

SHARP

SPEC. No. ED-04P020
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OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC123

Business dealing name

PC123Z03J00F		PC123Y03J00F
PC123Z13J00F		PC123Y13J00F
PC123Z23J00F	○	PC123Y23J00F
PC123Z53J00F		PC123Y53J00F
PC123Z83J00F		PC123Y83J00F

Specified for _____

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 copy of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

PRESENTED

DATE

DATE

BY

BY Id, e.

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

Product name : PHOTOCOUPLER

Model No. : PC123

Business dealing name

PC123Z03J00F	PC123Y03 J00F
PC123Z13 J00F	PC123Y13 J00F
PC123Z23 J00F	PC123Y23 J00F
PC123Z53 J00F	PC123Y53 J00F
PC123Z83 J00F	PC123Y83 J00F

1. These specification sheets include materials protected under copyright of Sharp Corporation ("Sharp"). Please do not reproduce or cause anyone to reproduce them without Sharp's consent.
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"> · OA equipment Audio visual equipment · Home appliances · Telecommunication equipment (Terminal) · Measuring equipment · Tooling machines · Computers |
|---|

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"> · Transportation control and safety equipment (aircraft, train, automobile etc.) · Traffic signals · Gas leakage sensor breakers · Rescue and security equipment · Other safety equipment etc. |
|---|

- (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"> · Space equipment · Telecommunication equipment (for trunk lines) · Nuclear power control equipment · Medical equipment etc. |
|--|

- (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 (Lead-Free Type).

- 2. Outline Refer to the attached sheet, page 3.
- 3. Ratings and characteristics Refer to the attached sheet, page 4.
- 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 and cathode on the primary side and between collector and 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 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)
	PC123Z03J00F		PC123Y03 J00F	with or without	2.5 to 20.0
	PC123Z13J00F		PC123Y13 J00F	L	2.5 to 7.5
	PC123Z23 J00F	○	PC123Y23 J00F	M	5.0 to 12.5
	PC123Z53 J00F		PC123Y53 J00F	N	10.0 to 20.0
	PC123Z83 J00F		PC123Y83 J00F	E	5.0 to 10.0

Test conditions
I _F =5mA
V _{CE} =5V
T _a =25°C

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

6.3 Package specifications Refer to the attached sheet, page 8, 9.

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 on minimum unit package.

6.6 This product is approved by BSL (BS EN60065, BS EN60950)

Approved Model No. : PC123
Certificate No. : 70877409

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 : CFCS, Halon, Carbon tetrachloride, 1,1,1-Trichloroethane (Methyl chloroform)

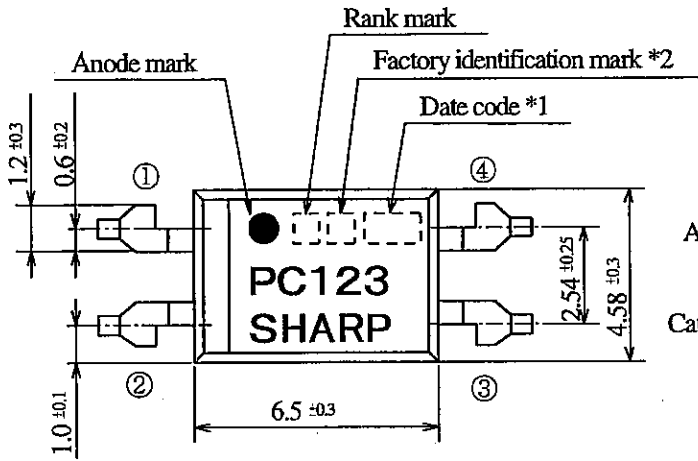
6.10 Brominated flame retardants

Specific brominated flame retardants such as the PBBOS and PBBS are not used in this device at all.

