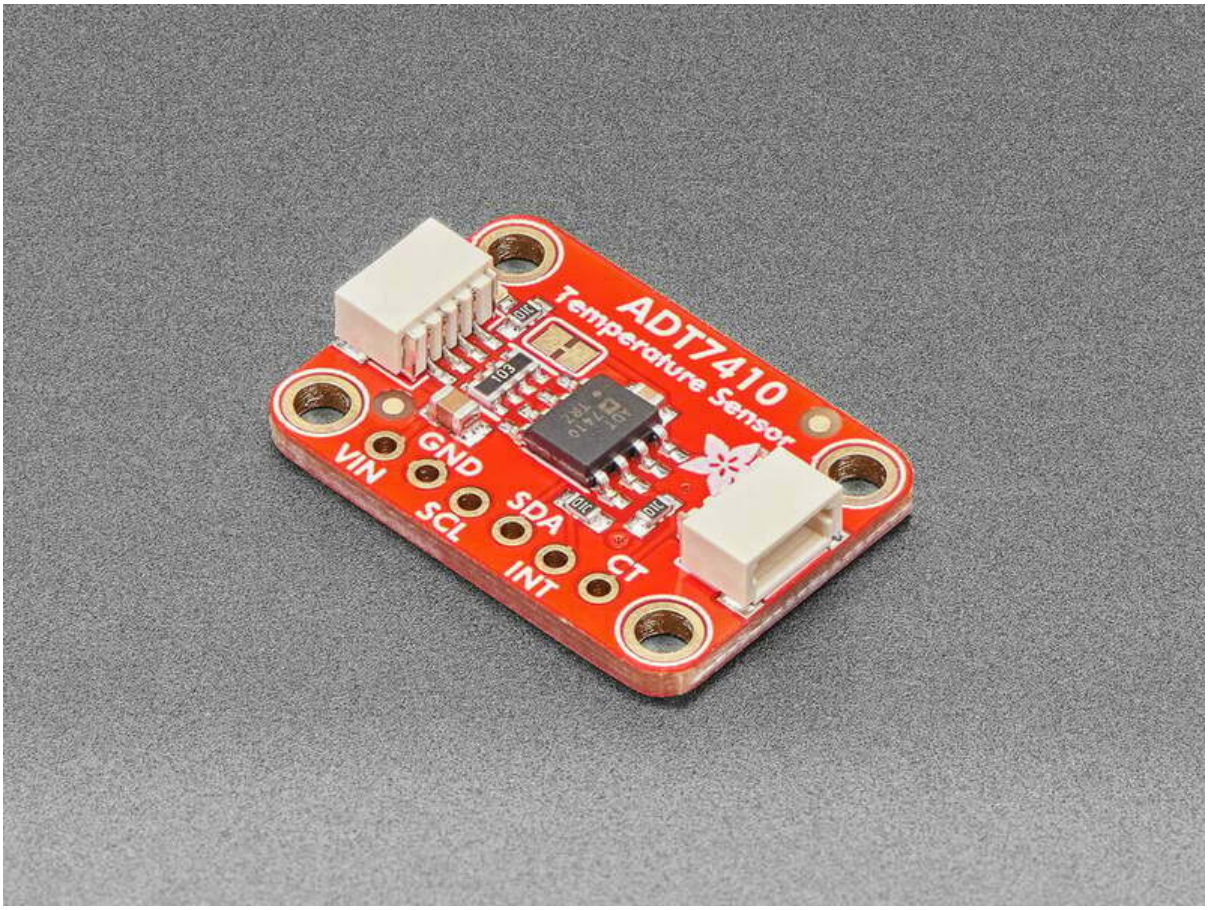
Analog Devices ADT7410 Breakout

Created by Brent Rubell



https://learn.adafruit.com/adt7410-breakout

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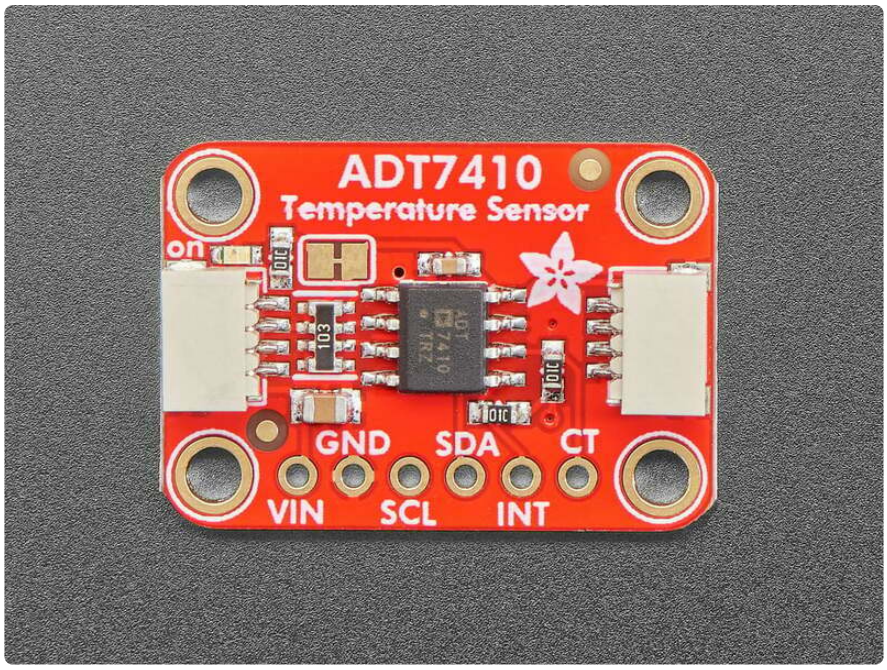
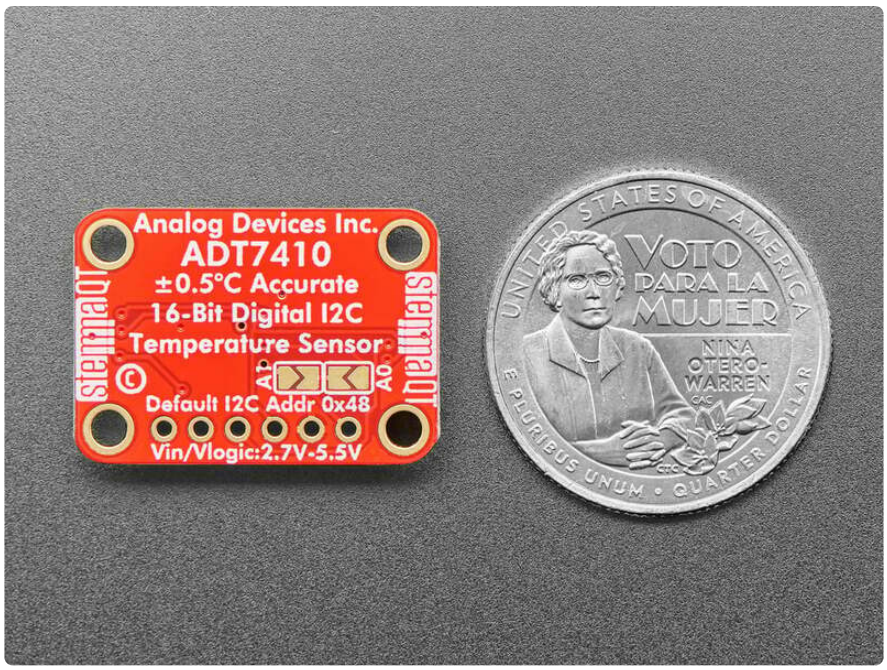
Overview

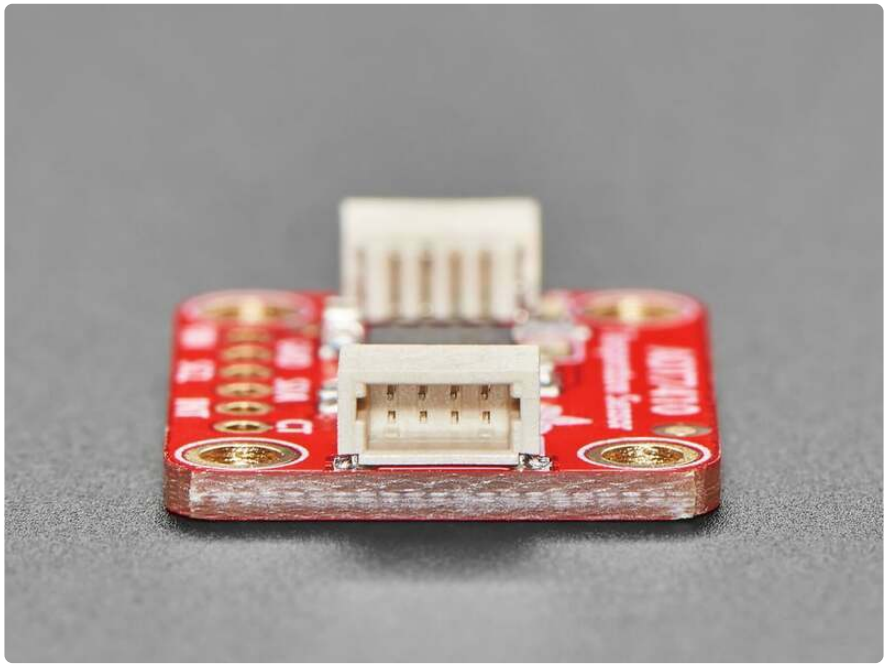


Analog Devices, known for their reliable and well-documented sensor chips - has a high precision and high resolution temperature sensor on the market, and we've got a breakout to make it easy to use! The **Analog Devices ADT7410** gets straight to the point - it's an I2C temperature sensor, with 16-bit 0.0078°C temperature resolution and 0.5°C temperature tolerance. Wire it up to your microcontroller or single-board computer to get reliable temperature readings with ease.

