

# SHARP

OPTO-ELECTRONIC DEVICES DIVISION  
ELECTRONIC COMPONENTS GROUP  
SHARP CORPORATION

## SPECIFICATION

SPEC. No. ED-05P059  
ISSUE August 26, 2005

REFERENCE

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC925L

(Business dealing name : PC925L0NIP0F)

Specified for

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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

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BY

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PRESENTED

DATE

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BY

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



Product name : PHOTOCOUPLER

Model No. : PC925L

(Business dealing name : PC925L0NIP0F)

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 for OPIC type photocoupler PC925L(Lead-Free Type) for IGBT or MOS-FET Gate Drive.

2. Outline

Refer to the attached sheet, page 3.

3. Ratings and characteristics

Refer to the attached sheet, page 4 to 7.

4. Reliability

Refer to the attached sheet, page 8.

5. Outgoing inspection

Refer to the attached sheet, page 9.

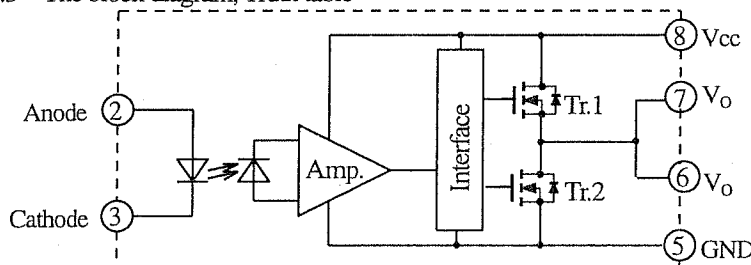
6. Supplement

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 PC925L0NIP0F.

6.3 The block diagram, Truth table



Input	V <sub>O</sub> Output	Tr.1	Tr.2
ON	High level	ON	OFF
OFF	Low level	OFF	ON

6.4 Package specification

Refer to the attached sheet, page 10, 11.

