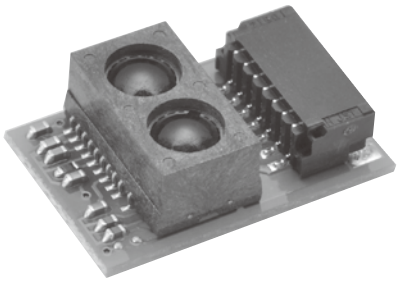
GP2Y0E03

Distance Measuring Sensor Unit
Measuring distance : 4 to 50 cm
Digital(I^2C) / Analog output type



■Description

GP2Y0E03 is a distance measuring sensor unit, composed of an integrated combination of CMOS image sensor and IR-LED.
The variety of the reflectivity of the object, the environmental temperature and the operating duration are not influenced easily to the distance detection because of adopting the triangulation method.
This device outputs the voltage corresponding to the detection distance and digital(I^2C) data.
So this sensor can also be used as a proximity sensor.

■Features

1. Infrared LED and CMOS image sensor with built-in signal processing circuit
2. Distance measuring range : 4 to 50 cm
3. Low voltage operation : Min 2.7V
4. Compact size (16.7 × 11.0 × 5.2mm)
5. High-precision measurement
6. Digital(I^2C) / Analog output type

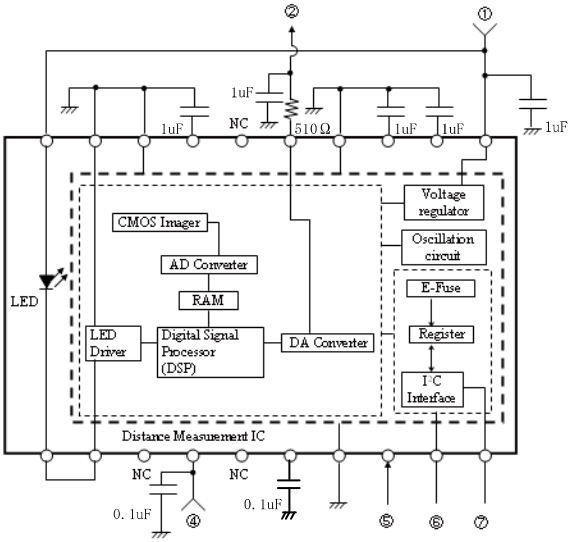
■Agency approvals/Compliance

1. Compliant with RoHS directive (2011/65/EU)

■Applications

1. Cleaning Robot
2. Human type Robot
3. Touch-less switch
   (Sanitary equipment, Control of illumination, etc)
4. Sensor for energy saving
   (ATM, Copier, LCD monitor, etc)
5. Amusement equipment
   (Robot, game machine, etc)

■Schematic

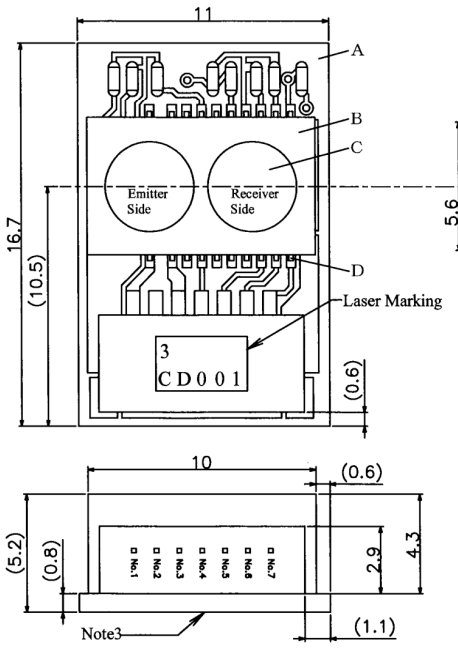


① VDD
② Vout(A)
③ GND
④ VIN(IO)
⑤ GPIO1
⑥ SCL
⑦ SDA

Please use an electric source with an output current of 150mA or more because LED pulse current is more than 100mA.

■Outline

(Drawing No. CY15117i02A) Scale: 5/1 Unit: mm



Note1: Unspecified tolerance shall be ±0.2mm
Note2: The dimensions in parenthesis are shown for reference
Note3: The PCB backside has some open pattern.
Please do not short circuit of these pattern.

