

PC1231xxFZ0X Series Photocoupler

Product Specification

November 2009

PC1231xxFZ0X Series

Full Specification for part numbers:

PC12310NFZ0X

PC12310YFZ0X

PC12311NFZ0X

PC12311YFZ0X

REFERENCE

SPIC No. D0-09P036A
ISSUE November 18, 2009

SHARP

SYSTEM DEVICE DIVISION I
ELECTRONIC COMPONENTS AND DEVICES GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC1231

Business dealing name			
	PC12310NFZ0X		PC12310YFZ0X
	PC12311NFZ0X		PC12311YFZ0X

Specified for

Enclosed please find copies of the Specifications which consists of 15 pages including cover.
This specification sheets and attached sheets shall be both side copy.
After confirmation of the contents, please be sure to send back copy of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

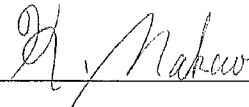
DATE

BY

PRESENTED

DATE

BY



for M. Kubo,
Department General Manager of
Development Dept. IV
System Device Div. I
Electronic Components and Devices Group
SHARP CORPORATION

REFERENCE

Product name : PHOTOCOUPLER

Model No. : PC1231

Business dealing name	
PC12310NFZ0X	PC12310YFZ0X
PC12311NFZ0X	PC12311YFZ0X

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) Please do verify the validity of this part after assembling it in customer's products, when customer wants to make catalogue and instruction manual based on the specification sheet of this part.
- (2) This product is designed for use in the following application areas ;
(
 - 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 (3) or (4), please be sure to observe the precautions given in those respective paragraphs.
- (3) 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 ;
(
 - Transportation control and safety equipment (aircraft, train, automobile etc.)
 - Traffic signals Gas leakage sensor breakers Rescue and security equipment
 - Other safety equipment)
- (4) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;
(
 - Space equipment Telecommunication equipment (for trunk lines)
 - Nuclear power control equipment Medical equipment)
- (5) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above four paragraphs.

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

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 Specified brominated flame retardants

Specified brominated flame retardants (PBB and PBDE) are not used in this device at all.

6.11 Compliance with each regulation

(1) The RoHS directive (2002/95/EC)

This product complies with the RoHS directive (2002/95/EC) .

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).

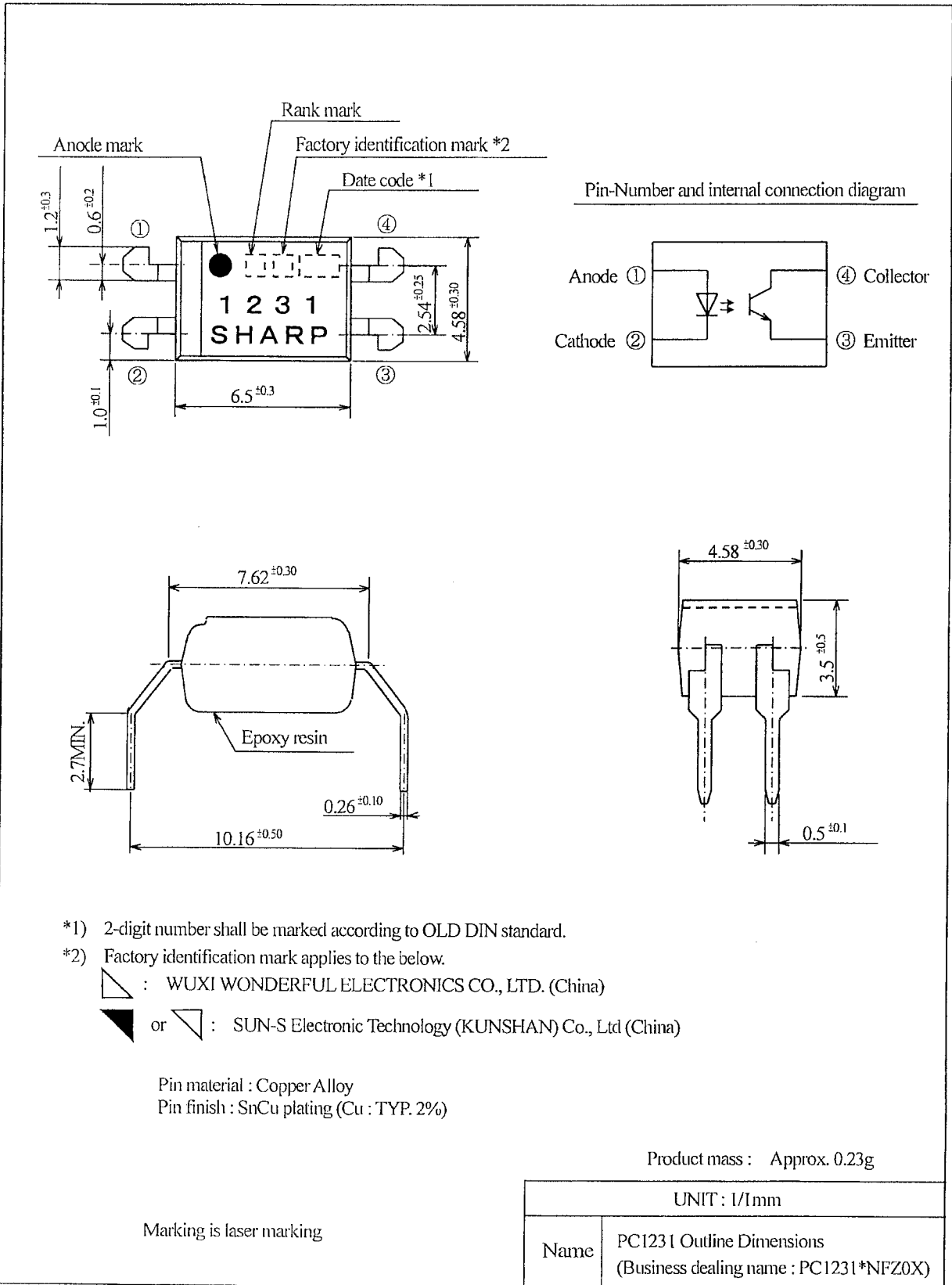
Category	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr ⁶⁺)	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Photocoupler	✓	✓	✓	✓	✓	✓

