

GP2AP002S30F

Proximity Sensor



■Description

GP2AP002S30F provide a digital detection system integrated into one package the light emitting element and a light receiving element.

So small package size, it is easy to mount on the equipment.

■Agency approvals/Compliance

1. Compliant with RoHS directive (2002/95/EC)

■Applications

1. Mobile phone
2. Smartphone, Tablet
3. Digital single-lens reflex camera

■Features

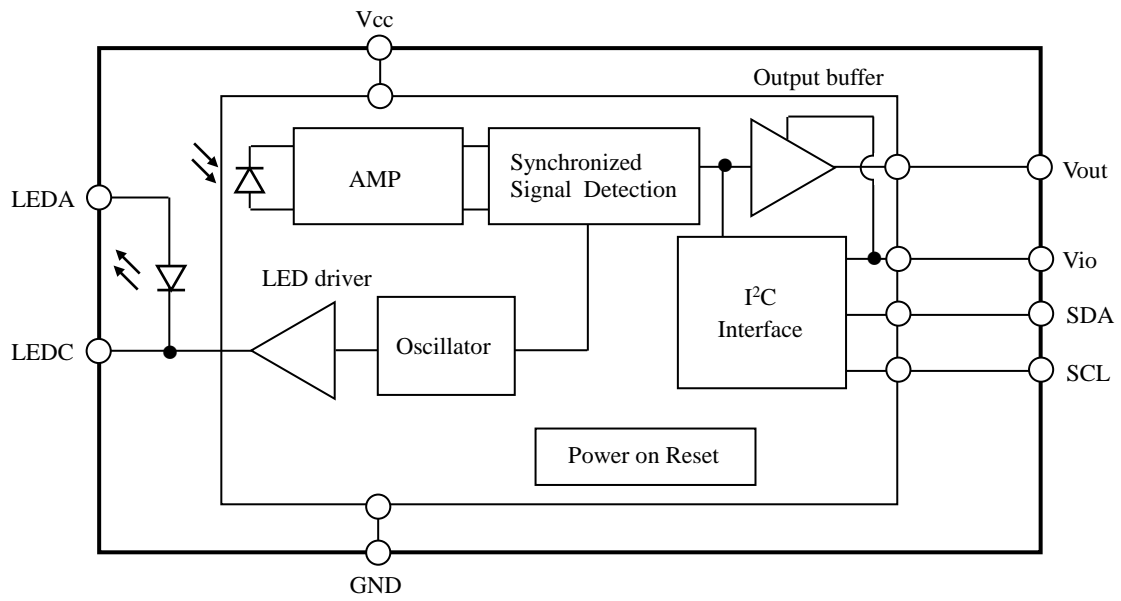
1. Drastically reduced LED current consumption by employing a light modulation system
2. Compact size (4.0 × 2.0 × 1.25t mm)
3. Built-in LED for simple optical design
4. I²C output type

Notice The content of data sheet is subject to change without prior notice.

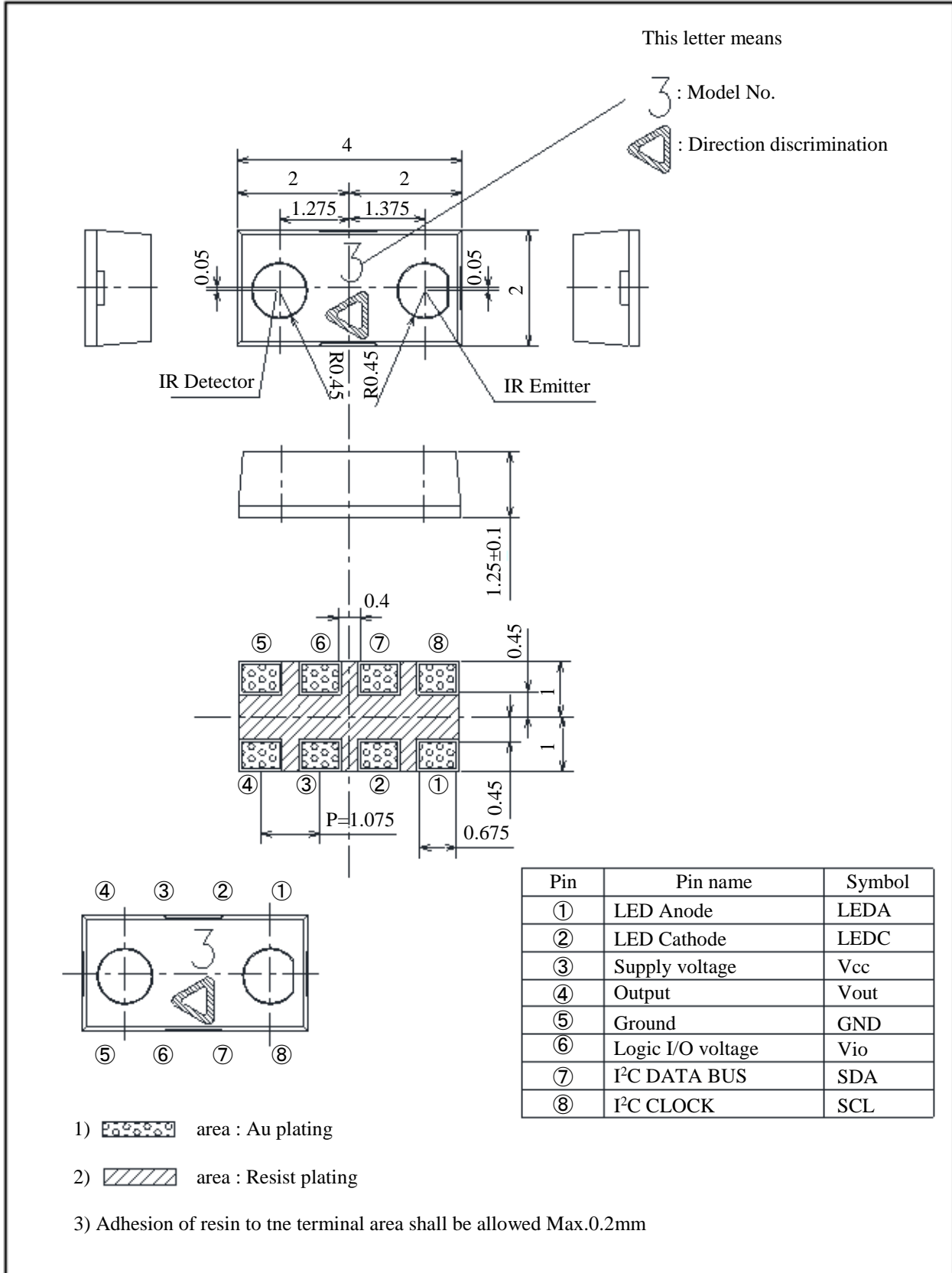
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Sheet No.: OP13036EN

