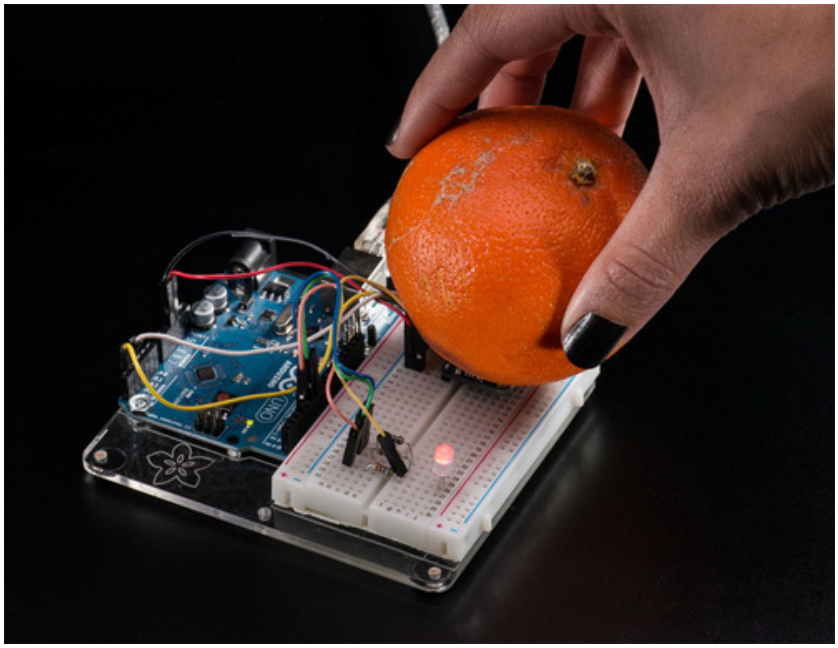
adafruit learning system

Adafruit Color Sensors

Created by Bill Earl



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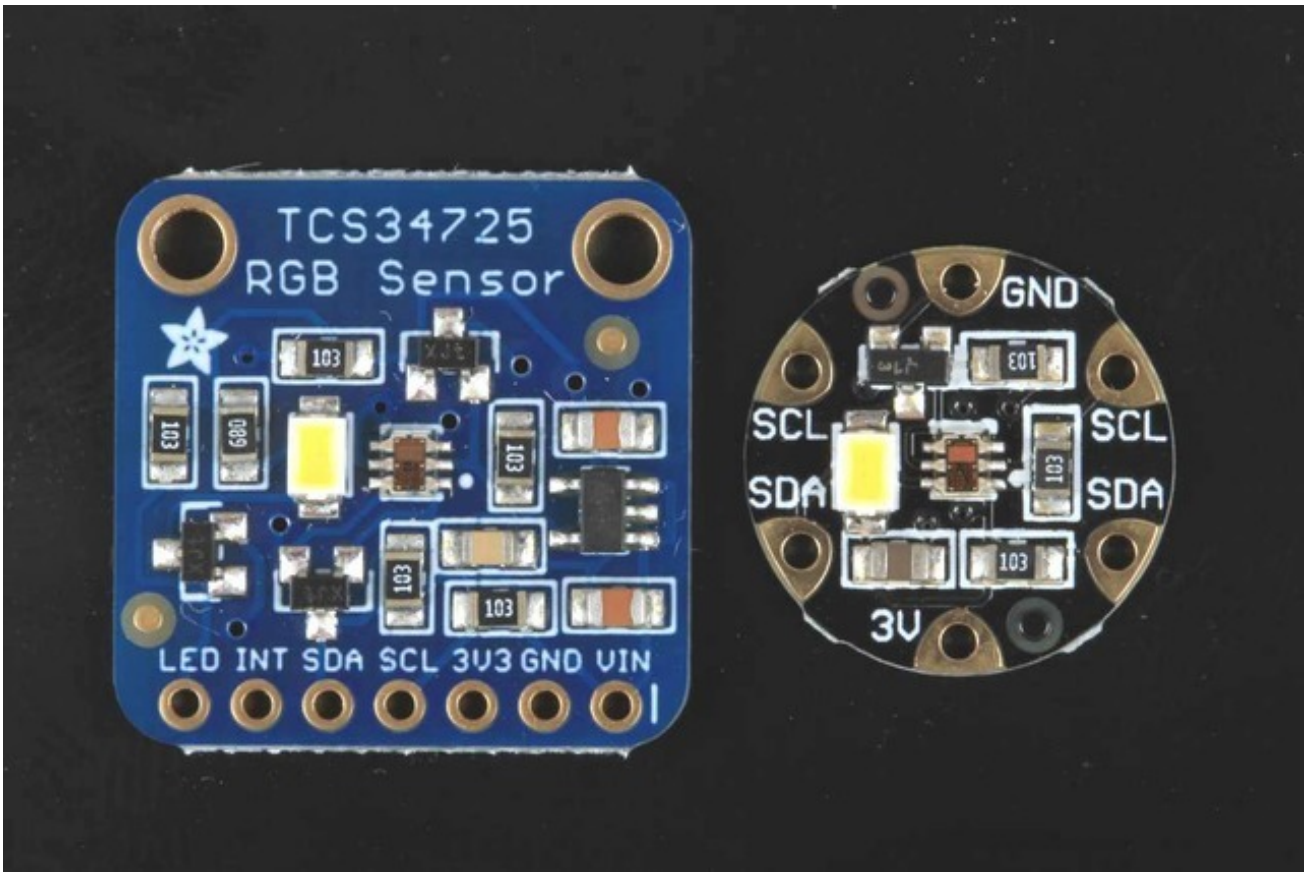
Guide Contents

