

SHARP

OPTO-ANALOG DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC4D10S

(Business dealing name : PC4D10SNIPSF)

Specified for

Enclosed please find copies of the Specifications which consists of 14 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 ☐ copies of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

DATE

June 22, 2007

BY

H. Imanaka

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Engineering Dept., II
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ELECOM Group
SHARP CORPORATION



Product name : PHOTOCOUPLER

Model No. : PC4D10S

Business dealing name : PC4D10SNIPSF

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 ;

· 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 ;

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

- (3) 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

- (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 OPIC photocoupler Model No. PC4D10S(Lead free type).

2. Outline

Refer to the attached sheet, page 4.

3. Ratings and characteristics

Refer to the attached sheet, page 5 to 7.

4. Reliability

Refer to the attached sheet, page 8.

5. Outgoing inspection

Refer to the attached sheet, page 9.

6. Supplement

6.1 Isolation voltage shall be measured in the following method.

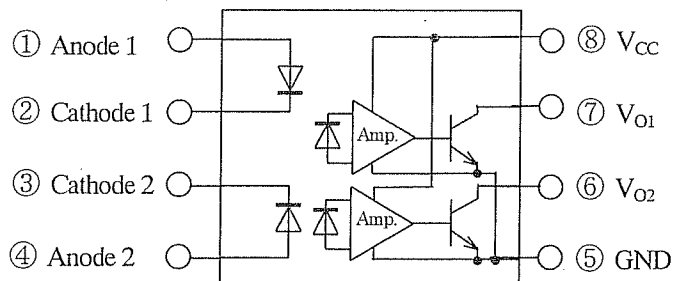
- (1) Short between pins 1 and 4 on the primary side and between pins 5 and 8 on the secondary side.
- (2) The dielectric withstanding tester with zero-cross circuit shall be used.
- (3) The wave form of applied voltage shall be a sine wave.

6.2 The business dealing name used for this product when ordered or delivered shall be PC4D10SNIPSF.

6.3 Package specification

Refer to the attached sheet, page 10, 11.

6.4 The block diagram, Truth table



• Truth table

Channel	Input	Output
Channel 1	H	L
	L	H
Channel 2	H	L
	L	H

6.5 This Model is approved by UL.

Approved Model No. : PC4D10S

UL file No. : E64380

6.6 This product is not designed against irradiation.

This product is assembled with electrical input and output.

This product incorporates non-coherent light emitting diode.

6.7 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 : CFC₃, Halon, Carbon tetrachloride, 1,1,1-Trichloroethane (Methyl chloroform)

6.8 Specified brominated flame retardants

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

6.9 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).