■ Schematic Internal Block Diagram



■ Outline Dimensions



Pin	Pin name	Symbol
①	LED Anode	LEDA
②	LED Cathode	LEDC
③	Supply voltage	Vcc
④	Output	Vout
⑤	Ground	GND
⑥	Logic I/O voltage	Vio
⑦	I ² C DATA BUS	SDA
⑧	I ² C CLOCK	SCL

SCALE	MATERIAL	FINISH	Name	GP2AP002S30F Outline dimension									
10/1													
UNIT	Terminal : Cu Package : Epoxy resin	Terminal : Ni(≥3μm),	Drawing No.	C	Y	1	5	0	6	0	i	0	2
1=1/1mm													

■ Absolute Maximum Ratings

Ta=25°C (unless otherwise specified)

Parameter	Symbol	Rating	Unit	Remarks
Supply voltage	V _{CC}	-0.3 to 3.8	V	
LED supply voltage	V _{LED}	-0.3 to 3.8	V	
LED peak forward current	I _{LED}	300	mA	
Logic I/O supply voltage	V _{IO}	-0.3 to V _{CC} +0.3 and 3.8V or less	V	Cf. 7)Notes, 5) Directions for power-line connection
SDA/SCL pull-up voltage	-	V _{IO} -0.3 to V _{IO} +0.3 and 3.8V or less	V	Cf. 7)Notes, 5) Directions for power-line connection
Operating temperature	T _{opr}	-25 to +85	°C	
Storage temperature	T _{stg}	-40 to +85	°C	
Soldering temperature	T _{sol}	260	°C	peak temperature duration:10sec

■ Recommended Operating Conditions

Ta=25°C (unless otherwise specified)

Parameter	Symbol	Operating condition	Unit	Remarks
Supply voltage	V _{CC}	2.4 to 3.6	V	
LED supply voltage	V _{LED}	2.4 to 3.6	V	
Operating temperature	T _{opr}	-25 to 85	°C	
Logic I/O supply voltage	V _{IO}	1.65 to V _{CC}	V	
SCL, SDA input low level	V _{IL}	-0.3 to 0.2×V _{IO}	V	
SCL, SDA input high level	V _{IH}	0.8×V _{IO} to V _{IO} +0.3	V	

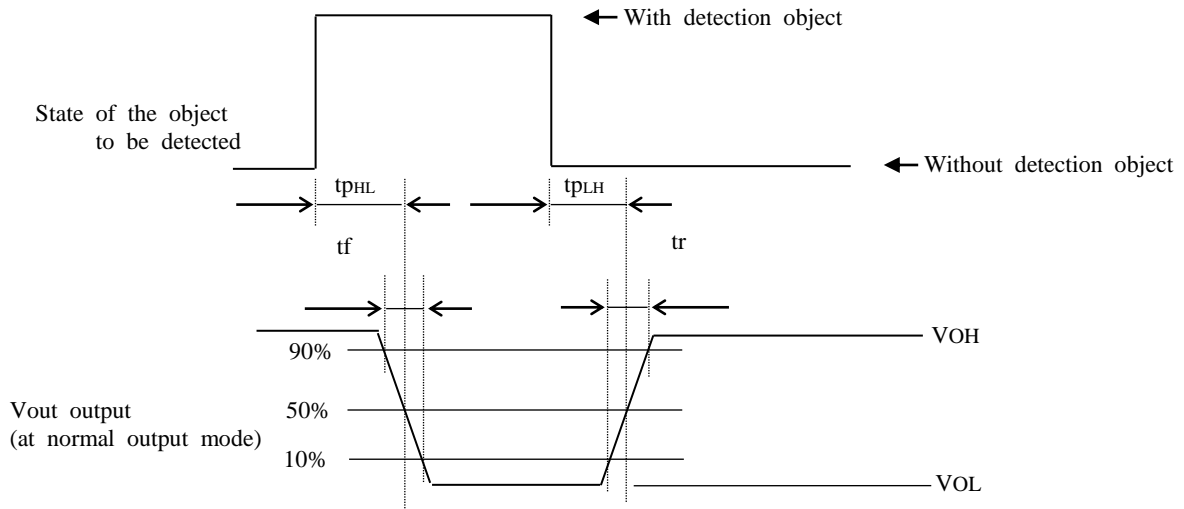
■ Electrical and Optical Characteristics

Ta=25°C, V_{CC}=3.3V, V_{LED}=3.3V R_{LED}=6.8Ω (unless otherwise specified)

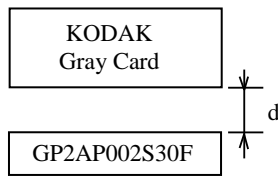
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
Current consumption	operating mode	I _{CC}	-	240	600	uA	No detection object, Ev=0 lx. *1, except for LED and driver
	shutdown mode	I _{CC-S}	-	-	1.0		No input signal. *1, except for LED and driver
LED peak current		I _{LED}	-	170	-	mA	
Peak emission wavelength		λ _p	-	940	-	nm	
Vout terminal High level output voltage		V _{OH}	V _{IO} -0.5	V _{IO} -0.3	V _{IO} +0.3	V	I _{OH} =0.3mA, *2
Vout terminal Low level output voltage		V _{OL}	-	-	0.5	V	I _{OL} =1mA, *2
Response time (H→L)		t _{PHL}	-	-	50	ms	*2
Response time (L→H)		t _{PLH}	-	-	50	ms	
Rise time		t _r	-	1	-	μs	*2, CL=15pF
Fall time		t _f	-	1	-	μs	
Maximum detection distance		L _{on}	25	65	-	mm	*3, Detection object: KODAK Gray Card (r = 0.18) Operation mode B1
Minimum no detection distance		L _{off}	-	78	150	mm	
Wake up time		t _{sdw}	-	-	100	ms	*4
Maximum acceptable illuminance		E _v	3000	-	-	lx	*5
SCL clock frequency		SCL	4	-	400	kHz	

*1. Current consumption through VLED terminal (including LED and its driver output) depends on actual environment and situations. (See attached document **【1】** 1-1)

