

REFERENCE
SPEC. No. ED-03083
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SHARP

OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No. PC923L

	Business dealing name	Business dealing name
<input checked="" type="radio"/>	PC923L0NIP	PC923L0YIP

Specified for _____

Enclosed please find copies of the Specifications which consists of 17 pages including cover.
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

K.H

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

Product name : PHOTOCOUPLER

Model No. : PC923L

Business dealing name	Business dealing name
PC923LONIP	PC923LOYIP

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 ;

<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 (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 ;

<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 etc.

- (3) 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
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- (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs. etc.

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. PC923L.

- 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

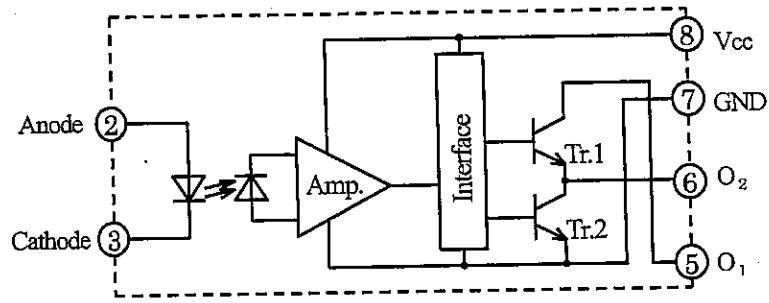
- 6.1 Isolation voltage shall be measured in the following method.
- (1) Short between pins 1 and 4 on the primary side and between pins 5 and 8 on the secondary side.
 - (2) The dielectric withstand tester with zero-cross circuit shall be used.
 - (3) The wave form of applied voltage shall be a sine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

6.2 Business dealing name

("O" mark indicates business dealing name of ordered product)

Product	Business dealing name	Remark
○	PC923LONIP	
	PC923L0YIP	Applied to product as a option (Attachment-2-1 to 2-3.)

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 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 : CFC_s, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methyl chloroform)

6.8 Brominated flame retardants

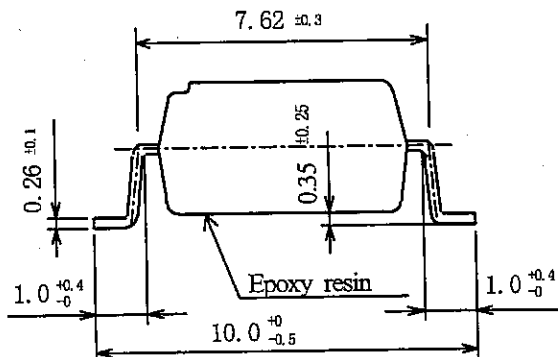
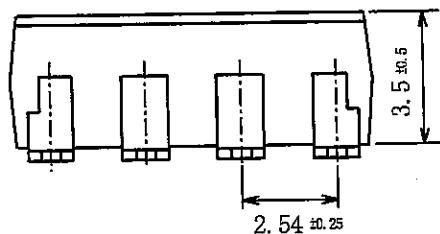
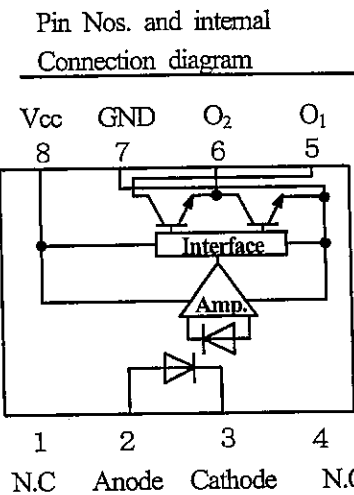
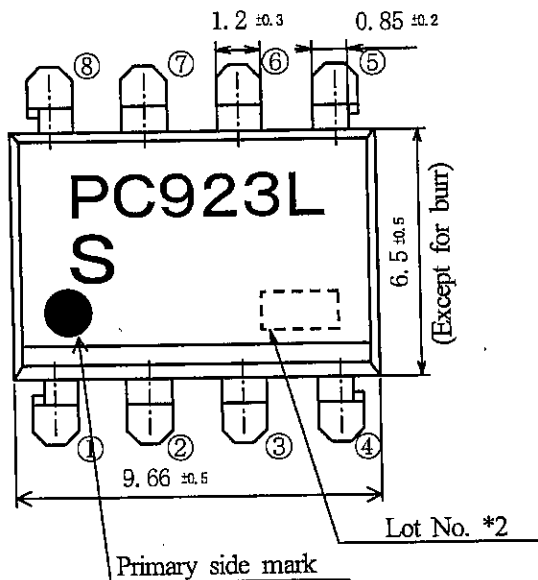
Specific brominated flame retardants such as the PBBO_s and PBB_s are not used in this device at all.

