



This module is based on the color sensor TCS3414CS with digital output I2C. Based on the 8*2 array of filtered photodiodes and 16-bit analog-to-digital converters, you can measure the color chromaticity of ambient light or the color of objects. Of the 16 photodiodes, 4 have red filters, 4 have green filters, 4 have blue filters and 4 have no filter(clear). With the synchronization input pin, an external pulsed light source can provide precise synchronous conversion control.

**Note**

Please note that the latest version V2.0 has replaced the IC with TCS3472 and the old library has also been updated, If you are using the V2.0 version, please use the **new library** [https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor_TCS3472].

Version

| Revision | Descriptions | Release | How to buy |
|----------|--|--------------|--|
| v1.2 | Initial public release (beta) | Jan 17, 2013 | Get One Now  [https://www.seeedstudio.com/i2c-color-sensor-p-854.html] |
| v2.0 | Replace TCS3472(EOL) with TCS34725FN and optimize PCB Layout | Apr 27, 2017 | Get One Now  [https://www.seeedstudio.com/Color-Sensor-V2-p-2890.html] |



Features

- Grove compatible interface
- 16-Bit digital output with I2C
- SYNC Input Synchronizes Integration Cycle to Modulated Light Sources
- Operating temperature range -40°C to 85°C

- Programmable interrupt function with User-Defined Upper and lower threshold settings
- RoHS Compliant



**Tip**

More details about Grove modules please refer to [Grove System](https://wiki.seeedstudio.com/Grove_System/)
[https://wiki.seeedstudio.com/Grove_System/]

Specifications

| Parameter | Value/Range |
|-----------|------------------------|
| PCB Size | 2.0 cm * 4.0 cm |
| Interface | 2.0mm pitch pin header |
| VCC | 3.3 - 6.0 V |
| I2C Speed | 400 kHz |

Platforms Supported

| | | | |
|---|---|--|--|
| Arduino | Raspberry Pi | | |
|  |  | | |

**Caution**

The platforms mentioned above as supported is/are an indication of the module's software or theoretical compatibility. We only provide software library or code examples for Arduino platform in most cases. It is not possible to provide software library / demo code for all possible MCU platforms. Hence, users have to write their own software library.

Getting Started

Following documents help in getting the user started with Grove.

- [Preface - Getting Started](https://www.seeedstudio.com/document/pdf/Preface.pdf)
[<https://www.seeedstudio.com/document/pdf/Preface.pdf>]
- [to Grove](https://www.seeedstudio.com/document/pdf/Introduction%20to%20Grove.pdf)
[<https://www.seeedstudio.com/document/pdf/Introduction%20to%20Grove.pdf>]

Hardware Connections

Grove products have an eco system and all have the same connector which can plug onto the [Grove Base Shield](#) [/Base_Shield_V2]. Connect this module to the I2C port of Base Shield. However, you can also connect Grove - I2C Color Sensor to Arduino without Base Shield by jumper wires.

| Arduino UNO | Grove - I2C Color Sensor |
|-------------|--------------------------|
| 5V | VCC |
| GND | GND |
| SDA | SDA |
| SCL | SCL |

Software Installation

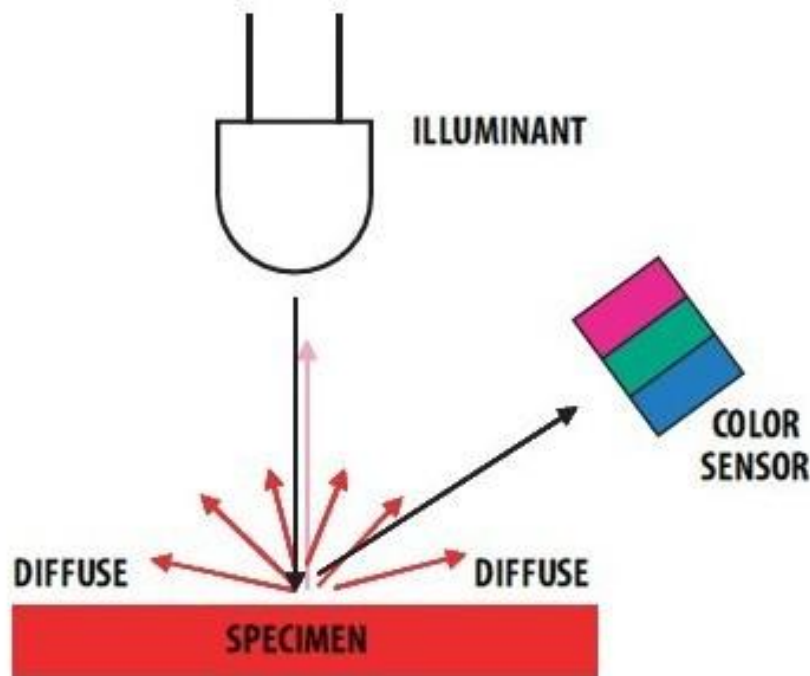
[Download Arduino and install Arduino driver](#) [/Driver_for_Seeduino]

