

PREPARED BY: <i>Y. Yasuda</i>	DATE: <i>Oct 8, 1996</i>	<h1>SHARP</h1> ELECTRONIC COMPONENTS GROUP SHARP CORPORATION <b>SPECIFICATION</b>	SPEC. No. ED-96143
APPROVED BY: <i>J. Yoshikawa</i>	DATE: <i>Oct. 8, 1996</i>		ISSUE: October 2, 1996
			PAGE: 12 Pages
			REPRESENTATIVE DIVISION OPTO-ELECTRONIC DEVICES DIV.

DEVICE SPECIFICATION FOR  
  
PHOTOCOUPLER  
  
MODEL No. **PC451**  
  
(Business dealing name : PC451T)

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- 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)

  - 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.
  - 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
  - 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
  - Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.
- Please contact and consult with a Sharp sales representative for any questions about this product.

CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

DATE PRESENTED BY *J. M*

T. Matsumura,  
Department General Manager of  
Engineering Dept. II  
Opto-Electronic Devices Div.  
ELECOM Group  
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**1. Application**

This specification applies to the outline and characteristics of photocoupler Model No. PC451.

**2. Outline**

Refer to the attached drawing No. CY8619K02.

**3. Ratings and characteristics**

Refer to the attached sheet, page 3 to 5.

**4. Reliability**

Refer to the attached sheet, page 6.

**5. Incoming inspection**

Refer to the attached sheet, page 7.

**6. Supplement**

6.1 Isolation voltage shall be measured in the following method.

- (1) Short between anode and cathode on the primary side and between collector and emitter 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.  
(It is recommended that the isolation voltage be measured in insulation oil.)

**6.2 Package specification**

Refer to the attached sheet, page 8 to 10.

6.3 The business dealing name used for this product when ordered or delivered shall be PC451T.

6.4 This product is not designed against irradiation.

This product is assembled with electrical input and output.

This product incorporates non-coherent light emitting diode.

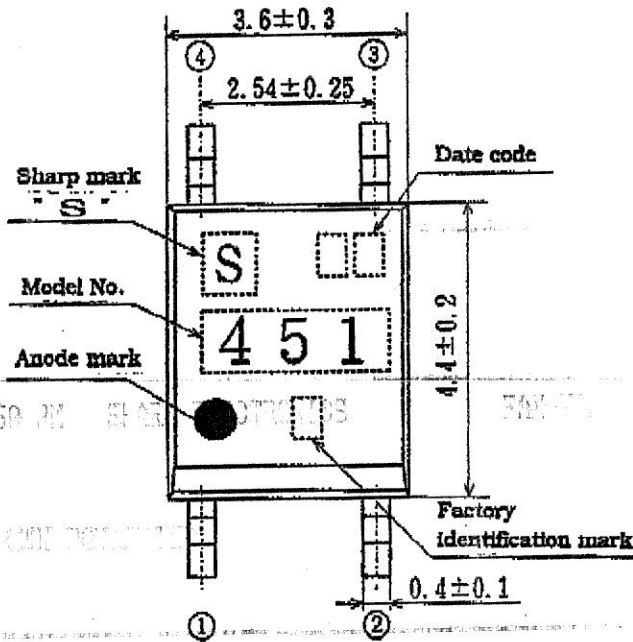
**7. Notes**

Refer to the attached sheet-1-1, 2.

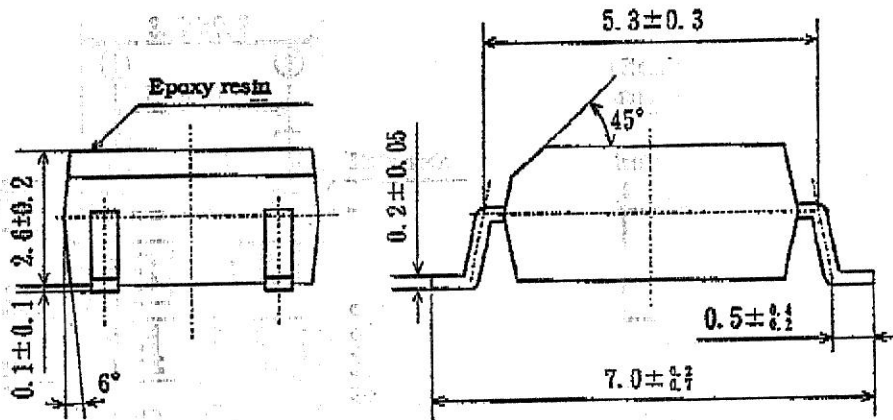
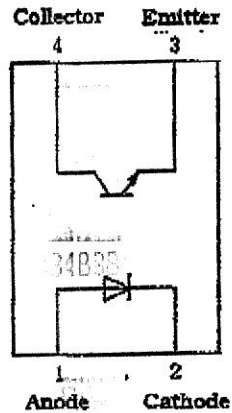
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Pin Nos. and internal connection diagram