7. Notes

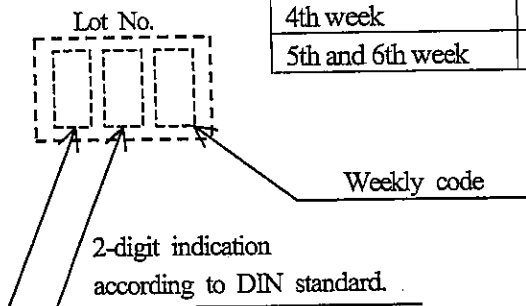
Refer to the attachment-1 (Precautions for Photocouplers).

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2. Outline



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



Product mass : Approx. 0.51g

*1) Marking is laser marking

*2) As shown the left drawing, it is consisted of 2-digit indication according to DIN standard and the weekly code.

UNIT : 1/1 mm	
Name	PC923L Outline Dimensions (Business dealing name : PC923LONIP)

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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 _{stg}	-40 to +85	°C
	Storage temperature	T _{stg}	-55 to +125	°C
	Soldering temperature	T _{sol}	270 (For 10s)	°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 $\leq 0.15 \mu s$, Duty ratio : 0.01

*5 AC for 1 min, 40 to 60%RH, Ta=25°C

3.2 Electro-optical characteristics

(Unspecified : Ta=-40 to +85°C)

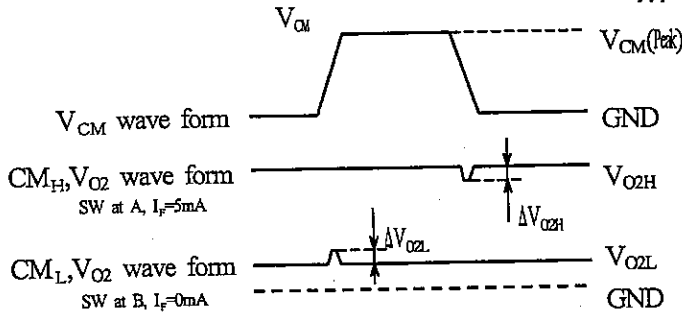
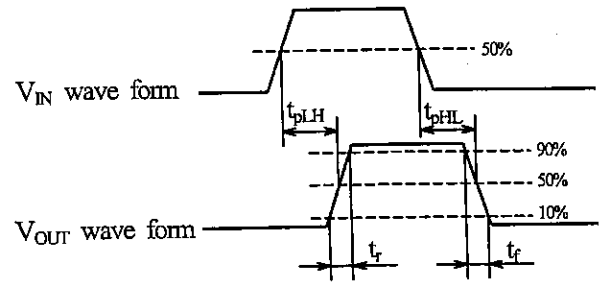
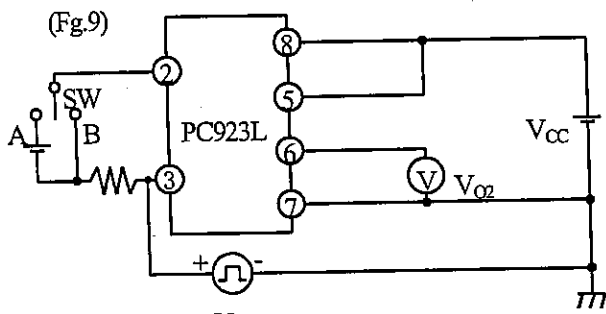
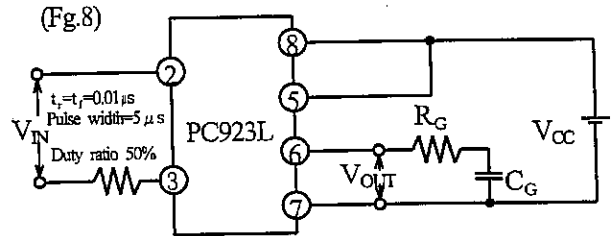
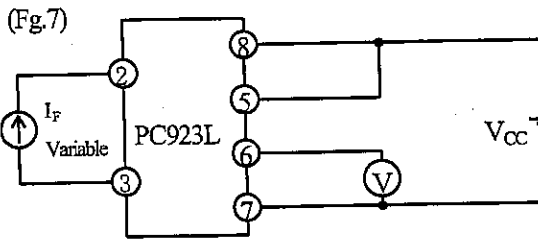
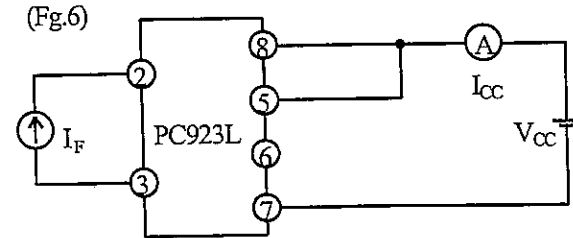
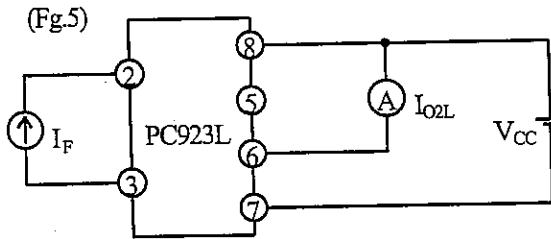