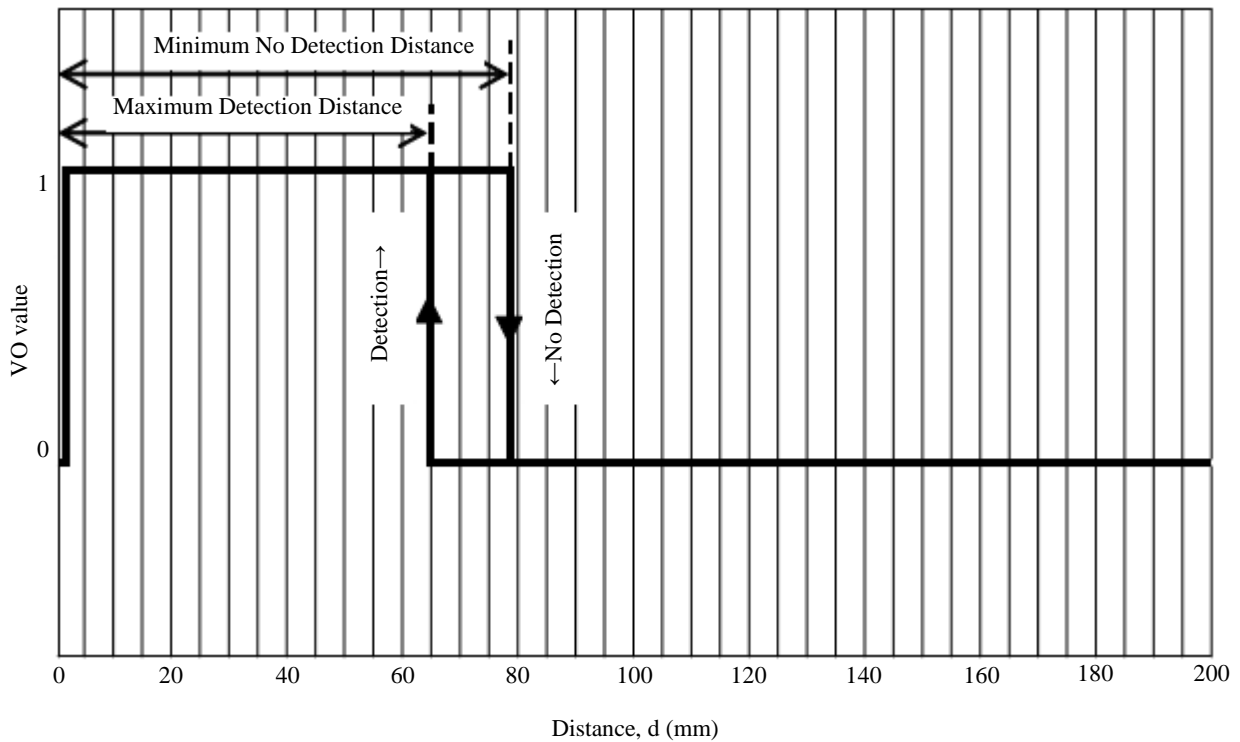
*2. Parameters defined for Vout output waveform specifications.



*3. Detection distance

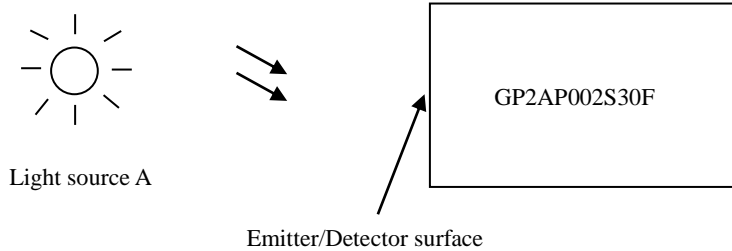


GP2AP002S30F output example vs. distance characteristics (operation mode B1)



*4. Wake up time, t_{sdw} , is defined as a delay of the 1st LED emission after issuing the I²C write command to release GP2AP002S30F from the shutdown mode. Note that there should be no external light noise sources in this particular examination. Also, by definition, it does not matter where reflective object is, but it is recommended that the object should be placed at $d \ll L_{on}$ because VO is initialized to 0 and the next expected change is 0 to 1.

*5. Test set-up for “Maximum Acceptable Illuminance” measurement



Illuminance should be measured and evaluated at Emitter/Detector surface of GP2AP002S30F. The maximum acceptable illuminance, E_v , is a maximum level of illuminance at which GP2AP002S30F should keep its sensing result, VO, as "0" (no detection) as long as no reflective objects exist. However, GP2AP002S30F may start to exhibit false detection with external light noise beyond this level. See attached document 【1】 1-10 for more details.

■Supplement

- This product is built-in photodiode.
- Compliance with each regulation
 - 1) The RoHS directive (2002/95/EC)
 This product complies with the RoHS directive (2002/95/EC).
 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	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr ⁶⁺)	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Proximity sensor	✓	✓	✓	✓	✓	✓

✓ : indicates that the content of the toxic and hazardous substance in all the homogeneous materials of the part is below the concentration limit requirement as described in SJ/T 11363-2006 standard .

- 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 (Methylchloroform)
- Brominated flame retardants
 Specific brominated flame retardants such as the PBB and PBDE are not used in this device at all.
- Product mass : Approx . 0.017 g
- Country of origin : China
- Packing : Refer to the attached sheet, Page 16.
- Moisture level: MSL3

■Notes**●Before the circuit design**

In circuit designing, make allowance for the degradation of the light emitting diode output that results from long continuous operation. (50% degradation/5 years)

●Please take proper methods to prevent ESD. The IC built in GP2AP002S30F is ESD-sensitive because it is fabricated by sub-micron CMOS process. For example, in handling GP2AP002S30F, human body and soldering iron etc. should be grounded.**●As it takes at most 100ms to let GP2AP002S30F go to active operation from shut-down mode, please take this delay into system design consideration. Also, if the host system relies on the actual value of this delay, e.g. to do frequent software shutdown, please thoroughly make sure that the operation be successful in any realistic situation.****●Regarding to prevention of malfunction**

To prevent GP2AP002S30F from faulty operation due to external light noise sources, do not set the detection surface to these sources directly. Under very unlikely situation, GP2AP002S30F output may fall into malfunction

(See attached document **【1】** 1-10 for more detail). It can be reset by letting GP2AP002S30F go shutdown once, and then activating GP2AP002S30F again. In case of this, take it into consideration, in software implementation, to prepare a method to reset GP2AP002S30F. Also, if some other electronic components are placed close to this device, faulty operation may occur. (The light reflection caused by the other components may slip into the photo-detecting portion of the device and may cause faulty operation.)

●Directions for power-line connection

Avoid that GP2AP002S30F's SDA/SCL terminals are pulled-up to the other power line than GP2AP002S30F's Vio terminal even if they are in the same operating voltage. See also ●Recommended external circuit. For example, when you shut down GP2AP002S30F by letting Vcc and Vio terminals go to GND level (instead of using software shutdown function), and if GP2AP002S30F's SDA/SCL terminals are still pulled-up to another active power line, these terminals will draw significant currents from a pull-up resistor through internal ESD devices and the SCL and SDA lines are pulled-down, which causes system error (I²C bus error).