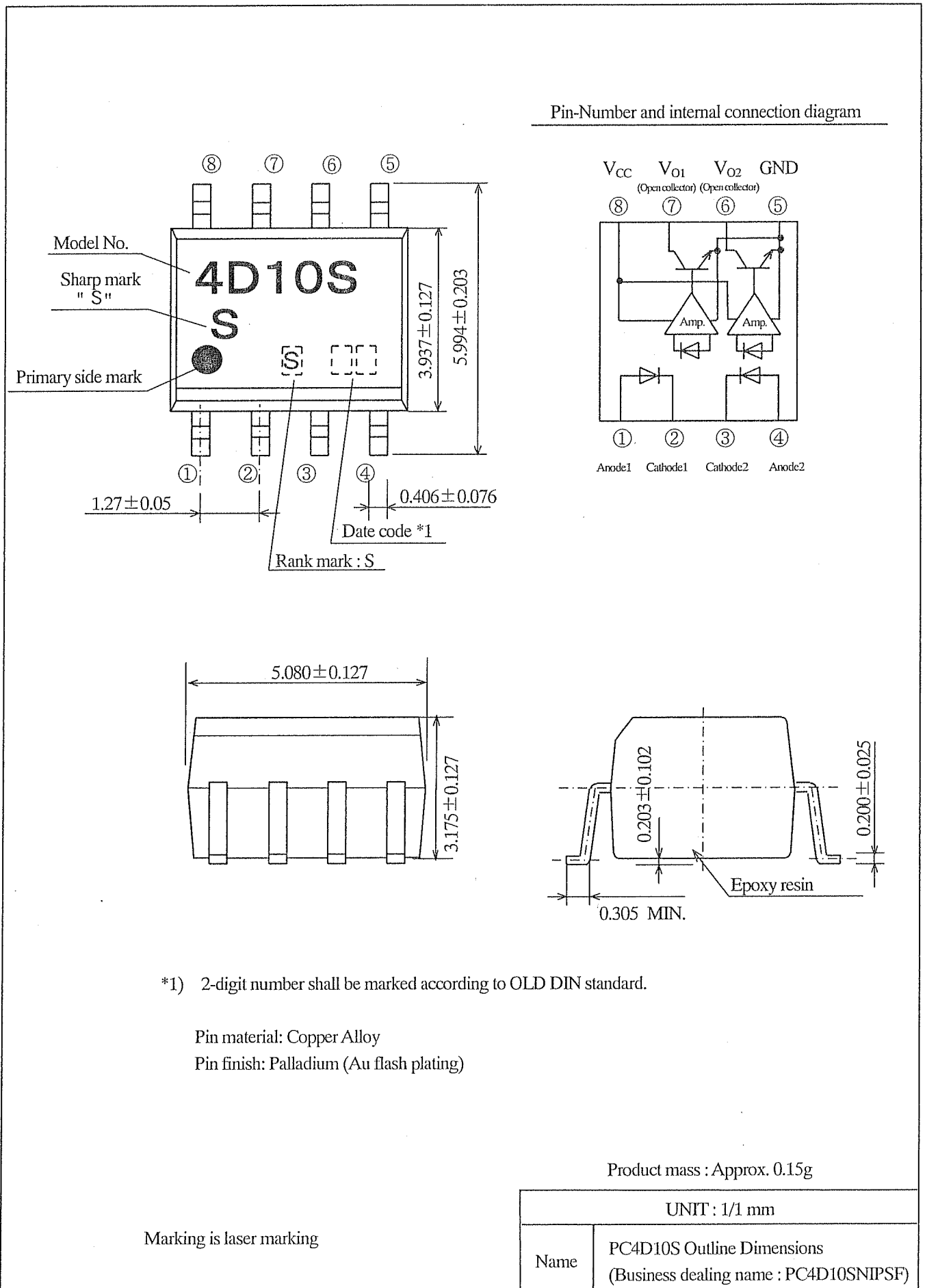
Category	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr ⁶⁺)	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Photocoupler	✓	✓	✓	✓	✓	✓

✓ : 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



3. Ratings and characteristics

3.1 Absolute maximum ratings

$T_a=25^{\circ}\text{C}$

Parameter		Symbol	Rating	Unit
Input	*1 Forward input current	I_F	20	mA
	Reverse input voltage	V_R	5	V
	Input power dissipation	P_I	40	mW
Output	Supply voltage	V_{CC}	7	V
	Output collector voltage	V_O	7	V
	Output collector current	I_O	50	mA
	*1 Output collector power dissipation	P_C	60	mW
	*2 Isolation voltage	$V_{iso(m)}$	3.75	kV
	Operating temperature	T_{opr}	-40 to +85	$^{\circ}\text{C}$
Storage temperature		T_{stg}	-55 to +125	$^{\circ}\text{C}$
*3 Soldering temperature		T_{sol}	270	$^{\circ}\text{C}$