[Getting Started with Seeeduino/Arduino](#)

[/Getting_Started_with_Seeduino]

Demos

This module can be used to detect the color of light source or the color of objects. When used to detect the color of the light source, the led switch should be turned off, and the light source should shine the sensor directly. When used to detect the color of things, the led should be on and you should put the object on the top of the enclosure closely. The theory of sensing the color of objects is Reflective Sensing Theory. Like the picture below.



Color Sensor Library

We have created a library to help you start playing quickly with the Seeeduino/Arduino, in this section we'll show you how to set up the library.

Setup

1. Download the **library code as a zip file** [https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor] from the Grove_I2C_Color_Sensor github page. If you are using the latest version V2.0(IC is TCS3472), please use this **new library** [https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor_TCS3472]
2. Unzip the downloaded file into your .../arduino/libraries.
3. Rename the unzipped folder "Color_Sensor"

4. Start the Arduino IDE (or restart if it is open).

Description of function

This is the most important/useful function in the library, we invite you to look at the .h and .cpp files yourself to see all the functions available.

READ RGB DATA THROUGH THE LIBRARY FUNCTION

readRGB(int *red, int *green, int *blue)

- **red:** The variable address to save R.
- **green:** The variable address to save G.
- **blue:** The variable address to save B.

```
1  void loop()
2  {
3      int red, green, blue;
4      GroveColorSensor colorSensor;
5      colorSensor.ledStatus = 1;           // When turn on
6      while(1)
7      {
8          colorSensor.readRGB(&red, &green, &blue); //Read RGB value
9          delay(300);
10         Serial.print("The RGB value are: RGB( ");
11         Serial.print(red,DEC);
12         Serial.print(", ");
13         Serial.print(green,DEC);
14         Serial.print(", ");
15         Serial.print(blue,DEC);
16         Serial.println(" )");
17         colorSensor.clearInterrupt();
18     }
19 }
```

Color Sensor Examples/Applications

This example shows how to use features of Grove - I2C Color Sensor and display the detected color with a [Chainable RGB LED Grove](#) [/Grove-Chainable_RGB_LED].



Note

If you haven't downloaded [Grove-Chainable RGB LED library](#) [https://github.com/Seeed-Studio/Grove_Chainable_RGB_LED] to your Arduino IDE before, please download and set up the library first.

- Open File->Examples->Color_Sensor->example->ColorSensorWithRGB-LED sketch for a complete example, or copy and paste code below to a new Arduino sketch.

Description: This example can measure the color chromaticity of ambient light or the color of objects, and via Chainable RGB LED Grove, display the detected color.

You also can use other display modules to display the detected color by Grove - I2C Color Sensor.

```
1  #include <Wire.h>
2  #include <GroveColorSensor.h>
3  #include <ChainableLED.h>
4
5  #define CLK_PIN    7
6  #define DATA_PIN  8
7  #define NUM_LEDS   1           //The number of Chainable
8
9  ChainableLED leds(CLK_PIN, DATA_PIN, NUM_LEDS);
10
11 void setup()
12 {
13     Serial.begin(9600);
```



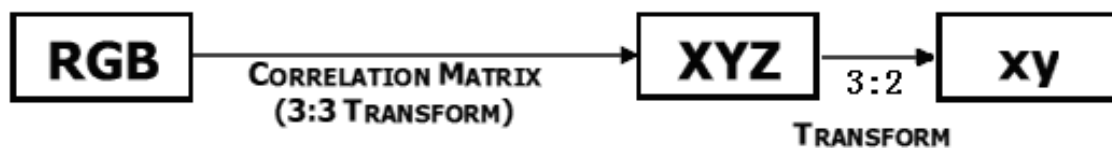
```
14     Wire.begin();
15 }
16
17 void loop()
18 {
19     int red, green, blue;
20     GroveColorSensor colorSensor;
21     colorSensor.ledStatus = 1;           // When turn on
22     while(1)
23     {
24         colorSensor.readRGB(&red, &green, &blue); //Read RGB value
25         delay(300);
26         Serial.print("The RGB value are: RGB( ");
27         Serial.print(red,DEC);
28         Serial.print(", ");
29         Serial.print(green,DEC);
30         Serial.print(", ");
31         Serial.print(blue,DEC);
32         Serial.println(" )");
33         colorSensor.clearInterrupt();
34         for(int i = 0; i<NUM_LEDS; i++)
35         {
36             leds.setColorRGB(i, red, green, blue);
37         }
38     }
39 }
```

