MATRIX Color Sensor
MS-002 V2

Warning: Color sensor V1,2 and V3 are **Different Sensors**, and use **Different Code**.

1.Feature

· Support RGB, CMYK, and Grayscale format.
· Internal 14 colors auto detect by number.
· Support gamma correction.
· On-board auto fill light.

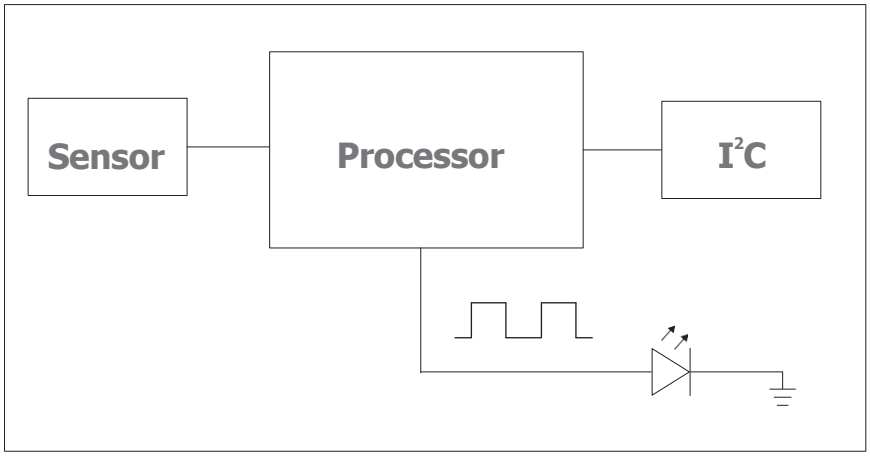
2. Application

· Signage recognize
· Industrial automation
· Grayscale monitor

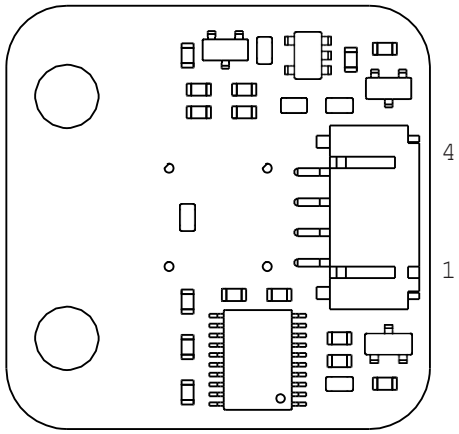
3. Introduction

The MATRIX Color Sensor is an RGB color sensor. The on-board fill light allows the sensor to work under low illumination conditions. User can set the fill light to automatic mode or adjust the light PWM through the register table. The sensor also support gamma correction algorithm to make the detected color closer to the human eye.

4. Block Diagram



5. Pinout



Pinout			
NO.	Name	I/O	Description
1	SDA	I/O	Serial data line.
2	SCL	I	Serial clock line.
3	VCC	I	Supply voltage.
4	GND	-	Supply ground.

6. Electrical Characteristics

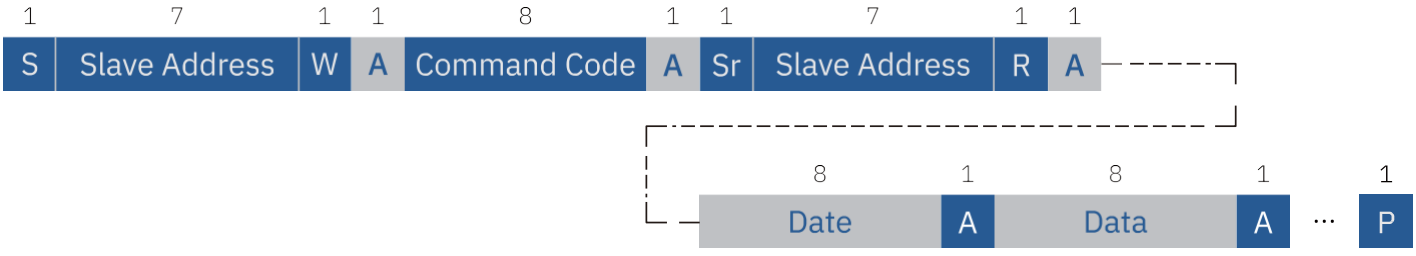
Parameter	Min	Typ	Max	Units
Supply Voltage (VCC)	3	3.3	5	V
Red channel wavelength	-	465	-	nm
Green channel wavelength	-	525	-	nm
Blue channel wavelength	-	615	-	nm
I2C operating speed	100	-	400	KHz
I2C Low-Level Input Voltage	-0.5V	-	0.33*VCC	-
I2C High-Level Input Voltage	0.7*VCC	-	VCC	-

7. Usage

The MATRIX color sensor follows the 7-bit I2C bus protocol by Philips. To access the sensor's functions, there are two ways that the master device should follow depends on Read or Write situation.