Material

A	PCB	Glass Epoxy(UL94-V0)
B	Package	Black LCP(UL94-V0)
C	Lens	Epoxy Resin with visible-cut filter
D	Device Terminal	42ALLOY(Pd-Au plating)

・Connector
11002W90-7PA-S-H1-S1-HF
Shenglan Technology Co., Ltd
(JCTC)

Connection Diagram

No	Symbol	Pin name
No1	VDD	Supply Voltage
No2	Vout(A)	Output Terminal
No3	GND	Ground
No4	VIN(IO)	I/O Supply Voltage
No5	GPIO1	Input Terminal for Active/Stand-by Control
No6	SCL	I2C Clock
No7	SDA	I2C Data Bus

Laser Marking

3 GP2Y0E03 (Model No)
CD001
Lot No.
Month (1 to 9,O,N,D)
(DIN standard symbol)
Year (DIN standard symbol)
DIN standard year production
(Remove G,I,O,Q,Y,Z)
(It repeats itself by a period for 20 years.)

Year	Symbol
2012	C
2013	D
⋮	⋮
2028	W
2029	X

■Absolute maximum ratings

Ta=25°C (unless otherwise specified)

Parameter	Symbol	Ratings	Unit	Remark
Supply voltage	VDD	-0.3 to + 5.5	V	-
Output terminal voltage	Vout (A)	-0.3 to +2.8	V	-
Output current	Iout (A)	-6.0 to +6.0	mA	-
I/O supply voltage	VIN (IO)	-0.3 to VDD+0.3 (VDD ≦ 3.3V) -0.3 to +3.6 (VDD > 3.3V)	V	Refer to 3-4
Input terminal voltage	GPIO1	-0.3 to VIN(IO)+0.3	V	Refer to 3-4
I^2C input terminal voltage	SCL	-0.3 to VIN(IO)+0.3	V	Refer to 3-4
I^2C I/O terminal voltage	SDA	-0.3 to VIN(IO)+0.3	V	Refer to 3-4
Operating temperature	Topr	-10 to +60	°C	-
Storage temperature	Tstg	-40 to +70	°C	-

■Recommended operating conditions

Parameter	Symbol	Rating	Unit	Remark
Supply voltage	VDD	2.7 to 5.5	V	-
I/O supply voltage	VIN (IO)	1.8 to 3.3	V	-
SCL, SDA High level input	VIH1	Min. VIN(IO) x 0.7	V	-
SCL, SDA Low level input	VIL1	Max. VIN(IO) x 0.3	V	-
GPIO1 High level input	VIH	Min. VIN(IO) x 0.7	V	Operating state
GPIO1 Low level input	VIL	Max. VIN(IO) x 0.3	V	Stand-by state