Overview

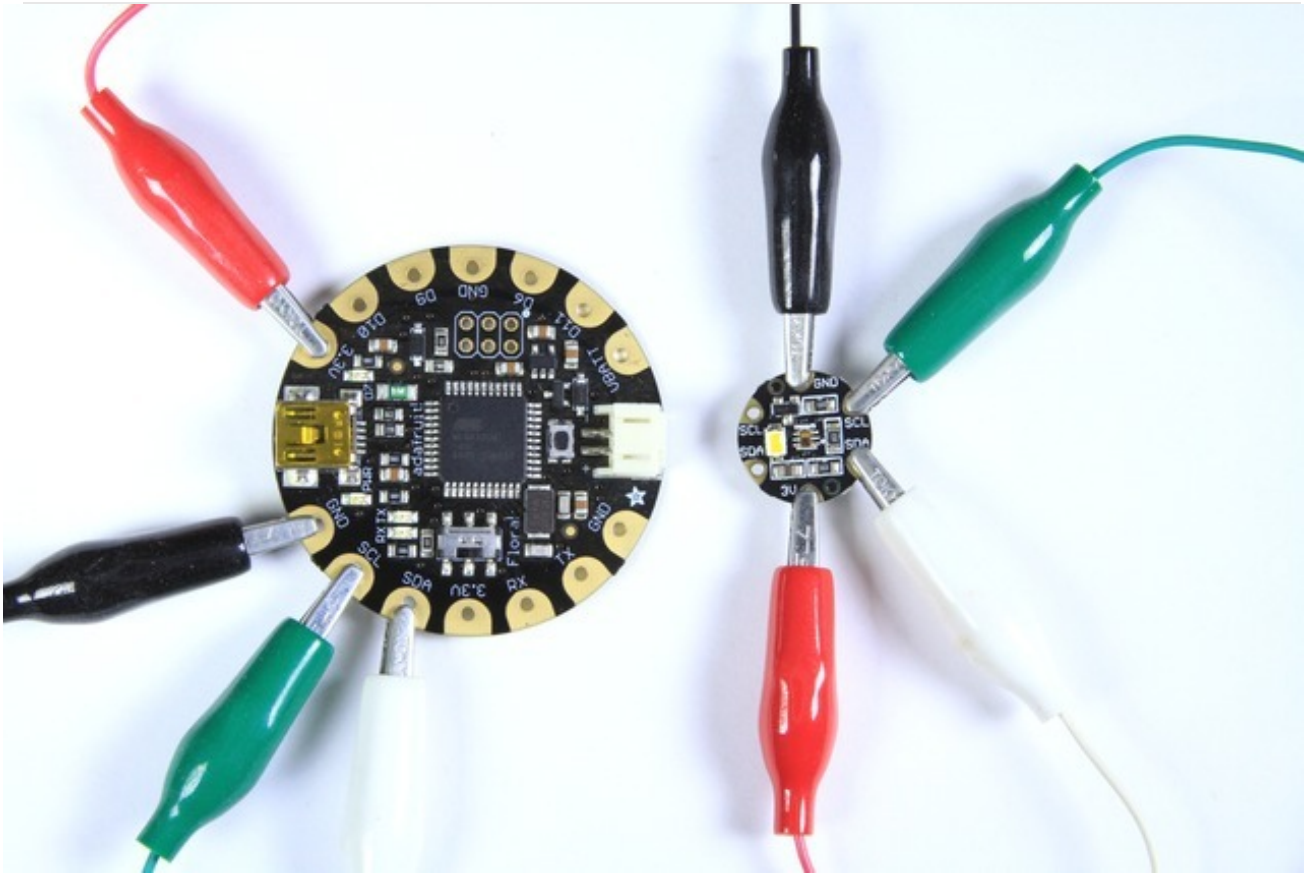
Your electronics can now see in dazzling color with this lovely color light sensor. We found the best color sensor on the market, the TCS34725, which has RGB and Clear light sensing elements. An IR blocking filter, integrated on-chip and localized to the color sensing photodiodes, minimizes the IR spectral component of the incoming light and allows color measurements to be made accurately. The filter means you'll get much truer color than most sensors, since humans don't see IR. The sensor also has an incredible 3,800,000:1 dynamic range with adjustable integration time and gain so it is suited for use behind darkened glass.

We add supporting circuitry as well, such as a 3.3V regulator so you can power the breakout with 3-5VDC safely and level shifting for the I2C pins so they can be used with 3.3V or 5V logic. Finally, we specified a nice neutral 4150°K temperature LED with a MOSFET driver onboard to illuminate what you're trying to sense. The LED can be easily turned on or off by any logic level output.

For more flexibility, we've made two different versions of this board: A breadboard-friendly breakout, and a wearable version designed to work with the Flora wearable platform.

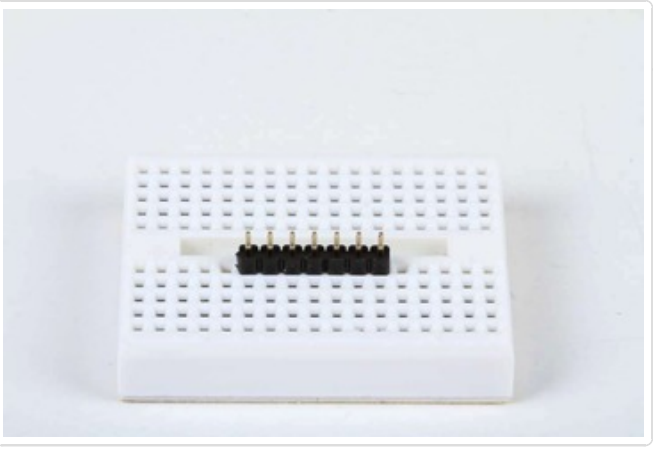

TCS34725
RGB Sensor
LED INT SDA SCL 3V3 GND VIN
GND
SCL
SCL
SDA
SDA
3V

Assembly and Wiring



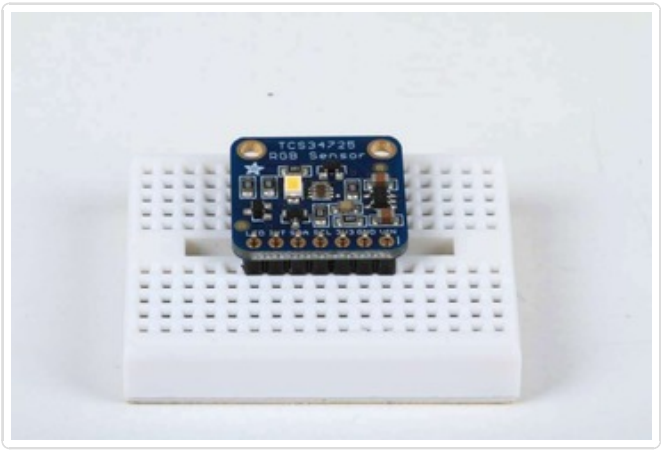
Both color sensors come with all surface mount components pre-soldered. The breakout-board version comes with an optional header for breadboard use. Soldering the header is a simple process:

