Application note of Sharp dust sensor GP2Y1010AU0F

Contents

1. **Outline of this document**

    This application note of Sharp dust sensor "GP2Y1010AU0F" is a document consists from Explanation how to use, cautions when using it, characteristics data, etc. 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.

2. **Features of GP2Y1010AU0F**
    ・Compact ＆ thin package (46 × 30 × 17.6mm)
    ・With application of pulse output system, the device can detect even single house dust.
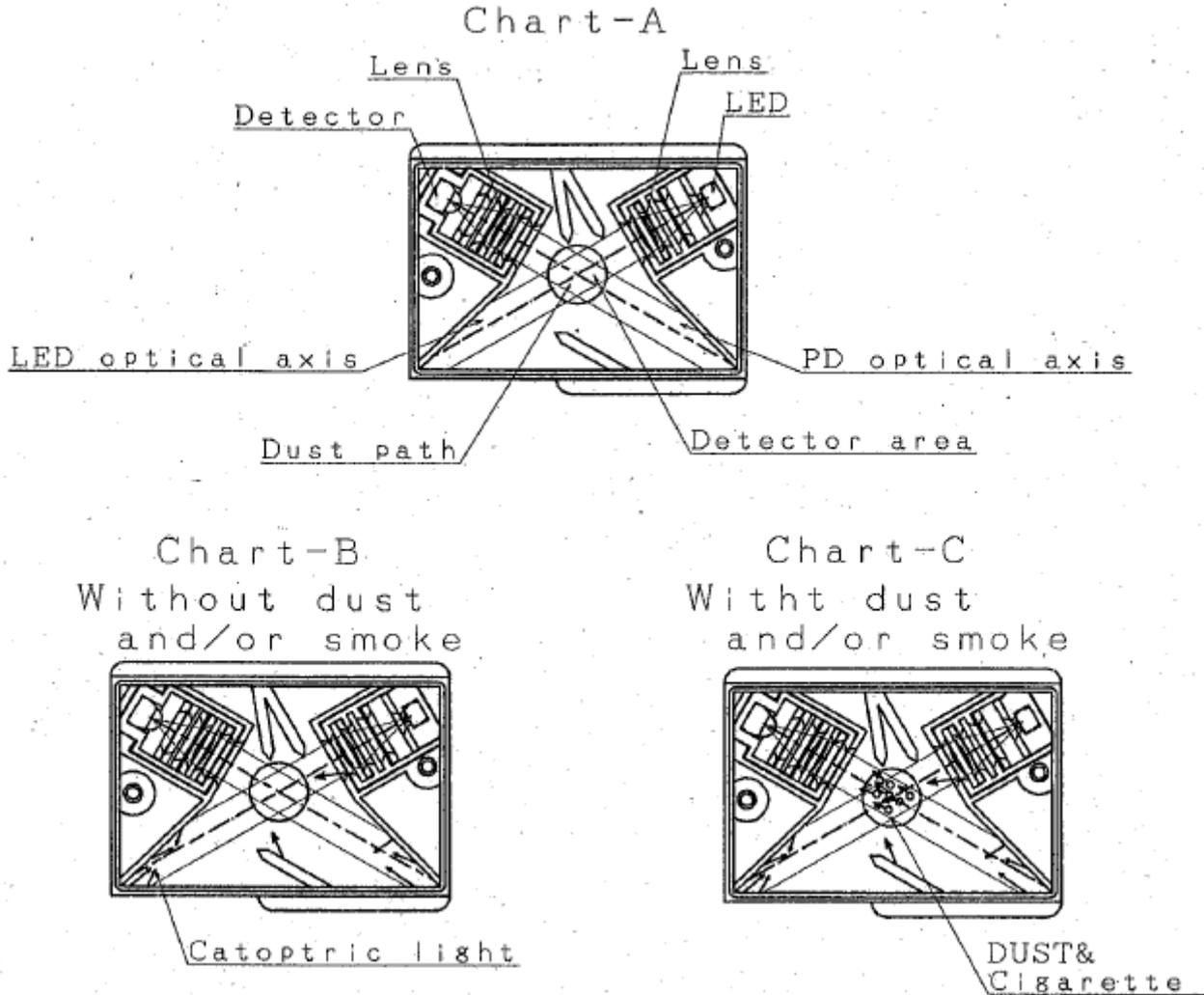   ・House dust and cigarette smoke can be distinguished.

