

## GP2Y40010K0F Color Density Sensor

### Product Specification

February 2007

Range = 9.75 to 10.25 mm;

Typical Risetime = 70  $\mu$ s;

Nominal If = 4 mA.

REFERENCE

SPEC. NO. ED-06G053B  
ISSUE February 21, 2007

**SHARP**

OPTO-ANALOG DEVICES DIVISION  
ELECTRONIC COMPONENTS GROUP  
SHARP CORPORATION

**SPECIFICATION**

DEVICE SPECIFICATION FOR

2PD Type Color Toner Density Sensor

MODEL No.

GP2Y40010K0F

Specified for

Enclosed please find copies of the Specifications which consists of 11 pages including cover.  
After confirmation of the contents, please be sure to send back ☐ copies of the Specifications  
with approving signature on each.

CUSTOMER'S APPROVAL

DATE

\_\_\_\_\_

BY

\_\_\_\_\_

PRESENTED

DATE

\_\_\_\_\_

BY

*HO*

H. Ogura,  
Department General Manager of  
Engineering Dept., III  
Opto-Analog Devices Division.  
ELECOM Group  
SHARP CORPORATION

Product name : 2PD Type Color Toner Density Sensor

Model No. : GP2Y40010K0F

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2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

(Precautions)

- (1) This product is designed for use in the following application areas ;

• Computers • OA equipment • Telecommunication equipment (Terminal)  
• Measuring equipment • Tooling machines • Audio visual equipment  
• Home appliances

If the use of the product in the above application areas is for equipment listed in paragraphs (2) or (3), please be sure to observe the precautions given in those respective paragraphs.

- (2) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

• Transportation control and safety equipment (aircraft, train, automobile etc.)  
• Traffic signals • Gas leakage sensor breakers • Rescue and security equipment  
• Other safety equipment

- (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

• Space equipment • Telecommunication equipment (for trunk lines)  
• Nuclear power control equipment • Medical equipment

- (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

1. Application

This specification applies to the outline and the characteristics of the 2PD Type Color Toner Density Sensor  
Model No. GP2Y40010K0F.

2. Outline

Refer to the attached drawing No.CY13543i02

3. Ratings and characteristics

Refer to the attached sheet, page 4 to 7.

4. Reliability

Refer to the attached sheet, Page 8.

5. Outgoing inspection

Refer to the attached sheet, Page 8.

6. Supplements

6-1 GP2Y40010K0F Example of output distance characteristics

Refer to the attached sheet, page 9.

6-2 This product shall not contain the following materials.

Also, the following materials shall not be used in the production process for this product.

Materials for ODS : CFCs, Halon, Carbon tetrachloride 1.1.1-Trichloroethane (Methyl chloroform)

