

# PC1231xNSZ1B Series

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



## ■ Description

**PC1231xNSZ1B Series** contains an IRED optically coupled to a phototransistor.

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

Input-output isolation voltage(rms) is 5kV.

CTR is 50% to 400% (at  $I_F=0.5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )

## ■ Features

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

## ■ Agency approvals/Compliance

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **PC1231**)
2. Approved by BSI, BS-EN62368-1  
(as model No. **PC1231**)
3. Approved by SEMKO, EN60065, EN60335-1, EN60950  
(as model No. **PC1231**)
4. Approved by DEMKO, EN60065, EN60335-1, EN60950,  
(as model No. **PC1231**)
5. Approved by NEMKO, EN60065, EN60335-1, EN60950  
(as model No. **PC1231**)
6. Approved by FIMKO, EN60065, EN60335-1, EN60950,  
(as model No. **PC1231**)
7. Recognized by CSA file No. CA95323  
(as model No. **PC1231**)
8. Approved by VDE, DIN EN60747-5-5( \*) (as an option)  
File No. 40008087 (as model No. **PC1231**)
9. Package resin : UL flammability grade (94V - 0)

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

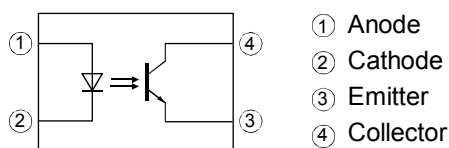
## ■ Applications

1. Primary to secondary isolation in switch mode power supply
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.

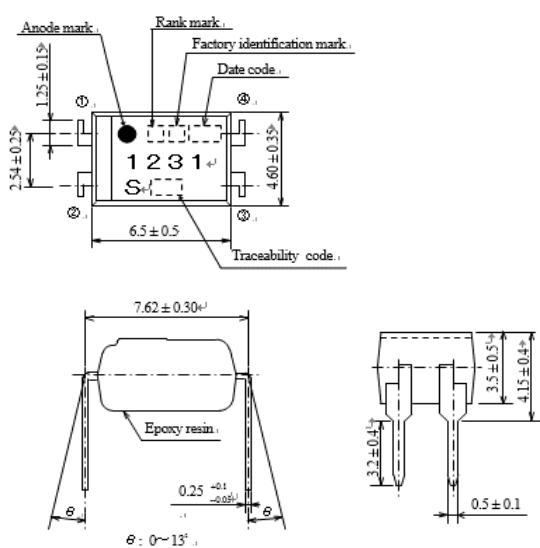
### Internal Connection Diagram



### Outline Dimensions

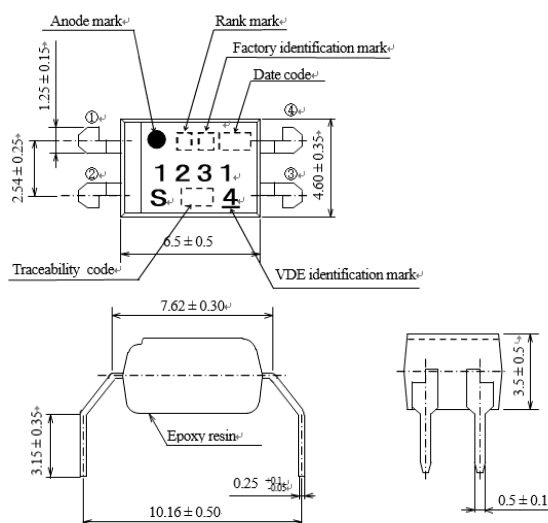
(Unit : mm)

#### 1 . Through-Hole [ex. PC12310NSZ1B]



Product mass : approx. 0.23g

#### 2 . Wide Through-Hole Lead-Form [ex. PC12310YFZ1B]



Product mass : approx. 0.23g

### Date code indication (Ex.)

3-digit number shall be marked the age indication of 1-digit number, and week code of 2-digit number.

