

# GP2S60

**SMT, Detecting Distance : 0.5mm  
Phototransistor Output,  
Compact Reflective  
Photointerrupter**



## ■ Description

**GP2S60** is a compact-package, phototransistor output, reflective photointerrupter, with emitter and detector facing the same direction in a molding that provides non-contact sensing. The compact package series is a result of unique technology, combining transfer and injection molding, that also blocks visible light to minimize false detection.

This photointerrupter can be ordered in different CTR ranks, and has a thin, leadless (T&R) package, suitable for reflow soldering.

## ■ Features

1. Reflective with Phototransistor Output
2. Highlights :
  - Compact Size
  - Surface Mount Type (SMT), reflow soldering, with gullwing leads
  - Tape and Reel (T&R) 1 000 pcs per reel
3. Key Parameters :
  - Optimal Sensing Distance : 0.7mm
  - Package : 4×3×1.7mm
  - Visible light cut resin to prevent
4. Lead free and RoHS directive compliant

## ■ Agency approvals/Compliance

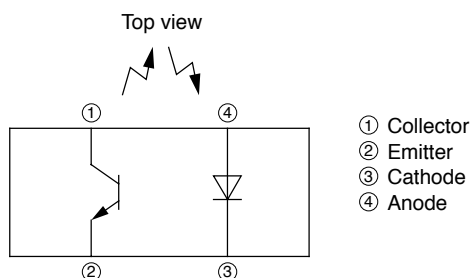
1. Compliant with RoHS directive

## ■ Applications

1. Detection of object presence or motion.
2. Any application, which production is migrating to 100% surface mount components.
3. Example : printer, optical storage

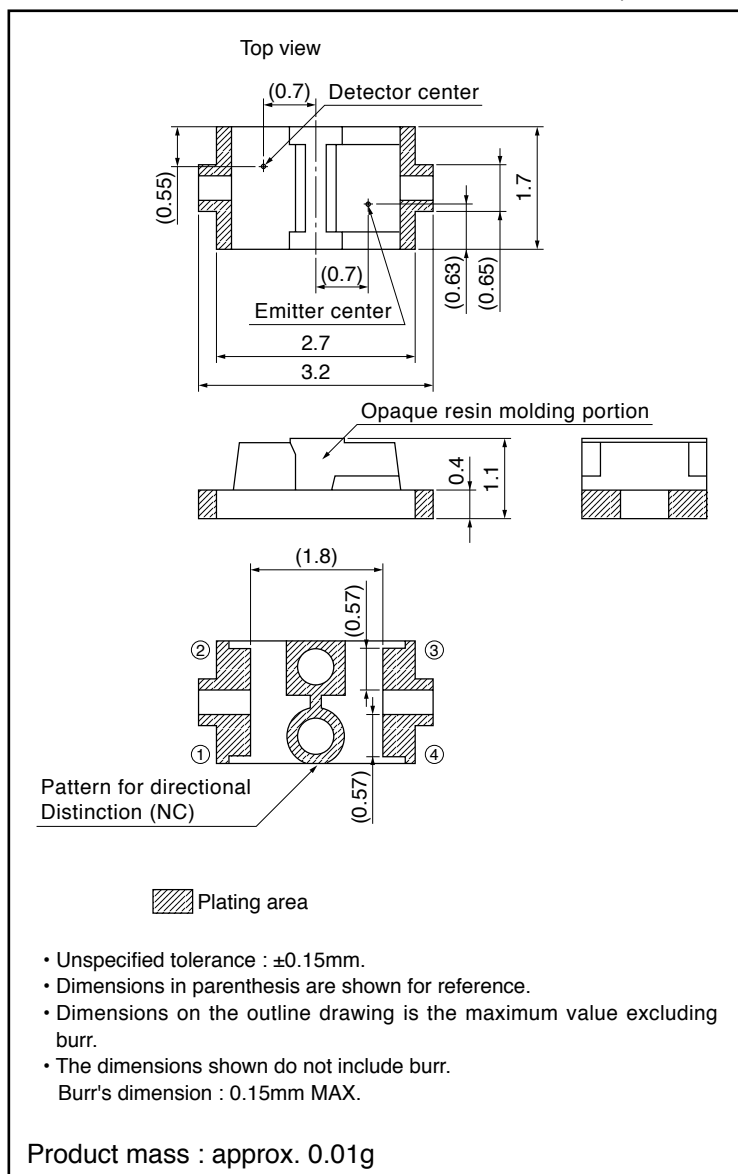
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## Internal Connection Diagram