*1 No delating required up to 85°C

*2 AC for 1 minute, 40 to 60%RH, $f=60\text{Hz}$

*3 For 10 s

3.2 Electro-optical characteristics *4

Unless otherwise specified.: Ta=-40 to +85°C, All typicals at V_{CC}=5V, Ta=25°C

Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Conditions	
Input	Input Forward Voltage	V _F	1.4	1.6	1.8	V	Ta=25°C, I _F =10mA	
	Reverse Input Voltage	I _R	—	—	10	μA	Ta=25°C, V _R =5V	
	Input capacitance	C _T	—	60	—	pF	Ta=25°C, V=0, f=1MHz	
Output	Low level output voltage	V _{OL}	—	0.4	0.6	V	I _{OL} =13mA, V _{CC} =5.5V, I _F =5mA	
	High level output current	I _{OH}	—	0.02	100	μA	V _{CC} =V _O =5.5V, I _F =250μA	
	High level supply current	I _{CCH}	—	10	15	mA	V _{CC} =5.5V, I _F =0	
	Low level supply current	I _{CCL}	—	13	21	mA	V _{CC} =5.5V, I _F =10mA	
	"H→L" threshold input current	I _{FHL}	—	2.5	5	mA	V _{CC} =5V, V _O =0.6V, R _L =350Ω	
Transfer characteristics	Isolation resistance	R _{ISO}	5×10 ¹⁰	10 ¹¹	—	Ω	DC=500V, 40~60%RH	
	Floating capacitance	C _f	—	0.6	—	pF	Ta=25°C, V=0, f=1MHz	
	Response time	“High→Low” propagation delay time *5	t _{PHL}	—	—	100	Ta=25°C V _{CC} =5V, I _F =7.5mA R _L =350Ω, C _L =15pF	
			25	50	75	ns		
		“Low→High” propagation delay time *5	t _{PLH}	—	—	100		
			25	50	75	ns		
		Fall time	t _f	—	10	—		
		Rise time	t _r	—	20	—		
		Distortion of pulse width *6	Δtw	—	3.5	35		
		Propagation delay skew	t _{PSK}	—	—	40		
	Instantaneous common mode rejection voltage (High level output) *7	CM _H	10	20	—	kV/μs	I _F =0, V _O (MIN.)=2V	Ta=25°C, V _{CC} =5V, R _L =350Ω, V _{CM} =1kV _(P-P)
	Instantaneous common mode rejection voltage (Low level output) *7	CM _L	-10	-20	—	kV/μs	I _F =7.5mA, V _O (MAX.)=0.8V	

*4 It is necessary to connect a by-pass capacitor of 0.01 μF or more between V_{CC}(Pin No.8) and GND(Pin No.5) near the device, when measuring the transfer characteristics and the output side characteristics.

*5 Propagation delay time : Refer to Fig.1.

*6 Distortion of pulse width Δtw=t_{PHL}-t_{PLH}

*7 Instantaneous common mode rejection voltage : Refer to Fig.2.

Fig.1 t_{PHL} , t_{PLH} , t_b , t_f test circuit

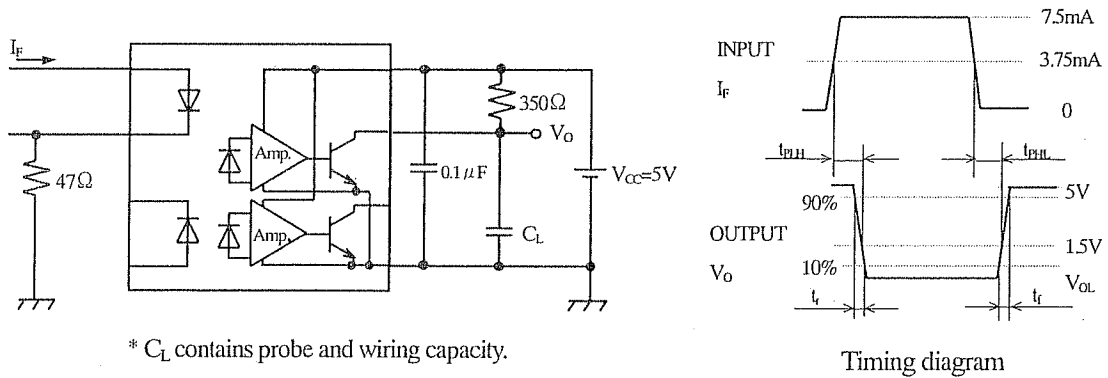
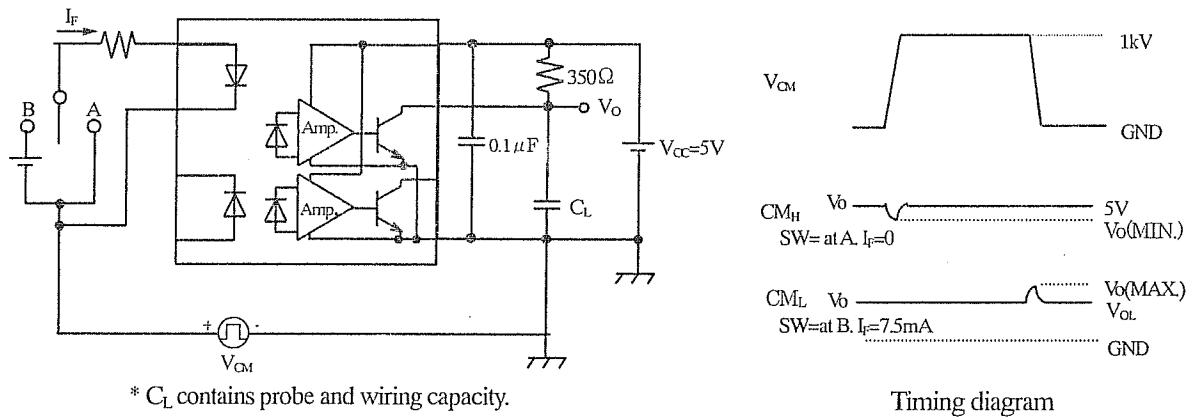