✓ : indicates that the content of the toxic and hazardous substance in all the homogeneous materials of the part is below the concentration limit requirement as described in SJ/T 11363-2006 standard .

7. Notes

Precautions for Photocouplers : Attachment-1.

2. Outline



UNIT : 1/1mm	
Name	PC1231 Outline Dimensions (Business dealing name : PC1231*NFZ0X)

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25°C

Parameter		Symbol	Rating	Unit
Input	Forward current *1	I _F	10	mA
	Peak forward current *2	I _{FM}	200	mA
	Reverse voltage	V _R	6	V
	Power dissipation *1	P	15	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}	170	mW
Operating temperature		T _{opr}	-30 to +100	°C
Storage temperature		T _{stg}	-55 to +125	°C
Isolation voltage *3		V _{iso(mms)}	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 =5mA	-	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 μA, I _F =0	6	-	-	V
Transfer characteristics	Collector current	I _c	I _F =0.5mA, V _{CE} =5V	0.25	-	2.0	mA
	Collector-emitter saturation voltage	V _{CE(sat)}	I _F =10mA, I _c =1mA	-	-	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
	Response time (Rise)	t _r	V _{CE} =2V, I _c =2mA	-	4	18	μs
	Response time (Fall)	t _f	R _L =100Ω	-	3	18	μs
Common mode rejection ratio *5		CMR	Ta=25°C, R _L =470 Ω V _{CM} =1.5kV(peak), I _F =0, V _{CC} =9V, V _{np} =100mV	10	-	-	kV/μs

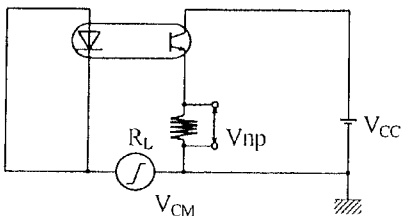
*1 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1 to 4.

*2 Pulse width ≤ 100 μs, Duty ratio : 0.001 (Refer to Fig. 5)

