

SHARP

REFERENCE
SPEC. No. ED-02269
ISSUE: November 7, 2002

OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER.

MODEL No.

PC410L

	Business dealing name		Business dealing name
<input checked="" type="radio"/>	PC410LENIP	<input type="checkbox"/>	PC410LEYIP

Specified for _____

Enclosed please find copies of the Specifications which consists of 15 pages including cover.
After confirmation of the contents, please be sure to send back copy of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

PRESENTED

DATE

DATE

7 Nov. 2002

BY

BY

Y. Yashiro

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

REFERENCE

Product name : PHOTOCOUPLER

Model No. : PC410L

Business dealing name	Business dealing name
PC410LENIP	PC410LEYIP

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 etc.)
- (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 etc.)
- (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.

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1. Application

This specification applies to the outline and characteristics of OPIC photocoupler Model No. PC410L.

- 2. Outline Refer to the attached sheet, page 3.
- 3. Ratings and characteristics Refer to the attached sheet, page 4 to 5.
- 4. Reliability Refer to the attached sheet, page 6.
- 5. Outgoing inspection Refer to the attached sheet, page 7.

6. Supplement

6.1 Isolation voltage shall be measured in the following method.

- (1) Short between pins 1 and 3 on the primary side and between pins 4, 5 and 6 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
	PC410LENIP	
	PC410LEYIP	Applied to product as a option (Attachment-2-1 to 2-3.)

6.3 Package specification Refer to the attached sheet, page 8, 9.

6.4 This Model is approved by UL.

Approved Model No. : PC410L

UL file No. : E64380

6.5 This product is not designed against irradiation.

This product is operated with electrical input and output.

This product incorporates non-coherent light emitting diode.

6.6 ODS materials

This product shall not contain the following materials.

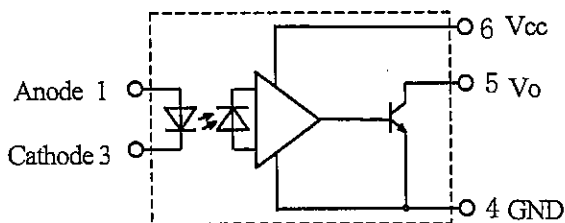
Also, the following materials shall not be used in the production process for this product.

