

# SHARP

**REFERENCE**  
SPEC. No. ED-03P046  
ISSUE November 21, 2003

OPTO-ELECTRONIC DEVICES DIVISION  
ELECTRONIC COMPONENTS GROUP  
SHARP CORPORATION

## SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC123

Business dealing name

	PC123XNNFZ0F		PC123XNYFZ0F
	PC123X1NFZ0F		PC123X1YFZ0F
	PC123X2NFZ0F		PC123X2YFZ0F
	PC123X5NFZ0F		PC123X5YFZ0F
	PC123X8NFZ0F		PC123X8YFZ0F
	PC123X9NFZ0F		PC123X9YFZ0F

Specified for

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Enclosed please find copies of the Specifications which consists of 14 pages including cover.  
After confirmation of the contents, please be sure to send back  copies of the Specifications  
with approving signature on each.

CUSTOMER'S APPROVAL

PRESENTED

DATE

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DATE

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BY

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BY

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*K. H.*  
K. Hachimura,  
Department General Manager of  
Engineering Dept.,II  
Opto-Electronic Devices Div.  
ELECOM Group  
SHARP CORPORATION

Product name : PHOTOCOUPLER

Model No. : PC123

Business dealing name

PC123XNNFZ0F	PC123XNYFZ0F
PC123X1NFZ0F	PC123X1YFZ0F
PC123X2NFZ0F	PC123X2YFZ0F
PC123X5NFZ0F	PC123X5YFZ0F
PC123X8NFZ0F	PC123X8YFZ0F
PC123X9NFZ0F	PC123X9YFZ0F

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2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

(Precautions)

- (1) This product is designed for use in the following application areas ;

<ul style="list-style-type: none"> <li>· OA equipment    Audio visual equipment    · Home appliances</li> <li>· Telecommunication equipment (Terminal)    · Measuring equipment</li> <li>· Tooling machines    · Computers</li> </ul>
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If the use of the product in the above application areas is for equipment listed in paragraphs (2) or (3), please be sure to observe the precautions given in those respective paragraphs.

- (2) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

<ul style="list-style-type: none"> <li>· Transportation control and safety equipment (aircraft, train, automobile etc.)</li> <li>· Traffic signals    · Gas leakage sensor breakers    · Rescue and security equipment</li> <li>· Other safety equipment</li> </ul>
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- (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

<ul style="list-style-type: none"> <li>· Space equipment    · Telecommunication equipment (for trunk lines)</li> <li>· Nuclear power control equipment    · Medical equipment</li> </ul>
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- (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

1. Application

This specification applies to the outline and characteristics of photocoupler Model No. PC123.

- 2. Outline Refer to the attached sheet, page 3.
- 3. Ratings and characteristics Refer to the attached sheet, page 4, 5.
- 4. Reliability Refer to the attached sheet, page 6.
- 5. Outgoing inspection Refer to the attached sheet, page 7.
- 6. Supplement

6.1 Isolation voltage shall be measured in the following method.

- (1) Short between anode to cathode on the primary side and between collector to emitter on the secondary side.
- (2) The dielectric withstand tester with zero-cross circuit shall be used.
- (3) The wave form of applied voltage shall be a sine wave.  
 (It is recommended that the isolation voltage be measured in insulation oil.)

6.2 Packing specifications Refer to the attached sheet, page 8, 9.

6.3 Collector current (Ic) Delivery rank table ("O" mark indicates business dealing name of ordered product)

Rank at delivery	Business dealing name	Rank at delivery	* Business dealing name	Rank mark	Ic (mA)
	PC123XNNFZ0F		PC123XNYFZ0F	with or without	2.5 to 20.0
	PC123X1NFZ0F		PC123X1YFZ0F	L	2.5 to 7.5
	PC123X2NFZ0F		PC123X2YFZ0F	M	5.0 to 12.5
	PC123X5NFZ0F		PC123X5YFZ0F	N	10.0 to 20.0
	PC123X8NFZ0F		PC123X8YFZ0F	E	5.0 to 10.0
	PC123X9NFZ0F		PC123X9YFZ0F	C	8.0 to 15.0

Test conditions
I <sub>F</sub> =5mA
V <sub>CE</sub> =5V
Ta=25°C


\*Applied to products as option (Attachment 2-1 to 2-3)

6.4 This Model is approved by UL.

Approved Model No. : PC123  
 UL file No. : E64380

6.5 This Model is approved by CSA.

Approved Model No. : PC123  
 CSA file No. : CA95323

CSA approved mark "  " shall be indicated on sleeve package.

6.6 This product is approved by BSI (BS415, BS7002)

Approved Model No. : PC123  
 Certificate No. : 7087/7409

6.7 This product is approved by SEMKO, DEMKO, NEMKO and FIMKO.

6.8 This product is not designed against irradiation.

This product is assembled with electrical input and output.  
 This product incorporates non-coherent light emitting diode.

6.9 ODS materials

This product shall not contain the following materials.

Also, the following materials shall not be used in the production process for this product.