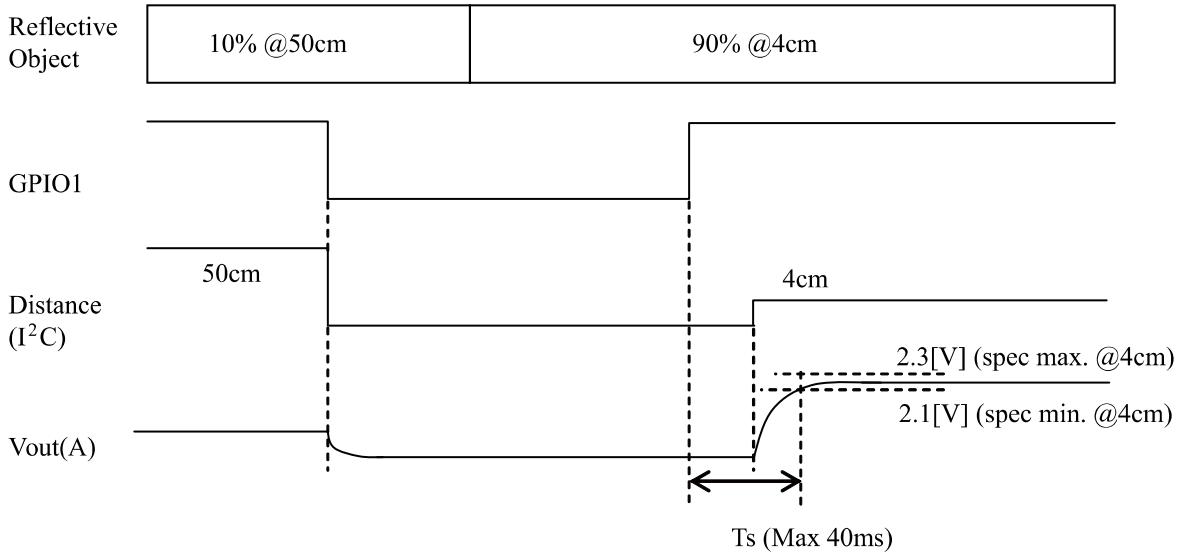
■Electro-optical Characteristics

(Ta=25°C, VDD =3V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Measuring distance range	L ※	(Note 1, 2)	4	-	50	cm
Distance value	D1	L=50cm (Note 1, 2, 3)	45	50	55	cm
Distance value	D2	L=10cm (Note 1, 2, 3)	9	10	11	cm
Distance value	D3	L=4cm (Note 1, 2, 3)	3	4	5	cm
Output terminal voltage	Vout(A)1	L=50cm (Note 1, 2)	0.3	0.55	0.8	V
Output terminal voltage	Vout(A)2	L=10cm (Note 1, 2)	1.9	2.0	2.1	V
Output terminal voltage	Vout(A)3	L=4cm (Note 1,2)	2.1	2.2	2.3	V
Average supply current	Icc1	L=50cm, GPIO1=VIN(IO)	-	26	36	mA
Stand-by supply current	Icc2	GPIO1=GND	-	20	60	μA
Response time (Note 4)	Ts	L=50cm → L=4cm (Note 5)	-	-	40	ms

※L : Distance to reflective object

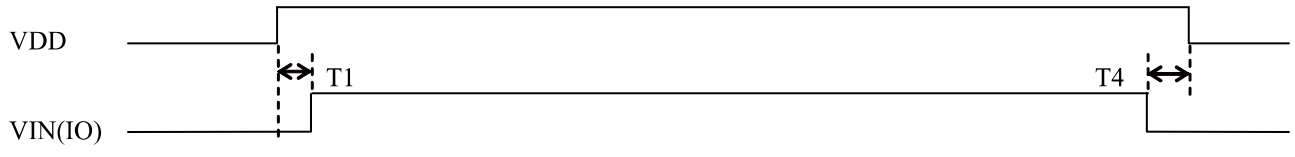
(Note 1) Under dark condition
(Note 2) Using reflective object :
White paper (Made by Japan Color Research Institute order made color chart : mat, reflective ratio : 90%)
(Note 3) Distance data through I^2C bus
(Note 4) Max. time means that it takes time to stabilize output due to the change of reflected signal light.
Definition : the case that object condition is changed suddenly from the least reflection(max. gain condition in internal circuit) to the most reflection (min. gain condition in internal circuit).
(Note 5) Method of measuring (Ts)
Connect GPIO1 with GND during measuring L=50cm with reflective object:
Gray paper (mat, reflective ratio : 10%).
After changing the position (L=4cm with reflective object: White paper (mat, reflective ratio : 90%),
Measuring the time of the output terminal : Vout(A) until stabilizing after connecting GPIO1 with VIN(IO)



Response time of I^2C output is faster than that of Vout(A) because it is stabilized soon after distance data output.
Distance data is updated every 20ms after response time.

■Timing Chart

1. Power On/Off Timing Sequence



T1, T4 : Refer to 2

VIN(IO) should be turned off before VDD is turned off, or at the same time when VDD is turned off. I^2C communication with other devices connected to the same bus is not allowed after VDD or VIN(IO) is turned off. In case that both of VDD and VIN(IO) turn off, GPIO1, SCL and SDA should be pull low. In case that only VIN(IO) turn off, GPIO1, SCL and SDA should be pull low. If this product is operated under the condition except the above, this product or other device around it may give damage due to excessive current.