6.5 UL : Under preparation

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

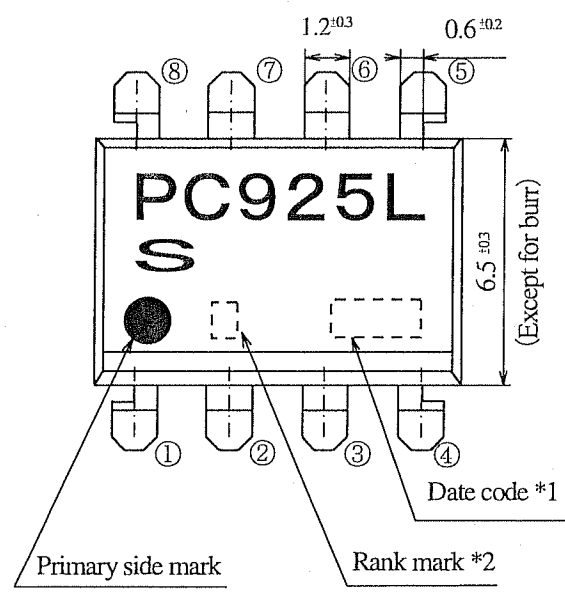
6.8 Brominated flame retardants

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

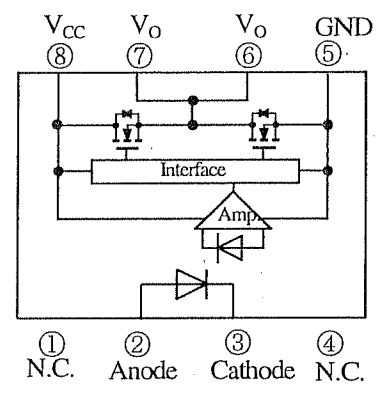
7. Notes

Precautions for photocouplers : Attachment-1

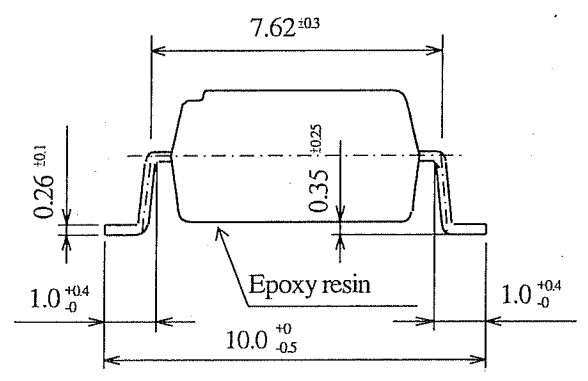
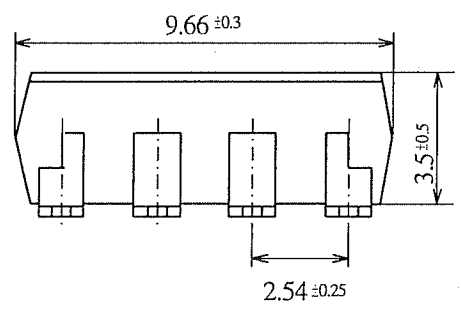
## 2. Outline



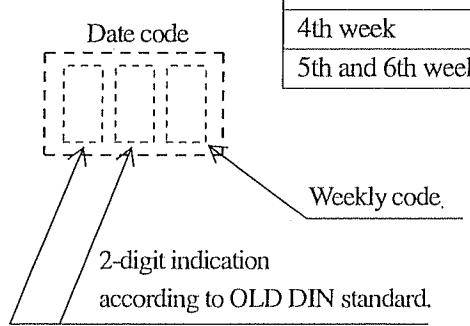
Pin-Number and internal connection diagram



As for N.C. terminal (①, ④), external connection is not allowed.



1st week	1
2nd week	2
3rd week	3
4th week	4
5th and 6th week	5



- \*1) As shown in the left drawing, Date code consists of 2-digit indication according to OLD DIN standard and the weekly code.
- \*2) Rank mark shall be or shall not be marked

Pin material : Copper Alloy  
Pin finish : Palladium (Au flash plating)

Product mass: Approx. 0.51g

UNIT : 1/1 mm	
Name	PC925L Outline Dimensions (Business dealing name : PC925L0NIP0F)

Marking is laser marking

### 3. Ratings and characteristics

#### 3.1 Absolute maximum ratings

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

	Parameter	Symbol	Rating	Unit
Input	*1 Forward current	$I_F$	25	mA
	Reverse voltage	$V_R$	5	V
	*4 Peak forward current	$I_{FM}$	1	A
Output	Supply voltage	$V_{CC}$	35	V
	*5 Peak output current	$I_{O(PEAK)}$	2.5	A
	Output voltage	$V_O$	$V_{CC}$	V
	*2 Power dissipation	$P_o$	250	mW
	*3 Total power dissipation	$P_{tot}$	295	mW
	*6 Isolation voltage	$V_{iso(rms)}$	5.0	kV
	Operating temperature	$T_{opr}$	-40 to +100	$^{\circ}\text{C}$
	Storage temperature	$T_{stg}$	-55 to +125	$^{\circ}\text{C}$
	Soldering temperature	$T_{sol}$	270 (For 10s)	$^{\circ}\text{C}$

\*1 When ambient temperature goes above  $70^{\circ}\text{C}$ , the forward current goes down at the rate of  $0.3\text{mA}/^{\circ}\text{C}$ . (Fig. 10)

\*2 When ambient temperature goes above  $70^{\circ}\text{C}$ , the forward current goes down at the rate of  $4.8\text{mW}/^{\circ}\text{C}$ . (Fig. 11)

\*3 When ambient temperature goes above  $70^{\circ}\text{C}$ , the forward current goes down at the rate of  $5.4\text{mW}/^{\circ}\text{C}$ . (Fig. 12)

The maximum LED junction temperature should not exceed  $125^{\circ}\text{C}$

\*4 Pulse width  $\leq 1\mu\text{s}$ , 300pps

\*5 Pulse width  $\leq 10\mu\text{s}$ , Duty ratio : 0.002

\*6 AC for 1 min, 40 to 60%RH,  $T_a=25^{\circ}\text{C}$

### 3.2 Electro-optical characteristics \*7 \*13

(Unspecified : Ta=-40 to +100°C, I<sub>F(ON)</sub>=7 to 16mA, V<sub>CC</sub>=15 to 30V, V<sub>F(OFF)</sub>= -3 to 0.8V)

Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Test circuit	Conditions
Input	Forward voltage	V <sub>F</sub>	1.2	-	1.8	V	-	I <sub>F</sub> =10mA
	Reverse current	I <sub>R</sub>	-	-	10	μA	-	V <sub>R</sub> =5V
	Terminal capacitance	C <sub>t</sub>	-	60	150	pF	-	Ta=25°C, V=0, f=1MHz
Output	High level output current	I <sub>OH</sub>	0.5	1.5	-	A	(1)	V <sub>O</sub> =(V <sub>CC</sub> -4V), I <sub>F(ON)</sub> *8
			2.0	-	-	A		V <sub>O</sub> =(V <sub>CC</sub> -15V), I <sub>F(ON)</sub> *9
	Low level output current	I <sub>OL</sub>	0.5	1.5	-	A	(2)	V <sub>O</sub> =2.5V, V <sub>F(OFF)</sub> *8
			2.0	-	-	A		V <sub>O</sub> =15V, V <sub>F(OFF)</sub> *9
	High level output voltage	V <sub>OH</sub>	V <sub>CC</sub> -4	V <sub>CC</sub> -3	-	V	(3)	I <sub>O</sub> =-0.1A, I <sub>F(ON)</sub>
	Low level output voltage	V <sub>OL</sub>	-	0.1	0.5	V	(4)	I <sub>O</sub> =0.1A, V <sub>F(OFF)</sub>
	High level supply current *10	I <sub>CCH</sub>	-	2.5	5.0	mA	(5)	I <sub>F(ON)</sub>
	Low level supply current *10	I <sub>CCL</sub>	-	2.5	5.0	mA		V <sub>F(OFF)</sub>
	UVLO Threshold	V <sub>UVLO+</sub>	11.0	12.3	13.5	V	(6)	V <sub>O</sub> >5V, I <sub>F</sub> =10mA
		V <sub>UVLO-</sub>	9.5	10.7	12.0	V		
	UVLO Hysteresis	UVLO <sub>HYS</sub>	—	1.6	—	V		
Transfer characteristics	"L→H" threshold input current *11	I <sub>FLH</sub>	-	-	5.0	mA	(7)	V <sub>O</sub> >5V, I <sub>O</sub> =0
	Isolation resistance	R <sub>ISO</sub>	5×10 <sup>10</sup>	10 <sup>11</sup>	-	Ω	-	Ta=25°C, DC=500V, 40 to 60%RH
	Response time	"L→H" propagation delay time	t <sub>PLH</sub>	0.1	0.3	0.5	μs	(8)
		"H→L" propagation delay time	t <sub>PHL</sub>	0.1	0.3	0.5		
		Distortion of pulse width *12	Δt <sub>w</sub>	—	—	0.3		
		Propagation delay skew	t <sub>PSK</sub>	-0.35	—	0.35		
		Rise time	t <sub>r</sub>	-	0.1	-		
		Fall time	t <sub>f</sub>	-	0.1	-		
		UVLO turn on delay	t <sub>UVLO ON</sub>	-	0.8	-		
		UVLO turn off delay	t <sub>UVLO OFF</sub>	-	0.6	-		
	Instantaneous common mode rejection voltage (High level output)	ICM <sub>H</sub>	15	-	-	kV/μs	(9)	Ta=25°C, V <sub>CM</sub> =1.5kV(p-p) I <sub>F</sub> =10 to 16mA, V <sub>CC</sub> =30V V <sub>OH</sub> >15V
	Instantaneous common mode rejection voltage (Low level output)	ICM <sub>L</sub>	15	-	-			Ta=25°C, V <sub>CM</sub> =1.5kV(p-p) V <sub>F</sub> =0, V <sub>CC</sub> =30V V <sub>OL</sub> <1.0V

\*7 It is necessary to connect a by-pass capacitor of 0.1 μF or more between Vcc (Pin No. 8) and GND (Pin No. 5) near the device, when measuring the transfer characteristics and the output side characteristics.