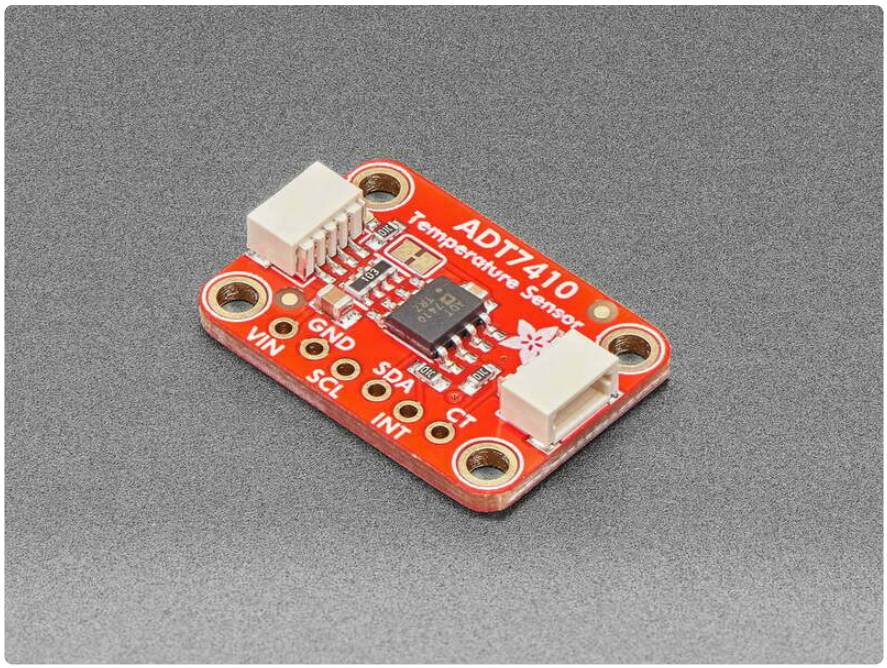


The ADT7410 has 2 address pins, so you can have up to 4 sensors on one I2C bus. There's also interrupt and critical-temperature alert pins. The sensor is good from 2.7V to 5.5V power and logic, for easy integration.

We've got both Arduino (C/C++) (https://adafru.it/DSE) and CircuitPython (Python 3) (https://adafru.it/18E7) libraries available so you can use it with any microcontroller like Arduino (https://adafru.it/DSE), ESP8266, Metro, etc. or with Raspberry Pi or other Linux computers (https://adafru.it/18E7) thanks to Blinka (our CircuitPython library support helper) (https://adafru.it/BSN).



To get you going fast, we spun up a custom made PCB with the ADT7410 and some supporting circuitry such as pullup resistors and capacitors, in the **STEMMA QT** form factor (https://adafru.it/LBQ), making them easy to interface with. The STEMMA QT connectors (https://adafru.it/JqB) on either side are compatible with the SparkFun Qwiic (https://adafru.it/Fpw) I2C connectors. This allows you to make solderless connections between your development board and the ADT7410 or to chain them with a wide range of other sensors and accessories using a **compatible cable** (https://adafru.it/JnB). A QT Cable is not included, but we have a variety in the shop (https://adafru.it/17VE).



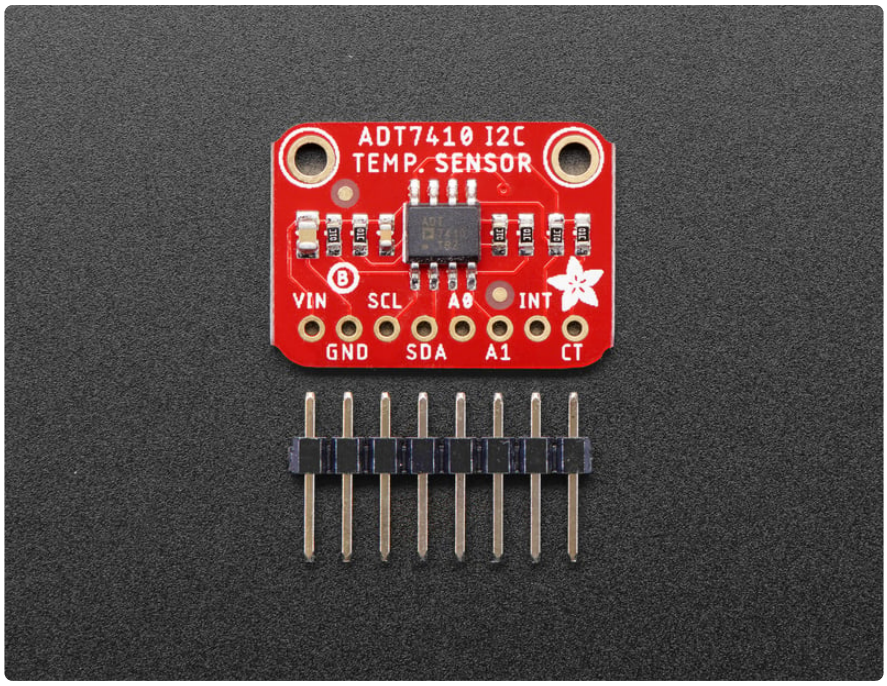
Each order comes with a fully tested and assembled breakout and some header for soldering to a PCB or breadboard. You'll be up and running in under 5 minutes!

Thanks to Digi-Key (https://adafru.it/BJr) and Analog Devices (https://adafru.it/DPF) for sponsoring the development of this breakout board - we've made the PCB "Digi-Key red (https://adafru.it/BJr)" in their honor!

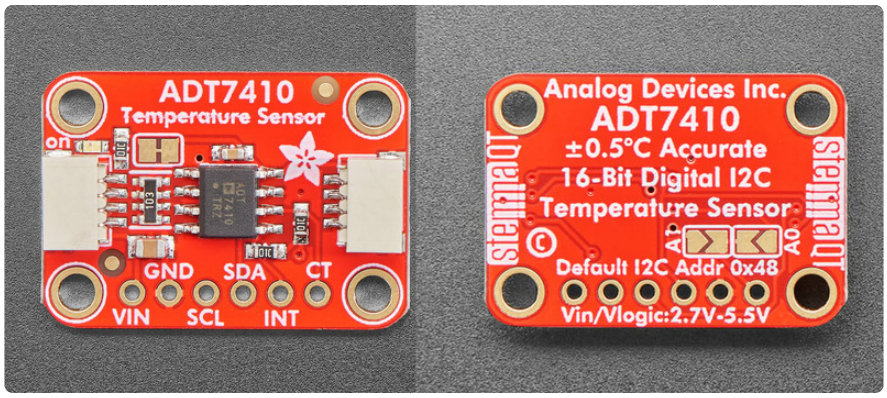
Technical Specs

- Wide input-voltage range: 2.7 V to 5.5 V.
- Up to 16-bit temperature resolution (0.0078°C per lsb), default is 13 bits (0.0625°C per lsb).
- Highly accurate temperature tolerances:
    - ±0.5°C from −40°C to +105°C (2.7 V to 3.6 V)
    - ±0.4°C from −40°C to +105°C (3.0 V)
- Configurable I2C address allows up to four sensors on the I2C bus.
- Operates over I2C, so only two shared lines required.

There are two versions of this board - the STEMMA QT version shown above, and the original header-only version shown below. Code works the same on both!



Pinouts



The default I2C address is **0x48**.

Power Pins

- **VIN**: This is the voltage input to power for the sensor. You can connect either 5V or 3.3V to this, depending on the logic level of the MCU you are using. (Do not exceed 5V on this pin or you will permanently damage the sensor!)
- **GND**: Common ground for data and power.

I2C Logic Pins

- **SCL** - I2C clock pin, connect to your microcontroller's I2C clock line. This pin has a **10K pullup** to VIN

- **SDA** - I2C data pin, connect to your microcontroller's I2C data line. This pin has a **10K pullup** to VIN.
- **STEMMA QT** (https://adafru.it/Ft4) **-** These connectors allow you to connect to development boards with **STEMMA QT** connectors, or to other things, with various associated accessories (https://adafru.it/Ft6).

Address Pins and Jumpers

On the back of the board are **two address jumpers**, labeled **A0** and **A1,** above the **I2C Addr** label on the board silk. These jumpers allow you to chain up to 4 of these boards on the same pair of I2C clock and data pins. To do so, you solder the jumper "closed" by connecting the two pads.

On the front of the board are two address pins, labeled **A0** and **A1**. Just like the jumpers, these pins allow you to change the I2C address to connect multiple boards by connecting them to **VIN**.

The default I2C address is **0x48**. The other address options can be calculated by “adding” the **A0** and **A1** to the base of **0x48**.

A0 sets the lowest bit with a value of **1** and **A1** sets the next bit with a value of **2**. The final address is **0x48** + **A0** + **A1** which would be **0x4B**.

If **A0** is soldered closed, the address is **0x48** + **1** = **0x49.**

If **A1** is soldered closed, the address is **0x48** + **2** = **0x4A.**

The table below shows all possible addresses, and whether the pin(s) should be high (closed) or low (open).