Also, when you consider reducing total current consumption of the I²C devices by turning off the power line(s), avoid that one of the Vcc and Vio terminals of GP2AP002S30F is turned off and the other is kept on. It never shuts down GP2AP002S30F's current consumption, but possibly yields excessive current between these power lines.

Please consider making use of "software shutdown" function. However, when you do have to turn off one of these power lines (Vcc, Vio, SDA/SCL pull-up level), all of them in GP2AP002S30F should be turned off for the purpose of choking GP2AP002S30F's current consumption regardless of the register setting for the software shutdown function.

●Directions for I²C-bus interface

GP2AP002S30F is equipped with a 7-bit address as a slave device on the I²C bus interface. Through the SDA and SCL terminals, GP2AP002S30F's registers can be set up, and also GP2AP002S30F's sensing result can be read out.

However, the read format specified for GP2AP002S30F is a proprietary one that differs from the normal read format (immediately after the first byte) or the combined format shown in the I²C-bus specification version 2.1, January 2000. For more details to let GP2AP002S30F operate properly, see attached document **【1】** 1-2, I²C-bus interface, and **【2】** recommended operation mode / register setting procedure.

●After being mounted and soldered, if GP2AP002S30F is deformed by external force or impact, e.g. something falls onto the device, it may result in defective implementation such as lift-off of the terminals. Careful handling should be taken.**●For soldering**

Refer to the page 10

●For cleaning

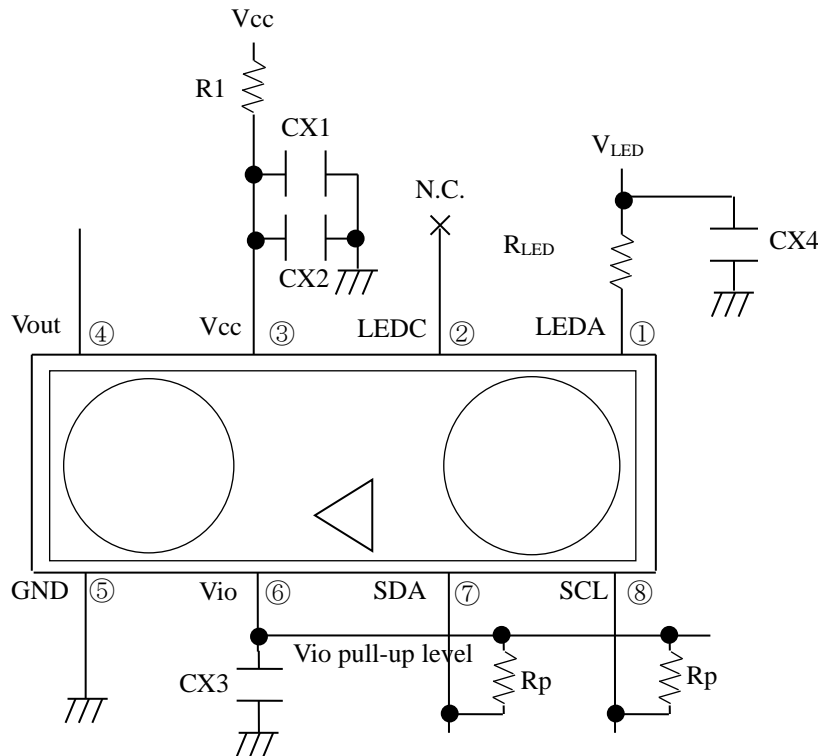
Cleaning shall carry out as the below items to avoid keeping solvent, solder and flux on the device

- (1) Solvent cleaning : Solvent temperature 45°C or less, Immersion for 3 min or less
- (2) Ultrasonic cleaning : Please don't carry out ultrasonic cleaning.
- (3) The cleaning shall be carried out with solvent below.

Solvent : Ethyl alcohol, Methyl alcohol, Isopropyl alcohol

●Recommended external circuit

(Top View)



Components		Recommended values
CX1		4.7uF (Ceramic)
CX2		0.1uF (Ceramic)
CX3		1.0uF (Ceramic)
CX4		10uF (Ceramic)
R1	1/20W	10 Ω
R _{LED}	1/20W	6.8Ω±1% (V _{CC} =V _{LED} =3.3V)
R _p	1/20W	10k Ω (*)

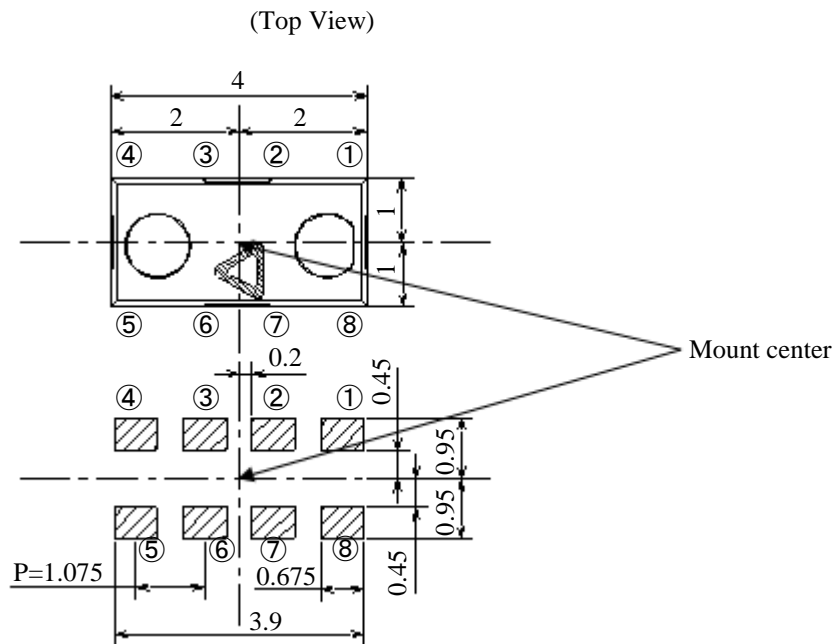
Notes:

Place the capacitors CX1 ~ CX4 as close as possible to the corresponding terminals. For CX1 ~ CX3, at most 5mm or less is preferable. Depending on the level and / or frequency component(s) of the power supply noise, CX's and R1 listed above may not completely eliminate its influence. Therefore, to avoid GP2AP002S30F's false detection which can be greatly influenced by the supply noises, please carefully make sure that there is no problem with the actual electrical implementation.

Whenever considering to change V_{LED} voltage, choose proper value for R_{LED} so that the desired I_{LED} is obtained. SDA terminal (as output) and LEDA terminal are NMOS open-drain output. On the other hand, Vout terminal is CMOS output, but it has no high-impedance state.