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

6.7 Brominated flame retardants

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

6.8 The block diagram

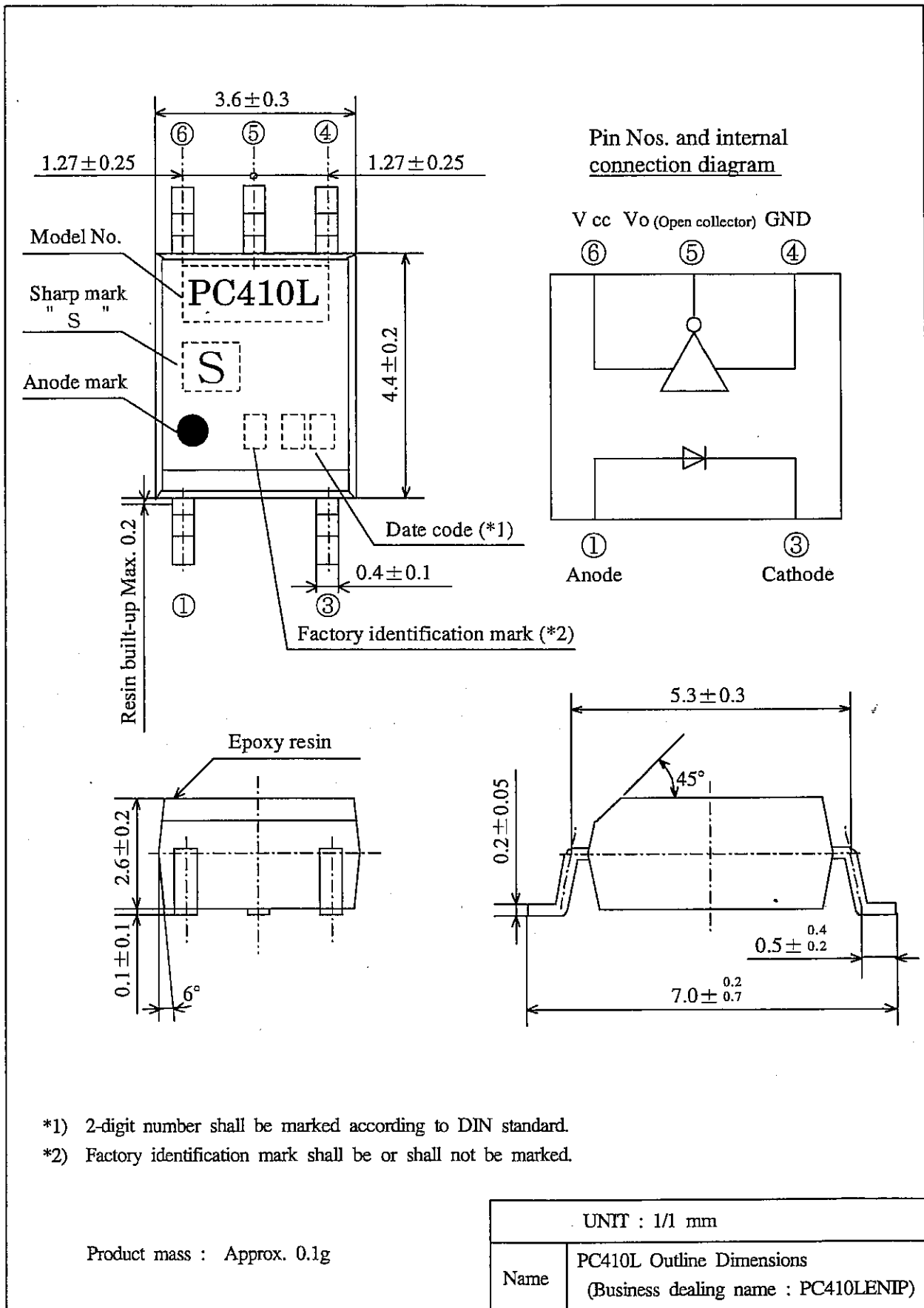


7. Notes

Refer to the attachment-1-1, 2 (Precautions for Photocouplers).

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2. Outline



*1) 2-digit number shall be marked according to DIN standard.
 *2) Factory identification mark shall be or shall not be marked.

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3. Ratings and characteristics

3.1 Absolute maximum ratings

Parameter		Symbol	Rating	Unit
Input	*1 Forward current	I_F	20	mA
	Reverse voltage	V_R	5	V
	Power dissipation	P	40	mW
Output	Supply voltage	V_{CC}	7	V
	High level output voltage	V_{OH}	7	V
	Low level output current	I_{OL}	50	mA
	*2 Output collector power dissipation	P_o	85	mW
*3 Isolation voltage	Viso(rms)	3.75	kV	
Operating temperature		Topr	-40 to +85	°C
Storage temperature		Tstg	-40 to +125	°C
*4 Soldering temperature	Tsol	270	°C	

- *1 The derating factors of forward current vs. ambient temperature are shown in Fig. 3.
- *2 The derating factors of output collector power dissipation due to ambient temperature are shown in Fig. 4.
- *3 AC for 1 min, 40 to 60%RH
- *4 For 10 s or less, 0.2mm or more from lead base.

3.2 Electro-optical characteristics

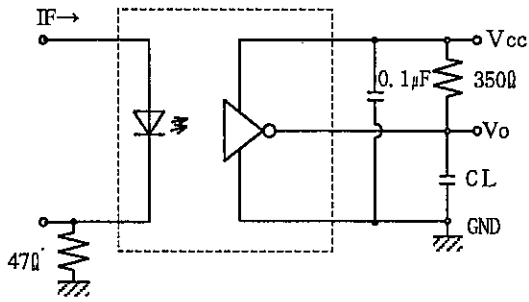
($T_a = -40$ to $+85^\circ\text{C}$ unless otherwise specified.)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit		
Input	Forward voltage	V_F	$T_a = 25^\circ\text{C}$, $I_F = 10\text{mA}$	1.4	1.6	1.9	V		
	Reverse current	I_R	$T_a = 25^\circ\text{C}$, $V_R = 5\text{V}$	-	-	10	μA		
	Terminal capacitance	C_t	$T_a = 25^\circ\text{C}$, $V = 0\text{V}$, $f = 1\text{MHz}$	-	60	150	pF		
Output	Low level output voltage	V_{OL}	$I_{OL} = 13\text{mA}$, $V_{CC} = 5.5\text{V}$, $I_F = 5\text{mA}$	-	0.4	0.6	V		
	High level output current	I_{OH}	$V_{CC} = V_o = 5.5\text{V}$, $I_F = 250\mu\text{A}$	-	0.02	100	μA		
	Low level supply current	I_{CCL}	$V_{CC} = 5.5\text{V}$, $I_F = 10\text{mA}$	-	7	13	mA		
	High level supply current	I_{CCH}	$V_{CC} = 5.5\text{V}$, $I_F = 0\text{mA}$	-	5	10	mA		
Transfer characteristics	"H→L" threshold input current	I_{FHL}	$V_{CC} = 5\text{V}$, $R_L = 350\Omega$, $V_o = 0.6\text{V}$	-	2.5	5	mA		
	Isolation resistance	R_{ISO}	$T_a = 25^\circ\text{C}$, DC=500V, 40 to 60%RH	5×10^{10}	10^{11}	-	Ω		
	Floating capacitance	C_f	$T_a = 25^\circ\text{C}$, $V = 0\text{V}$, $f = 1\text{MHz}$	-	0.6	-	pF		
	Response time	"H→L" propagation time	t_{PHL}	$T_a = 25^\circ\text{C}$ $V_{CC} = 5\text{V}$, $I_F = 7.5\text{mA}$, $R_L = 350\Omega$, $C_L = 15\text{pF}$, (Refer to Fig. 1)	25	48	75	ns	
		"L→H" propagation time	t_{PLH}		25	50	75		
		Fall time	t_f		-	10	-		
		Rise time	t_r		-	20	-		
		Distortion of pulse width $ t_{PHL} - t_{PLH} $	Δtw		-	-	35		
	CMR	Instantaneous common mode rejection voltage (High level output)	CM_H	$I_F = 0\text{mA}$ $V_o(\text{MIN}) = 2\text{V}$	$V_{CC} = 5\text{V}$ $V_{CM} = 1\text{kV}_{(P-P)}$ $R_L = 350\Omega$	10	20	-	kV/ μs
		Instantaneous common mode rejection voltage (Low level output)	CM_L	$I_F = 5\text{mA}$ $V_o(\text{MAX}) = 0.8\text{V}$	$T_a = 25^\circ\text{C}$ (Refer to Fig. 2)	-10	-20	-	