Materials for ODS : CFC<sub>s</sub>, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methyl chloroform)

6.10 Brominated flame retardants

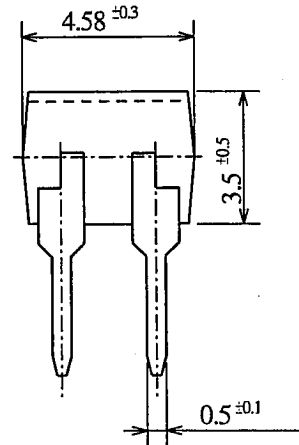
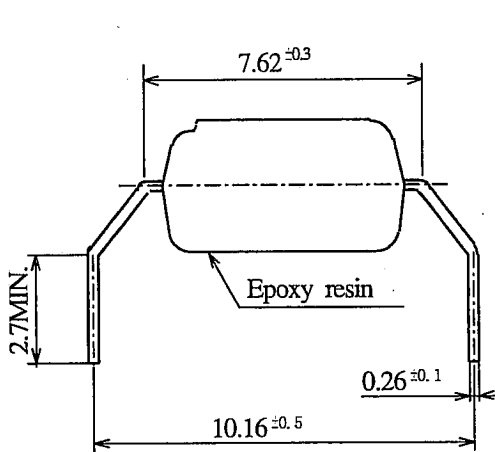
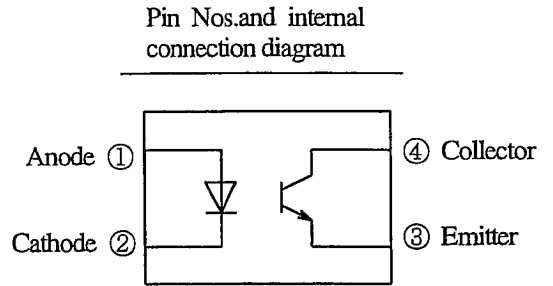
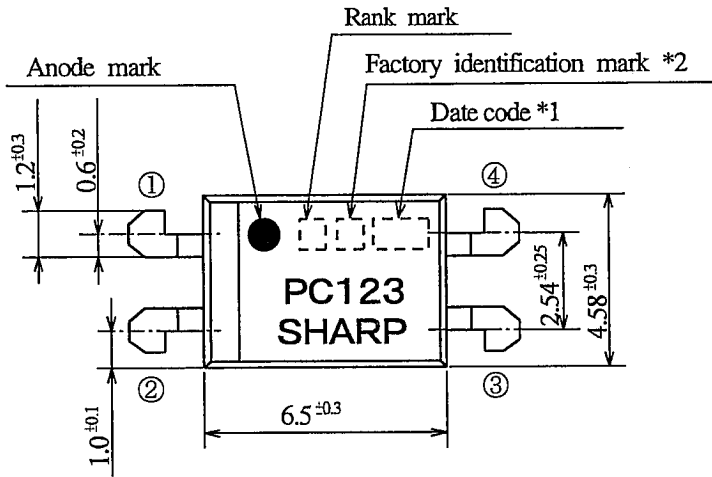
Specific brominated flame retardants such as the PBBO<sub>s</sub> and PBB<sub>s</sub> are not used in this device at all.

7. Notes

Precautions for Photocouplers

Refer to the attachment-1.

2. Outline



- \*1) 2-digit number shall be marked according to OLD DIN standard
- \*2) Factory identification mark shall be or shall not be marked.

Pin material : Copper Alloy  
Pin finish : SnCu plating (Cu : TYP. 2%)

Product mass : Approx. 0.23 g

Marking is laser marking

UNIT : 1/1 mm	
Name	PC123 Outline Dimensions (Business dealing name : PC123X*NFZ0 F)

### 3. Ratings and characteristics

#### 3.1 Absolute maximum ratings

Ta=25°C

Parameter		Symbol	Rating	Unit
Input	Forward current *1	$I_F$	50	mA
	Peak forward current *2	$I_{FM}$	1	A
	Reverse voltage	$V_R$	6	V
	Power dissipation *1	$P$	70	mW
Output	Collector-emitter voltage	$V_{CEO}$	70	V
	Emitter-collector voltage	$V_{ECO}$	6	V
	Collector current	$I_c$	50	mA
	Collector power dissipation *1	$P_c$	150	mW
Total power dissipation *1		$P_{tot}$	200	mW
Operating temperature		$T_{opr}$	-30 to +100	°C
Storage temperature		$T_{stg}$	-55 to +125	°C
Isolation voltage *3		$V_{iso (rms)}$	5	kV
Soldering temperature *4		$T_{sol}$	270	°C

#### 3.2 Electro-optical characteristics

Ta=25°C

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	$V_F$	$I_F=20mA$	-	1.2	1.4	V
	Reverse current	$I_R$	$V_R=4V$	-	-	10	$\mu A$
	Terminal capacitance	$C_t$	$V=0, f=1kHz$	-	30	250	pF
Output	Dark current	$I_{CEO}$	$V_{CE}=50V, I_F=0$	-	-	100	nA
	Collector-emitter breakdown voltage	$BV_{CEO}$	$I_c=0.1mA, I_F=0$	70	-	-	V
	Emitter-Collector breakdown voltage	$BV_{ECO}$	$I_c=10 \mu A, I_F=0$	6	-	-	V
Transfer characteristics	Collector current	$I_c$	$I_F=5mA, V_{CE}=5V$	2.5	-	20	mA
	Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_F=20mA, I_c=1mA$	-	0.1	0.2	V
	Isolation resistance	$R_{ISO}$	DC500V 40 to 60%RH	$5 \times 10^{10}$	$10^{11}$	-	$\Omega$
	Floating capacitance	$C_f$	$V=0, f=1MHz$	-	0.6	1.0	pF
	Cut-off frequency	$f_c$	$V_{CE}=5V, I_c=2mA$ $R_L=100 \Omega, -3dB$	-	80	-	kHz
	Response time (Rise)	$t_r$	$V_{CE}=2V, I_c=2mA$	-	4	18	$\mu s$
Response time (Fall)	$t_f$	$R_L=100,,$	-	3	18	$\mu s$	

