Dust sensor GP2Y1014AU0F Application Notes

Dust Sensor
GP2Y1014AU0F

This is Application Note of dust sensor module (GP2Y1014AU0F) is a document consists from explanation how to use, cautions when using it, characteristics data for the customer's reference when applying this device.
When designing the device, please refer to this document and also evaluate it under actual usage conditions.

Dust Sensor Applications

- Air purifier / cleaner
- Air conditioner
- Air quality monitor
- HVAC, environmental monitoring
- Portable consumer products
- Wearable products and smartphone integration
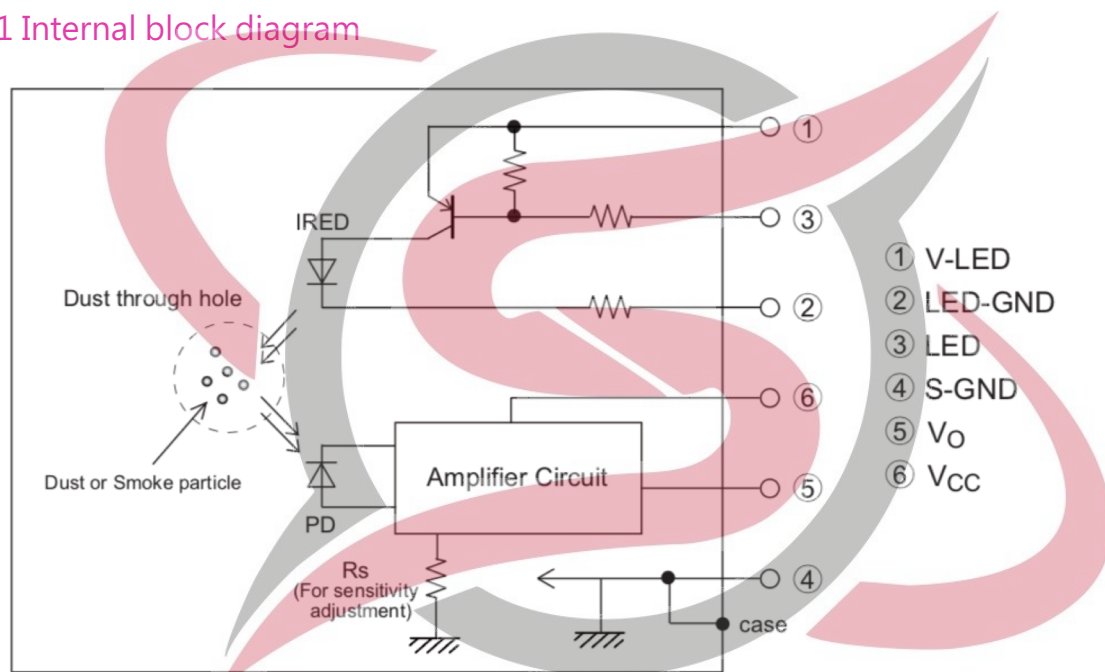- Customers range from home appliance makers to startup companies

1.概述 Overview

這是灰塵傳感器模塊的應用說明（GP2Y1014AU0F）是一個文件，包括說明如何使用，使用時的注意事項，特徵數據，供客戶在使用本設備時參考。
在設計設備時，請參閱此文檔，並在實際使用條件下進行評估。

This is Application Note of dust sensor module (GP2Y1020AU0F) is a document consists from explanation how to use, cautions when using it, characteristics data for the customer's reference when applying this device.

When designing the device, please refer to this document and also evaluate it under actual usage conditions.
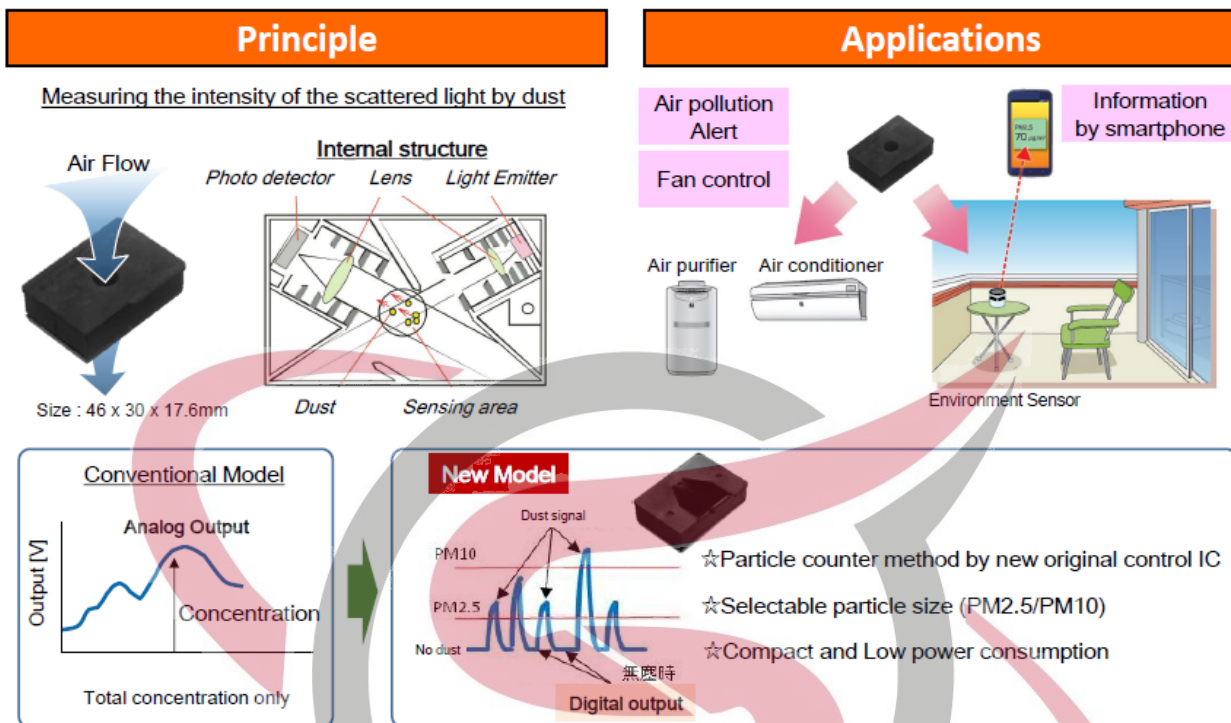
1.1 Internal block diagram