(*) To determine the appropriate value for R_p's, see section 16 of The I²C-Bus Specification.

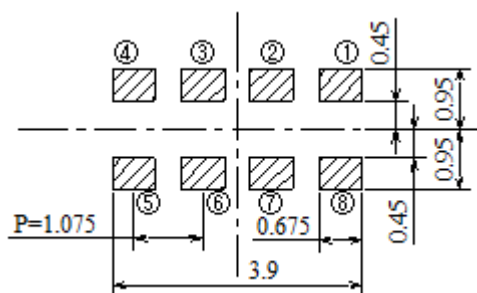
- Foot pattern of PCB
Dimensions are shown for reference.



1. Dimension in parenthesis are shown for reference.
2. Unit : mm

Pin	Pin name	Symbol
①	LED Anode	LEDA
②	LED Cathode	LEDC
③	Vcc	Vcc
④	Output	Vout
⑤	Ground	GND
⑥	Logic I/O Supply Voltage	Vio
⑦	I ² C DATA BUS	SDA
⑧	I ² C CLOCK	SCL

- Recommendable size of solder creamed paste (Reference)



: Soldering paste area

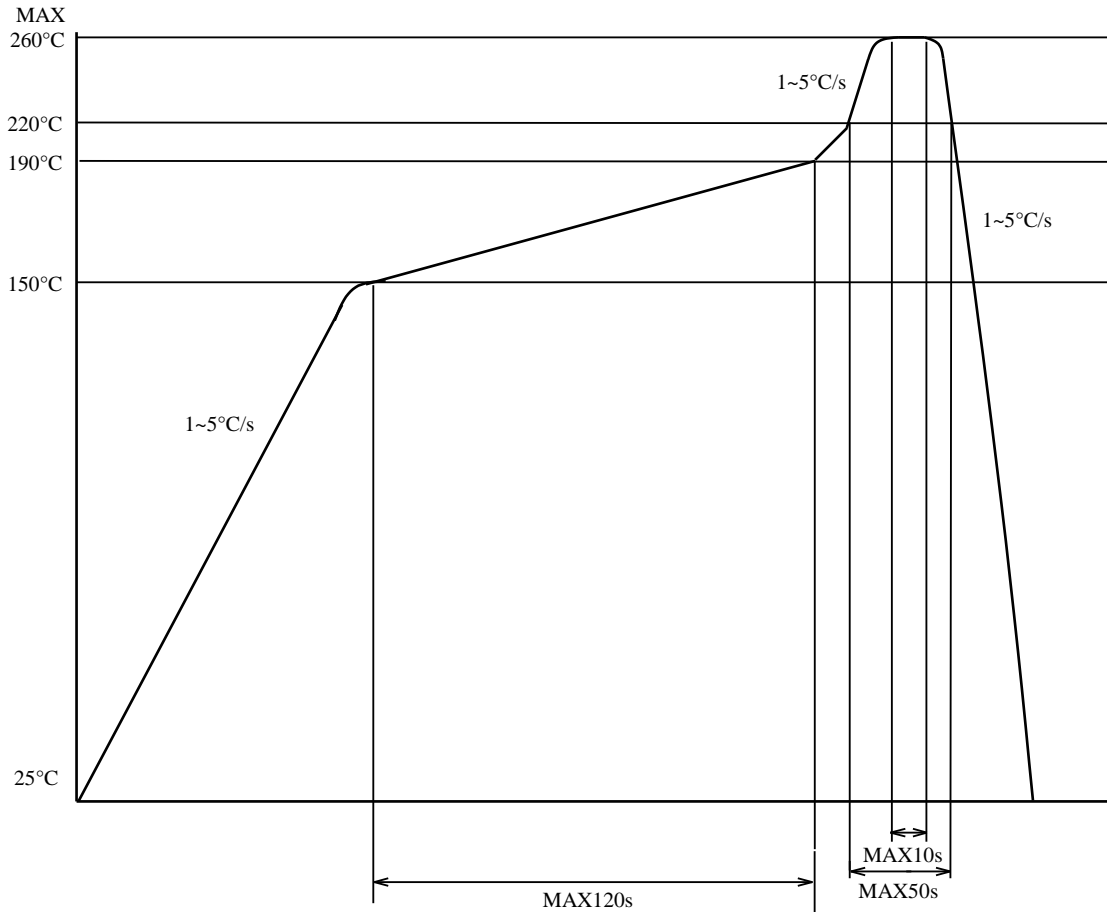
*Dimension in parenthesis are shown for reference.
Unit : mm

■Precautions for Soldering

1. In case of solder reflow

Reflow is allowed only twice at the temperature and the time within the temperature profile as shown in the figure below.

Reflow interval shall be within 7days under conditions, 10 to 30°C, 70%RH or less.



2. Other precautions

An infrared lamp used to heat up for soldering may cause a localized temperature rise in the resin.

Also avoid immersing the resin part in the soldering.

Even if within the temperature profile above, there is the possibility that the gold wire in package is broken in case that the deformation of PCB gives the affection to lead pins.

Please use after confirmation the conditions fully actual solder reflow machine.

■Taping specifications

1. Application

This packing specification sheets specify the taping specifications for GP2AP002S30F.

2. Taping method

2-1. Taping material

Name	Material	Counter measure for ESD
Reel	PPE	Conductive type
Carrier tape	PC	Conductive type
Cover tape	PET	Conductive type

2-2. Tape structure and Dimensions (Refer to the page 12.)

The tape shall have a structure in which a cover tape is sealed pressed on the carrier tape of conductive Polycarbonate.

2-3. Reel structure and Dimensions (Refer to the page 13.)

The taping reel shall be conductive plastic with its dimensions as shown in the attached drawing.

2-4. Direction of product insertion (Refer to the page 13.)

Product direction in carrier tape shall be that IR emitter places on the hole side of the tape.

2-5. The way to repair taped failure devices

The way to repair taped failure devices cut a bottom of carrier tape with a cutter, and after replacing to good devices, the cutting portion shall be sealed with adhesive tape.

3. Adhesiveness of cover tape

The exfoliation force between carrier tape cover tape shall be 0.2N to 1.2N for the angle from 160 degrees to 180 degrees.

4. Rolling method and quantity

Wind the tape back on the reel so that the cover tape will be outside the tape.

Attach 16cm or more of blank tape to the trailer and 40cm or more of blank tape to the leader and fix the both ends with adhesive tape.

