

SHARP

SENSING DEVICE DIVISION
ELECTRONIC COMPONENTS AND DEVICES GROUP
SHARP CORPORATION
SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC923L

(Business dealing name : PC923LENIP0F)

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 copies of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

DATE

BY

T. Ichinose,
Department General Manager of
Development Dept. VI
Sensing Device Div.
Electronic Components and Devices Group
SHARP CORPORATION

Product name : PHOTOCOUPLER

Model No. : PC923L

(Business dealing name : PC923LENIP0F)

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 ;

- | |
|---|
| <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 (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 ;

- | |
|---|
| <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 |
|---|

(4) 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 · Power generation and power transmission control system (Key system) |
|---|

(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 for OPIC type photocoupler PC923L(Lead-Free Type) for IGBT or MOS-FET Gate Drive.

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

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

4. Reliability Refer to the attached sheet, page 9.

5. Outgoing inspection Refer to the attached sheet, page 10.

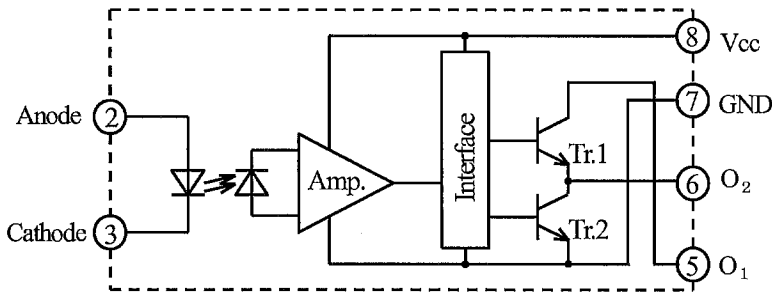
6. Supplement

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 PC923LENIP0F.

6.3 The block diagram, Table truth



Input	O ₂ 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 11, 12.

6.5 This Model is approved by UL.
 Approved Model No. : PC923L
 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 : CFC_s, 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).

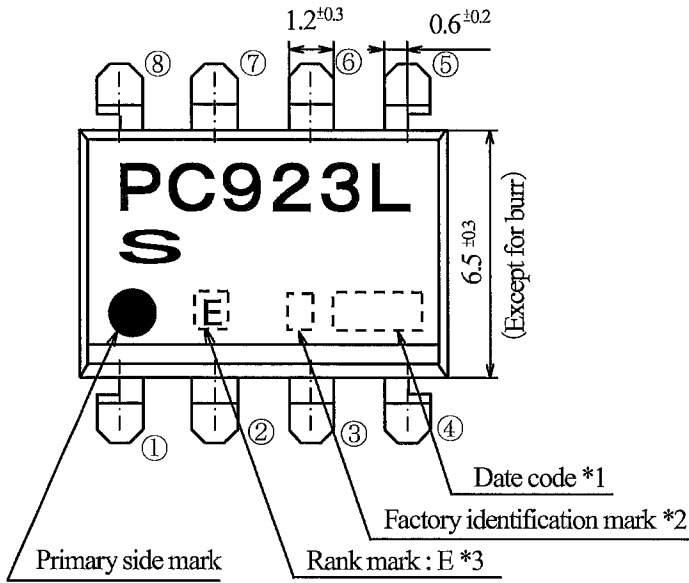
Category	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr ⁶⁺)	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Photocoupler	✓	✓	✓	✓	✓	✓

✓: 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.