①	V-LED
②	LED-GND
③	LED
④	S-GND
⑤	V_O
⑥	V_{CC}

1.2 原理 Principle

Principle

Measuring the intensity of the scattered light by dust

Air Flow

Internal structure
Photo detector Lens Light Emitter

Size : 46 x 30 x 17.6mm

Dust Sensing area

Conventional Model

Analog Output

Output [V]

Concentration

Total concentration only

Applications

Air pollution Alert

Fan control

Air purifier Air conditioner

Information by smartphone

Environment Sensor

New Model

Dust signal

PM10

PM2.5

No dust

無塵時

Digital output
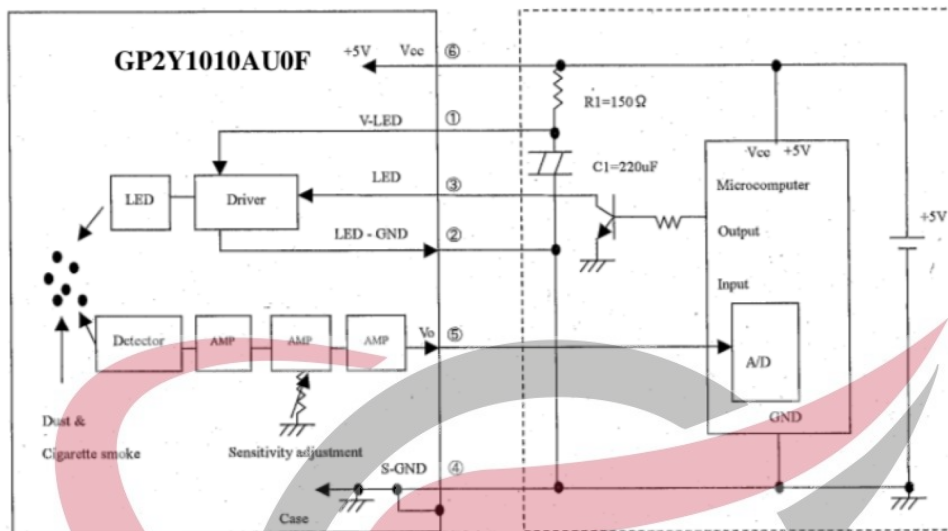
☆Particle counter method by new original control IC

☆Selectable particle size (PM2.5/PM10)

☆Compact and Low power consumption

1.3 Example of system connection

- Resister, R1=150 Ω and capacitor, C1=220uF mentioned above is required for pulse drive of the LED of GP2Y1010AU. Please use the ones with the above mentioned constants. Without these components, the device does not work.
- As input conditions of the LED terminal, please apply LED drive conditions mentioned in Electro-optical characteristics chart of the specification. When it is impossible to apply those conditions, please make it within the recommended input conditions mentioned in the specification. When the LED is driven under the condition beyond the specification, characteristics of the device will be affected. Please refer to 7-2 LED operation data. (T (Cycle) – Vo (Output voltage), Pw (Pulse width) – Vo (Output voltage)).

Parameter	Symbol	Specified condition	Recommended condition	Unit
Pulse cycle	T	10	10±1	ms
Pulse width	Pw	0.32	0.32±0.02ms	ms

Sampling timing of output pulse
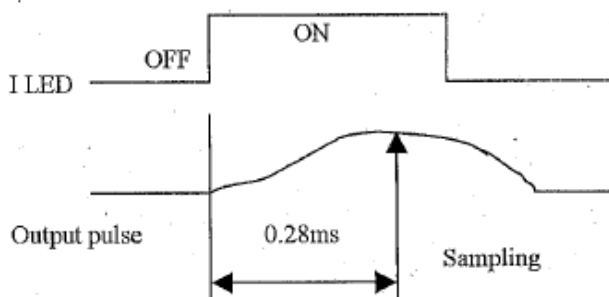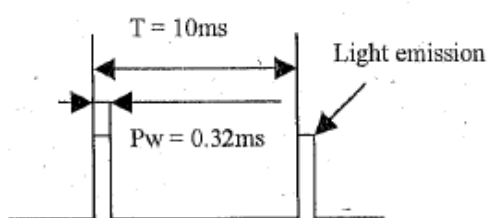
- Time required for the device to be ready to detect dust from when the system is turned on is less than 1 sec. Since GP2Y1010AU does not have peak hold circuit, the time is shorter

1.4 注意事项 Note in the use

★為了降低積灰的影響，傳感器需要垂直放置。
Please mount the devices so that printed model name on the devices to be
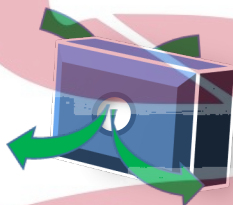in upper side to minimize the affect of dust sticking.

