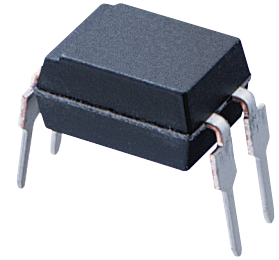


# PC1231xNSZ Series

DIP 4pin Reinforced Insulation Type,  
High CMR, Low Input Current  
Photocoupler



## ■ Description

**PC1231xNSZ Series** contains an IRED optically coupled to a phototransistor.

It is packaged in a 4-pin DIP, available in wide-lead spacing option and SMT gullwing lead-form option.

Input-output isolation voltage(rms) is 5.0kV.

CTR is 50% to 400% at input current of 0.5mA.

## ■ Features

1. 4pin DIP package
2. Double transfer mold package (Ideal for Flow Soldering)
3. Low input current type ( $I_F=0.5\text{mA}$ )
4. High resistance to noise due to high common rejection voltage (CMR : MIN.  $10\text{kV}/\mu\text{s}$ )
5. Reinforced insulation type (Isolation distance : MIN. 0.4mm)
6. Long creepage distance type (wide lead-form type only : MIN. 8mm)
7. High isolation voltage between input and output ( $V_{\text{iso(rms)}} : 5.0\text{kV}$ )

## ■ Agency approvals/Compliance

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **PC1231**)
2. Approved by BSI, BS-EN60065, file No. 7087, BS-EN60950, file No. 7409, (as model No. **PC1231**)
3. Package resin : UL flammability grade (94V-0)
4. Approved by SEMCO, EN60065, EN60950, file No. 9933036 (as model No. **PC1231**)
5. Approved by DEMCO, EN60065, EN60950, file No. 99-03814 (as model No. **PC1231**)
6. Approved by NEMKO, EN60065, EN60950, file No. P99102251 (as model No. **PC1231**)
7. Approved by FIMKO, EN60065, EN60950, file No. 13986 (as model No. **PC1231**)
8. Recognized by CSA file No. CA095323 (as model No. **PC1231**)
9. Approved by VDE, VDE0884 (as an option) file No. 83601, No. 134349 or No. 40005304(as model No. **PC1231**)

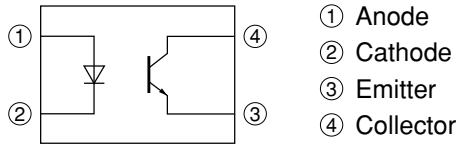
## ■ Applications

1. Primary to secondary isolation in switch mode power supply
2. Noise suppression in switching circuit
3. Signal transmission between circuits of different potentials and impedances
4. Over voltage detection

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

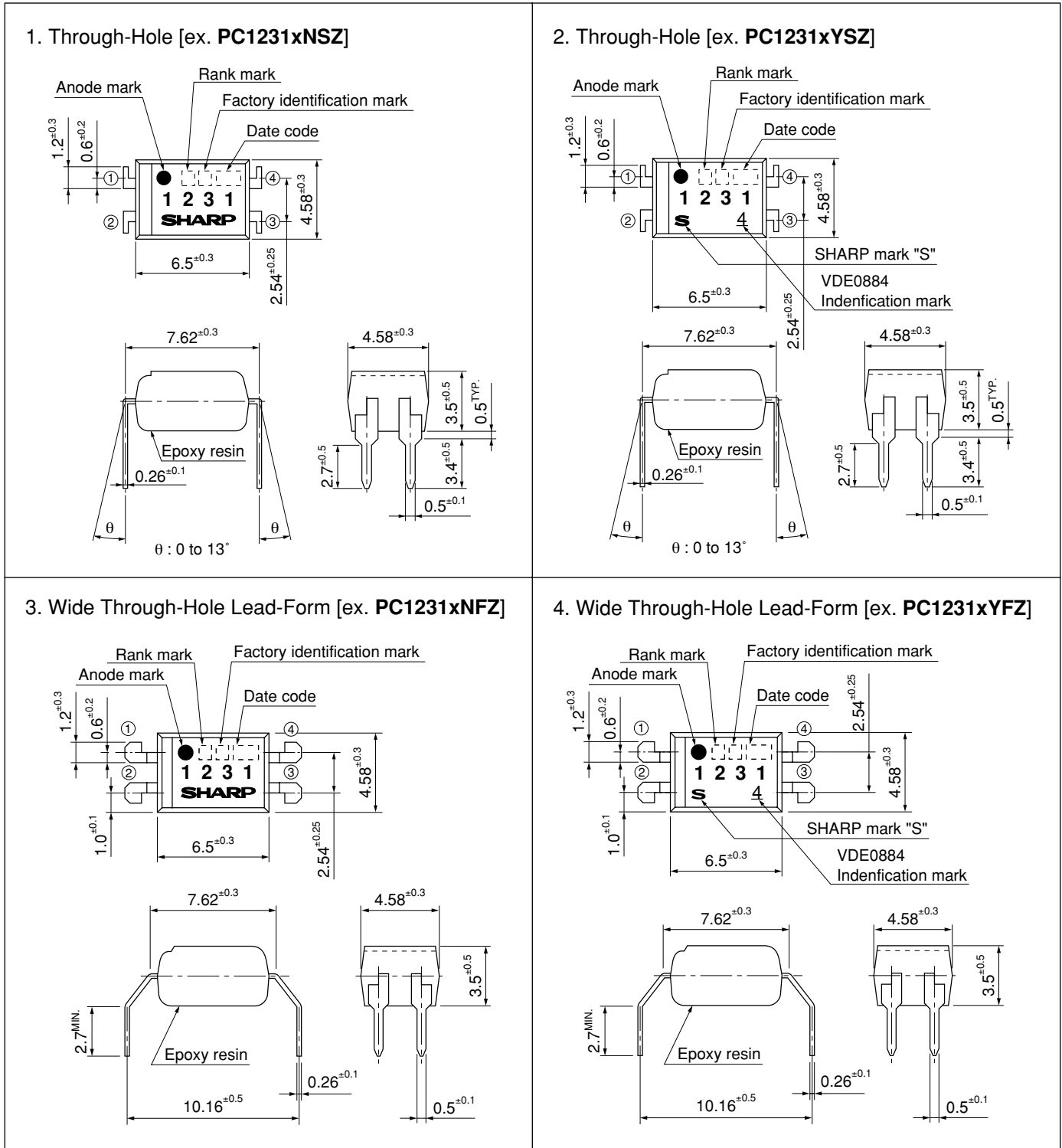
In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that may occur in equipment using any SHARP devices shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device.