Fig.2 CM_H , CM_L test circuit



4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

LTPD : 10 or 20

Test Items	Test Conditions *1	Failure Judgment Criteria	Samples (n) Defective (C)
Solderability *2	245±3°C, 5 s	—————	n=11, C=0
Soldering heat *3	(Flow soldering) 270°C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $V_{OL} > U \times 1.2$ $I_{OH} > U \times 2$ $I_{CCL} > U \times 1.2$ $I_{CCH} > U \times 1.2$ $I_{FHL} > U \times 1.3$ 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 (Bending) *4	Weight : 1N 1 time/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 minutes) (30 minutes) 20 cycles test		n=22, C=0
High temp. and high humidity storage *5	+85°C, 85%RH, 500h		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 =20mA, V _{CC} =5.5V R _L =350Ω, T _a =25°C 1000h		n=22, C=0

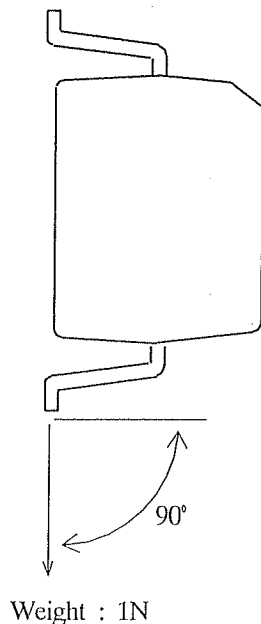
*1 Test method, conforms to EIAJ ED 4701.

*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 It is evaluated the temperature conditions in attachment-1.

*4 Terminal bending direction is shown below.

*5 It is evaluated after washing by specified solvent in attachment-1.



5. Outgoing inspection

5.1 Inspection items

(1) Electrical characteristics

V_F , I_R , V_{OL} , I_{OH} , I_{CCL} , I_{CCH} , I_{FHL} , 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 10)
The carrier tape has the heat pressed structure of A-PET material carries tape of protect against static electricity and three layers cover tape (PET material base).
- (2) Reel structure and Dimensions (Refer to the attached sheet, Page 11)
The taping reel shall be of plastic (PS material).
- (3) Direction of product insertion (Refer to the attached sheet, Page 11)
- (4) Joint of tape
The cover tape and carrier tape in one reel shall be joint less.
- (5) To repair failure - taped devices, cutting a bottom of carrier tape with a cutter.
After replacing 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 basically shall contain 1500pcs.