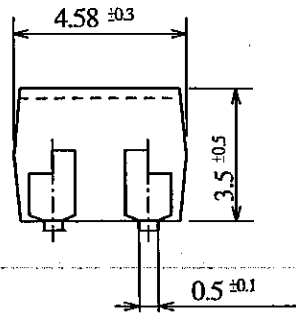
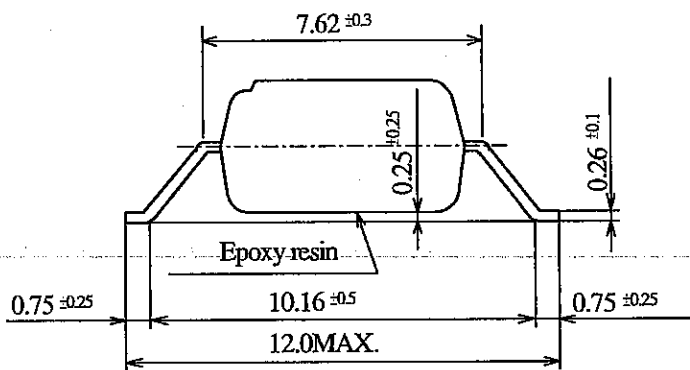
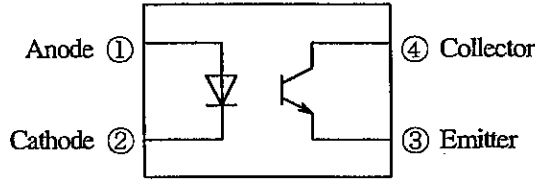
7. Notes

Precautions for photocouplers : Attachment-1

2. 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. 0.22 g

Marking is laser marking

UNIT : 1/1 mm	
Name	Outline Dimensions PC123 (Business dealing name : PC123Z*3J00F)

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25°C

Parameter		Symbol	Rating	Unit
Input	*1 Forward current	I_F	50	mA
	*2 Peak forward current	I_{FM}	1	A
	Reverse voltage	V_R	6	V
	*1 Power dissipation	P	70	mW
Output	Collector-emitter voltage	V_{CEO}	70	V
	Emitter-collector voltage	V_{ECO}	6	V
	Collector current	I_c	50	mA
	*1 Collector power dissipation	P_c	150	mW
*1 Total power dissipation		P_{tot}	200	mW
Operating temperature		T_{opr}	-30 to +100	°C
Storage temperature		T_{sg}	-55 to +125	°C
*3 Isolation voltage		$V_{iso(ms)}$	5	kV
*4 Soldering temperature		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	μA
	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}	$I_E=10 \mu A, I_F=0$	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	5×10^{10}	10^{11}	-	Ω
	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
	Rise time	t_r	$V_{CE}=2V, I_c=2mA$	-	4	18	μs
	Fall time	t_f	$R_L=100 \Omega$	-	3	18	μs

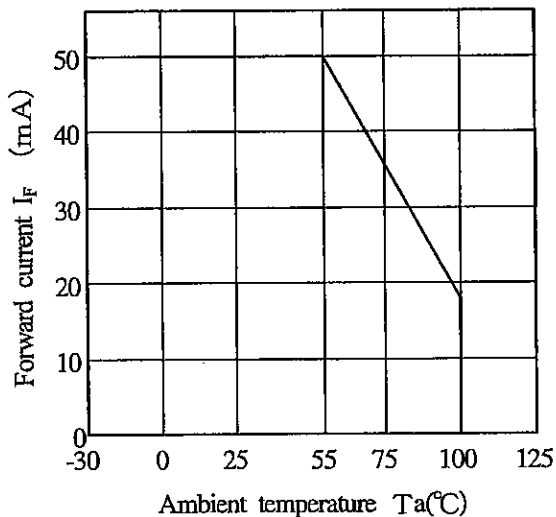
*1 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1 to 4.

