Adafruit MCP9808 Precision I2C Temperature Sensor Guide
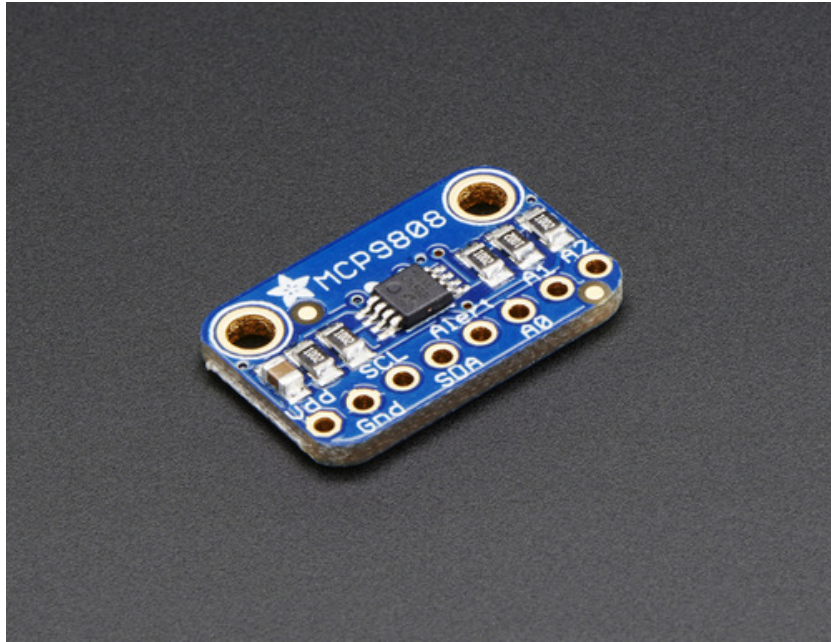
Created by lady ada
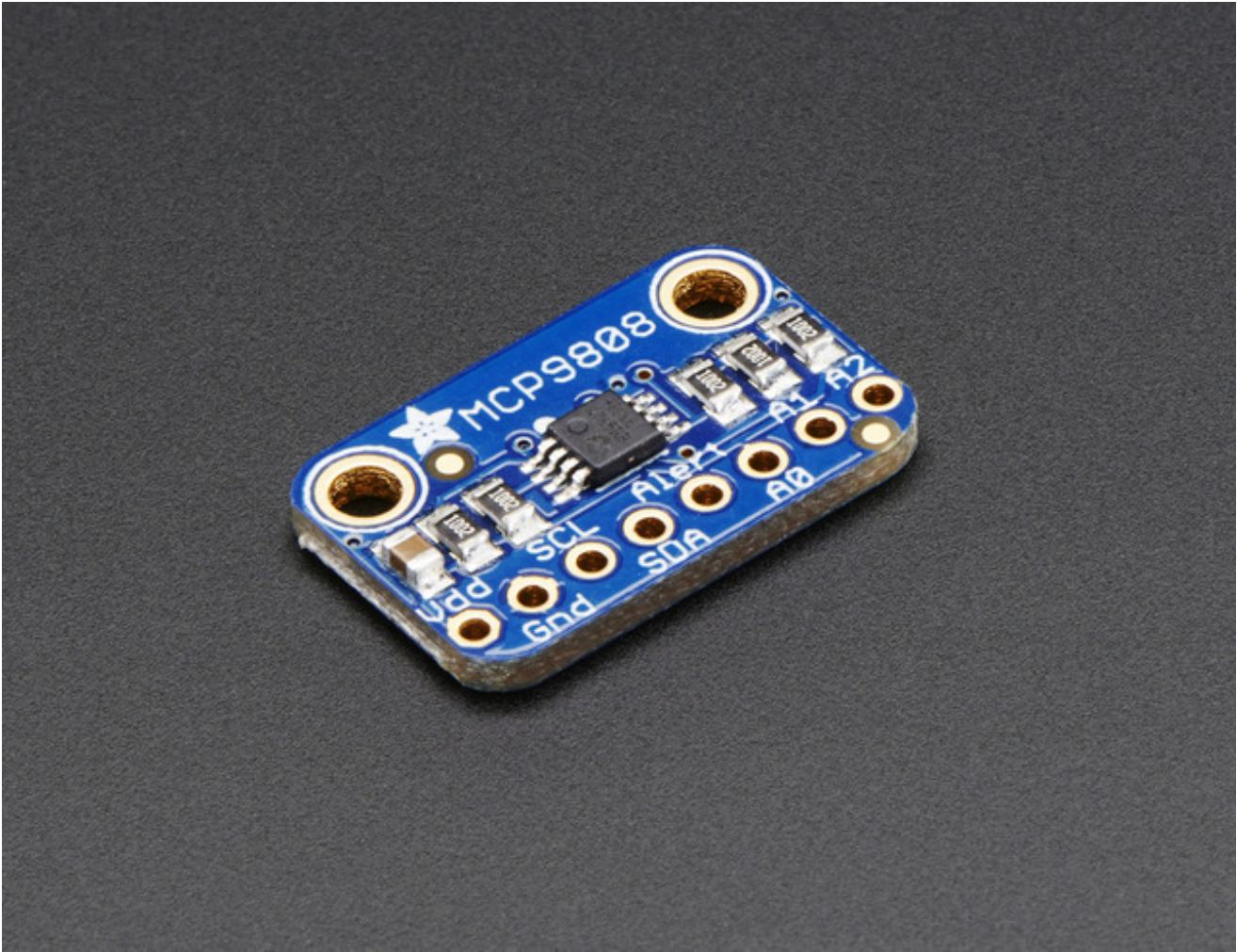