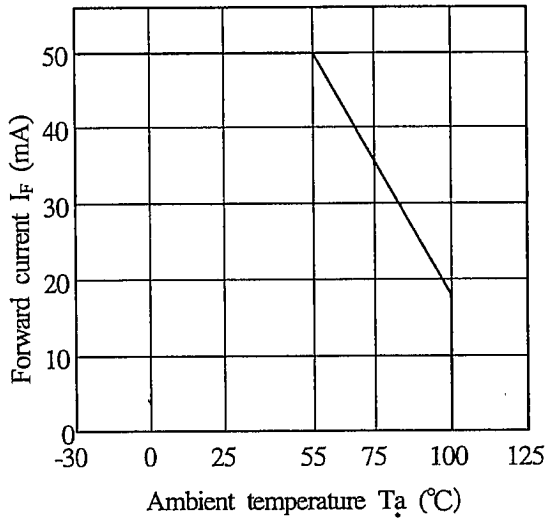
\*1 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1 to 4.

\*2 Pulse width  $\leq 100 \mu s$ , Duty ratio : 0.001 (Refer to Fig. 5)

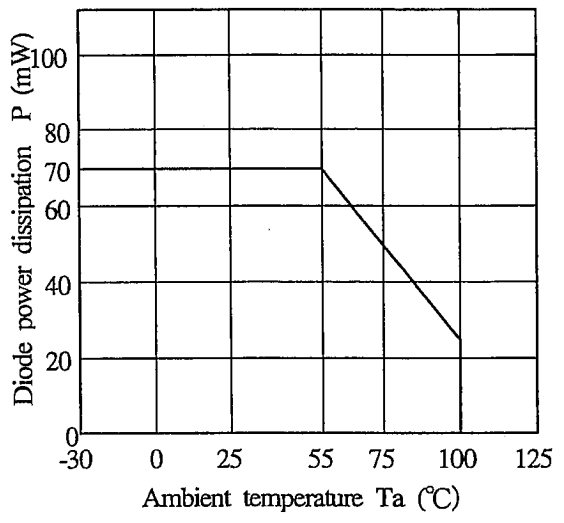
\*3 AC for 1 min, 40 to 60%RH

\*4 For 10s

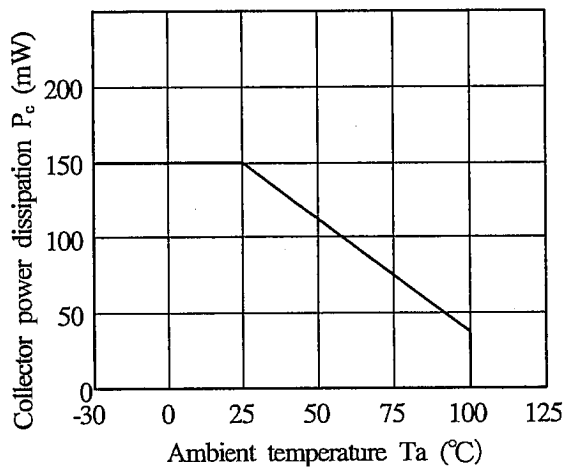
(fig.1) Forward current vs. ambient temperature



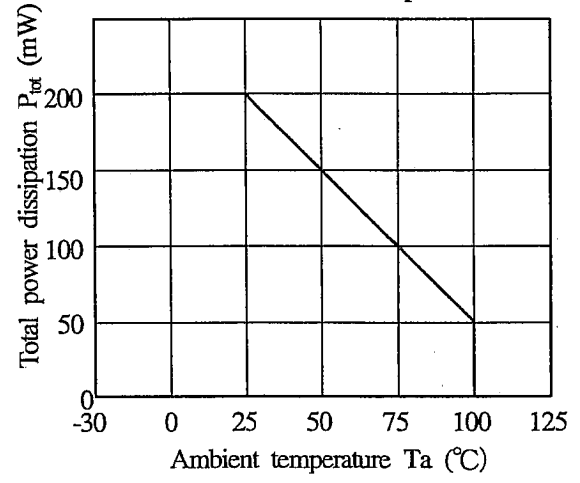
(fig.2) Diode power dissipation vs. ambient temperature