Week code "01" indicate the week including the first Thursday of January. And later, Monday is the starting point.

| Year | Week |
|------|------|
|------|------|

| Date code | MON   | TUE   | WED   | THU   | FRI   | SAT   | SUN   |
|-----------|-------|-------|-------|-------|-------|-------|-------|
| 652       | 12/26 | 12/27 | 12/28 | 12/29 | 12/30 | 12/31 | 1/1   |
| 701       | 1/2   | 1/3   | 1/4   | 1/5   | 1/6   | 1/7   | 1/8   |
| 702       | 1/9   | 1/10  | 1/11  | 1/12  | 1/13  | 1/14  | 1/15  |
| 703       | 1/16  | 1/17  | 1/18  | 1/19  | 1/20  | 1/21  | 1/22  |
| .         | .     | .     | .     | .     | .     | .     | .     |
| .         | .     | .     | .     | .     | .     | .     | .     |
| .         | .     | .     | .     | .     | .     | .     | .     |
| 752       | 12/11 | 12/12 | 12/13 | 12/14 | 12/15 | 12/16 | 12/17 |
| 751       | 12/18 | 12/19 | 12/20 | 12/21 | 12/22 | 12/23 | 12/24 |
| 752       | 12/25 | 12/26 | 12/27 | 12/28 | 12/29 | 12/30 | 12/31 |
| 801       | 1/1   | 1/2   | 1/3   | 1/4   | 1/5   | 1/6   | 1/7   |

### Factory identification mark and Plating material

| Factory identification Mark | Country of origin | Plating material |
|-----------------------------|-------------------|------------------|
| K                           | Japan             | SnBi (Bi : 1~4%) |

### 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>       | 80          | 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</sub> (rms) | 5           | kV   |
| Operating temperature    |                             | T <sub>opr</sub>       | −30 to +100 | °C   |
| Storage temperature      |                             | T <sub>stg</sub>       | −55 to +125 | °C   |
| *2 Soldering temperature |                             | T <sub>sol</sub>       | 270         | °C   |

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

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

\*3 For 10s

## ■ 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> =5mA                                                                                                                           | —                  | 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                   | 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                                                                                                      | 80                 | —                  | —    | 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 ratio          |           | CMR                  | T <sub>a</sub> =25°C, R <sub>L</sub> =470Ω<br>V <sub>CM</sub> =1.5kV(peak),<br>I <sub>F</sub> =0, V <sub>CC</sub> =9V, V <sub>NP</sub> =100mV | 10                 | —                  | —    | kV/μs |

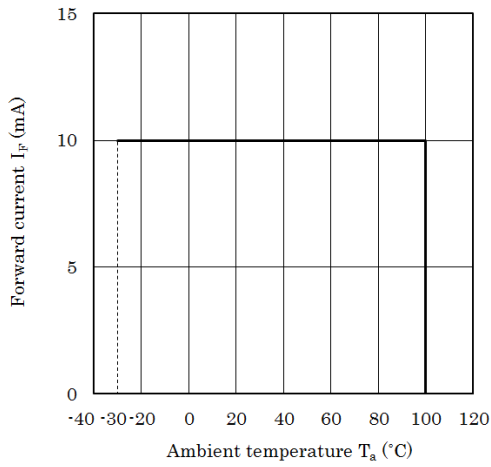
### ■ Model Line-up

|           |                     |             |                                                                                                 |
|-----------|---------------------|-------------|-------------------------------------------------------------------------------------------------|
| Lead Form | Through-Hole        | Rank mark   | I <sub>C</sub> [mA]<br>(I <sub>F</sub> =0.5mA,<br>V <sub>CE</sub> =5V,<br>T <sub>a</sub> =25°C) |
| Package   | Sleeve              |             |                                                                                                 |
|           | 100pcs/sleeve       |             |                                                                                                 |
| Model No. | <b>PC12310NSZ1B</b> | with or “_” | 0.25 ~ 2                                                                                        |
|           | <b>PC12311NSZ1B</b> | A           | 0.5 ~ 1.25                                                                                      |