Last updated on 2014-04-22 03:01:18 PM EDT

Guide Contents

Overview

This I2C digital temperature sensor is one of the more accurate/precise we've ever seen, with a typical accuracy of ±0.25°C over the sensor's -40°C to +125°C range and precision of +0.0625°C. They work great with any microcontroller using standard i2c. There are 3 address pins so you can connect up to 8 to a single I2C bus without address collisions. Best of all, a wide voltage range makes is usable with 2.7V to 5.5V logic!
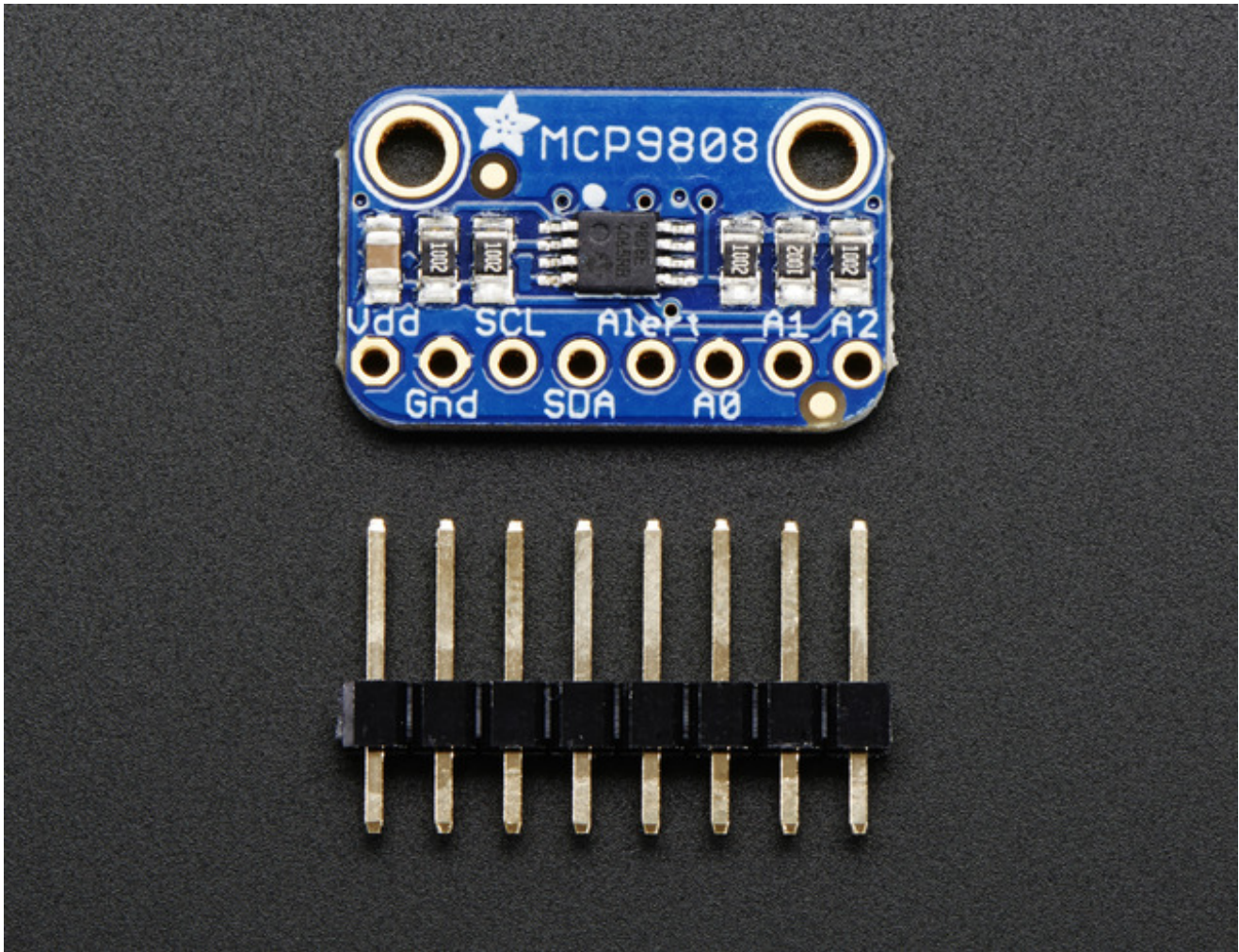