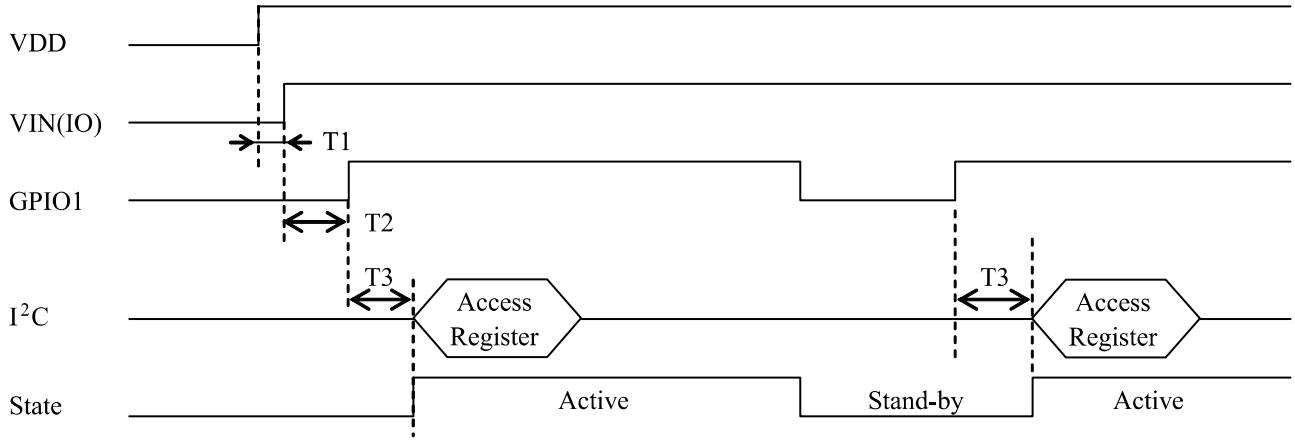
2. Active / Stand-by timing sequence

There are two ways (Hardware / Software) to control Active/stand-by state.

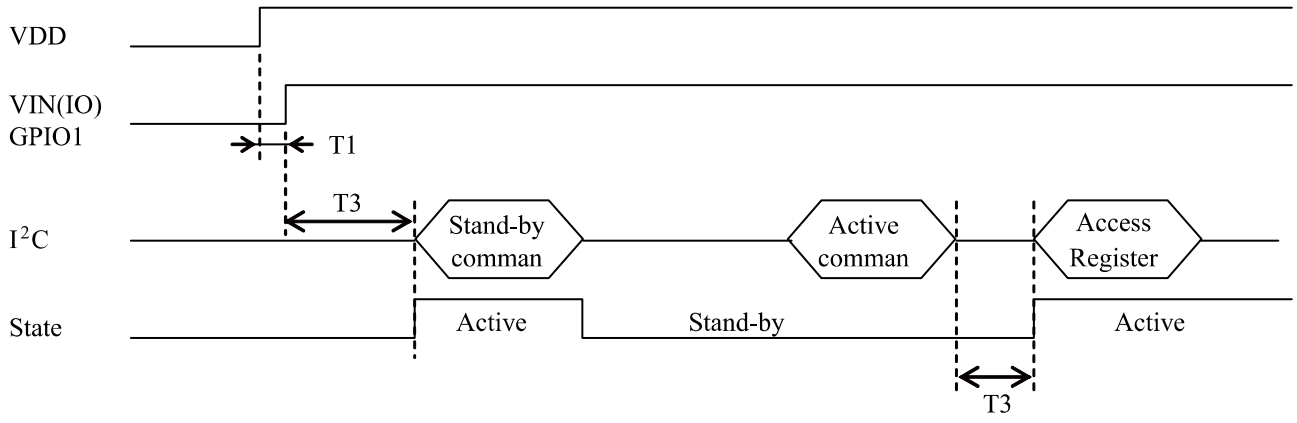
HW : GPIO1 is set High or Low
GPIO1=high : Active state
GPIO1=Low : Stand-by state

SW : I^2C register program
SW control is effective when GPIO1 is high.