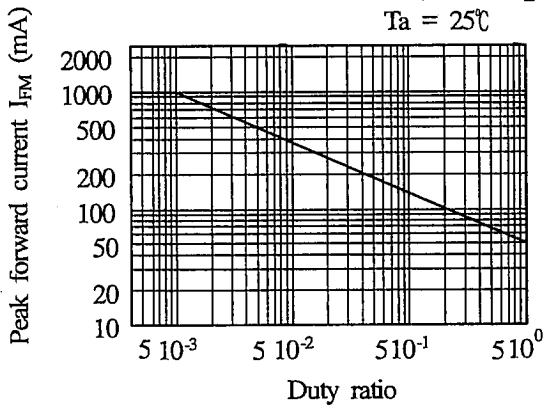
(fig.3) Collector power dissipation vs. ambient temperature



(fig.4) Total power dissipation vs. ambient temperature



(fig.5) Peak forward current vs. Duty ratio  
 Pulse width  $\leq 100\mu s$   
 $T_a = 25^\circ C$



4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

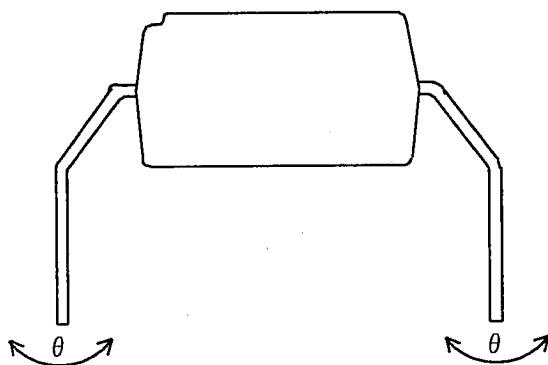
LTPD : 10 or 20

Test Items	Condition	Failure Judgement Criteria	Samples (n) Defective (C)
Solderability *2	245±3°C, 5s	-	n=11, C=0
Soldering heat	(Flow soldering) 270°C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $I_{CBO} > U \times 2$ $I_C < L \times 0.7$ $V_{CE(sat)} > U \times 1.2$  U: Upper specification limit L: Lower specification limit	n=11, C=0
	(Soldering by hand) 400°C, 3 s		n=11, C=0
Terminal strength (Tension)	Weight: 5N 5 s/each terminal		n=11, C=0
Terminal strength (Bending) *3	Weight: 2.5N 2 times/each terminal		n=11, C=0
Mechanical shock	15km/s <sup>2</sup> , 0.5ms 3 times/±X, ±Y, ±Z direction		n=11, C=0
Variable frequency vibration	100 to 2000 to 100Hz/4 min 200m/s <sup>2</sup> 4 times/X, Y, Z direction		n=11, C=0
Temperature cycling	1 cycle -55 °C to +125 °C (30 min) (30 min) 20 cycles test		n=22, C=0
High temp. and high Humidity storage	+85°C, 85%RH, 1000h		n=22, C=0
High temp. storage	+125 °C, 1000h		n=22, C=0
Low temp. storage	-55 °C, 1000h		n=22, C=0
Operation life	$I_F=50mA, P_{tot}=200mW$ $T_a=25 °C, 1000h$		n=22, C=0

\*1 Test method, conforms to EIAJ ED 4701.

\*2 Solder shall adhere at the area of 95% or more of immersed portion of lead, and pin hole or other holes shall not be concentrated on one portion.

\*3 Terminal bending direction is shown below.



5. Outgoing inspection

5.1 Inspection items

(1) Electrical characteristics

$V_F, I_R, I_{CEO}, V_{CE(sat)}, I_C, R_{ISO}, V_{iso}$

(2) Appearance

5.2 Sampling method and Inspection level

A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

Defect	Inspection item	AQL (%)
Major defect	Electrical characteristics Unreadable marking	0.065
Minor defect	Appearance defect except the above mentioned.	0.25