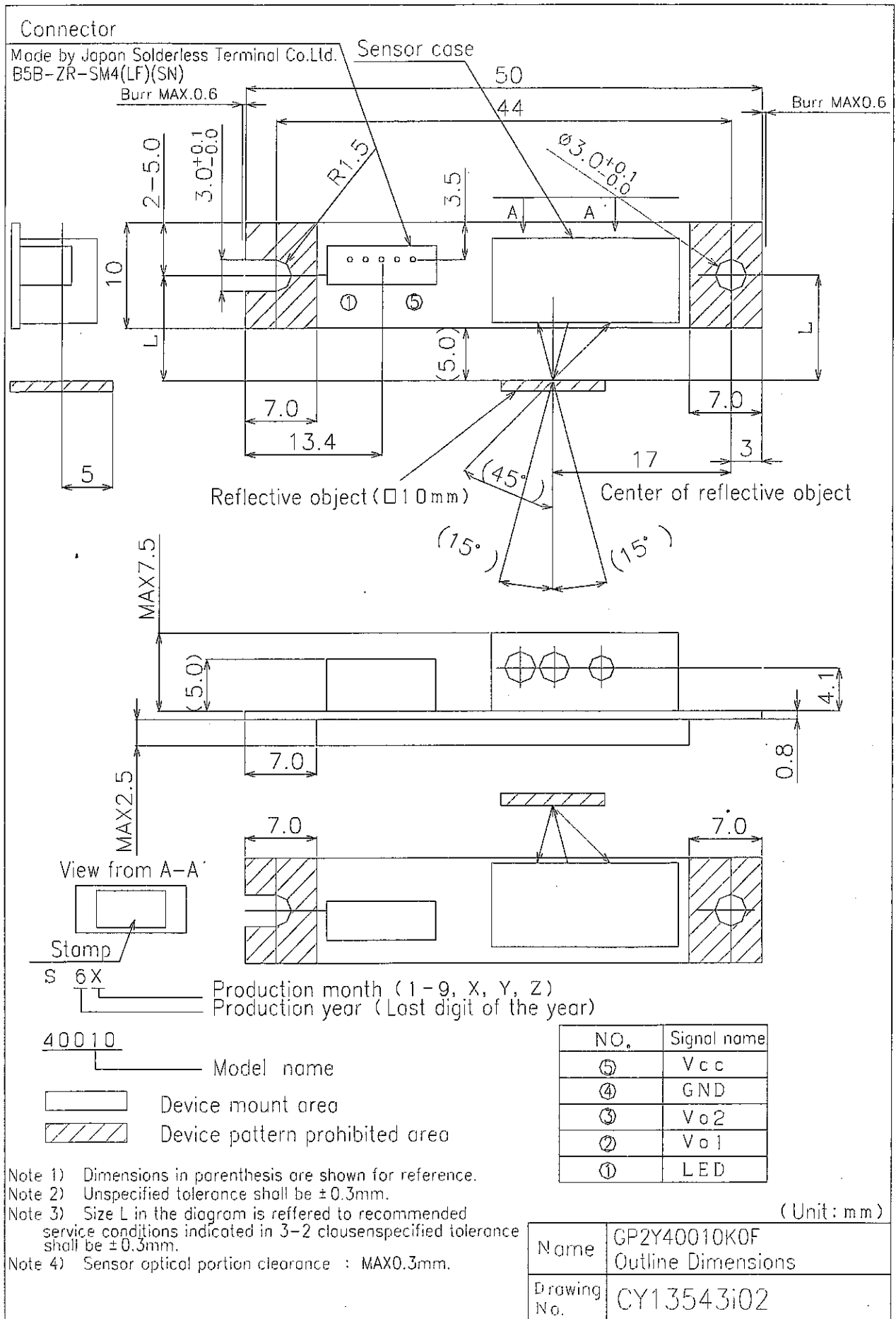
6-3 Product mass : Approx. 2g (TYP)

6-4 This product does not contain the chemical materials regulated by RoHS directive.  
(except for the parts NOT regulated by RoHS directive)