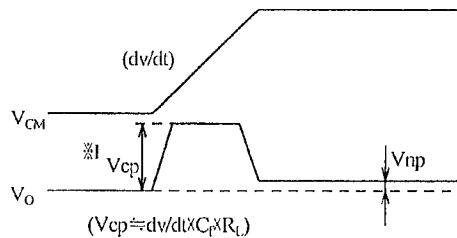
*3 AC for 1 min, 40 to 60%RH

*4 For 10s

*5 Measuring circuit

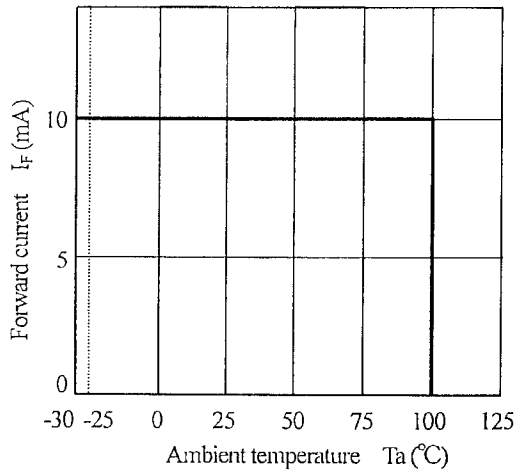


V_{CM} : Higher value of pulse wave
 $R_L=470\Omega$
 $V_{CC}=9V$

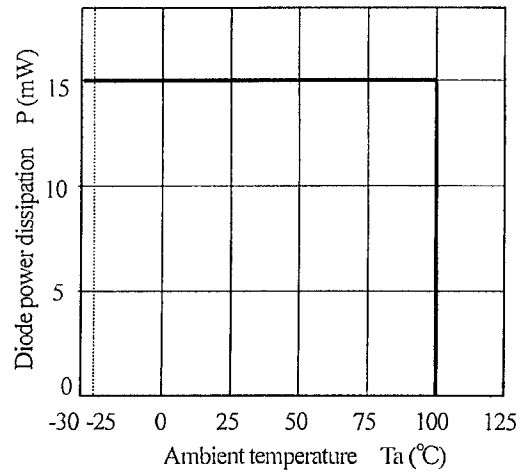


*1 The voltage generated by a displacement current which flow through floating capacity between primary and secondary side

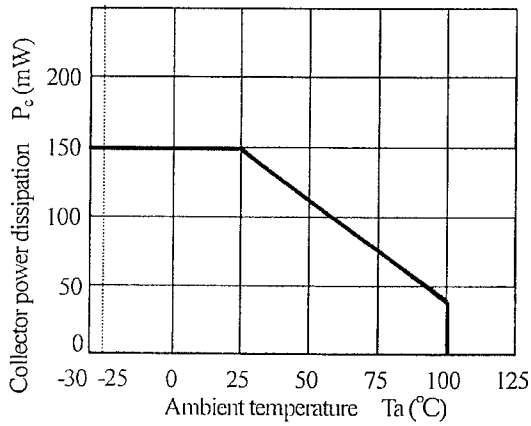
(Fig. 1)
Forward current vs. ambient temperature



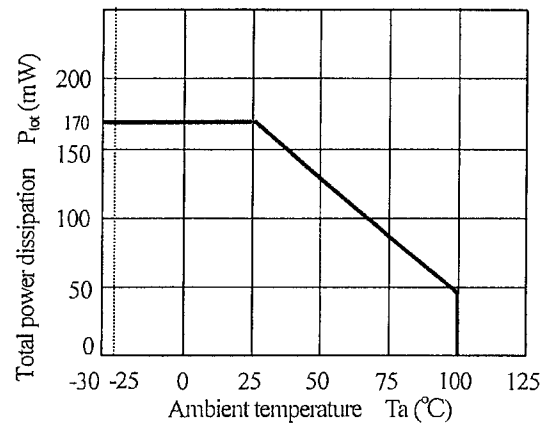
(Fig. 2)
Diode power dissipation vs. ambient temperature



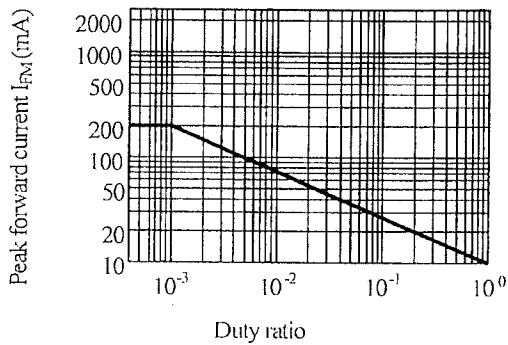
(Fig. 3)
Collector power dissipation vs. ambient temperature