\*8 Pulse width ≤ 50 μs, Duty ratio : 0.005

\*9 Pulse width ≤ 10 μs, Duty ratio : 0.002

\*10 Output pin is open.

\*11 I<sub>FLH</sub> is the value of forward current when output changes from "L" to "H".

\*12 Pulse width Δt<sub>w</sub> = |t<sub>PHL</sub> - t<sub>PLH</sub>|

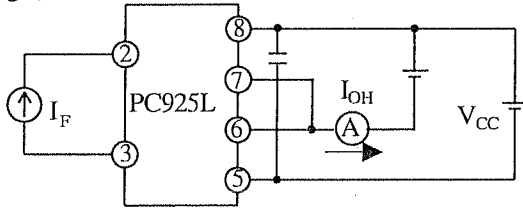
\*13 All typical values are at Ta=25°C, V<sub>CC</sub>=30V.

# PC925L0NIP0F

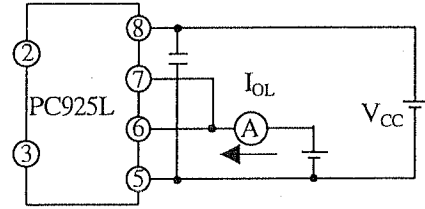
## REFERENCE

Test circuit

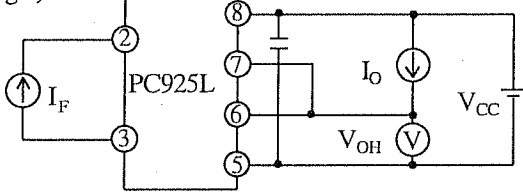
(Fig.1)



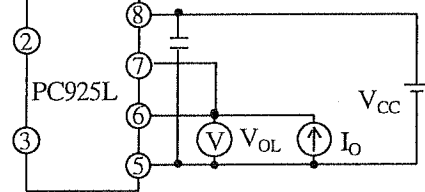
(Fig.2)



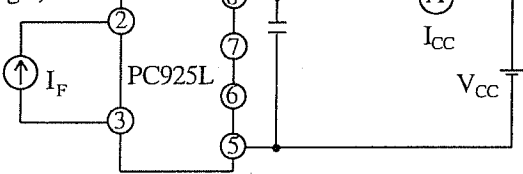
(Fig.3)



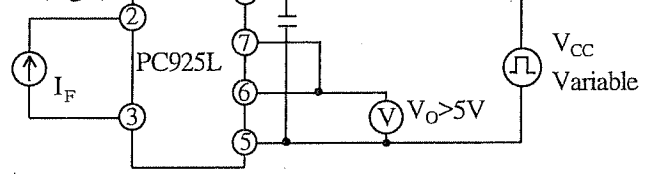
(Fig.4)



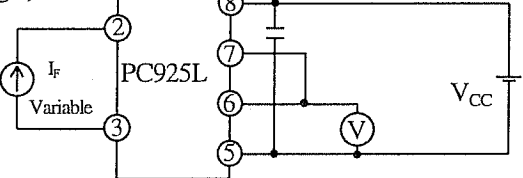
(Fig.5)



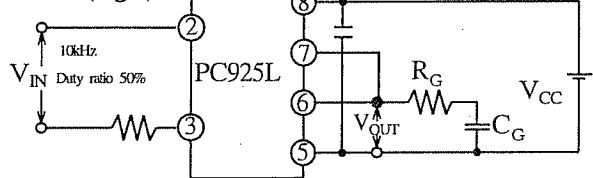
(Fig.6)