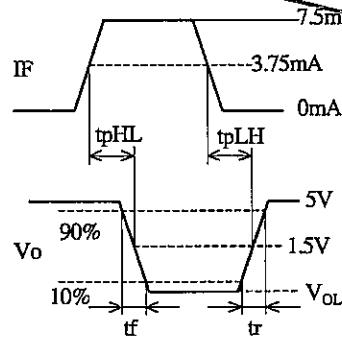
Note) All typical values are at $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$.

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

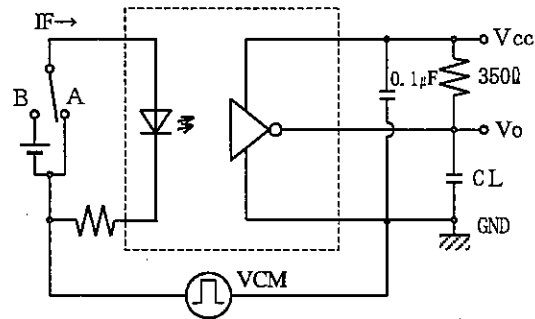


* CL contains probe and wiring capacity.

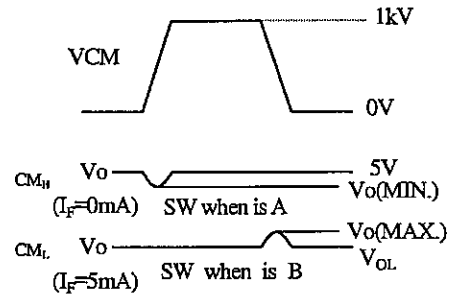


Timing diagram

Fig.2 CM_H , CM_L test circuit

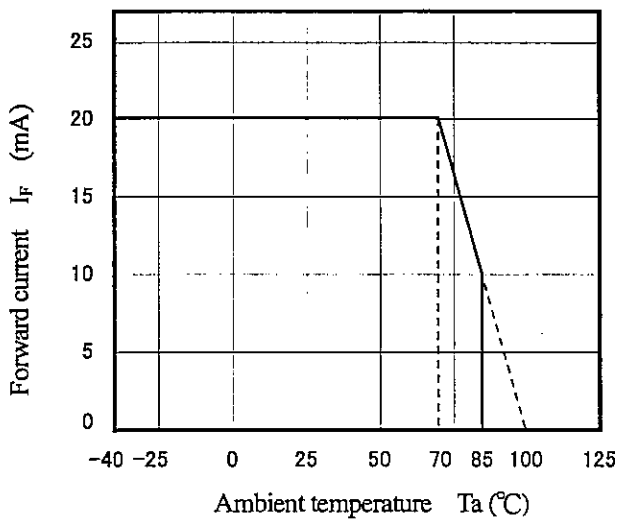


* CL contains probe and wiring capacity.

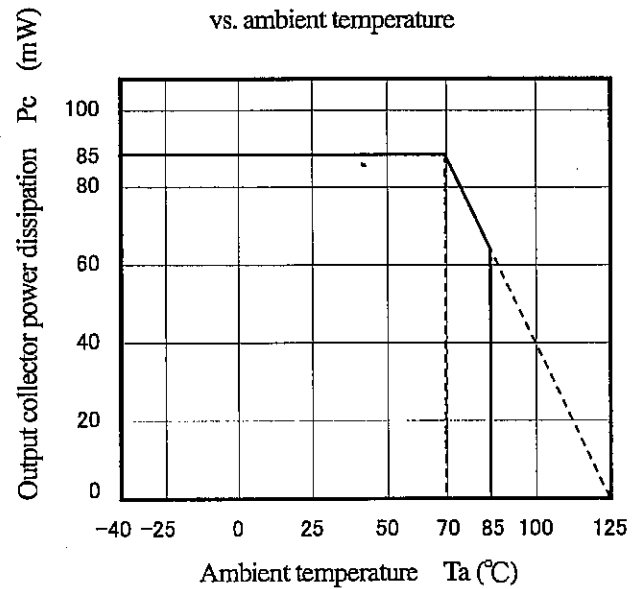


Timing diagram

(Fig.3) Forward current vs. ambient temperature



(Fig.4) Output collector power dissipation vs. ambient temperature



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Confidence level: 90%
LTPD : 10 or 20

4. Reliability

The reliability of products shall satisfy items listed below.

