Technical Document

LED Specification

EC/Opto Group

PC1231xxFZ0X Series Photocoupler

Product Specification
November 2009

PC1231xxFZ0X Series
Full Specification for part numbers:
PC12310NFZ0X
PC12310YFZ0X
PCI2311NFZ0X
PC12311YFZ0X

SHARP

REFERENCE

SPEC No. FU-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.

1. Application
   This specification applies to the outline and characteristics of photocoupler Model No. PC1231.

2. Outline — Refer to the attached sheet, page 4.

3. Ratings and characteristics — Refer to the attached sheet, page 5, 6.

4. Reliability — Refer to the attached sheet, page 7.

5. Outgoing inspection — Refer to the attached sheet, page 8.

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 withstanding 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 Package specifications — Refer to the attached sheet, page 9, 10.

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

Rank at delivery	Business dealing name	Rank at delivery	* Business dealing name	Rank mark	Ic (mA)
	PC12310NFZ0X		PC12310YFZ0X	with or without	0.25 to 2.0
	PC12311NFZ0X		PC12311YFZ0X	A	0.5 to 1.25

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

Test conditions
I_F=0.5mA V_{CE}=5V Ta=25℃

6.4 This Model is approved by UL.
Approved Model No. : PC1231
UL file No. : E64380

6.5 This Model is approved by CSA.
Approved Model No. : PC1231
CSA file No. : CA095323
CSA approved mark " " shall be indicated on minimum unit package.

6.6 This product is approved by BSI. (BS EN60065, BS EN60950)
Approved Model No. : PC1231
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.

REFERENCE

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_S, 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).

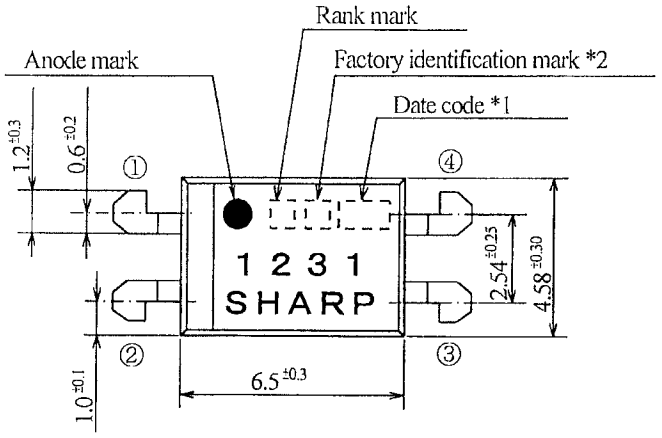
Category	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr^{6+})	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Photocoupler	✓	✓	✓	✓	✓	✓

✓ : 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 .

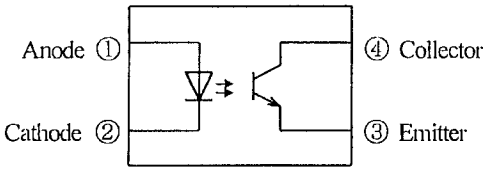
7. Notes

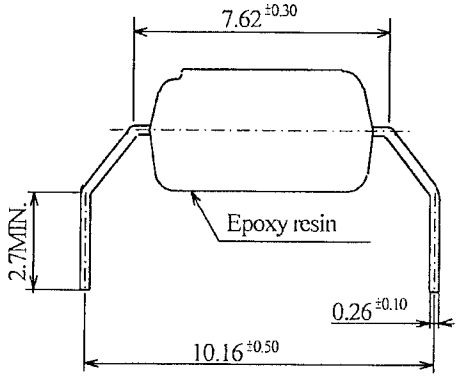
Precautions for Photocouplers : Attachment-1.

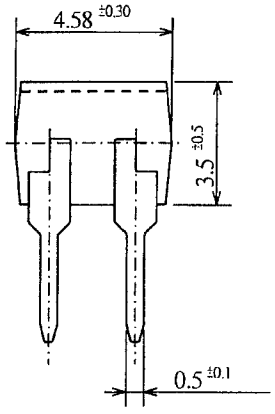
2. Outline



Pin-Number and internal connection diagram







*1) 2-digit number shall be marked according to OLD DIN standard.

*2) Factory identification mark applies to the below.