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

UNIT : 1/1 mm	
Name	PC451 Outline Dimensions (Business dealing name : PC451T)
Drawing No.	CY8619K02

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**3. Ratings and characteristics**

**3.1 Absolute maximum ratings**

Ta=25°C

	Parameter	Symbol	Rating	Unit
Input	*1 Forward current	$I_F$	50	mA
	Reverse voltage	$V_R$	6	V
	*1 Power dissipation	P	70	mW
Output	Collector-emitter voltage	$V_{CE0}$	350	V
	Emitter-collector voltage	$V_{ECO}$	6	V
	Collector current	$I_C$	50	mA
	*1 Collector power dissipation	$P_C$	150	mW
	*1 Total power dissipation	$P_{tot}$	170	mW
	Operating temperature	$T_{opr}$	-25 to +100	°C
	Storage temperature	$T_{stg}$	-40 to +125	°C
	*2 Isolation voltage	$V_{iso}$	3.75	kVrms
	*3 Soldering temperature	$T_{sol}$	260	°C

\*1 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1 to 4.

\*2 AC for 1 min, 40 to 60%RH

\*3 For 10 s or less at the position of 0.2mm or more from the root of lead pins.

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3.2 Electro-optical characteristics

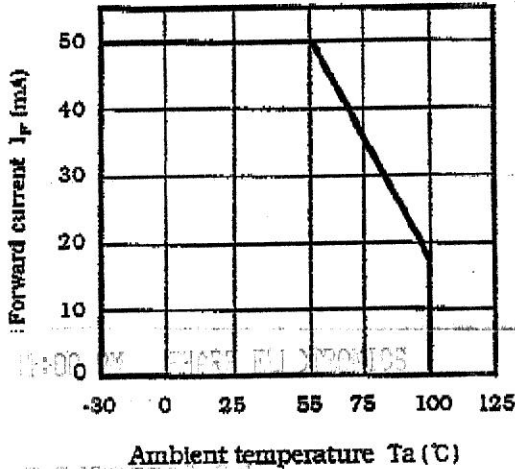
Ta=25°C

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	$V_F$	$I_F=20\text{mA}$	-	1.2	1.4	V
	Reverse current	$I_R$	$V_R=4\text{V}$	-	-	10	$\mu\text{A}$
	Terminal capacitance	$C_t$	$V=0, f=1\text{kHz}$	-	30	250	pF
Output	Dark current	$I_{CEO}$	$V_{CE}=200\text{V}, I_F=0$	-	-	1000	nA
	Collector-emitter breakdown voltage	$EV_{CEO}$	$I_C=0.1\text{mA}$ $I_F=0$	350	-	-	V
Transfer characteristics	Collector current	$I_C$	$I_F=5\text{mA}, V_{CE}=5\text{V}$	2	4	-	mA
	Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_F=20\text{mA}$ $I_C=1\text{mA}$	-	0.1	0.3	V
	Isolation resistance	$R_{iso}$	DC500V 40 to 60%RH	$5 \times 10^{10}$	$10^{11}$	-	$\Omega$
	Floating capacitance	$C_f$	$V=0, f=1\text{MHz}$	-	0.6	1.0	pF
	Cut-off frequency	$f_c$	$V_{CE}=5\text{V}, I_C=2\text{mA}$ $R_L=100\Omega, -3\text{dB}$	-	50	-	kHz
	Response time (Rise)	$t_r$	$V_{CE}=2\text{V}$ $I_C=2\text{mA}$ $R_L=100\Omega$	-	4	10	$\mu\text{s}$
Response time (Fall)	$t_f$		-	5	12	$\mu\text{s}$	