## Outline Dimensions

(Unit : mm)



Plating material : Au

Country of origin  
Japan

## Absolute Maximum Ratings

(T<sub>a</sub>=25°C)

|                          | Parameter                   | Symbol           | Rating      | Unit |
|--------------------------|-----------------------------|------------------|-------------|------|
| Input                    | Forward current             | I <sub>F</sub>   | 50          | mA   |
|                          | Reverse voltage             | V <sub>R</sub>   | 6           | V    |
|                          | Power dissipation           | P <sub>D</sub>   | 75          | mW   |
| Output                   | Collector-emitter voltage   | V <sub>CEO</sub> | 35          | V    |
|                          | Emitter-collector voltage   | V <sub>ECO</sub> | 6           | V    |
|                          | Collector current           | I <sub>C</sub>   | 20          | mA   |
|                          | Collector power dissipation | P <sub>C</sub>   | 75          | mW   |
| Total power dissipation  |                             | P <sub>tot</sub> | 100         | mW   |
| Operating temperature    |                             | T <sub>opr</sub> | -25 to +85  | °C   |
| Storage temperature      |                             | T <sub>stg</sub> | -40 to +100 | °C   |
| *1 Soldering temperature |                             | T <sub>sol</sub> | 260         | °C   |

\*1 For 5s or less

## Electro-optical Characteristics

(T<sub>a</sub>=25°C)

|                          | Parameter              |           | Symbol            | Condition                                                                 | MIN. | TYP. | MAX. | Unit |
|--------------------------|------------------------|-----------|-------------------|---------------------------------------------------------------------------|------|------|------|------|
| Input                    | Forward voltage        |           | V <sub>F</sub>    | I <sub>F</sub> =20mA                                                      | –    | 1.2  | 1.4  | V    |
|                          | Reverse current        |           | I <sub>R</sub>    | V <sub>R</sub> =6V                                                        | –    | –    | 10   | μA   |
| Output                   | Collector dark current |           | I <sub>CEO</sub>  | V <sub>CE</sub> =20V                                                      | –    | 1    | 100  | nA   |
| Transfer characteristics | *2 Collector Current   |           | I <sub>C</sub>    | I <sub>F</sub> =4mA, V <sub>CE</sub> =2V                                  | 40   | 85   | 130  | μA   |
|                          | *3 Leak current        |           | I <sub>LEAK</sub> | I <sub>F</sub> =4mA, V <sub>CE</sub> =2V                                  | –    | –    | 500  | nA   |
|                          | Response time          | Rise time | t <sub>r</sub>    | V <sub>CE</sub> =2V, I <sub>C</sub> =100μA,<br>R <sub>L</sub> =1kΩ, d=1mm | –    | 20   | 100  | μs   |
|                          |                        | Fall time | t <sub>f</sub>    |                                                                           | –    | 20   | 100  |      |

\*2 The condition and arrangement of the reflective object are shown below.

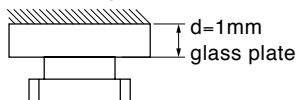
The rank splitting of collector current (I<sub>C</sub>) shall be executed according to the table below.

| Rank | Collector current, I <sub>C</sub> [μA]<br>(I <sub>F</sub> =4mA, V <sub>CE</sub> =2V) |
|------|--------------------------------------------------------------------------------------|
| A    | 40 to 80                                                                             |
| B    | 65 to 130                                                                            |

\*3 Without reflective object.