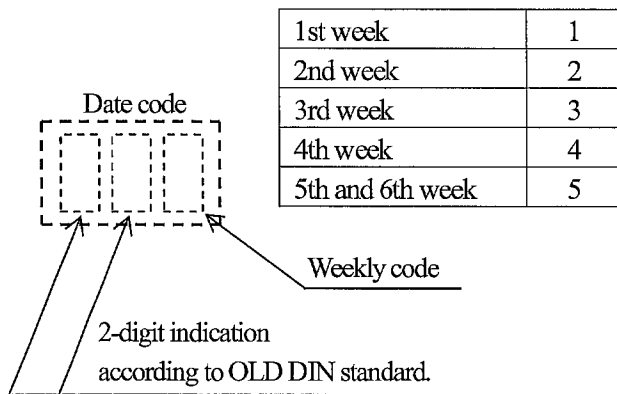
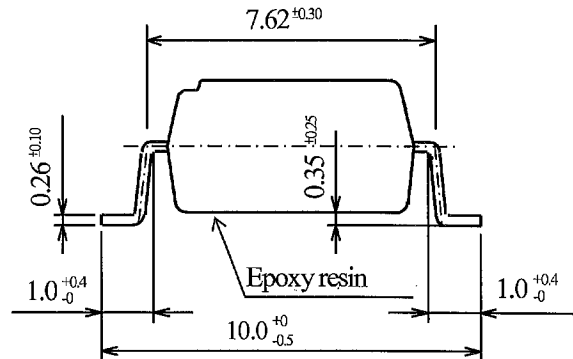
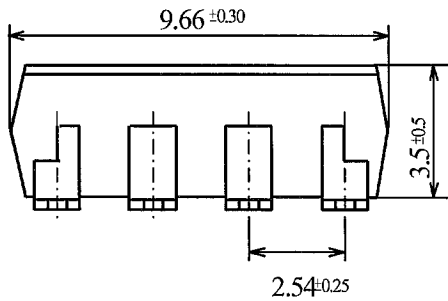
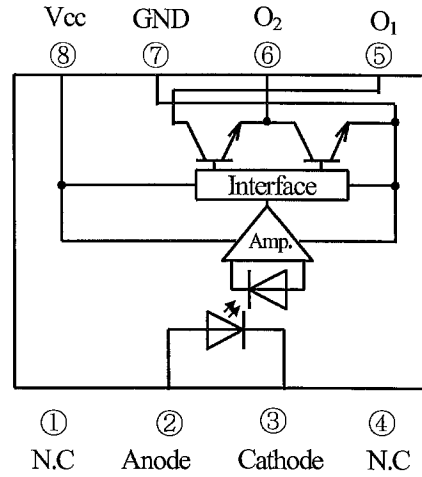
7. Notes

Precautions for photocouplers : Attachment-1

2. Outline



Pin-Number and internal connection diagram



*1) As shown in the left drawing, Date code consists of 2-digit indication according to OLD DIN standard and the weekly code.

*2) Factory identification mark shall be or shall not be marked.

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

*3) Rank mark : "E"

Product mass: Approx. 0.51g

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

Marking is laser marking

UNIT : 1/1 mm	
Name	PC923L Outline Dimensions (Business dealing name : PC923LENIP0F)

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25°C

	Parameter	Symbol	Rating	Unit
Input	*1 Forward current	I _F	20	mA
	Reverse voltage	V _R	5	V
Output	Supply voltage	V _{CC}	35	V
	O ₁ Output current	I _{O1}	0.1	A
	*4 O ₁ Peak output current	I _{O1P}	0.6	A
	O ₂ Output current	I _{O2}	0.1	A
	*4 O ₂ Peak output current	I _{O2P}	0.6	A
	O ₁ Output voltage	V _{O1}	35	V
	*2 Power dissipation	P _O	500	mW
	*3 Total power dissipation	P _{tot}	550	mW
	*5 Isolation voltage	V _{iso(rms)}	5.0	kV
	Operating temperature	T _{opr}	-40 to +85	°C
	Storage temperature	T _{stg}	-55 to +125	°C
	*6 Soldering temperature	T _{sol}	270	°C

*1, 2, 3 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 10, 11, 12.

