

# PC1S3021NTZF Series

$V_{\text{DRM}} : 400\text{V}$

Non-zero cross type

DIP 6pin

Phototriac Coupler for triggering



## ■ Description

**PC1S3021NTZF Series** Phototriac Coupler include an infrared emitting diode (IRED) optically coupled to an output Phototriac.

These devices feature full wave control and are ideal isolated drivers for medium to high current Triacs.

DIP package provides 5kV isolation from input to output with superior commutative noise immunity.

## ■ Features

1. High repetitive peak off-state voltage ( $V_{\text{DRM}} : 400\text{V}$ )
2. Non-zero crossing functionality
3. 6pin DIP package
4. Superior noise immunity ( $dV/dt : \text{MIN. } 1\,000\text{V}/\mu\text{s}$ )
5. Double transfer mold construction (Ideal for Flow Soldering)
6. High isolation voltage between input and output ( $V_{\text{iso}}(\text{rms}) : 5\text{kV}$ )
7. Lead-free and RoHS directive compliant

## ■ Agency approvals/Compliance

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **1S3021**)
2. Approved by CSA, file No. CA95323 (as model No. **1S3021**)
3. Optionary available VDE Approved (DIN EN 60747-5-2), file No. 4008189 (as model No. **1S3021**)
4. Package resin : UL flammability grade (94V-0)

## ■ Applications

1. Triggering for Triacs used to switch on and off devices which require AC Loads  
For example heaters, fans, motors, solenoids, and valves
2. Triggering for Triacs used for implementing phase control in applications such as lighting control and temperature control (HVAC).
3. AC line control in power supply applications.

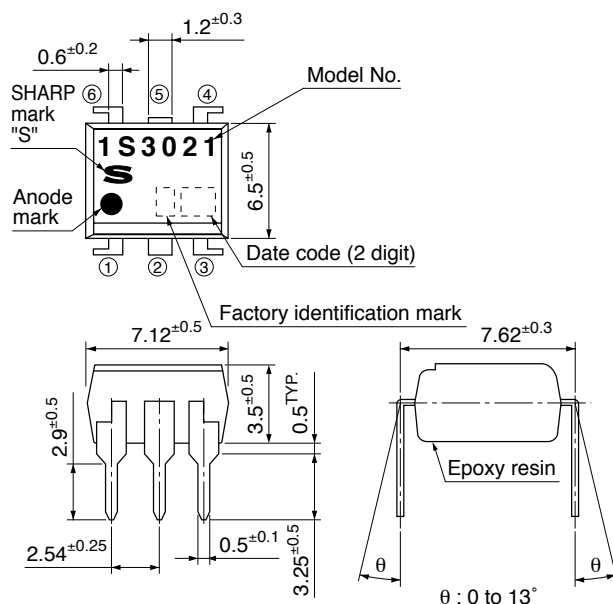
## Internal Connection Diagram



## Outline Dimensions

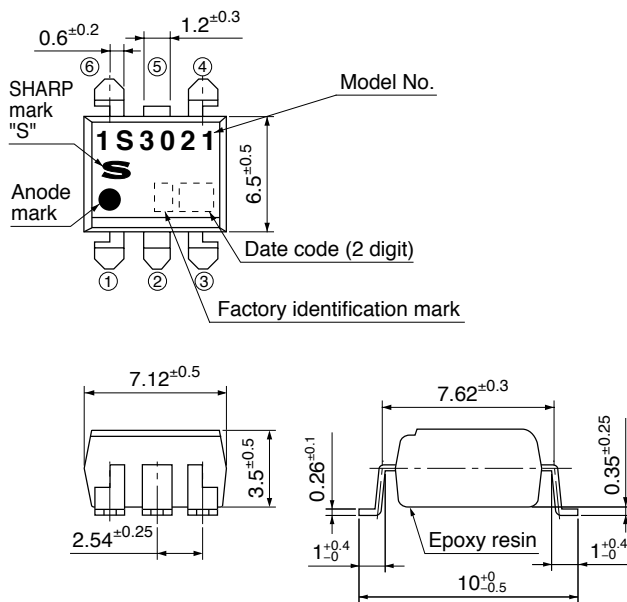
(Unit : mm)

### 1. Through-Hole [ex. PC1S3021NTZF]



Product mass : approx. 0.35g

### 2. SMT Gullwing Lead-Form [ex. PC1S3021NXPf]



Product mass : approx. 0.33g

\*Pin ⑤ is not allowed external connection

Plating material : SnCu (Cu : TYP. 2%)