: WUXI WONDERFUL ELECTRONICS CO., LTD. (China)

or : SUN-S Electronic Technology (KUNSHAN) Co., Ltd (China)

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

Product mass : Approx. 0.23g

Marking is laser marking

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

REFERENCE

3. Ratings and characteristics

3.1 Absolute maximum ratings Ta=25℃

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	℃
Storage temperature		T_{stg}	-55 to +125	℃
Isolation voltage *3		$V_{iso(rms)}$	5	kV
Soldering temperature *4		T_{sol}	270	℃

3.2 Electro-optical characteristics Ta=25℃

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=10μA, I_F=0	6	-	-	V
Transfer charac -teristics	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℃, R_L=470Ω V_{CM}=1.5kV(peak), I_F=0, Vcc=9V, Vnp=100mV	10	-	-	kV/μs

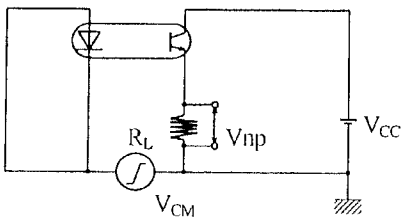
*1 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1 to 4.

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

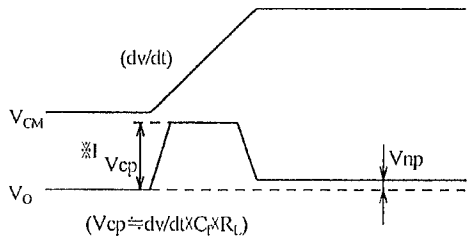
*3 AC for 1 min, 40 to 60%RH

*4 For 10s

*5 Measuring circuit



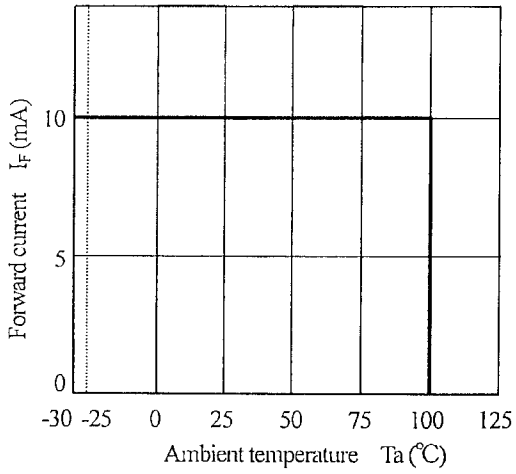
V_{CM}:Higher value of pulse wave
R_L=470Ω
V_{CC}=9V



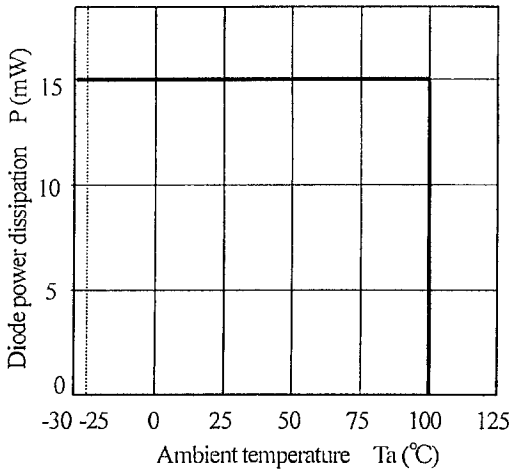
*1 The voltage generated by a displacement current which flow through floating capacity between primary and secondary side

REFERENCE

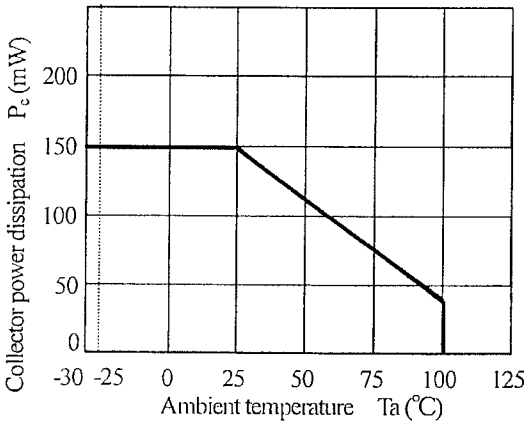
(Fig. 1)
Forward current vs. ambient temperature