(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%

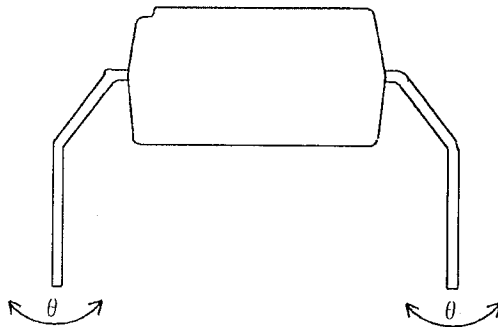
LTPD : 10 or 20

Test Items	Condition	Failure Judgment Criteria	Samples (n) Defective (C)
Solderability	245±3°C, 5s	*2	n=11, C=0
Soldering heat	(Flow soldering) 270°C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $I_{CEO} > U \times 2$ $I_C < L \times 0.7$ $V_{CE(sat)} > U \times 1.2$	n=11, C=0 n=11, C=0 n=11, C=0 n=11, C=0 n=11, C=0 n=22, C=0 n=22, C=0 n=22, C=0 n=22, C=0 n=22, C=0
	(Soldering by hand) 400°C, 3 s		
Terminal strength (Tension)	Weight: 5N 5 s/each terminal		
Terminal strength (Bending) *3	Weight: 2.5N 2 times/each terminal		
Mechanical shock	15km/s ² , 0.5ms 3 times/±X, ±Y, ±Z direction		
Variable frequency vibration	100 to 2000 to 100Hz/4 min 200m/s ² 4 times/X, Y, Z direction		
Temperature cycling	1 cycle -55 °C to +125 °C (30 min) (30 min) 20 cycles test		
High temp. and high Humidity storage	+85°C, 85%RH, 1000h		
High temp. storage	+125 °C, 1000h		
Low temp. storage	-55 °C, 1000h		
Operation life	I _F =10mA, P _{tot} =170mW T _a =25 °C, 1000h		

*1 Test method, conforms to EIAJ ED 4701.

*2 The product whose not-soldered area is more than 5% for all of the dipped area and/or whose pinholes or voids are concentrated on one place shall be judged defect.

*3 Terminal bending direction is shown below.



5. Outgoing inspection

5.1 Inspection items

(1) Electrical characteristics

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

(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

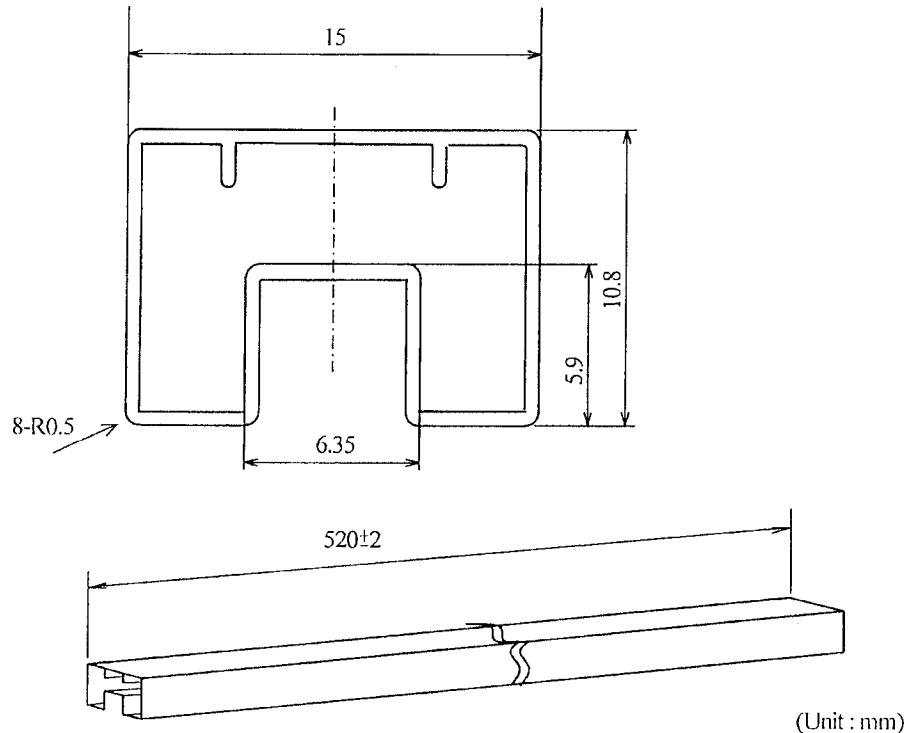
6.2.1 Package materials

No.	Name	Materials	Purposes
①	Sleeve	HIPS or ABS with preventing static electricity	Products packaged
②	Stopper	Styrene-Erastomer	Products fixed
③	Packing case	Corrugated cardboard	Sleeve packaged
④	Cushioning material	Urethane	Sleeve fixed
⑤	Kraft tape	Paper	Lid of packing case fixed
⑥	Label	Paper	Model No.,(Business dealing name),Lot No., Quantity, Country of origin , Company name and Inspection date specified