I²C Write Protocol

I²C Read Protocol



To get the i2c library for Matrix color sensor, please visit sites as below:

Arduino Library : https://github.com/Matrix-Robotics/MatrixColorSensor
Microbit Library : https://github.com/Matrix-Robotics/pxt-MatrixColor

8. I2C Register Tabel

1. Register deffinitions

Register Tabel (Summary)				
Register(hex)	Name	R/W	Reset Value	BITS Description
01h	Device ID	R	0x43	Device ID [7:0]
02h	Device Control	R/W	0x04	Device Control [4:0]
03h	Fill Light PWM	R/W	0x00	Fill Light PWM [7:0]
04h	R Data	R	0x00	Red data [7:0]
05h	G Data	R	0x00	Green data [7:0]
06h	B Data	R	0x00	Blue data [7:0]
07h	C Data	R	0x00	Cyan data [7:0]
08h	M Data	R	0x00	Magenta data [7:0]
09h	Y Data	R	0x00	Yellow data [7:0]
0Ah	K Data	R	0x00	Black data [7:0]
0Bh	Grayscale	R	0x00	Grayscale data [7:0]
0Ch	Color Number	R	0x00	Color Number [3:0]

8.2. Device ID

The Device ID register is one-byte / read-only data. This register will always return 0x43 even when the device power is disabled.

Device ID (01h)				
Bit	Name	R/W	Reset Value	Description
7 to 0	Device ID [7:0]	R	0x43	Device ID [7:0]

8.3. Device Control

The Device Control register is used primarily to power the device on and off, and enable functions that include gamma correction and fill light.

<table>
<tr><th colspan="6">Device Control (02h)</th></tr>
<tr><td>Bit</td><td>Name</td><td>R/W</td><td>Default</td><td colspan="2">Description</td></tr>
<tr><td>7</td><td>-</td><td>R</td><td>0</td><td colspan="2">Reserved</td></tr>
<tr><td>6</td><td>-</td><td>R</td><td>0</td><td colspan="2">Reserved</td></tr>
<tr><td>5</td><td>-</td><td>R</td><td>0</td><td colspan="2">Reserved</td></tr>
<tr><td>4</td><td>RST</td><td>W</td><td>0</td><td colspan="2">Set bit to 1 to reset sensor to default status.</td></tr>
<tr><td>3</td><td>PWR</td><td>R/W</td><td>0</td><td colspan="2">Enable/disable device power.</td></tr>
<tr><td>2</td><td>GAMMA</td><td>R/W</td><td>1</td><td colspan="2">Enable/disable gamma correction.</td></tr>
<tr><td rowspan="5">1 to 0</td><td rowspan="5">LED Mode [1:0]</td><td rowspan="5">R/W</td><td rowspan="5">00</td><td colspan="2">Selects the type of mode of the fill light:</td></tr>
<tr><td>Value</td><td>Description</td></tr>
<tr><td>00</td><td rowspan="2">Disable LED Fill Light</td></tr>
<tr><td>01</td></tr>
<tr><td>10</td><td>LED Fill Light follow by PWM(0x03)</td></tr>
<tr><td>11</td><td>LED Fill Light Auto Adjust</td></tr>
</table>

8.4. Fill Light PWM

The Fill Light PWM register controls the brightness adjustment from 0 to 255.

Fill Light PWM (01h)				
Bit	Name	R/W	Reset Value	Description
7 to 0	Device ID [7:0]	R	0x43	Device ID [7:0]

8.5. Color Data

RGB, CMYK, and grayscale data are stored as 8-bit values. These registers are read-only.

Color Data(04h~0Bh)				
Register(hex)	Name	R/W	Reset Value	BITS Description
04h	Red data [7:0]	R	0x00	Data of the target color [7:0]
05h	Green data [7:0]			
06h	Blue data [7:0]			
07h	Cyan data [7:0]			
08h	Magenta data [7:0]			
09h	Yellow data [7:0]			
0Ah	Black data [7:0]			
0Bh	Grayscale data [7:0]			