## Date code (2 digit)

| 1st digit          |      |      |      | 2nd digit           |      |
|--------------------|------|------|------|---------------------|------|
| Year of production |      |      |      | Month of production |      |
| A.D.               | Mark | A.D. | Mark | Month               | Mark |
| 1990               | A    | 2002 | P    | January             | 1    |
| 1991               | B    | 2003 | R    | February            | 2    |
| 1992               | C    | 2004 | S    | March               | 3    |
| 1993               | D    | 2005 | T    | April               | 4    |
| 1994               | E    | 2006 | U    | May                 | 5    |
| 1995               | F    | 2007 | V    | June                | 6    |
| 1996               | H    | 2008 | W    | July                | 7    |
| 1997               | J    | 2009 | X    | August              | 8    |
| 1998               | K    | 2010 | A    | September           | 9    |
| 1999               | L    | 2011 | B    | October             | O    |
| 2000               | M    | 2012 | C    | November            | N    |
| 2001               | N    | :    | :    | December            | D    |

repeats in a 20 year cycle

## Factory identification mark

| Factory identification Mark                                                                                                                                                | Country of origin |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| no mark                                                                                                                                                                    | Japan             |
|                                                                                          |                   |
|                                                                                         | Indonesia         |
|                                                                                         | Philippines       |
|  or  | China             |

\* This factory marking is for identification purpose only.

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

## Rank mark

There is no rank mark indicator.

### ■ Absolute Maximum Ratings

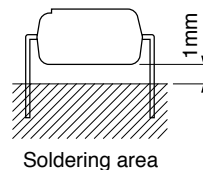
(T<sub>a</sub>=25°C)

| Parameter                           |                                   | Symbol                | Rating            | Unit |
|-------------------------------------|-----------------------------------|-----------------------|-------------------|------|
| Input                               | Forward current                   | I <sub>F</sub>        | 50                | mA   |
|                                     | Reverse voltage                   | V <sub>R</sub>        | 6                 | V    |
| Output                              | RMS ON-state current              | I <sub>T(rms)</sub>   | 0.1               | A    |
|                                     | Peak one cycle surge current      | I <sub>surge</sub>    | 1.2 <sup>*3</sup> | A    |
|                                     | Repetitive peak OFF-state voltage | V <sub>DRM</sub>      | 400               | V    |
| <sup>*1</sup> Isolation voltage     |                                   | V <sub>iso(rms)</sub> | 5                 | kV   |
| Operating temperature               |                                   | T <sub>opr</sub>      | −30 to +100       | °C   |
| Storage temperature                 |                                   | T <sub>stg</sub>      | −55 to +125       | °C   |
| <sup>*2</sup> Soldering temperature |                                   | T <sub>sol</sub>      | 270               | °C   |

<sup>\*1</sup> 40 to 60%RH, AC for 1minute, f=60Hz

<sup>\*2</sup> For 10s

<sup>\*3</sup> f=50Hz sine wave



### ■ Electro-optical Characteristics

(T<sub>a</sub>=25°C)