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

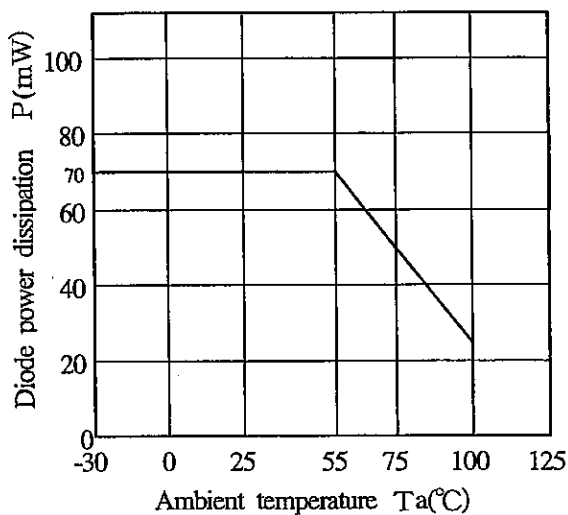
*3 AC for 1 min, 40 to 60%RH

*4 For 10 s

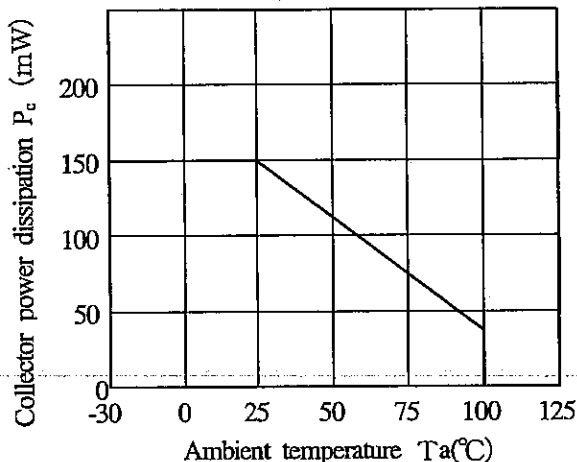
(fig.1) Forward current vs. ambient temperature



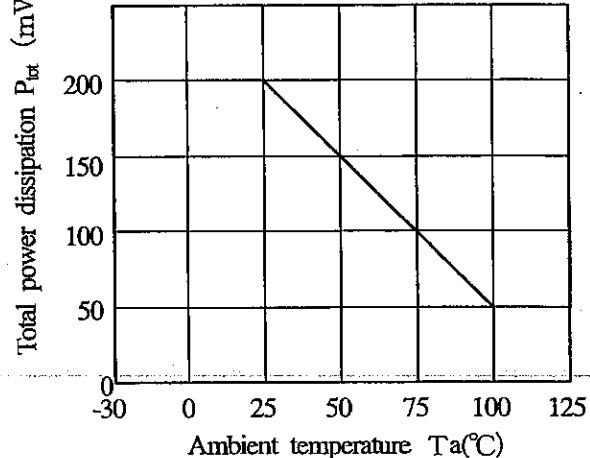
(fig.2) Diode power dissipation vs. ambient temperature



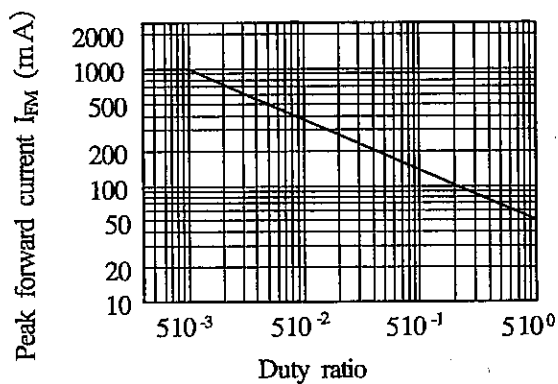
(fig.3) Collector power dissipation vs. ambient temperature



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



(fig.5) Forward current vs. ambient temperature



Pulse width $\leq 100 \mu s$
 $T_a = 25^\circ C$

4. Reliability

The reliability of products shall satisfy items listed below.

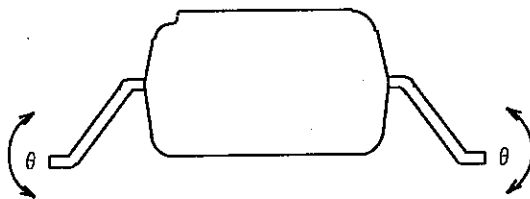
Confidence level : 90%
 LTPD : 10 or 20

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	$V_F > U \times 1.2$ $I_R > U \times 2$ $I_{CEO} > U \times 2$ $I_C < L \times 0.7$ $V_{CE(sat)} > U \times 1.2$ 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 ² , 0.5ms 3 times/±X, ±Y, ±Z direction		n=11, C=0
Variable frequency vibration	100 to 2000 to 100Hz/4 min 200m/s ² 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	+60, 90H, 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

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

(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

6.3 Package specifications

6.3.1 Taping conditions

- (1) Tape structure and Dimensions (Refer to the attached sheet, Page 8)
The carrier tape has the heat pressed structure of PS material carries tape and three layers cover tape (PET material base).
- (2) Reel structure and Dimensions (Refer to the attached sheet, Page 9)
The taping reel shall be of plastic (PS material) with its dimensions as shown in the attached drawing.
- (3) Direction of product insertion (Refer to the attached sheet, Page 9)
Product direction in carrier tape shall direct to the anode mark at the hole side on the tape.
- (4) Joint of tape
The cover tape and carrier tape in one reel shall be jointless.
- (5) To repair taped failure devices
To repair taped failure devices cutting a bottom of carrier tape with a cutter, and after replacing to good devices, the cut portion shall be sealed with adhesive tape.