Assembly (breakout version only)



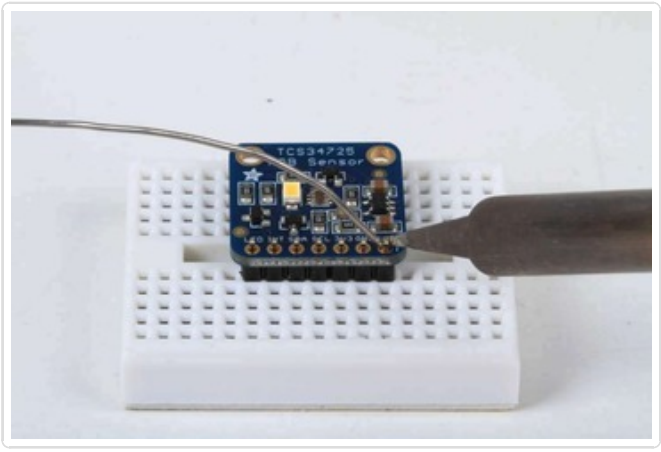
Position the header

Trim the header to length if necessary and insert it (long pins down) into your breadboard.



Position the Breakout

Place the breakout over the exposed short end of the header pins.

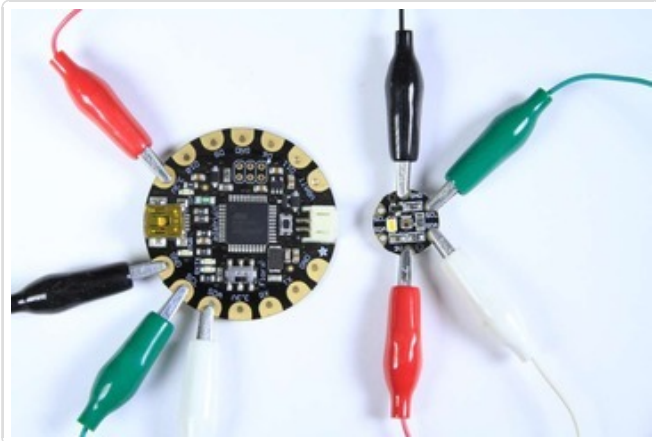


And Solder!

Solder all pins to ensure good electrical contact.

Wiring

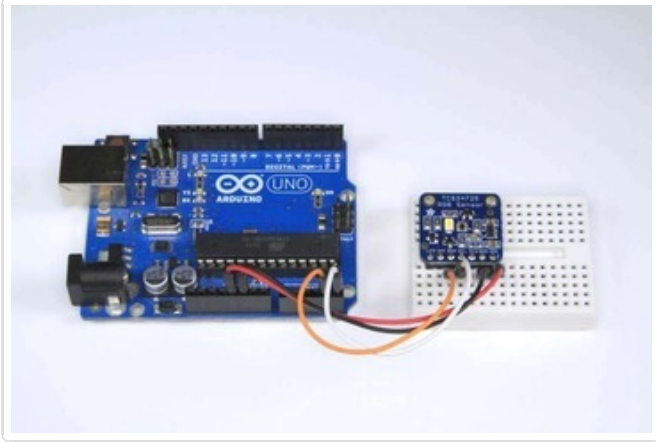
These sensors communicate via a 2-wire I2C interface. To connect to the processor, you need a total of just 4 wires.



Flora Wiring:

Connect from:

- **3.3v -> 3v (red wire)**
- **GND -> GND (black wire)**
- **SDA -> SDA (white wire)**
- **SCL -> SCL (green wire)**



Arduino Wiring:

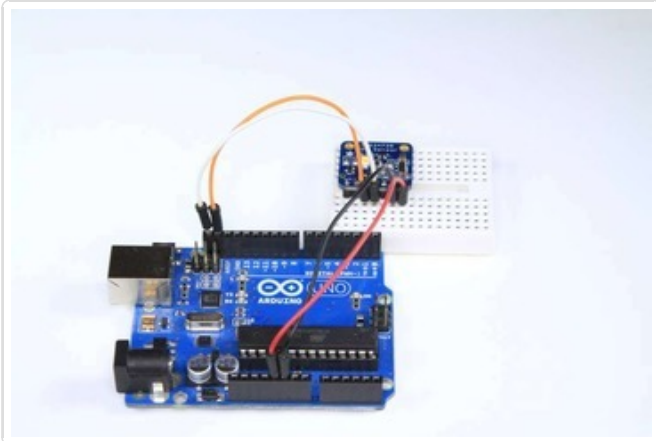
Connect jumpers from:

- **5v -> VIN (red wire)**
- **GND -> GND (black wire)**
- **SDA -> SDA (orange wire)**
- **SCL -> SCL (white wire)**

Note: On older Arduinos such as the Duemilanove and pre R3 UNOs, SDA is on Analog 4 and SCL is on Analog 5.

On pre-R2 Megas, SDA is on Digtital 20 and SCL is on digital 21.

For the Leonardo, SDA is digital pin 2 and SCL is digital pin 3.



To control the LED

(Breakout version only) - The LED pin can be pulled low to turn off the LED. This can be done in three ways:

1. Wire directly to ground to turn it off completely.
2. Wire to a spare digital pin and control it with digitalWrite().
3. Wire the LED pin to the INT pin and control with setInterrupt() (See Library Reference

for details).

Use It!