7. Notes

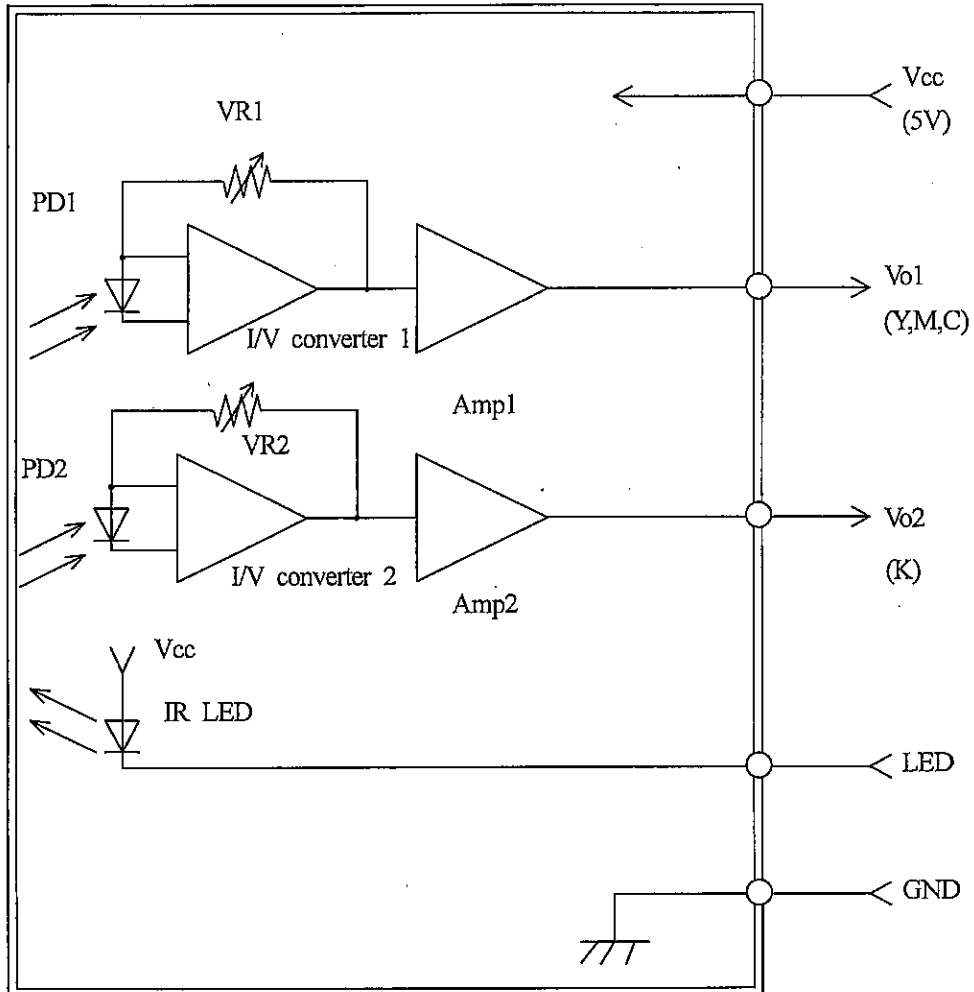
Refer to the attached sheet, page 10.

## 2. Outline



## 3. Ratings and characteristics

### 3-1 Constitution diagram



### 3-2 Absolute maximum ratings

(Ta=25°C, Vcc=5V)

Parameter	Symbol	Ratings	Unit	Remark
Supply voltage	Vcc	-0.3 to +7	V	
Output terminal voltage	Vo	-0.3 to Vcc+0.3	V	
Operating temperature	Topr	0 to +60	°C	
Storage temperature	Tstg	-20 to +70	°C	
LED current	IF	50	mA	

### Recommended service conditions

Parameter	Symbol	Rating	Unit	Remark
Supply voltage	Vcc	4.5 to 5.5	V	
Detection distance range	L	9.75 to 10.25	mm	Refer to outline dimensions

## 3-3 Electro-optical Characteristics

(Ta=25°C, Vcc=5V)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output voltage	Vo1A	(Note1)	0.69	1.27	1.85	V
	Vo2A	(Note1)	2.02	2.87	3.59	V
	Vo10	(Note2)	0.2	0.70	1.20	V
	Vo20	(Note2)	0.10	0.70	1.30	V
Displacement of Output voltage	$\Delta$ Vo1BA	(Note3)	1.38	1.74	2.10	V
	$\Delta$ Vo2C0	(Note4)	0.33	0.45	0.57	V
	$\Delta$ Vo1A0	(Note5)	0.49	0.57	0.65	V
	$\Delta$ Vo2A0	(Note6)	1.93	2.11	2.29	V
Displacement of Output voltage ratio	$\Delta$ Vo12	(Note7)	3.45	4.05	4.65	-
	$\Delta$ Vo22	(Note7)	0.17	0.21	0.25	-
Rise time	tr	(Note8)	-	70	300	$\mu$ s
Fall time	tf	(Note8)	-	70	300	$\mu$ s
Supply current	Icc	(Note9)	-	4	12	mA

(Note1) Reflective objects A (Vo1A:IFM=15mA ,Vo2A:IFM=20mA)

(Note2) LED current IFM=0mA

(Note3) Displacement of output voltage Vo1 when reflective object is changed A to B.(IFM=15mA)

(Note4)  $\Delta$  Vo2C0=Vo2C-Vo20 (Vo2C:Reflective objects C,IFM=20mA)