## 6.2 Packing specification

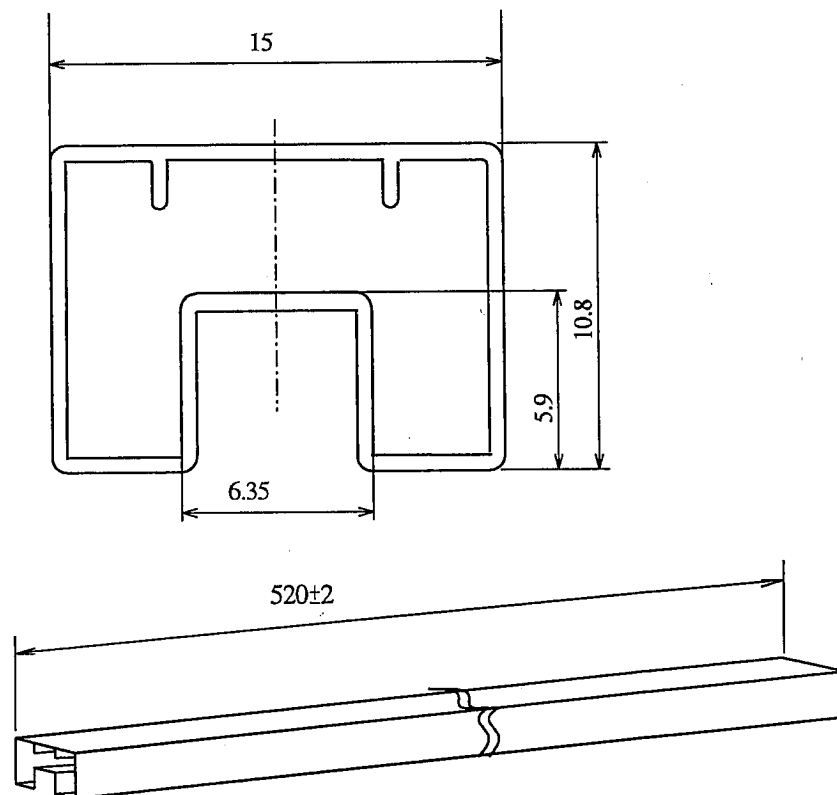
### 6.2.1 Package materials

No.	Name	Materials	Purposes
①	Sleeve	HIPS with preventing static electricity	Products packaged
②	Stopper	Styrene-Erastomer	Products fixed
③	Packing case	Corrugated cardboard	Sleeve packaged
④	Moltplane	Urethane	Sleeve fixed
⑤	Kraft tape	Paper	Lid of packing case fixed
⑥	Label	Paper	Model No., quantity, inspection date and lot No. specified

### 6.2.2 Package method

- (1) MAX. 100pcs. of products shall be packaged in a sleeve ① and both of sleeve edges shall be fixed by stoppers ②.
- (2) MAX. 20 sleeves (product : 2000pcs.) above shall be packaged in a packing case ③ and pack a sheet of Moltplane ④ at one side.
- (3) Model No., quantity, inspection date and lot No. shall be marked on the label ⑥ and this label shall be put on the side of the packing case.
- (4) Case shall be closed with the lid and enclosed with kraft tape ⑤.

### 6.2.3 Sleeve package ① outline dimensions



Note 1) Thickness :  $0.5 \pm 0.2$ mm

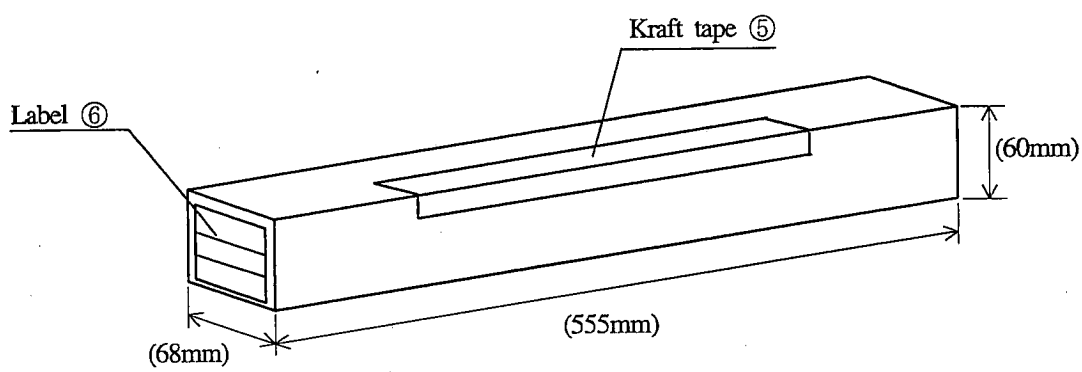
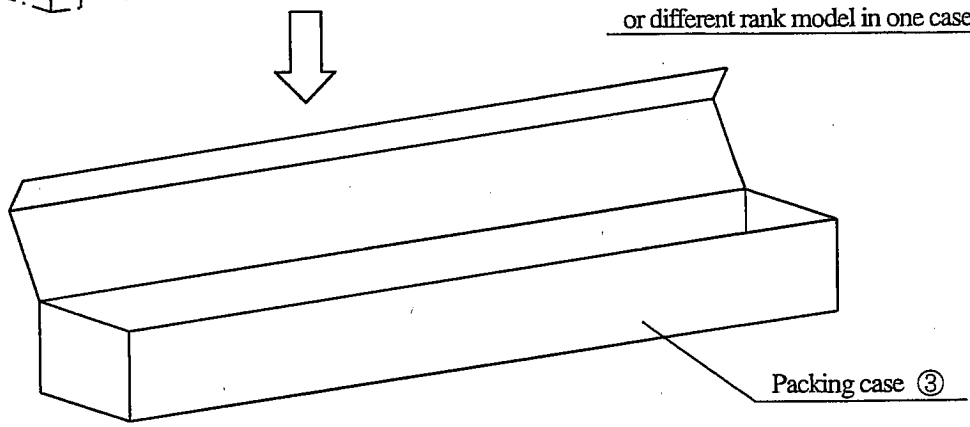
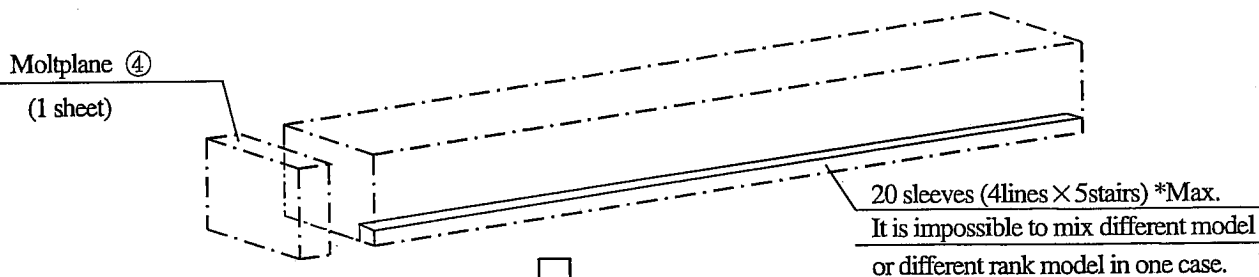
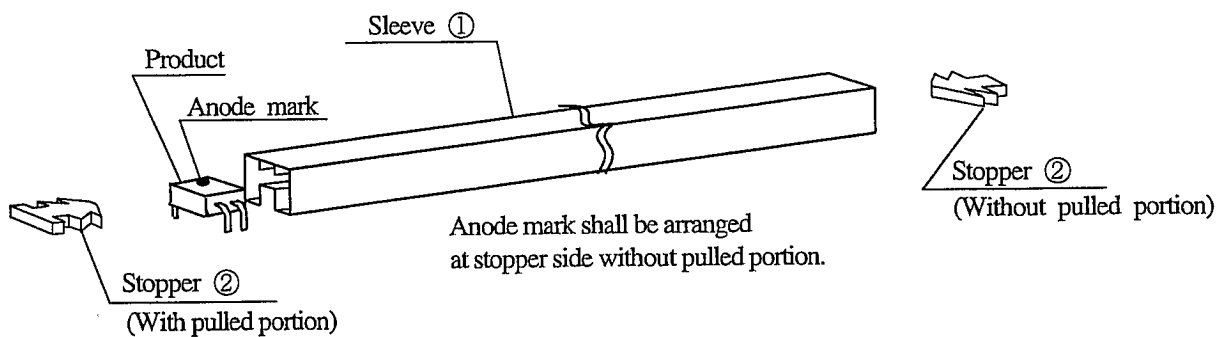
2) Outer R : 0.5mm