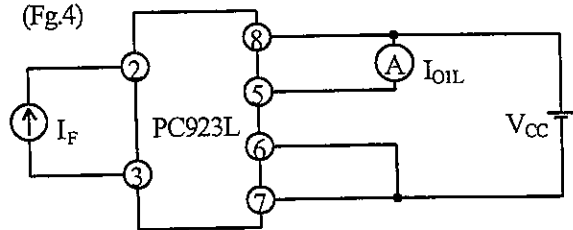
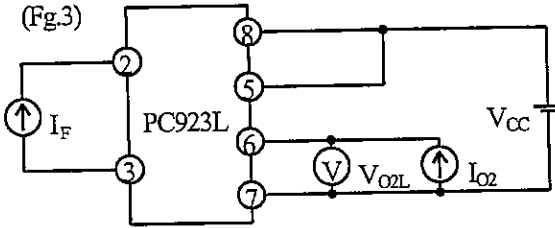
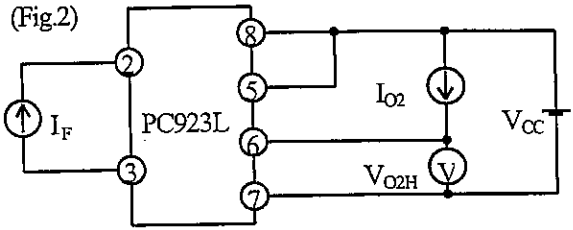
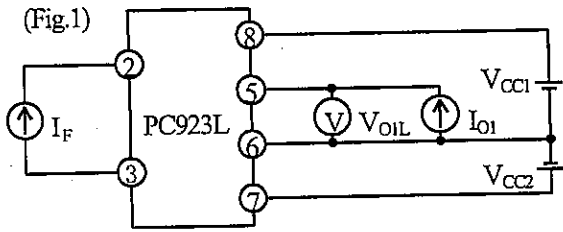
Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Test circuit	Conditions	
Input	Forward voltage	V _{F1}	-	1.6	1.75	V	-	Ta=25°C, I _F =10mA	
		V _{F2}	1.2	1.5	-	V	-	Ta=25°C, I _F =0.2mA	
	Reverse current	I _R	-	-	10	μA	-	Ta=25°C, V _R =5V	
	Terminal capacitance	C _t	-	60	150	pF	-	Ta=25°C, V=0, f=1MHz	
Output	Operating 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 =0mA	
	O ₁ Leak current	I _{O1L}	-	-	500	μA	(4)	V _{CC} =V _{O1} =35V, I _F =0mA	
	O ₂ Leak current	I _{O2L}	-	-	500	μA	(5)	V _{CC} =V _{O1} =35V, I _F =5mA	
	High level supply current	I _{CCH}	-	1.3	3.0	mA	(6)	V _{CC} =24V, I _F =5mA	
	Low level supply current	I _{CCL}	-	1.3	3.0	mA		V _{CC} =24V, I _F =0mA	
Transfer characteristics	"L→ H" threshold input current *2	I _{FLH}	0.3	1.5	3.0	mA	(7)	Ta=25°C, V _{CC} =24V	
			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 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 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 =0mA, V _{CC} =24V ΔV _{O2L} =2.0V		