(Note5) Vo1A-Vo10

(Note6) Vo2A-Vo20

(Note7)  $\Delta$  Vo12=( $\Delta$  Vo1BA+ $\Delta$  Vo1A0)/ $\Delta$  Vo1A0 ,  $\Delta$  Vo22= $\Delta$  Vo2C0/ $\Delta$  Vo2A0

(Note8) Reflective objects C (Munsell N2 no gloss (Reflectance 3.1%))

(Vo1A:IFM=15mA ,Vo2A:IFM=20mA)

(Note9) Supply current at LED current IFM=0mA

## 3-4 Measuring method

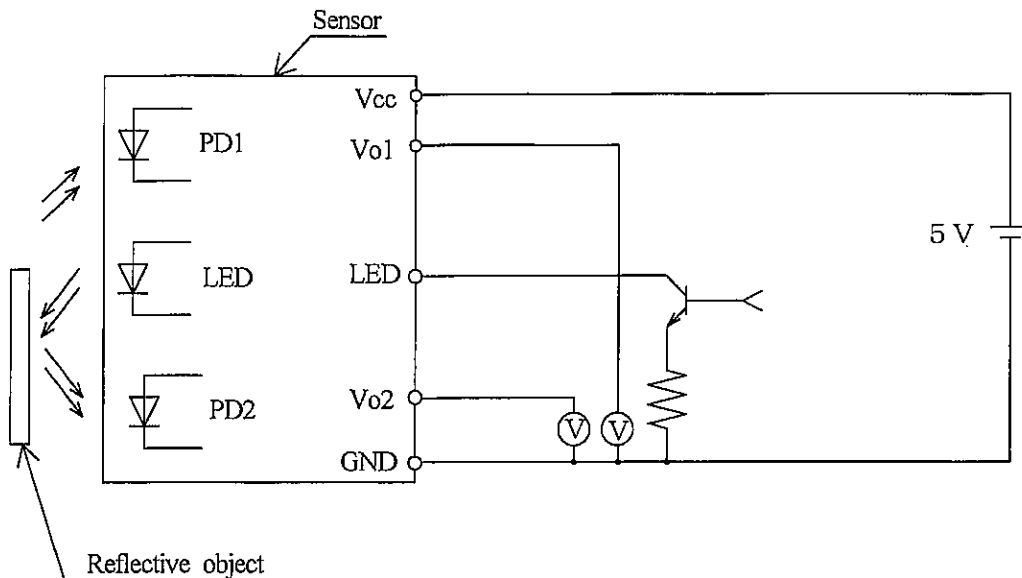
(Reflective object)

A : Munsell N4.5 no gloss (Reflectance 15.6%)

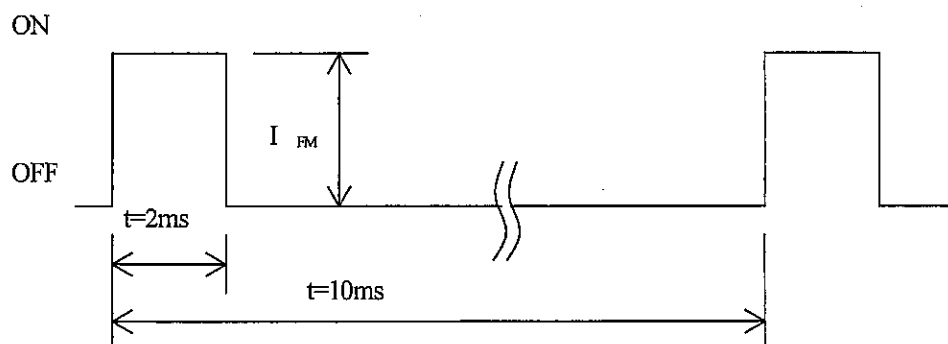
B : Munsell N7.75 no gloss (Reflectance 54.8%)

C : Munsell N2 no gloss (Reflectance 3.1%)

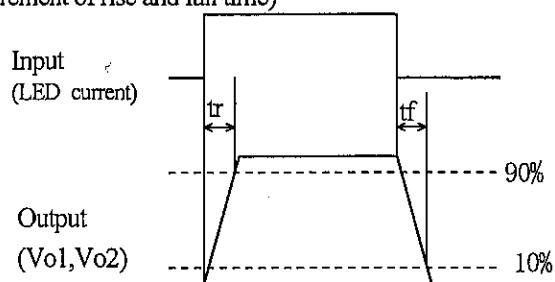
(Schematic measurement block diagram)