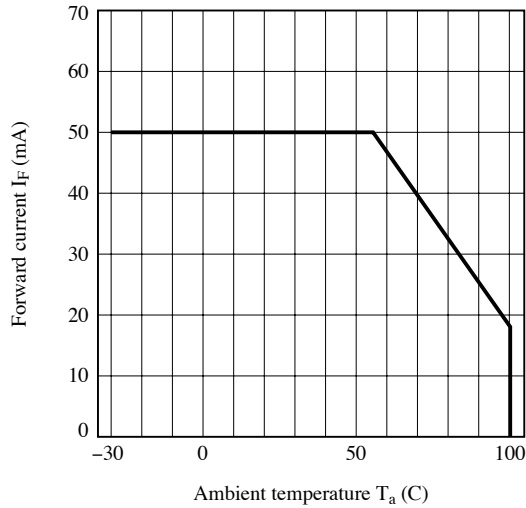
| Parameter                |                                            | Symbol           | Condition                                                      | MIN.               | TYP.             | MAX. | Unit |
|--------------------------|--------------------------------------------|------------------|----------------------------------------------------------------|--------------------|------------------|------|------|
| 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> =3V                                             | –                  | –                | 10   | μA   |
| Output                   | Repetitive peak OFF-state current          | I <sub>DRM</sub> | V <sub>D</sub> =V <sub>DRM</sub>                               | –                  | –                | 1    | μA   |
|                          | ON-state voltage                           | V <sub>T</sub>   | I <sub>T</sub> =0.1A                                           | –                  | –                | 2.5  | V    |
|                          | Holding current                            | I <sub>H</sub>   | V <sub>D</sub> =6V                                             | 0.1                | –                | 3.5  | mA   |
|                          | Critical rate of rise of OFF-state voltage | dV/dt            | V <sub>D</sub> =1/√2 · V <sub>DRM</sub>                        | 1 000              | –                | –    | V/μs |
| Transfer characteristics | Minimum trigger current                    | I <sub>FT</sub>  | V <sub>D</sub> =6V, R <sub>L</sub> =100Ω                       | –                  | –                | 15   | mA   |
|                          | Isolation resistance                       | R <sub>ISO</sub> | DC500V, 40 to 60%RH                                            | 5×10 <sup>10</sup> | 10 <sup>11</sup> | –    | Ω    |
|                          | Turn-on time                               | t <sub>ON</sub>  | V <sub>D</sub> =6V, R <sub>L</sub> =100Ω, I <sub>F</sub> =20mA | –                  | –                | 50   | μs   |

**■ Model Line-up**

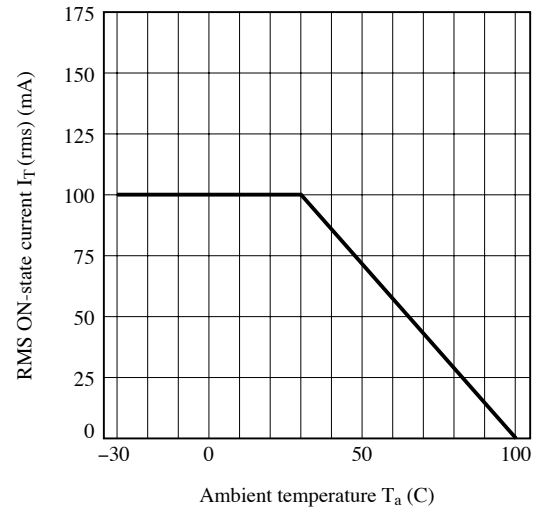
| Lead Form | Through-Hole        | SMT Gullwing Form   |                     |
|-----------|---------------------|---------------------|---------------------|
| Package   | Sleeve              |                     | Taping              |
|           | 50 pcs/sleeve       |                     | 1 000 pcs/reel      |
| Model No. | <b>PC1S3021NTZF</b> | <b>PC1S3021NXZF</b> | <b>PC1S3021NXPF</b> |

Please contact a local SHARP sales representative to inquire about production status or any product related questions.

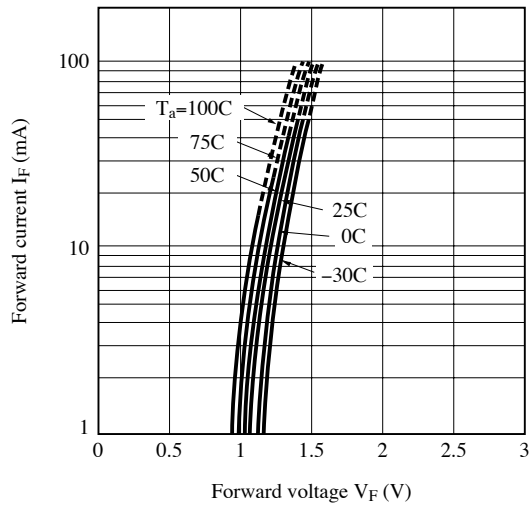
**Fig.1 Forward Current vs. Ambient Temperature**



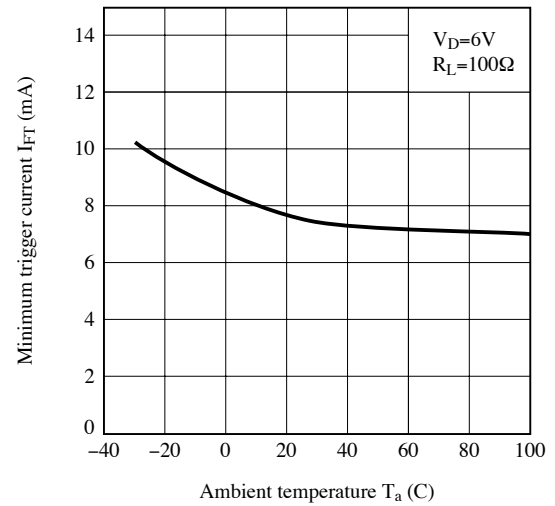
**Fig.2 RMS ON-state Current vs. Ambient Temperature**