*1 It shall connect a by-pass capacitor of 0.01 μ F 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 output becomes from "L" to "H".

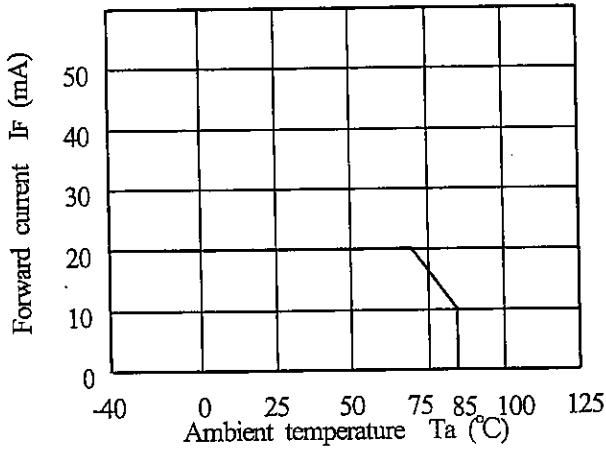
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Test circuit

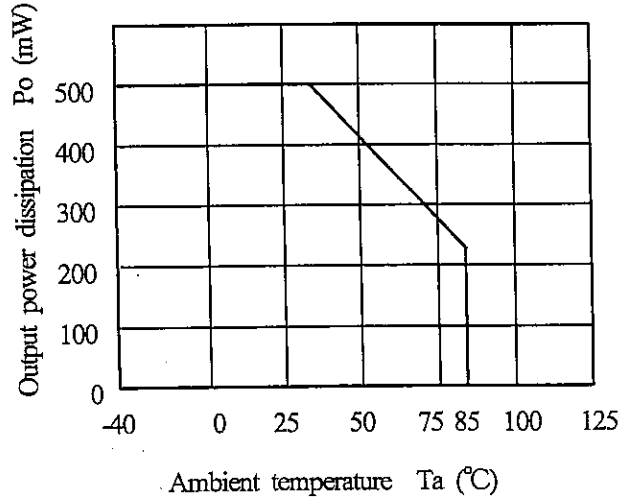


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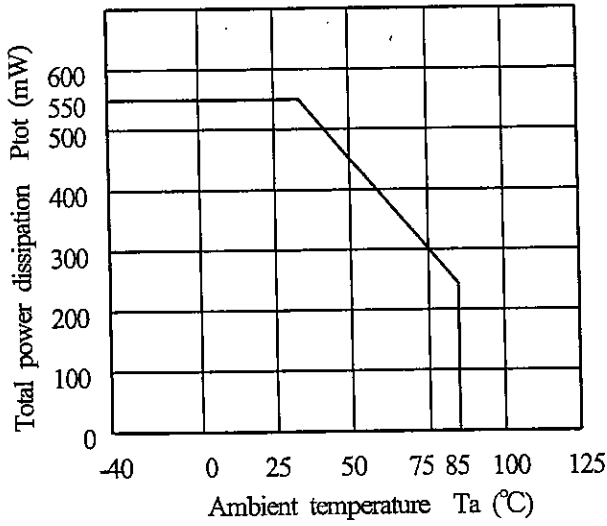
(Fig.10) Forward current vs. ambient temperature



(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

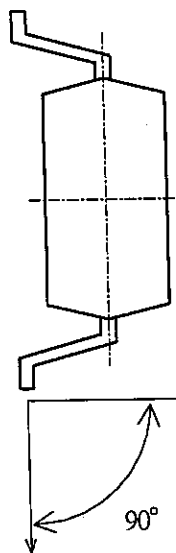
Test Items	Test Conditions *1	Failure Judgement Criteria	Samples (n)
			Defective (C)
Solderability *2	245±2°C, 3 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $V_{O1L} > U \times 1.2$ $V_{O2H} < L \times 0.8$ $V_{O2L} > U \times 1.2$ $I_{O1L} > U \times 1.2$ $I_{O2L} > U \times 1.2$ $I_{CCH} > U \times 1.2$ $I_{CCL} > U \times 1.2$ $I_{FLH} > U \times 1.3$	n=11, C=0
Soldering heat	270 °C, 10 s		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		n=22, C=0
High temp. storage	+125 °C, 1000h		U: Upper specification limit n=22, C=0
Low temp. storage	- 55 °C, 1000h		L: Lower specification limit 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 ELAJ 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.

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



Weight 1N

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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 10)
 The carrier tape has the heat pressed structure of PS material carries tape 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) with its dimensions as shown in the attached drawing.
- (3) Direction of product insertion (Refer to the attached sheet, Page 11)
 Product direction in carrier tape shall direct to the anode mark at the hole side on the tape.
- (4) Joint of tape
 The cover tape and carrier tape in one reel shall be jointless.
- (5) The way to repair taped failure devices
 The way to repair taped failure devices cut a bottom of carrier tape with a cutter, and after replacing to good devices, 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 from 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 shall contain 1000pcs.

6.4.4 Outer packing appearance

- Refer to the attached sheet, page 11.

6.4.5 Marking

- The outer packaging case shall be marked with following information.
 * Model No. * Number of pieces delivered * Production date