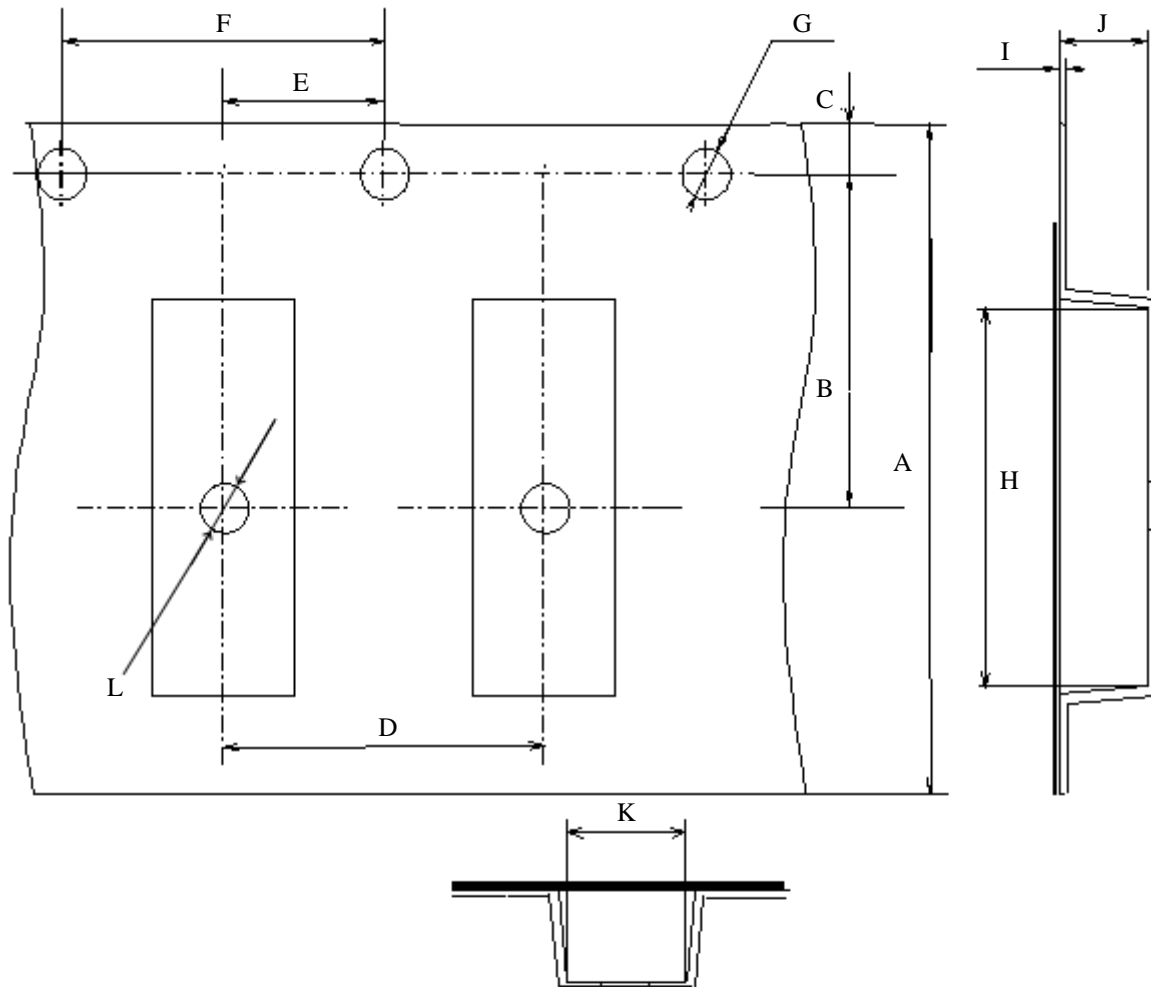
One reel shall contain 2000pcs.

There must not be continuously two or more Stock-Outs.

5. Safety protection during shipping

There shall be no deformation of component or degradation of electrical characteristics due to shipping.

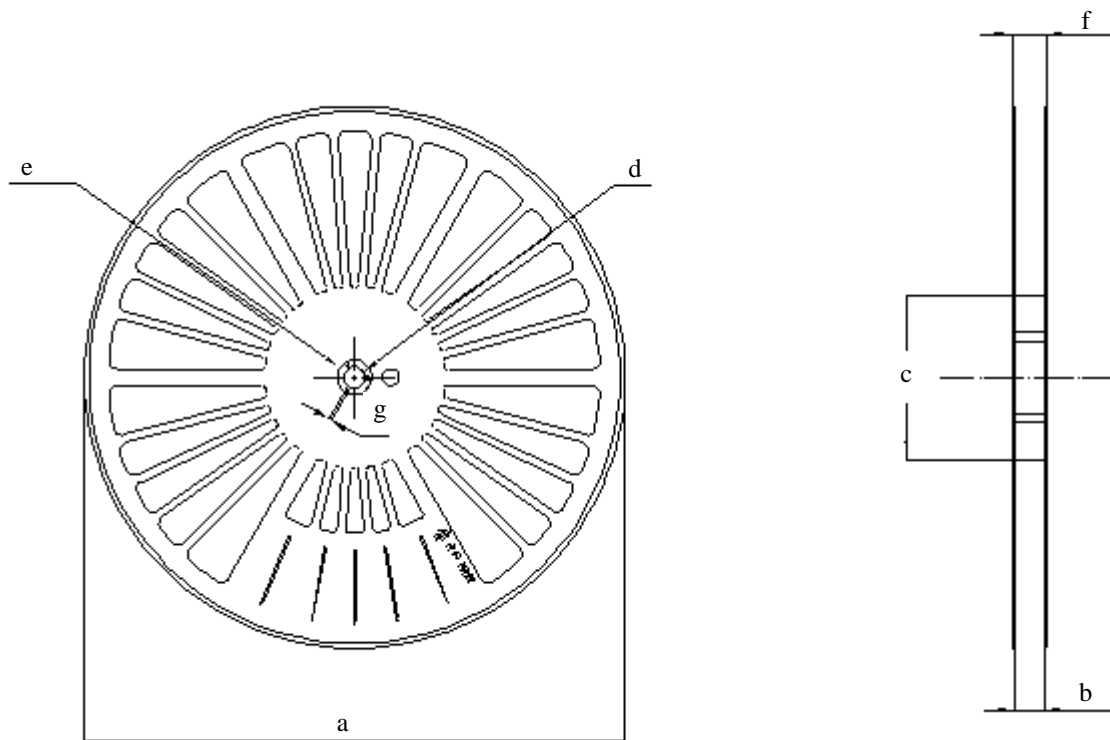
6-1. Tape structure and Dimensions



Symbol	A	B	C	D	E	F
Unit						
mm	± 0.3 12.0	± 0.1 5.5	± 0.1 1.75	± 0.1 4.0	± 0.1 2.0	± 0.1 4.0