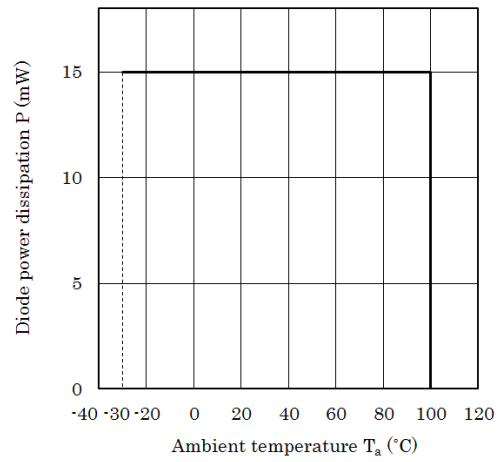
|           |                     |             |                                                                                                 |
|-----------|---------------------|-------------|-------------------------------------------------------------------------------------------------|
| Lead Form | Wide Through-Hole   | Rank mark   | I <sub>C</sub> [mA]<br>(I <sub>F</sub> =0.5mA,<br>V <sub>CE</sub> =5V,<br>T <sub>a</sub> =25°C) |
| Package   | Sleeve              |             |                                                                                                 |
|           | 100pcs/sleeve       |             |                                                                                                 |
| Model No. | <b>PC12310YFZ1B</b> | with or “_” | 0.25 ~ 2                                                                                        |
|           | <b>PC12311YFZ1B</b> | A           | 0.5 ~ 1.25                                                                                      |

Please contact a local SHARP sales representative to inquire about production status.

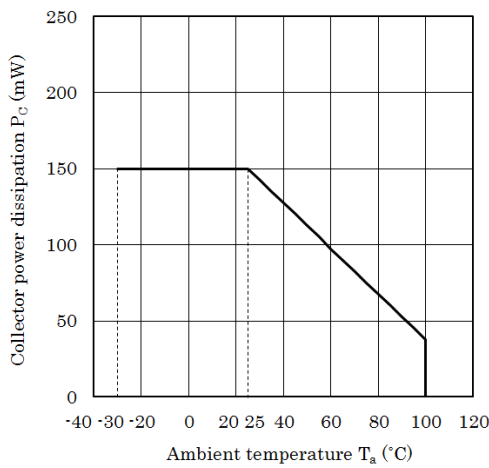
**Fig.1 Forward Current vs. Ambient Temperature**



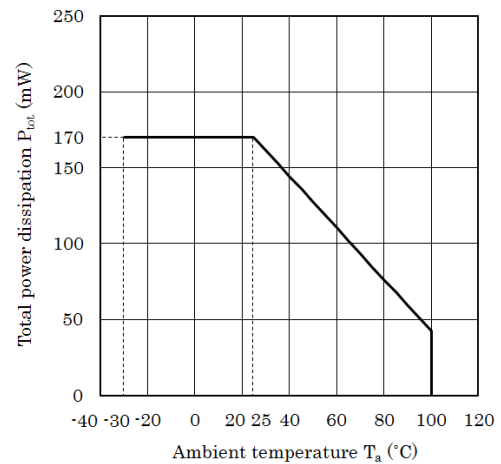
**Fig.2 Diode Power Dissipation vs. Ambient Temperature**



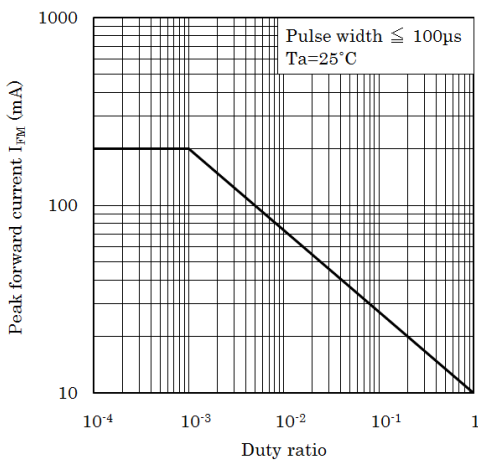
**Fig.3 Collector Power Dissipation vs. Ambient Temperature**



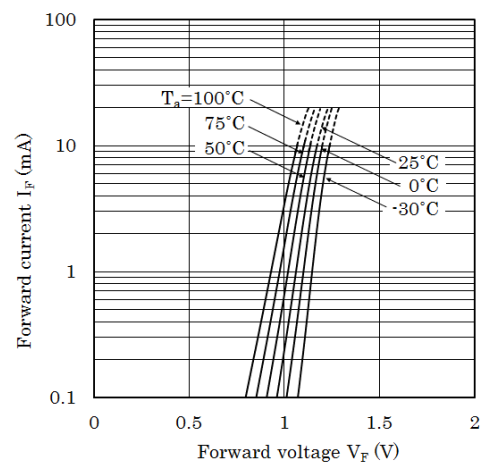
**Fig.4 Total Power Dissipation vs. Ambient Temperature**