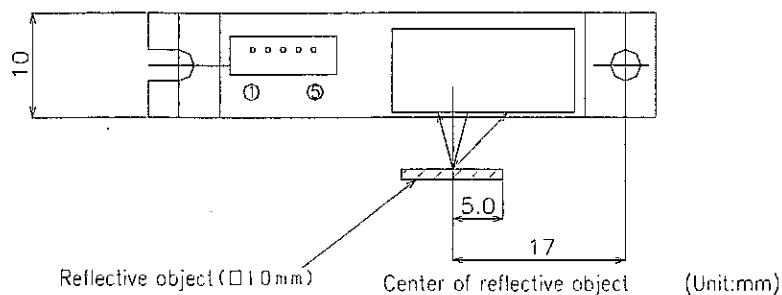
(LED lighting condition)



(Measurement of rise and fall time)



(Measuring condition)





## 3-5 Example of application

- ① Apply  $V_{cc}=5V$  and measure  $V_{o10}$  at  $V_{o1}$ ,  $V_{o20}$  at  $V_{o2}$ .
- ② In order to stabilize output voltage measure ③ to ⑤ on the LED lighting condition shown in 3 and 4 clause as for example.
- ③ Measure the output voltage  $V_{o1}$  and  $V_{o2}$  and adjust  $I_{FM}$  in order to fix  $\Delta V_{o11}$  and  $\Delta V_{o21}$  (determine value by your actual application).  
 After the adjustment, memorize the values,  $V_{o1}$ ,  $V_{o2}$ , and  $I_{FM}$ .  
 (Adjust  $I_{FM}$  for  $V_{o1}$  and  $V_{o2}$  each, and memorize them.)  
 (If there are the initial memorized values,  $V_{o1}$ ,  $V_{o2}$  and  $I_{FM}$ , measure  $V_{o1}$  and  $V_{o2}$  at memorized  $I_{FM}$ . If there are difference between the measured values and memorized values adjust  $I_{FM}$  to let  $V_{o1}$  and  $V_{o2}$  be initial values.)
- ④ Attach the color toner and measure the output voltage at  $V_{o1}$  ( $I_{FM}$  at the value memorized at ③).  
 Determine the output voltage difference  $\Delta V_{o1}$  between the measured value and memorized value  $V_{o1}$  at ③, and adjust the attached color toner amount.
- ⑤ Attach the black toner and measure the output voltage at  $V_{o2}$  ( $I_{FM}$  at the value memorized at ③).  
 Determine the output voltage difference  $\Delta V_{o2}$  between the measured value and memorized value  $V_{o2}$  at ③, and adjust the attached black toner amount.
- ⑥ After the measurement, set  $I_{FM}=0mA$  and turn off the LED.
- ⑦ If it is necessary to measure them again, return to ①.

(Note)  $V_{o10}$  : Output voltage at  $I_{FM}=0mA$   
 $V_{o20}$  : Output voltage at  $I_{FM}=0mA$   
 $V_{o1}$  :  $V_{o1}$  terminal output voltage at no toner  
 $V_{o2}$  :  $V_{o2}$  terminal output voltage at no toner  
 $\Delta V_{o11}$  :  $V_{o1} - V_{o10}$   
 $\Delta V_{o21}$  :  $V_{o2} - V_{o20}$   
 $\Delta V_{o1}$  : Output voltage when color toner is attached- $V_{o1}$   
 $\Delta V_{o2}$  : Output voltage when black toner is attached- $V_{o2}$   
 $I_{FM}$  : LED current

#### 4. Reliability

The reliability of products shall be satisfied with items listed below.