3. **Objects to detect**
    ・House dust
    ・Cigarette smoke

4. **Application**
    ・Air conditioner
    ・Air purifier.

5. Principles of dust detection

This dust sensor "GP2Y1010AU0F" is the device to detect house dust, cigarette smoke, etc. and designed as a sensor for automatic running of application like air purifier and air conditioner with air purifier function.

Chart-A

Lens
Lens
Detector
LED

LED optical axis
PD optical axis

Dust path
Detector area

Chart-B
Without dust
and/or smoke

Chart-C
Witht dust
and/or smoke

Catoptric light

DUST&
Cigarette

Light from the light emitter (Light Emitting Diode) is spotted with a lens and a slit as shown on the chart-A. Also for the light detector (Photodiode), a lens and a slit is positioned in front of it to cut disturbance light and to detect light reflection (when detecting dust) efficiently. Area where those two optical axis cross is detection area of the device.

Chart-B shows what is ongoing inside of the device when no dust exists and Chart-C shows that when dust exists.

The device makes voltage output even when dust is not being detected. This output voltage at no dust condition is specified as Voc on the specification. This is because light emitted from the LED reflects at case of the device & some part of it gets to the detector.

Chart-C shows how the device works when dust and/or cigarette smoke exists inside of it. In this case, the detector detects the light reflected from the dust and/or a particle of the cigarette smoke. Current in proportion to amount of the detected light comes out from the detector and the device makes analog voltage output (Pulse output) after the amplifier circuit amplifies the current from the detector.

6. Application guidance

6-1 Example of system connection

<Example>
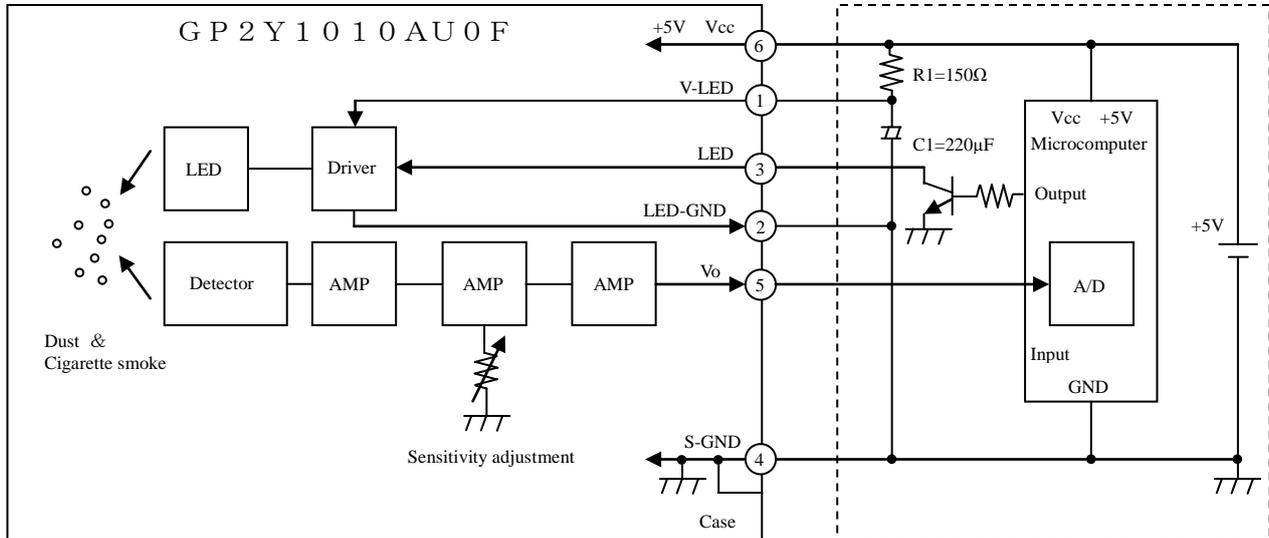
・Resister, R1=150Ω and capacitor, C1=220uF mentioned above is required for pulse drive of the LED of GP2Y1010AU0F. Please use the ones with the above mentioned constants. Without these cmponents, the device does not work.