6.2.2 Package method

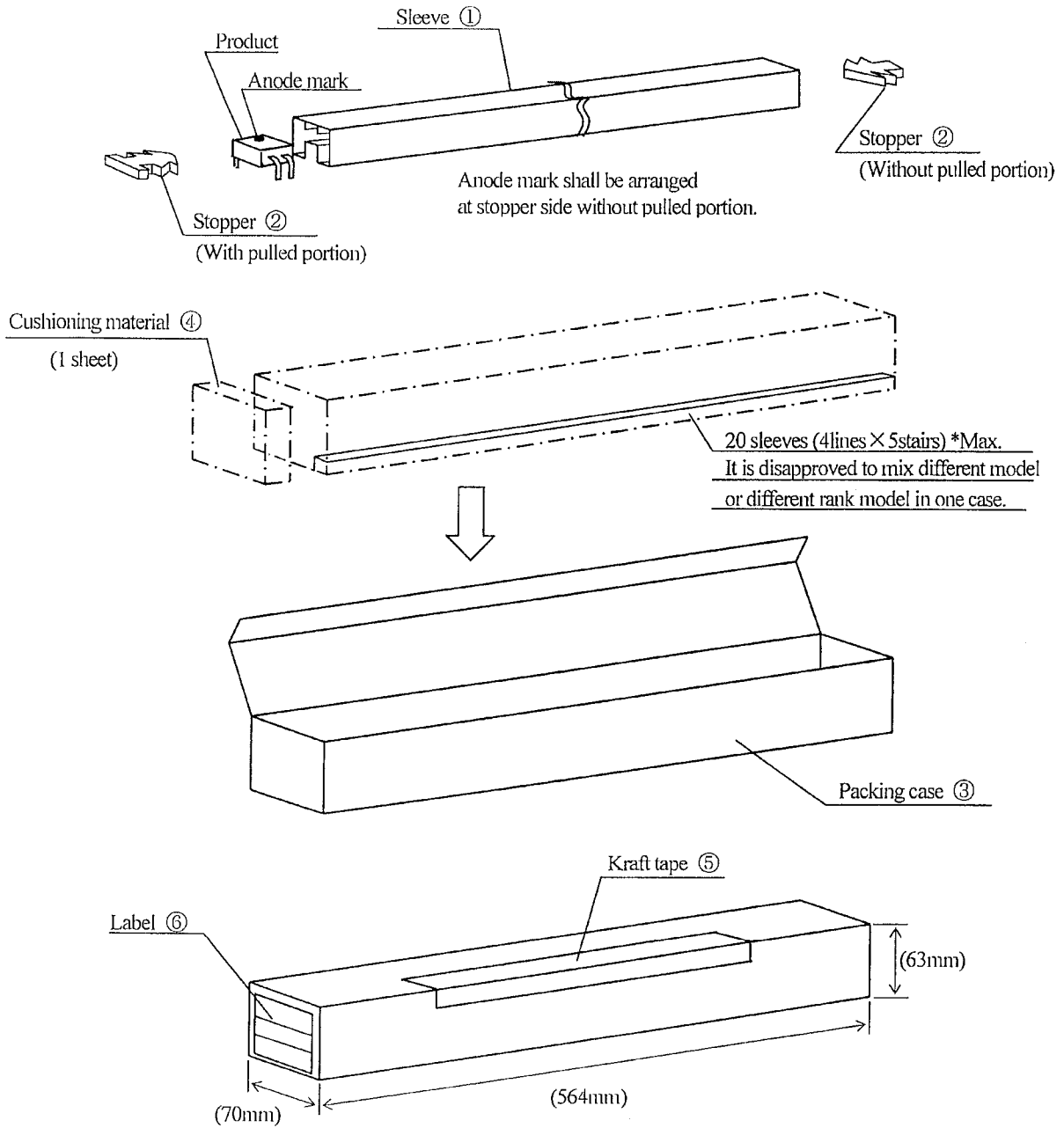
- (1) MAX. 100pcs. of products shall be packaged in a sleeve ① and both of sleeve edges shall be fixed by stoppers ②.
- (2) MAX. 20 sleeves (product : 2000pcs.) above shall be packaged in a packing case ③ and pack a sheet of cushioning material ④ at one side.
- (3) The label ⑥ and this label shall be 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 ± 0.2 mm
 2) Process with applying antistatic treatment
 3) Unless otherwise specified tolerances shall be ± 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. 910g
 () : Reference dimensions

Precautions for Photocouplers

1. 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 any defect doesn't occur 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. 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 in consideration of 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 in consideration of the setting value of $I_F < 0.5\text{mA}$. 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 soldering should be at 270°C or less for 10 s or less
(Pre-heating : 100 to 150°C, 30 to 80s). (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
Depending on equipment and soldering conditions (temperature, Using solder etc.),
the effect to the device and the PCB is different.
Please confirm that there is no problem on the actual use conditions in advance.