ADDR	A0	A1
0x48	L	L
0x49	H	L
0x4A	L	H
0x4B	H	H

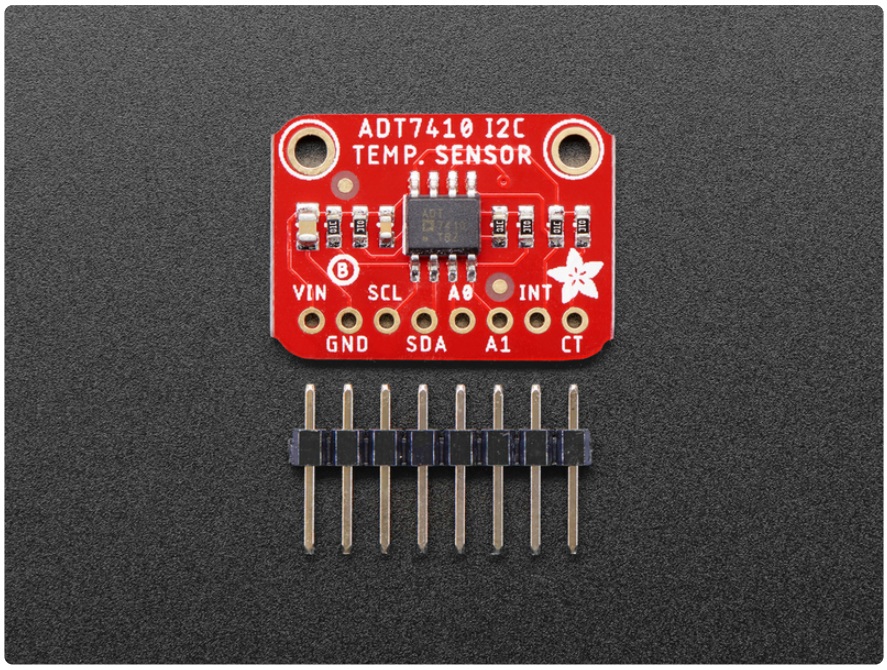
Other Pins

- **INT -** This is the 'open-drain' interrupt output pin, and can be optionally connected to your MCU to trigger a HW interrupt whenever an appropriate event happens with the sensor. See the datasheet and driver for further details. It will go low or logic '0' when it is asserted.
- **CT -** This 'open-drain' pin can be configured to trigger to go low or to logic '0' when a **Critical Temperature (CT)** threshold is passed.

Power LED and Jumper

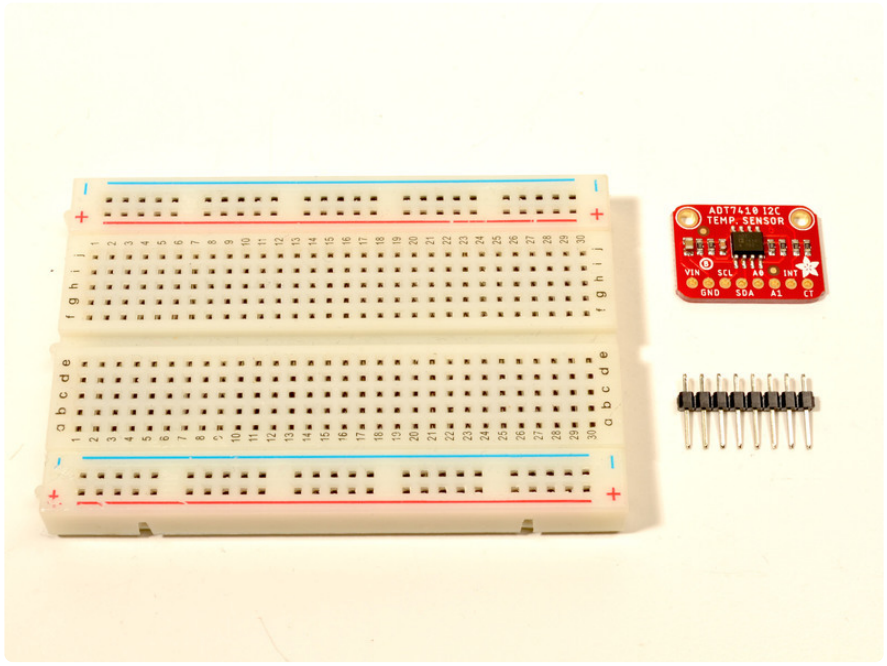
- **Power LED -** In the upper left corner, above the STEMMA connector, on the front of the board, is the power LED, labeled **on**. It is the green LED.
- **LED jumper** - To the right of the power LED is a jumper for the power LED. If you wish to disable the power LED, simply cut the trace on this jumper.

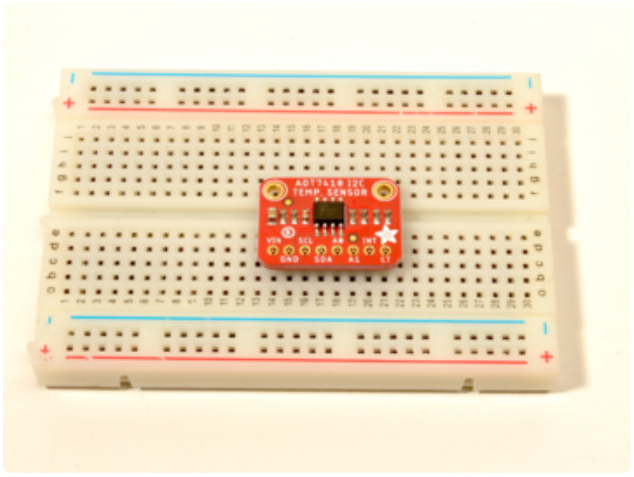
Assembly



Assembly

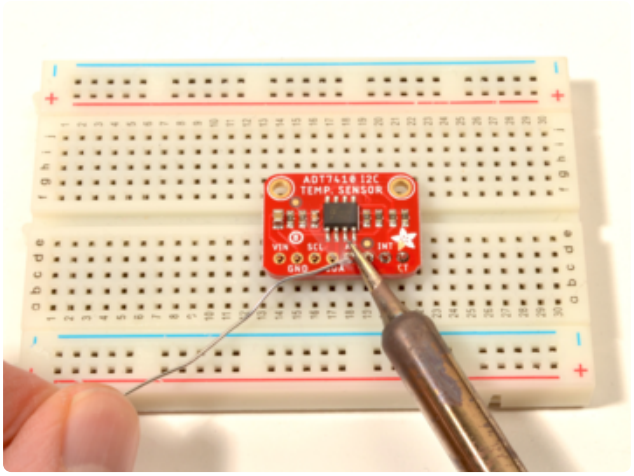
Start by preparing the header strip, cut to length if necessary. It will be easier to solder if you insert it into a breadboard - **long pins down**.





Add the ADT7410:

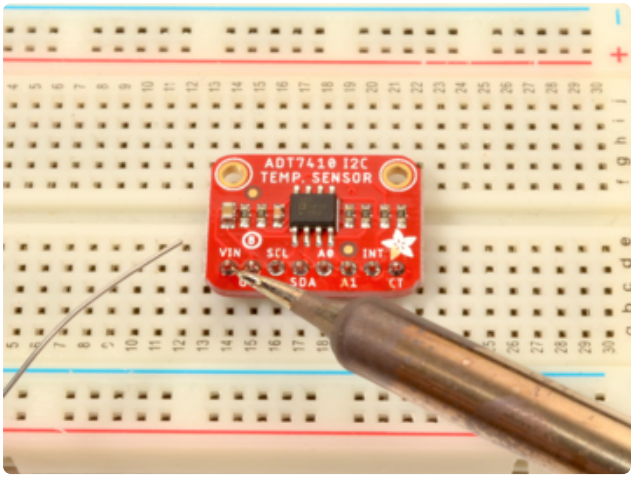
Place the board over the pins so that the short pins poke through the top of the breakout pads



And Solder!

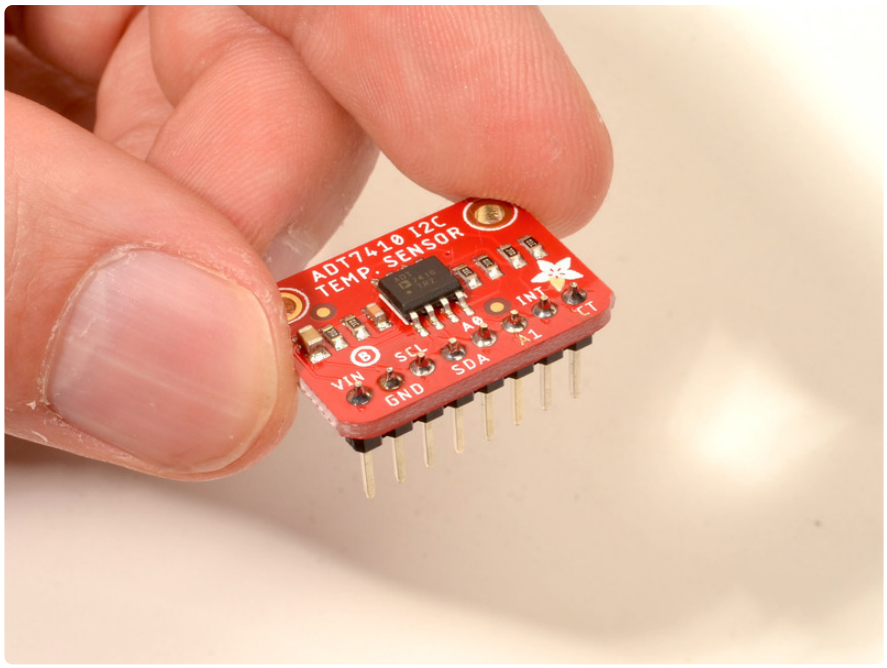
Be sure to solder all pins for reliable electrical contact.

(For tips on soldering, be sure to check out the Guide to Excellent Soldering (https://adafru.it/aTk)).



OK, you're done!