Install the Library

Download the Adafruit_TCS34725 (http://adafru.it/cb1) Library from Github and install according to the instructions in this guide: Arduino Libraries | All About Arduino Libraries | Adafruit Learning System (http://adafru.it/aYM)

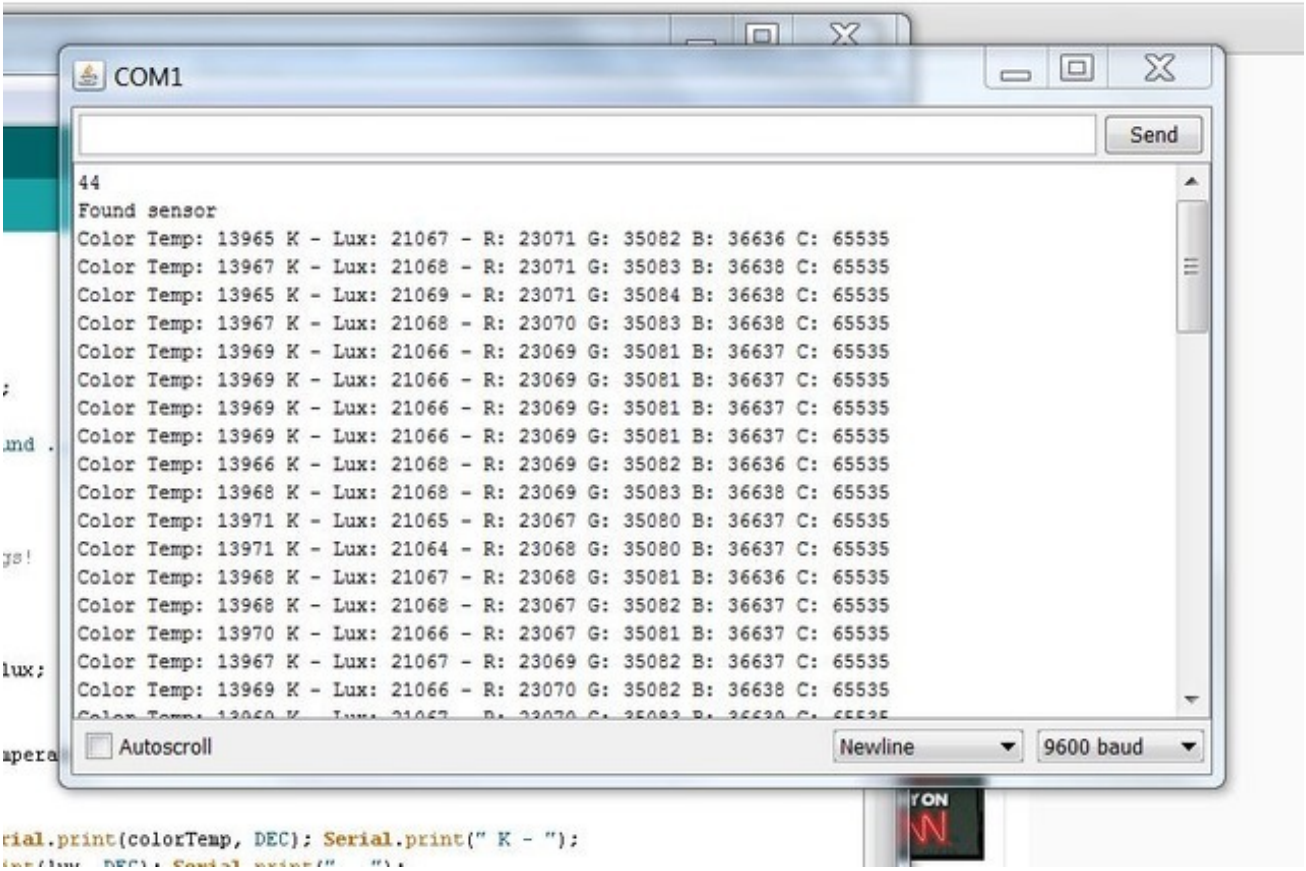
Test the Sensor

Run the TCS34725 test sketch to verify that your sensor is working properly.

Upload the sketch to your Aruduino or Flora and open the Serial Monitor to see the output. The sketch should print out basic color measurement parameters as shown below. Move the sensor around, cover it and/or expose it to different light sources to see how it reacts.

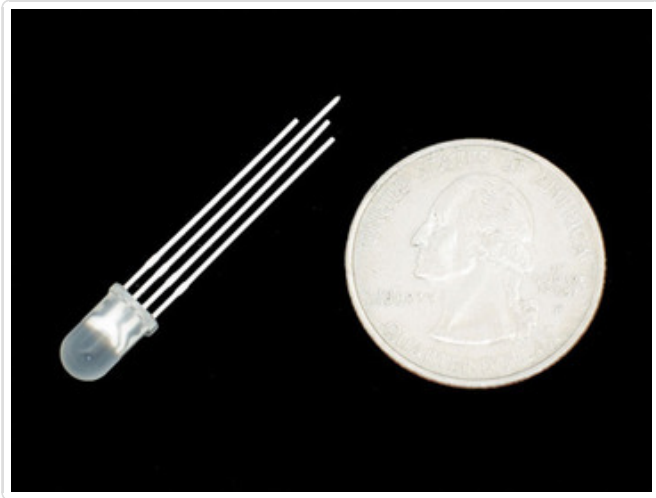
Color parameters reported are:

- **Color Temperature** (http://adafru.it/cb3) - measured in Kelvin
- **Lux (http://adafru.it/aKS)** - or Lumens (http://adafru.it/cb4)per Square Meter
- **R, G** and **B** (filtered) values
- **Clear** (unfiltered) value



ColorView!

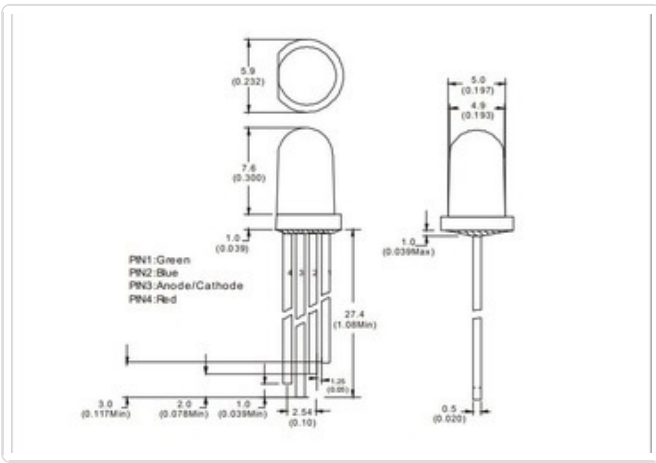
The ColorView sketch demonstrates reflected-light measurement using the on-board led. The white led is used to illuminate nearby objects and the sensor measures the light reflected from the object. The ColorView sketch then uses the RGB outputs of the sensor to drive an RGB led to match the color that is seen by the sensor!