1. This specification shall be applied to photocoupler, Model No. PC1231 as an option.

2. Applicable Models (Business dealing name)

PC12310YFZ0X, PC12311YFZ0X


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

Approved Model No. : PC1231

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

- Operating isolation voltage $U_{IORM(PEAK)}$: 1140V
- Transient voltage : 9000V
- Pollution : 2
- 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
- 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 "  " is printed 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	-	-	55/110/21	-	
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)					
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	$U_{OTM(PEAK)}$	$t_{NI}=60s$	9000	V	
Safety maximum ratings					Refer to Fig. 6,7 (Attachement-2-3)
1) Case temperature	Tsi	$I_f=0, P_C=0$	150	°C	
2) Input current	Isi	$P_C=0$	200	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 ⁹	Ω	
		$T_a=T_{opr}(MAX.)$	MIN.10 ¹¹		
		$T_a=25°C$	MIN.10 ¹²		

6. Precautions in performing isolation test

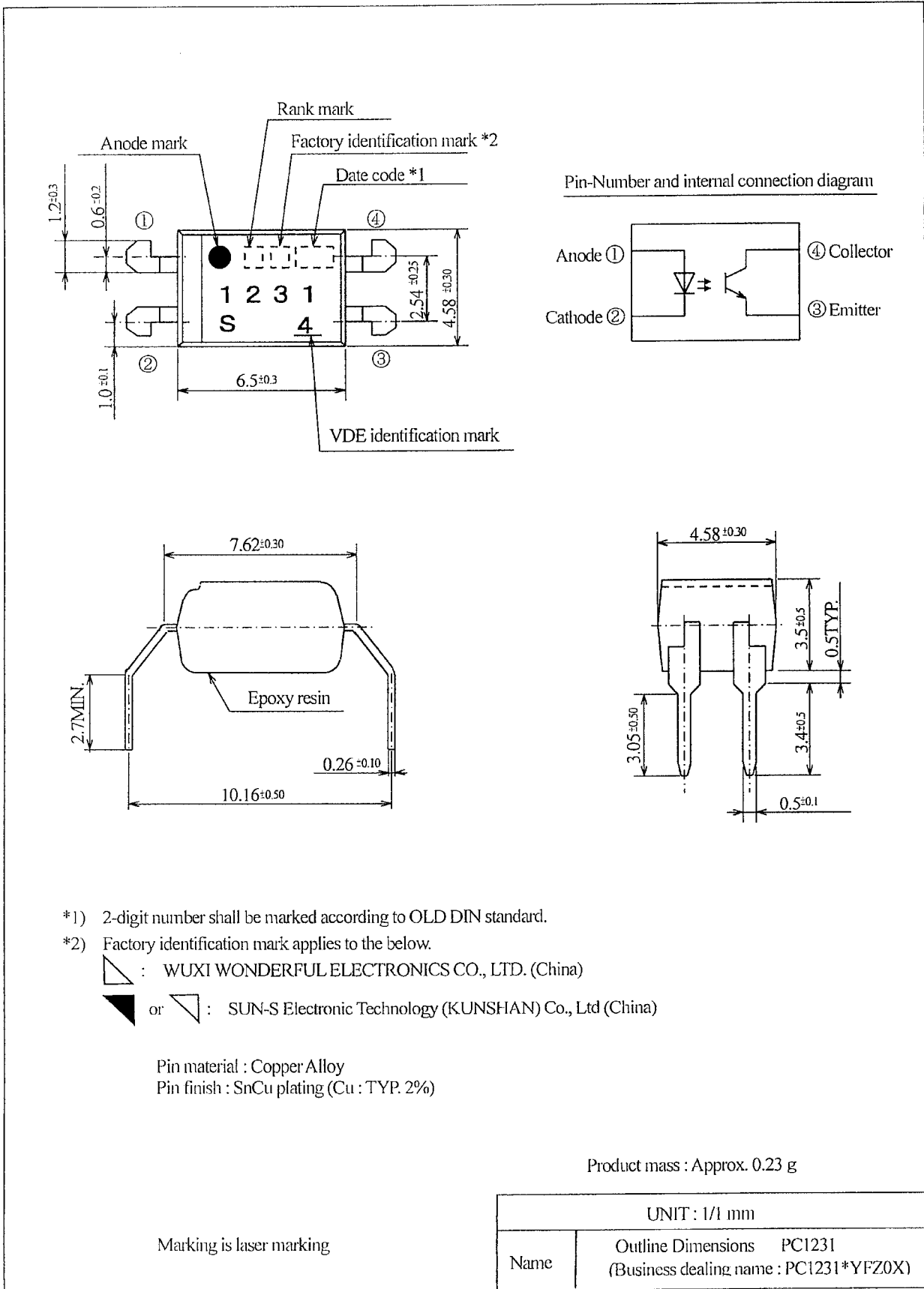
6.1 Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-2