6.3.2 Adhesiveness of cover tape

The exfoliation force between carrier tape and cover tape shall be 0.2N to 0.7N for the angle 160° to 180° .

6.3.3 Rolling method and quantity

Wind the tape back on the reel so that the cover tape will be outside the tape.
Attach more than 20cm of blank tape to the trailer and the leader of the tape and fix the both ends with adhesive tape.
One reel shall contain 2000pcs.

6.3.4 Outer packing appearance (Refer to attached sheet, Page 9)

6.3.5 Marking

The outer packaging case shall be marked with following information.
* Model No. * Number of pieces delivered * Production date

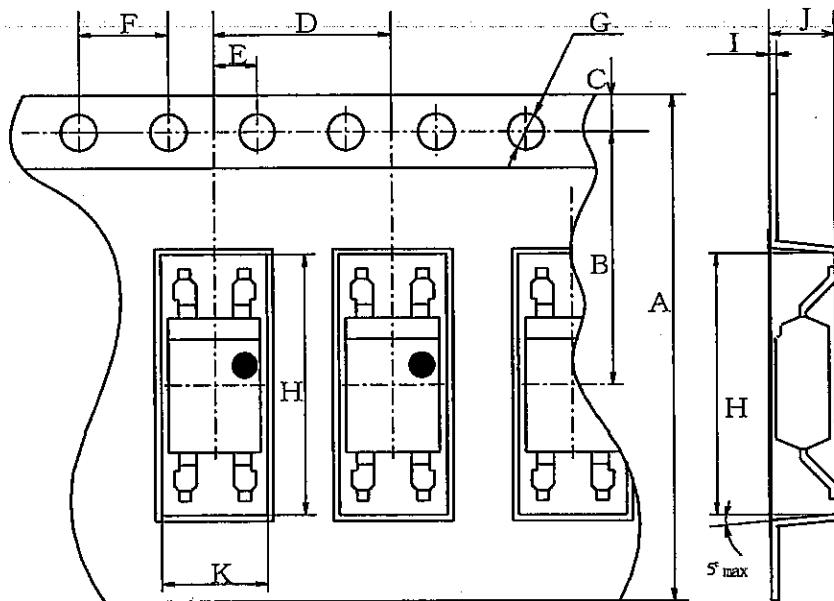
6.3.6 Storage condition

Taped products shall be stored at the temperature 5 to 30°C and the humidities lower than 70%RH.

6.3.7 Safety protection during shipping

There shall be no deformation of component or degradation of electrical characteristics due to shipping.

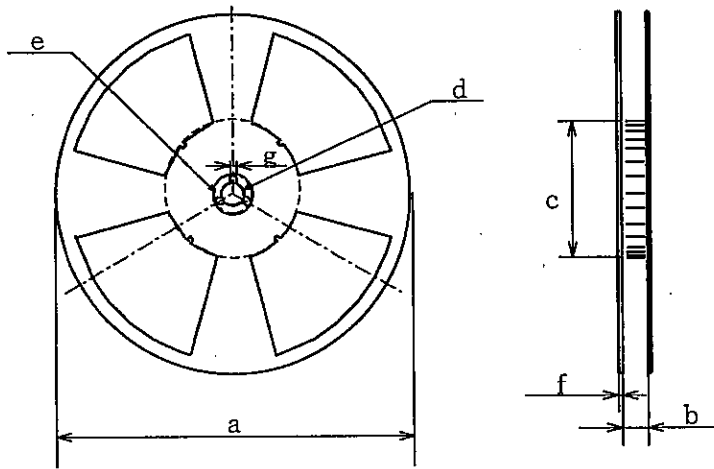
Carrier tape structure and Dimensions



Dimensions list (Unit : mm)