*4 Pulse width ≤ 0.15 μs, Duty ratio : 0.01

*5 AC for 1 min, 40 to 60%RH, Ta=25°C

*6 For 10s

3.2 Electro-optical characteristics

(Unspecified : Ta=-40 to +85°C)

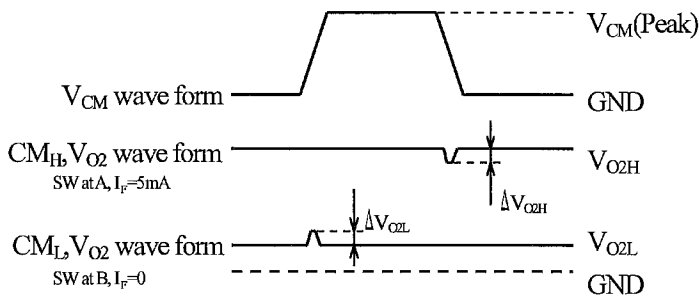
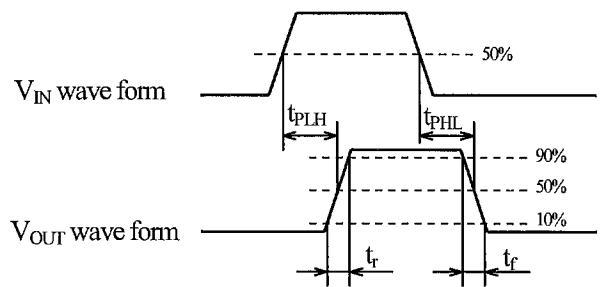
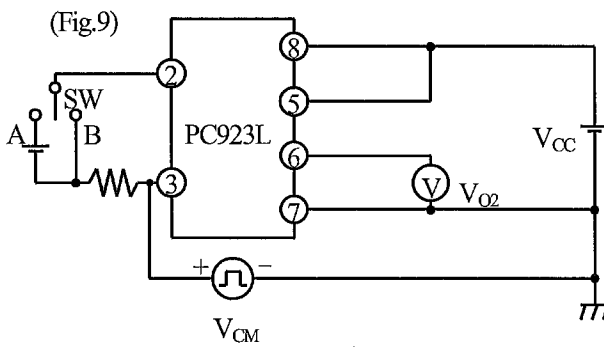
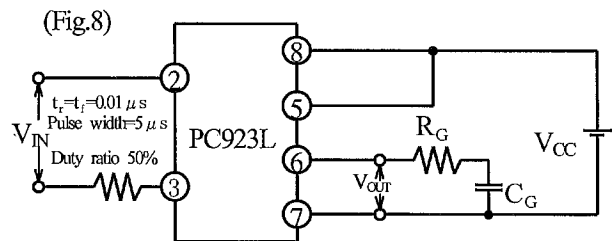
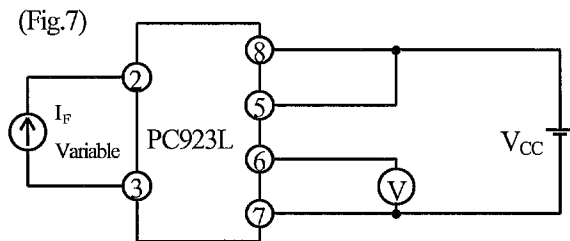
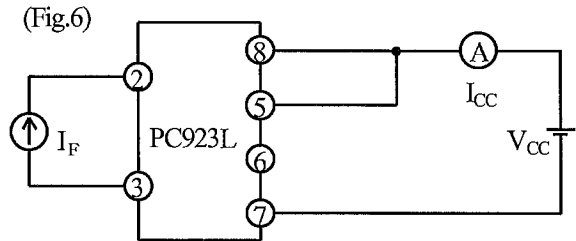
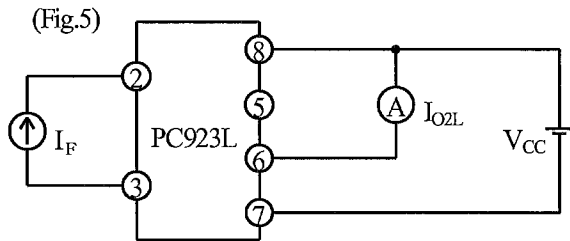
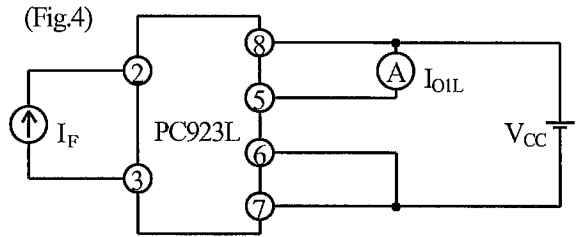
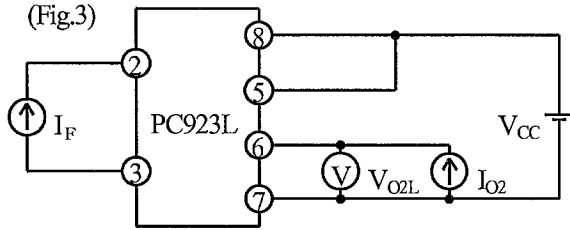
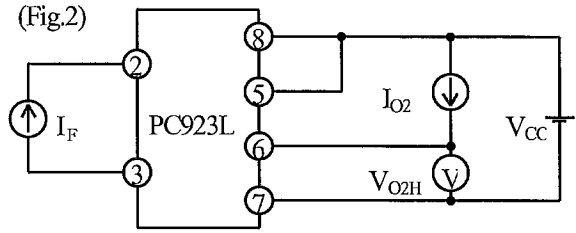
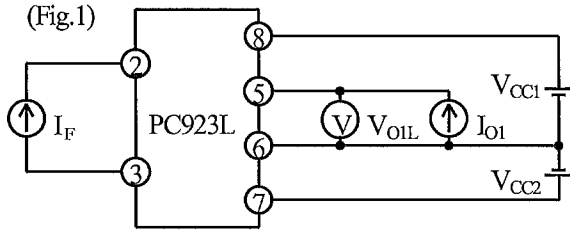
Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Test circuit	Conditions		
Input	Forward voltage	V _{F1}	-	1.6	1.75	V	-	Ta=25°C, I _F =10mA		
		V _{F2}	1.2	1.5	-	V	-	Ta=25°C, I _F =0.2mA		
	Reverse current	I _R	-	-	10	μA	-	Ta=25°C, V _R =5V		
	Terminal capacitance	C _t	-	60	150	pF	-	Ta=25°C, V=0, f=1MHz		
Output	Operating supply voltage range	V _{CC}	15	-	30	V	-			
	O ₁ Low level output voltage	V _{O1L}	-	0.2	0.4	V	(1)	V _{CC1} =12V, V _{CC2} =-12V, I _{O1} =0.1A, I _F =5mA		
	O ₂ High level output voltage	V _{O2H}	20	22	-	V	(2)	V _{CC} =V _{O1} =24V, I _{O2} =-0.1A, I _F =5mA		