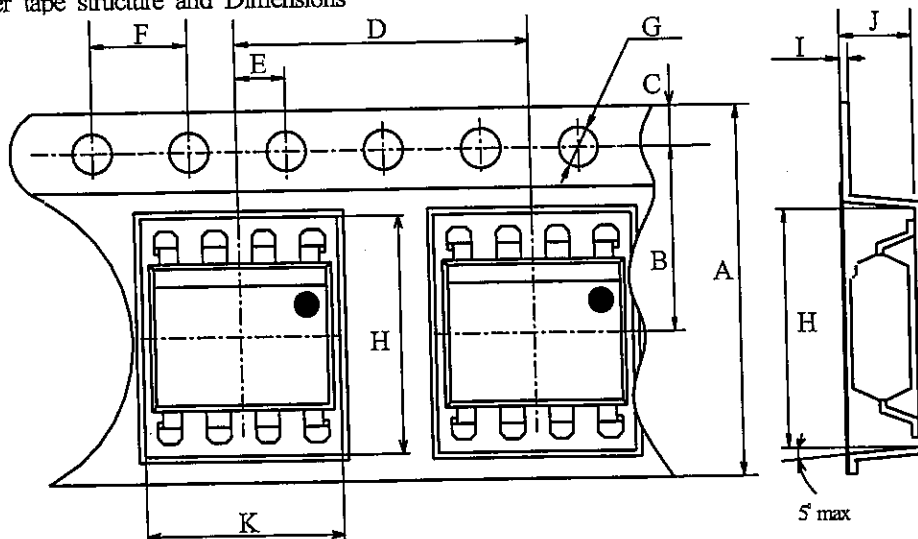
6.4.6 Storage condition

- Taped products shall be stored at the temperature 5 to 30°C and the humidities lower than 70%RH.

6.4.7 Safety protection during shipping

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

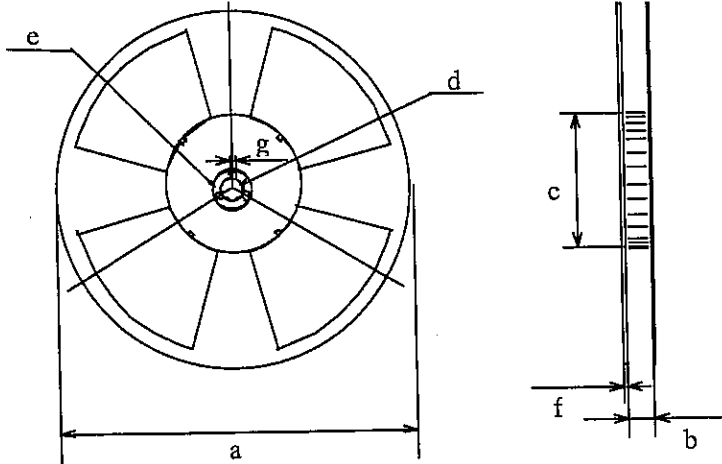
Carrier tape structure and Dimensions



Symbol	A	B	C	D	E
Unit					
mm	±0.3 16.0	+0.1 7.5	±0.1 1.75	±0.1 12.0	±0.1 2.0

Symbol	F	G	H	I	J	K
Unit						
mm	±0.1 4.0	+0.1 -0.0 φ 1.5	±0.1 10.4	±0.05 0.4	±0.1 4.2	±0.1 10.2

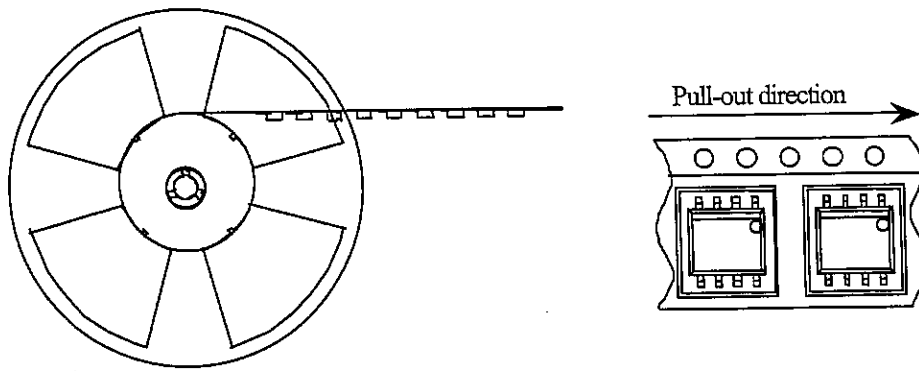
Reel structure and Dimensions



Dimensions list (Unit : mm)