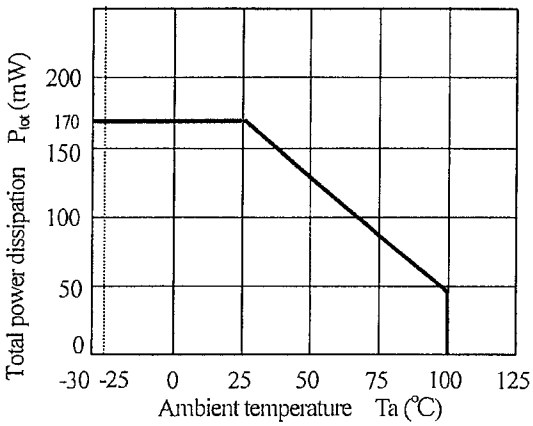
(Fig. 2)
Diode power dissipation vs. ambient temperature



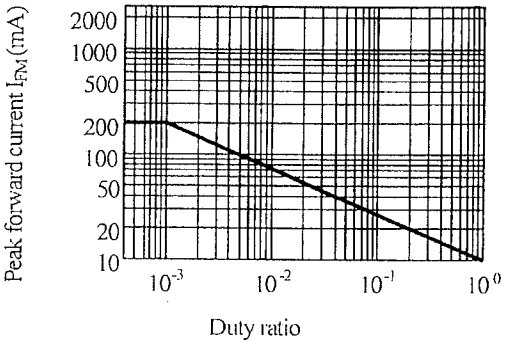
(Fig. 3)
Collector power dissipation vs. ambient temperature



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



(Fig.5) Peak forward current vs. duty ratio
Pulse width ≦ 100μs
Ta = 25℃



REFERENCE

4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

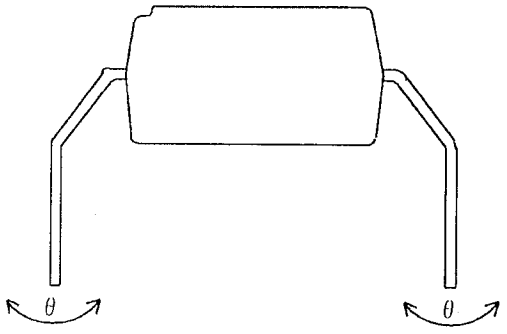
LTPD : 10 or 20

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×1.2 I_R >U×2 I_{CEO} >U×2 I_C <L×0.7 $V_{CE(sat)}$>U×1.2 U: Upper specification limit L: Lower specification limit	n=11, C=0
	(Soldering by hand) 400°C, 3 s		
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	+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=10mA, P_{tot}=170mW Ta=25 °C, 1000h		n=22, C=0

*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.



REFERENCE

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

REFERENCE

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

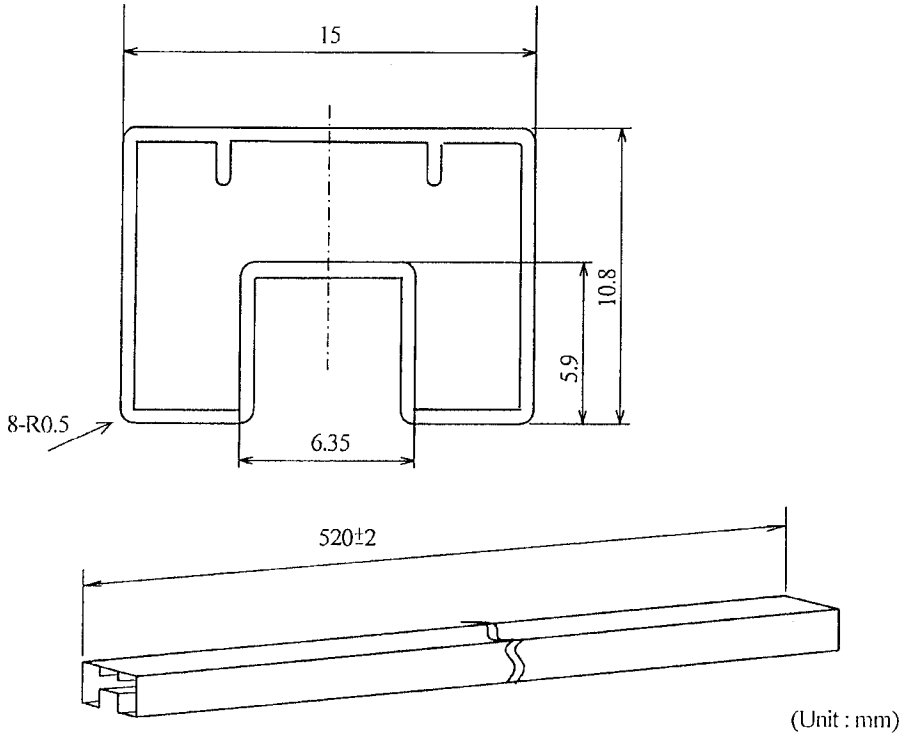
(1) MAX. 100pcs. of products shall be packaged in a sleeve ① and both of sleeve edges shall be fixed by stoppers ②.