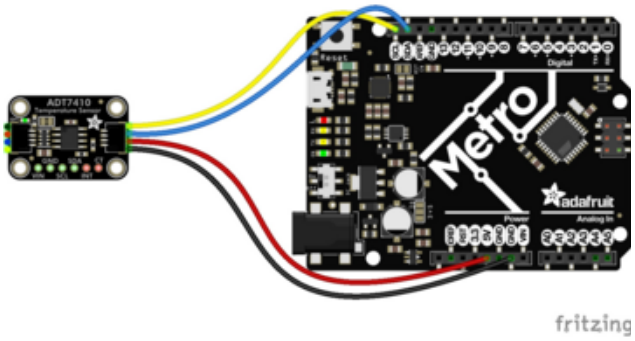
You can now plug in your ADT7410 breakout and enjoy using this high precision and high resolution temperature sensor.



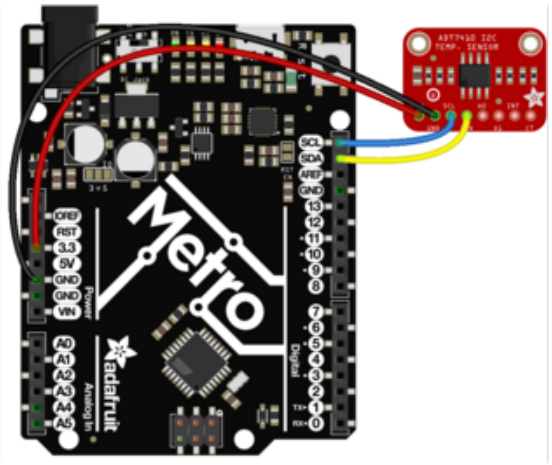
Arduino

Arduino Wiring

You can easily wire this breakout to any Arduino-compatible microcontroller.



Make the following connections between the **Metro** and the **ADT7410**

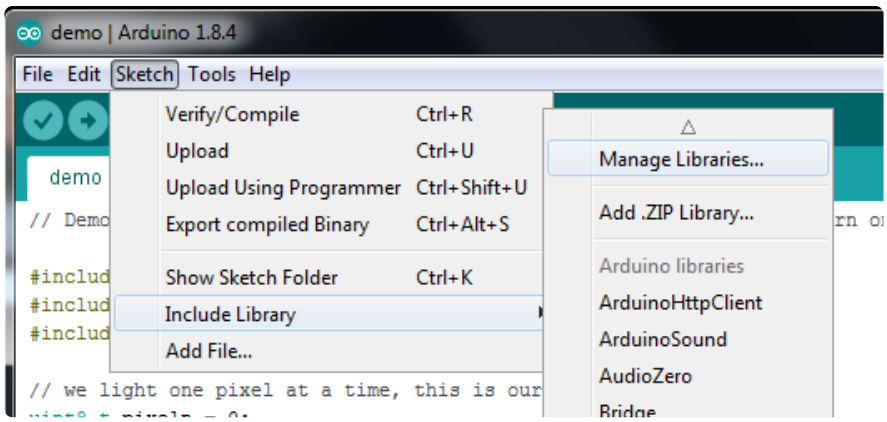


ADT7410 Vin to **3V or 5V** (depending on the logic level of your board).
ADT7410 GND to **Metro GND**.
ADT7410 SCL to **Metro SCL**
ADT7410 SDA to **Metro SDA**

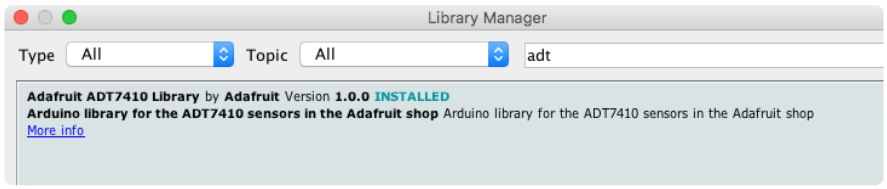
Install Adafruit_ADT7410 Library

To read data from your ADT7410, you will need to install the Adafruit_ADT7410 library (https://adafru.it/DPy). It is available from the Arduino library manager so we recommend using that.

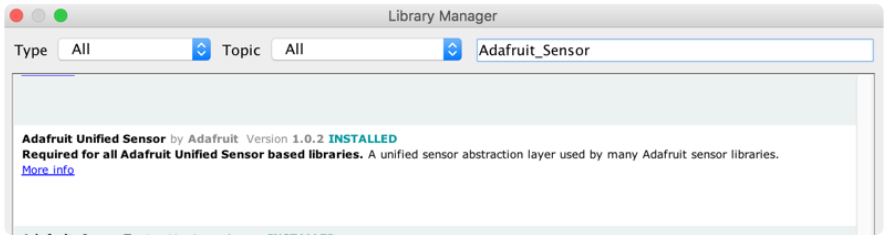
From the Arduino IDE, open the Library Manager (**Sketch -> Include Library -> Manage Libraries**)



Type in **Adafruit ADT7410** and **click Install**



You'll also need to install **Adafruit Unified Sensor Library**:



Load Example

Open up **File -> Examples -> Adafruit ADT7410 Library -> adt7410test** and upload to your Arduino wired up to the sensor

```
/***************************************************************************/
/*!
This is a demo for the Adafruit ADT7410 breakout
----> http://www.adafruit.com/products/4089
Adafruit invests time and resources providing this open source code,
please support Adafruit and open-source hardware by purchasing
products from Adafruit!
*/
/***************************************************************************/

#include <Wire.h>
#include "Adafruit_ADT7410.h"

// Create the ADT7410 temperature sensor object
Adafruit_ADT7410 tempsensor = Adafruit_ADT7410();

void setup() {
  Serial.begin(115200);
  Serial.println("ADT7410 demo");

  // Make sure the sensor is found, you can also pass in a different i2c
  // address with tempsensor.begin(0x49) for example
  if (!tempsensor.begin()) {
    Serial.println("Couldn't find ADT7410!");
    while (1);
  }

  // sensor takes 250 ms to get first readings
  delay(250);

  // ** Optional **
  // Can set ADC resolution
  // ADT7410_13BIT = 13 bits (default)
  // ADT7410_16BIT = 16 bits
  tempsensor.setResolution(ADT7410_16BIT);
  Serial.print("Resolution = ");
  switch (tempsensor.getResolution()) {
    case ADT7410_13BIT:
      Serial.print("13 ");
```

```
      break;
    case ADT7410_16BIT:
      Serial.print("16 ");
      break;
    default:
      Serial.print("??");
  }
  Serial.println("bits");
}

void loop() {
  // Read and print out the temperature, then convert to *F
  float c = tempsensor.readTempC();
  float f = c * 9.0 / 5.0 + 32;
  Serial.print("Temp: "); Serial.print(c); Serial.print("*C\t");
  Serial.print(f); Serial.println("*F");

  delay(1000);
}
```

Upload the sketch to your board and open up the Serial Monitor (**Tools->Serial Monitor**). You should see the temperature in Celsius and Fahrenheit.

```
Temp: 23.25*C   73.85*F
Temp: 23.19*C   73.74*F
Temp: 23.25*C   73.85*F
Temp: 23.25*C   73.85*F
```

Library Reference

Create the ADT7410 Sensor Object:

```
Adafruit_ADT7410 tempsensor = Adafruit_ADT7410();
```

Initialize the sensor with:

```
tempsensor.begin()
```

This function returns **True** if the ADT7410 was initialized correctly, and **False** if it was not.

Once initialized, you can query the temperature in °C with

```
tempsensor.readTempC()
```

Which will return floating point (decimal + fractional) temperature. You can convert to Fahrenheit by multiplying by 1.8 and adding 32 as you have learned in grade school!

Arduino API

Arduino API (https://adafru.it/DPC)

Python and CircuitPython

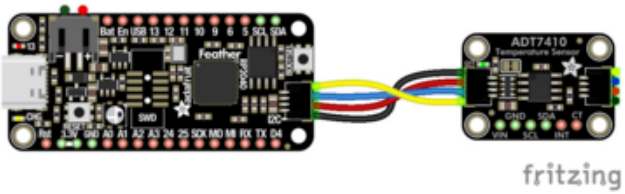
It's easy to use the ADT7410 sensor with Python or CircuitPython, and the Adafruit CircuitPython ADT7410 (https://adafru.it/DPz) module. This module allows you to easily write Python code that reads temperature from the sensor.

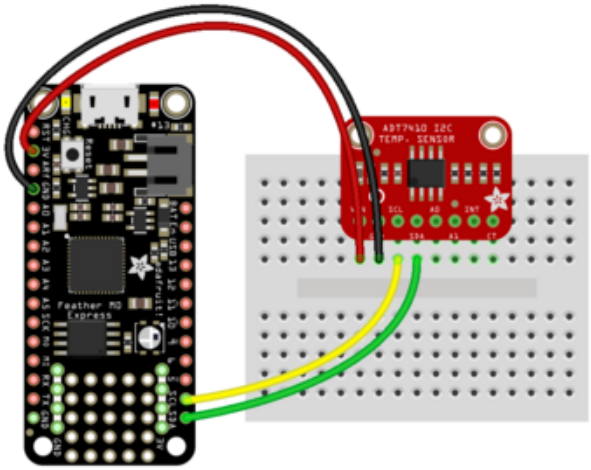
You can use this sensor with any CircuitPython microcontroller board or with a computer that has GPIO and Python thanks to Adafruit_Blinka, our CircuitPython-for-Python compatibility library (https://adafru.it/BSN).

CircuitPython Microcontroller Wiring

First wire up a ADT7410 to your board exactly as shown on the previous page for Arduino.