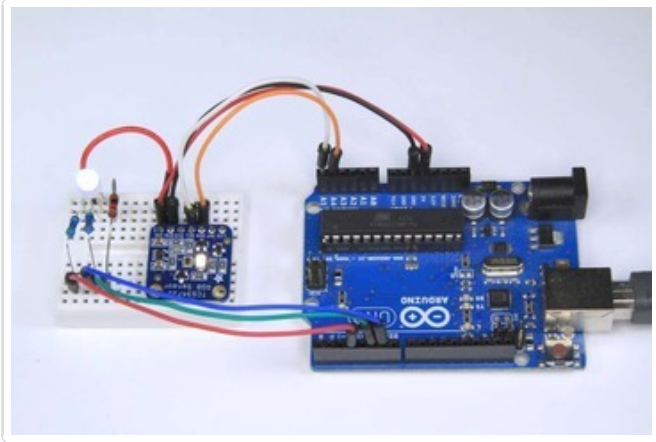


ColorView Components

In addition to a processor and a color sensor, you will need an RGB LED (http://adafru.it/159) and some resistors:

- 1x 1K ohm resistor (Brown, Black Red Gold)
- 2x 560 ohm resistor (Green Blue Brown Gold)



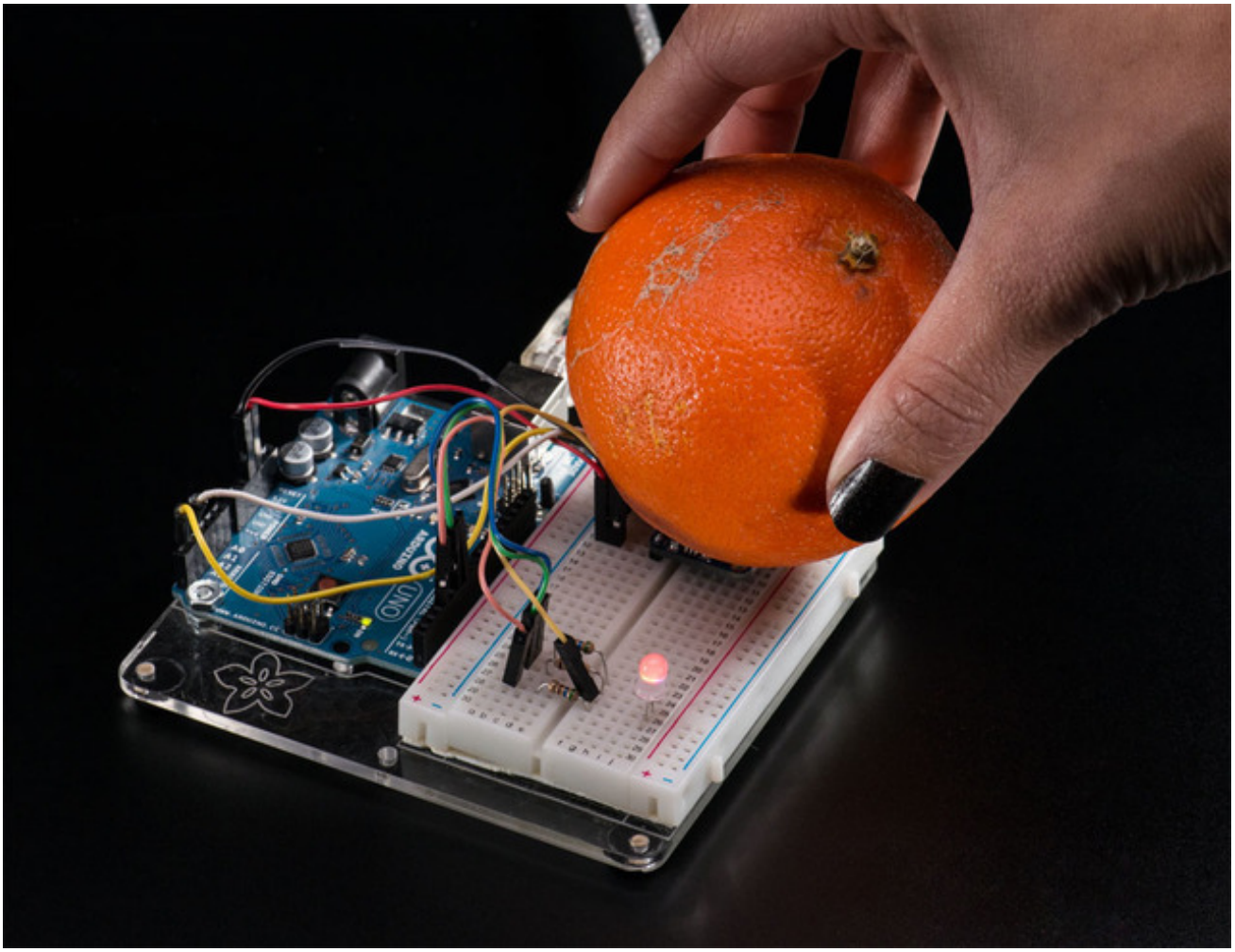


ColorView Wiring

In addition to the basic power and I2C wiring, you will need the following connections:

- LED common anode (long pin) -> 5v.
- LED Red Pin -> 1K resistor -> Arduino Pin 3
- LED Green Pin -> 560 ohm resistor -> Arduino Pin 5
- LED Blue Pin -> 560 ohm resistor -> Arduino Pin 6

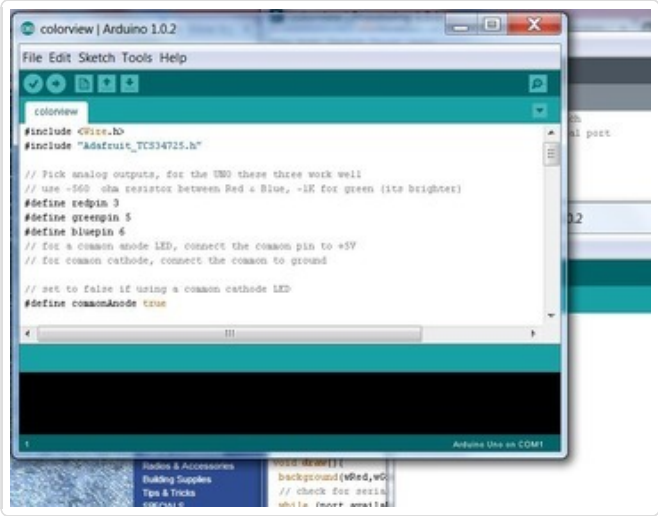
Upload the ColorView sketch to your Arduino, then place different objects in front of the sensor. The LED color should match the color of the sensed object!