A	B	C	D	E	F	G	H	I	J	K
±0.3	±0.1	±0.1	±0.1	±0.1	±0.1	+0.1 -0	±0.1	±0.05	±0.1	±0.1
24.0	11.5	1.75	8.0	2.0	4.0	φ1.5	12.4	0.4	4.1	5.1

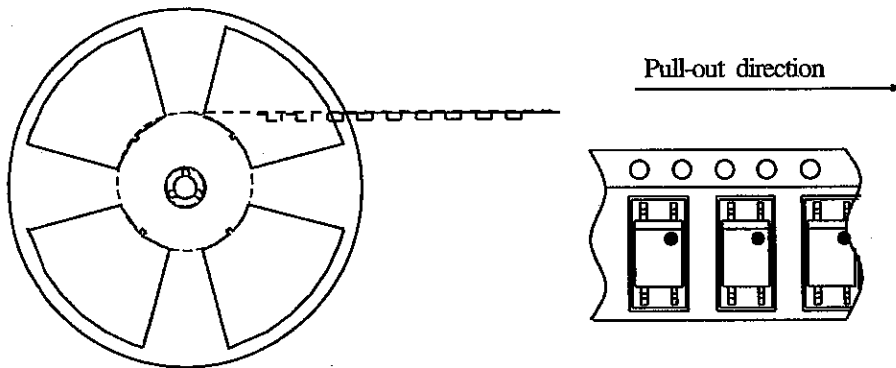
Reel structure and Dimensions



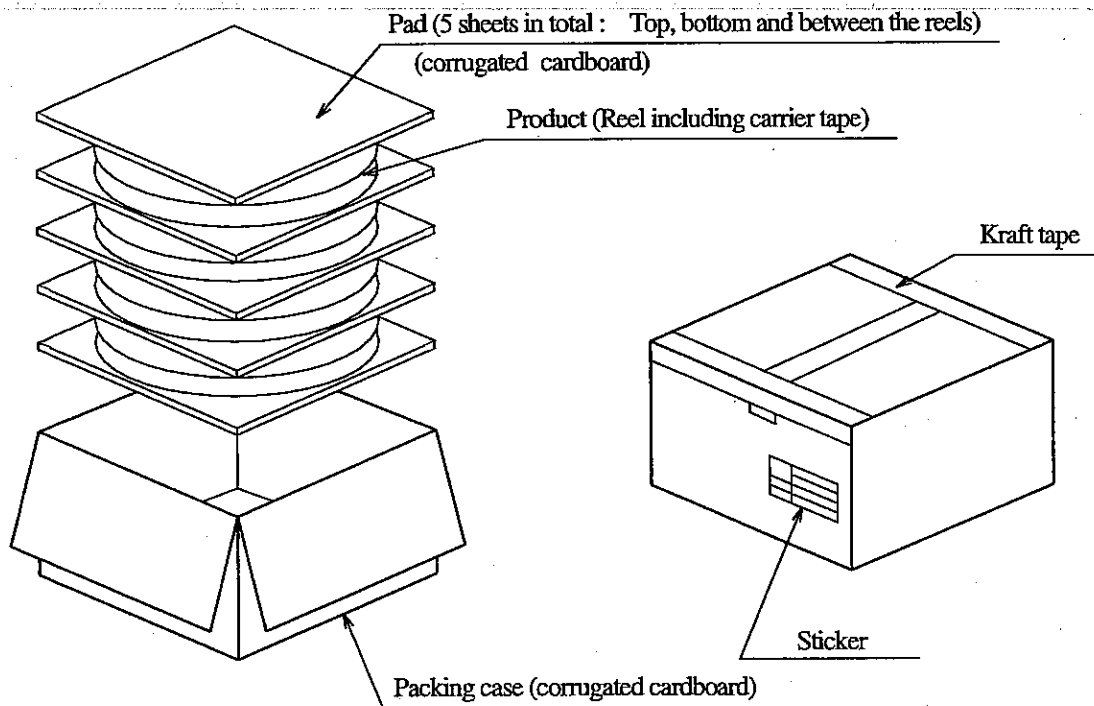
Dimensions list (Unit : mm)