■ Internal Connection Diagram



■ Outline Dimensions

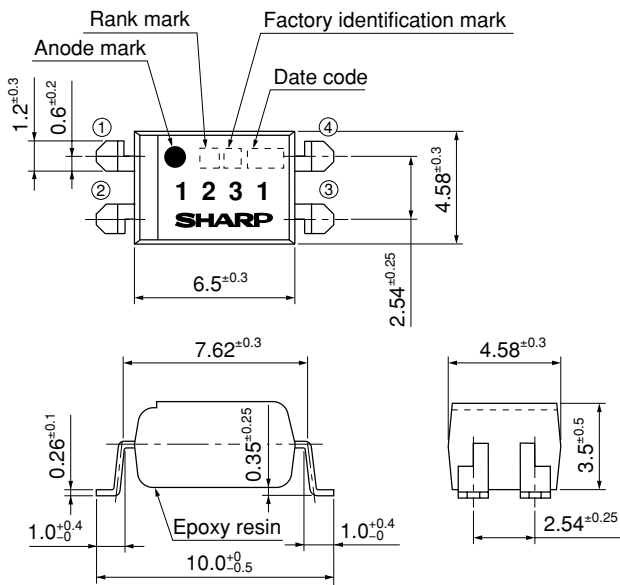
(Unit : mm)



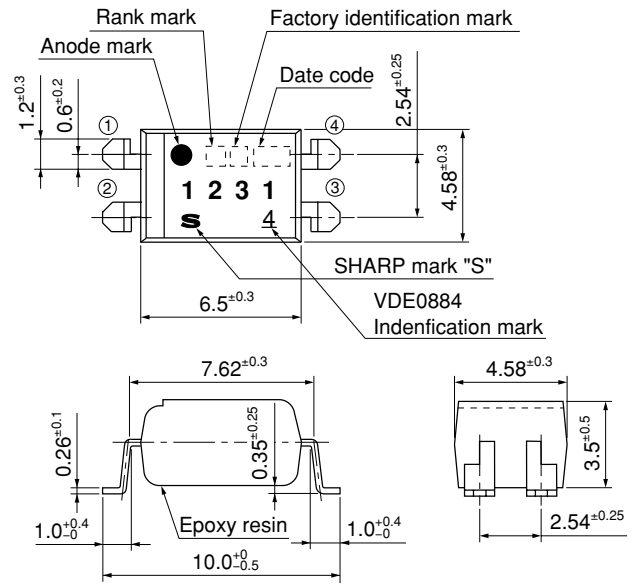
Product mass : approx. 0.18g

(Unit : mm)

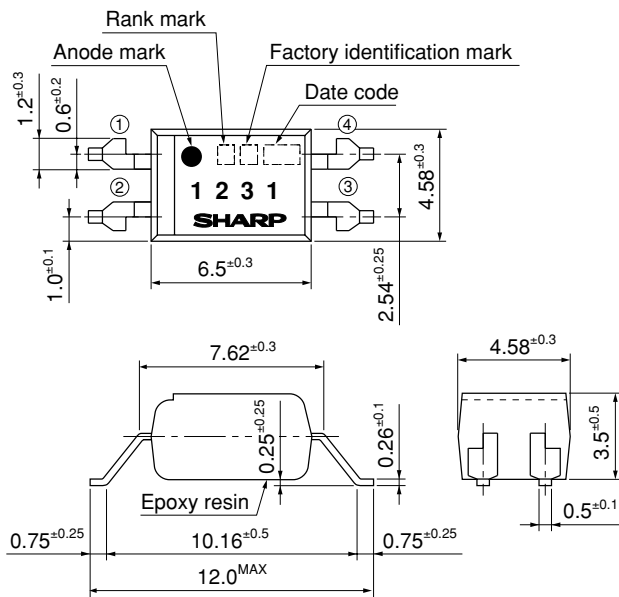
**5. SMT Gullwing Lead-Form [ex. PC1231xNIP]**



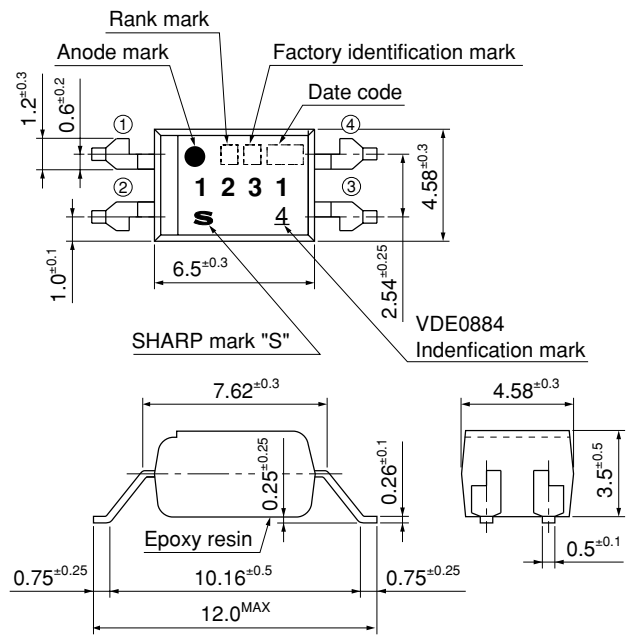
**6. SMT Gullwing Lead-Form [ex. PC1231xYIP]**