Use it with Processing!

The Adafruit_TCS34725 Library includes a processing sketch to communicate with the ColorView Arduino sketch and display color on your computer screen in real time

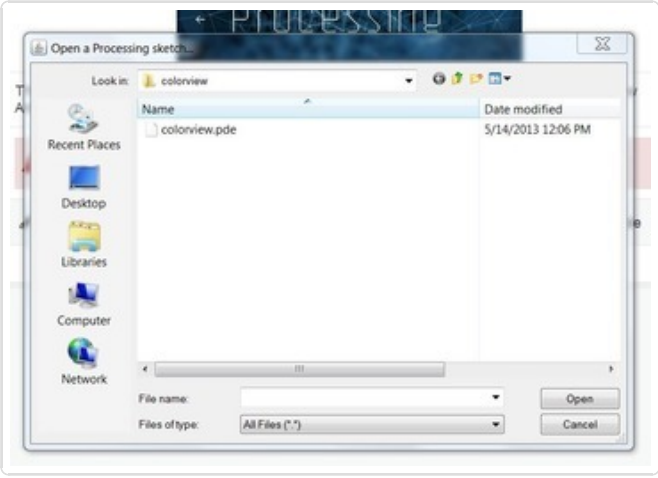
> The Processing Sketch only works with Processing 1.5.1. It is not compatible with Processing version 2.0!



Load ColorView on the Arduino

Open the ColorView example sketch and upload it to your Arduino.

Make note of the serial port used by your Arduino.

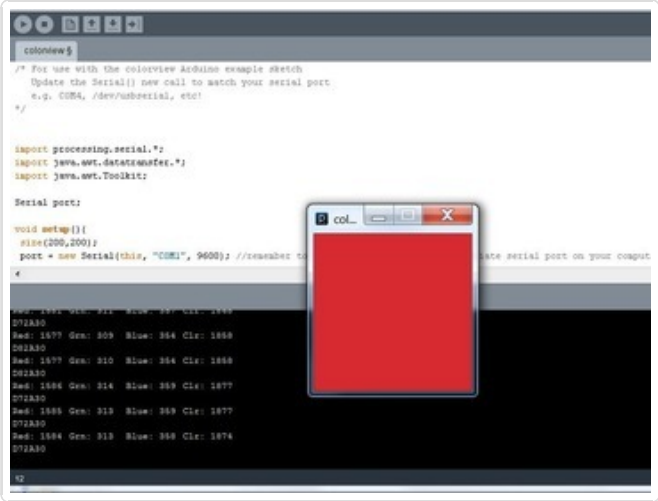


Load ColorView.pde in Processing

Navigate to the "Processing" folder inside the Adafruit_TCS34725 Library folder and open "ColorView.pde".

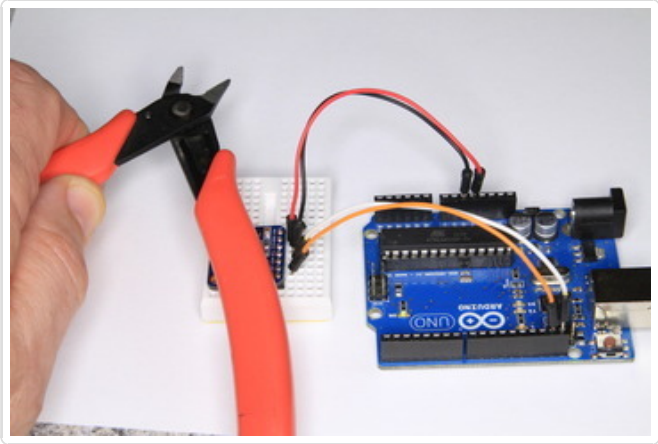
Edit the Serial Port

Find the line where the Serial port is opened and edit it to use the same port as your Arduino.



And Run!

When you run the processing sketch, it will display the sensor text output and pop up a window with a color patch matching the color seen by your sensor.



Construction and Initialization:

Adafruit_TCS34725(tcs34725IntegrationTime_t = TCS34725_INTEGRATIONTIME_2_4MS,

> **tcs34725Gain_t = TCS34725_GAIN_1X);**

> Declare a TCS34725 sensor with optional integration time and gain values.

boolean Adafruit_TCS34725::begin(void)

> Initialize the TCS34725 Color Sensor. Call this function before anything else.

Gain and Integration Time:

void Adafruit_TCS34725::setIntegrationTime(tcs34725IntegrationTime_t it)

> Sets the integration time for color samples from the sensor. Longer integration times can be used for increased sensitivity at low light levels. Valid integration times are:
>
> - TCS34725_INTEGRATIONTIME_2_4MS = 0xFF, /**< 2.4ms */
> - TCS34725_INTEGRATIONTIME_24MS = 0xF6, /**< 24ms */
> - TCS34725_INTEGRATIONTIME_50MS = 0xEB, /**< 50ms */
> - TCS34725_INTEGRATIONTIME_101MS = 0xD5, /**< 101ms */
> - TCS34725_INTEGRATIONTIME_154MS = 0xC0, /**< 154ms */
> - TCS34725_INTEGRATIONTIME_700MS = 0x00 /**< 700ms */

void Adafruit_TCS34725::setGain(tcs34725Gain_t gain)

> Sets the gain of the ADC to control the sensitivity of the sensor. Valid gain settings

are:

- TCS34725_GAIN_1X = 0x00, /**< No gain */
- TCS34725_GAIN_4X = 0x01, /**< 2x gain */
- TCS34725_GAIN_16X = 0x02, /**< 16x gain */
- TCS34725_GAIN_60X = 0x03 /**< 60x gain */

Light Readings and Calculations:

void Adafruit_TCS34725::getRawData (uint16_t *r, uint16_t *g, uint16_t *b, uint16_t *c)

Reads the raw sensor output for the Red, Green, Blue and Clear segments of the sensor.

uint16_t Adafruit_TCS34725::calculateColorTemperature(uint16_t r, uint16_t g, uint16_t b)

Calculates the color temperature from the Red, Green and Blue components.

uint16_t Adafruit_TCS34725::calculateLux(uint16_t r, uint16_t g, uint16_t b)

Calculates Lux from the Red, Green and Blue components.

