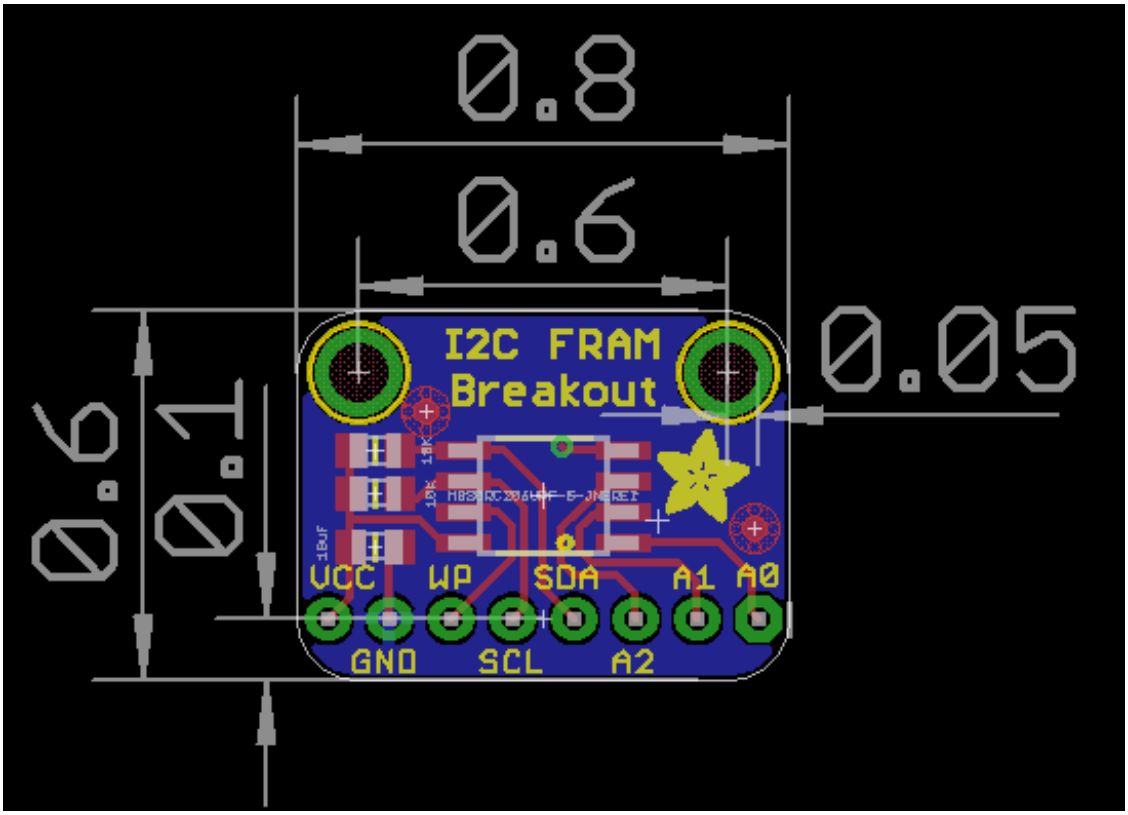
Downloads

- Datasheet for the MB85RC256VPF FRAM chip (http://adafru.it/xDK)
- Fritzing object in the Adafruit Fritzing library (http://adafru.it/aP3)
- EagleCAD PCB files in GitHub (http://adafru.it/q6a)

Schematics



Fabrication Print


0.8
0.6
0.05
0.6
0.1
I2C FRAM
Breakout
VCC
WP
SDA
A1
A0
GND
SCL
A2