Test Items	Test Conditions *1	Failure Judgement Criteria	Samples (n)
			Defective(C)
Solderability *2	245±2°C, 3 s	—————	n=11, C=0
Soldering heat *3	270°C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $I_{OH} > U \times 2$ $I_{CCL} > U \times 1.2$ $I_{CCH} > U \times 1.2$ $I_{FHL} > U \times 1.3$ $V_{OL} > U \times 1.2$ U : Upper specification limit L : Lower specification limit	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	200m/s ² 100 to 2000 to 100Hz/4min. 4 times/ X, Y, Z direction		n=11, C=0
Temperature cycling	1 cycle -40°C to +125°C (30min.) (30min.) 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	-40°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

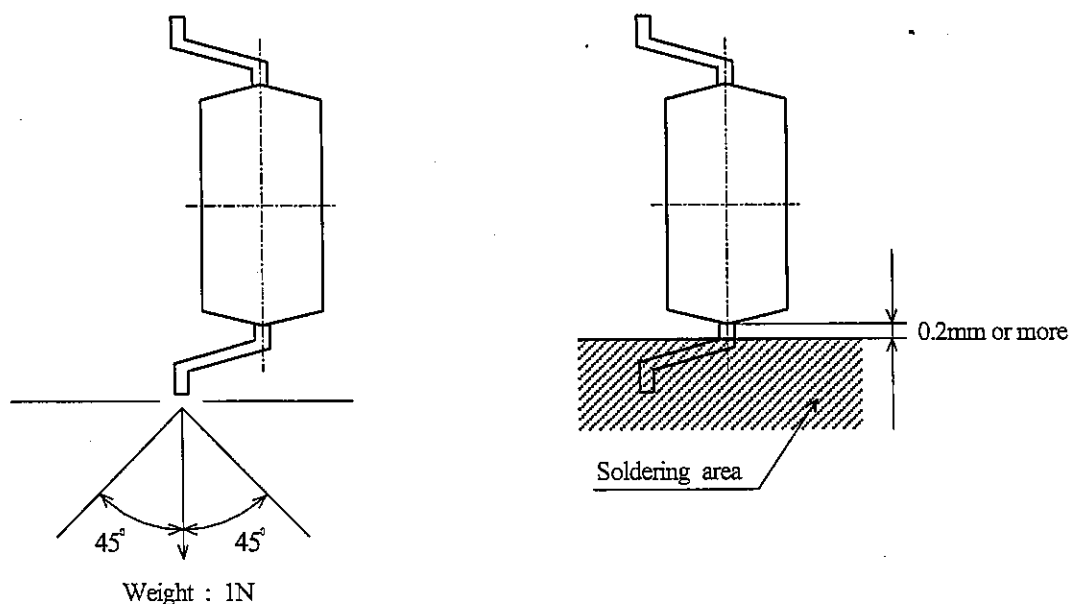
*1 Test method, conforms to EIAJ ED 4701.

*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 The lead pin depth dipped into solder shall be 0.2mm away from the root of lead pins. (Refer to the below)

*4 Terminal bending direction is shown below.

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



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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

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6.3 Package specifications

6.3.1 Taping conditions

- (1) Tape structure and Dimensions (Refer to the attached sheet, Page 8)
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 9)
The taping reel shall be of plastic with its dimensions as shown in the attached drawing.
- (3) Direction of product insertion (Refer to the attached sheet, Page 9)
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.

6.3.2 Adhesiveness of cover tape

- The exfoliation force between carrier tape and cover tape shall be 0.2N to 0.7N for the angle from 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 shall contain 3000pcs.