a	b	c	d
330	25.5±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



Outer packing appearance



Regular packing mass : Approx. 4.3kg

Precautions for Photocouplers

1 For cleaning

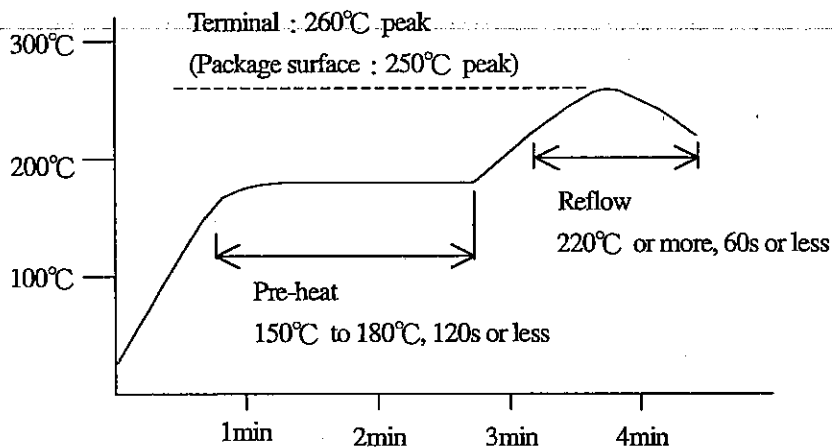
- (1) Solvent cleaning : Solvent temperature 45°C or less
 Immersion for 3 min or less
- (2) Ultrasonic cleaning : The effect to device by ultrasonic cleaning differs by cleaning bath size, ultrasonic power output, cleaning time, PCB size or device mounting condition etc. Please test it in actual using 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

- (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) 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 is less than 1.0mA. 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) If solder reflow :
 It is recommended to be done at the temperature and the time within the temperature profile as shown in the figure below. (2 times or less)



- (3) 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
- (4) Other precautions
 Since, influence to the device is different according to reflow equipment and its condition, please use the device after confirming no damage in the actual using condition.

1. This specification shall be applied to photocoupler, Model No. PC123 as an option.

2. Applicable Models (Business dealing name)

PC123Y03J00F, PC123Y13J00F, PC123Y23J00F, PC123Y53J00F, PC123Y83J00F

3. The relevant models are the models Approved by VDE according to DIN EN 60747-5-2.


Up to date code "RD" (December 2003), the relevant models are approved by VDE according to DIN VDE 0884/08.87.

Approved Model No. : PC123

VDE approved No. : 40008087 (According to the specification DIN EN 60747-5-2)

- Operating isolation voltage $U_{IORM(peak)}$: 1140V
- Transient voltage $U_{TR(peak)}$: 9000V
- Pollution : 2
- Clearances distance (Between input and output) : 8.0mm (MIN.)
- Creepage distance (Between input and output) : 8.0 mm (MIN.)
- Isolation thickness between input and output : 0.4mm (MIN.)
- Tracking-proof : CTI 175
- Safety limit values
 - Current (Isi) : 200mA (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 minimum unit package.