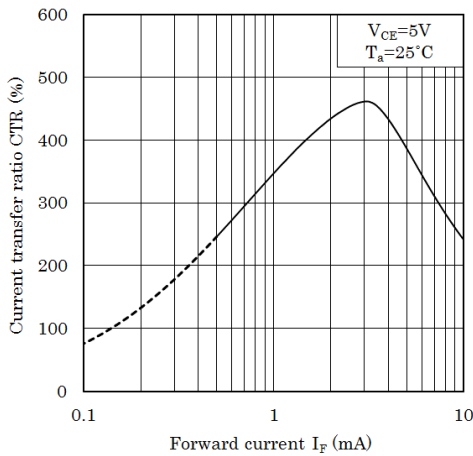
**Fig.5 Peak Forward Current vs. Duty Ratio**



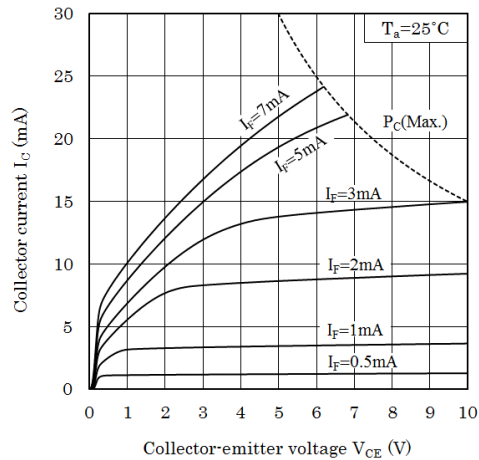
**Fig.6 Forward Current vs. Forward Voltage**



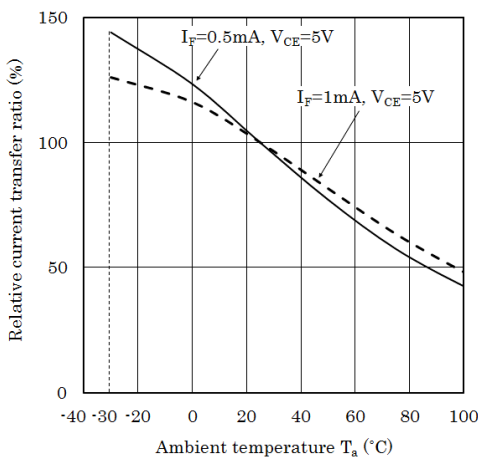
**Fig.7 Current Transfer Ratio vs. Forward Current**



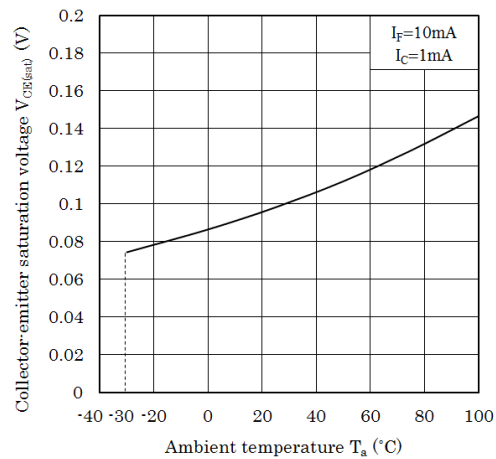
**Fig.8 Collector Current vs. Collector-emitter Voltage**



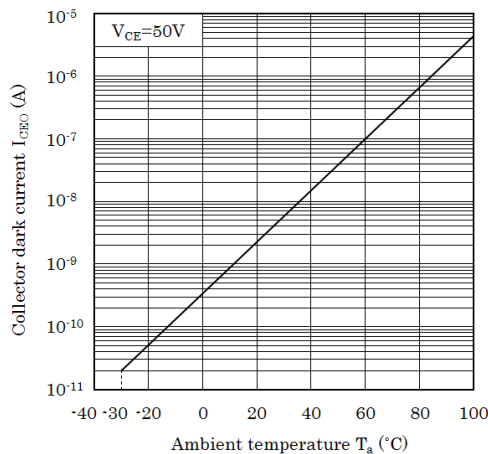
**Fig.9 Relative Current Transfer Ratio vs. Ambient Temperature**