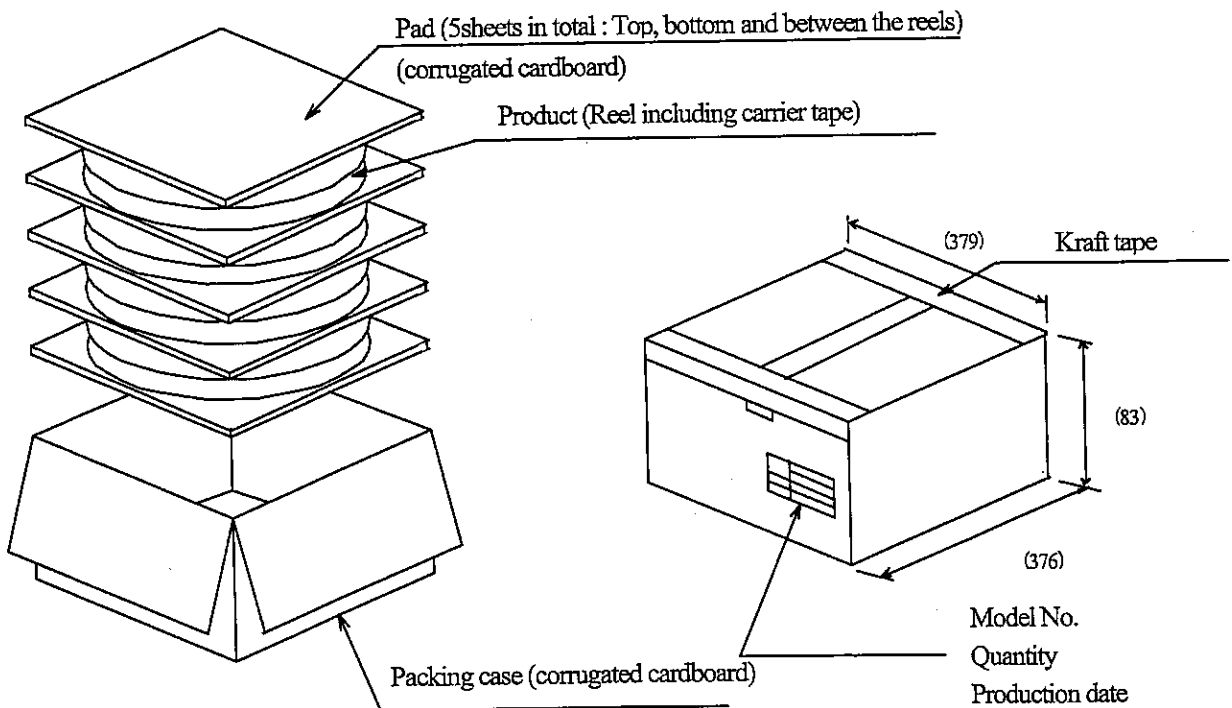
a	b	c	d
330	17.5±1.5	100±1.0	13±0.5
e	f	g	
23±1.0	2.0±0.5	2.0±0.5	

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

Dimensions : Reference value

Unit : mm

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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

Sharp recommends usage of the device under the above conditions to secure reliability and allowance for over time degradation of light emitting diode.

2. For 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 doesn't occur any defect 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. Precaution for use

Transistor of detector side in bipolar configuration is apt to be affected by static electricity for its minute design. When handling them, general counterpane against static electricity should be taken to avoid breakdown of devices or degradation of characteristics.

4. Caution the 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 where used in a 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 possibly may be occurred if electric potential of any pin becomes below GND level even for 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} .

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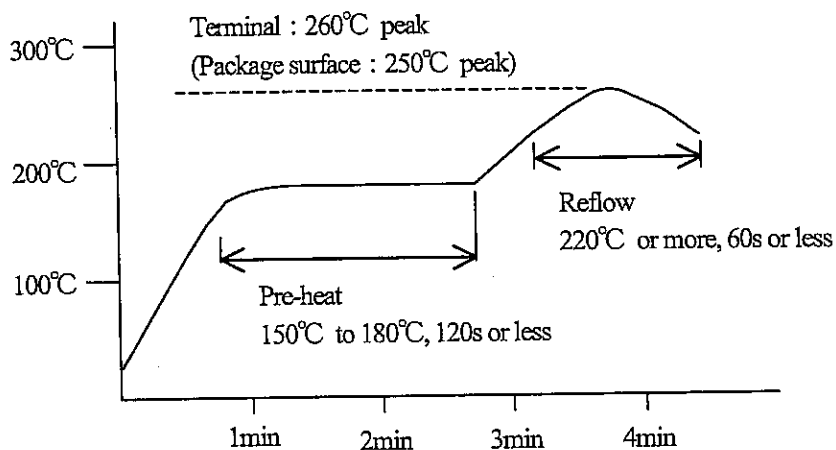
5. Precautions for Soldering Photocouplers

- (1) In the case of flow soldering (Whole device dipping)

It is recommended that flow solder be at 270°C and within 10 seconds (Pre-heating : 100 to 150°C, 30 to 80seconds).
(2 times or less)

- (2) If solder reflow :

It is recommended that only one soldering 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 : $390 \pm 10^\circ\text{C}$

Time : 3s or less

- (4) Other precautions

Since, influence to the device is different according to reflow equipment and its condition, please use the device after confirming no damage in the actual using condition.

1. This specification shall be applied to photocoupler, Model No. PC923L as an option.
2. Applicable Models (Business dealing name)
PC923L0YIP
3. The relevant models are the models Approved by VDE according to DIN VDE0884/08.87.

Approved Model No. : PC923L

VDE approved No. : 87446

(According to the specification DIN VDE0884/08.87)

- Operating isolation voltage $U_{IORM(Peak)}$: 710V
- Transient voltage $U_{TR(Peak)}$: 6000V
- Pollution : 2 (According to VDE0110/01.89)
- Clearances distance (Between input and output) : 6.4mm (MIN.)
- Creepage distance (Between input and output) : 6.4mm (MIN.)
- Isolation thickness between input and output : 0.15mm (MIN.)
- Tracking-proof : CTI 175 (Material group IIIa : VDE0110/01.89)
- Safety limit values
 - Current (Isi) : 120mA (Diode side)
 - Power (Psi) : 687mW (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 prints " 0884 " on sleeve package.