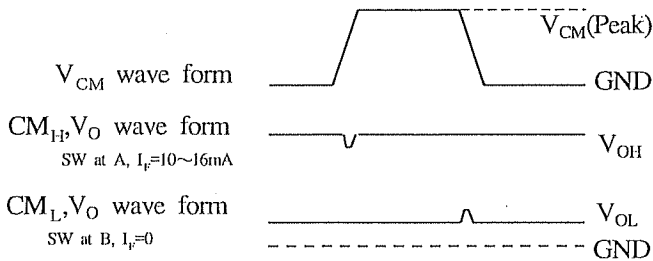
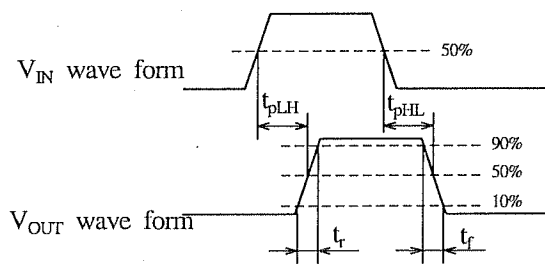
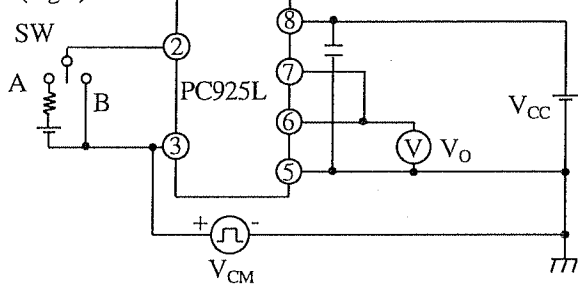
(Fig.7)



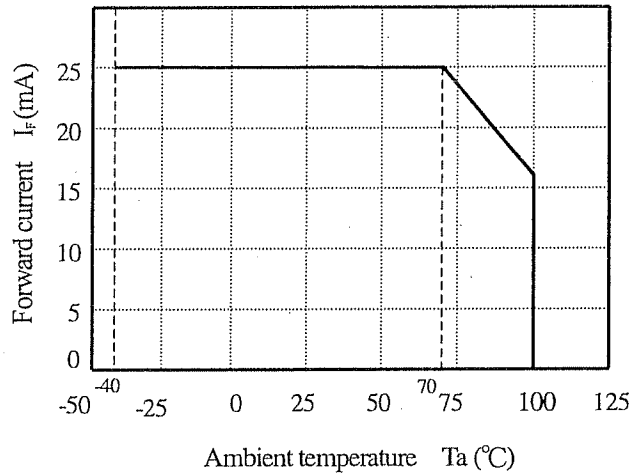
(Fig.8)



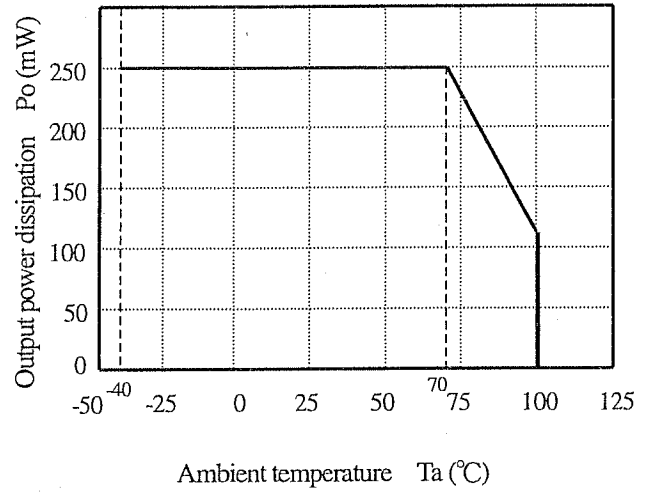
(Fig.9)



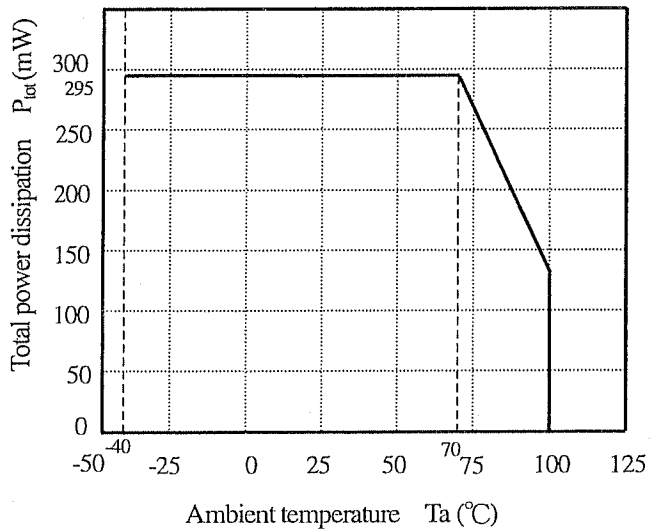
(Fig.10) Forward current vs.  
ambient temperature