## Test Condition and Arrangement for Collector Current

Aluminum evaporation

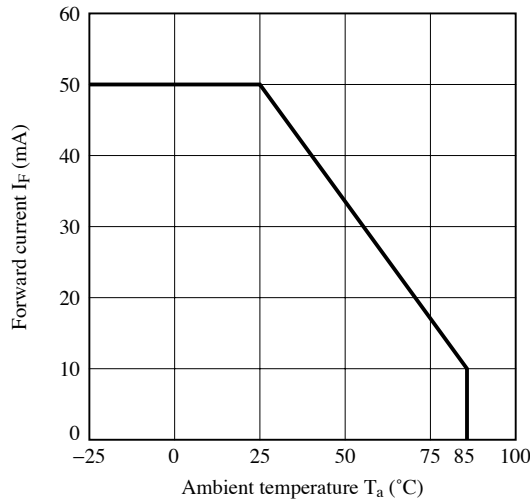


**■ Model Line-up**

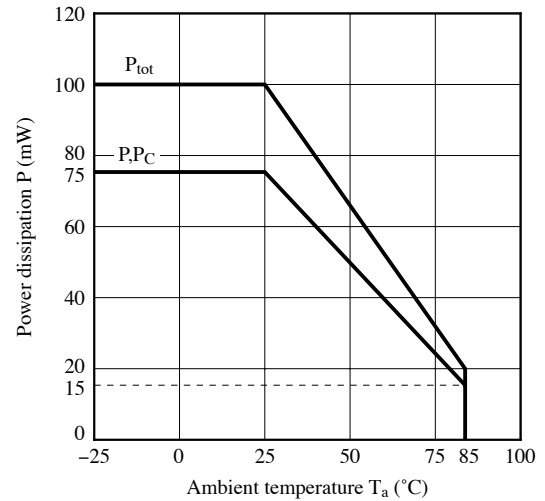
| Model No.      | Rank   | I <sub>C</sub> (μA) | Conditions                                                         |
|----------------|--------|---------------------|--------------------------------------------------------------------|
| <b>GP2S60</b>  | A or B | 40 to 130           | I <sub>F</sub> =4mA<br>V <sub>CE</sub> =2V<br>T <sub>a</sub> =25°C |
| <b>GP2S60A</b> | A      | 40 to 80            |                                                                    |
| <b>GP2S60B</b> | B      | 65 to 130           |                                                                    |

Please contact a local SHARP sales representative to see the actual status of the production.

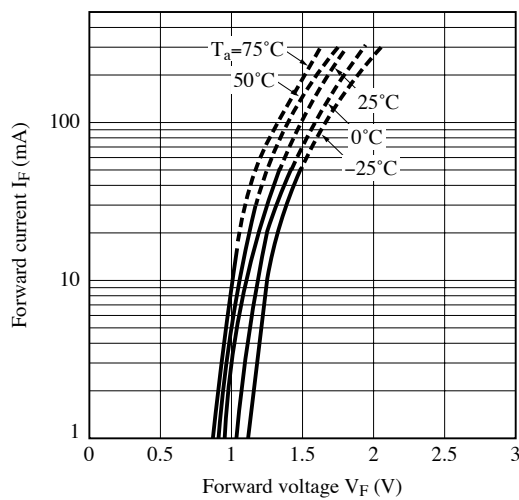
**Fig.1 Forward Current vs. Ambient Temperature**



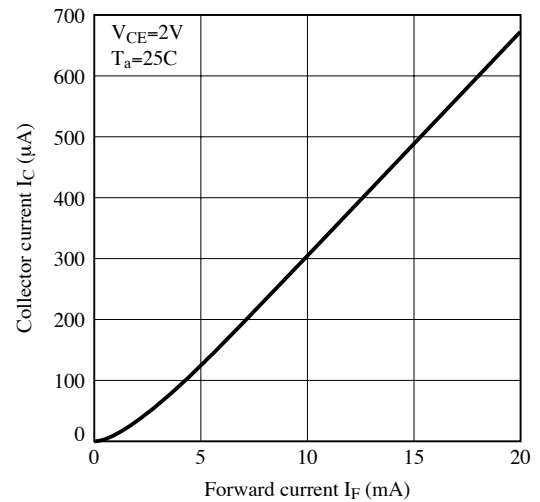
**Fig.2 Collector Power Dissipation vs. Ambient Temperature**