Unlike the DS18B20, this sensor does not come in through-hole package so we placed this small sensor on a breakout board PCB for easy use. The PCB includes mounting holes, and pull down resistors for the 3 address pins. We even wrote a lovely little library for Arduino that will work with any Arduino compatible. You'll be up and running in 15 minutes or less.
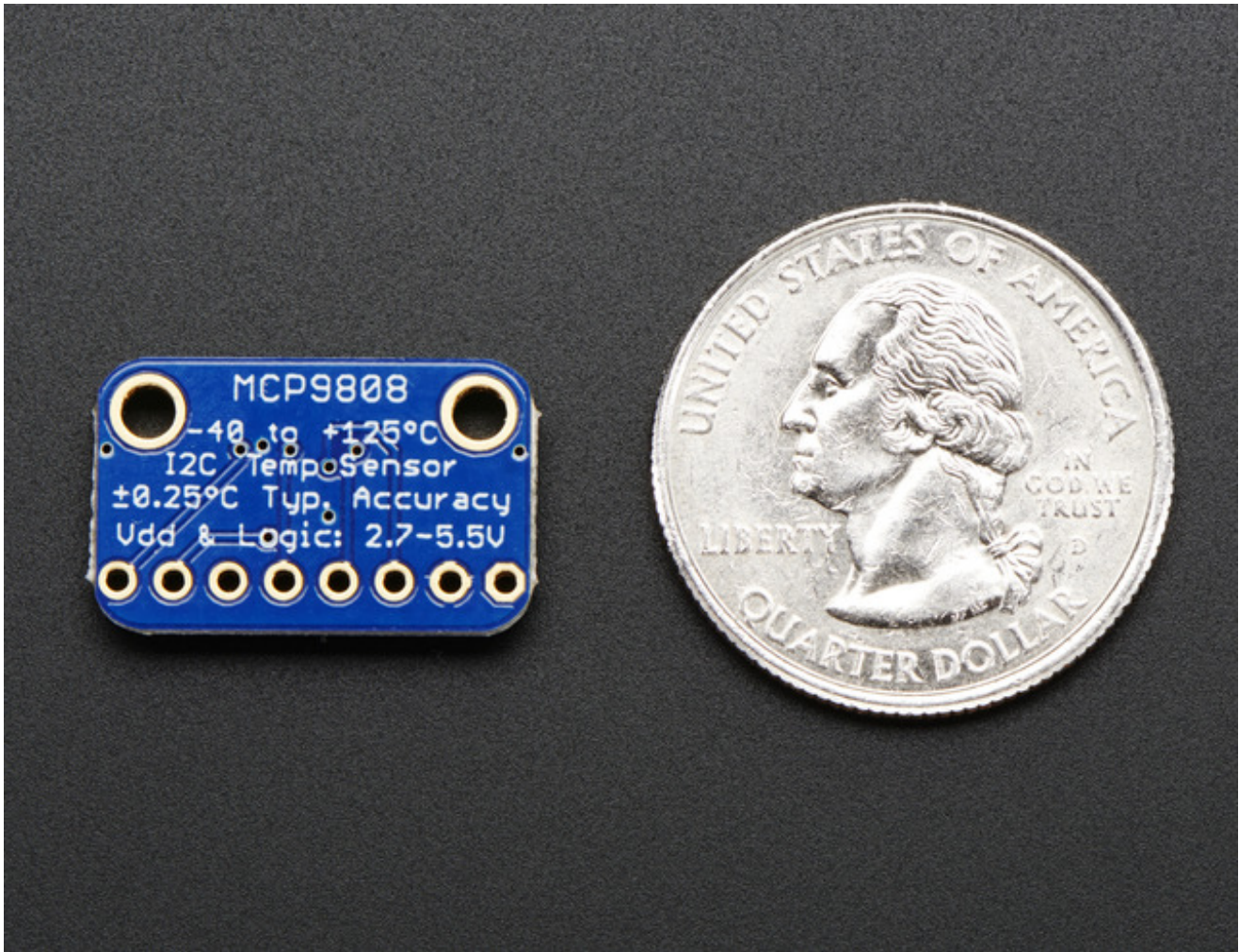
- Simple I2C control
- Up to 8 on a single I2C bus with adjustable address pins
- 0.25°C typical precision over -40°C to 125°C range (0.5°C guaranteed max from -20°C to 100°C)
- 0.0625°C resolution
- 2.7V to 5.5V power and logic voltage range
- Operating Current: 200 ΠA (typical)