(Fig.11) Output power dissipation vs.  
ambient temperature



(Fig. 12) Total power dissipation  
vs. ambient temperature





#### 4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

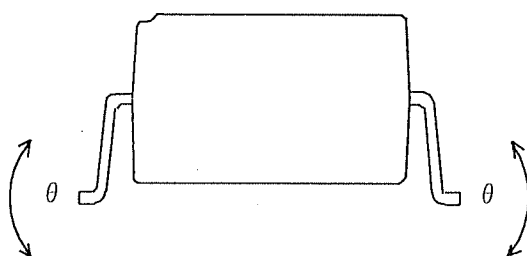
LTPD : 10 or 20

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	(Flow soldering) 270 °C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $V_{OL} > U \times 1.2$ $V_{OH} < L \times 0.8$ $I_{CCH} > U \times 1.2$ $I_{CCL} > U \times 1.2$ $I_{FLH} > U \times 1.3$  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 (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 <sub>F</sub> =25mA, V <sub>CC</sub> =30V T <sub>a</sub> =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

$V_F$ ,  $I_R$ ,  $V_{OH}$ ,  $V_{OL}$ ,  $I_{CCH}$ ,  $I_{CCL}$ ,  $I_{FLH}$ ,  $R_{ISO}$ ,  $V_{iso}$

#### (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

#### 6.4 Package specifications

##### 6.4.1 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 protected 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.

##### 6.4.2 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° .

##### 6.4.3 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 1000pcs.

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

##### 6.4.5 Marking

The label with following information shall be pasted at appointed place of the outer packing case.

\* Model No. \* Number of pieces delivered \* Production date

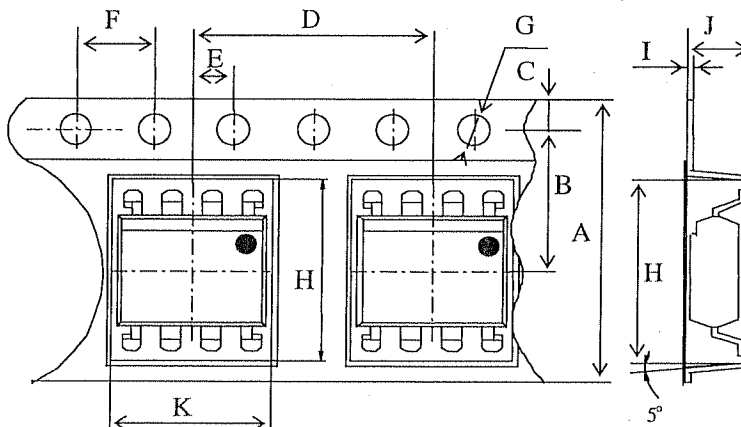
##### 6.4.6 Storage condition

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

##### 6.4.7 Safety protection during shipping

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

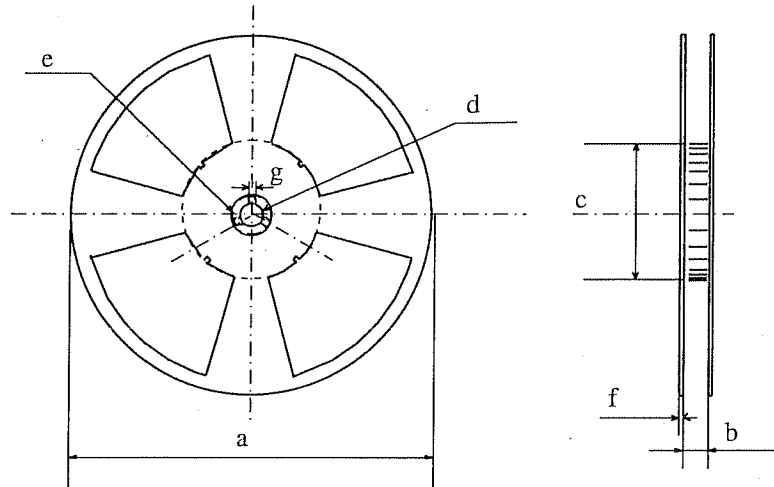
#### Carrier tape structure and Dimensions