6.3.4 Outer packing appearance (Refer to attached sheet, Page 9)

6.3.5 Marking

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

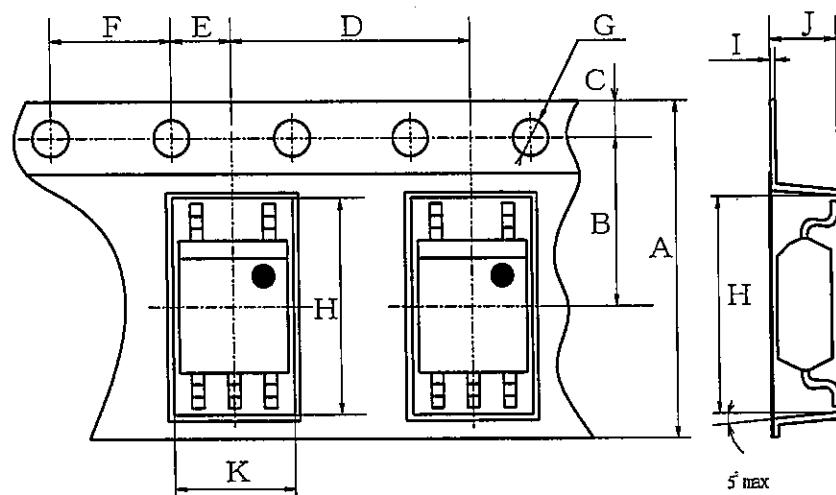
6.3.6 Storage condition

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

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

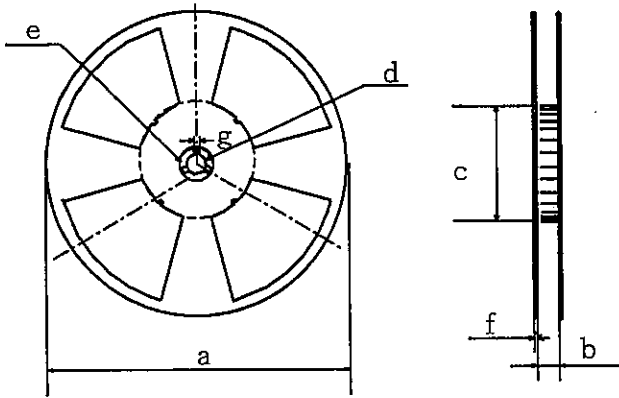


Dimensions list (Unit : mm)

A	B	C	D	E	F	G	H	I	J	K
±0.3	±0.05	±0.1	±0.1	±0.1	±0.1	+0.1 -0.0	±0.1	±0.05	±0.1	±0.1
12.0	5.5	1.75	8.0	2.0	4.0	φ1.5	7.4	0.3	3.1	4.0

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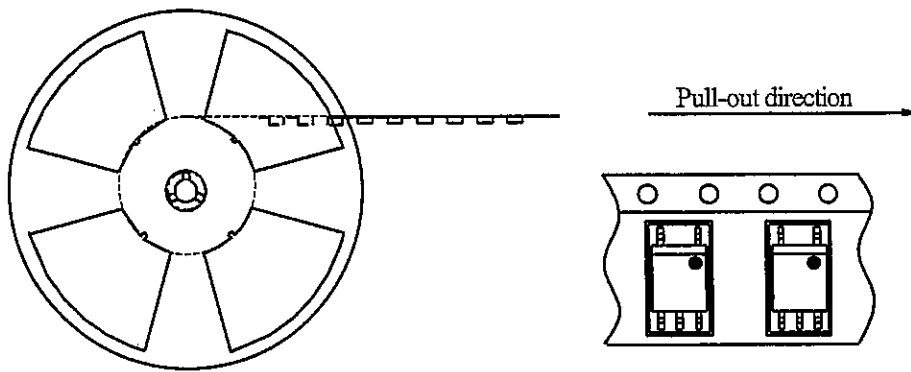
Reel structure and Dimensions



Dimensions list (Unit : mm)

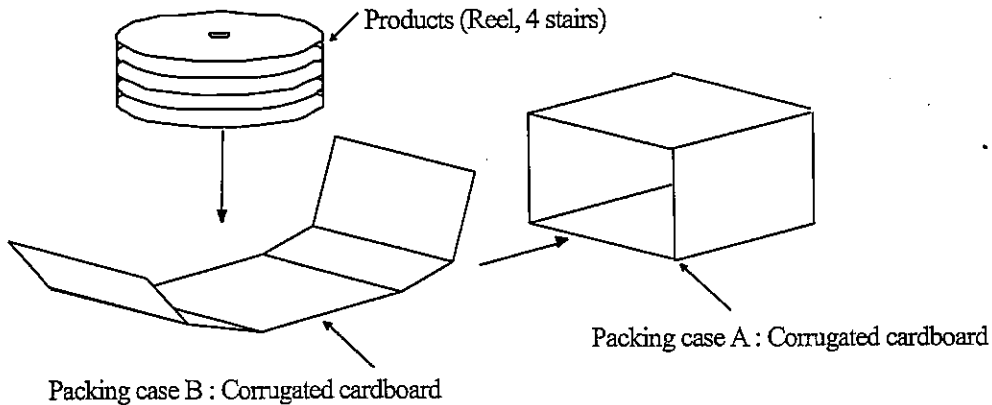
a	b	c	d
370	13.5±1.5	80±1.0	13±0.5
e	f	g	
21±1.0	2.0±0.5	2.0±0.5	