Pinouts
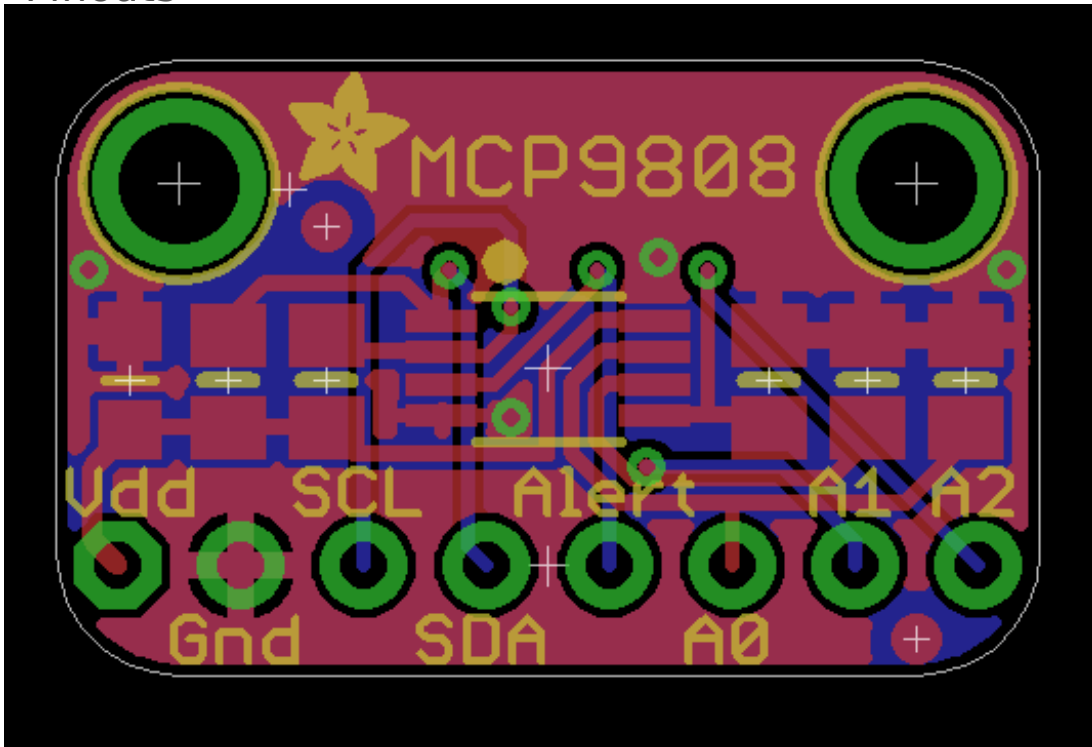
The MCP9808 is a very straight-forward sensor, lets go thru all the pins so you can understand what you need to connect to get started

Power Pins

- **VDD** - This is the positive power and logic level pin. It can be 2.7-5.5VDC, so fine for use with 3 or 5V logic. Power VDD with whatever logic level you plan to use on the i2c lines.
- **GND** - this is the ground power and logic reference pin.

I2C Data Pins

- **SCL** - this is the I2C clock pin. There's a 10K pull-up already on the board, so connect this directly to the i2c master clock pin on your microcontroller
- **SDA** - this is the I2C data pin. There's a 10K pull-up already on the board, so connect this directly to the i2c master data pin on your microcontroller

Optional Pins

These are pins you don't need to connect to unless you want to!

- **Alert** - This is the interrupt/alert pin from the MCP9808. The chip has some capability to 'alert' you if the chip temperature goes above or below a set amount. This output can trigger to let you know. It is **open collector** so you need to use a pull-up resistor if you want to read signal from this pin.
- **A0 A1 A2** - These are the address select pins. Since you can only have one device with a given address on an i2c bus, there must be a way to adjust the address if you

want to put more than one MCP9808 on a shared i2c bus. The A0/A1/A2 pins set the bottom three pins of the i2c address. There are pull-down resistors on the board so connect them to VDD to set the bits to '1'. They are read on power up, so de-power and re-power to reset the address