	O ₂ Low level output voltage	V _{O2L}	-	0.5	0.8	V	(3)	V _{CC} =24V, I _{O2} =0.1A, I _F =0		
	O ₁ Leak current	I _{O1L}	-	-	500	μA	(4)	V _{CC} =V _{O1} =35V, I _F =0		
	O ₂ Leak current	I _{O2L}	-	-	500	μA	(5)	V _{CC} =V _{O2} =35V, I _F =5mA		
	High level supply current *3	I _{CCH}	-	1.3	3.0	mA	(6)	V _{CC} =24V, I _F =5mA		
Low level supply current *3	I _{CCL}	-	1.3	3.0	mA	V _{CC} =24V, I _F =0				
Transfer characteristics	"L→H" threshold input current *2		I _{FLH}	0.3	1.5	3.0	mA	(7)	Ta=25°C, V _{CC} =24V	
			I _{FLH}	0.2	-	5.0			V _{CC} =24V	
	Isolation resistance		R _{ISO}	5×10 ¹⁰	10 ¹¹	-	Ω	-	Ta=25°C, DC=500V, 40 to 60%RH	
	Response time	"L→H" propagation delay time		t _{PLH}	-	0.3	0.5	μs	(8)	Ta=25°C V _{CC} =24V, I _F =5mA, R _G =47Ω, C _G =3000pF
		"H→L" propagation delay time		t _{PHL}	-	0.3	0.5			
		Rise time		t _r	-	0.2	0.5			
		Fall time		t _f	-	0.2	0.5			
Instantaneous common mode rejection voltage (High level output)		CM _H	-15	-	-	kV/μs	(9)	Ta=25°C, V _{CM} =1.5kV(p-p) I _F =5mA, V _{CC} =24V ΔV _{O2H} =2.0V		
Instantaneous common mode rejection voltage (Low level output)		CM _L	15	-	-			Ta=25°C, V _{CM} =1.5kV(p-p) I _F =0, V _{CC} =24V ΔV _{O2L} =2.0V		