**7. Wide SMT Gullwing Lead-Form [ex. PC1231xNUP]**



**8. Wide SMT Gullwing Lead-Form [ex. PC1231xYUP]**



Product mass : approx. 0.18g

## 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       |
|  | 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

Refer to the Model Line-up table

## ■ Absolute Maximum Ratings (T<sub>a</sub>=25°C)

|        | Parameter                   | Symbol                 | Rating      | Unit |
|--------|-----------------------------|------------------------|-------------|------|
| Input  | Forward current             | I <sub>F</sub>         | 10          | mA   |
|        | *1 Peak forward current     | I <sub>FM</sub>        | 200         | mA   |
|        | Reverse voltage             | V <sub>R</sub>         | 6           | V    |
|        | Power dissipation           | P                      | 15          | mW   |
| Output | Collector-emitter voltage   | V <sub>CEO</sub>       | 70          | V    |
|        | Emitter-collector voltage   | V <sub>ECO</sub>       | 6           | V    |
|        | Collector current           | I <sub>C</sub>         | 50          | mA   |
|        | Collector power dissipation | P <sub>C</sub>         | 150         | mW   |
|        | Total power dissipation     | P <sub>tot</sub>       | 170         | mW   |
|        | *2 Isolation voltage        | V <sub>iso (rms)</sub> | 5.0         | kV   |
|        | Operating temperature       | T <sub>opr</sub>       | -30 to +100 | °C   |
|        | Storage temperature         | T <sub>stg</sub>       | -55 to +125 | °C   |
|        | *3 Soldering temperature    | T <sub>sol</sub>       | 260         | °C   |

\*1 Pulse width ≤ 100μs, Duty ratio : 0.001

\*2 40 to 60%RH, AC for 1 minute, f=60Hz

\*3 For 10s

## ■ Electro-optical Characteristics (T<sub>a</sub>=25°C)

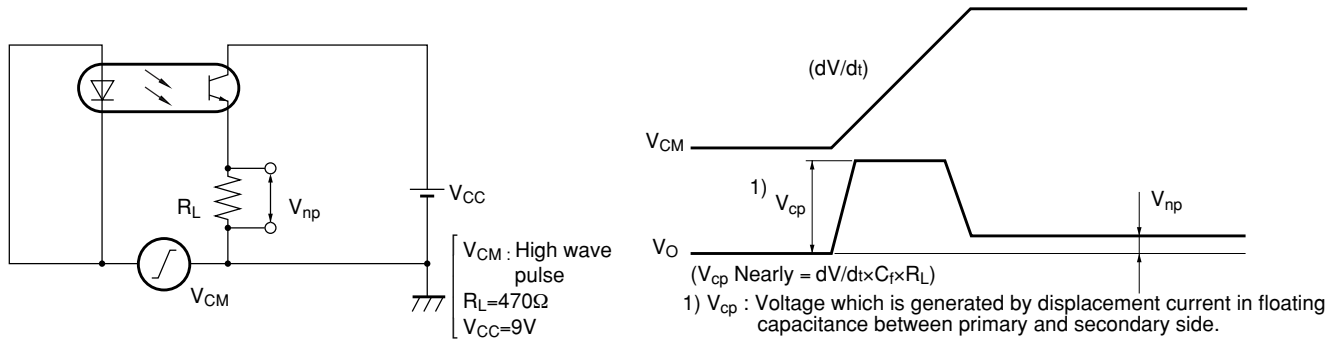
|                          | Parameter                            | Symbol                | Conditions   | MIN.   | TYP.               | MAX. | Unit  |    |
|--------------------------|--------------------------------------|-----------------------|--|--|--------------------|------|-------|----|
| Input                    | Forward voltage                      | V <sub>F</sub>        | I <sub>F</sub> =10mA   | -  | 1.2                | 1.4  | V     |    |
|                          | Reverse current                      | I <sub>R</sub>        | V <sub>R</sub> =4V   | -  | -                  | 10   | μA    |    |
|                          | Terminal capacitance                 | C <sub>t</sub>        | V=0, f=1kHz  | -  | 30                 | 250  | pF    |    |
| Output                   | Collector dark current               | I <sub>CEO</sub>      | V <sub>CE</sub> =50V, I <sub>F</sub> =0  | -  | -                  | 100  | nA    |    |
|                          | Collector-emitter breakdown voltage  | BV <sub>CEO</sub>     | I <sub>C</sub> =0.1mA, I <sub>F</sub> =0   | 70   | -                  | -    | V     |    |
|                          | Emitter-collector breakdown voltage  | BV <sub>ECO</sub>     | I <sub>E</sub> =10μA, I <sub>F</sub> =0  | 6  | -                  | -    | V     |    |
| Transfer characteristics | Collector current                    | I <sub>C</sub>        | I <sub>F</sub> =0.5mA, V <sub>CE</sub> =5V   | 0.25   | -                  | 2.0  | mA    |    |
|                          | Collector-emitter saturation voltage | V <sub>CE (sat)</sub> | I <sub>F</sub> =10mA, I <sub>C</sub> =1mA  | -  | -                  | 0.2  | V     |    |
|                          | Isolation resistance                 | R <sub>ISO</sub>      | DC500V, 40 to 60%RH  | 5×10 <sup>10</sup>   | 1×10 <sup>11</sup> | -    | Ω     |    |
|                          | Floating capacitance                 | C <sub>f</sub>        | V=0, f=1MHz  | -  | 0.6                | 1.0  | pF    |    |
|                          | Response time                        | Rise time             | t <sub>r</sub>   | V <sub>CE</sub> =2V, I <sub>C</sub> =2mA, R <sub>L</sub> =100Ω | -                  | 4    | 18    | μs |
|                          |                                      | Fall time             | t <sub>f</sub>   |  | -                  | 3    | 18    | μs |
|                          | Common mode rejection voltage        | CMR                   | V <sub>CM</sub> =1.5kV(peak), I <sub>F</sub> =0<br>R <sub>L</sub> =470Ω, V <sub>CC</sub> =9V, V <sub>np</sub> =100mV | 10   | -                  | -    | kV/μs |    |