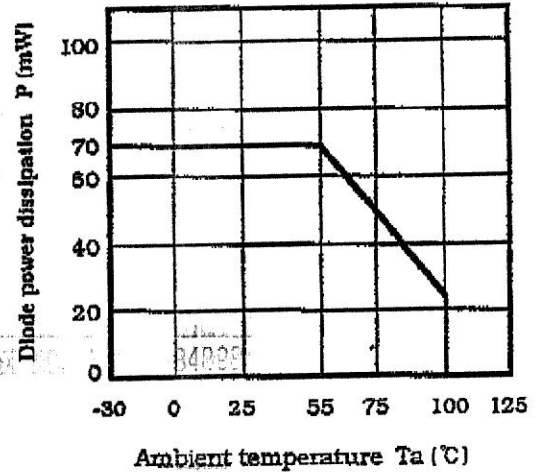
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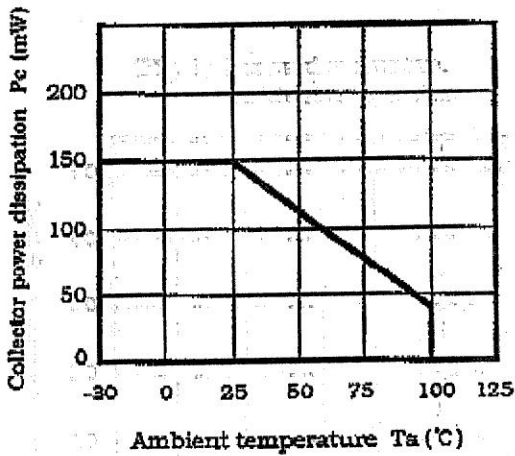
(Fig. 1) Forward current vs. ambient temperature



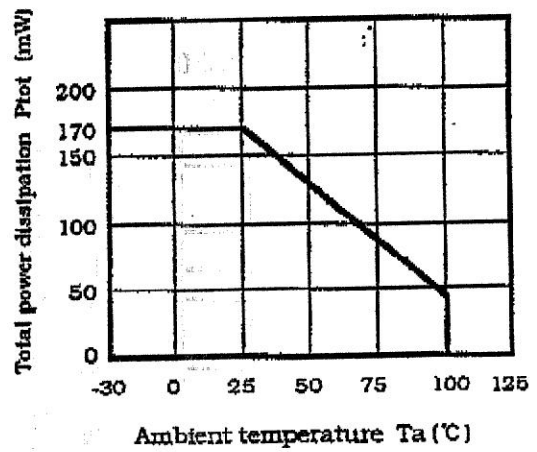
(Fig. 2) Diode power dissipation vs. ambient temperature



(Fig. 3) Collector power dissipation vs. ambient temperature



(Fig. 4) Total power dissipation vs. ambient temperature



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**4. Reliability**

The reliability of products shall be satisfied with items listed below.

Confidence level : 90%  
LTPD : 10%/20%

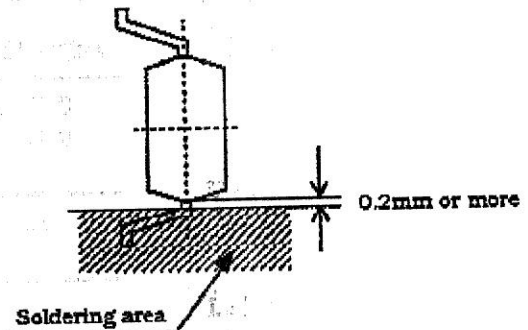
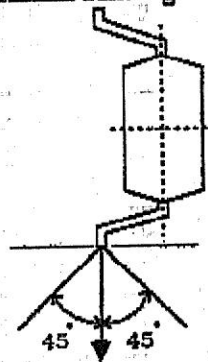
Test Items	Test Conditions *1	Failure Judgement Criteria	Samples (n) Defective(C)
Solderability *2	230°C, 5 s	—	n=11, C=0
Soldering heat *3	260°C, 10 s	$V_p > U \times 1.2$	n=11, C=0
Terminal strength (Bending) *4	Weight : 1N 1 time/each terminal	$I_R > U \times 2$	n=11, C=0
Mechanical shock	15000m/s <sup>2</sup> , 0.5ms 3 times/ ±X, ±Y, ±Z direction	$I_{CEO} > U \times 2$ $I_C < L \times 0.7$	n=11, C=0
Variable frequency vibration	100 to 2000 to 100Hz/4min 200m/s <sup>2</sup> 4 times/ X, Y, Z direction	$V_{CS(max)} > U \times 1.2$ $BV_{CEO} < L \times 0.8$	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	+60°C, 90%RH, 500h	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	-40°C, 1000h		n=22, C=0
Operation life	$I_p=50mA$ , $P_{tot}=170mW$ $T_a=25°C$ , 1000h		n=22, C=0

\*1 Test method, conforms to JIS C 7021.