8.6. Color Number

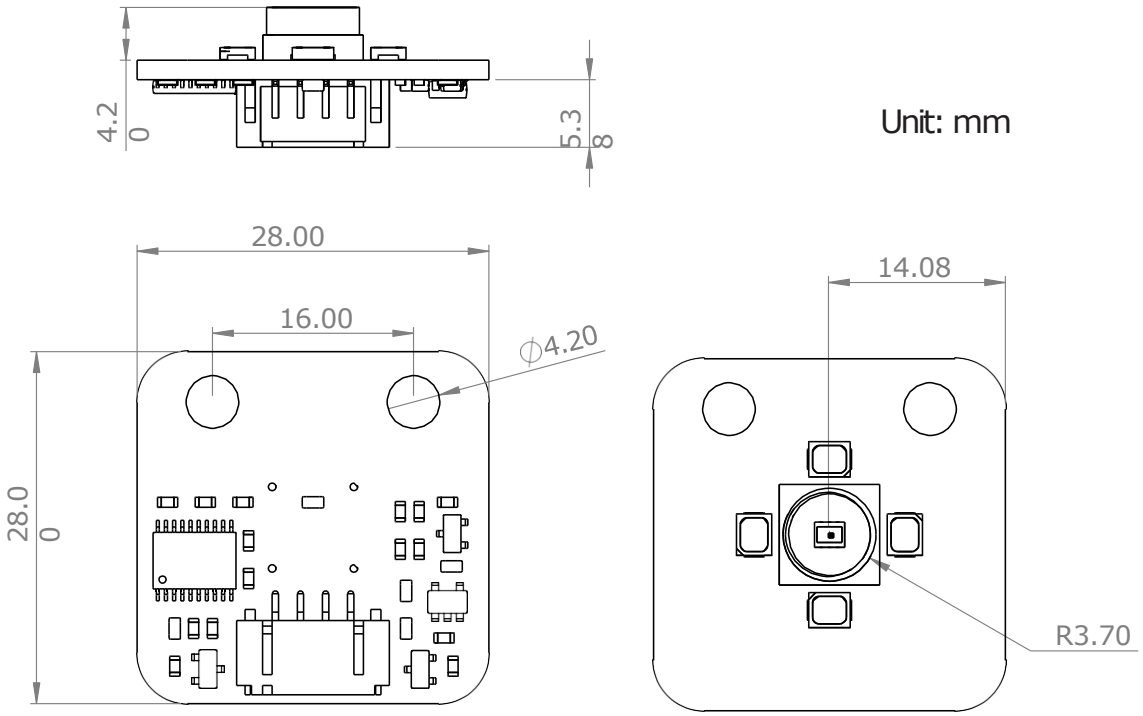
The Color Number register returns the number which the sensor auto-detects color. The sensor will automatically classify the color to the closest number by CMYK value. Detailed rule of color number as shown in Figure 5.

<table>
<tr><th colspan="5">Device Control (02h)</th></tr>
<tr><th>Bit</th><th>Name</th><th>R/W</th><th>Default</th><th>Description</th></tr>
<tr><td>7</td><td>-</td><td>R</td><td>0</td><td>Reserved</td></tr>
<tr><td>6</td><td>-</td><td>R</td><td>0</td><td>Reserved</td></tr>
<tr><td>5</td><td>-</td><td>R</td><td>0</td><td>Reserved</td></tr>
<tr><td>4</td><td>-</td><td>R</td><td>0</td><td>Reserved</td></tr>
<tr><td rowspan="18">3 to 0</td><td rowspan="18">Color Number [3:0]</td><td rowspan="18">R</td><td rowspan="18">0000</td><td>The type of color as following as below:</td></tr>
<tr><td>Value: Description</td></tr>
<tr><td>0000: Black</td></tr>
<tr><td>0001: White</td></tr>
<tr><td>0010: Cyan</td></tr>
<tr><td>0011: Ocean</td></tr>
<tr><td>0100: Blue</td></tr>
<tr><td>0101: Violet</td></tr>
<tr><td>0110: Magenta</td></tr>
<tr><td>0111: Raspberry</td></tr>
<tr><td>1000: Red</td></tr>
<tr><td>1001: Orange</td></tr>
<tr><td>1010: Yellow</td></tr>
<tr><td>1011: Spring Green</td></tr>
<tr><td>1100: Green</td></tr>
<tr><td>1101: Turquoise</td></tr>
<tr><td>1110: Reserved</td></tr>
<tr><td>1111: Reserved</td></tr>
</table>

Note: Color Number has been **Deprecated** since MATRIXblock v1.0.5, A new algorithm will replace this feature in the future.

Figure 5

9. Dimensions



10. Disclaimer

The information contained on datasheet is for general information purposes only. KKITC assumes no responsibility for errors or omissions in the contents of the datasheet.

In no event shall KKITC be liable for any special, direct, indirect, consequential, or incidental damages or any damages whatsoever, whether in an action of contract, negligence or other tort, arising out of or in connection with the use of the Service or the contents of the datasheet.

KKITC reserves the right to make additions, deletions, or modification to the contents on the Service at any time without prior notice.

KKITC does not warrant that the website is free of viruses or other harmful components.