Make the following connections between the CircuitPython board and the ADT7410:



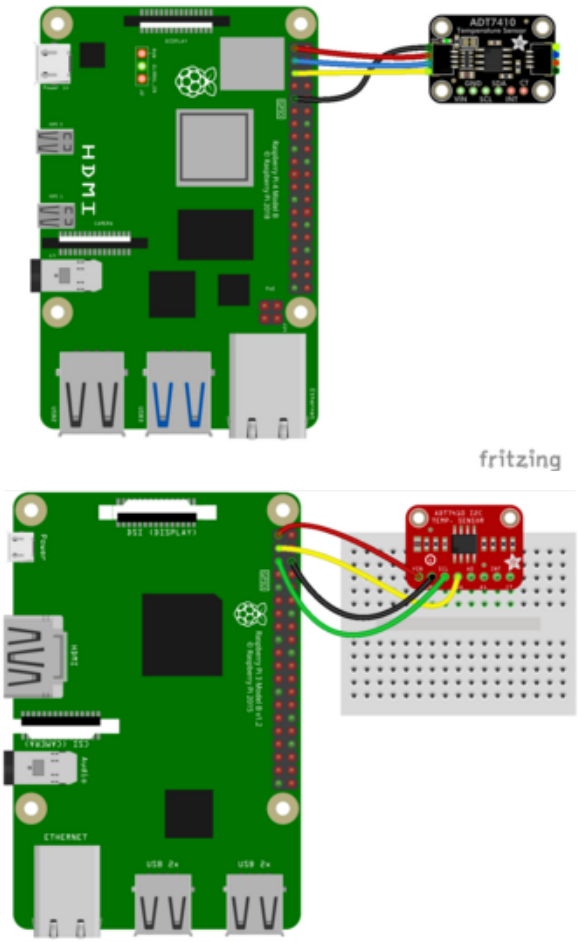


Board 3V to **ADT7410 VIN**
Board GND to **ADT7410 GND**
Board SCL to **ADT7410 SCL**
Board SDA to **ADT7410 SDA**

Python Computer Wiring

Since there's dozens of Linux computers/boards you can use we will show wiring for Raspberry Pi. For other platforms, please visit the guide for CircuitPython on Linux to see whether your platform is supported (https://adafru.it/BSN).

Make the following connections between the Pi and the ADT7410:



Pi 3V to **ADT7410 VIN**
Pi GND to **ADT7410 GND**
Pi SCL to **ADT7410 SCL**
Pi SDA to **ADT7410 SDA**

Python Installation of ADT7410 Library

You'll need to install the Adafruit_Blinka library that provides the CircuitPython support in Python. This may also require enabling I2C on your platform and verifying you are running Python 3. Since each platform is a little different, and Linux changes often, please visit the CircuitPython on Linux guide to get your computer ready (https://adafru.it/BSN)!

Once that's done, from your command line run the following command:

- `sudo pip3 install adafruit-circuitpython-adt7410`

If your default Python is version 3 you may need to run 'pip' instead. Just make sure you aren't trying to use CircuitPython on Python 2.x, it isn't supported!

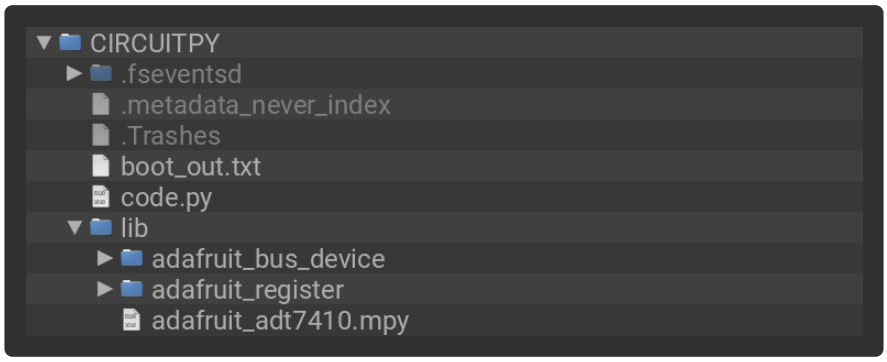
CircuitPython Installation of ADT7410 Library

To use with CircuitPython, you need to first install the Adafruit CircuitPython ADT7410 (https://adafru.it/DPA) library, and its dependencies, into the **lib** folder on your **CIRCUITPY** drive. Then you need to update **code.py** with the example script.

Thankfully, we can do this in one go. In the example below, click the **Download Project Bundle** button below to download the necessary libraries and the **code.py** file in a zip file. Extract the contents of the zip file, and copy the **entire lib folder** and the **code.py** file to your **CIRCUITPY** drive.

Your **CIRCUITPY/lib** folder should contain the following folders and file:

- **adafruit_adt7410.mpy**
- **/adafruit_bus_device**
- **/adafruit_register**



Example Code

```
# SPDX-FileCopyrightText: 2021 ladyada for Adafruit Industries
# SPDX-License-Identifier: MIT

import time
import board
import adafruit_adt7410

i2c = board.I2C()  # uses board.SCL and board.SDA
# i2c = board.STEMMA_I2C()  # For using the built-in STEMMA QT connector on a
microcontroller
adt = adafruit_adt7410.ADT7410(i2c, address=0x48)
adt.high_resolution = True

while True:
    print(adt.temperature)
    time.sleep(0.5)
```

Python Usage

To demonstrate the usage of the ADT7410, we'll use the Python REPL.

First, we'll import the following modules:

```
import time
import board
import busio
import adafruit_adt7410
```

Next, we'll initialize the I2C bus and create the ADT object. We'll set it's `high_resolution` property to `True`, to use 16-bit resolution (instead of the default 13-bit).

```
i2c_bus = busio.I2C(board.SCL, board.SDA)
adt = adafruit_adt7410.ADT7410(i2c_bus, address=0x48)
adt.high_resolution = True
```

You can read the temperature using the `.temperature` property (the output will be in degrees Celsius). Try putting your finger on the sensor or holding it against something cold to see the values change.

```
adt.temperature
```

```
>>> import board
>>> import busio
>>> import adafruit_adt7410
>>> i2c_bus = busio.I2C(board.SCL, board.SDA)
>>> adt = adafruit_adt7410.ADT7410(i2c_bus, address=0x48)
>>> adt.high_resolution = True
>>> adt.temperature
22.9141
>>> adt.temperature
22.9063
>>> adt.temperature
22.9063
```

You can convert to Fahrenheit by multiplying by 1.8 and adding 32:

```
tempC = adt.temperature
tempF = tempC * 1.8 + 32.0
tempF
```

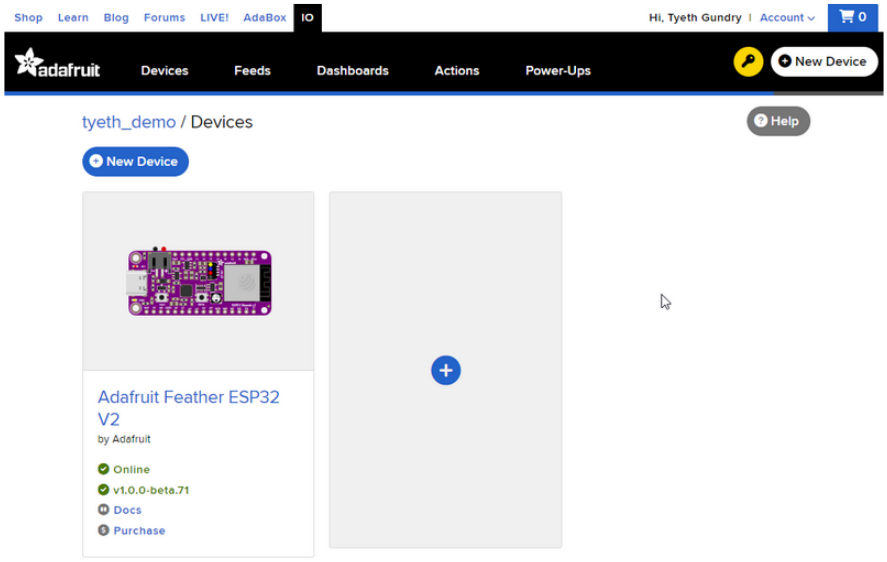
```
>>> tempC = adt.temperature
>>> tempF = tempC * 1.8 + 32
>>> tempF
73.2875
```

That's all there is to reading the temperature with the ADT7410. Now you can use the ADT7410 temperature sensor to read the temperature in your project!

Python Docs

Python Docs (https://adafru.it/DPD)

WipperSnapper



What is WipperSnapper

WipperSnapper is a firmware designed to turn any WiFi-capable board into an Internet-of-Things device without programming a single line of code. WipperSnapper connects to Adafruit IO (https://adafru.it/fsU), a web platform designed (by Adafruit! (https://adafru.it/Bo5)) to display, respond, and interact with your project's data.

Simply load the WipperSnapper firmware onto your board, add credentials, and plug it into power. Your board will automatically register itself with your Adafruit IO account.

From there, you can add components to your board such as buttons, switches, potentiometers, sensors, and more! Components are dynamically added to hardware, so you can immediately start interacting, logging, and streaming the data your projects produce without writing code.

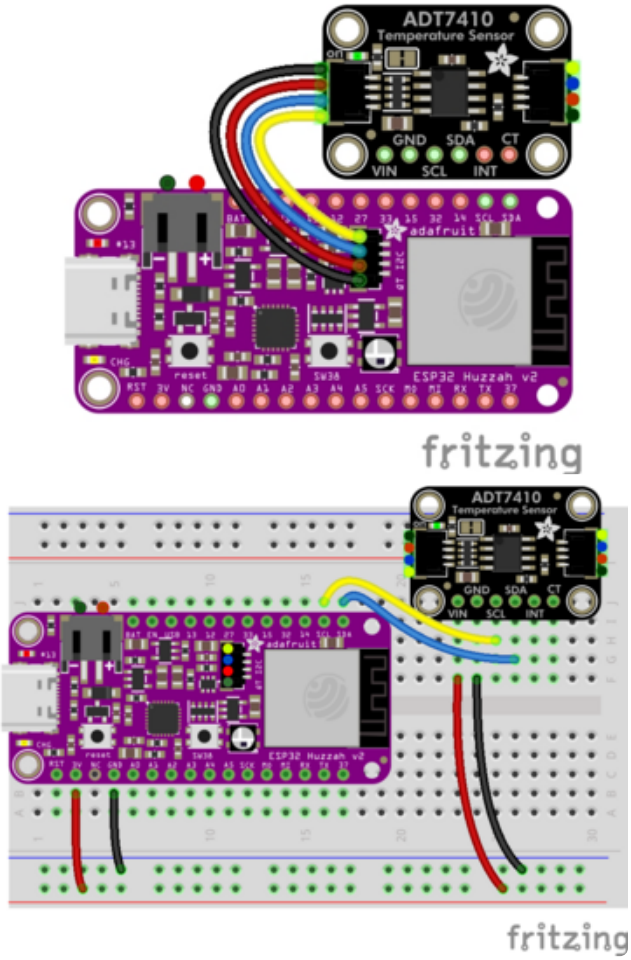
If you've never used WipperSnapper, click below to read through the quick start guide before continuing.