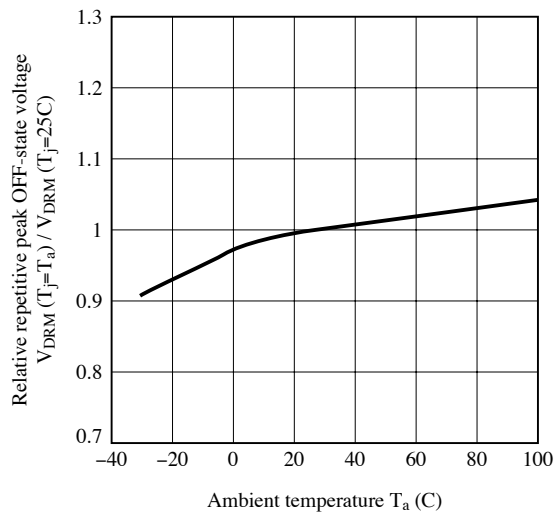
**Fig.3 Forward Current vs. Forward Voltage**



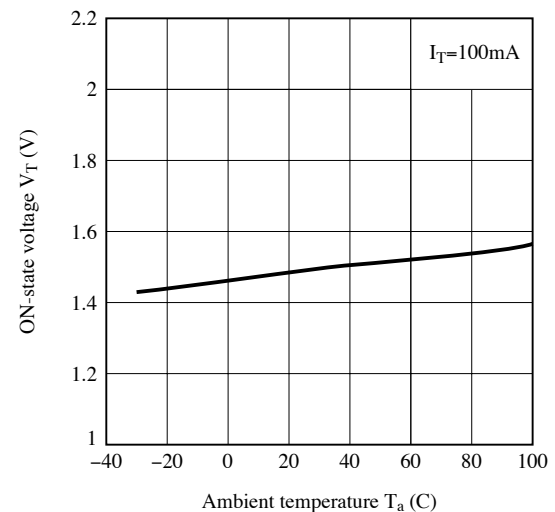
**Fig.4 Minimum Trigger Current vs. Ambient Temperature**



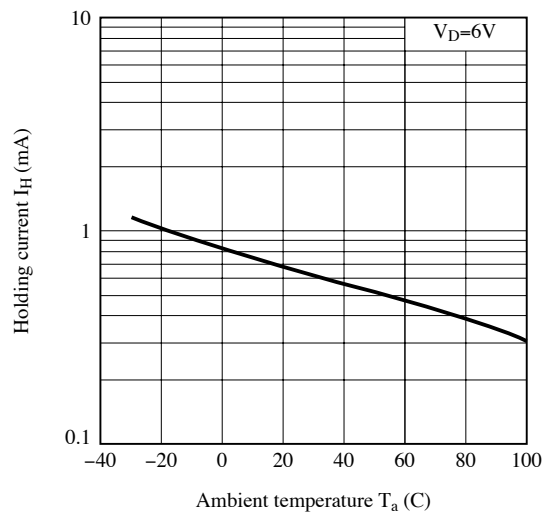
**Fig.5 Relative Repetitive Peak OFF-state Voltage vs. Ambient Temperature**



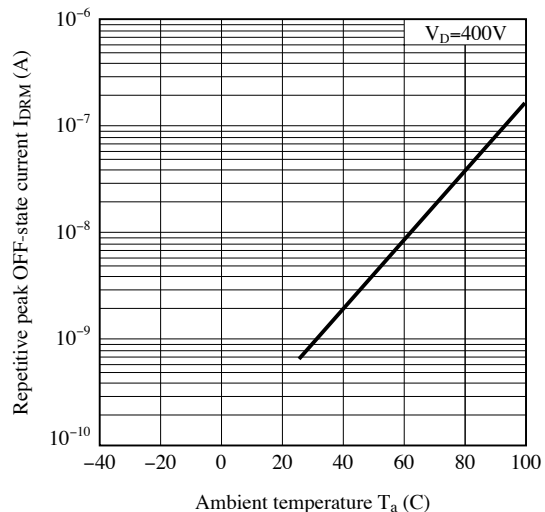
**Fig.6 ON-state Voltage vs. Ambient Temperature**