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

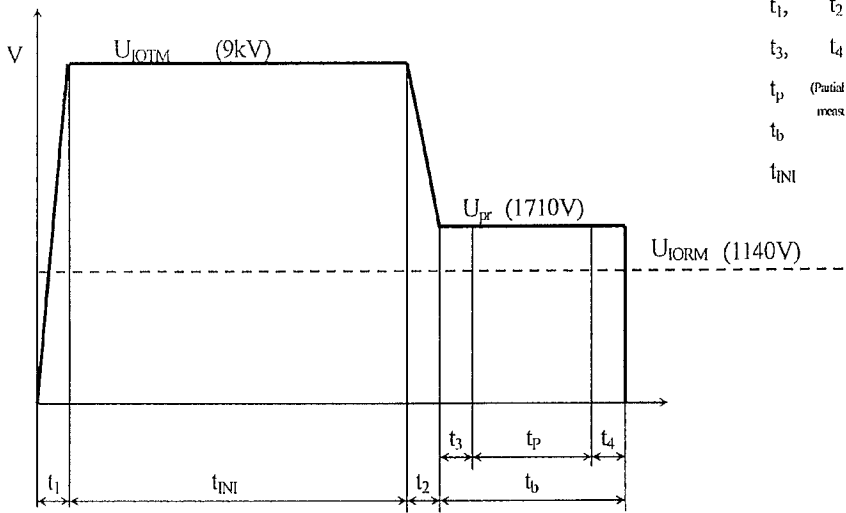
This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. U_{OTM}).

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

4. Outline

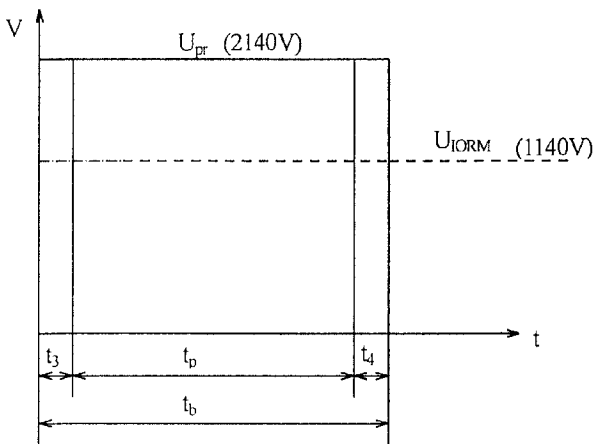


Method of Diagram 1: Breakdown test (Apply to type test and sampling test)



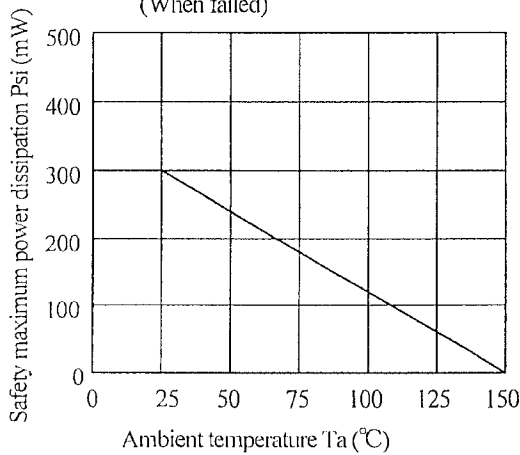
- $t_1, t_2 = 1 \text{ to } 10 \text{ s}$
- $t_3, t_4 = 1 \text{ s}$
- t_p (Partial discharge measuring time) = 10 s
- $t_b = 12 \text{ s}$
- $t_{INI} = 60 \text{ s}$