Quickstart: Adafruit IO WipperSnapper

https://adafru.it/Vfd

Wiring

First, wire up an ADT7410 to your board exactly as follows. Here is an example of the ADT7410 wired to an Adafruit ESP32 Feather V2 (http://adafru.it/5400) using I2C with a STEMMA QT cable (no soldering required) (http://adafru.it/4210)

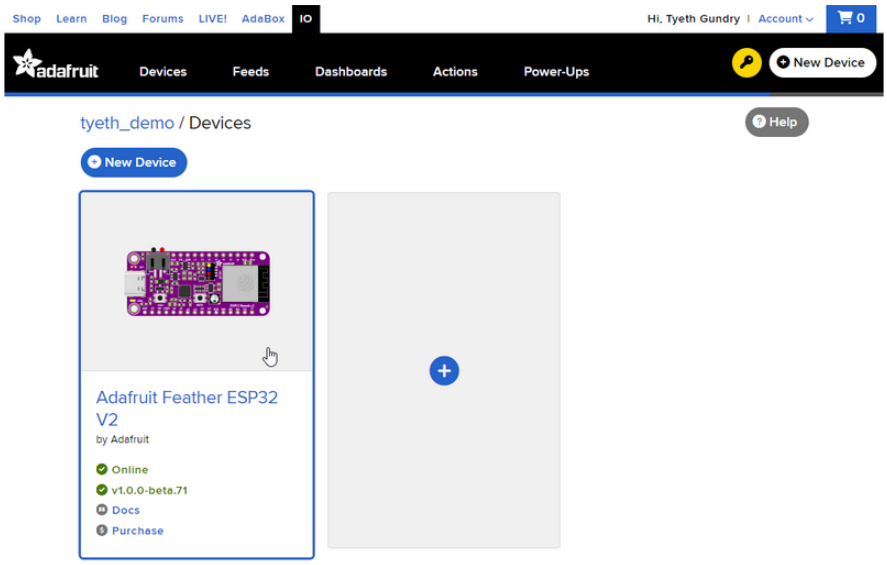


Board 3V to **sensor VIN (red wire on STEMMA QT)**
Board GND to **sensor GND (black wire on STEMMA QT)**
Board SCL to **sensor SCL (yellow wire on STEMMA QT)**
Board SDA to **sensor SDA (blue wire on STEMMA QT)**

Usage

Connect your board to Adafruit IO Wippersnapper and navigate to the WipperSnapper board list **(https://adafru.it/TAu)**.

On this page, **select the WipperSnapper board you're using** to be brought to the board's interface page.



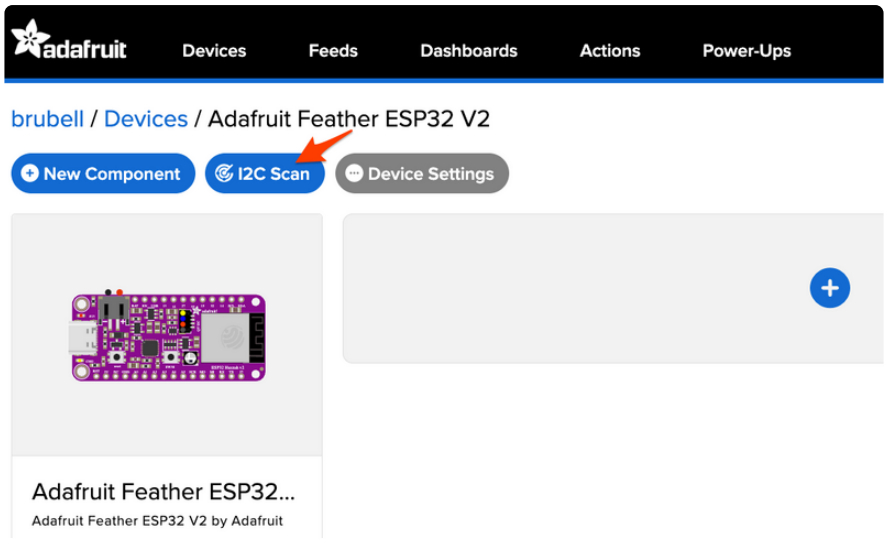
If you do not see your board listed here - you need to connect your board to Adafruit IO (https://adafru.it/Vfd) first.

On the device page, quickly **check that you're running the latest version of the WipperSnapper firmware**.

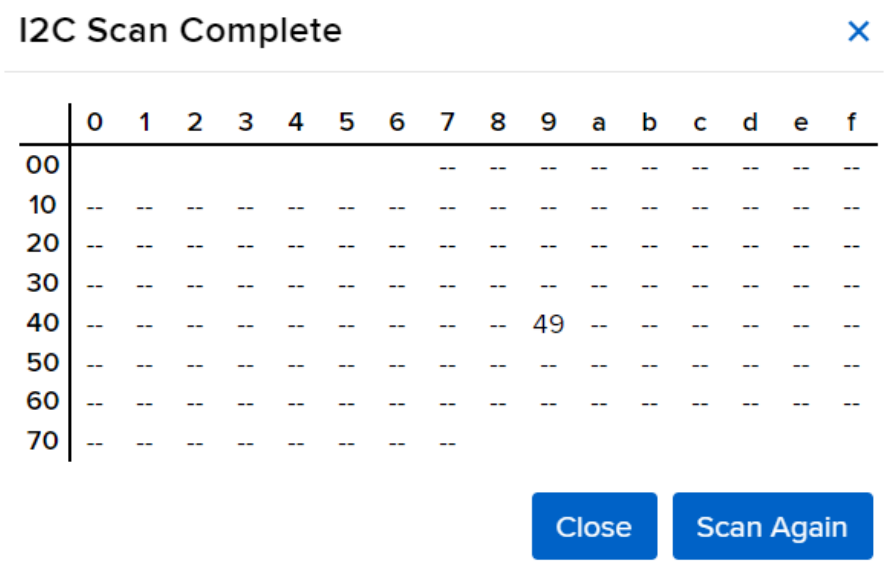
The device tile on the left indicates the version number of the firmware running on the connected board.

If the firmware version is green with a checkmark - continue with this guide.
If the firmware version is red with an exclamation mark "!" - update to the latest WipperSnapper firmware (https://adafru.it/Vfd) on your board before continuing.

Next, make sure the sensor is plugged into your board and click the **I2C Scan** button.



You should see one of the ADT7410's supported I2C addresses pop-up in the I2C scan list. The ADT7410 supports four different I2C addresses: `0x48`, `0x49`, `0x4a`, `0x4b`



I don't see the sensor's I2C address listed!

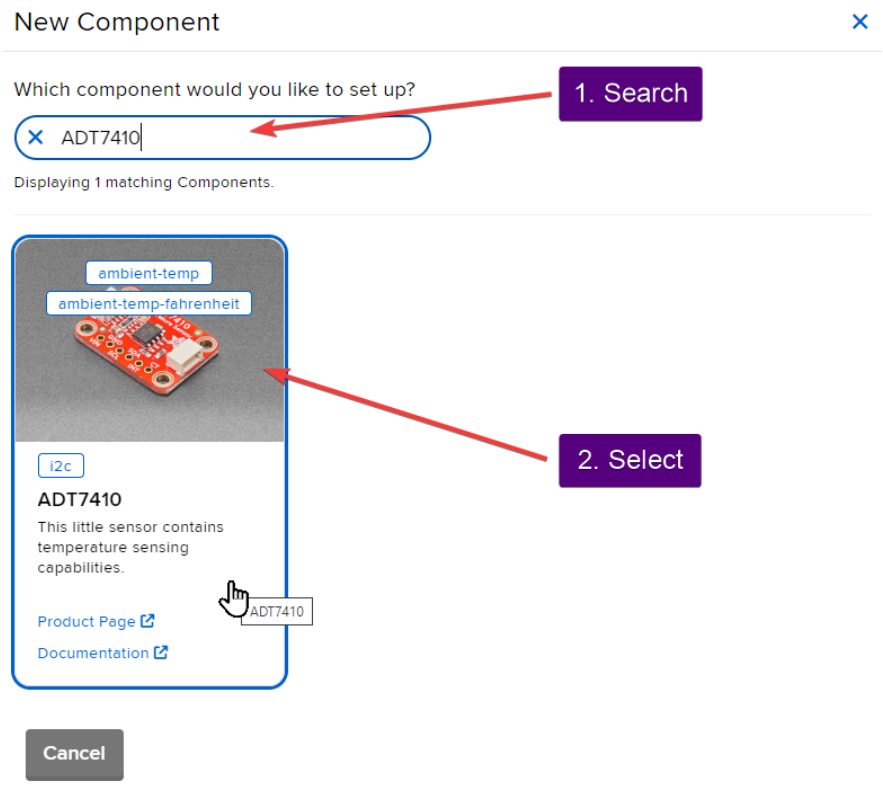
First, double-check the connection and/or wiring between the sensor and the board.