(1) Controlled by GPIO1



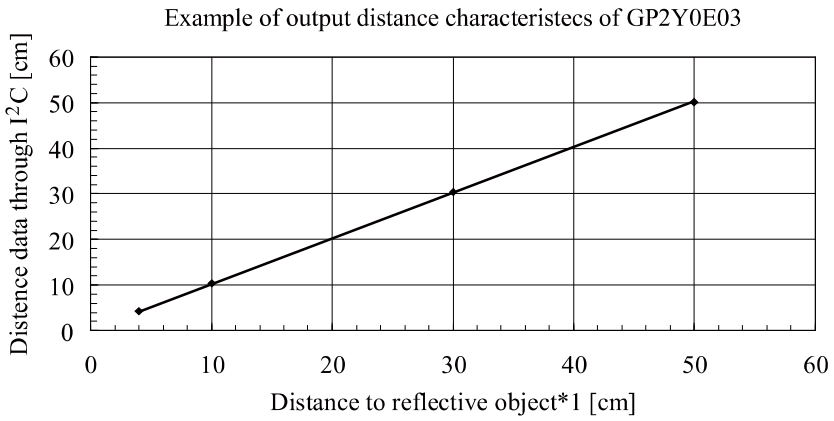
(2) Controlled by I^2C

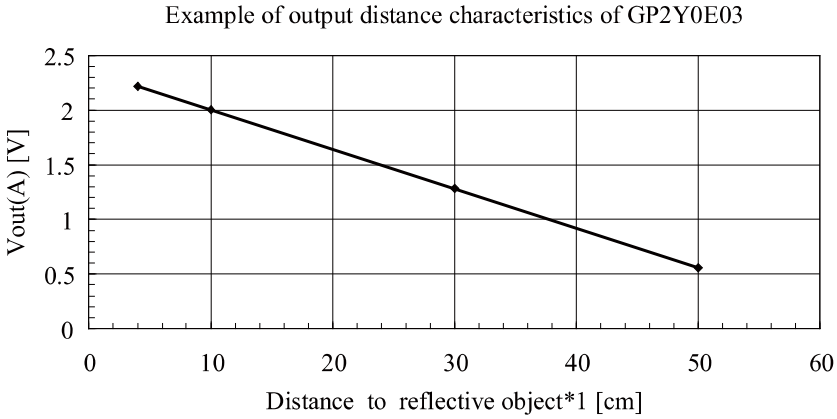


	Description	Min	Max	Unit
T1	IO power delay after VDD power on	0	5	ms
T2	GPIO1 delay after VIN(IO) power on	0	-	ms
T3	I^2C access delay after GPIO1 high or active command completed	500	-	us
T4	VIN(IO) leading to VDD power off	0	-	us

■Supplements

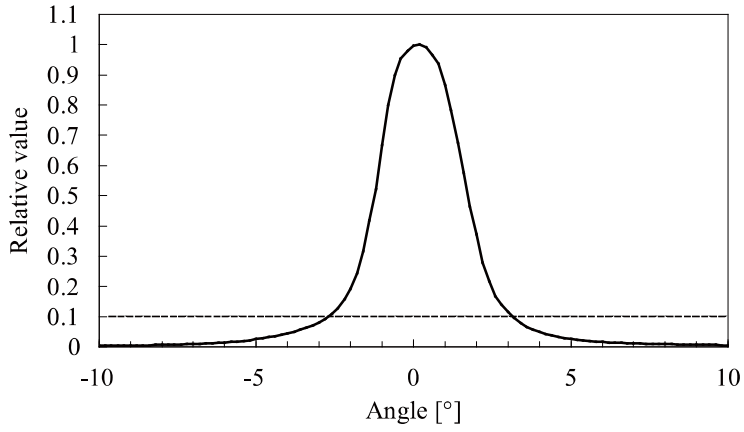
1. Example of output distance characteristics





*1 : Using reflective object : White paper (reflective ratio : 90%)

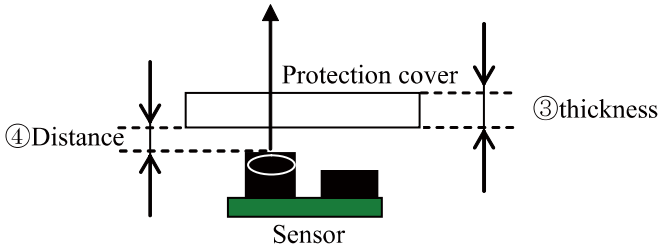
2. Example of directional angle of emitting beam