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

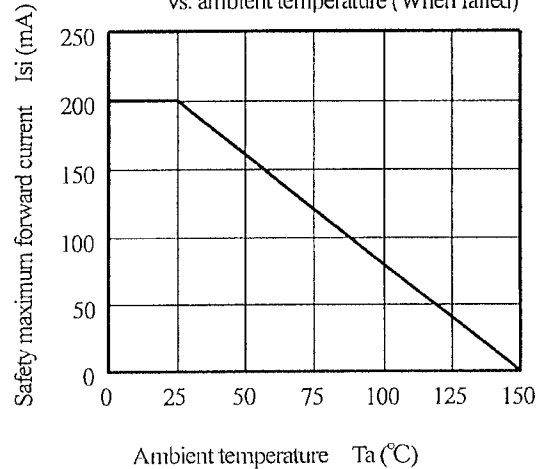


- $t_3, t_4 = 0.1 \text{ s}$
- t_p (Partial discharge measuring time) = 1 s
- $t_b = 1.2 \text{ s}$

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



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



Opto Specification

Opto/EC Group



NORTH AMERICA

Sharp Microelectronics of the Americas
5700 NW Pacific Rim Blvd.
Camas, WA 98607, U.S.A.
Phone: (1) 360-834-2500
Fax: (1) 360-834-8903
www.sharpsma.com

TAIWAN

Sharp Electronic Components
(Taiwan) Corporation
8F-A, No. 16, Sec. 4, Nanking E. Rd.
Taipei, Taiwan, Republic of China
Phone: (886) 2-2577-7341
Fax: (886) 2-2577-7326/2-2577-7328

CHINA

Sharp Microelectronics of China
(Shanghai) Co., Ltd.
28 Xin Jin Qiao Road King Tower 16F
Pudong Shanghai, 201206 P.R. China
Phone: (86) 21-5854-7710/21-5834-6056
Fax: (86) 21-5854-4340/21-5834-6057
Head Office:
No. 360, Bashen Road,
Xin Development Bldg. 22
Waigaoqiao Free Trade Zone Shanghai
200131 P.R. China
Email: smc@china.global.sharp.co.jp

EUROPE

Sharp Microelectronics Europe
Division of Sharp Electronics (Europe) GmbH
Sonninstrasse 3
20097 Hamburg, Germany
Phone: (49) 40-2376-2286
Fax: (49) 40-2376-2232
www.sharpsme.com

SINGAPORE

Sharp Electronics (Singapore) PTE., Ltd.
438A, Alexandra Road, #05-01/02
Alexandra Technopark,
Singapore 119967
Phone: (65) 271-3566
Fax: (65) 271-3855

KOREA

Sharp Electronic Components
(Korea) Corporation
RM 501 Geosung B/D, 541
Dohwa-dong, Mapo-ku
Seoul 121-701, Korea
Phone: (82) 2-711-5813 ~ 8
Fax: (82) 2-711-5819

JAPAN

Sharp Corporation
Electronic Components & Devices
22-22 Nagaïke-cho, Abeno-Ku
Osaka 545-8522, Japan
Phone: (81) 6-6621-1221
Fax: (81) 6117-725300/6117-725301
www.sharp-world.com

HONG KONG

Sharp-Roxy (Hong Kong) Ltd.
Level 26, Tower 1, Kowloon Commerce Centre,
No. 51, Kwai Cheong Road, Kwai Chung,
New Territories, Hong Kong
Phone: (852) 28229311
Fax: (852) 28660779
www.sharp.com.hk
Shenzhen Representative Office:
Room 602-603, 6/F,
International Chamber of Commerce Tower,
168 Fuhua Rd. 3, CBD,
Futian District, Shenzhen 518048,
Guangdong, P.R. China
Phone: (86) 755-88313505
Fax: (86) 755-88313515

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Suggested applications (if any) are for standard use; See Important Restrictions for limitations on special applications. See Limited Warranty for SHARP's product warranty.

The Limited Warranty is in lieu, and exclusive of, all other warranties, express or implied.

ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR USE AND FITNESS FOR A PARTICULAR PURPOSE, ARE SPECIFICALLY EXCLUDED. In no event will SHARP be liable, or responsible in any way, for any incidental or consequential economic or property damage.