Then, reset the board and let it re-connect to Adafruit IO WipperSnapper.

With the sensor detected in an I2C scan, you're ready to add the sensor to your board.

Click the New Component button or the + button to bring up the component picker.

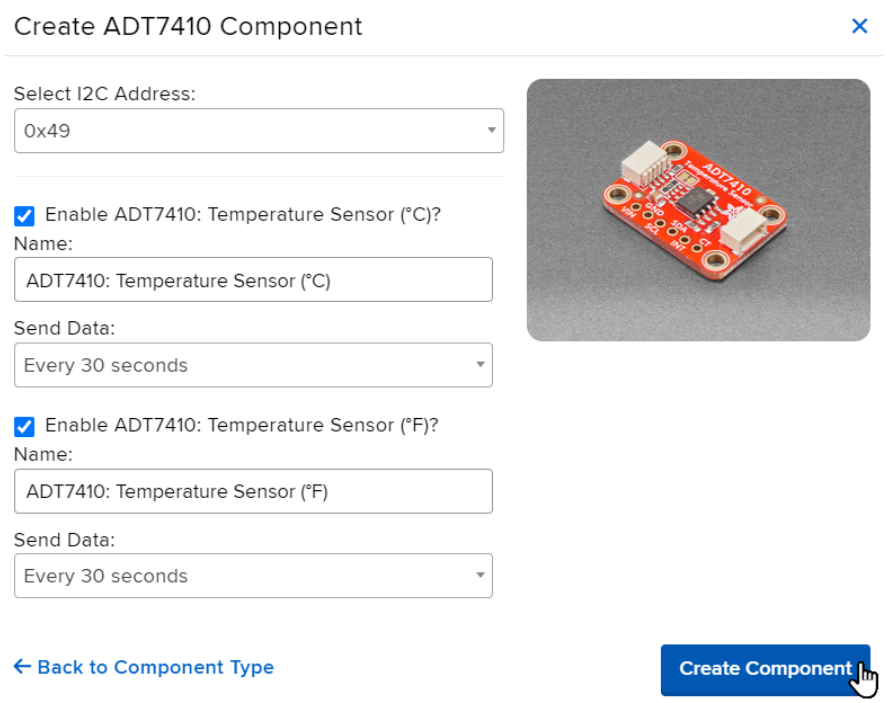
Adafruit IO supports a large amount of components. To quickly find your sensor, type `ADT7410` into the search bar, then select the **ADT7410** component.



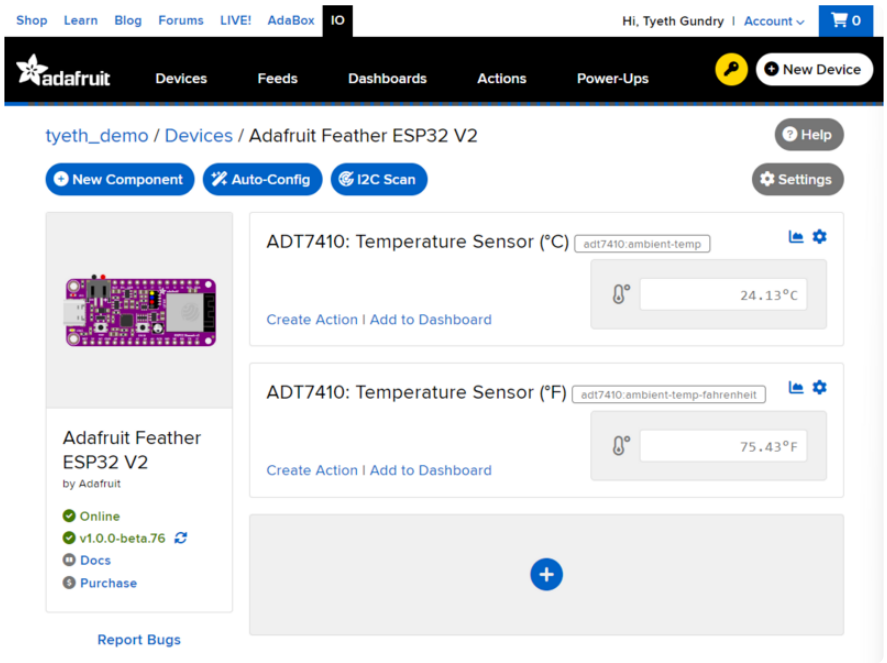
On the component configuration page, the **ADT7410**'s sensor address should be listed along with the sensor's settings.

The **Send Every** option is specific to each sensor's measurements. This option will tell the Feather how often it should read from the **ADT7410** sensor and send the data to Adafruit IO. Measurements can range from every 30 seconds to every 24 hours.

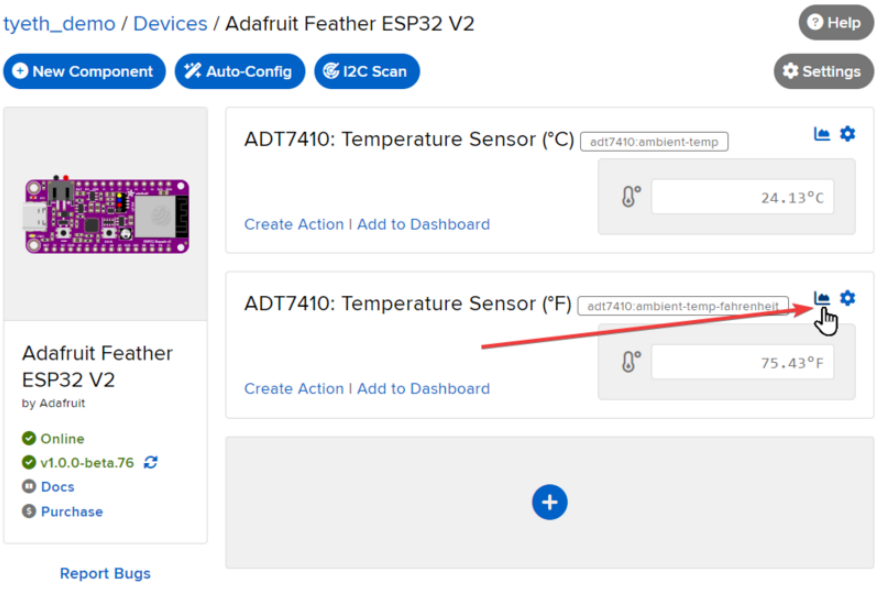
For this example, set the **Send Every** interval to every 30 seconds.



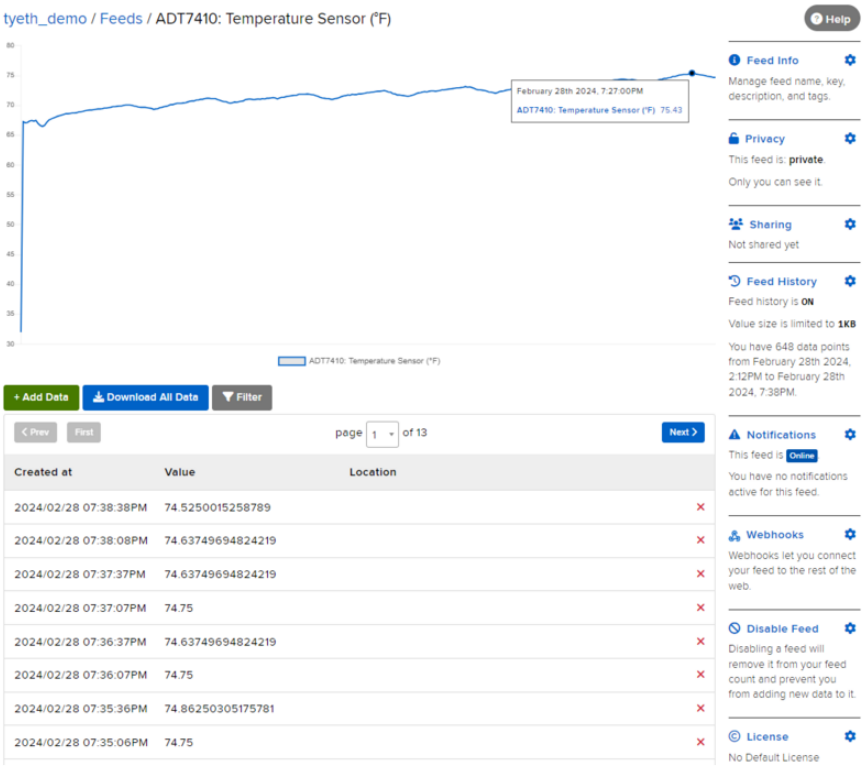
Your device interface should now show the sensor components you created. After the interval you configured elapses, WipperSnapper will automatically read values from the sensor(s) and send them to Adafruit IO.



To view the data that has been logged from the sensor, click on the graph next to the sensor name.



Here you can see the feed history and edit things about the feed such as the name, privacy, webhooks associated with the feed and more. If you want to learn more about how feeds work, check out this page (https://adafru.it/10aZ).