■Notes

[Advice for the optics]

- ●Lens of this device shall be kept cleanly. There are cases that dust, water or oil and so on deteriorate the characteristics of this device. Please consider in actual application.
- ●In case that protection cover is set in front of this sensor , the protection cover shall be recommended to use material which doesn't scatter light and be matt finish. And the protection cover which has the most efficient transmittance at the emitting wavelength range of LED for this product (λ=850nm±70nm). And this protection cover is recommend to be flat. And this protection cover shall be recommended to be parallel to the emitter and detector portion. In case that protection cover is set in front of this sensor, It emits reflected light from this protection cover. If this reflect light reaches in detector portion, the output distance of this product may be changed. The output distance characteristics of this product may be changed with according to material (①) or transmittance (②) or the thickness (③) or the distance between the protection cover and this product (④) or the angle between surface and back (⑤) or the angle between this cover and this sensor(⑥). In case that protection cover is set, please design to consider that this reflective light is minimized. And it shall be effective to put light shield wall between emitting lens and receiving lens as shown in below.

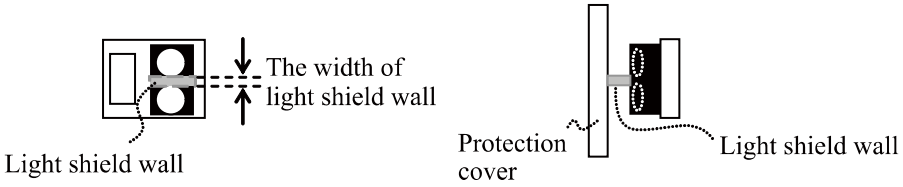


Condition	③thickness	④distance	light shield wall
No1	1mm	0mm	-
No2	1mm	1mm	nonexistence
No3	2mm	0mm	-
No4	2mm	1mm	exisitence【*】

Direct reflective light becomes large as Distance from sensor to protection cover and thickness of this cover become large. In case thickness is 2mm and distance is 1mm, measuring distance is changed shift larger from actual distance than other condition. It shifts can make small by using installation of light shield【*】and compensation function【**】.

【*】Noted for installation of light shield

Inner distance between lens of detector and lens of emitter is around 0.6mm (reference). So the width of light shield is recommended to be less than 0.6mm. In case the width of light shield is longer than inner distance, measuring distance is changed by Shield a part of emitter lens or detector lens. Please confirm that there is no problem under the actual equipment. And In case between protection cover and light shield or between light shield and this sensor exists space, The effect of light shield is small because light from emitter leaks. The light shield wall is recommended to use the material that have the low transmittance at the emitting wavelength range of LED for this product (λ=850nm±70nm). When the material of light shield wall is hard, and the power stress in which it is added to this product is large, measuring distance may shift from actual distance.



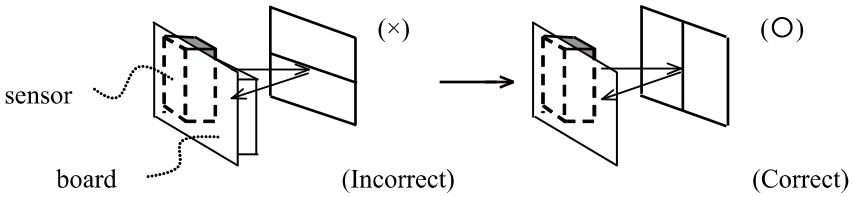
【**】Noted of compensation function

This product has the function which rectifies error shift by the direct reflective light from protection cover. The accuracy after compensation is based on a protection cover or its installation condition. This function can be active when it set correction factor in this product by I^2C or E-fuse. Please refer to application manual about the detail of this function. Neither installation of a light shield wall nor use of a compensation function guarantees the distance characteristic. These improve error shift of the distance characteristic.