Direction of product insertion

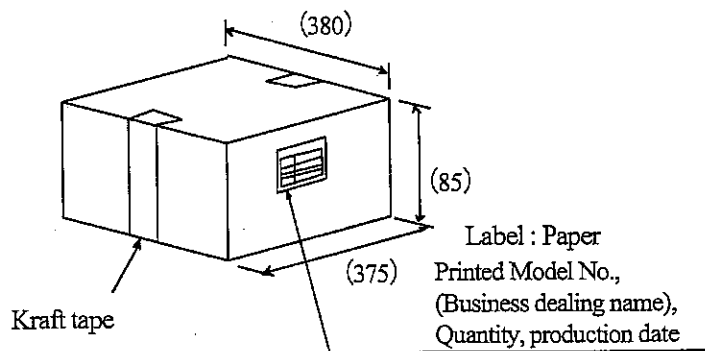


Outer packing appearance

- (1) Carrier tape with 3,000pcs. 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. 12,000pcs. of devices are in one carton.))



Regular packing mass : 3kg
() : Reference dimensions
(Unit : mm)



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Precautions for Photocouplers

1. Recommended operating conditions

Parameter	Symbol	MIN.	MAX.	Unit
Low level input current	I_{FL}	0	250	μA
High level input current	I_{FH}	8	15	mA
Supply voltage	V_{CC}	4.5	5.5	V
Fan out (TTL load)	N	-	5	-
Operating temperature	T_{opr}	-40	+85	$^{\circ}C$

2. For cleaning

- (1) Solvent cleaning : Solvent temperature 45 $^{\circ}C$ 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 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 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_{FHL} .

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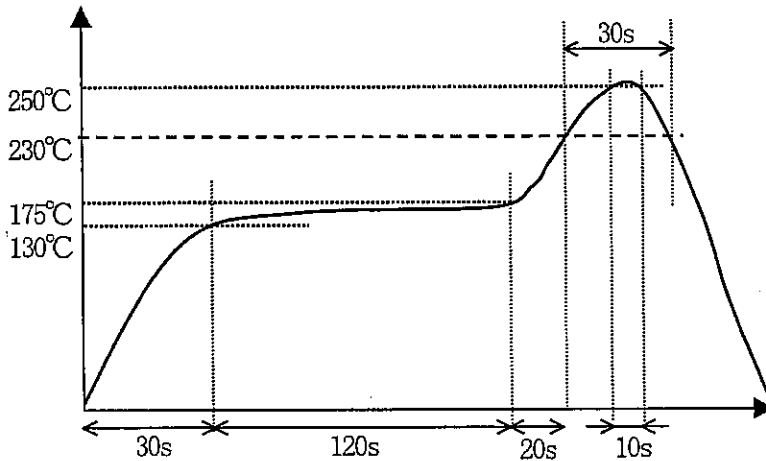
5. Precautions for Soldering Photocouplers

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

It is recommended that flow solder be at 270°C and within 6 seconds (Pre-heating : 100 to 105°C, 30±5seconds).

- (2) If solder reflow :

It is recommended that soldering be done at the temperature and the time within the temperature profile as shown in the figure below. (2 times or less)



- (3) Other precautions

An infrared lamp used to heat up for soldering may cause a localized temperature rise in the resin.


So keep the package temperature within that specified in Item (1). Also avoid immersing the resin part in the solder.

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1. This specification shall be applied to photocoupler, Model No. PC410L as an option.
2. Applicable Models (Business dealing name)
PC410LEYIP
3. The relevant models are the models Approved by VDE according to DIN VDE0884.
Approved Model No. : PC410L
VDE approved No. : 5911ÜG (According to the specification DIN VDE0884/08.87)

- Operating isolation voltage $U_{IORM(Peak)}$: 570V
- Transient voltage $U_{TR(Peak)}$: 4000V
- Pollution : 2 (According to VDE0110/01.89)
- Clearances distance (Between input and output) : 4.0mm (MIN.)
- Creepage distance (Between input and output) : 4.0mm (MIN.)
- Tracking-proof : CTI 175 (Material group IIIa : VDE0110/01.89)
- Safety limit values
Current (Isi) : 120mA (Diode side)
Power (Psi) : 240mW (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 "  -Reg. -Nr. 5911 " on 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	40/85/21	-	
Pollution	-	DIN VDE0110	2	-	
Maximum operating isolation voltage	$U_{IORM(PEAK)}$	-	570	V	
Partial discharge test voltage (Between input and output)					Refer to the Diagram 1,2 (Attachement-2-3)
Diagram 1	$U_{pr(PEAK)}$	$t_p=60s, q_c<5pC$	684	V	
Diagram 2		$t_p=1s, q_c<5pC$	912	V	
Maximum over-voltage	$U_{INITIAL(PEAK)}$	$t_{IN}=10s$	4000	V	
Safety maximum ratings					Refer to Fig. 6,7 (Attachement-2-3)
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	-	240	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		
		$T_a=25^\circ C$	MIN.10 ¹²		