・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.

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

・The LED emits pulse light. Detected signal is amplified by the amplifier circuit and goes out as the output synchronized to the pulse mission of the LED.

・The specified output value is the one that is measured 0.28ms after the LED is turned on. Therefore, it is recommended that microcomputer to read the output 0.28ms after the LED emission also.
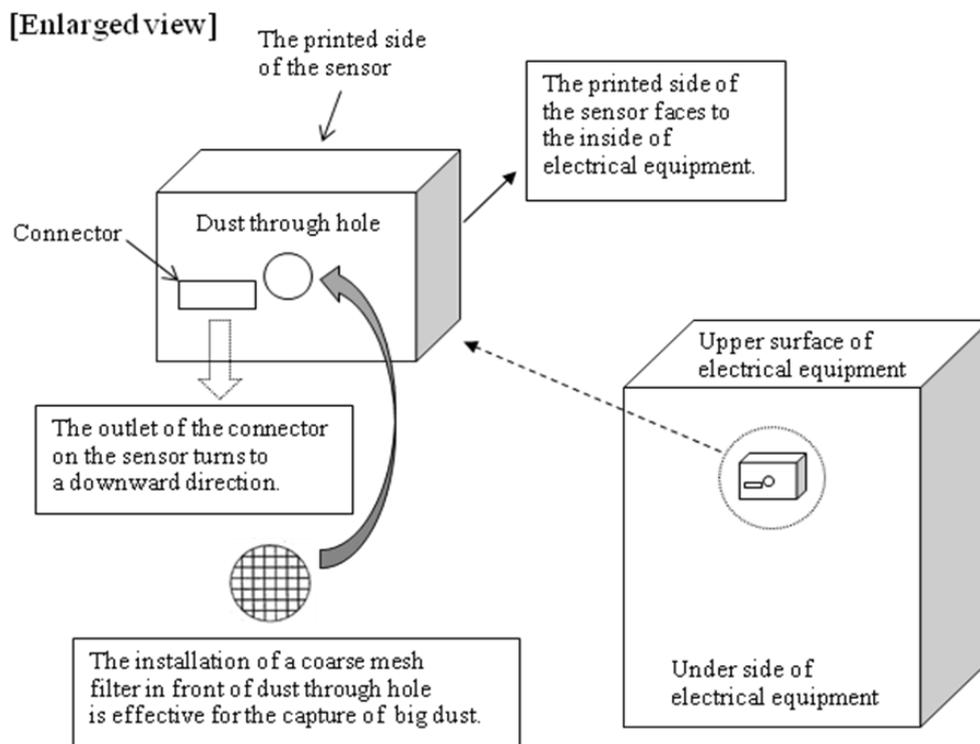
Sampling timing of output pulse
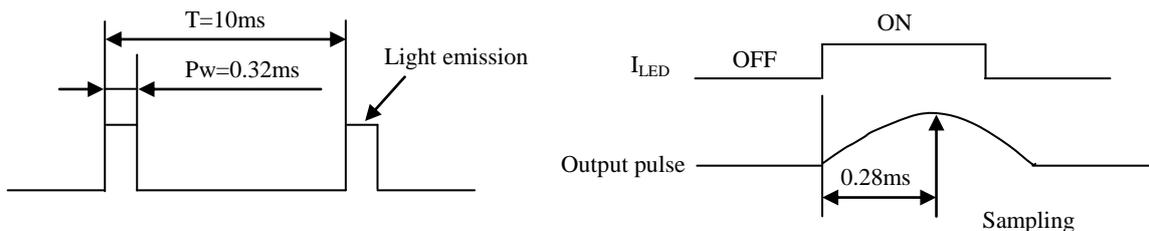
・Time required for the device to be ready to detect dust from when the system is turned on is less than 1 sec.