4. Outline Refer to the attachment-2-2.

5. Isolation specification according to VDE 0884

Parameter	Symbol	Condition	Rating	Unit	Remark
Class of environmental test	-	DIN IEC68	40/100/21	-	
Pollution	-	DIN VDE0110	2	-	
Maximum operating isolation voltage	$U_{IORM(PEAK)}$	-	710	V	Refer to the Diagram 1,2 (Attachement-2-3)
Partial discharge test voltage (Between input and output)					
Diagram 1	$U_{PI(PEAK)}$	$t_p=60s, q_c < 5pC$	852	V	
Diagram 2		$t_p=1s, q_c < 5pC$	1136	V	
Maximum over-voltage	$U_{INITIAL(PEAK)}$	$t_{IN}=10s$	6000	V	Refer to Fig. 13,14 (Attachement-2-3)
Safety maximum ratings					
1) Case temperature	Tsi	$I_F=0, P_C=0,$	150	°C	
2) Input current	Isi	$P_C=0$	120	mA	
3) Electric power (Output or Total power dissipation)	Psi	-	687	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		

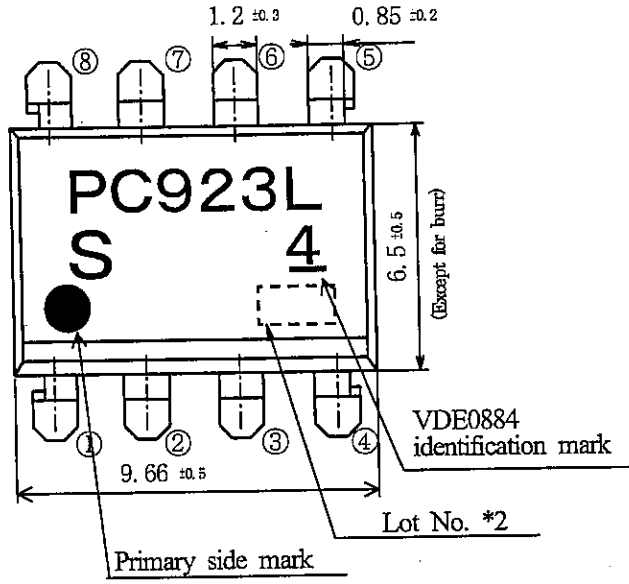
6. Precautions in performing isolation test

6.1 Partial discharge test methods shall be the ones according to the specifications of VDE 0884/08.87

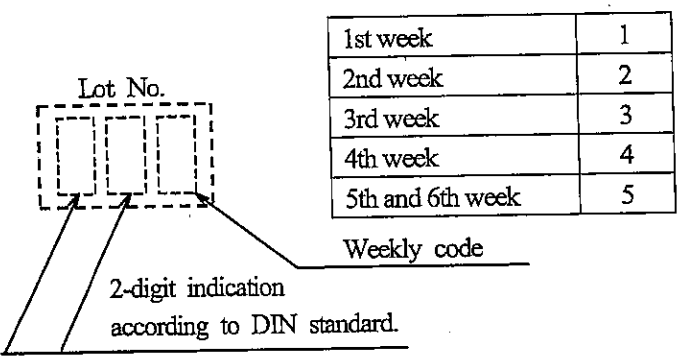
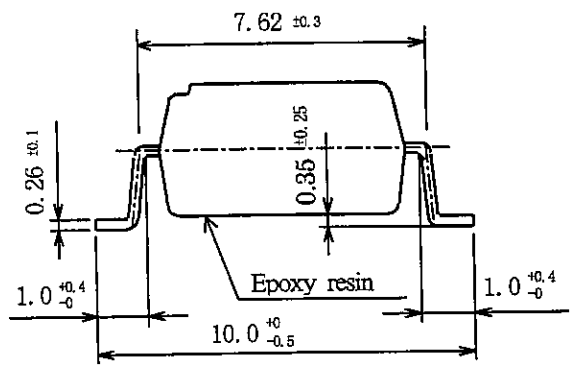
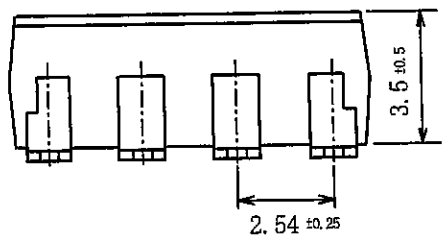
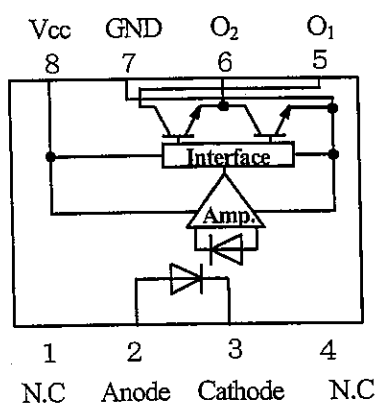
6.2 Please don't carry out isolation test (Viso) over $U_{INITIAL}$. This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. $U_{INITIAL}$). And there is possibility that this product occurs partial discharge in operating isolation voltage. (U_{IORM}).