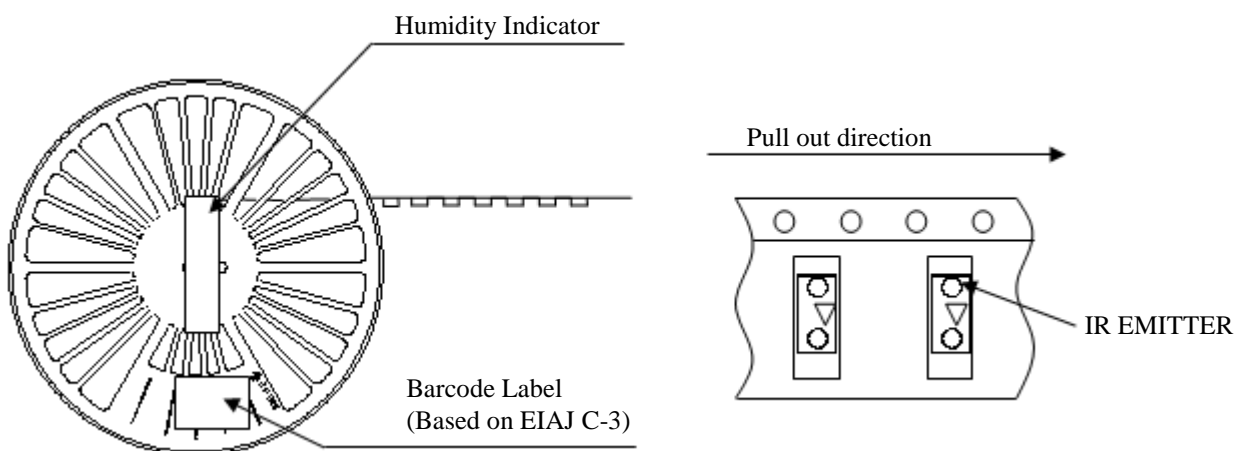
Symbol	G	H	I	J	K	L
Unit						
mm	$\phi 1.5$ $\begin{matrix} +0.1 \\ -0.0 \end{matrix}$	± 0.1 4.3	± 0.05 0.25	± 0.1 1.4	± 0.1 2.3	$\phi 1.5$ $\begin{matrix} +0.2 \\ -0.0 \end{matrix}$

6-2. Reel structure and Dimensions



Symbol Unit	Check word						
	a	b	c	d	e	f	g
mm	$\phi 180 \pm 2.0$	12 ± 1.0	$\phi 60 \pm 1.0$	$\phi 13 \pm 0.2$	$\phi 21 \pm 0.8$	15.4 ± 1.0	2 ± 0.5

6-3. Direction of product insertion



■Taping moisture-proof packing

1. Application

This packing specification sheets apply to the moist-proof packing for the GP2AP002S30F in the taping package.

2. Packaging specifications

2-1. Packaging material

Name	Material	Counter measure for ESD	Quantity
Aluminum laminate bag	Aluminum polyethylene	Conductive type	Refer to 2.2
Label	Paper(-made)	Non	
Siccative	-	Non	
Packing case	Paper	Non	
Pads	Paper	Non	
Indicator	Paper	Non	

2-2. Packaging method

- (1) Fill necessary information to barcode labels.
- (2) Paste one of the barcode labels and a moisture indicator to a tape reel (contains 2,000 devices per reel).
- (3) Seal the aluminum laminated bag that contains the tape reel and siccative, and paste one of the barcode labels.
- (4) Pack 5 aluminum laminated bags (contains 1 reel each) into the designated packing case, where paper pads are placed on the bottom and top of the packing case, as well as each layer of the aluminum laminated bags.

Package shape	Product	Quantity	Moisture-proof sack Quantity
Tape reel (φ 180mm)	1 model	2000pcs. / reel *	1 reel / laminated bag

Minimum order / shipment quantity should be 1 laminated bag.

- (5) The packing case would be then sealed with the craft tape, with barcode label (based on EIAJ C-3) (Total of 10,000pcs. per carton) * Except for the case that device is removed.

3. Storage and Treatment after Unsealed

- 3-1. Storage conditions The delivered product should be stored with the conditions shown below;
 Storage temperature : 10 to 30°C
 Humidity : below 70%RH

The warranty term for the shipped product shall be for 1 year after shipping to the designated place by the ordered customer.

3-2. Treatment after open

- (1) After unsealed, devices should be mounted under the temperature condition of 10 to 30°C, at the humidity condition of below 70%RH, within 7days.
- (2) In case that long term storage is needed, devices should either be stored in dry box, or re-sealed to moist-proof bag with siccative and leave them in the environment where the temperature is 10 to 30°C, at the humidity condition of below 70%RH. Devices must be mounted within 2 weeks.

3-3. Baking before mounting (Refer to the page 15.)

In the event that the devices are not maintained in the storage conditions described above, or the enclosed siccative indicator already turned its color to pink, baking must be applied before devices are to be mounted.

The case that GP2AP002S30F was not mounted under the temperature condition of 10 to 30°C, at humidity condition of 70%RH or lower within 7 days Baking process must be applied before devices are to be mounted.

Please also note that baking should only be applied twice.

Recommended condition : ①100°C, 12 to 24 hours ②125°C, 6 to 24hours

※Baking will not properly done in packing condition.

To complete the baking properly, devices should be placed to the metal tray.

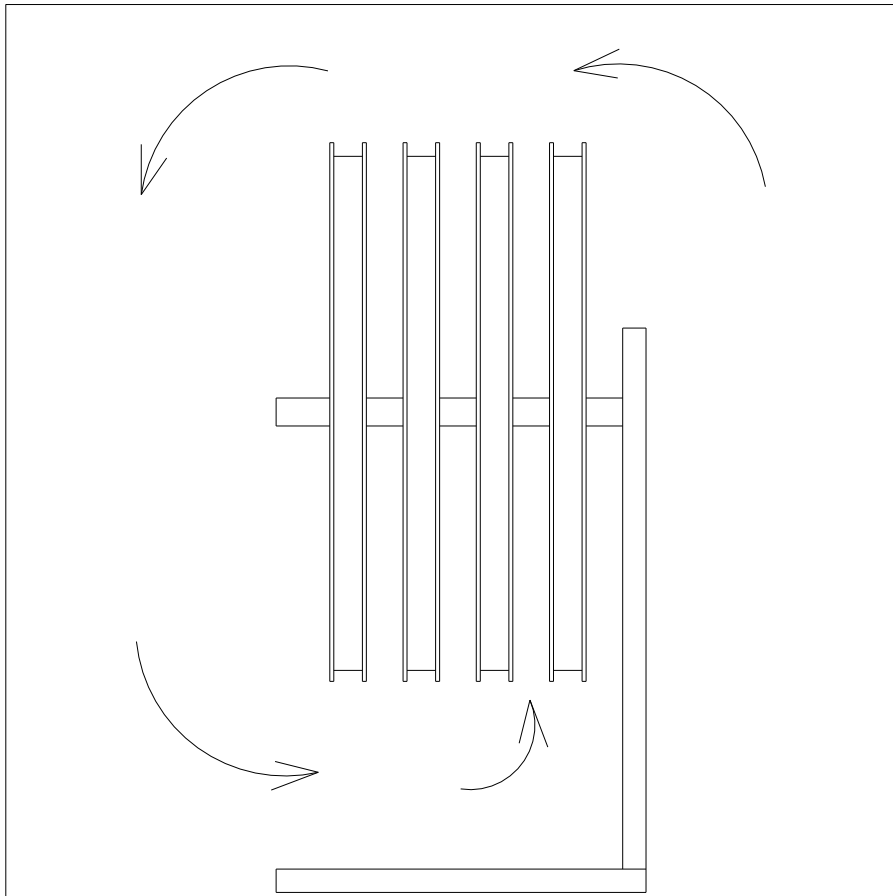
Recommended condition of reel baking : 125°C, 6 to 24hours