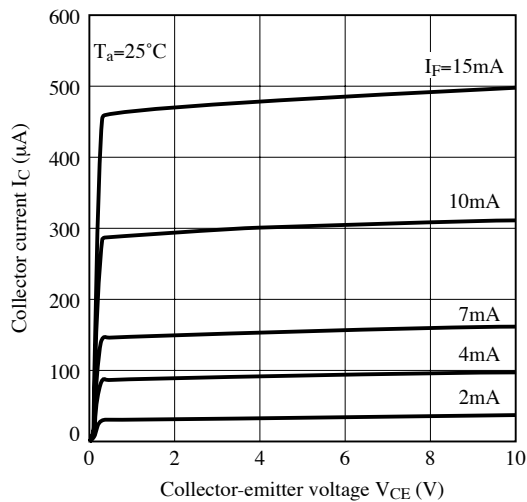
**Fig.3 Forward Current vs. Forward Voltage**



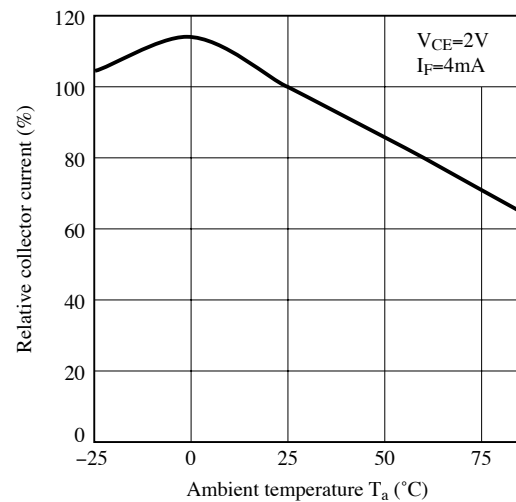
**Fig.4 Collector Current vs. Forward Current**



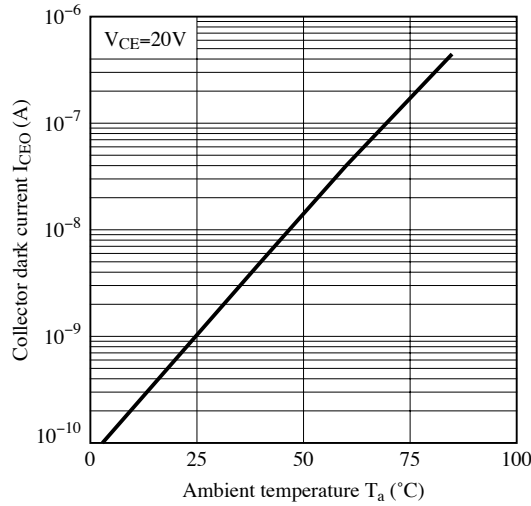
**Fig.5 Collector Current vs. Collector-Emitter Voltage**



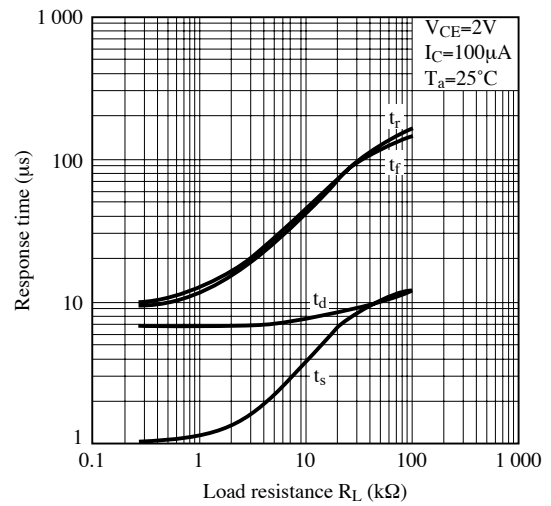
**Fig.6 Relative Collector Current vs. Ambient Temperature**