The default address is **0x18** and the address can be calculated by 'adding' the **A0/A1/A2** to the base of 0x18
A0 sets the lowest bit with a value of **1**, **A1** sets the middle bit with a value of **2** and **A2** sets the high bit with a value of **4**. The final address is **0x18 + A2 + A1 + A0**.
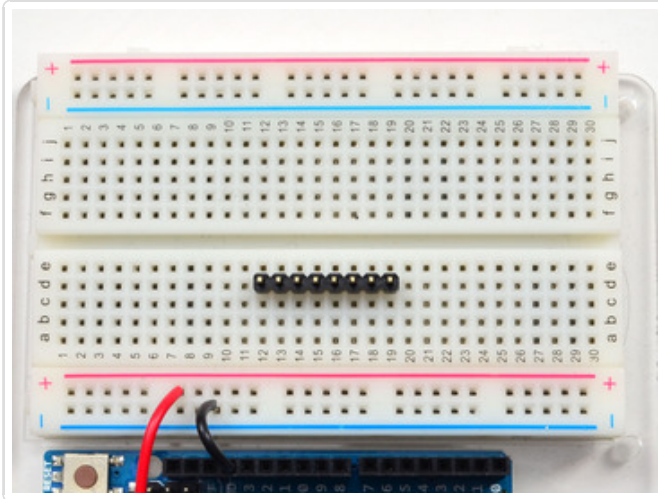So for example if **A2** is tied to VDD and **A0** is tied to VDD, the address is **0x18 + 4 + 1 = 0x1D.**
If only A0 is tied to VDD, the address is **0x18 + 1 = 0x19**
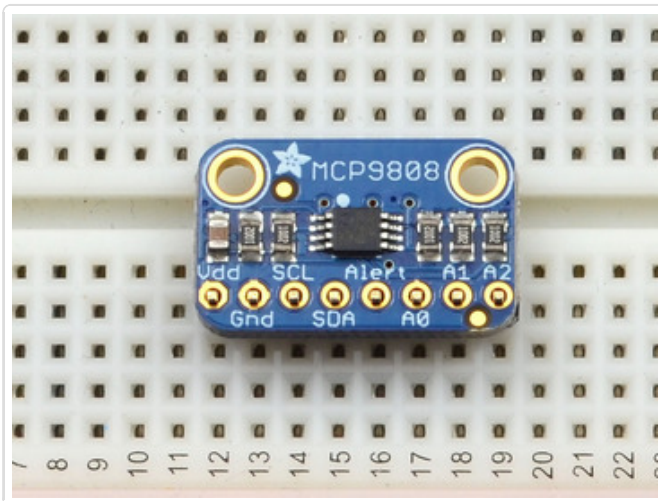If only A1 is tied to VDD, the address is **0x18 + 2 = 0x1A**
If only A2 is tied to VDD, the address is **0x18 + 4 = 0x1C**

Wiring & Test

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
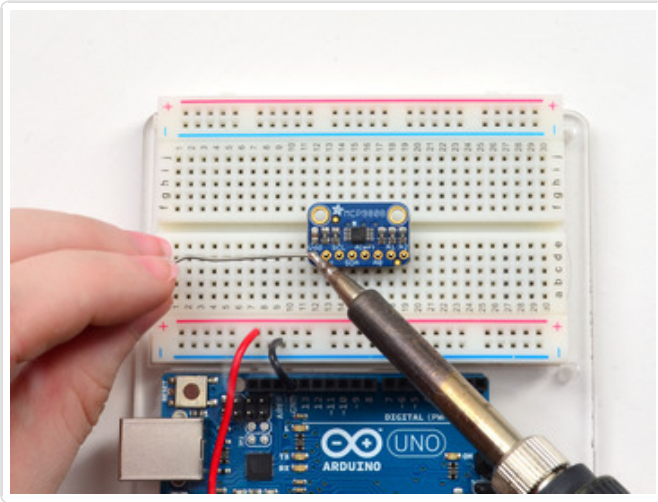
And Solder!

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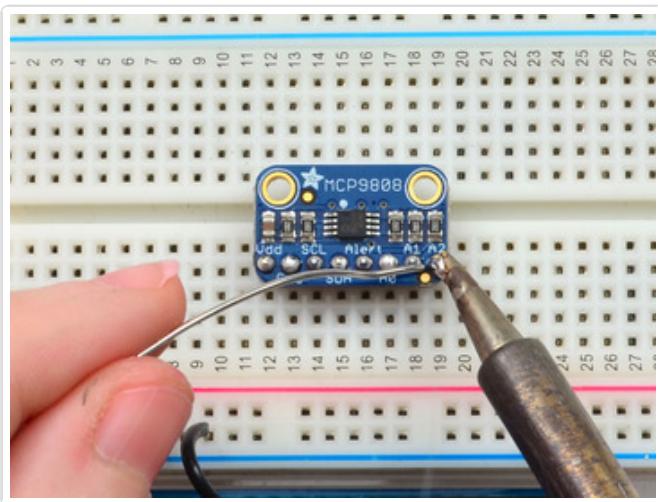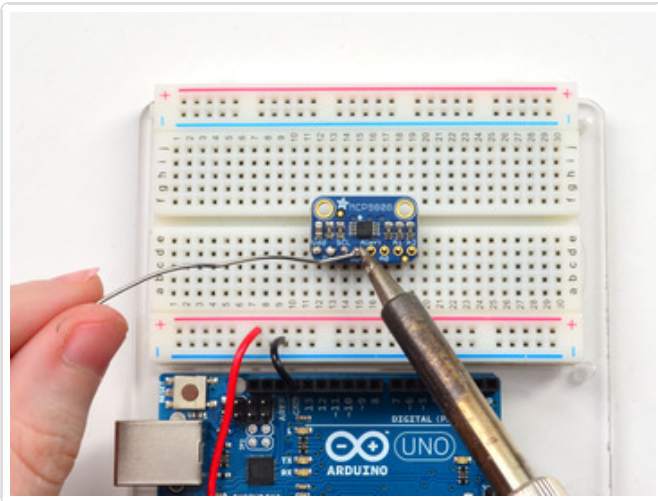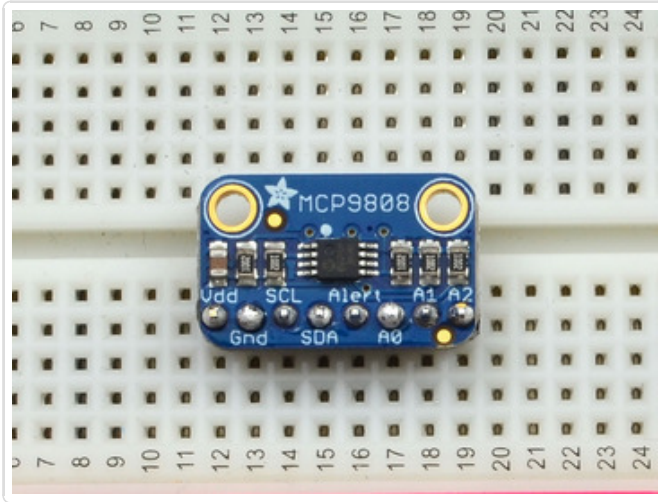
You're done! Check your solder joints visually and continue onto the next steps