### ■ Model Line-up

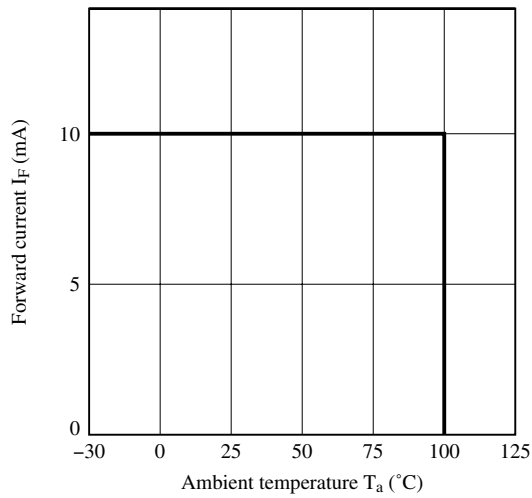
| Lead Form | Trough-Hole   |            | Wide Trough-Hole |            | SMT Gullwing |            | Wide SMT Gullwing |            | Rank mark       | I <sub>C</sub> [mA]<br>(I <sub>F</sub> =0.5mA, V <sub>CE</sub> =5V, T <sub>a</sub> =25°C) |
|-----------|---------------|------------|------------------|------------|--------------|------------|-------------------|------------|-----------------|---|
| Package   | Sleeve        |            |                  |            | Taping       |            |                   |            |                 |   |
|           | 100pcs/sleeve |            |                  |            | 2000pcs/reel |            |                   |            |                 |   |
| VDE0884   | –             | Approved   | –                | Approved   | –            | Approved   | –                 | Approved   | –               |   |
| Model No. | PC12310NSZ    | PC12310YSZ | PC12310NFZ       | PC12310YFZ | PC12310NIP   | PC12310YIP | PC12310NUP        | PC12310YUP | with or without | 0.25 to 2.0   |
|           | PC12311NSZ    | PC12311YSZ | PC12311NFZ       | PC12311YFZ | PC12311NIP   | PC12311YIP | PC12311NUP        | PC12311YUP | A               | 0.5 to 1.25   |

Please contact a local SHARP sales representative to inquire about production status and Lead-Free options.

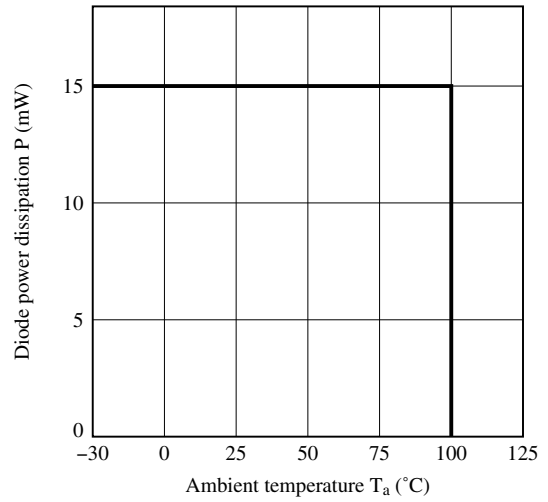
**Fig.1 Test Circuit for Common Mode Rejection Voltage**



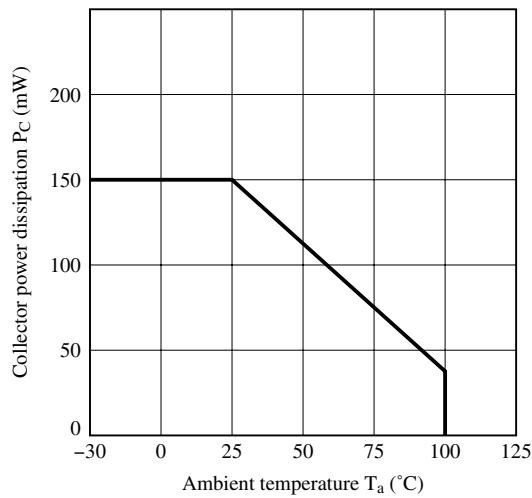
**Fig.2 Forward Current vs. Ambient Temperature**



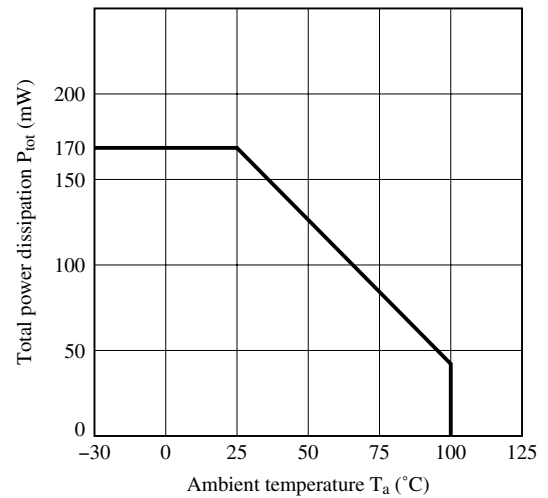
**Fig.3 Diode Power Dissipation vs. Ambient Temperature**



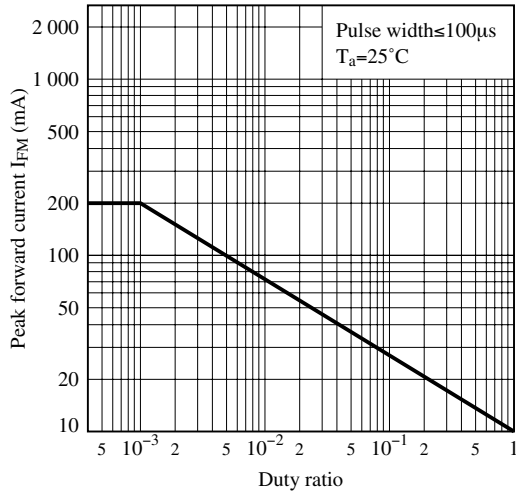
**Fig.4 Collector Power Dissipation vs. Ambient Temperature**