★為了避免太陽光等外部光源的影響，印字的一面需要超內側放置。
Please mount the device so that a plane with the print to face inside
of the system to minimize the affect of disturbance light

★為了測定房間内的空氣質量，需要有能夠讓空氣進去傳感器感應孔的簡單氣流。
A simple airflow that takes air in the sensor hole is necessary to measure the
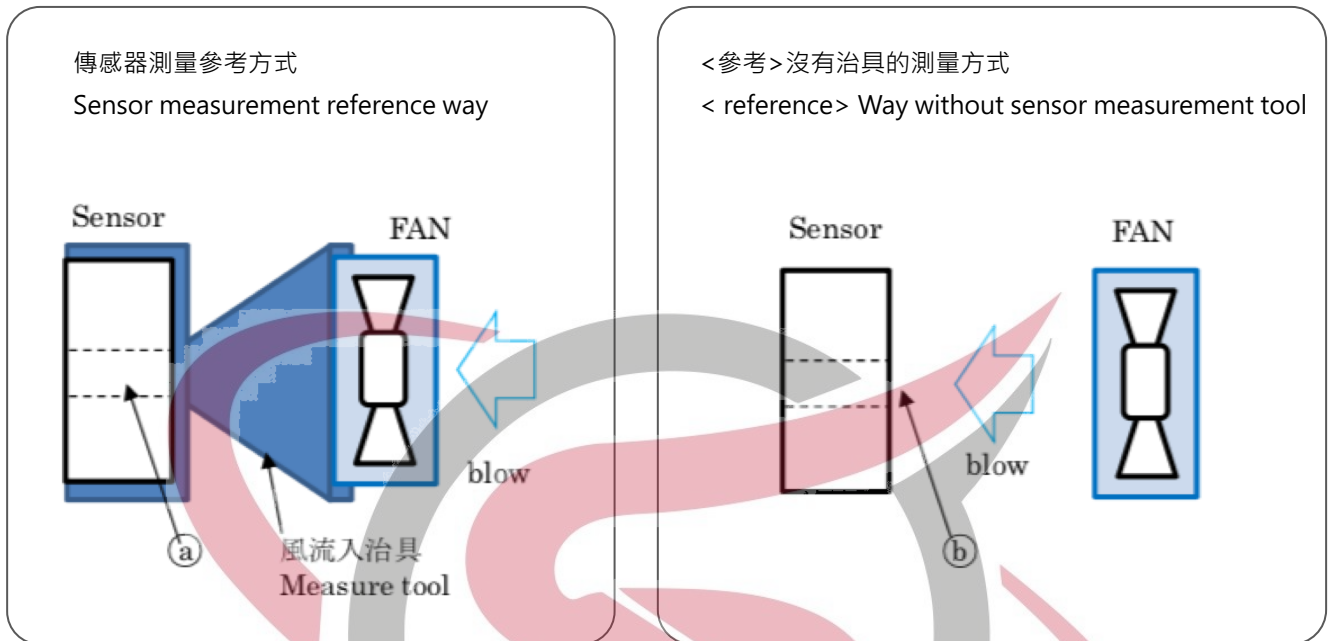atmosphere of the room.

★為了防止絲狀灰塵或大顆粒灰塵進入傳感器內部積存，推薦在灰塵的通過孔（感應孔）的前面設置小孔
徑過濾泡棉。
Please consider the structure and the mechanism of the equipment so that big dust (string dust,
etc.) should not enter the inside of the sensor. The installation of a coarse moltfilter in front of dust
through hole is effective for the capture of big dust .

1.5 治具 Measure tool

傳感器測量參考方式
Sensor measurement reference way
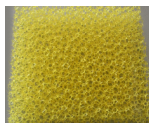
<參考>沒有治具的測量方式
< reference> Way without sensor measurement tool

1.6 建議風速 Recommended wind speed

- 0.1 - 4.0 m/s

2.其他 Other

2.1設置方法 The installation method

- 當光線通過打印面上的灰塵通孔時，傳感器輸出可能會受到影響。
- 為了減少外部光線的影響，請將傳感器的打印面朝向設備內部。
- 如果可以確保進氣口有風，即使進氣口朝上下左右，也可以毫無問題地測量。
- 請考慮設備的結構，使大灰塵不容易進入傳感器內部。 在灰塵傳感器通孔前安裝粗網過濾器可有效過濾大灰塵。

- There is a case that the sensor output may be affected when outer-light comes through dust through hole on the printed side.
- In order to make it less susceptible to external light, please place the sensor's print side facing the inside of the equipment you are using.
- The direction of the sensor itself can be measured without problems if the air intake can be secured even if the intake port faces up, down, left, or right.
- Please consider the structure and the mechanism of the equipment so that big dust should not enter the inside of the sensor. The installation of a coarse mesh filter in front of dust through hole is effective for the capture of big dust .