(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



(Unit : mm)

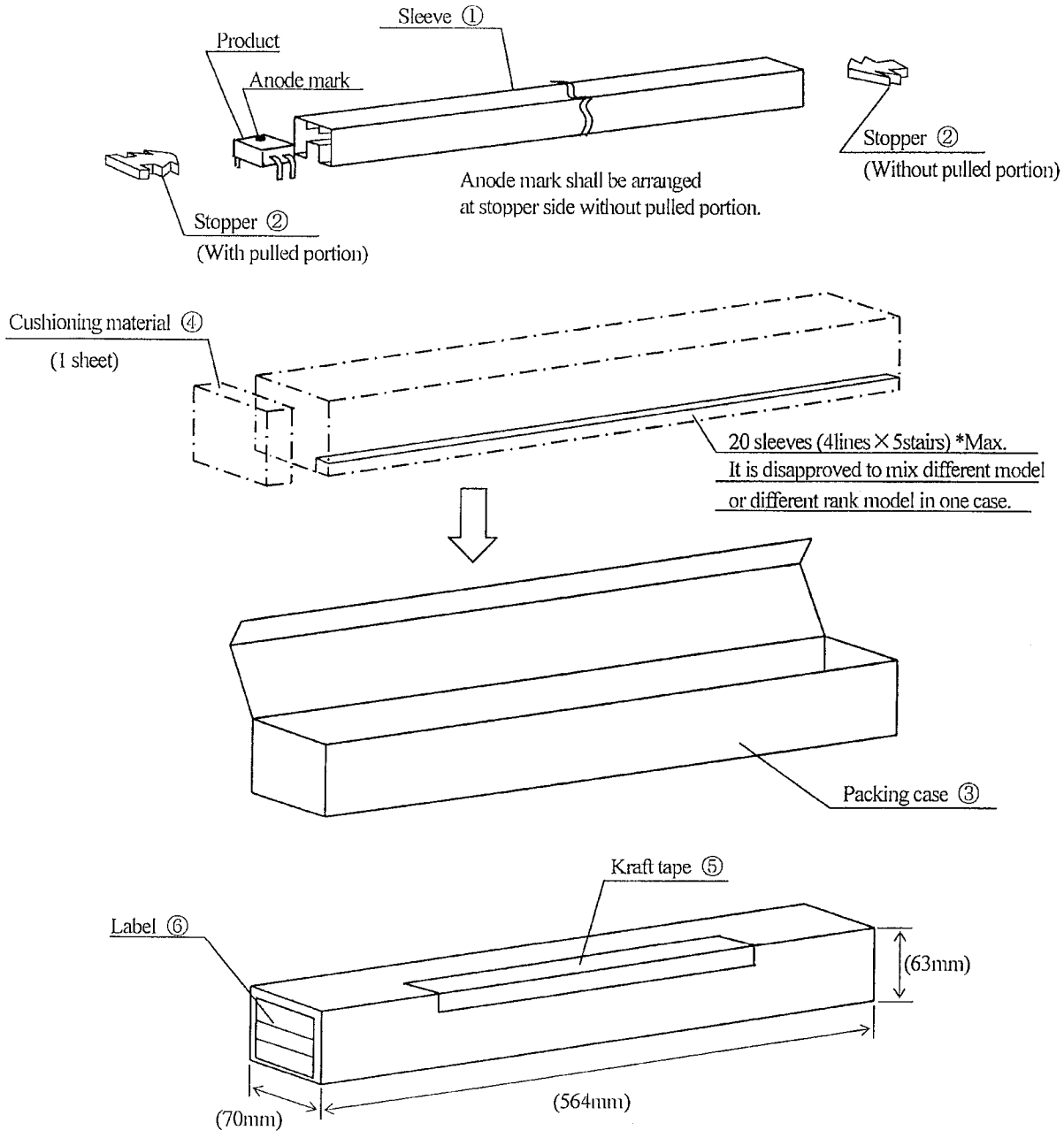
Note 1) Thickness : 0.5±0.2mm

2) Process with applying antistatic treatment

3) Unless otherwise specified tolerances shall be ±0.5mm
(However except for deformation due to the rubber stopper in sleeve.)