6. Precautions in performing isolation test

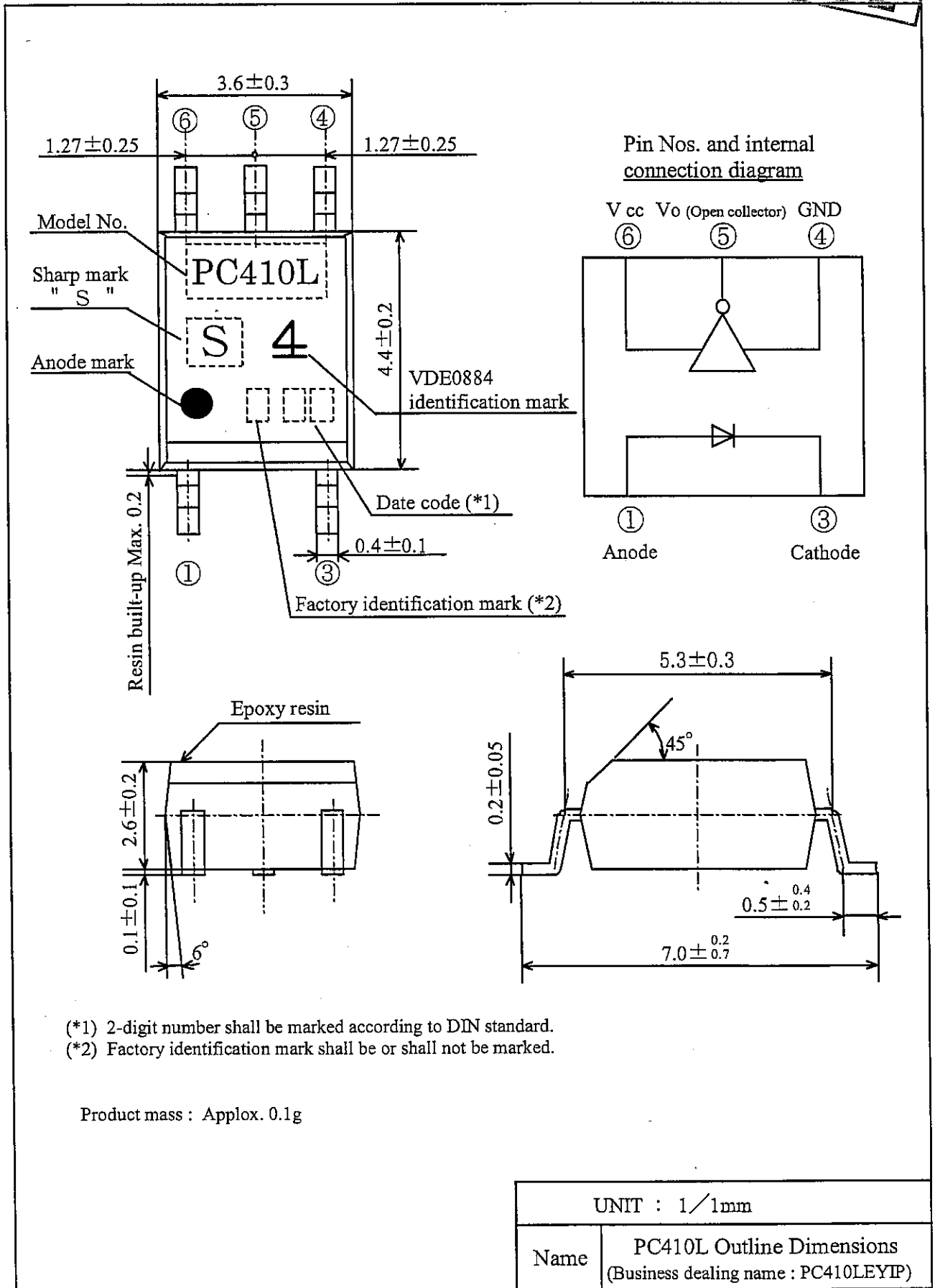
6.1 Partial discharge test methods shall be the ones according to the specifications of VDE 0884/08.87

6.2 Please don't carry out isolation test (V_{iso}) 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}).

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2. Outline



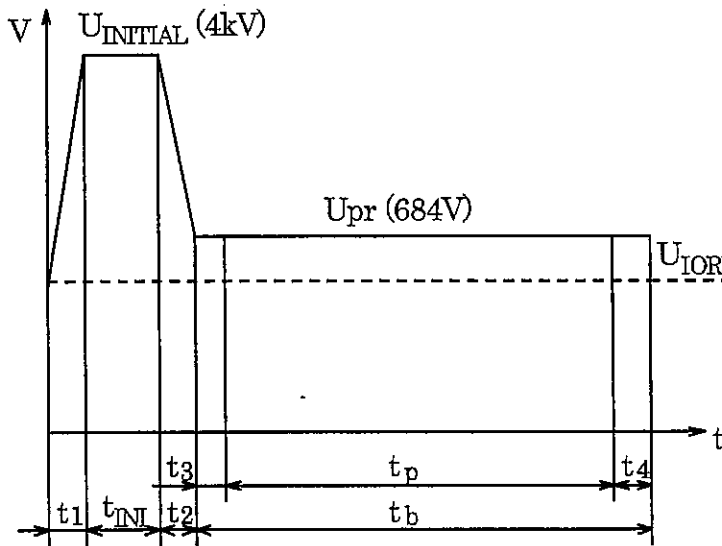
(*1) 2-digit number shall be marked according to DIN standard.
 (*2) Factory identification mark shall be or shall not be marked.