2.2拆解模組Disassemble of this module

請勿拆卸本產品。 拆卸後，即使組裝，也可能無法滿足原本規格值
Don't disassemble the module. Sharp will not guarantee the specification even after re-assebling.
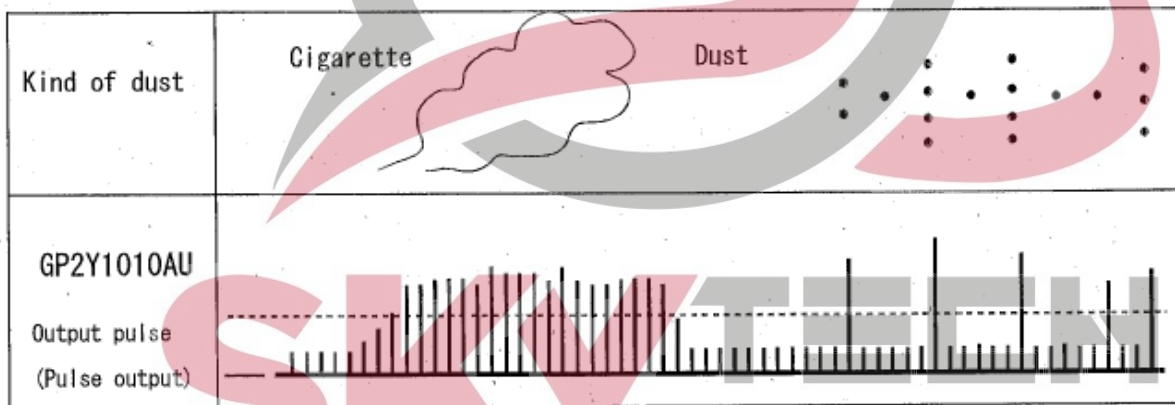
3.1 Detection of dust and cigarette smoke

Distinguishing between dust and cigarette smoke

In general, cigarette smoke consists of highly dense small particles and is diffusing while moving slowly. On the other hands, dust is big, density is low and it comes periodically into the detection area. As on the below chart, cigarette smoke can be detected & the sensor can make detection output continuously. But the output when detecting dust becomes intermittent. Therefore, by reading a transition of the sensor output (pulse output synchronized to the LED emission) during a certain time period by microcomputer, the system can distinguish;
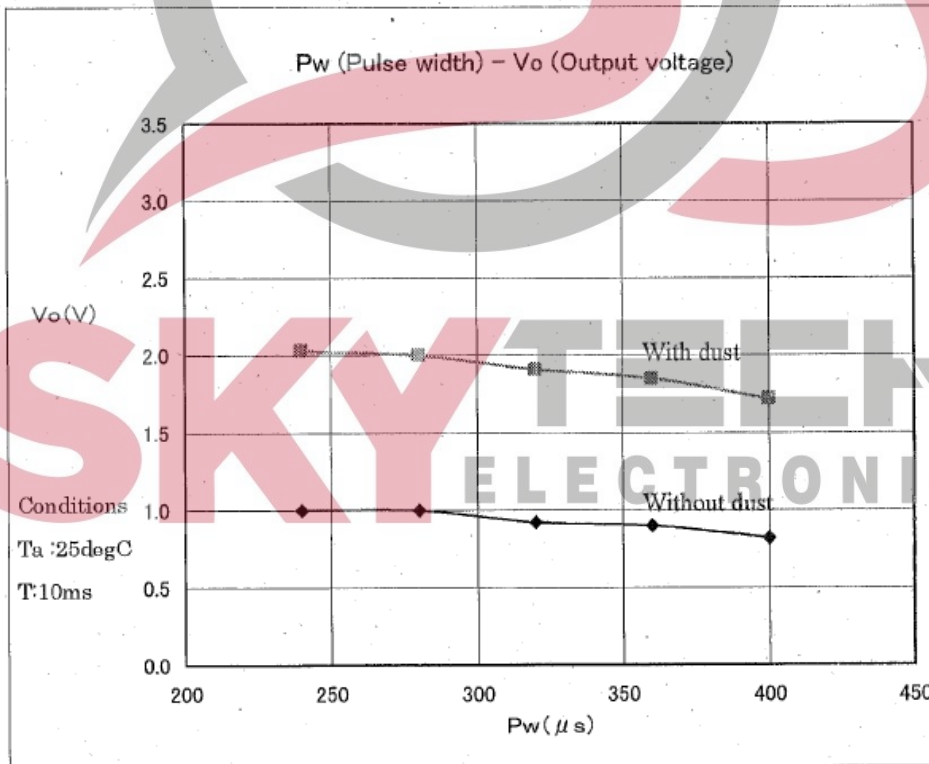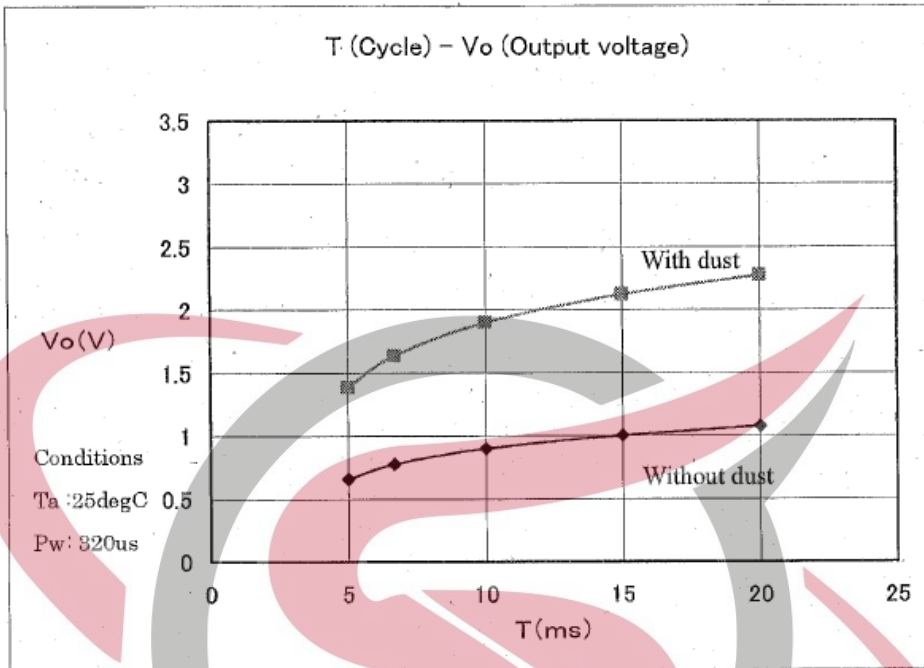
    (a) No dust