- Upload the code to the development board.
- Then Grove_-_Chainable_RGB_LED would display the color which is detected.

Other Reference

This module is based on the color sensor TCS3414CS. The TCS3414CS digital color sensor returns data from four channels: red(R), green(G), blue(B) and clear(C)(non-filtered). The response

from the red, green and blue channels (RGB) can be used to determine a particular source's chromaticity coordinates (x, y). These standards are set by the Commission Internationale de l'Eclairage (CIE). The CIE is the main international organization concerned with color and color measurement. In order to acquire the color of a given object using TCS3414CS, we must first map the sensor response (RGB) to the CIE tristimulus values (XYZ). It is then necessary to calculate the chromaticity coordinates (x, y).



Chromaticity Calculation Process Overview

The equations to do the transformation:

$$X = (-0.14282)(R) + (1.54924)(G) + (-0.95641)(B)$$

$$Y = (-0.32466)(R) + (1.57837)(G) + (-0.73191)(B)$$

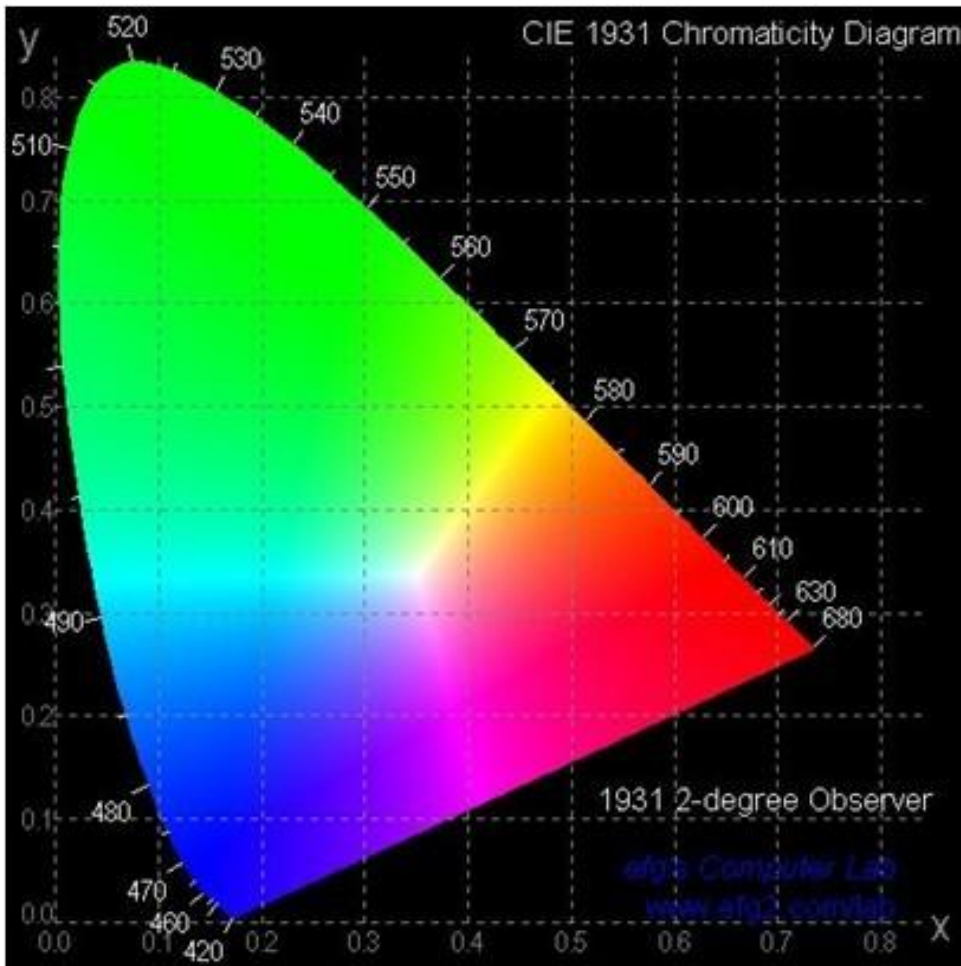
$$Z = (-0.68202)(R) + (0.77073)(G) + (0.56332)(B)$$

$$x = X/(X+Y+Z)$$

$$y = Y/(X+Y+Z)$$

Transformation Equations

- When we get coordinates (x, y), please reference the below figure so as to get the recommended color.