*1 It shall connect a by-pass capacitor of 0.01μF or more between V_{CC} (Pin No. 8) and GND (Pin No. 7) near the device, when it measures the transfer characteristics and the output side characteristics.

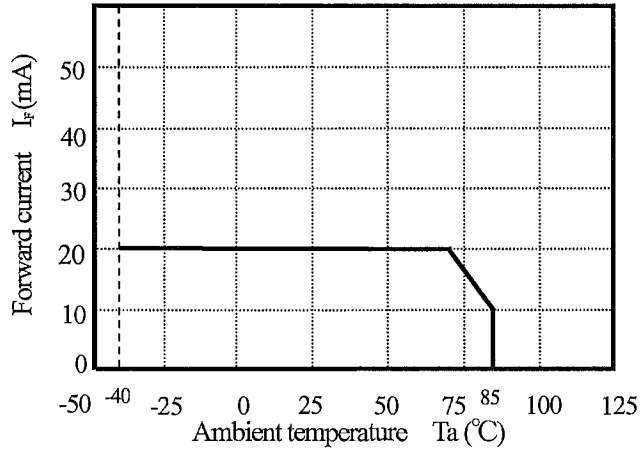
*2 I_{FLH} is the value of forward current when O₂ output changes from "L" to "H".

*3 O₂ Output pin is open (please refer to the precautions for Photocouplers).

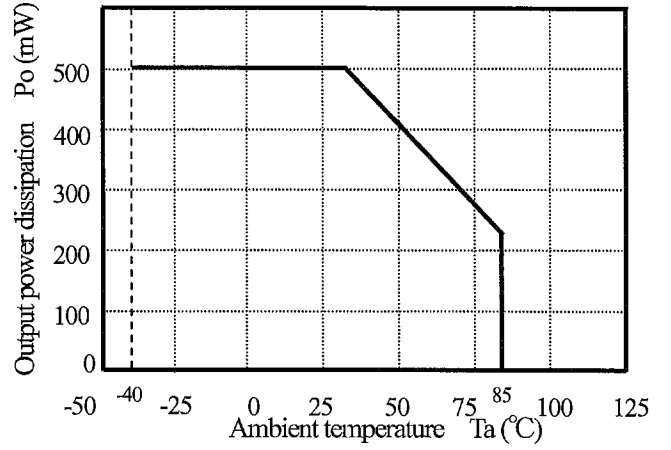
Test circuit



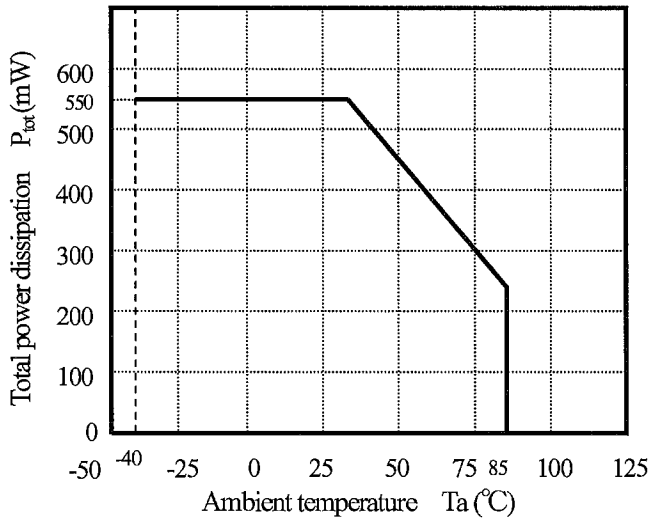
(Fig.10) Forward current vs. ambient temperature