Arduino Wiring

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

- Connect **Vdd** 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**
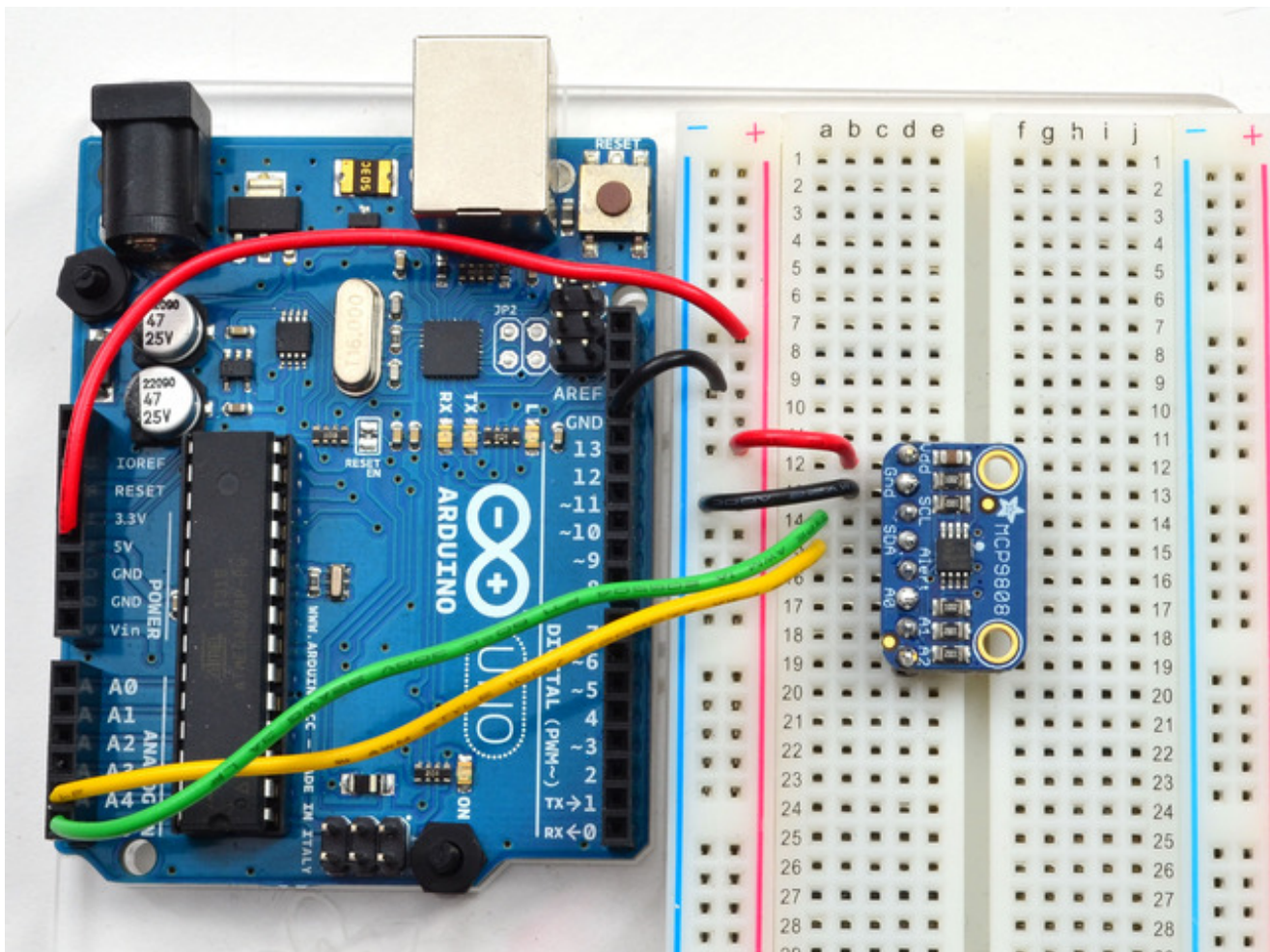- Connect the **SDA** pin to the I2C data **SDA** pin on your Arduino. On an UNO & '328 based Arduino, this is also known as **A4**, on a Mega it is also known as **digital 20** and on a Leonardo/Micro, **digital 2**

The MCP9808 has a default I2C address of **0x18** but you can set the address to any of 8 values between 0x18 and 0x1F so you can have up to 8 of these sensors all sharing the same SCL/SDA pins.