    (b) Cigarette smoke exists

    (c) Dust exists

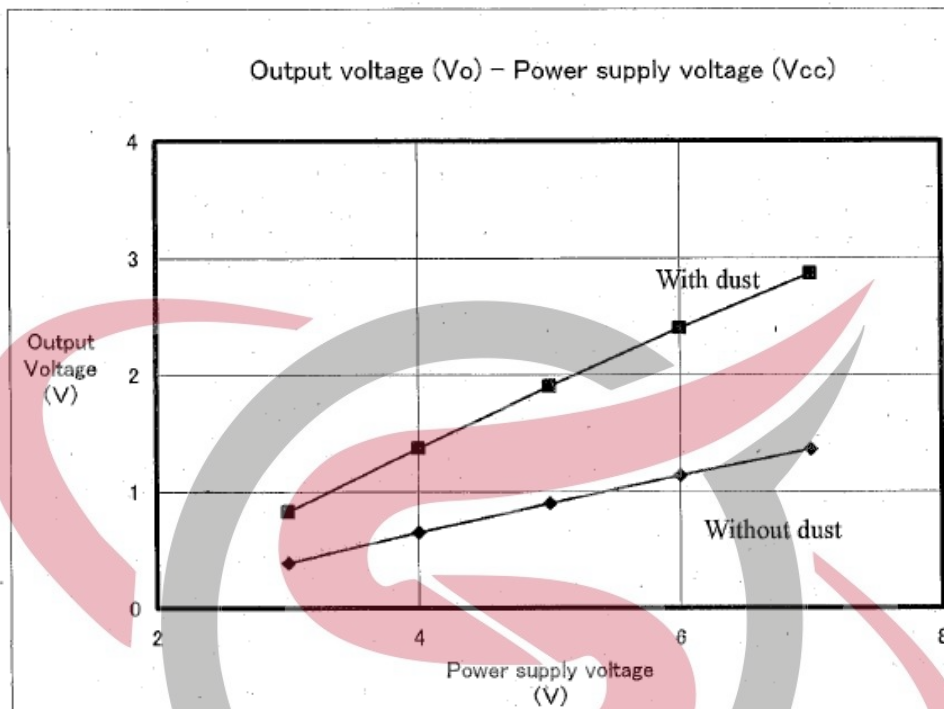And the system can also detect how much air is polluted.

Since the conventional models have the peak-hold circuit and time constant is big, response time (rise/fall time) is long and it may difficult to detect sporadic dust sometimes.


Kind of dust	Cigarette Dust
GP2Y1010AU Output pulse (Pulse output)	

3.2 LED operation data

T (Cycle) – Vo (Output voltage)

Vo(V)

With dust

Without dust

Conditions
Ta :25degC
Pw: 320us

T(ms)

Pw (Pulse width) – Vo (Output voltage)

Vo(V)

With dust

Without dust

Conditions
Ta :25degC
T:10ms

Pw(μs)

3.3 Power supply voltage vs Output Vlotage

Output voltage (Vo) – Power supply voltage (Vcc)