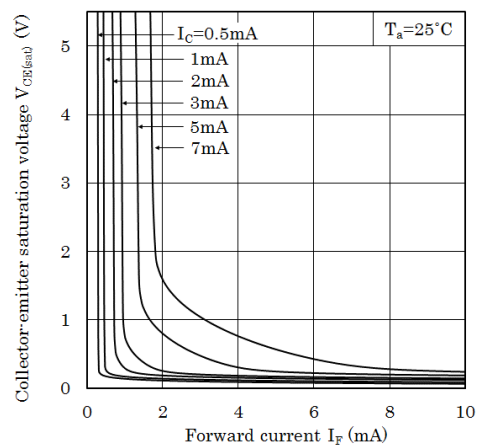
**Fig.10 Collector - emitter Saturation Voltage vs. Ambient Temperature**



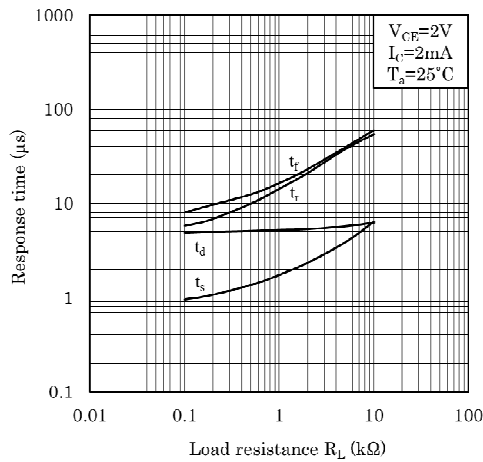
**Fig.11 Collector Dark Current vs. Ambient Temperature**



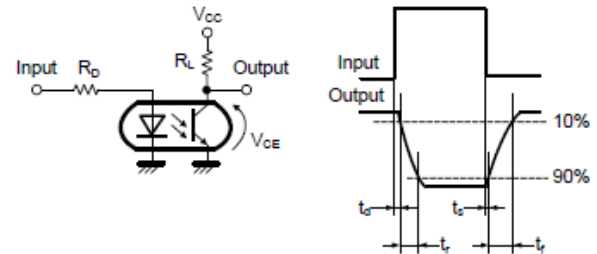
**Fig.12 Collector-emitter Saturation Voltage vs. Forward Current**



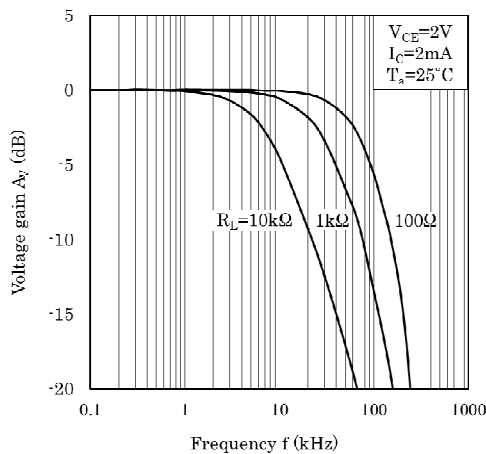
**Fig.13 Response Time vs. Load Resistance**



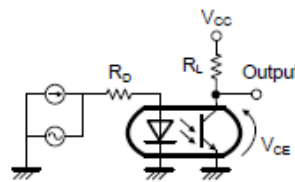
**Fig.14 Test Circuit for Response Time**



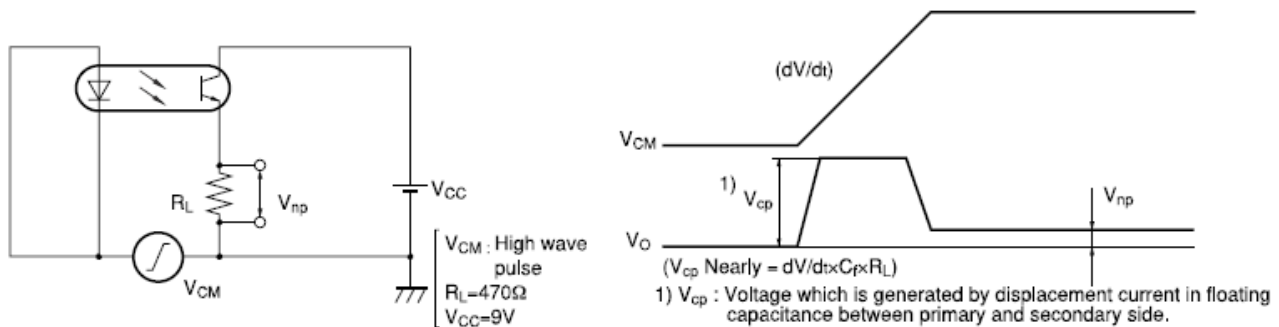
**Fig.15 Frequency Response**



**Fig.16 Test Circuit for Frequency Response**



**Fig.17 Test Circuit for Common Mode Rejection Voltage**



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 5 years) into the design consideration.