6.3.4 Outer packing appearance (Refer to attached sheet, Page 11)

6.3.5 Marking

- The label with following information shall be pasted at appointed place of the outer packing case.
 - * Model No. * (Business dealing name) * Lot No. * Quantity
 - * Country of origin * Company name * Inspection date specified

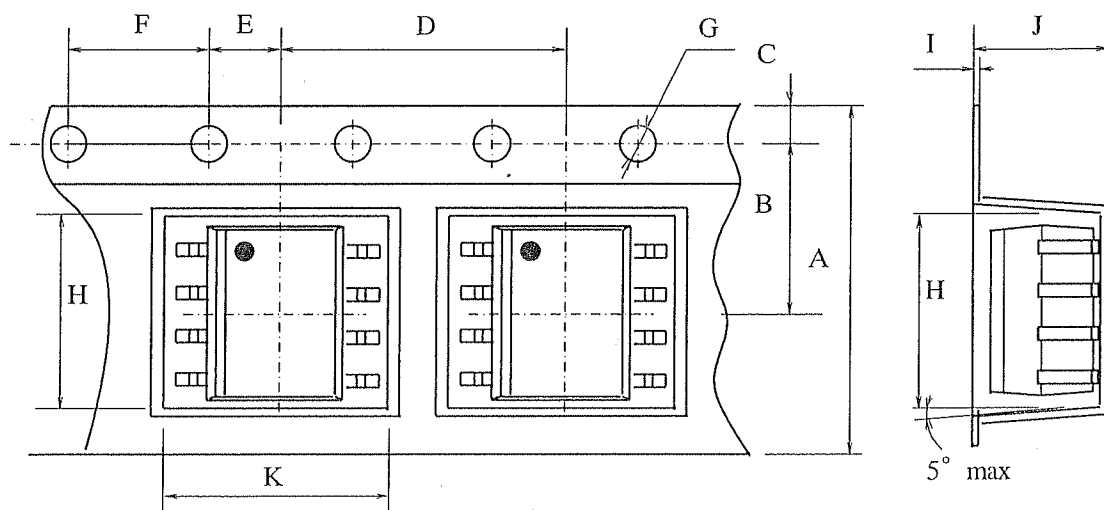
6.3.6 Storage condition

- Taped products shall be stored at the temperature 5 to 30°C and the humidity 70%RH or less
away from direct sunlight.

6.3.7 Safety protection during shipping

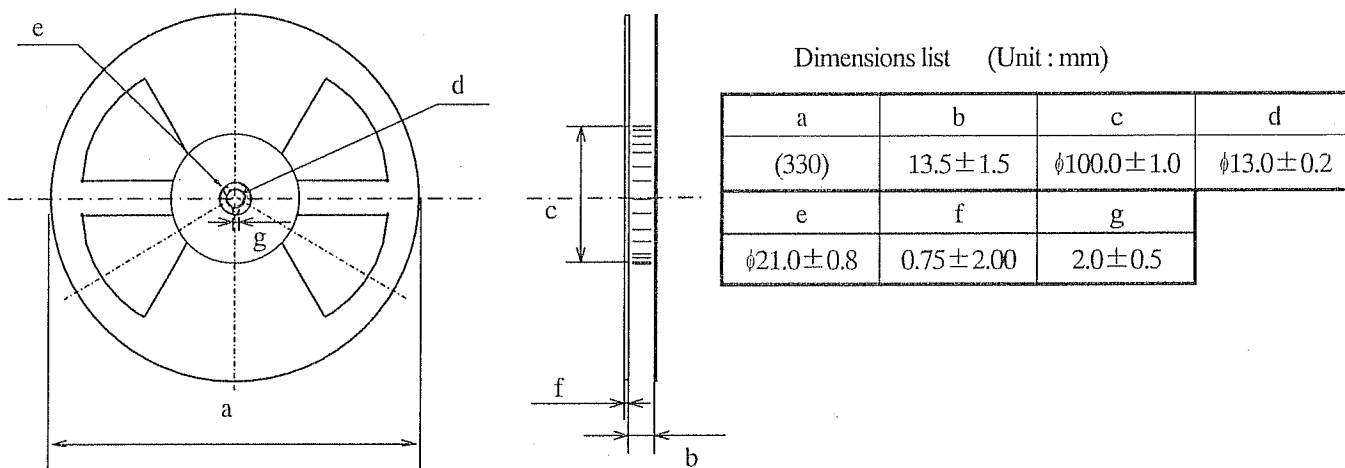
- There shall be no deformation of component or degradation of electrical characteristics due to shipping.