Interrupts and LED control:

void Adafruit_TCS34725::setInterrupt(boolean i)

Sets the sensor interrupt to generate an interrupt when the detected level is within the limits (see setIntLimits() below). The Int pin is only available on the breakout version.

The boolean parameter can be used to control the LED. On the breakout version, you must connect the LED pin to the INT pin for LED control.

- Passing "false" will enable the on-board led for reflected light measurement.
- Passing "true" will turn the led off for incident light measurement.

void Adafruit_TCS34725::clearInterrupt(void)

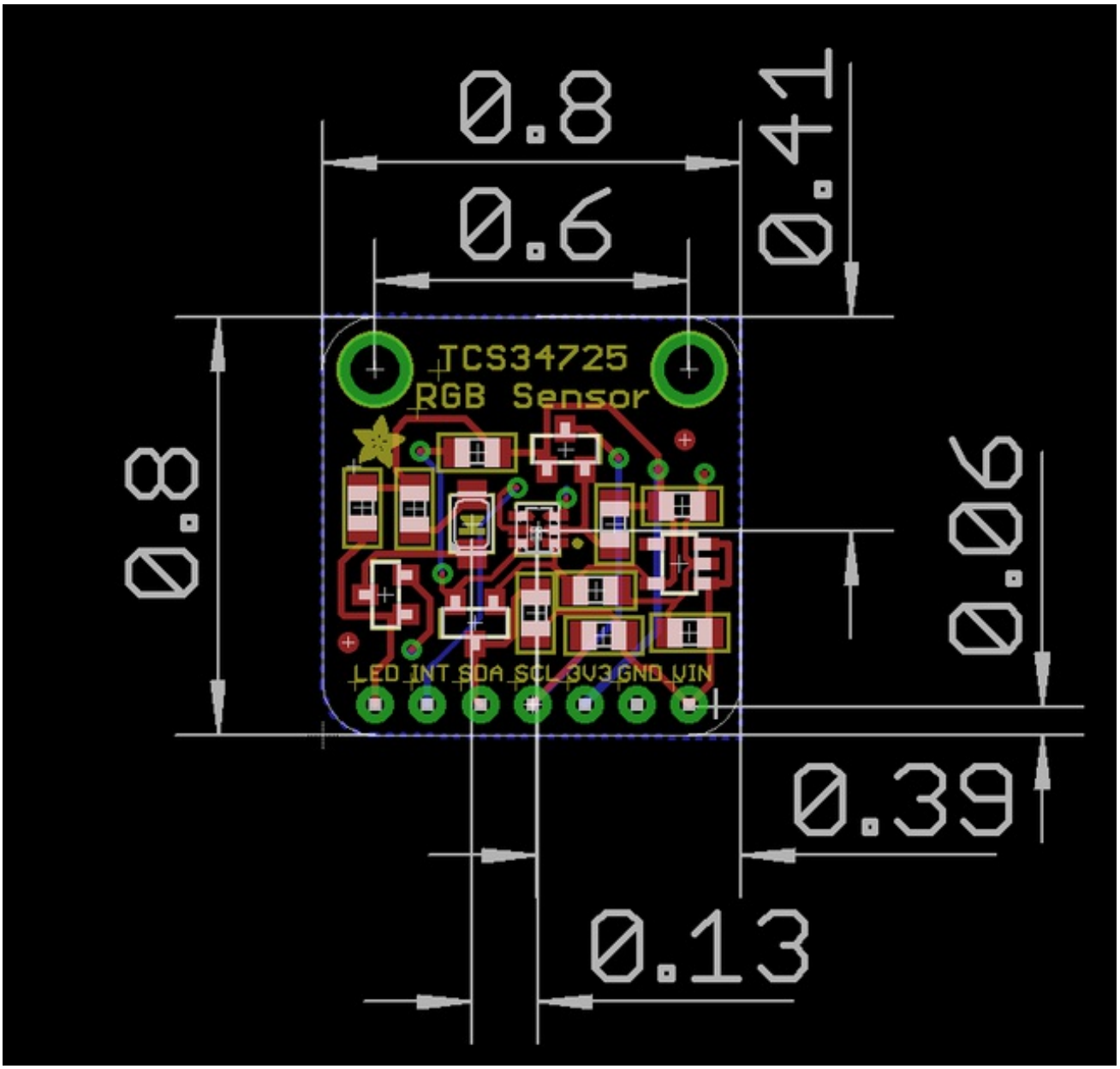
Clears the sensor interrupt.