4. Outline Refer to the attachment-2-2.

5. Isolation specification according to EN 60747-5-2

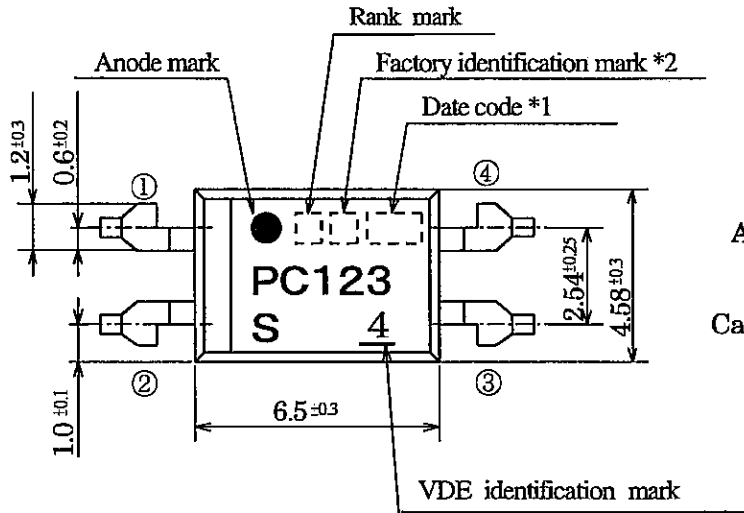
Parameter	Symbol	Condition	Rating	Unit	Remark									
Class of environmental test	-	-	55/100/21	-										
Pollution	-	-	2	-										
Maximum operating isolation voltage	$U_{IORM(PEAK)}$	-	1140	V	Refer to the Diagram 1,2 (Attachement-2-3)									
Partial discharge test voltage (Between input and output)														
<table border="1" style="width: 100%;"> <tr> <td>Diagram 1</td> <td>$U_{pr(PEAK)}$</td> <td>$t_p=10s, q_c<5pC$</td> <td>1710</td> <td>V</td> </tr> <tr> <td>Diagram 2</td> <td></td> <td>$t_p=1s, q_c<5pC$</td> <td>2140</td> <td>V</td> </tr> </table>	Diagram 1	$U_{pr(PEAK)}$	$t_p=10s, q_c<5pC$	1710		V	Diagram 2		$t_p=1s, q_c<5pC$	2140	V			
Diagram 1	$U_{pr(PEAK)}$	$t_p=10s, q_c<5pC$	1710	V										
Diagram 2		$t_p=1s, q_c<5pC$	2140	V										
Maximum over-voltage	$U_{IOTM(PEAK)}$	$t_{MI}=60s$	9000	V										
Safety maximum ratings					Refer to the Diagram 6,7 (Attachement-2-3)									
1) Case temperature	Tsi	$I_f=0, P_C=0$	150	°C										
2) Input current	Isi	$P_C=0$	200	mA										
3) Electric power (Output or Total power dissipation)	Psi	-	300	mW										
Isolation resistance (Test voltage between input and output ; DC500V)	R_{ISO}		<table border="1" style="width: 100%;"> <tr> <td>$T_a=T_{si}$</td> <td>MIN.10⁹</td> </tr> <tr> <td>$T_a=T_{opr(MAX.)}$</td> <td>MIN.10¹¹</td> </tr> <tr> <td>$T_a=25°C$</td> <td>MIN.10¹²</td> </tr> </table>	$T_a=T_{si}$	MIN.10 ⁹	$T_a=T_{opr(MAX.)}$	MIN.10 ¹¹	$T_a=25°C$	MIN.10 ¹²	Ω				
$T_a=T_{si}$	MIN.10 ⁹													
$T_a=T_{opr(MAX.)}$	MIN.10 ¹¹													
$T_a=25°C$	MIN.10 ¹²													

6. Precautions in performing isolation test

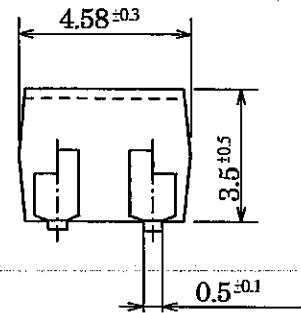
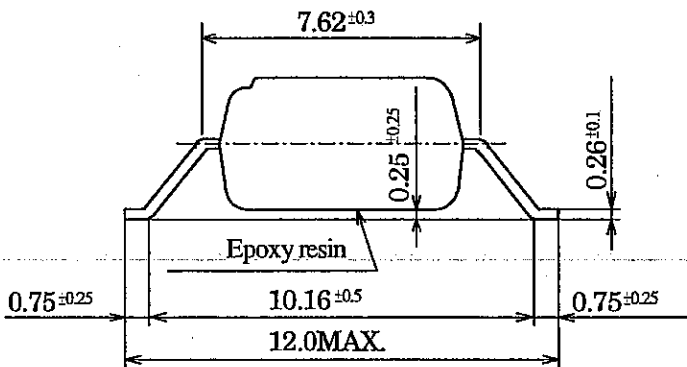
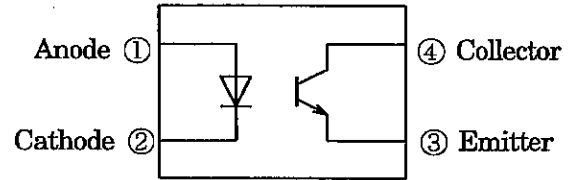
6.1 Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-2

6.2 Please don't carry out isolation test (V_{iso}) over U_{IOTM} . This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. U_{IOTM}). 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

