PC123XNNSZ0F Series

■ Description
PC123XNNSZ0F 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 5kV.
CTR is 50% to 400% at input current of 5mA

■ Features
1. 4-pin DIP package
2. Double transfer mold package (Ideal for Flow Soldering)
3. Current transfer ratio (CTR : MIN. 50% at I_F=5 mA, V_CE=5V)
4. Several CTR ranks available
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_iso(rms) : 5kV)
8. RoHS directive compliant

■ Agency approvals/Compliance
1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. PC123)
2. Approved by BSI, BS-EN60065, file No. 7087, BS-EN60950 file No. 7409, (as model No. PC123)
3. Approved by SEMKO, EN60065, EN60950, (as model No. PC123)
4. Approved by DEMKO, EN60065, EN60950, (as model No. PC123)
5. Approved by NEMKO, EN60065, EN60950, (as model No. PC123)
6. Approved by FIMKO, EN60065, EN60950, (as model No. PC123)
7. Recognized by CSA file No. CA95323, (as model No. PC123)
8. Approved by VDE, DIN EN60747-5-2(*) (as an option), file No. 40008087 (as model No. PC123)
9. Package resin : UL flammability grade (94V - 0)

(*) DIN EN60747-5-2 : successor standard of DIN VDE0884

■ Applications
1. I/O isolation for MCUs (Micro Controller Units)
2. Noise suppression in switching circuits
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.
**PC123XNNNSZ0F Series**

### Internal Connection Diagram

1. Anode  
2. Cathode  
3. Emitter  
4. Collector

### Outline Dimensions (Unit: mm)

#### 1. Through-Hole [ex. PC123XNNNSZ0F]

- Anode mark: 0.26 ± 0.10
- Epoxy resin: 7.62 ± 0.30
- Collector: 4.58 ± 0.30
- Date code: 0.5 ± 0.1

Product mass: approx. 0.23g

#### 2. Through-Hole (VDE option) [ex. PC123XNYSZ0F]

- Anode mark: 0.26 ± 0.10
- Epoxy resin: 7.62 ± 0.30
- Collector: 4.58 ± 0.30
- Date code: 0.5 ± 0.1

Product mass: approx. 0.23g

#### 3. Wide Through-Hole Lead-Form [ex. PC123XNNFZ0F]

- Rank mark: 0.5 ± 0.1
- Anode mark: 0.26 ± 0.10
- Epoxy resin: 10.16 ± 0.50

Product mass: approx. 0.23g

#### 4. Wide Through-Hole Lead-Form (VDE option) [ex. PC123XNYFZ0F]

- Rank mark: 0.5 ± 0.1
- Anode mark: 0.26 ± 0.10
- Epoxy resin: 10.16 ± 0.50

Product mass: approx. 0.23g
5. SMT Gullwing Lead-Form (VDE option) [ex. PC123XNYIP0F]

- Product mass: approx. 0.22g

6. Wide SMT Gullwing Lead-Form [ex. PC123XNNUP0F]

- Product mass: approx. 0.22g

7. Wide SMT Gullwing Lead-Form (VDE option) [ex. PC123XNYUP0F]

- Product mass: approx. 0.22g
## Date code (2 digit)

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<td>Month of production</td>
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<td>2000</td>
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<td>2001</td>
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repeats in a 20 year cycle

### Factory identification mark and Plating material

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<th>Country of origin</th>
<th>Plating material</th>
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<td>SnCu (Cu : TYP. 2%)</td>
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<tr>
<td>or</td>
<td>Indonesia</td>
<td>SnBi (Bi : TYP. 2%)</td>
</tr>
<tr>
<td>or</td>
<td>China</td>
<td>SnCu (Cu : TYP. 2%)*</td>
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* Up to Date code "T4" (April 2005), SnBi (Bi : TYP. 2%).