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

**■ Manufacturing Guidelines****• Soldering Method****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.

(1) The RoHS directive(2011/65/EU)

This product complies with the RoHS directive(2011/65/EU)

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     | Hazardous Substances |              |              |                                         |                                |                                       |
|--------------|----------------------|--------------|--------------|-----------------------------------------|--------------------------------|---------------------------------------|
|              | Lead (Pb)            | Mercury (Hg) | Cadmium (Cd) | Hexavalent chromium (Cr <sup>6+</sup> ) | Polybrominated biphenyls (PBB) | Polybrominated diphenyl ethers (PBDE) |
| Photocoupler | ○                    | ○            | ○            | ○                                       | ○                              | ○                                     |

This table is prepared in accordance with the provisions of SJ/T 11364.

○ : Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

■ Package specification

• Sleeve package

Through-Hole

Package materials

Sleeve : HIPS/PS or PC (with anti-static material)

Stopper : EPM

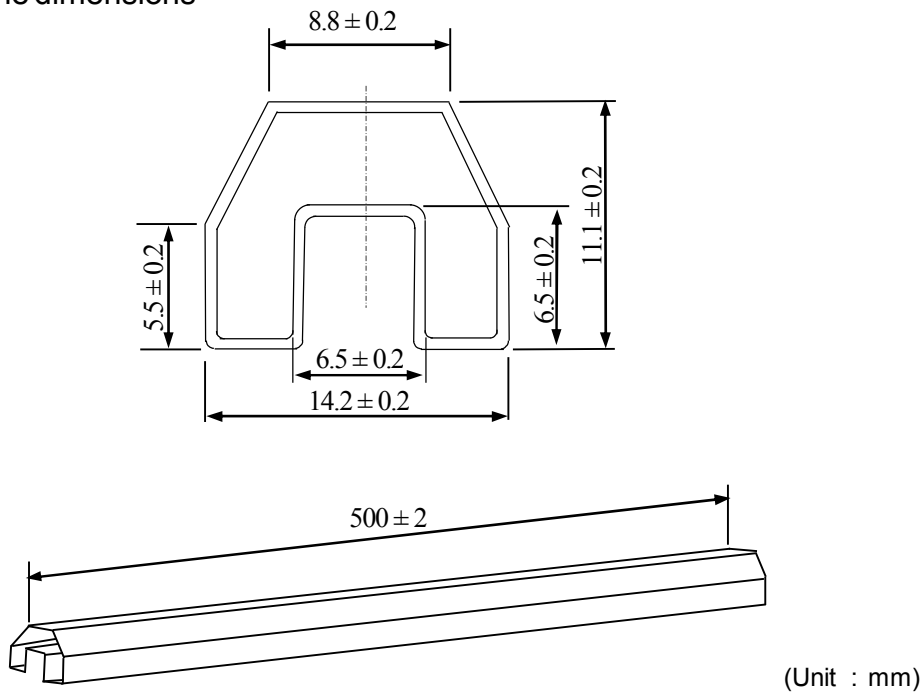
Package method

MAX. 100pcs. of products shall be packaged in a sleeve and both of sleeve edges shall be fixed by stoppers.

MAX. 25 sleeves (Product : 2,500pcs.) above shall be packaged in inner case and sealed by tape .

Max 2 bags(product : 5,000pcs) above shall be packaged in packing case , and put a cushioning material inside.

Sleeve outline dimensions



## ■ Important Notices

·The circuit application examples in this publication are provided to explain representative applications of SHARP devices and are not intended to guarantee any circuit design or license any intellectual property rights. SHARP takes no responsibility for any problems related to any intellectual property right of a third party resulting from the use of SHARP's devices.

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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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