7-4 Ambient temperature vs Output Voltage

Output voltage(Vo)–Ambienent temperature(Ta)
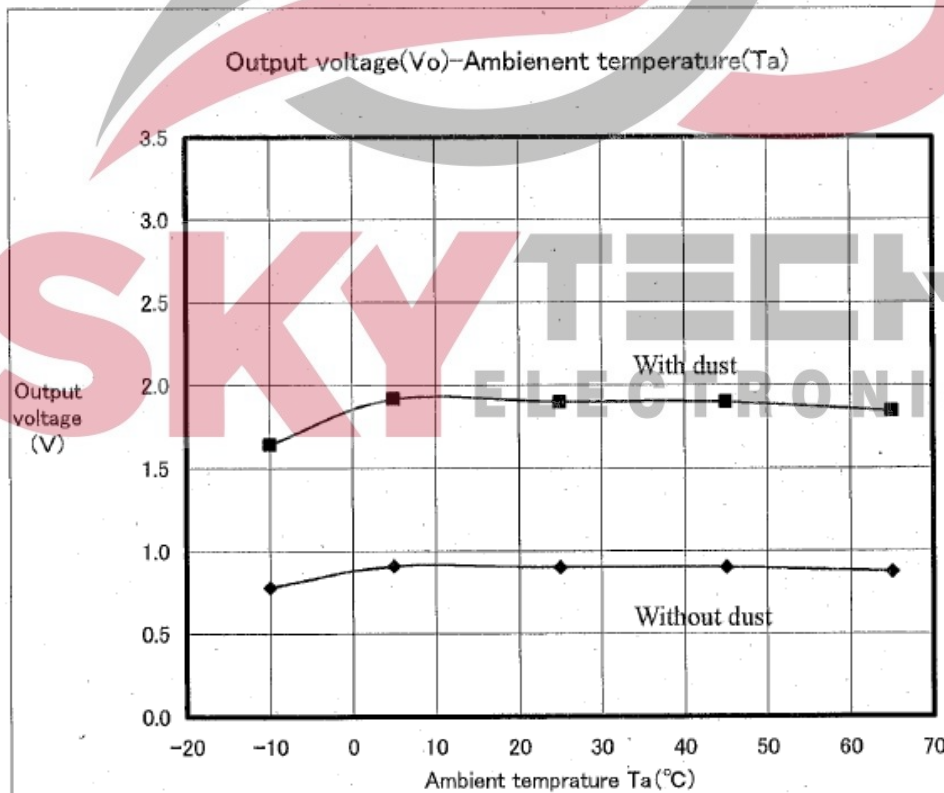
4. Demo Kits介紹

4.1.Getting Started with Arduino

The Arduino Software (IDE) allows you to write programs and upload them to your board.
Below we use Arduino 2560 as an example:

1.Install the Arduino Desktop IDE : https://www.arduino.cc/en/Guide/HomePage
To get step-by-step instructions select one of the following link accordingly to your operating system.

   Windows(https://www.arduino.cc/en/Guide/Windows)
   Mac OS X(https://www.arduino.cc/en/Guide/MacOSX)
   Linux(https://www.arduino.cc/en/Guide/Linux)
   Portable IDE (Windows and Linux) (https://www.arduino.cc/en/Guide/PortableIDE)

  (Reference: https://www.arduino.cc/en/Guide/HomePage)

2.Use your Arduino Mega 2560 on the Arduino Desktop IDE
        (https://www.arduino.cc/en/Guide/ArduinoMega2560)