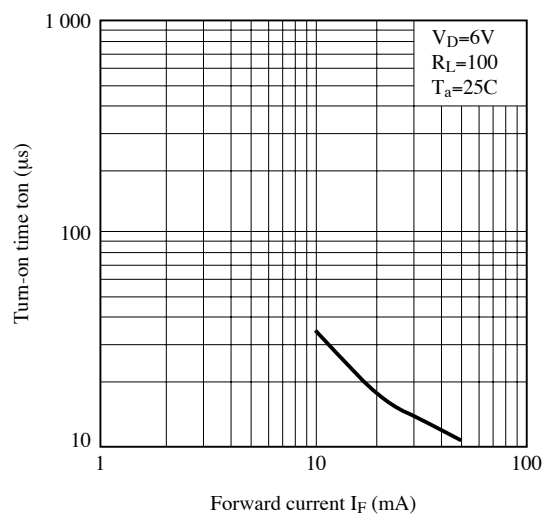
**Fig.7 Holding Current vs. Ambient Temperature**



**Fig.8 Repetitive Peak OFF-state Current vs. Ambient Temperature**



**Fig.9 Turn-on Time vs. Forward Current**



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

## ■ Design Considerations

### ● Design guide

In order for the Phototriac to turn off, the triggering current ( $I_F$ ) must be 0.1mA or less

Please refrain from using these devices in a direct drive configuration.

These Phototriac Coupler are intended to be used as triggering device for main Triacs.

Please ensure that the output rating of these devices will be sufficient for triggering the main output Triac of your choice. Failure to do may result in malfunctions.

In phase control applications or where the Phototriac Coupler is being by a pulse signal, please ensure that the pulse width is a minimum of 1ms

For designs that will experience excessive noise or sudden changes in load voltage, please include an appropriate snubber circuit as shown in the below circuit.

Please keep in mind that Sharp Phototriac Couplers incorporate superior dV/dt ratings which can often eliminate the need for a snubber circuit.

### ● Degradation

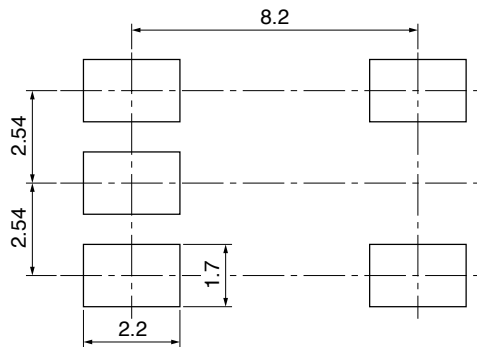
In general, the emission of the IRED used in Phototriac Couplers will degrade over time.

In the case where long term operation and / or constant extreme temperature fluctuations will be applied to the devices, please allow for a worst case scenario of 50% degradation over 5 years.

Therefore in order to maintain proper operation, a design implementing these Phototriac Couplers should provide at least twice the minimum required triggering current from initial operation.

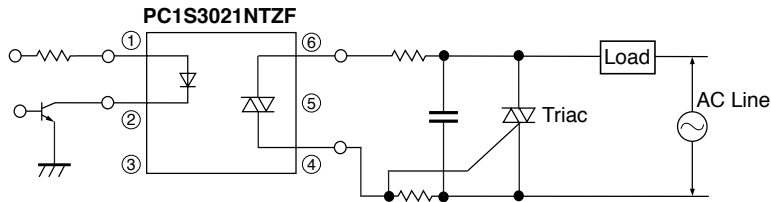
### ● Recommended foot print (reference)

SMT Gullwing Lead-form



(Unit : mm)