Confidence level : 90%

LTPD : 20 or 30

No.	Test Items	Test Conditions	Failure Judgement Criteria	Samples (n)
				Defective (c)
1	Temperature cycling	1 cycle -20°C to +70°C (30min.) (30min.) 20 cycle test	$\text{Initial value} \times 0.8 \geq \text{Vo10}$ $\text{Vo20}$ $\text{Initial value} \times 1.2 \leq \text{Vo10}$ $\text{Vo20}$ $\text{Initial value} \times 0.8 \geq \text{Vo1BA}$ $\text{Vo2CO}$ $\text{Initial value} \times 1.2 \leq \text{Vo1BA}$ $\text{Vo2CO}$  (Note 1)	n=11, c=0
2	High temp. and high humidity storage	+40°C, 90%RH, 240h		n=11, c=0
3	High temp. storage	+70°C, 240h		n=11, c=0
4	Low temp. storage	-20°C, 240h		n=11, c=0
5	Operation life (High temp.)	+60°C, Vcc=5V, If=20mA(DC) 240h		n=11, c=0
	Operation life (High humidity.)	+40°C, 95%RH, Vcc=5V, If=20mA (DC) 240h		n=11, c=0
6	Mechanical shock	1000m/s <sup>2</sup> , 6.0ms 3times/±X, ±Y, ±Z direction		n=8, c=0
7	Variable frequency vibration	5 to 55 to 5Hz/1min. 2h/X, Y, Z direction overall amplitude : 1.5mm		n=8, c=0

(Note 1) Test conditions are according to 3-3 Electro-optical characteristics.  
and 3-4 Measuring method.

(Note 2) After test, measurement shall be carried out after leaving under the normal temperature and the normal humidity for two hours. But no dew point.

#### 5. Outgoing inspection

##### (1) Inspection lot

Inspection shall be carried out per each delivery lot.

##### (2) Inspection method

A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

Defect	Inspection item	AQL (%)
Major defect	Electro-optical characteristics defect (In para. 3-3)	0.4
Minor defect	Defect on appearance and dimension ※ Crack, chip, scratch, stain	1.0