6-2   Mounting method

・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 avoid any influence from outer-light, please locate the printed side of the sensor
  facing to inside of the application.

・In order to avoid any influence from the attachment of dust to the inside of the sensor,
  please mount the sensor to the application so that the outlet of the connector on the sensor
  turns to a downward direction.

・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 mesh
  filter in front of dust through hole is effective for the capture of big dust .

・Please consider the maintenance by vacuum cleaner in preparation for the false sensor output
  by the attachment of dust to the inside of the sensor.

[Enlarged view]

The printed side of the sensor

The printed side of the sensor faces to the inside of electrical equipment.

Connector

Dust through hole

The outlet of the connector on the sensor turns to a downward direction.

Upper surface of electrical equipment

The installation of a coarse mesh filter in front of dust through hole is effective for the capture of big dust.

Under side of electrical equipment

6-3 Basic output handling

・The output voltage Vo of this sensor is the sum of output voltage at no dust Voc and
output proportional to dust density ΔV.
Output proportional to dust density ΔV is shown as follows.
ΔV = Vo - Voc   (Vo : monitor value)

・Output voltage at no dust Voc is caused by the stray light ocuurring in this sensor.
This sensor makes Voc voltage even at dust density 0mg/m^3.
If dust attached within this sensor increases, Voc becomes bigger. On the other hand,
if dust attached within this sensor decreases, Voc becomes smaller.

・To store Voc in the memory of application is necessary to calculate ΔV from monitor value Vo.
If monitor value Vo lower than the memorized Voc appears, this monitor value Vo
should be stored in the memory of application as a new Voc.

・If monitor value Vo maintains a bigger value than the memorized Voc for a certain
period of time, this monitor value Vo should be stored in the memory of application as a new Voc.
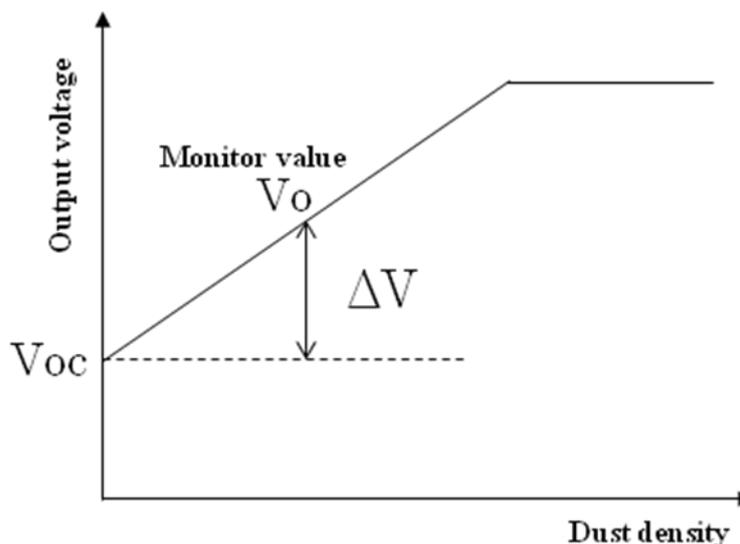
6-4 Other cautions

・Please do not clean the device since cleaning may affect characteristics of the devive
and it may result in operation failure of the device.

・VR for sensivity adjustment is adjusted in accordance to the specification at the time of
shipment from Sharp. Therefore, please do not change value of it, or the value may
become out of the specifications.

・Please do not disassemble the device. Once disassembled, the device may not have the
same characteristics that it has had before the disassembly even if it is assembled again.

・Vibration may affect the characteristics of the device. Therefore, please make sure that
the device works properly under actual usage conditions.

・The device does not work properly if bedewing occurs inside of it. Please design products
so that the bedewing does not occur inside of the device.

・If the device is placed close to a noise generator (Electric dust collector, etc.), the sensor
output may fluctuate due to inductive noise from the noise generator. Please consider
the effect of the noise generator to the device when designing products.

7. Dust density characteristics (Example)

Test condition : According to "Electro-optical characteristics" of the specification of GP2Y1010AU0F.

Dust density characteristics (Example)