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



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



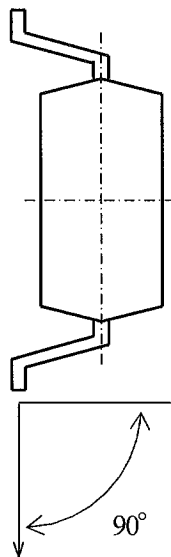
4. Reliability

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	245 ± 3°C 5 s	*2	n=11, C=0	
Soldering heat	(Flow soldering) 270°C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $V_{O1L} > U \times 1.2$ $V_{O2H} < L \times 0.8$ $V_{O2L} > U \times 1.2$ $I_{O1L} > U \times 1.2$ $I_{O2L} > U \times 1.2$ $I_{CCH} > U \times 1.2$ $I_{CCL} > U \times 1.2$ $I_{FLH} > U \times 1.3$	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: 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 min) (30 min) 20 cycles test		n=22, C=0	
High temp. and high humidity storage *4	+85°C, 85%RH, 1000h		U: Upper specification limit	n=22, C=0
High temp. storage	+125°C, 1000h		L: Lower specification limit	n=22, C=0
Low temp. storage	-55°C, 1000h			n=22, C=0
Operation life	I _F =20mA, V _{CC} =24V T _a =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.
- *4 It is evaluated after washing by specified solvent in attachment-1.



Weight : 1N

5. Outgoing inspection

5.1 Inspection items

(1) Electrical characteristics

$V_F, I_R, V_{O1L}, V_{O2H}, V_{O2L}, I_{O1L}, I_{O2L}, I_{CCH}, I_{CCL}, I_{FLH}, R_{ISO}, V_{iso}$

(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 11)

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 12)

The taping reel shall be of plastic (PS material).

- (3) Direction of product insertion (Refer to the attached sheet, Page 12)

- (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 12)

6.4.5 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

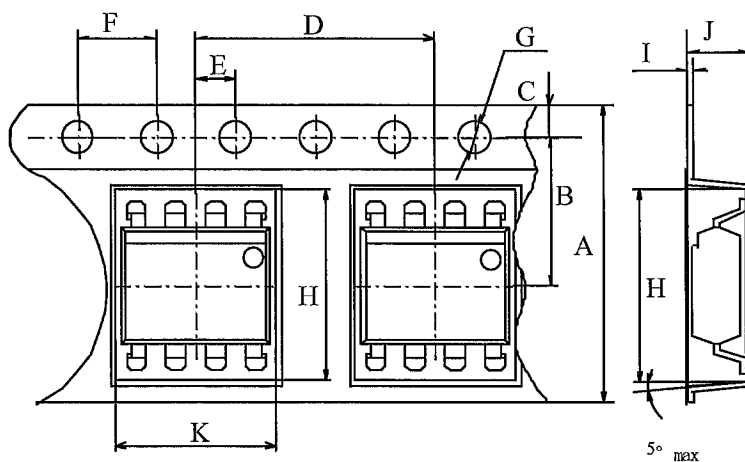
6.4.6 Storage condition

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

6.4.7 Safety protection during shipping

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

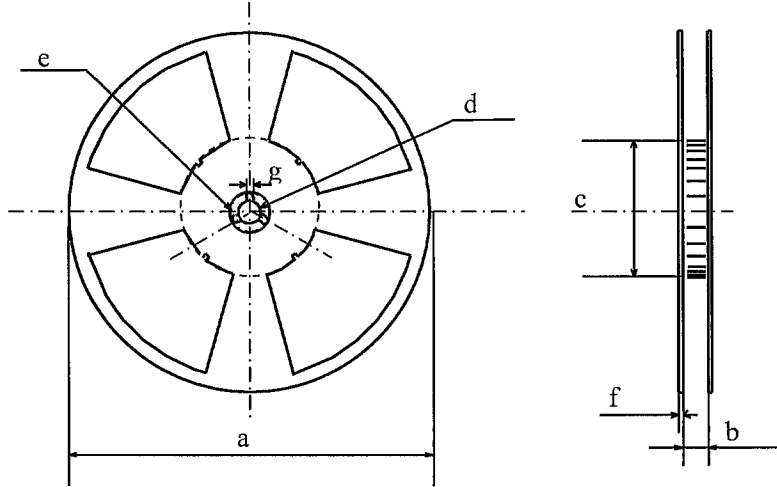
Carrier tape structure and Dimensions



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	±0.1	±0.1
16.0	7.5	1.75	12.0	2.0	4.0	φ 1.5	10.4	0.40	4.2	10.2