※ Crack, chip, scratch, stain

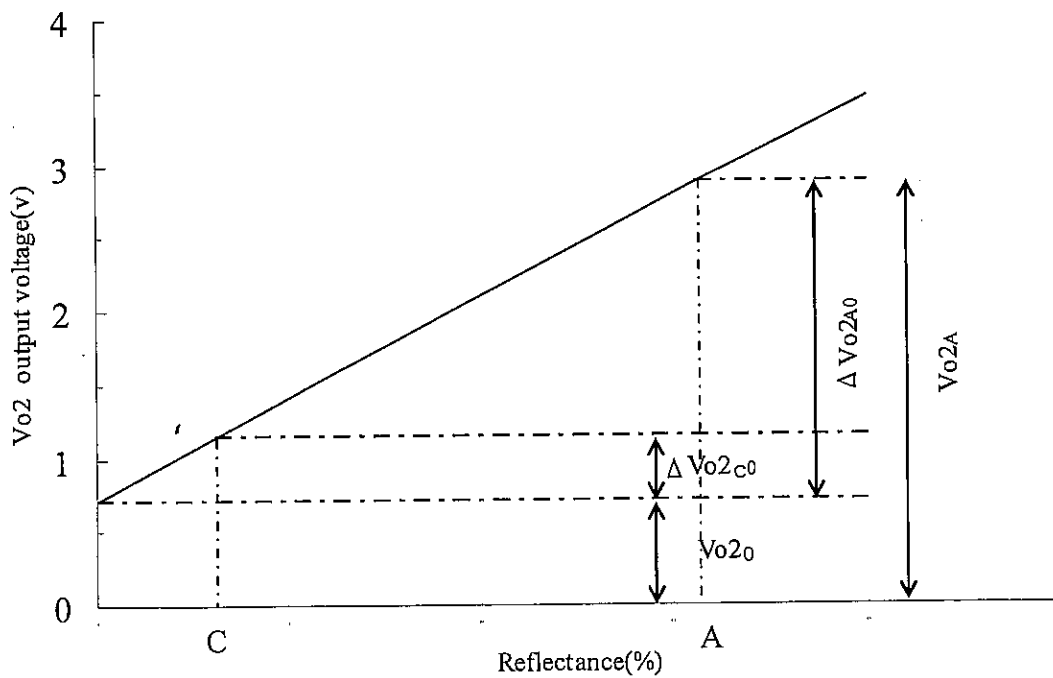
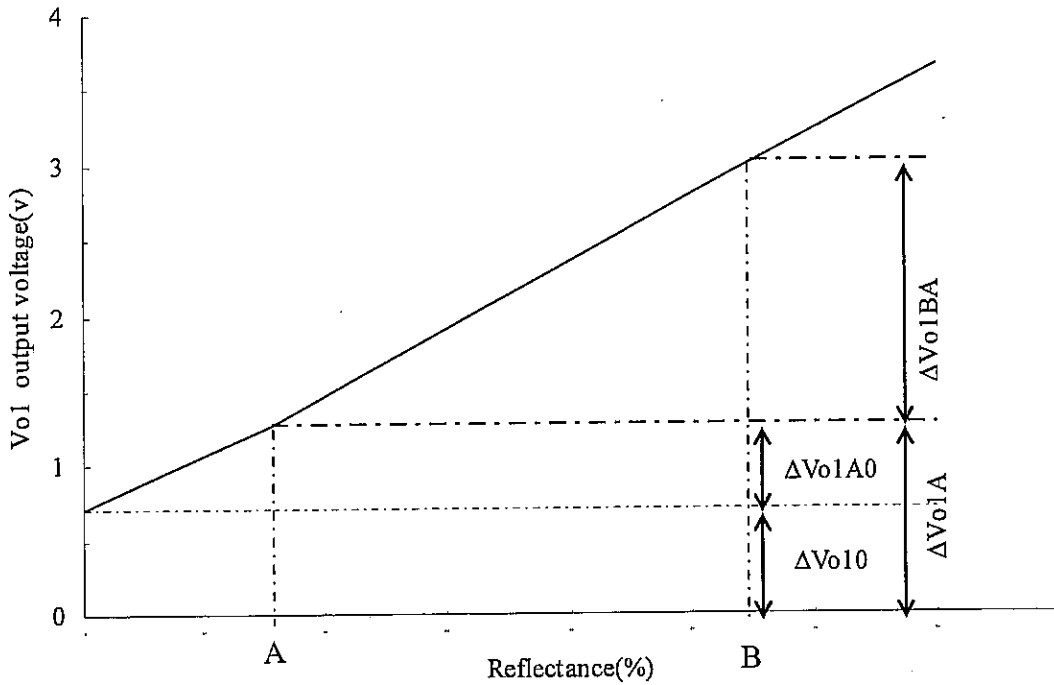
One which affects the characteristics of para. 3-3 shall be defect.

## 7. Notes

- 7-1 If dust, water and so on, which refracts light, adhere on the filter in front of the detector and emitter, there is case that the characteristics of the device may be deteriorated.  
Dust, water and so on shall be wiped by dry cloth. (There is case that organic solvents deteriorate the characteristics of the filter. Therefore, please do not use organic solvents.)
- 7-2 VR (Variable Resistance) for sensitivity adjustment is set up at shipping from Sharp.  
Please do not touch the VR on the printed board through the assembly process of the equipment and so on so as not to change the characteristics.
- 7-3 In order to stabilize power supply line, we recommend to connect a by-pass capacitor of  $10\ \mu\text{F}$  or more between Vcc and GND near the GP2Y40010K0F.  
Also, the shortest wiring shall be recommended. In case that this device is used with long wiring, Please confirm that the characteristics shall not be influenced.
- 7-4 To prevent photointerrupter from faulty operation caused by external light, do not set the detecting face to the external light.
- 7-5 In order to prevent electrostatic discharge of integrated circuit, human body and equipment, etc. shall be grounded.
- 7-6 In circuit designing, make allowance for the degradation of the light emitting diode output that results from long continuous operation. (50% degradation/5 years)

# REFERENCE

## 6-1 GP2Y40010K0F Example of output characteristics



A : Munsell N4.5	no gloss (Reflectivity 15.6%)
B : Munsell N7.75	no gloss (Reflectivity 54.8%)
C : Munsell N2	no gloss (Reflectivity 3.1%)

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