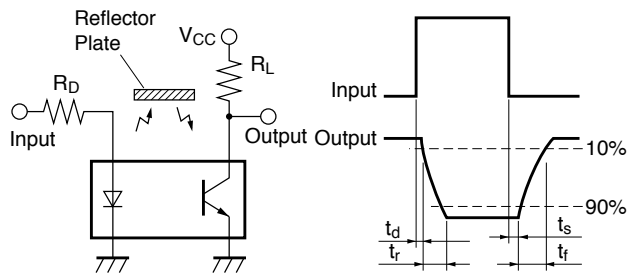
**Fig.7 Collector Dark Current vs. Ambient Temperature**



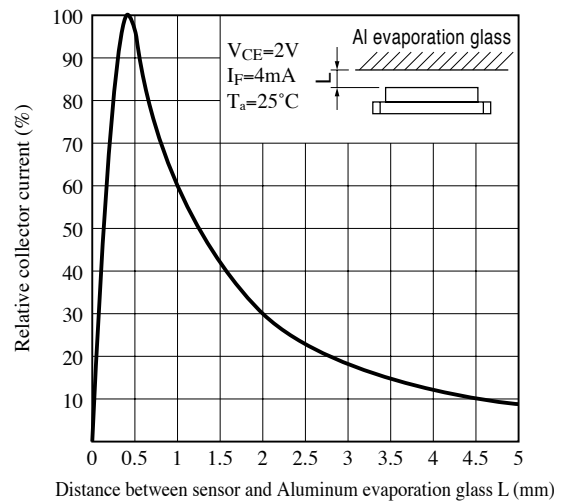
**Fig.8 Response Time vs. Load Resistance**



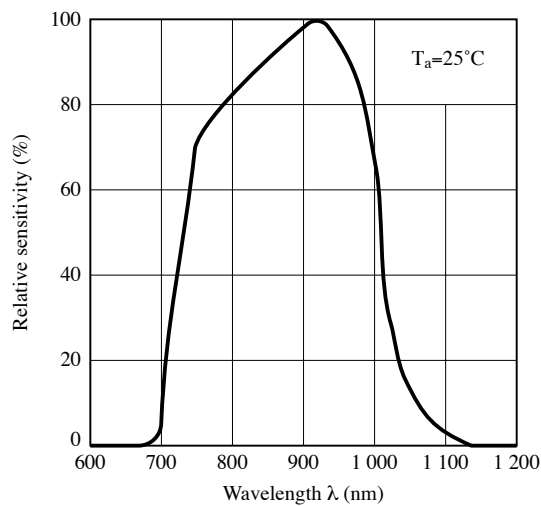
**Fig.9 Test Circuit for Response Time**



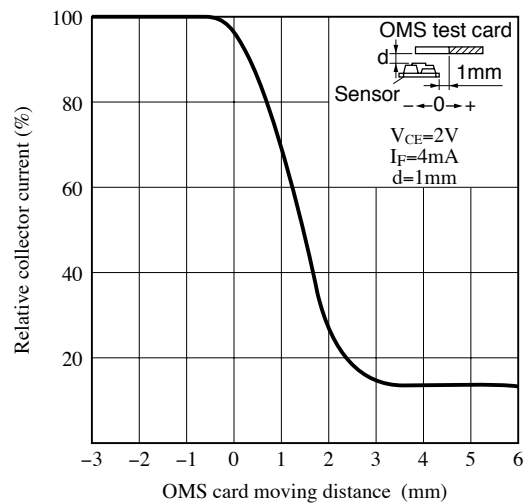
**Fig.10 Relative Collector Current vs. Distance**



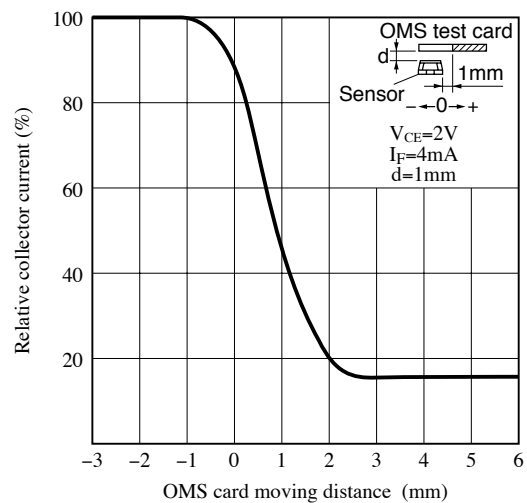
**Fig.11 Spectral Sensitivity**



**Fig.12 Detecting Position Characteristics (1)**



**Fig.13 Detecting Position Characteristics (2)**



Remarks : Please be aware that all data in the graph are just for reference and not for guarantee.