** 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>α=25°C</sub>)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
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<tr>
<td>Input</td>
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<tr>
<td>Forward current</td>
<td>I&lt;sub&gt;F&lt;/sub&gt;</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>*1 Peak forward current</td>
<td>I&lt;sub&gt;FM&lt;/sub&gt;</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td>V&lt;sub&gt;R&lt;/sub&gt;</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>P</td>
<td>70</td>
<td>mW</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
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<tr>
<td>Collector-emitter voltage</td>
<td>V&lt;sub&gt;CEO&lt;/sub&gt;</td>
<td>70</td>
<td>V</td>
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<tr>
<td>Emitter-collector voltage</td>
<td>V&lt;sub&gt;ECO&lt;/sub&gt;</td>
<td>6</td>
<td>V</td>
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<tr>
<td>Collector current</td>
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<td>50</td>
<td>mA</td>
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<td>200</td>
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<tr>
<td>*2 Isolation voltage</td>
<td>V&lt;sub&gt;iso(rms)&lt;/sub&gt;</td>
<td>5</td>
<td>kV</td>
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<td>Operating temperature</td>
<td>T&lt;sub&gt;opr&lt;/sub&gt;</td>
<td>−30 to</td>
<td>+100</td>
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<tr>
<td>Storage temperature</td>
<td>T&lt;sub&gt;sol&lt;/sub&gt;</td>
<td>−55 to</td>
<td>+125</td>
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<tr>
<td>*2 Soldering temperature</td>
<td>T&lt;sub&gt;sol&lt;/sub&gt;</td>
<td>260</td>
<td>°C</td>
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</table>

*1 Pulse width:100ms, Duty ratio : 0.001
*2 40 to 60%RH, AC for 1 minute, f = 60Hz
*3 For 10s

### Electro-optical Characteristics

*(T<sub>α=25°C</sub>)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
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<tr>
<td>Input</td>
<td></td>
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<tr>
<td>Forward voltage</td>
<td>V&lt;sub&gt;F&lt;/sub&gt;</td>
<td>I&lt;sub&gt;F&lt;/sub&gt;=20mA</td>
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<td>1.2</td>
<td>1.4</td>
<td>V</td>
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<td>Reverse current</td>
<td>I&lt;sub&gt;R&lt;/sub&gt;</td>
<td>V&lt;sub&gt;R&lt;/sub&gt;=4V</td>
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<td>10</td>
<td>μA</td>
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<td>Terminal capacitance</td>
<td>C&lt;sub&gt;t&lt;/sub&gt;</td>
<td>V&lt;sub&gt;t&lt;/sub&gt;=0, f=1kHz</td>
<td>–</td>
<td>30</td>
<td>250</td>
<td>pF</td>
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<tr>
<td>Collector dark current</td>
<td>I&lt;sub&gt;CEO&lt;/sub&gt;</td>
<td>V&lt;sub&gt;CEO&lt;/sub&gt;=50V, I&lt;sub&gt;F&lt;/sub&gt;=0</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>nA</td>
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<tr>
<td>Collector-emitter breakdown voltage</td>
<td>BV&lt;sub&gt;CEO&lt;/sub&gt;</td>
<td>I&lt;sub&gt;C&lt;/sub&gt;=0.1mA, I&lt;sub&gt;F&lt;/sub&gt;=0</td>
<td>70</td>
<td>–</td>
<td>–</td>
<td>V</td>
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<tr>
<td>Emitter-collector breakdown voltage</td>
<td>BV&lt;sub&gt;ECO&lt;/sub&gt;</td>
<td>I&lt;sub&gt;E&lt;/sub&gt;=10μA, I&lt;sub&gt;F&lt;/sub&gt;=0</td>
<td>6</td>
<td>–</td>
<td>–</td>
<td>nA</td>
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<tr>
<td>Transfer characteristics</td>
<td></td>
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<tr>
<td>Collector current</td>
<td>I&lt;sub&gt;C&lt;/sub&gt;</td>
<td>I&lt;sub&gt;P&lt;/sub&gt;=5mA, V&lt;sub&gt;CE&lt;/sub&gt;=5V</td>
<td>2.5</td>
<td>–</td>
<td>20</td>
<td>mA</td>
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<td>Collector-emitter saturation voltage</td>
<td>V&lt;sub&gt;CE(sat)&lt;/sub&gt;</td>
<td>I&lt;sub&gt;F&lt;/sub&gt;=20mA, I&lt;sub&gt;C&lt;/sub&gt;=1mA</td>
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<td>0.1</td>
<td>0.2</td>
<td>V</td>
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<td>Isolation resistance</td>
<td>R&lt;sub&gt;ISO&lt;/sub&gt;</td>
<td>DC500V, 40 to 60%RH</td>
<td>5×10&lt;sup&gt;10&lt;/sup&gt;</td>
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<td>Floating capacitance</td>
<td>C&lt;sub&gt;f&lt;/sub&gt;</td>
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<td>Cut-off capacitance</td>
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<td>V&lt;sub&gt;CE&lt;/sub&gt;=5V, I&lt;sub&gt;C&lt;/sub&gt;=2mA, R&lt;sub&gt;L&lt;/sub&gt;=100Ω, −3dB</td>
<td>–</td>
<td>80</td>
<td>–</td>
<td>kHz</td>
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<td>Response time</td>
<td>Rise time</td>
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<td>Fall time</td>
<td>t&lt;sub&gt;f&lt;/sub&gt;</td>
<td>–</td>
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<td>18</td>
<td>μs</td>
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### Model Line-up