Download Adafruit_MCP9808

To begin reading sensor data, you will need to download Adafruit_MCP9808 from our github repository (http://adafru.it/dfP). You can do that by visiting the github repo and manually downloading or, easier, just click this button to download the zip

Download Adafruit MCP9808 Library

http://adafru.it/dfQ

Rename the uncompressed folder **Adafruit_MCP9808** and check that the **Adafruit_MCP9808** folder contains **Adafruit_MCP9808.cpp** and **Adafruit_MCP9808.h**

Place the **Adafruit_MCP9808** 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_MCP9808->mcp9808test** and upload to your Arduino wired up to the sensor
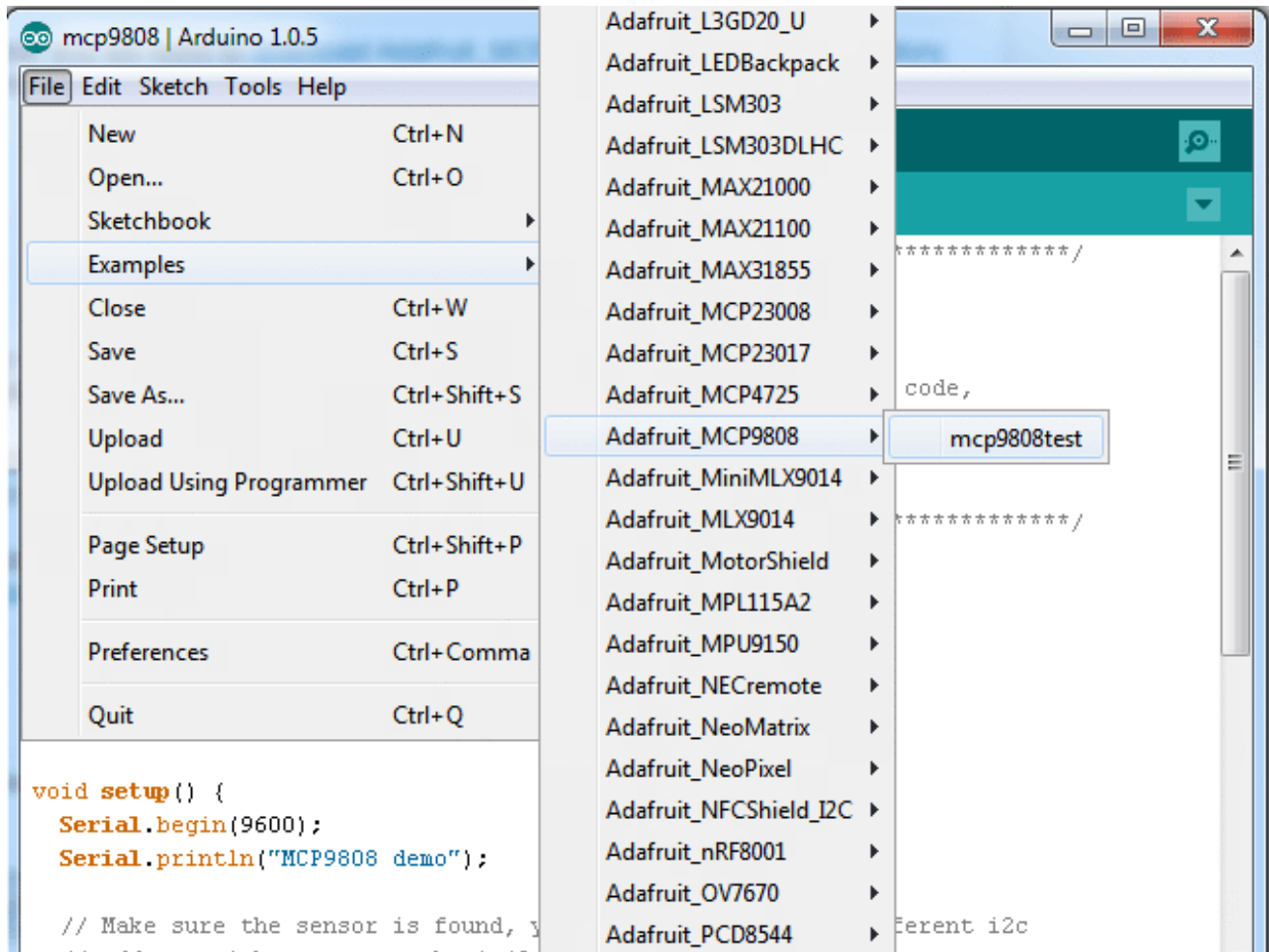
Thats it! Now open up the serial terminal window at 9600 speed to see the temperature in real time. You can try touching your finger to the sensor to see the temperature rise.

```
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[                                                    ]  [ Send ]

MCP9808 demo                                                    ▲
Temp: 25.50*C    77.90*F