## ■ Design Considerations

### ● Design guide

- 1) Regarding to prevention of malfunction  
To prevent photointerrupter from faulty operation caused by external light, do not set the detecting face to the external light.
- 2) Distance characteristic  
The distance between the photointerrupter and the object to be detected shall be determined the distance by referencing Fig.10 "Relative collector current vs. distance".
- 3) For wiring on a mounting PCB  
To avoid possibility for short, please do not apply pattern wiring on the back side of the device.
- 4) Regarding to mounting this product  
There is a possibility that the opaque molded resin portion may have a crack by force at mounting etc.  
Please use this product after well confirmation of conditions in your production line.

This product is not designed against irradiation and incorporates non-coherent IRED.

### ● Degradation

In the case of long term operation, please take the general IRED degradation (50% degradation over 5 years) into the design consideration.

### ● Parts

This product is assembled using the below parts.

#### • Light detector (qty. : 1)

| Category        | Material     | Maximum Sensitivity wavelength (nm) | Sensitivity wavelength (nm) | Response time (μs) |
|-----------------|--------------|-------------------------------------|-----------------------------|--------------------|
| Phototransister | Silicon (Si) | 930                                 | 700 to 1 200                | 20                 |

#### • Light emitter (qty. : 1)

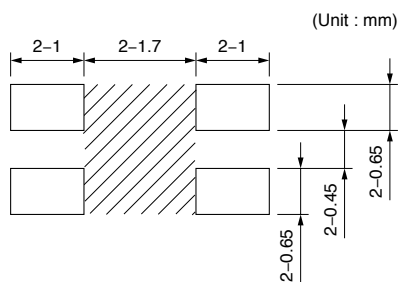
| Category                               | Material                | Maximum light emitting wavelength (nm) | I/O Frequency (MHz) |
|----------------------------------------|-------------------------|----------------------------------------|---------------------|
| Infrared emitting diode (non-coherent) | Gallium arsenide (GaAs) | 950                                    | 0.3                 |

#### • Material

| Case                                       | PCB               | Lead frame plating |
|--------------------------------------------|-------------------|--------------------|
| Epoxy resin<br>Black polyphenylene sulfide | Glass epoxy resin | Au plating         |



## ● Recommended pattern



 area : Please do not apply the pattern wiring to avoid the possibility of short circuit.

Regarding amount of solder, if there is solder leakage in terminal wiring pattern between PCB and housing main body, the reliability will be deteriorated.

Please check the proper amount of solder in advance not to have solder leakage into terminal wiring pattern between PCB and housing main body.

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**■ Manufacturing Guidelines****● Storage and management after open****Storage condition**

Storage temp.: 5 to 30°C, Storage humidity : 70%RH or less at regular packaging.

**Treatment after opening the moisture-proof package**

After opening, you should mount the products while keeping them on the condition of 5 to 25°C and 70%RH or less in humidity within 4 days.

After opening the bag once even if the prolonged storage is necessary, you should mount the products within two weeks.

And when you store the rest of products you should put into a DRY BOX. Otherwise after the rest of products and silicagel are sealed up again, you should keep them under the condition of 5 to 30°C and 70%RH or less in humidity.

**Baking before mounting**

When the above-mentioned storage method could not be executed, please process the baking treatment before mounting the products.

However the baking treatment is permitted within one time.