Product mass : Aplox. 0.1g

UNIT : 1/1mm	
Name	PC410L Outline Dimensions (Business dealing name : PC410LEYIP)

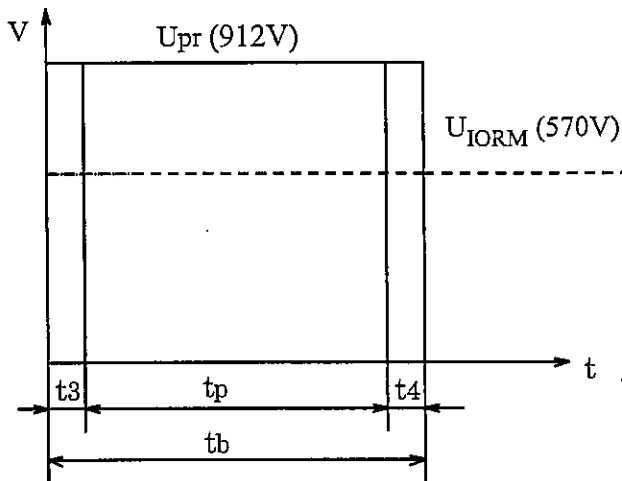
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Method of Diagram 1 : Breakdown test (Apply to tape test and sampling test)



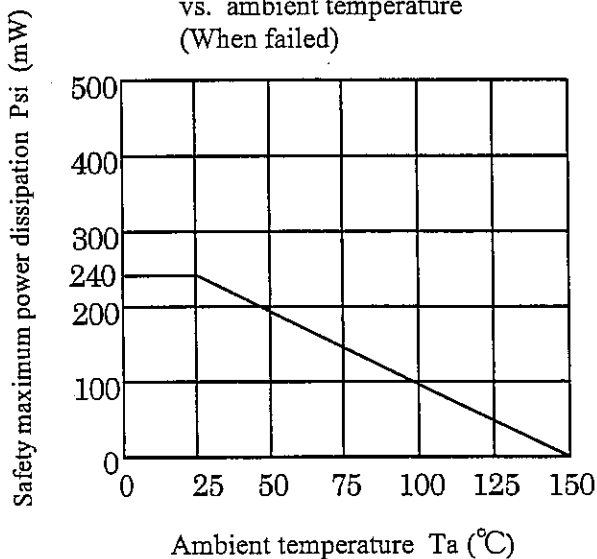
$t_1, t_2 = 1 \text{ to } 10 \text{ s}$
 $t_3, t_4 = 1 \text{ s}$
 $t_p \text{ (Partial discharge measuring time)} = 60 \text{ s}$
 $t_b = 62 \text{ s}$
 $t_{INI} = 10 \text{ s}$

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

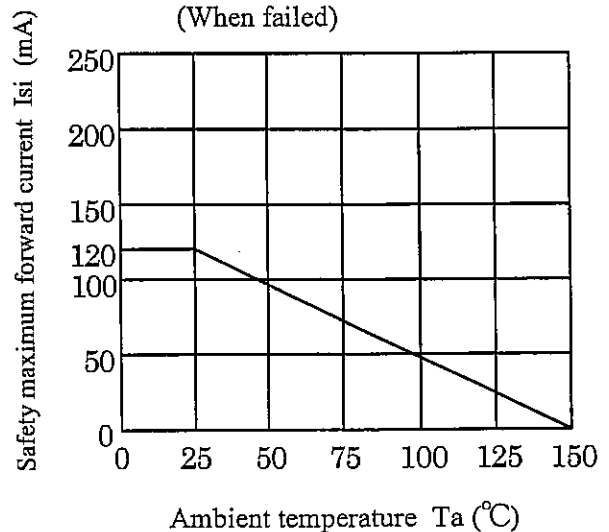


$t_3, t_4 = 0.1 \text{ s}$
 $t_p \text{ (Partial discharge measuring time)} = 1 \text{ s}$
 $t_b = 1.2 \text{ s}$

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



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



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SPEC. No. TED:02269
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OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOCOUPLER

MODEL No.

PC410L

	Business dealing name		Business dealing name
	PC410LENIP		PC410LEYIP

Specified for _____

Enclosed please find copies of the Specifications which consists of 15 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

for Y.Y.

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