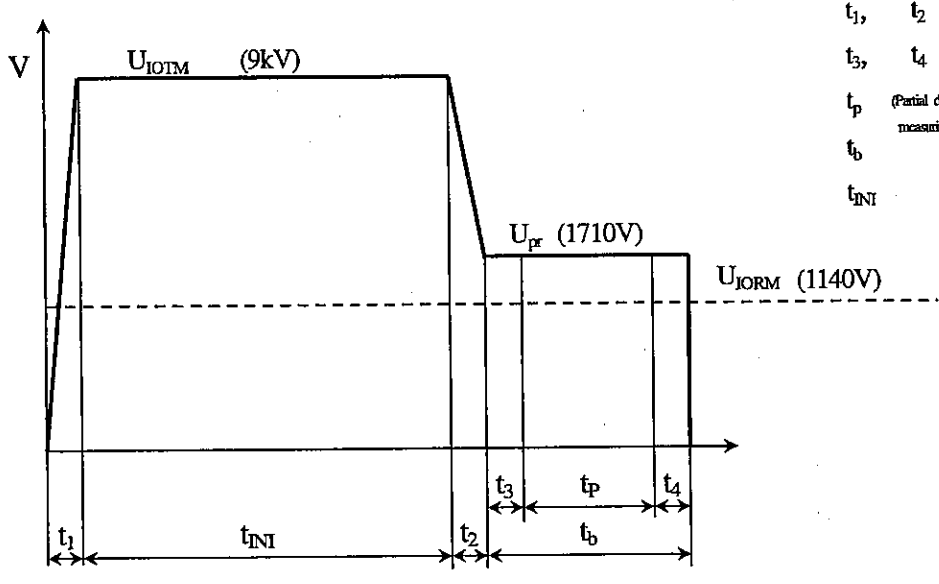
Pin material : Copper Alloy
 Pin finish : SnCu plating (Cu : TYP. 2%)

Product mass : Approx. 0.22 g

Marking is laser marking

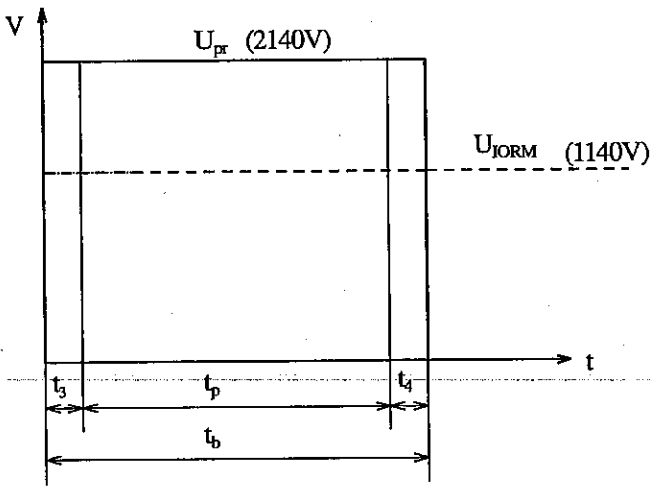
UNIT : 1/1 mm	
Name	PC123 Outline Dimensions (Business dealing name: PC123Y*3J00F)

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



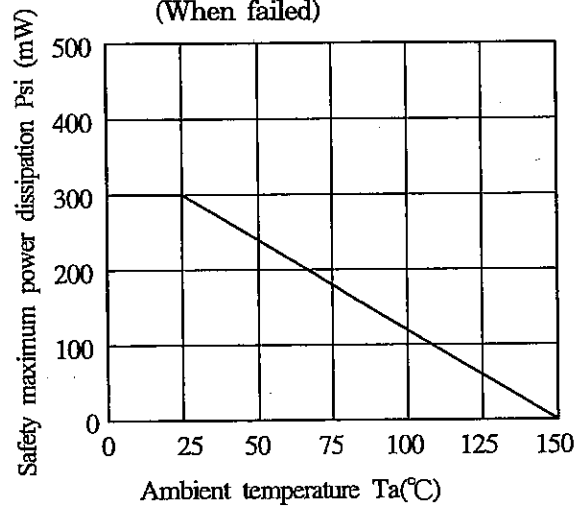
- $t_1, t_2 = 1 \text{ to } 10 \text{ s}$
- $t_3, t_4 = 1 \text{ s}$
- t_p (Partial discharge measuring time) = 10 s
- $t_b = 12 \text{ s}$
- $t_{INI} = 60 \text{ s}$

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)