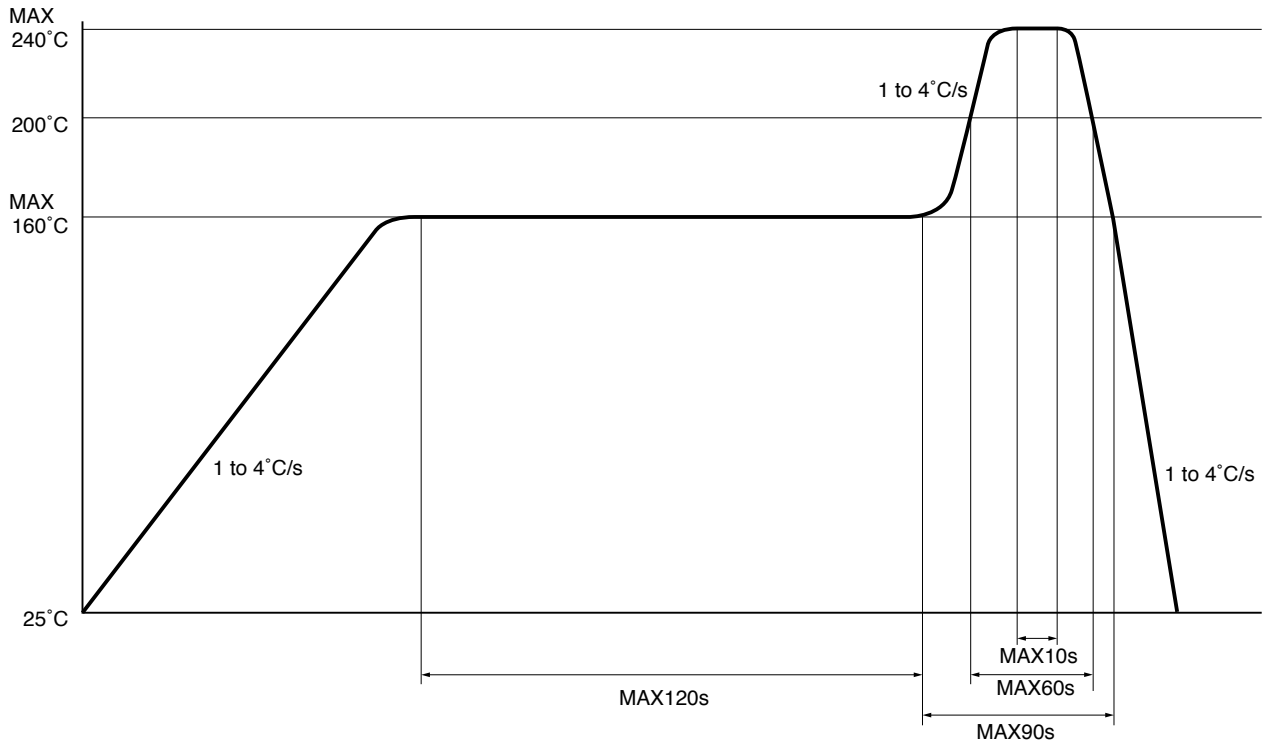
Recommended condition : 125°C, 16 to 24 hours

\*Do not process the baking treatment with the product wrapped. When the baking treatment processing, you should move the products to a metallic tray or fix temporarily the products to substrate.

## ● Soldering Method

### Reflow Soldering:

Reflow soldering should follow the temperature profile shown below.  
Soldering should not exceed the curve of temperature profile and time.  
Please solder within one time.



### Other notice

Please take care not to let any external force exert on lead pins.  
Please test the soldering method in actual condition and make sure the soldering works fine, since the impact on the junction between the device and PCB varies depending on the cooling and soldering conditions.

## ● Cleaning instructions

### Solvent cleaning :

Solvent temperature should be 45°C or below. Immersion time should be 3 minutes or less.

### Ultrasonic cleaning :

Do not execute ultrasonic cleaning.

### Recommended solvent materials :

Ethyl alcohol, Methyl alcohol and Isopropyl alcohol.

**● Presence of ODC**

This product shall not contain the following materials.

And they are not used in the production process for this product.

Regulation substances : CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform)

Specific brominated flame retardants such as the PBBOs and PBBs are not used in this product at all.

This product shall not contain the following materials banned in the RoHS Directive (2002/95/EC).

- Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE).