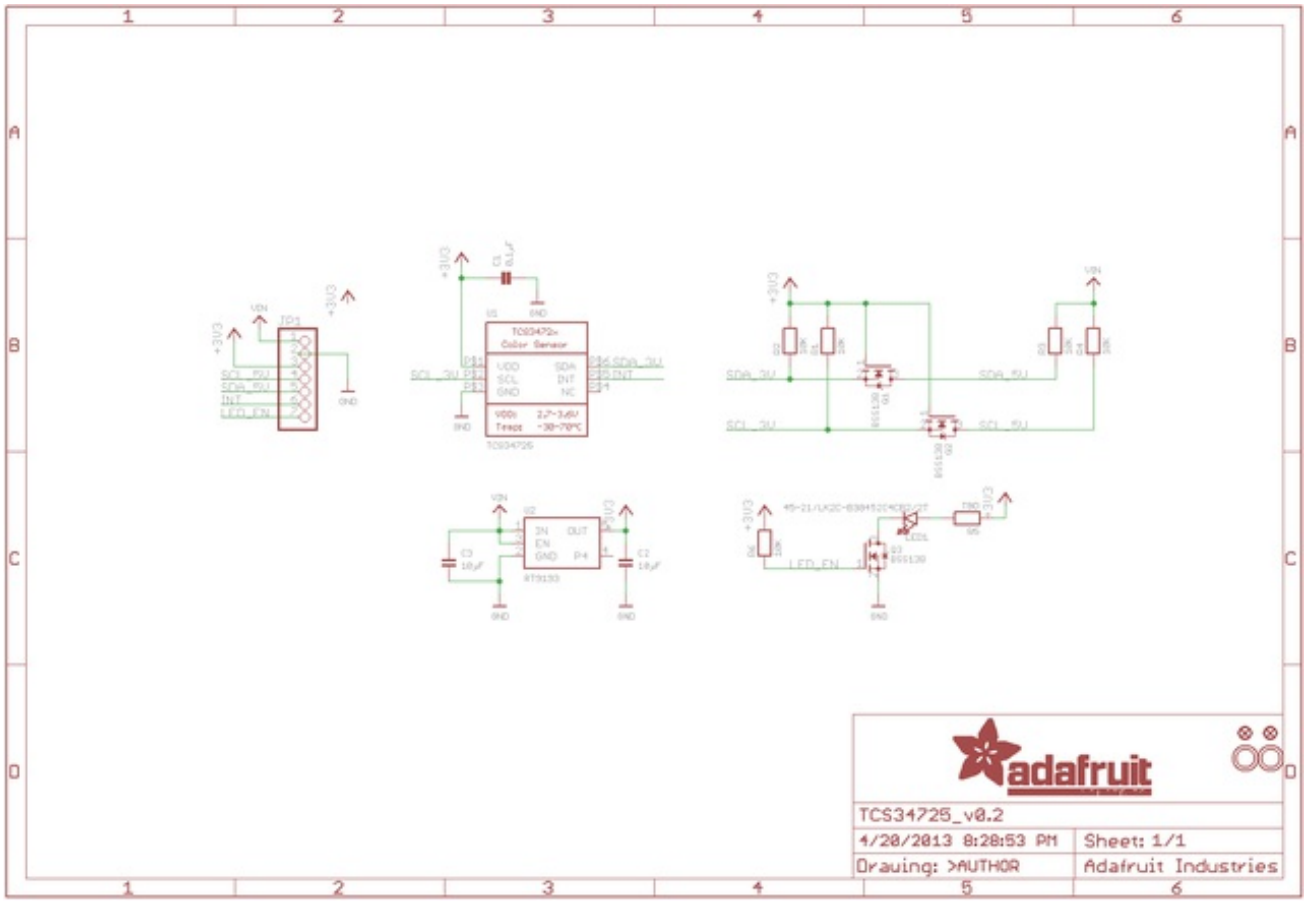
void Adafruit_TCS34725::setIntLimits(uint16_t low, uint16_t high)

Sets the high and low threshold levels for interrupts. For more detail on the operation of interrupts, please refer to the data sheet (http://adafru.it/cb6).

Downloads

Breakout Diagram

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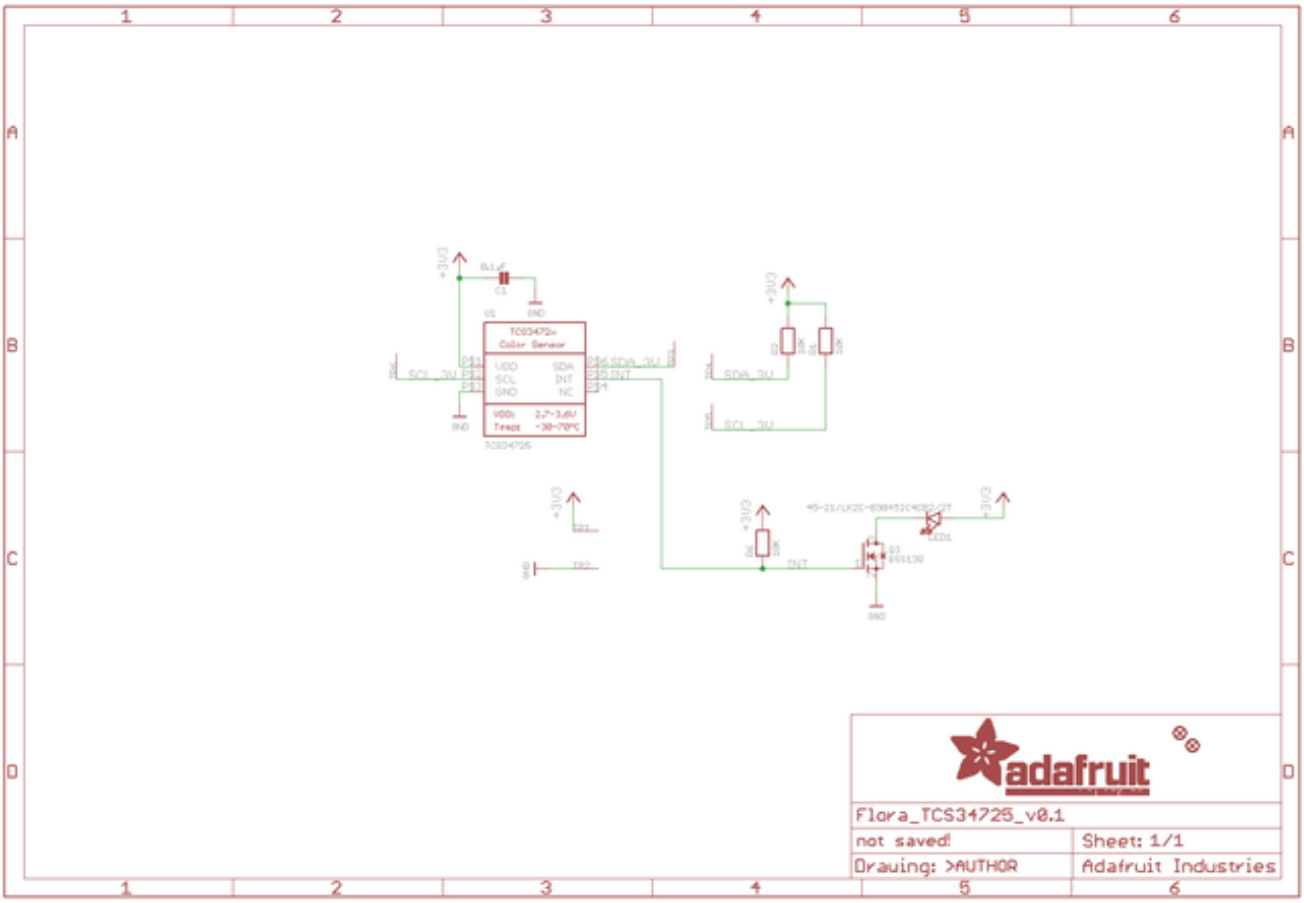
Adafruit Industries



(In Inches)

More documents

Adafruit TCS34725 Library (http://adafru.it/cb1)
TCS34725 Data Sheet (http://adafru.it/cb6)