REFERENCE

4. Outline



Pin Nos. and internal Connection diagram



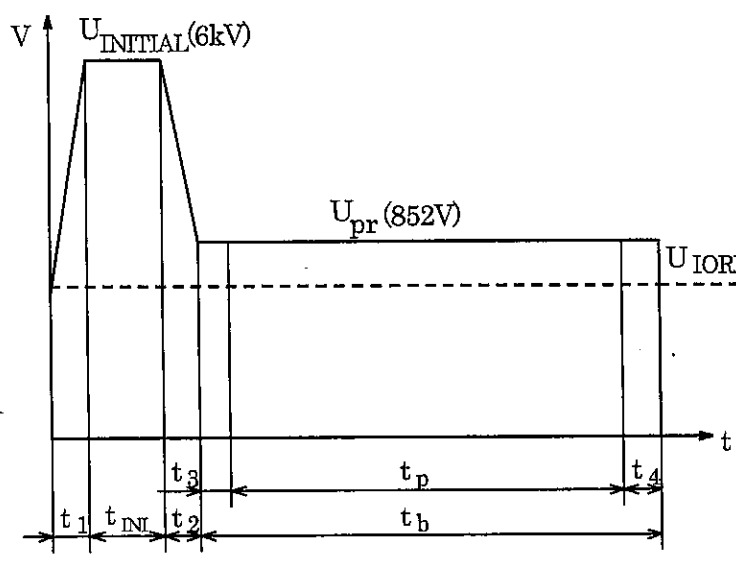
1st week	1
2nd week	2
3rd week	3
4th week	4
5th and 6th week	5

- *1) Marking is laser marking
- *2) As shown the left drawing, it is consisted of 2-digit indication according to DIN standard and the weekly code.

Product mass : Approx. 0.51g

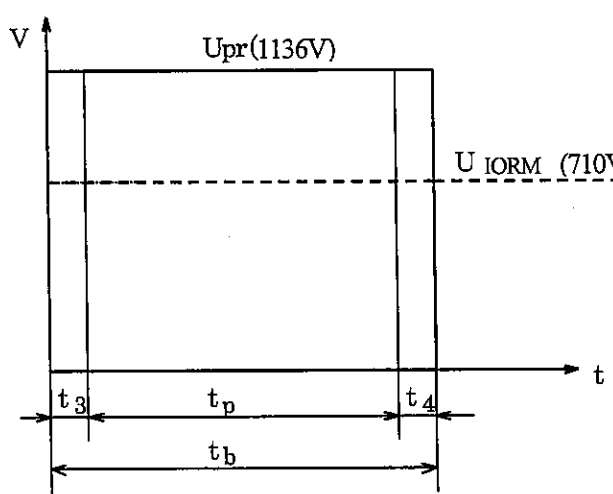
UNIT : 1/1 mm	
Name	PC923L Outline Dimensions (Business dealing name : PC923L0YIP)

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



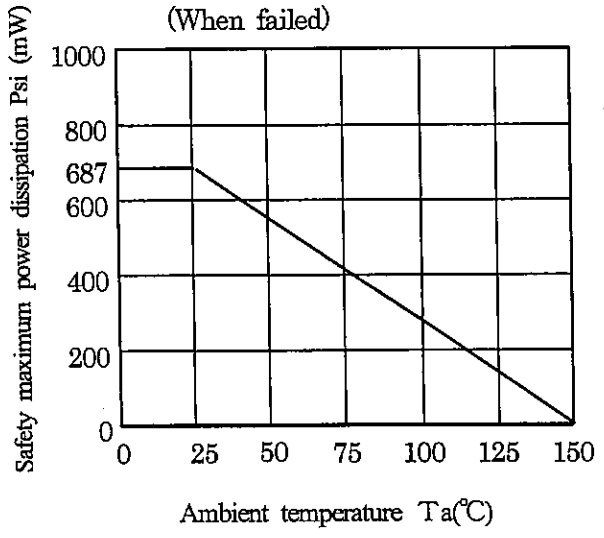
- $t_1, t_2 = 1 \text{ to } 10 \text{ s}$
- $t_3, t_4 = 1 \text{ s}$
- t_p (Partial discharge measuring time) = 60 s
- $t_b = 62 \text{ s}$
- $t_{INI} = 10 \text{ s}$

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



(Fig.14) Safety maximum forward current vs. ambient temperature (When failed)