## ■ Package specification

### ● Tape and Reel package

#### Package materials

Carrier tape : PS (with anti-static material)

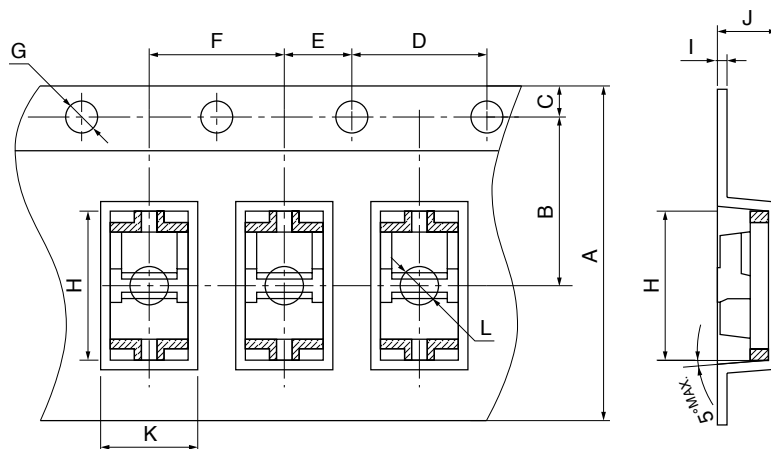
Cover tape : PET (three layer system)

Reel : PS

#### Package method

2 000 pcs of products shall be packaged in a reel. One reel with silicagel is enclosed in aluminum laminated bag. After sealing up the bag, it is enclosed in one case (5 bags/case).

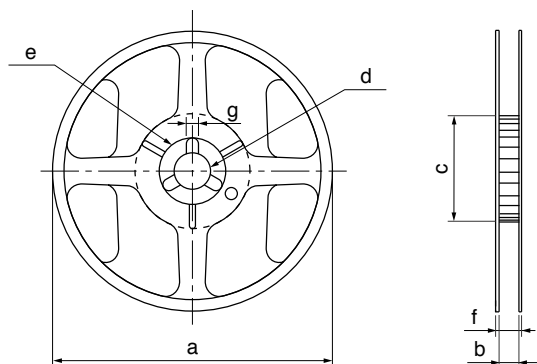
#### Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

| A                    | B              | C              | D              | E             | F                  |
|----------------------|----------------|----------------|----------------|---------------|--------------------|
| $8 \pm 0.3$          | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $4 \pm 0.1$    | $2 \pm 0.1$   | $4 \pm 0.1$        |
| G                    | H              | I              | J              | K             | L                  |
| $\phi 1.55 \pm 0.05$ | $3.6 \pm 0.1$  | $0.3 \pm 0.05$ | $1.25 \pm 0.1$ | $2.2 \pm 0.1$ | $\phi 1.1 \pm 0.1$ |

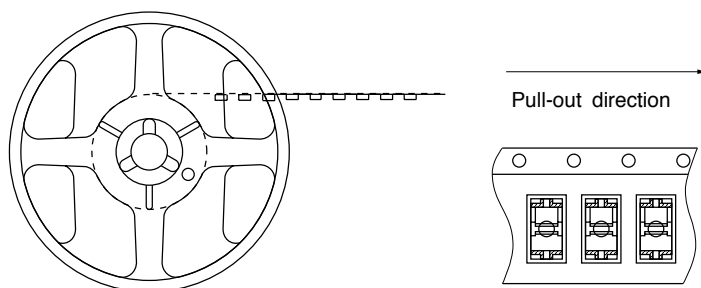
#### Reel structure and Dimensions



Dimensions List (Unit : mm)

| a                 | b            | c                | d                 |
|-------------------|--------------|------------------|-------------------|
| 180               | $9 \pm 1$    | $60^{+0.5}_{-0}$ | $\phi 13 \pm 0.2$ |
| e                 | f            | g                |                   |
| $\phi 21 \pm 0.8$ | $11.4 \pm 1$ | $2^{+0.3}_{-0}$  |                   |

### Direction of product insertion



[Packing : 2 000pcs/reel]

### Storage method

Storage conditions should follow the condition shown below.

Storage temperature : 5 to 30°C

Storage humidity : 70%RH or less

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- 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

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

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- Nuclear power control equipment
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