Dimensions list (Unit : mm)

A	B	C	D	E	F	G	H	I	J	K
±0.3	±0.1	±0.10	±0.1	±0.1	±0.1	+0.1 -0	±0.1	±0.05	±0.10	±0.1
16.0	7.5	1.75	12.0	2.0	4.0	φ 1.5	10.4	0.40	4.20	10.2

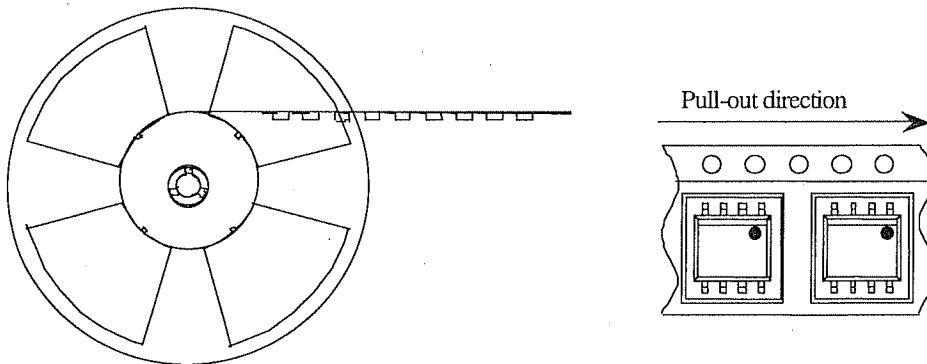
# Reel structure and Dimensions



Dimensions list (Unit : mm)

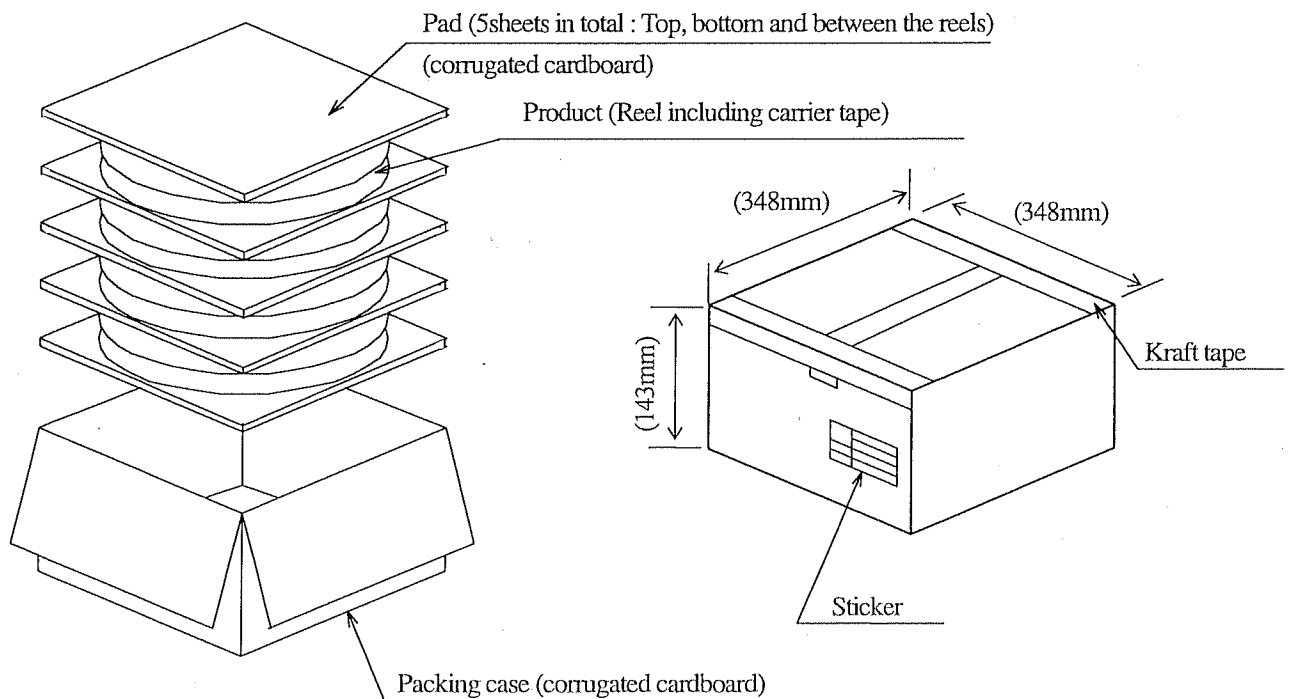
a	b	c	d
330	$17.5 \pm 1.5$	$\phi 100.0 \pm 1.0$	$\phi 13.0 \pm 0.5$
e	f	g	
$\phi 23.0 \pm 1.0$	$2.0 \pm 0.5$	$2.0 \pm 0.5$	