3) Process with applying antistatic treatment

4) Unless otherwise specified tolerances shall be  $\pm 0.5$ mm

(However except for deformation due to the rubber stopper in sleeve.)

### 6.2.4 Packing case outline dimensions



Regular packing mass : Approx. 860g  
 ( ) : typical value

**REFERENCE**Precautions for Photocouplers

## 1 For cleaning

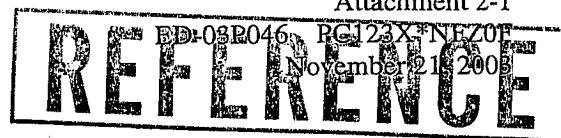
- (1) Solvent cleaning : Solvent temperature 45°C or less  
Immersion for 3 min or less
- (2) Ultrasonic cleaning : The effect to device by ultrasonic cleaning differs by cleaning bath size, ultrasonic power output, cleaning time, PCB size or device mounting condition etc. Please test it in actual using condition and confirm that doesn't occur any defect before starting the ultrasonic cleaning.
- (3) Applicable solvent : Ethyl alcohol, Methyl alcohol, Isopropyl alcohol  
When the other solvent is used, there are cases that the packaging resin is eroded.  
Please use the other solvent after thorough confirmation is performed in actual using condition.

## 2. For circuit design

- 2.1 The LED used in the Photocoupler generally decreases the light emission power by operation.  
In case of long operation time, please design the circuit with considering the degradation of the light emission power of the LED.  
(50%/5years)
- 2.2 There are cases that the deviation of the CTR and the degradation of the relative light emission power of the LED become big when the setting value of  $I_F < 1\text{mA}$ . Please design the circuit with considering this point.

## 3. Precautions for Soldering

- (1) In the case of flow soldering (Whole dipping is possible)  
It is recommended that flow solder be at 270°C or less and within 10 seconds (Pre-heating : 100 to 150°C, 30 to 80seconds).  
(2 times or less)
- (2) In the case of hand soldering  
What is done on the following condition is recommended.( 2 times or less)  
Soldering iron temperature : 400°C or less  
Time : 3s or less
- (3) Other precautions  
Depend on equipment and soldering conditions (temperature, Using solder etc.),  
the effect to junction between PCB and lead pins of photocoupler is different.  
Please confirm that there is no problem on the actual use conditions.




- This specification shall be applied to photocoupler, Model No. PC123 as an option.
- Applicable Models (Business dealing name)  
PC123XNYFZ0F, PC123X1YFZ0F, PC123X2YFZ0F, PC123X5YFZ0F, PC123X8YFZ0F, PC123X9YFZ0F
- The relevant models are the models approved by VDE according to DIN VDE0884/08.87.

Approved Model No. : PC123

VDE approved No. : 83601 (According to the specification DIN VDE0884/08.87)

- Operating isolation voltage  $U_{IORM}$  : 710V (Peak)
- Transient voltage  $U_{TR}$  : 6000V (Peak)
- Pollution : 2 (According to VDE0110/01.89)
- Clearances distance (Between input and output) : 8.0mm (MIN.)
- Creepage distance (Between input and output) : 8.0mm (MIN.)
- Isolation thickness between input and output : 0.4mm (MIN.)
- Tracking-proof : CTI 175 (Material group IIIa : VDE0110/01.89)
- Safety limit values
  - Current (Isi) : 120mA (Diode side)
  - Power (Psi) : 300mW (Phototransistor side)
  - Temperature (Tsi) : 150°C

In order to keep safety electric isolation of photocoupler, please set the protective circuit to keep within safety limit values when the actual application equipment troubled.