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<tr>
<th>Lead Form</th>
<th>Through-Hole</th>
<th>Wide Through-Hole</th>
<th>Rank mark</th>
<th>$I_C$[mA] ($I_F=5\text{mA}$, $V_{CE}=5\text{V}$, $T_a=25,^\circ\text{C}$)</th>
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<td>PC123XNYSZ0F</td>
<td>PC123XNNFZ0F</td>
<td>PC123XNYFZ0F</td>
<td>With or without 2.5 to 20</td>
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<td>PC123X1NSZ0F</td>
<td>PC123X1YSZ0F</td>
<td>PC123X1NFZ0F</td>
<td>PC123X1YFZ0F</td>
<td>L 2.5 to 7.5</td>
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<td>PC123X2NFZ0F</td>
<td>PC123X2YFZ0F</td>
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<td>PC123X5NFZ0F</td>
<td>PC123X5YFZ0F</td>
<td>N 10 to 20</td>
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<tr>
<td>PC123X8NSZ0F</td>
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<td>PC123X8NFZ0F</td>
<td>PC123X8YFZ0F</td>
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<th>Lead Form</th>
<th>SMT Gullwing</th>
<th>Wide SMT Gullwing</th>
<th>Rank mark</th>
<th>$I_C$[mA] ($I_F=5\text{mA}$, $V_{CE}=5\text{V}$, $T_a=25,^\circ\text{C}$)</th>
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<td>PC123X8YUP0F</td>
<td>PC123X8YUP0F</td>
<td>E 5 to 10</td>
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Please contact a local SHARP sales representative to inquire about production status.
Fig. 1 Forward Current vs. Ambient Temperature

Fig. 2 Diode Power Dissipation vs. Ambient Temperature

Fig. 3 Collector Power Dissipation vs. Ambient Temperature

Fig. 4 Total Power Dissipation vs. Ambient Temperature

Fig. 5 Peak Forward Current vs. Duty Ratio

Fig. 6 Forward Current vs. Forward Voltage
Fig. 7 Current Transfer Ratio vs. Forward Current

![Graph showing current transfer ratio vs. forward current with symbols and annotations.]

Fig. 8 Collector Current vs. Collector-emitter Voltage

![Graph showing collector current vs. collector-emitter voltage with symbols and annotations.]

Fig. 9 Relative Current Transfer Ratio vs. Ambient Temperature

![Graph showing relative current transfer ratio vs. ambient temperature with symbols and annotations.]