※In the case of reel baking hung the reel in the oven by passing the shaft in the center hole of reel.

Please avoid laying the reel.

3-4. Baking treatment before mounting

3.4.1 Placement of reels in an oven

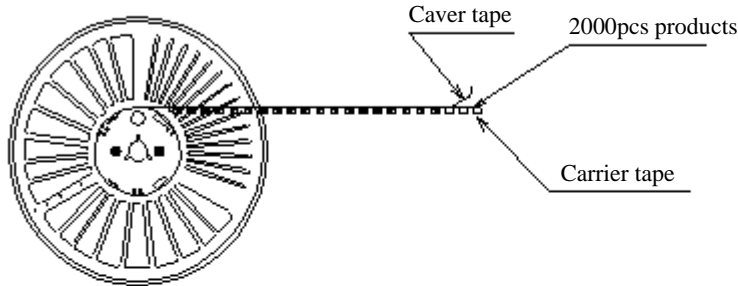


- (1) Please hang reels by using a center hole for fixing the reel.
Please keep some space between reels for better air rotation in the oven.
Please do not lay a reel down in the oven to avoid any damages for the tape edge
And the flange of reel.
- (2) Please make sure the carrier tape does not have any slack in a reel before baking
to avoid peeling the cover tale off.
Since the tape using for fixing carrier tape is not heatproof, there is a case to remain glue.
So if necessary, please change the tape to a heatproof one.

■Packing

4-1. Inner Packing

① Inner Packing drawing

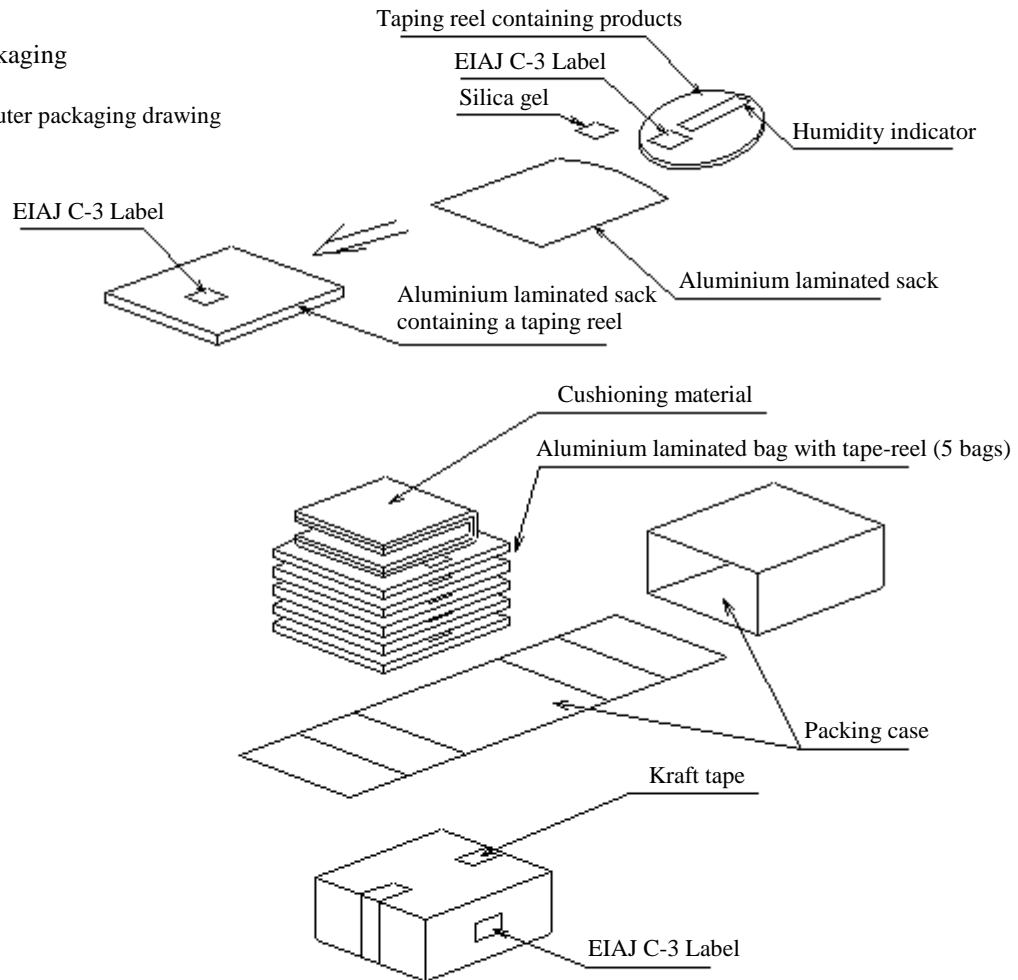


② Inner Packing material : • Reel(PPE) • Carrier tape(PC) • Cover tape(PET)

③ Quantity : 2000pcs./Reel

4-2. Outer Packaging

① Outer packaging drawing



② Outer packing material : Packing case (Corrugated cardboard), Cushioning material (Urethane)
Aluminium laminated bag (Alumi-Polyethylene)
Humidity indicator card (paper), Label (paper), silica gel, craft tape

③ Quantity : 10000pcs./box

④ The contents of the carton 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

⑤ Regular packaged mass : Approximately 700g

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

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection

with equipment that requires higher reliability such as:

- Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
- Traffic signals
- Gas leakage sensor breakers
- Alarm equipment
- Various safety devices, etc.

(iii) SHARP devices shall not be used for or in connection with equipment that requires an extremely high level of reliability and safety such as:

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

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