- Indication of VDE approval prints "  " on sleeve package.

- Outline Refer to the attachment-2-2.

- Isolation specification according to VDE 0884

Parameter	Symbol	Condition	Rating	Unit	Remark									
Class of environmental test	-	DIN IEC68	30/100/21	-										
Pollution	-	DIN VDE0110	2	-										
Maximum operating isolation voltage	$U_{IORM}$ (PEAK)	-	710	V	Refer to the Diagram 1, 2 (Attachement-2-3)									
Partial discharge test voltage (Between input and output)														
<table border="1" style="width: 100%;"> <tr> <td>Diagram 1</td> <td><math>U_{pr}</math> (PEAK)</td> <td><math>t_p=60s, q_c&lt;5pC</math></td> <td>852</td> <td>V</td> </tr> <tr> <td>Diagram 2</td> <td></td> <td><math>t_p=1s, q_c&lt;5pC</math></td> <td>1136</td> <td>V</td> </tr> </table>	Diagram 1	$U_{pr}$ (PEAK)	$t_p=60s, q_c<5pC$	852		V	Diagram 2		$t_p=1s, q_c<5pC$	1136	V			
Diagram 1	$U_{pr}$ (PEAK)	$t_p=60s, q_c<5pC$	852	V										
Diagram 2		$t_p=1s, q_c<5pC$	1136	V										
Maximum over-voltage	$U_{INITIAL}$ (PEAK)	$t_{NI}=10s$	6000	V										
Safety maximum ratings					Refer to the Fig. 6, 7 (Attachement-2-3)									
1) Case temperature	Tsi	$I_f=0, P_c=0$	150	°C										
2) Input current	Isi	$P_c=0$	120	mA										
3) Electric power (Output or Total power dissipation)	Psi	-	300	mW										
Isolation resistance (Test voltage between input and output ; DC500V)	$R_{ISO}$													
		$T_a=T_{si}$	MIN.10 <sup>9</sup>	Ω										
		$T_a=T_{opr}$ (MAX.)	MIN.10 <sup>11</sup>											
		$T_a=25°C$	MIN.10 <sup>12</sup>											

- Precautions in performing isolation test

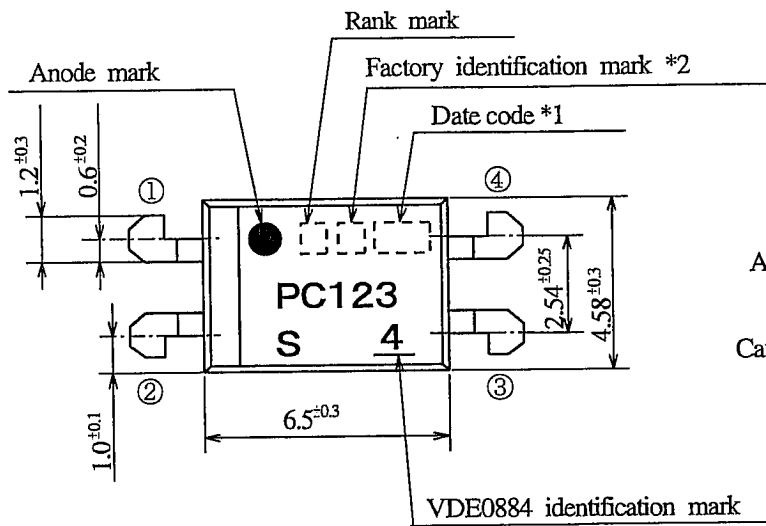
6.1 Partial discharge test methods shall be the ones according to the specifications of VDE 0884/08.87

6.2 Please don't carry out isolation test ( $V_{iso}$ ) over  $U_{INITIAL}$ .

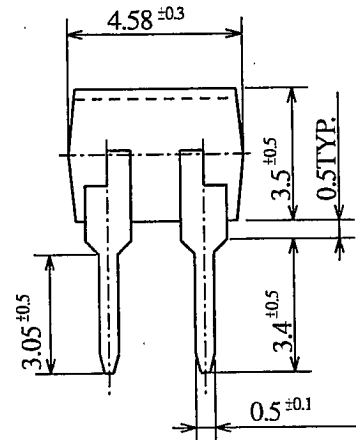
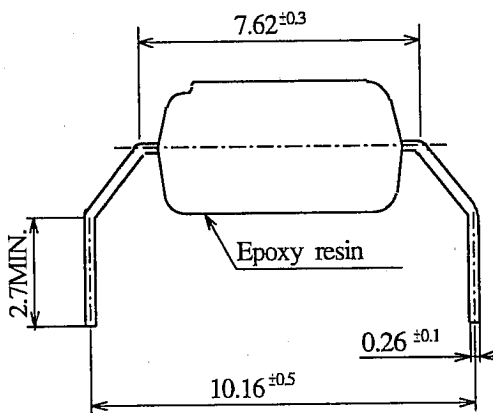
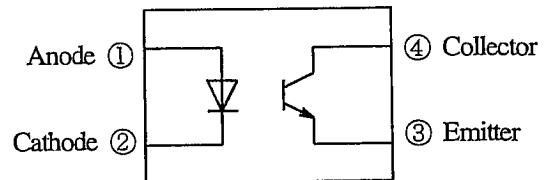
This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex.  $U_{INITIAL}$ ).