\*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 away 0.2mm from the root of lead pins.

\*4 Terminal bending direction is shown below.



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**5. Incoming inspection**

**5.1 Inspection items**

- (1) Electrical characteristics

$V_F, I_B, I_{CEO}, V_{CE(sat)}, I_c, R_{iso}, V_{iso}$

- (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	0.1
Minor defect	Appearance defect except the above mentioned.	0.4

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## 6.2 Package specifications

## 6.2.1 Taping conditions

- (1) Tape structure and Dimensions (Refer to the attached sheet, Page 9)

The tape shall have a structure in which a cover tape is sealed heat-pressed on the carrier tape to protect against static electricity.

- (2) Reel structure and Dimensions (Refer to the attached sheet, Page 10)

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 10)

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 cutting portion shall be sealed with adhesive tape.

## 6.2.2 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°.

## 6.2.3 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 750pcs.

## 6.2.4 Marking

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

## 6.2.5 Storage condition

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

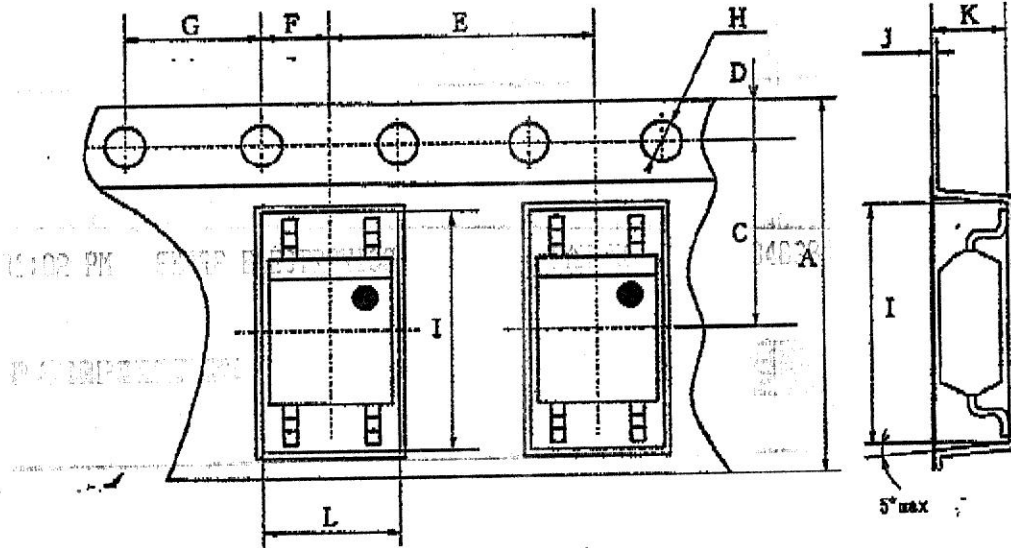
## 6.2.6 Safety protection during shipping

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

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Carrier tape structure and Dimensions



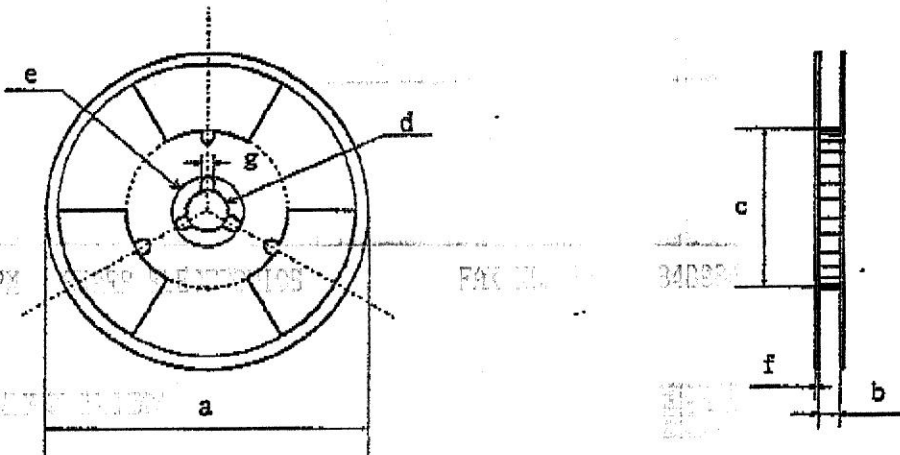
Symbol / Unit	A	C	D	E	F
mm	±0.3 12.0	±0.05 5.5	±0.1 1.75	±0.1 8.0	±0.05 2.0