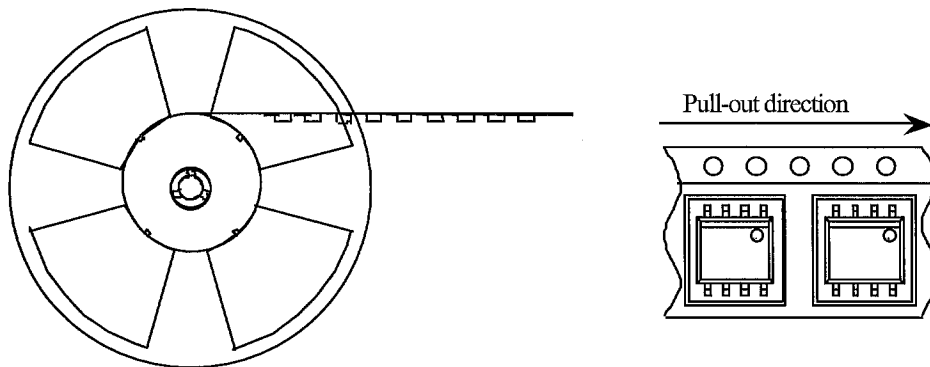
Reel structure and Dimensions



Dimensions list (Unit : mm)

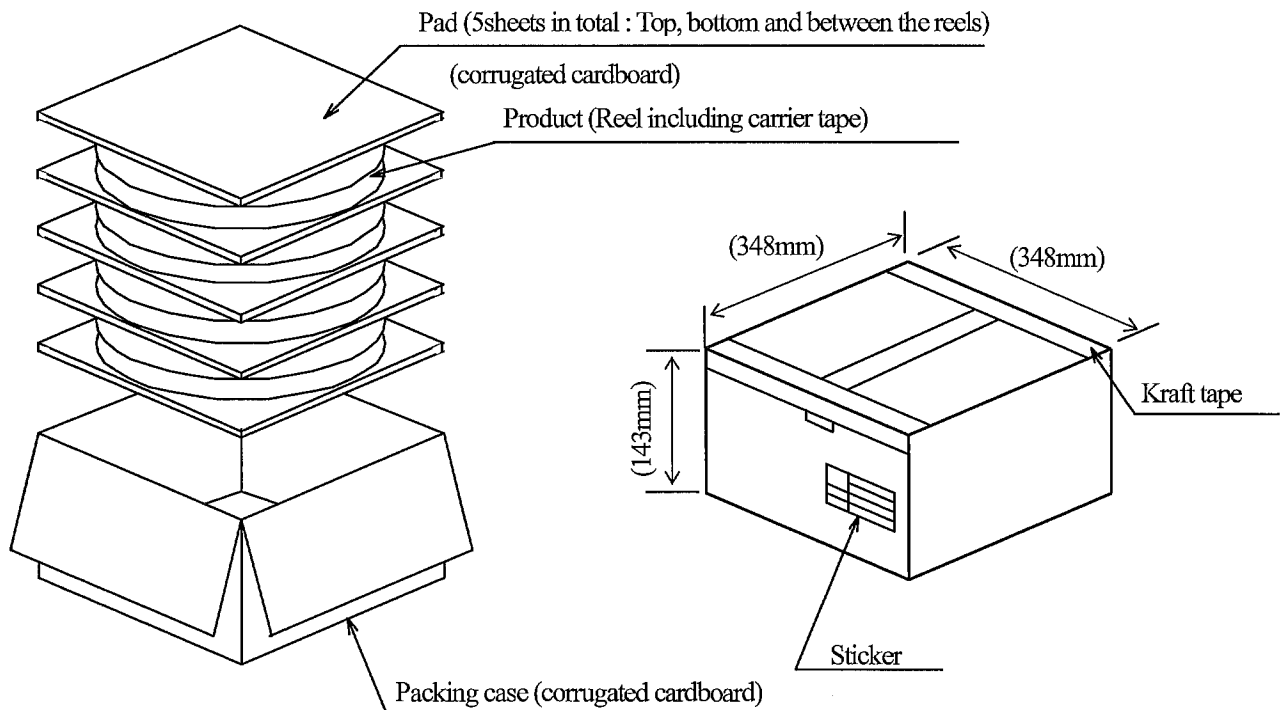
a	b	c	d
(330)	17.5±1.5	φ 100.0±1.0	φ 13.0±0.5
e	f	g	
φ 23.0±1.0	2.0±0.5	2.0±0.5	