And there is possibility that this product occurs partial discharge in operating isolation voltage. ( $U_{IORM}$ ).

4. Outline



Pin Nos. and internal connection diagram



- \*1) 2-digit number shall be marked according to OLD DIN standard
- \*2) Factory identification mark shall be or shall not be marked

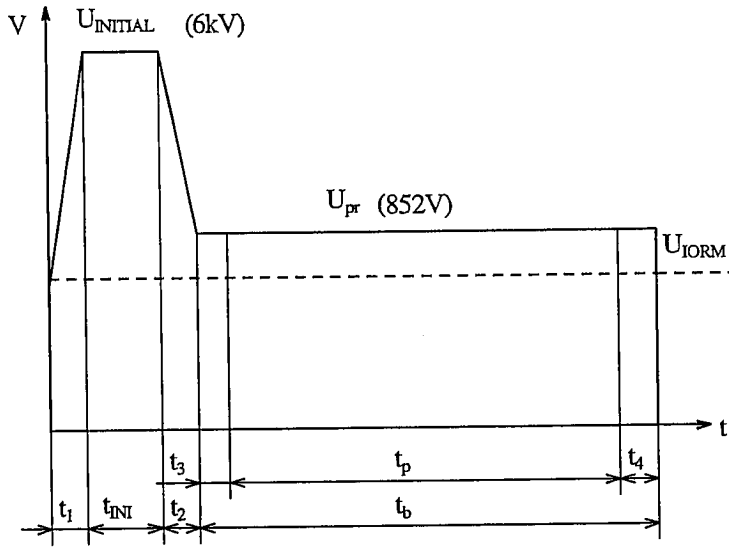
Pin material : Copper Alloy  
Pin finish : SnCu plating (Cu : TYP. 2%)

Product mass : Approx. 0.23 g

Marking is laser marking

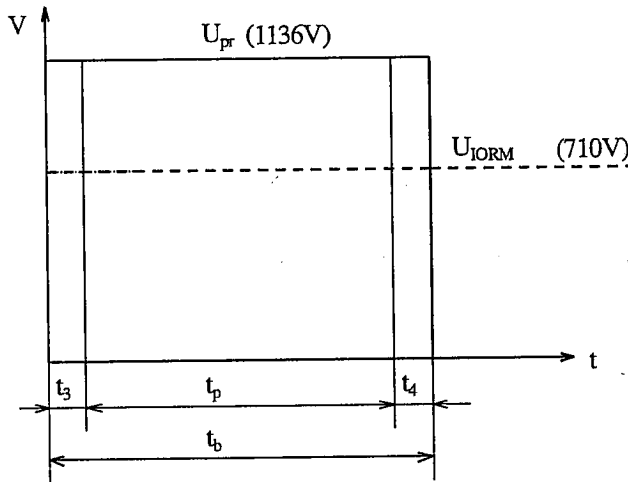
<b>UNIT : 1/1 mm</b>	
Name	PC123 Outline Dimensions (Business dealing name : PC123X*YFZ0F)

Method of Diagram 1: Breakdown test (Apply to tape test and sampling test)



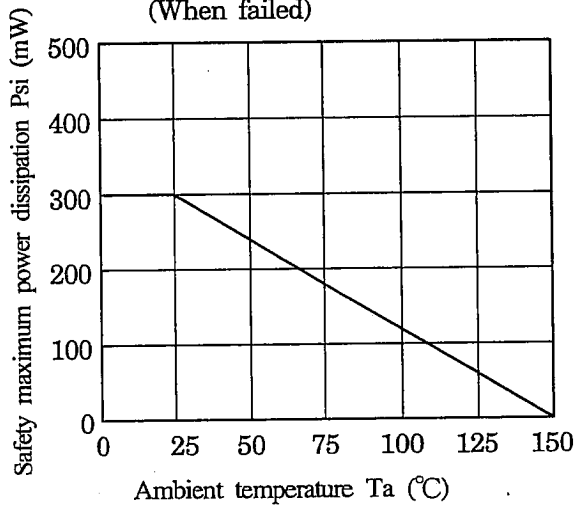
- $t_1, t_2 = 1 \text{ to } 10 \text{ s}$
- $t_3, t_4 = 1 \text{ s}$
- $t_p$  (Partial discharge measuring time) = 60 s
- $t_b = 62 \text{ s}$
- $t_{INI} = 10 \text{ s}$

Method of Diagram 2: Non breakdown test (Apply to all device test)



- $t_3, t_4 = 0.1 \text{ s}$
- $t_p$  (Partial discharge measuring time) = 1 s
- $t_b = 1.2 \text{ s}$

(Fig.6) Safety maximum power dissipation vs. ambient temperature (When failed)



(Fig.7) Safety maximum forward current vs. ambient temperature (When failed)