Downloads

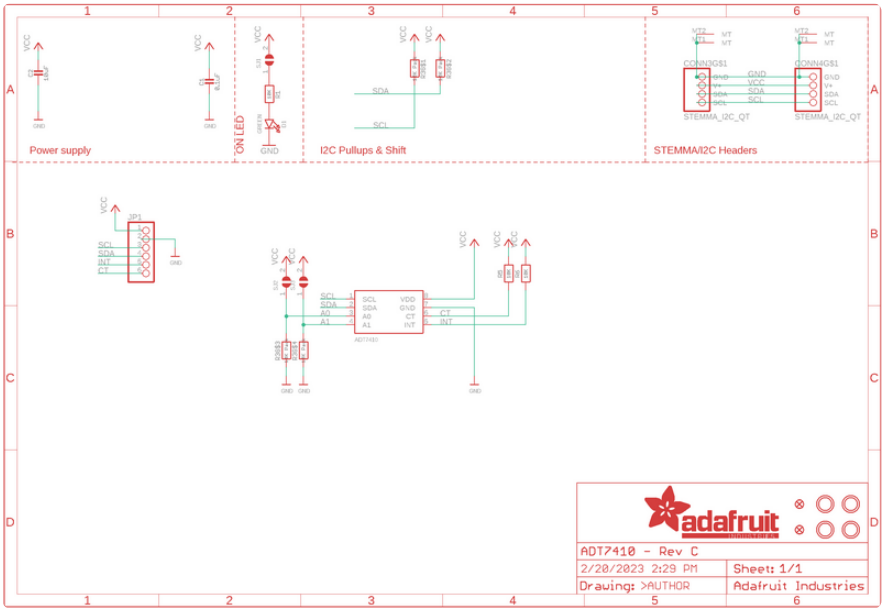
Files

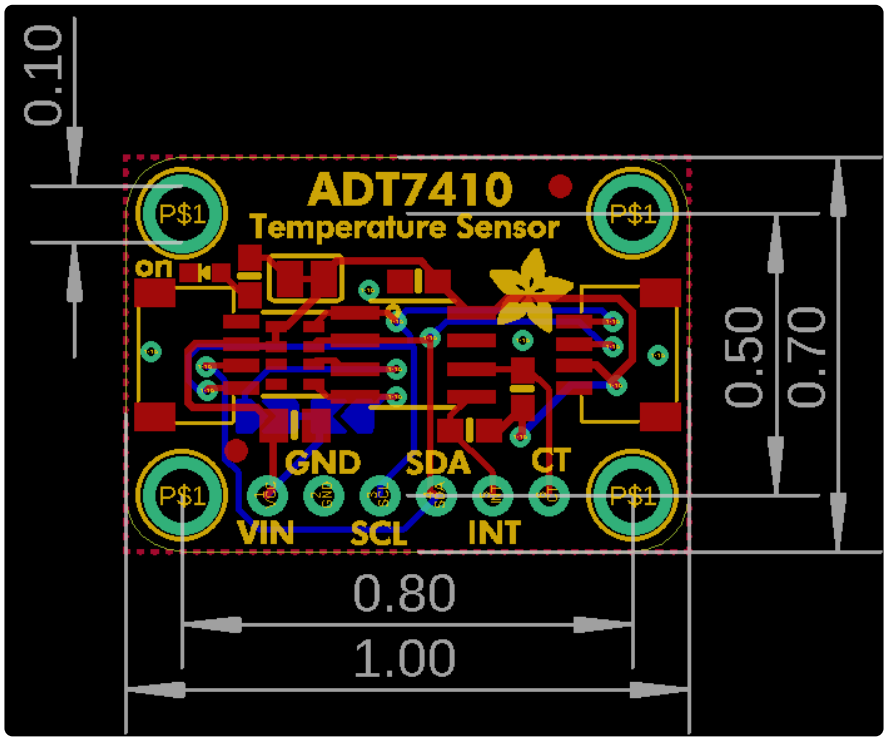
- ADT7410 Datasheet (https://adafru.it/DPv)

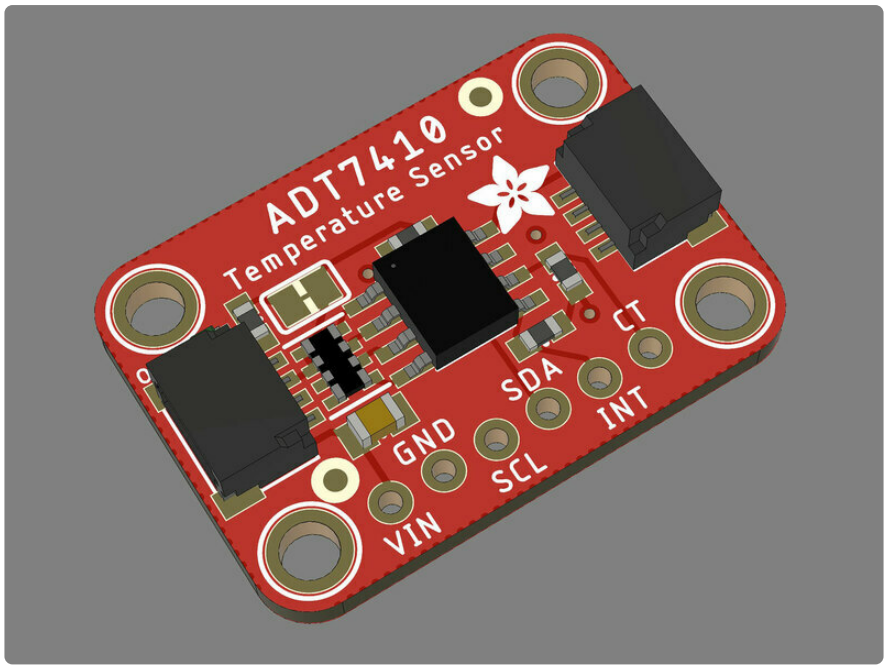
- Original Fritzing Object available in the Adafruit Fritzing Library (https://adafru.it/DPw)
- STEMMA QT Fritzing Object available in the Adafruit Fritzing Library (https://adafru.it/19dC)
- EagleCAD PCB files on GitHub (https://adafru.it/DPx)
- 3D models on GitHub (https://adafru.it/19dD)

STEMMA QT Schematic and Fab Print

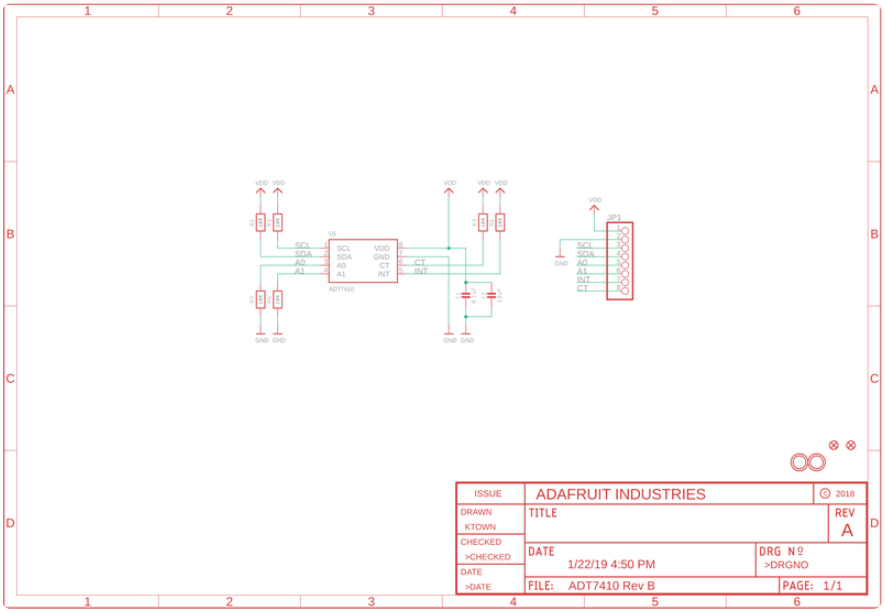
Dimensions are in inches.

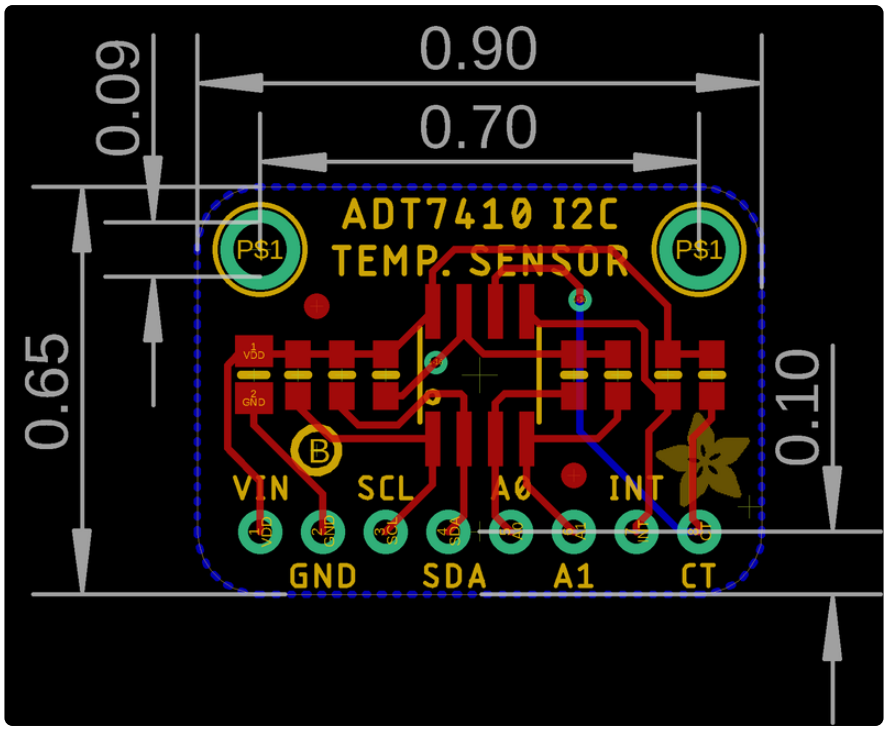






Original Schematic and Fab Print




0.90
0.70
0.09
0.65
0.10
ADT7410 I2C
TEMP. SENSOR
P$1
P$1
VIN
SCL
A0
INT
GND
SDA
A1
CT