REFERENCE

6.2.4 Packing case outline dimensions



Regular packing mass : Approx. 910g

( ) : Reference dimensions

REFERENCE

Precautions for Photocouplers

1 Cleaning

(1) Solvent cleaning : Solvent temperature 45℃ 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 <0.5mA. 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℃ or less for 10 s or less
(Pre-heating : 100 to 150℃, 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℃ 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.

REFERENCE PC123YFZ0X

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℃

   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.

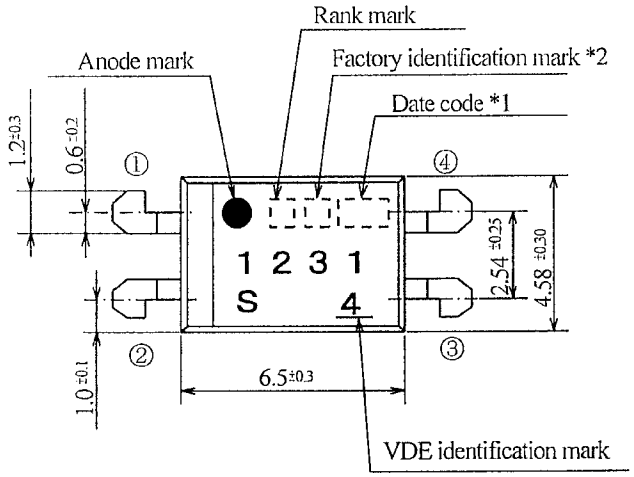
5. Isolation specification according to EN 60747-5-2.

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	Upr (PEAK)	tp=10s, qc<5pC	1710	V	
Diagram 2		tp=1s, qc<5pC	2140	V	
Maximum over-voltage	U_{IOTM} (PEAK)	t_{INI}=60 s	9000	V	
Safety maximum ratings					Refer to Fig. 6,7 (Attachement-2-3)
1) Case temperature	Tsi	I_F=0, P_C=0	150	℃	
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}	Ta=Tsi	MIN.10^9	Ω	
		Ta=Topr(MAX.)	MIN.10^{11}		
		Ta=25℃	MIN.10^{12}		

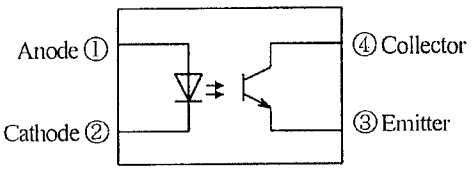
6. Precautions in performing isolation test
   6.1 Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-2
   6.2 Please don't carry out isolation test (V_{iso}) over U_{IOTM}.
   This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. U_{IOTM}).
   And there is possibility that partial discharge occurs in operating isolation voltage. (U_{IORM}).

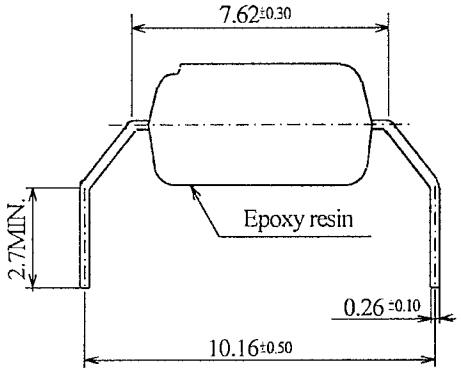
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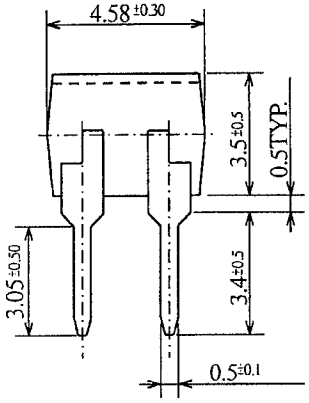
4. Outline



Pin-Number and internal connection diagram







*1) 2-digit number shall be marked according to OLD DIN standard.

*2) Factory identification mark applies to the below.