Carrier tape structure and Dimensions

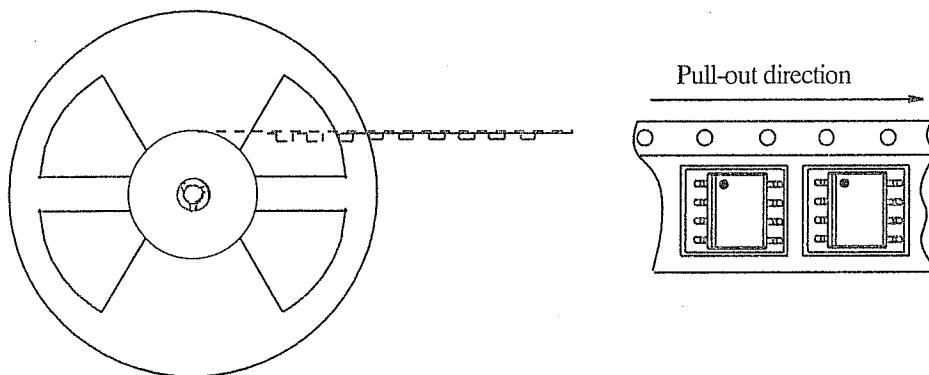


A	B	C	D	E	F	G	H
12.0±0.3	5.50±0.05	1.75±0.10	8.0±0.1	2.00±0.05	4.0±0.1	∅1.55±0.05	5.4±0.1
I	J	K					
0.30±0.05	3.7±0.1	6.3±0.1					