Temp: 25.44*C    77.79*F
Temp: 25.44*C    77.79*F
Temp: 25.44*C    77.79*F
Temp: 25.44*C    77.79*F
Temp: 25.44*C    77.79*F
Temp: 25.62*C    78.12*F
Temp: 26.06*C    78.91*F
Temp: 26.50*C    79.70*F
Temp: 26.94*C    80.49*F
Temp: 27.50*C    81.50*F
Temp: 27.94*C    82.29*F
Temp: 28.50*C    83.30*F
Temp: 29.19*C    84.54*F
Temp: 29.69*C    85.44*F
Temp: 30.19*C    86.34*F
Temp: 30.62*C    87.12*F
Temp: 30.81*C    87.46*F
Temp: 30.81*C    87.46*F
Temp: 30.62*C    87.12*F
Temp: 30.25*C    86.45*F
Temp: 29.87*C    85.77*F
Temp: 29.56*C    85.21*F          ≡
Temp: 29.25*C    84.65*F
Temp: 28.94*C    84.09*F
Temp: 28.69*C    83.64*F
Temp: 28.56*C    83.41*F
Temp: 28.44*C    83.19*F          ▼

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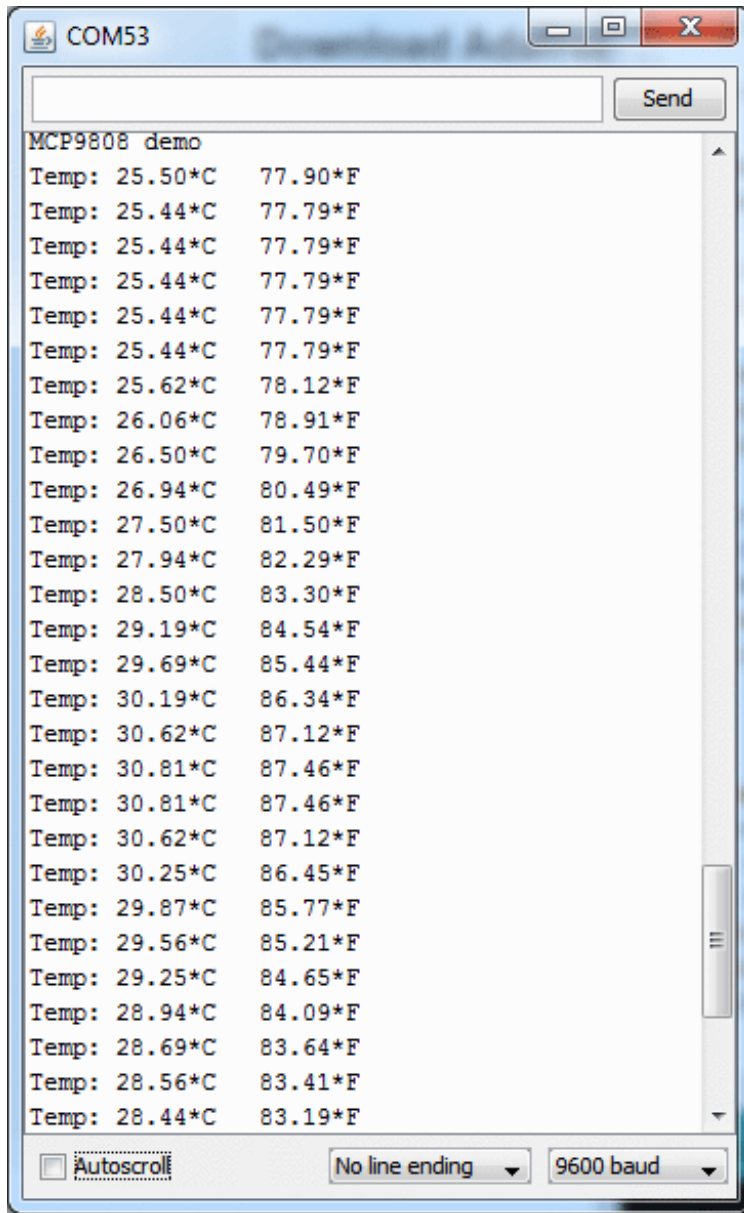
Downloads
Datasheets

- [MCP9808 datasheet (http://adafru.it/dfL)](http://adafru.it/dfL)

Schematic and Diagrams

MCP9808

SDA 1   SDA VDD   8
SCL 2   SCL   A0   7
ALERT 3   ALERT A1   6
         4   GND A2   5

IC1

GND

TP2

VDD   1
GND   2
SCL   3
SDA   4
ALERT 5
A0   6
A1   7
A2   8