Symbol / Unit	G	H	I	J	K	L
mm	±0.1 4.0	+0.1 -0.0 ±1.5	±0.01 7.4	±0.05 0.3	±0.1 3.1	±0.1 4.0

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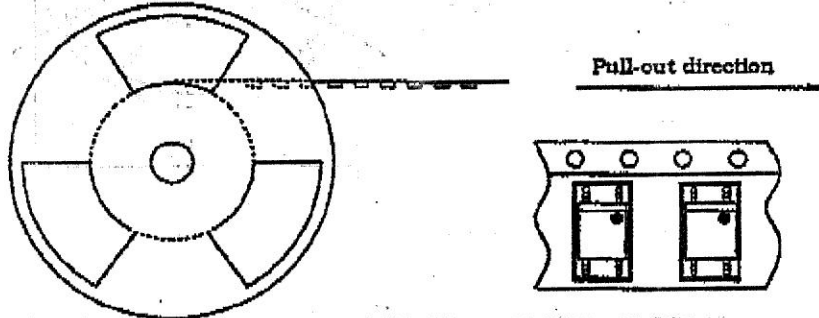
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**Reel structure and Dimensions**



Symbol Unit	Check word						
	a	b	c	d	e	f	g
mm	180	13.5±1.5	80±1	13±0.5	21±1	2.0±0.5	2.0±0.5

**Direction of product insertion**



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Precautions for Photocouplers

1 For cleaning

- (1) Solvent cleaning : Solvent temperature 45°C or less  
Immersion for 3 min or less
- (2) Ultrasonic cleaning : The affect to device by ultrasonic cleaning is different by cleaning bath size, ultrasonic power output, cleaning time, PWB 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.

Applicable solvent : Ethyl alcohol, Methyl alcohol, Fraon TE 113, TF  
Diflon-solvent S3-E, Trichloroethane

Please refrain from using Chloro Fluoro Carbon type solvent to clean devices as much as possible since it is internationally restricted to protect the ozonosphere. Before you use alternative solvent you are requested to confirm that it does not attack package resin.

- 2. 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 degradation of the light emission power of the LED. (50%/5years)

3 For handling

1. The LED is sensitive to static electricity. Please handle it with an anti-static wrist strap or anti-static mat.

2. The LED is sensitive to moisture. Please store it in a dry place and use it immediately after opening the package.

3. The LED is sensitive to heat. Please avoid high temperature and avoid using a soldering iron directly on the LED.

4. The LED is sensitive to mechanical stress. Please avoid bending or twisting the LED.

5. The LED is sensitive to vibration. Please avoid strong vibration during handling.

6. The LED is sensitive to shock. Please avoid dropping or hitting the LED.

7. The LED is sensitive to UV light. Please avoid direct UV light exposure.

8. The LED is sensitive to humidity. Please avoid high humidity environment.

9. The LED is sensitive to dust. Please avoid dust contamination.

10. The LED is sensitive to salt crystallization. Please avoid salt crystallization.

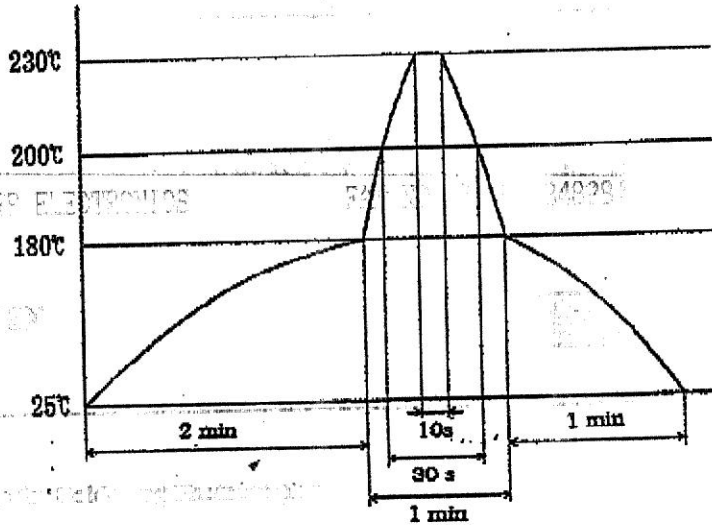
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**3. Precautions for Soldering Photocouplers**

**(1) 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.



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.

**(2) 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.