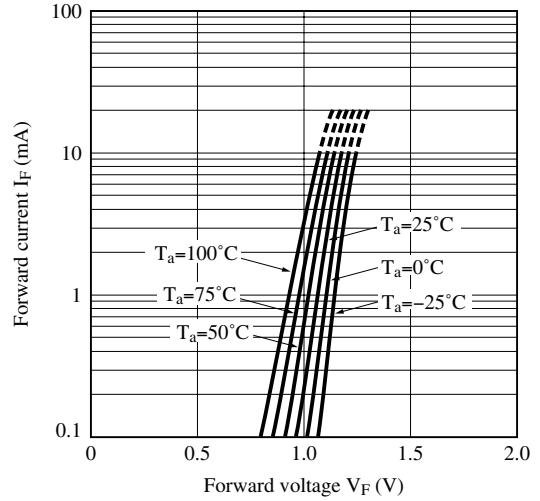
**Fig.5 Total Power Dissipation vs. Ambient Temperature**



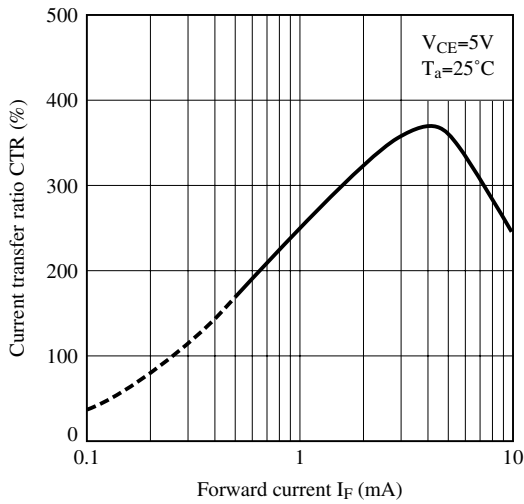
**Fig.6 Peak Forward Current vs. Duty Ratio**



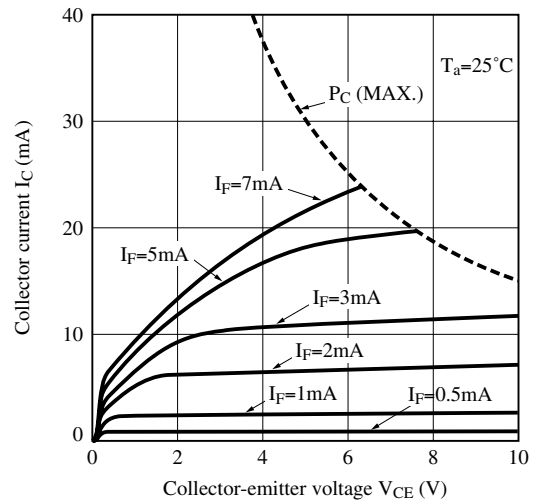
**Fig.7 Forward Current vs. Forward Voltage**



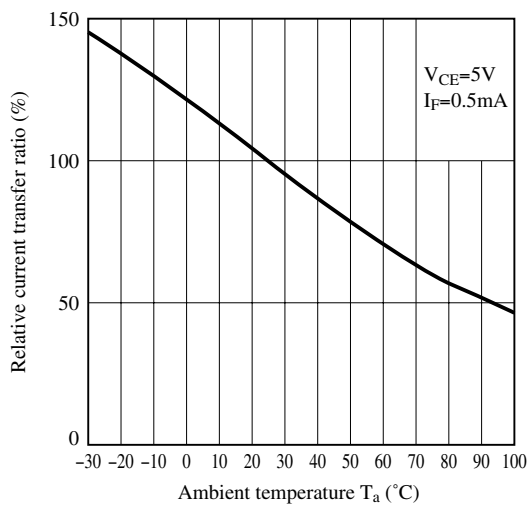
**Fig.8 Current Transfer Ratio vs. Forward Current**



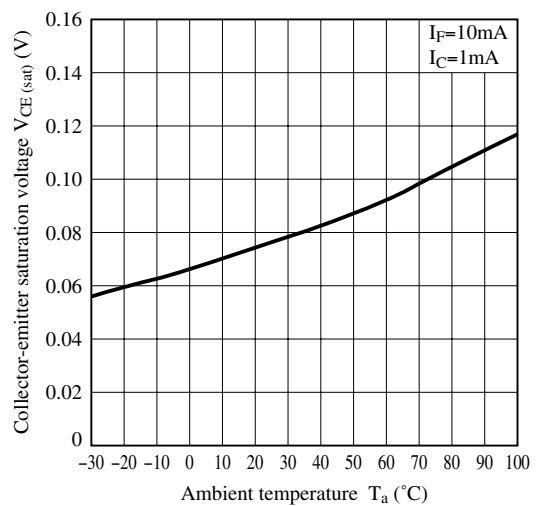
**Fig.9 Collector Current vs. Collector-emitter Voltage**