        2.1 Connect your board
               The USB connection with the PC is necessary to program the board and not just to power it up. The
               Mega2560 automatically draw power from either the USB or an external power supply. Connect
               the board to your computer using the USB cable. The green power LED (labelled PWR) should go
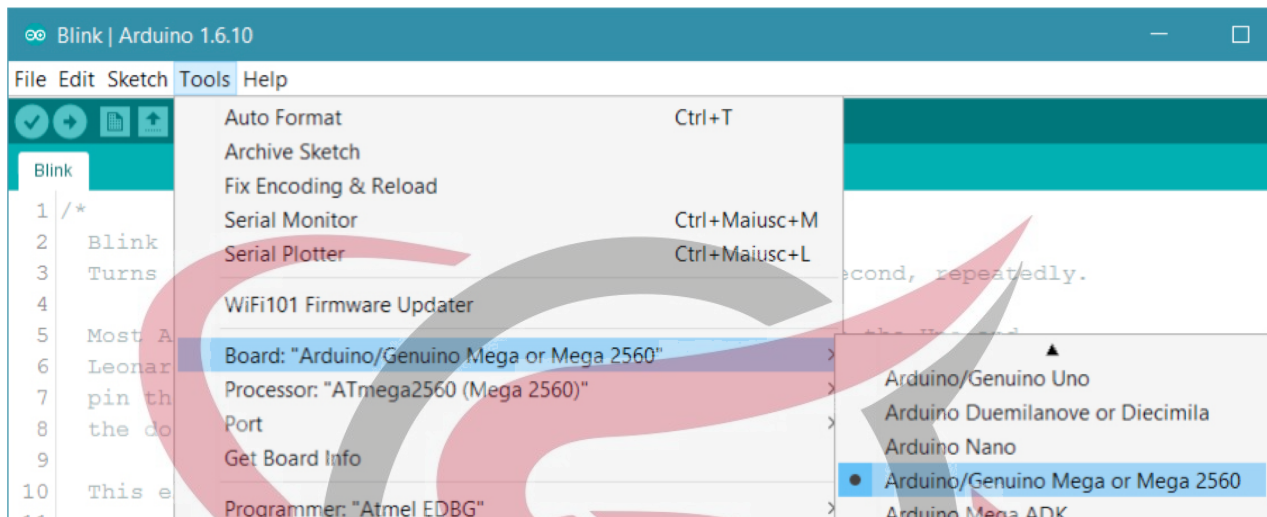   on.
        2.2 Open your first sketch and test
               Open the LED blink example sketch: File > Examples >01.Basics > Blink.
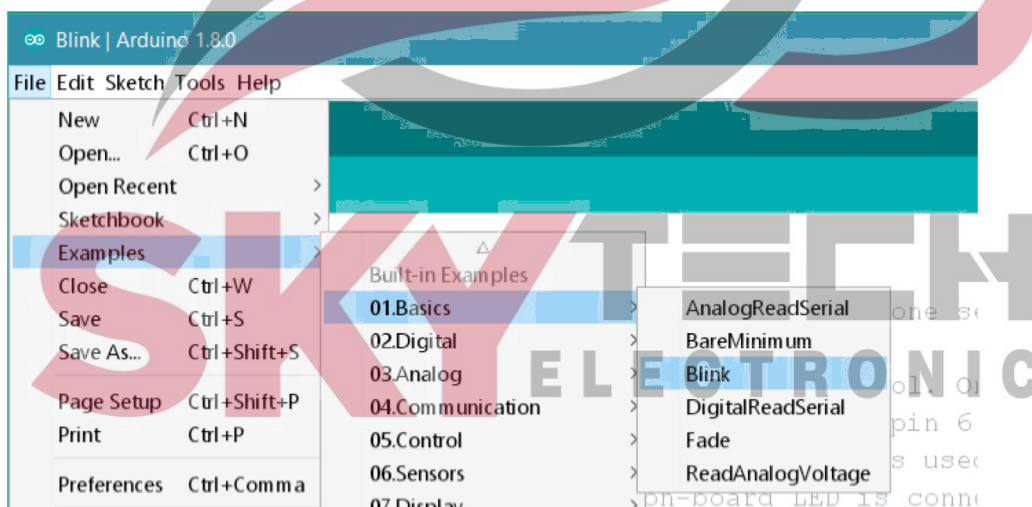
2.3 Select your board type and port

You'll need to select the entry in the Tools > Board menu that corresponds to your Arduino or Genuino board. You have a Mega2560, therefore it has an ATmega2560 microcontroller, selected by default as processor.