: WUXI WONDERFUL ELECTRONICS CO., LTD. (China)

or : SUN-S Electronic Technology (KUNSHAN) Co., Ltd (China)

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

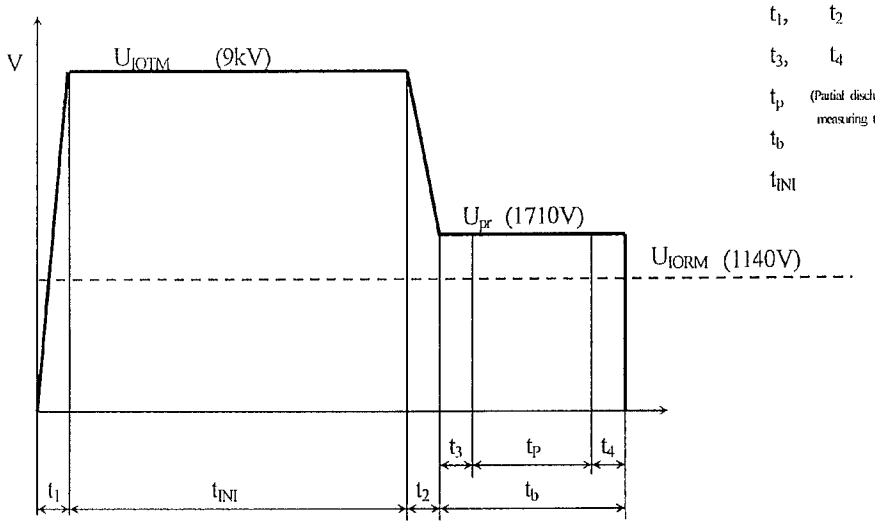
Product mass : Approx. 0.23 g

Marking is laser marking

UNIT : 1/1 mm	
Name	Outline Dimensions PC1231 (Business dealing name : PC1231*YFZ0X)

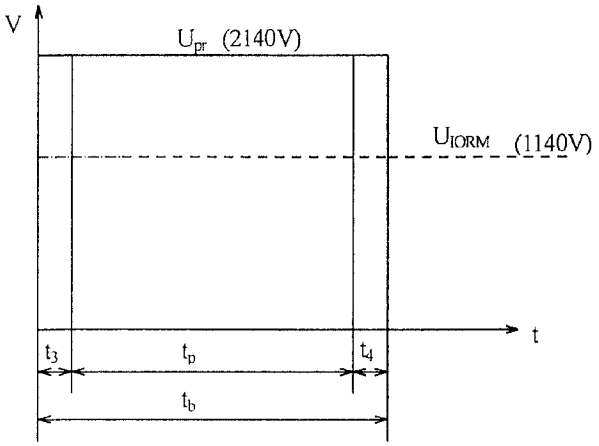
REFERENCE PC-123Y5E20K

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



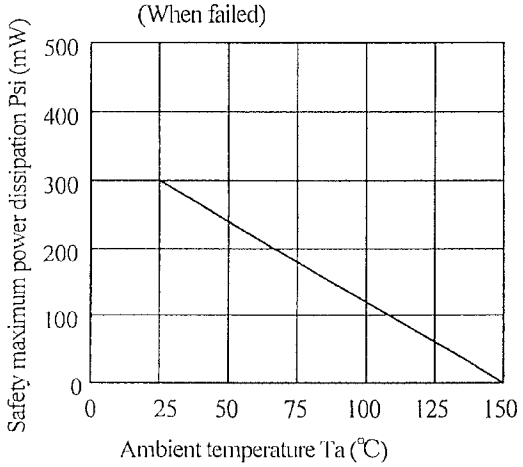
t_1,	t_2	= 1 to 10 s
t_3,	t_4	= 1 s
t_p	(Partial discharge measuring time)	= 10 s
t_b		= 12 s
t_{INI}		= 60 s

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

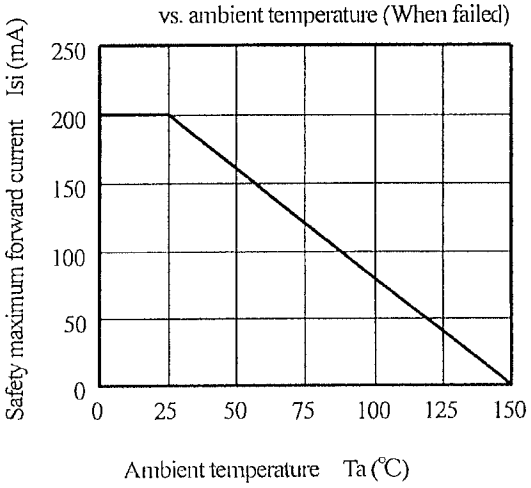


t_3,	t_4	= 0.1 s
t_p	(Partial discharge measuring time)	= 1 s
t_b		= 1.2 s

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



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



Technical Document

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