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
() : Reference dimensions

Precautions for Photocouplers

1. Recommended operating conditions

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward current	I_F	10	-	20	mA
Supply voltage	V_{CC}	15	-	30	V
Operating temperature	T_{opr}	-40	-	70	°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

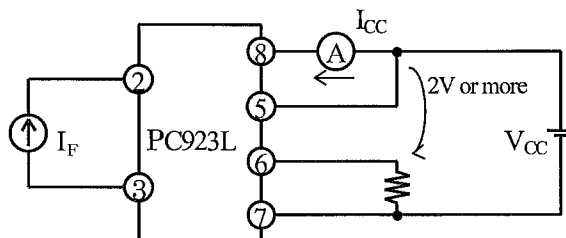
- (1) Solvent cleaning : Solvent temperature 45°C or less, Immersion for 3 min or less
- (2) Ultrasonic cleaning : The effect to device by ultrasonic cleaning differs by cleaning bath size, ultrasonic power output, cleaning time, PCB size or device mounting condition etc.
Please test it in actual using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

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 of 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 μ F 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 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 is recommended to design the circuit that electric potential of any pin does not become below GND level.
- 4.4 This photocoupler is designed to use for IGBT or MOS-FET Gate Drive. Please do not use this for the other application. As mentioned below, when the input is on, if DC load (resistance etc) is connected between O_2 output pin 6 and GND pin 7 and if the electric potential V_{O2} drops approx. more than or equal 2V compared with the electric potential V_{CC} pin 8 continuously, supply current I_{CC} may flow much more than ordinary current and go beyond critical power dissipation.

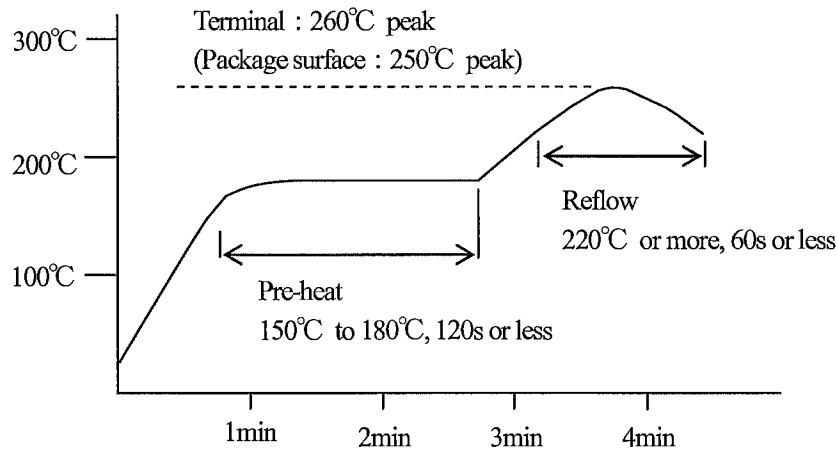


4.5 The LED used in the Photocoupler generally decreases the light emission power by operation.
 In case of long operation time, please design I_F value so that I_F is twice or more of the Maximum value of the "H→L" threshold input current at circuit design with considering the decreases of the light emission power of the LED.

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 PCB is different.
 Please confirm that there is no problem on the actual use conditions in advance.

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