**Fig.10 Relative Current Transfer Ratio vs. Ambient Temperature**

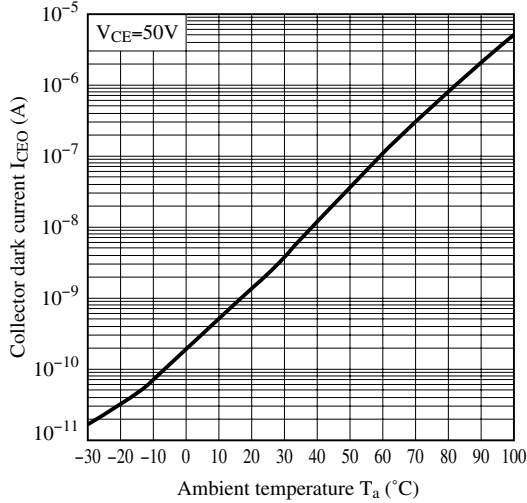


**Fig.11 Collector - emitter Saturation Voltage vs. Ambient Temperature**

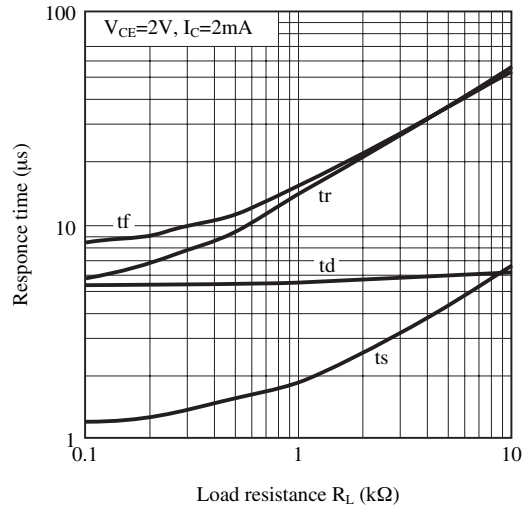




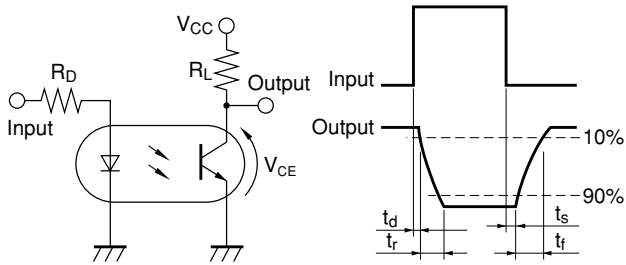
**Fig.12 Collector Dark Current vs. Ambient Temperature**



**Fig.13 Response Time vs. Load Resistance**

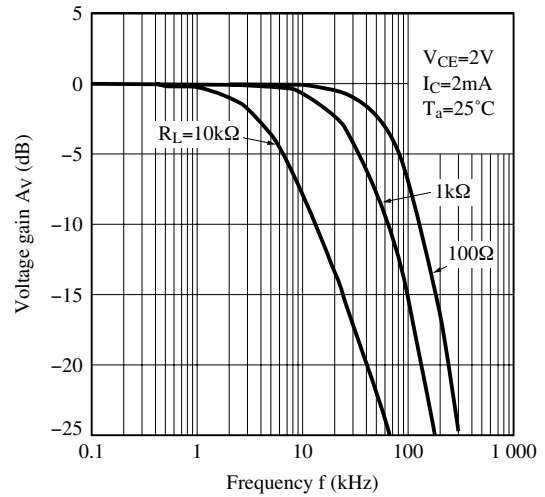


**Fig.14 Test Circuit for Response Time**

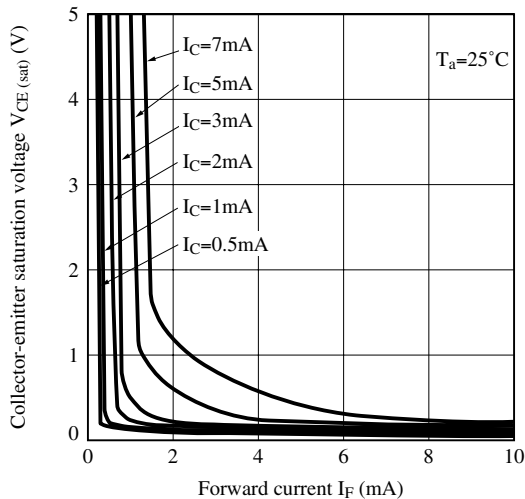


Please refer to the conditions in Fig.13.

**Fig.15 Frequency Response**



**Fig.16 Collector-emitter Saturation Voltage 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**

While operating at  $I_F < 0.5\text{mA}$ , CTR variation may increase.  
Please make design considering this fact.

In case that some sudden big noise caused by voltage variation is provided between primary and secondary terminals of photocoupler some current caused by it is floating capacitance may be generated and result in false operation since current may go through IRED or current may change.

If the photocoupler may be used under the circumstances where noise will be generated we recommend to use the bypass capacitors at the both ends of IRED.

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

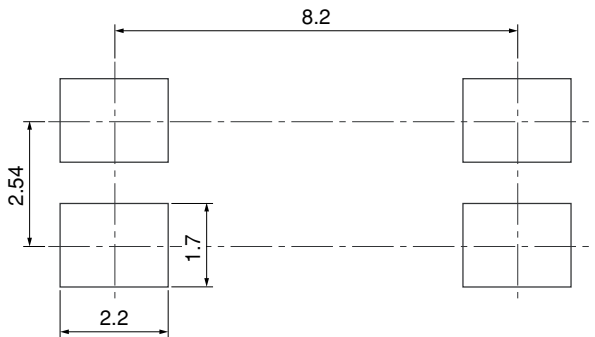
● **Degradation**

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

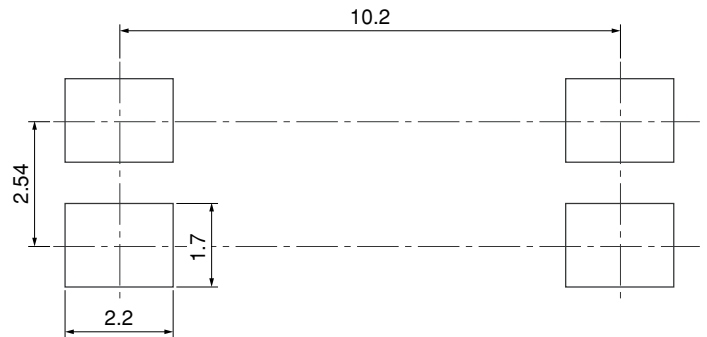
In the case of long term operation, please take the general IRED degradation (50% degradation over 5years) into the design consideration.