Reel structure and Dimensions

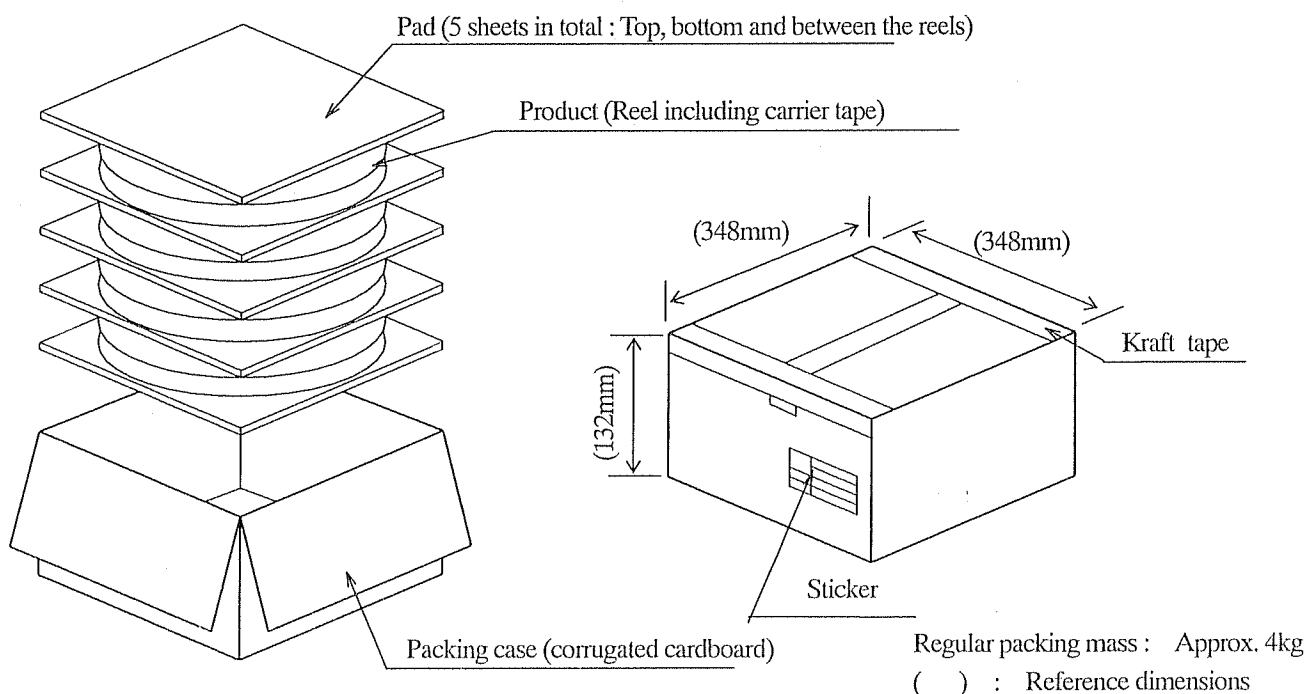


Direction of product insertion



Outer packing appearance

- (1) Carrier tape with 1,500pcs. of the devices (reeled) are packed in packing case.
 - (2) The packing case is sealed by kraft tape & the label is placed on it.
- (Max. 4 reels are packed in one carton. (Max. 6,000pcs. of devices are in one carton.))



Precautions for Photocouplers

1. Recommended operating conditions

Parameter	Symbol	MIN.	MAX.	Unit
Input current low level	I_{FL}	0	250	μA
Input current high level	I_{FH}	8	15	mA
Power supply voltage	V_{CC}	4.5	5.5	V
Fan out (TTL loads)	N	—	5	—
Output pull-up resistor	R_L	330	4k	Ω
Operating temperature	T_{opr}	-40	+85	$^{\circ}C$

We recommend that this device is used under the above conditions to secure reliability and allowance against time degradation of light emitting diode.

2. Cleaning

2.1 Solvent cleaning : Solvent temperature 45 $^{\circ}C$ or less, Immersion for 3 min or less

2.2 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.

2.3 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.

3. Static electricity

Transistor of detector side in bipolar configuration is apt to be affected by static electricity for its minute design.

When handling them, general countermeasure against static electricity should be taken to avoid breakdown and devices and degradation of characteristics.

4. Circuit design

4.1 In order to stabilize power supply line, we should certainly recommend to connect a by-pass capacitor of 0.01 μF or more between V_{CC} and GND near the device.

4.2 When steep voltage noise is applied between the primary side and the secondary side of the photocoupler, current flows or changes in the light emitting diode through a parasitic capacitance between the primary side and the secondary side of the photocoupler, then there is a case that miss operation occurs due to the applied noise level. We should certainly recommend to use a by-pass capacitor between both terminals of the light emitting diode when used in noisy environment.

4.3 The detector which is used in this device has parasitic diode between each pins and GND.

There are cases that miss operation or destruction may be occurred if electric potential of any pin fall below GND level in an instant.

4.4 The LED used in the Photocoupler generally decreases the light emission power by operation.

In case of long operation time, please design I_F value so that I_F is twice or more of the Maximum value of the "H $\rightarrow$ L" threshold input current at circuit design with considering the decreases of the light emission power of the LED. (50%/5years)

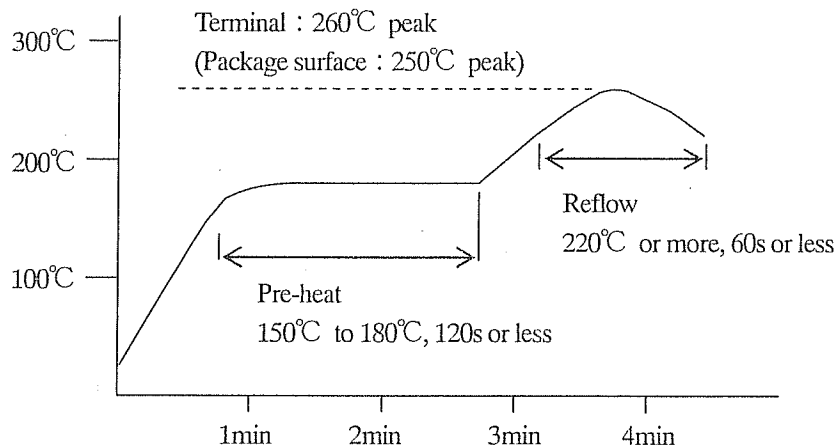
5. Precautions for Soldering Photocouplers

5.1 In the case of flow soldering (Whole device dipping)

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)

5.2 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)



5.3 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

5.4 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.