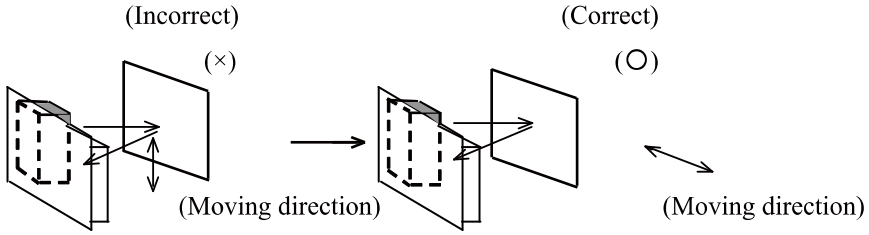
Regardless of use of a light shield wall or a compensation function, please use it after confirming with customer's product.

[Advice for the characteristics]

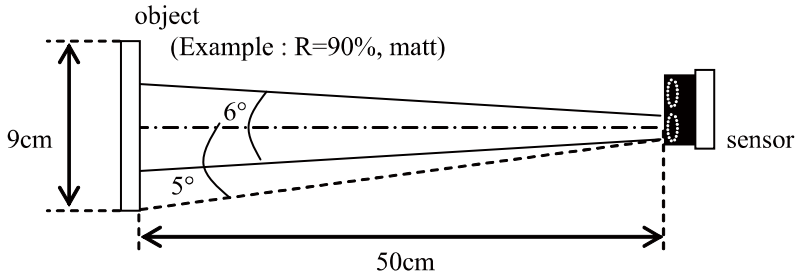
- In case that there is an object near to light exits of the sensor between the sensor and the detected object, please use this device after confirming sufficiently what the characteristics of this sensor do not change by the object.
- This product has the function to remove disturbance light by the cancellation function of ambient light, a visible light cut lens, etc. But when the detector receive direct light from the sun, tungsten lamp and so on, there are cases that it can not measure the distance exactly. Please consider the design that the detector does not receive direct light from such light source. When you operate the customer's set installing this product by the remote control, please consider soft that the output of this product being disregarded at the time of remote control operation by software.
- Distance between sensor and mirror reflector cannot be measured exactly.
- In case that reflective object has boundary line clearly, there is cases that distance can not measure exactly. At that time, if direction of boundary line and the line between emitter center and detector center are parallels, it is possible to decrease deviation of measuring distance.



- In order to decrease measuring error due to moving direction of object, we recommend to mount the sensor like below drawing.



- For satisfying the specification of the electro optical characteristic, it is necessary to install a flat surface of object in vertical of emitted light, and it is necessary to reflect the whole emitted light as shown in the following figure. As shown in the example of directional angle of emitting beam, The angle is around 6 ° (±3°) where emission becomes 10% of peaks. The object needs to exist in whole around 10 degrees (±5 degrees) area including the variation of peak position. For example, when the object is in 50 cm, it is necessary to install the object of at least 9cm diameter parallel to the surface of this sensor as follows. However above example doesn't guarantee specification, please use it after confirming with customer's product.



[Notes on handling]

- Please don't do washing. Washing may deteriorate the characteristics of optical system and so on. Please confirm resistance to chemicals under the actual usage since this product has not been designed against washing.
- Please use this product under the condition that applied stress to the connector below 0.49N. And, harness is pulled in the state where it attached this sensor, or please be careful so that the stress more than the above may not be added to this sensor.
- This product have the parts that mount to the substrate by soldering . Since there is a possibility that a solder mounting part may break when this product is used, the stress more than 4.9N should not be added to this product.

■Compliance with each regulation

1. The RoHS directive(2011/65/EU)
   This product complies with the RoHS directive(2011/65/EU).
   Object substances: mercury, lead, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)
2. Content of six substances specified in Management Methods for Control of Pollution Caused by Electronic Information Products Regulation (Chinese : 电子信息产品污染控制管理办法).