● **Recommended Foot Print (reference)**

SMT Gullwing lead-form



Wide SMT Gullwing lead-form



(Unit : mm)

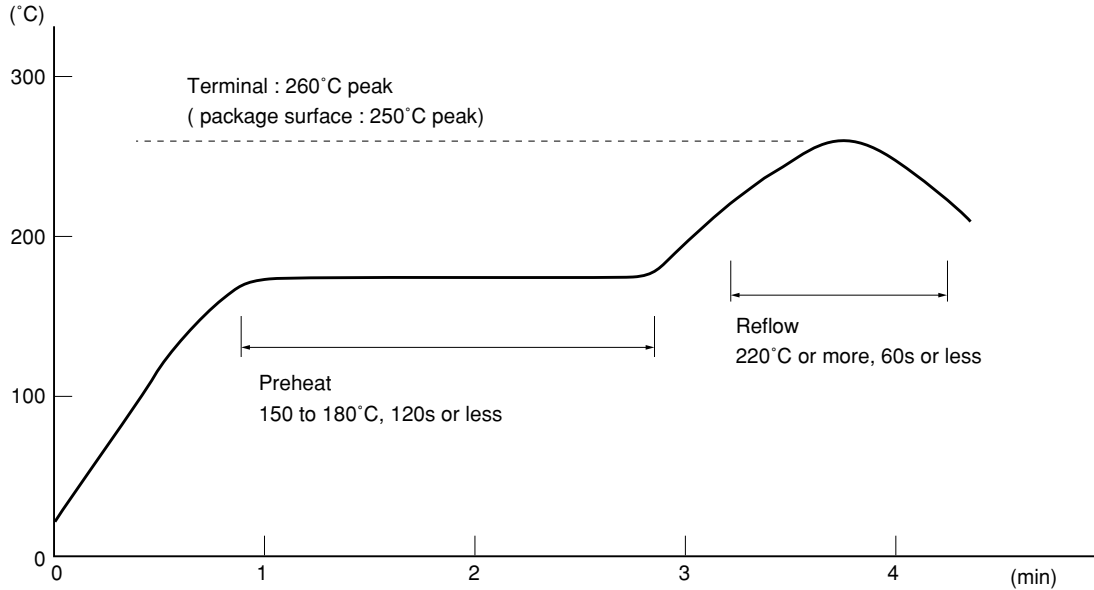
☆ For additional design assistance, please review our corresponding Optoelectronic Application Notes.

■ **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 notices

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 3minutes 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 device.

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.

■ **Package specification**

● **Sleeve package**

**1. Through-Hole**

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

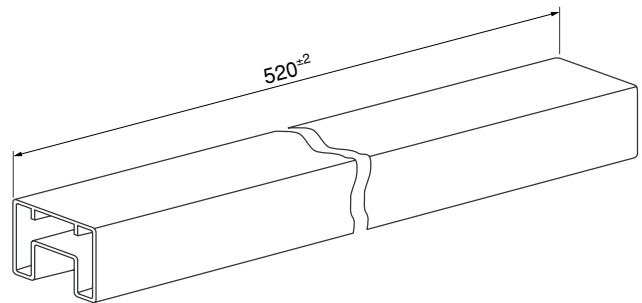
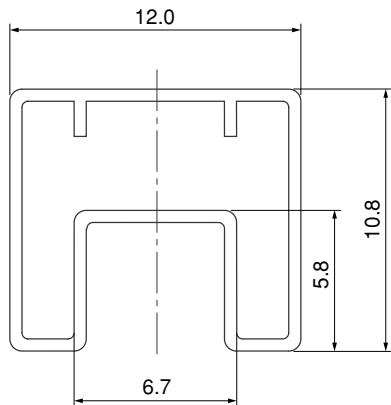
Package method

MAX. 100pcs 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)

**2. Wide Through-Hole**

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

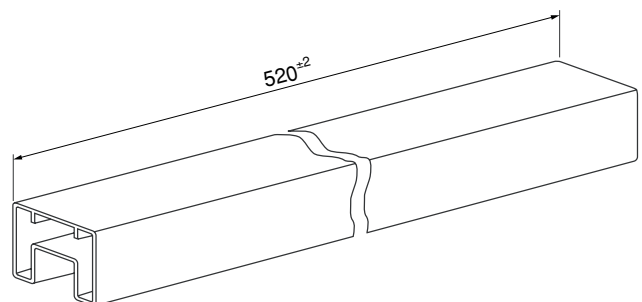
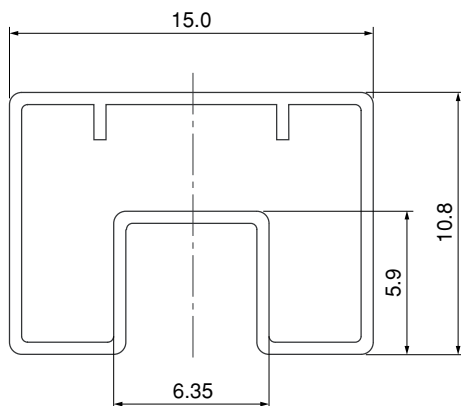
Package method

MAX. 100pcs 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)

## ● Tape and Reel package

### 1. SMT Gullwing

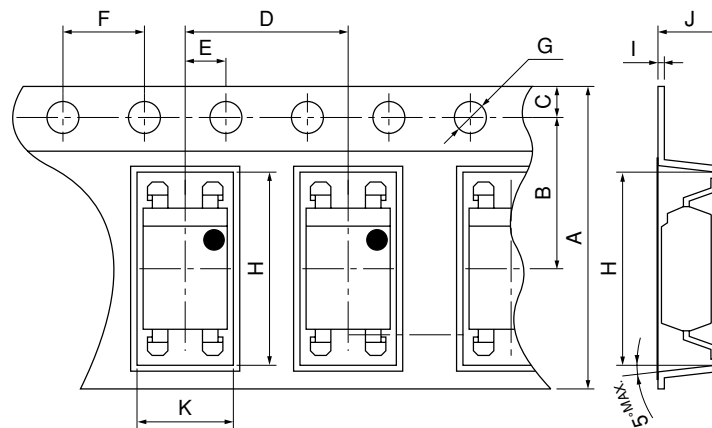
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