Select the serial device of the board from the Tools | Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your board and re-open the menu; the entry that disappears should be the Arduino or Genuino board. Reconnect the board and select that serial port.
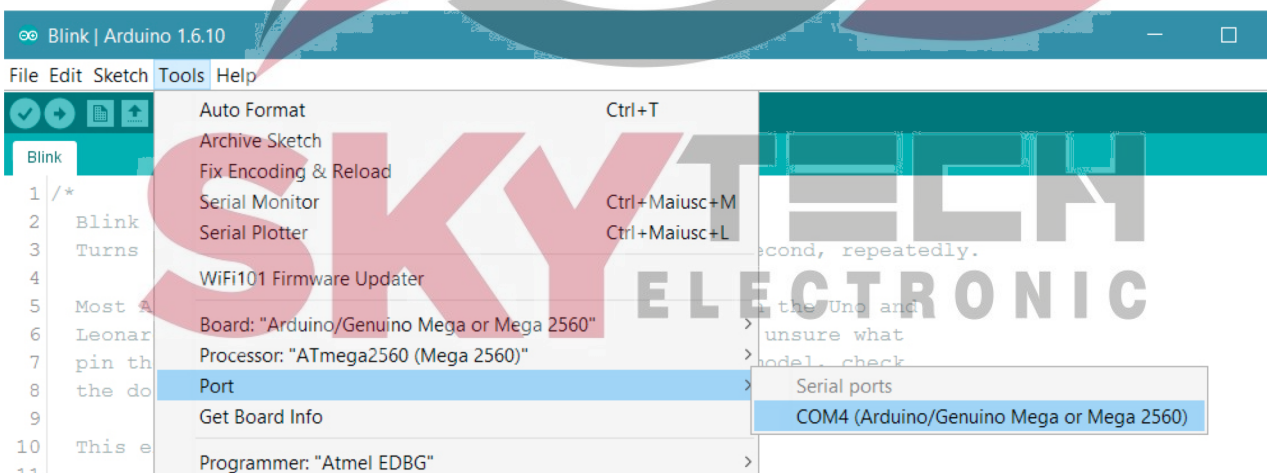
2.4 Upload the program
Now, simply click the "Upload" button in the environment. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar.
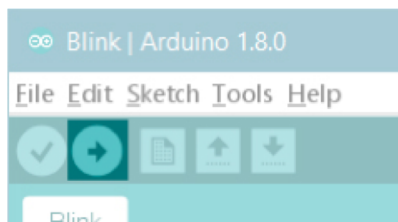
2.5 Run code
A few seconds after the upload finishes, you should see the pin 13 (L) LED on the board start to blink (in orange). If it does, congratulations! Your board is up-and-running.
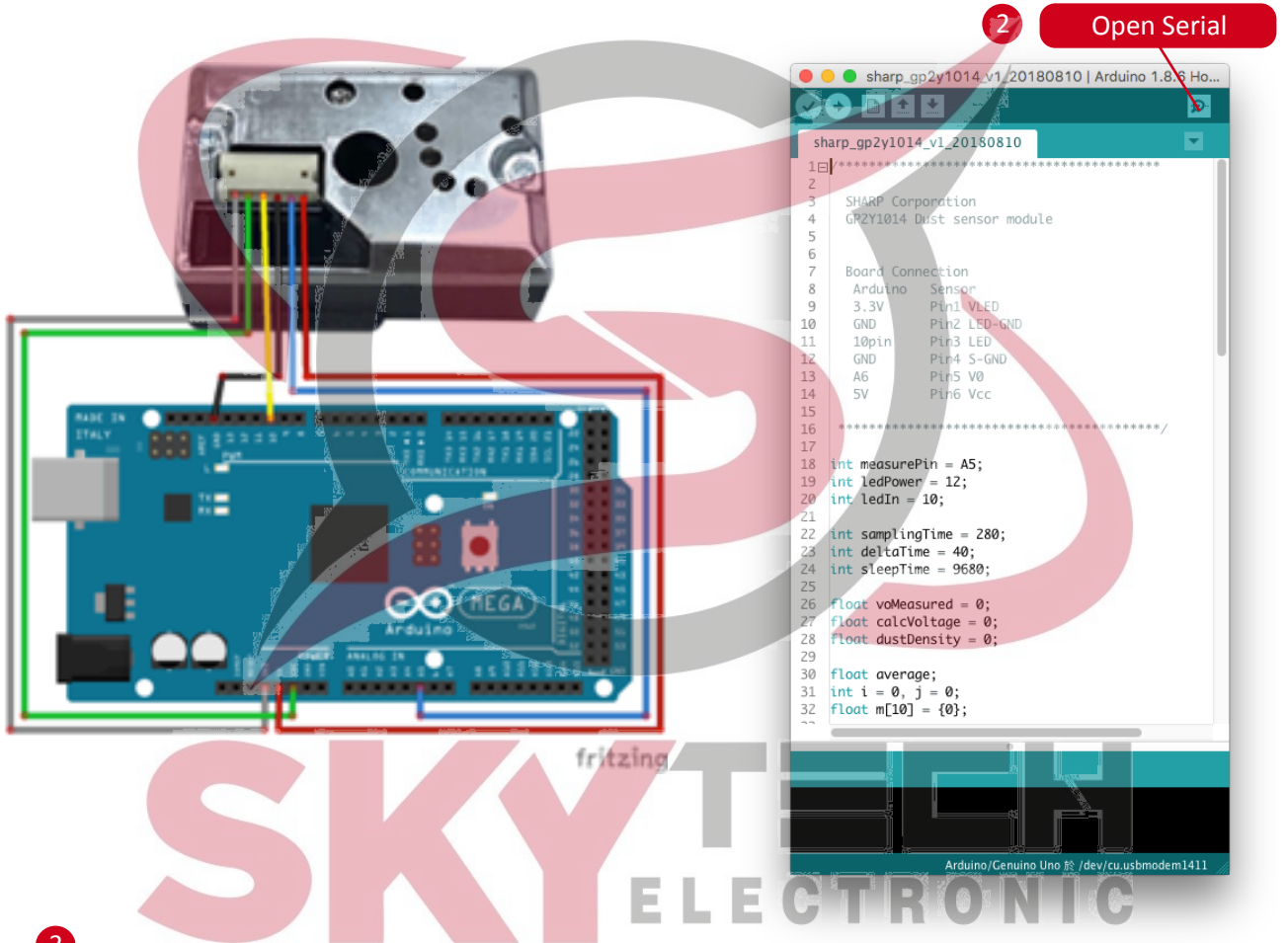
1.Open file:
2.Connect Arduino
3.Upload the code

4.2.Connect sensor to Arduino

1. Connect to sensor
2. Open serial window
3. Data show in serial window
4. Set Baud rate to 2400 and you can see the data

Open Serial

```
/**************************************

SHARP Corporation
GP2Y1014 Dust sensor module

Board Connection
Arduino    Sensor
3.3V       Pin1 VLED
GND        Pin2 LED-GND
10pin      Pin3 LED
GND        Pin4 S-GND
A6         Pin5 V0
5V         Pin6 Vcc

***************************************/

int measurePin = A5;
int ledPower = 12;
int ledIn = 10;

int samplingTime = 280;
int deltaTime = 40;
int sleepTime = 9680;

float voMeasured = 0;
float calcVoltage = 0;
float dustDensity = 0;

float average;
int i = 0, j = 0;
float m[10] = {0};
```

/dev/cu.usbmodem1411 (Arduino/Genuino Uno)

```
Raw Signal Value (0-1023): 833.89 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.69 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.67 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.67 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.57 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.79 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.58 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.46 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.55 - Voltage: 4.07 - Dust Density: 0.59
Raw Signal Value (0-1023): 833.55 - Voltage: 4.
```

自動捲動   沒有行結尾   9600 baud   Clear output

Revision History 版本更新

Version	Modification	Date
V1.401	1st version release	2018/10/01

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