FAQs

Q1: How to understand the commands? For example, REG_GREEN_LOW = 0xD0

A1: From the attached picture, you can see what's in the command. When using byte protocol command, it must be like 0x80+ADDRESS. For example, REG_TIMING(01h) = 0x81 For byte and block read, the command should be 0xC0+ADDRESS, REG_GREEN_LOW(10h) = 0xD0.

Command Register

The command register specifies the address of the target register for subsequent read and write operations. This register contains eight bits as described in Table 3 and defaults to 00h at power on.

Table 3. Command Register

| | | | | | | | |
|--------------|---|-------------|---|---------|---|---|---|
| | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| CMD | | TRANSACTION | | ADDRESS | | | |
| COMMAND | | | | | | | |
| Reset Value: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| FIELD | BITS | DESCRIPTION | | |
|-------------|------|--|-----------------|--|
| CMD | 7 | Select command register. Must write as 1. | | |
| TRANSACTION | 6:5 | Transaction. Selects type of transaction to follow in subsequent data transfer. | | |
| | | FIELD VALUE | TRANSACTION | DESCRIPTION |
| | | 00 | Byte protocol | SMB read/write byte protocol |
| | | 01 | Word protocol | SMB read/write word protocol |
| | | 10 | Block protocol | SMB read/write block protocol |
| | | 11 | Interrupt clear | Clear any pending interrupt and is a write-once-to-clear field |
| ADDRESS | 4:0 | Register Address. This field selects the specific control or status register for following write and read commands according to Table 2. | | |

- NOTES: 1. An I²C block transaction will continue until the Master sends a stop condition. See Figure 18 and Figure 19. Unlike the I²C protocol, the TCS3404/14 SMBus read/write protocol requires a Byte Count. All eight ADC Channel Data Registers (10h through 17h) can be read simultaneously in a single SMBus transaction. This is the only 64-bit data block supported by the TCS3404 SMBus protocol. The TRANSACTION field must be set to 10, and a read condition should be initiated with a COMMAND CODE of CFh. By using a COMMAND CODE of CFh during an SMBus Block Read Protocol, the TCS3404 device will automatically insert the appropriate Byte Count (Byte Count = 8) as illustrated in Figure 18. A write condition should not be used in conjunction with the 0Fh register.
2. Only the Send Byte Protocol should be used when clearing interrupts.

Grove-I2C Color Sensor Eagle File V1.2



Grove-I2C Color Sensor Eagle File V2.0



Resources

-
- **[Library]** [Library for Grove - I2C Color Sensor V1.2](https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor)
[https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor]
 - **[Library]** [Library for Grove - I2C Color Sensor V2.0](https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor_TCS3472)
[https://github.com/Seeed-Studio/Grove_I2C_Color_Sensor_TCS3472]

- **[Eagle]** [Grove-I2C Color Sensor Eagle File V1.2](https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/Grove-I2C%20Color%20Sensor%20Eagle%20File%20V1.2.zip)
[https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/Grove-I2C%20Color%20Sensor%20Eagle%20File%20V1.2.zip]
- **[Eagle]** [Grove-I2C Color Sensor Eagle File V2.0](https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/Grove%20I2C%20Color%20Sensor%20v2.0.zip)
[https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/Grove%20I2C%20Color%20Sensor%20v2.0.zip]
- **[Datasheet]** [TCS3414-A Datasheet](https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/res/TCS3404_TCS3414-A.pdf)
[https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/res/TCS3404_TCS3414-A.pdf]
- **[Datasheet]** [TCS3472 Datasheet](https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/res/TCS3472%20Datasheet.pdf)
[https://files.seeedstudio.com/wiki/Grove-I2C_Color_Sensor/res/TCS3472%20Datasheet.pdf]

Tech Support

Please submit any technical issue into our [forum](https://forum.seeedstudio.com/)

[https://forum.seeedstudio.com/].



[https://www.seeedstudio.com/act-4.html?utm_source=wiki&utm_medium=wikibanner&utm_campaign=newproducts]