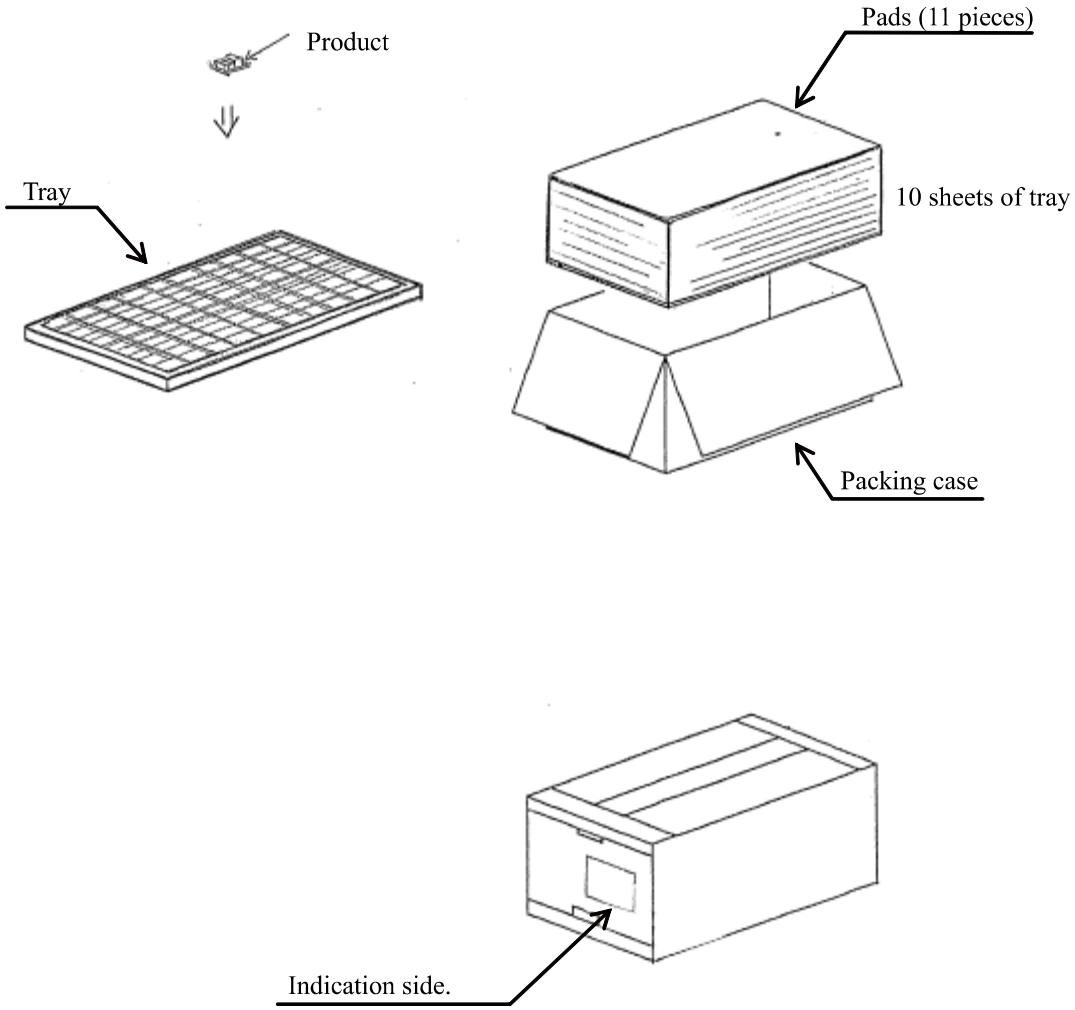
Category	Hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr^{6+})	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Distance measuring sensor	✓	✓	✓	✓	✓	✓

This table is prepared in accordance with the provisions of SJ/T 11364.

✓ : Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572

■Packing specification

(Drawing No. CY15118i09)



(1) Packing number
Max 100 pieces per tray
Max 1000 pieces per case
(2) Close the lid of case and seals with craft tape, and fill in the blanks of Model No., quantity and date.
(3) Outside : 264 x 203 x 105 (mm)
(4) Indication
The content of the indication conforms to EIAJ C-3 and the following items are indicated.
Model No., Internal production control name, Quantity, Packing date, Corporate name, Country of origin

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- --- Personal computers
- --- Office automation equipment
- --- Telecommunication equipment [terminal]
- --- Test and measurement equipment
- --- Industrial control
- --- Audio visual equipment
- --- Consumer electronics

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- --- Traffic signals
- --- Gas leakage sensor breakers
- --- Alarm equipment
- --- Various safety devices, etc.

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- --- Telecommunication equipment [trunk lines]
- --- Nuclear power control equipment
- --- Medical and other life support equipment (e.g., scuba).

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