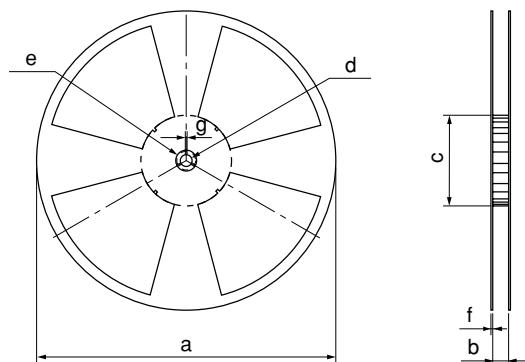
Reel : PS

Carrier tape structure and Dimensions



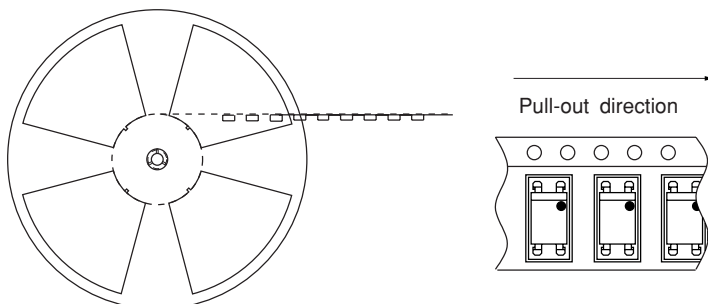
| Dimensions List |                |                |               |               |               |                           | (Unit : mm) |
|-----------------|----------------|----------------|---------------|---------------|---------------|---------------------------|-------------|
| A               | B              | C              | D             | E             | F             | G                         |             |
| 16.0 $\pm$ 0.3  | 7.5 $\pm$ 0.1  | 1.75 $\pm$ 0.1 | 8.0 $\pm$ 0.1 | 2.0 $\pm$ 0.1 | 4.0 $\pm$ 0.1 | $\phi$ 1.5 $^{+0.1}_{-0}$ |             |
| H               | I              | J              | K             |               |               |                           |             |
| 10.4 $\pm$ 0.1  | 0.4 $\pm$ 0.05 | 4.2 $\pm$ 0.1  | 5.1 $\pm$ 0.1 |               |               |                           |             |

### Reel structure and Dimensions



| Dimensions List |                |               |              | (Unit : mm) |
|-----------------|----------------|---------------|--------------|-------------|
| a               | b              | c             | d            |             |
| 330             | 17.5 $\pm$ 1.5 | 100 $\pm$ 1.0 | 13 $\pm$ 0.5 |             |
| e               | f              | g             |              |             |
| 23 $\pm$ 1.0    | 2.0 $\pm$ 0.5  | 2.0 $\pm$ 0.5 |              |             |

### Direction of product insertion



[Packing : 2 000pcs/reel]

**2. Wide SMT Gullwing**

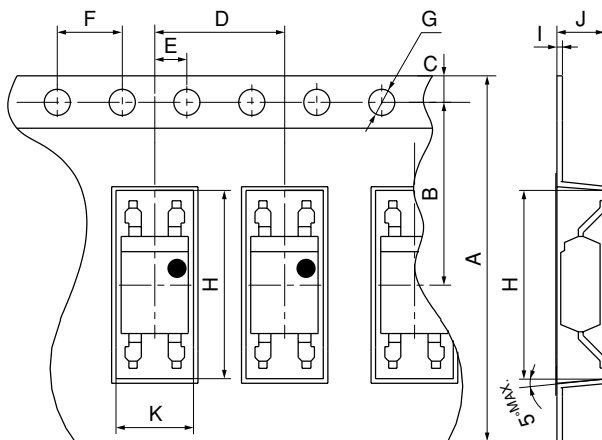
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

Reel : PS

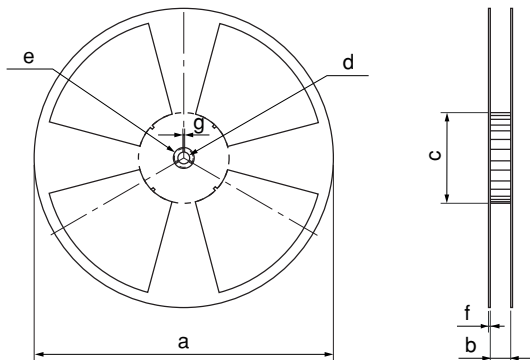
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

| A        | B        | C        | D       | E       | F       | G        |
|----------|----------|----------|---------|---------|---------|----------|
| 24.0±0.3 | 11.5±0.1 | 1.75±0.1 | 8.0±0.1 | 2.0±0.1 | 4.0±0.1 | φ1.5±0.1 |
| H        | I        | J        | K       |         |         |          |
| 12.4±0.1 | 0.4±0.05 | 4.1±0.1  | 5.1±0.1 |         |         |          |

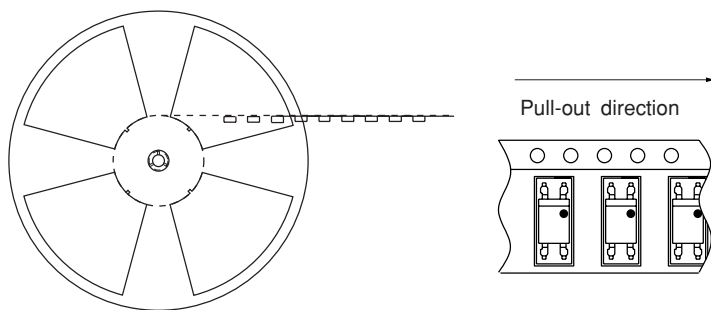
**Reel structure and Dimensions**



Dimensions List (Unit : mm)

| a      | b        | c       | d      |
|--------|----------|---------|--------|
| 330    | 22.5±1.5 | 100±1.0 | 13±0.5 |
| e      | f        | g       |        |
| 23±1.0 | 2.0±0.5  | 2.0±0.5 |        |

**Direction of product insertion**



[Packing : 2 000pcs/reel]

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- 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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