## Direction of product insertion



## Outer packing appearance

- (1) Carrier tape with 1,000pcs. 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. 4,000pcs of devices are in one carton))



Regular packing mass : Approx. 4kg

Dimensions : Reference dimensions

## Precautions for Photocouplers

### 1. Recommended operating conditions

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward current (ON)	$I_{F(ON)}$	7	-	16	mA
Forward voltage (OFF)	$V_{F(OFF)}$	-3.0	-	0.8	V
Supply voltage	$V_{CC}$	15	-	30	V
Operating temperature	$T_{opr}$	-40	-	100	°C

To ensure the reliability sufficiently, please design the circuit with considering the decreases of the light emission power of the LED.

### 2. 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.

### 3. Static electricity

This product consist of bipolar and CMOS type device in output side and is susceptible to static electricity due to its minute design.

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

### 4. Circuit design

- 4.1 In order to stabilize power supply line, please certainly connect a by-pass capacitor of 0.1  $\mu$ F or more between Vcc 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 depending upon 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.  
Therefore it shall be recommended to design the circuit that electric potential of any pin does not become below GND level.
- 4.4 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 decreases of the light emission power of the LED. (50%/5years)  
Please decide the input current which become 2 times of MAX.  $I_{FLH}$ .
- 4.5 As for N.C. terminal (①, ④), external connection is not allowed.

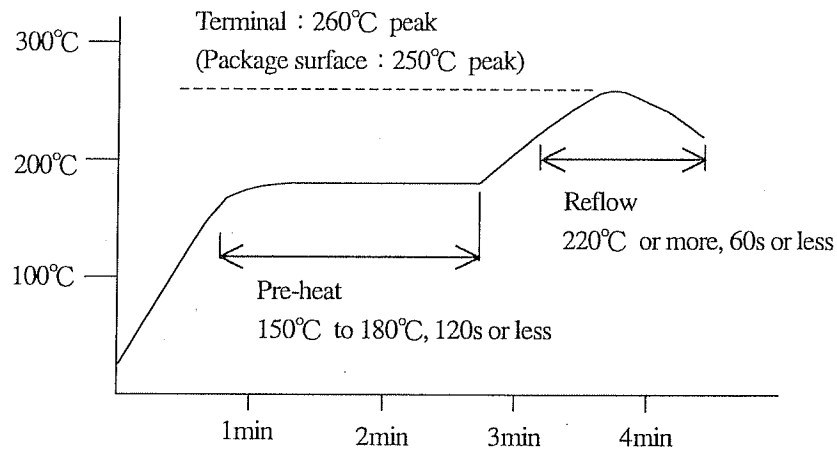
## 5. Precautions for Soldering

### (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) 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

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.