## ● Standard Circuit (Medium/High Power Triac Drive Circuit)



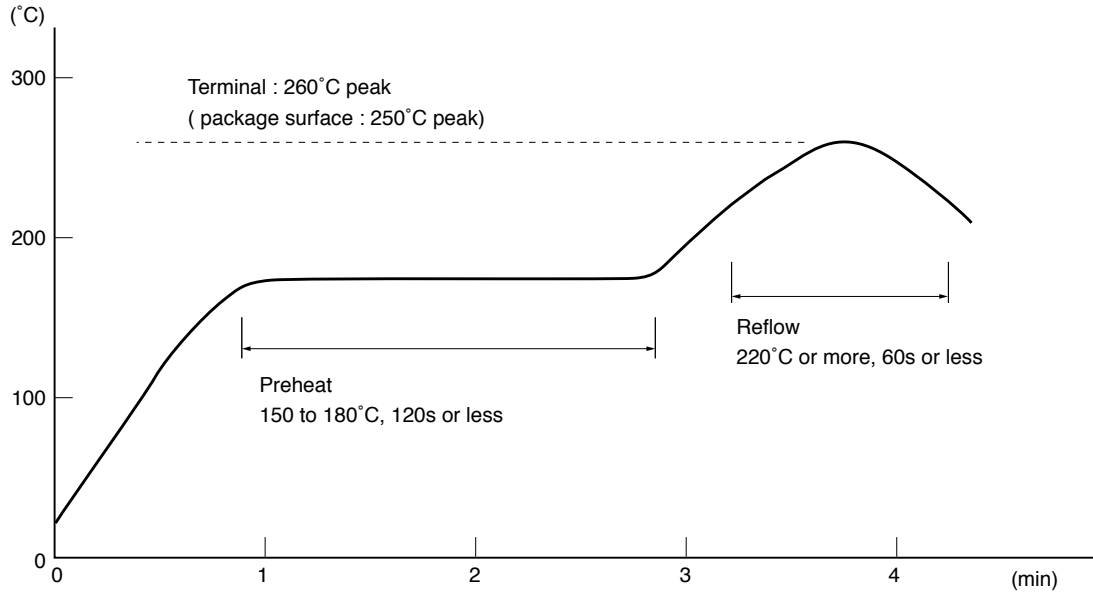
Note) Please add the snubber circuit according to a condition.  
Any snubber or varistor used for the above mentioned scenarios should be located as close to the main output triac as possible.

## ■ Manufacturing Guidelines

### ● 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 don't solder more than twice.



#### Flow Soldering :

Due to SHARP's double transfer mold construction submersion in flow solder bath is allowed under the below listed guidelines.

Flow soldering should be completed below 270°C and within 10s.  
Preheating is within the bounds of 100 to 150°C and 30 to 80s.  
Please don't solder more than twice.

#### Hand soldering

Hand soldering should be completed within 3s when the point of solder iron is below 400°C.  
Please don't solder more than twice.

#### Other notice

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 tooling 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 :**

The impact on the device varies depending on the size of the cleaning bath, ultrasonic output, cleaning time, size of PCB and mounting method of the device.

Therefore, please make sure the device withstands the ultrasonic cleaning in actual conditions in advance of mass production.

**Recommended solvent materials :**

Ethyl alcohol, Methyl alcohol and Isopropyl alcohol.

In case the other type of solvent materials are intended to be used, please make sure they work fine in actual using conditions since some materials may erode the packaging resin.

**● 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****● Sleeve package****Package materials**

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

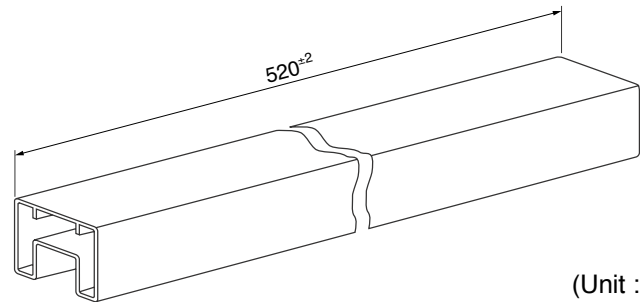
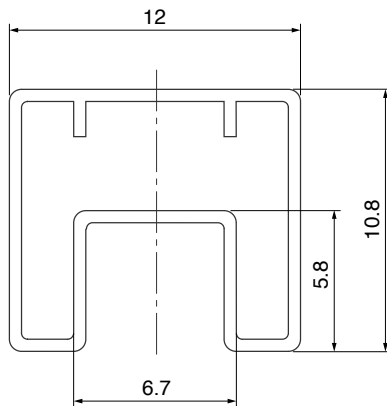
**Package method**

MAX. 50 pcs of products shall be packaged in a sleeve.

Both ends shall be closed by tabbed and tabless stoppers.

The product shall be arranged in the sleeve with its anode mark on the tabless stopper side.