Fig. 10 Collector-emitter Saturation Voltage vs. Ambient Temperature

![Graph showing collector-emitter saturation voltage vs. ambient temperature with symbols and annotations.]

Fig. 11 Collector Dark Current vs. Ambient Temperature

![Graph showing collector dark current vs. ambient temperature with symbols and annotations.]

Fig. 12 Response Time vs. Load Resistance

![Graph showing response time vs. load resistance with symbols and annotations.]

**Key Points:**
- **PC123XNNSZ0F Series**
- **Fig. 7** Current Transfer Ratio vs. Forward Current
- **Fig. 8** Collector Current vs. Collector-emitter Voltage
- **Fig. 9** Relative Current Transfer Ratio vs. Ambient Temperature
- **Fig. 10** Collector-emitter Saturation Voltage vs. Ambient Temperature
- **Fig. 11** Collector Dark Current vs. Ambient Temperature
- **Fig. 12** Response Time vs. Load Resistance

**Additional Information:**
- **Forward current** $I_F$ is varied from 0.1 mA to 100 mA.
- **Collector-emitter voltage** $V_{CE}$ is set to 5V.
- **Response time** is measured in μs.
- **Ambient temperature** $T_a$ is varied from -30°C to 100°C.
- **Collector dark current** $I_{CEO}$ is measured under specific conditions.
- **Collector-emitter saturation voltage** $V_{CE(sat)}$ is shown for different $I_F$ and $I_C$.
- **Response time** varies with load resistance from 0.1 kΩ to 100 kΩ.
Fig. 13 Test Circuit for Response Time

Please refer to the conditions in Fig.12.

Fig. 14 Frequency Response

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

Fig. 15 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 \(I_F<1\text{mA}\), CTR variation may increase.
  Please make design considering this fact.

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 5 years) 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 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 PBB and PBDE 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

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 tableless stoppers.
   The product shall be arranged in the sleeve with its anode mark on the tableless stopper side.
   MAX. 20 sleeves in one case.

Sleeve outline dimensions

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 tableless stoppers.
   The product shall be arranged in the sleeve with its anode mark on the tableless stopper side.
   MAX. 20 sleeves in one case.

Sleeve outline dimensions
● 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

Reel structure and Dimensions

Direction of product insertion

Dimensions List (Unit: mm)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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<td></td>
<td>16.0±0.3</td>
<td>7.5±0.1</td>
<td>1.75±0.05</td>
<td>8.0±0.1</td>
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<td>4.0±0.1</td>
<td>φ1.5±0.1</td>
</tr>
<tr>
<td>H</td>
<td>I</td>
<td>J</td>
<td>K</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>10.4±0.1</td>
<td>0.40±0.05</td>
<td>4.2±0.1</td>
<td>5.1±0.1</td>
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<td></td>
<td></td>
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</tbody>
</table>

Dimensions List (Unit: mm)

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>φ330</td>
<td>17.5±1.5</td>
<td>φ100±1</td>
<td>φ13.0±0.5</td>
</tr>
<tr>
<td>e</td>
<td>f</td>
<td>g</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>φ23±1</td>
<td>2.0±0.5</td>
<td>2.0±0.5</td>
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</tr>
</tbody>
</table>

[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

![Diagram of carrier tape structure and dimensions]

<table>
<thead>
<tr>
<th>Dimensions List (Unit : mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>24.0±0.3</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>12.4±0.1</td>
</tr>
</tbody>
</table>

Reel structure and Dimensions

![Diagram of reel structure and dimensions]

<table>
<thead>
<tr>
<th>Dimensions List (Unit : mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>φ330</td>
</tr>
<tr>
<td>e</td>
</tr>
<tr>
<td>φ2.3±1</td>
</tr>
</tbody>
</table>

Direction of product insertion

![Diagram of direction of product insertion]

>Packing : 2 000pcs/reel
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      --- Office automation equipment
      --- Telecommunication equipment [terminal]
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      --- Industrial control
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      --- Alarm equipment
      --- Various safety devices, etc.
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