MAX. 20 sleeves in one case.

**Sleeve outline dimensions**

(Unit : mm)

## ● Sleeve package

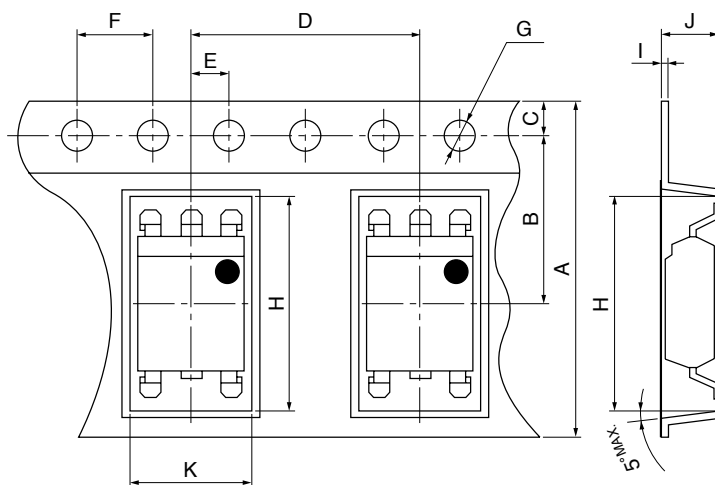
### Package materials

Carrier tape : A-PET (with anti-static material)

Cover tape : PET (three layer system)

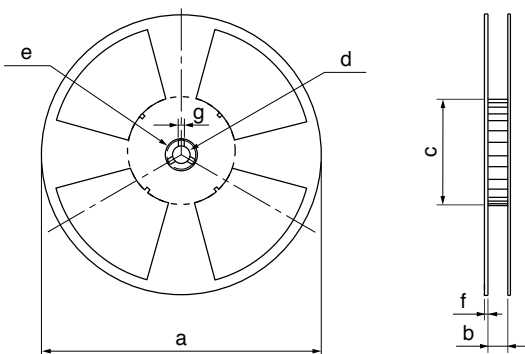
Reel : PS

### Carrier tape structure and Dimensions



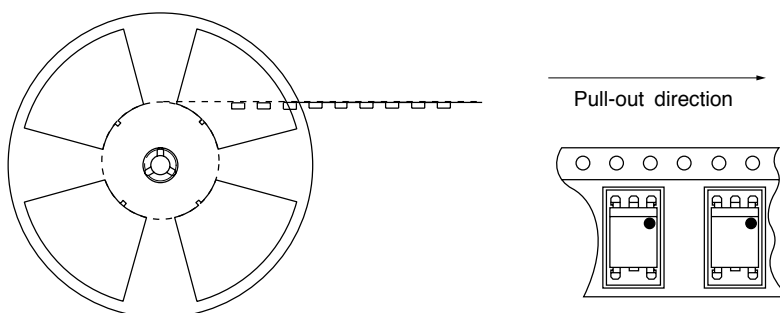
| Dimensions List (Unit:mm) |                |                |               |             |             |                      |
|---------------------------|----------------|----------------|---------------|-------------|-------------|----------------------|
| A                         | B              | C              | D             | E           | F           | G                    |
| 16 $\pm$ 0.3              | 7.5 $\pm$ 0.1  | 1.75 $\pm$ 0.1 | 12 $\pm$ 0.1  | 2 $\pm$ 0.1 | 4 $\pm$ 0.1 | $\phi$ 1.5 $\pm$ 0.1 |
| H                         | I              | J              | K             |             |             |                      |
| 10.4 $\pm$ 0.1            | 0.4 $\pm$ 0.05 | 4.2 $\pm$ 0.1  | 7.8 $\pm$ 0.1 |             |             |                      |

### Reel structure and Dimensions



| Dimensions List (Unit : mm) |                |             |              |
|-----------------------------|----------------|-------------|--------------|
| a                           | b              | c           | d            |
| 330                         | 17.5 $\pm$ 1.5 | 100 $\pm$ 1 | 13 $\pm$ 0.5 |
| e                           | f              | g           |              |
| 23 $\pm$ 1                  | 2 $\pm$ 0.5    | 2 $\pm$ 0.5 |              |

### Direction of product insertion



[Packing : 1 000 pcs/reel]

## ■ Important Notices

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(i) The devices in this publication are designed for use in general electronic equipment designs such as:

- 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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