

ISSUE: December 10, 2020

S P E C I F I C A T I O N S

Product Name PHOTOCOUPLER

Model No. PC457L

【Business dealing name : PC457L0NIP0F】
(CHINA products)

These specifications contain 14 pages including the cover and appendix.
This specification sheets and attached sheets shall be both side copy.
After confirmation of the contents, please be sure to send back 1 copy of the
Specifications with approving signature on each.
If you have any objections, please contact us before issuing purchasing order.

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1. These specification sheets include materials protected under copyright of Sharp Corporation ("Sharp").
Please handle with great cares and do not reproduce or cause anyone to reproduce them without Sharp's consent.
2. When using this Sharp product, please observe the absolute maximum ratings, other conditions and instructions for use described in the specification sheets, as well as the precautions mentioned below.
Sharp assumes no responsibility for any damages resulting from use of the product which does not comply with absolute maximum ratings, other conditions and instructions for use included in the specification sheets, and the precautions mentioned below.

(Precautions)

- (1) In making catalogue or instruction manual based on the specification sheets, please verify the validity of the catalogue or instruction manuals after assembling Sharp products in customer's products at the responsibility of customer.
- (2) This Sharp product is designed for use in the following application areas ;
 - Computers • OA equipment • Telecommunication equipment (Terminal) • Measuring equipment
 - Tooling machines • Audio visual equipment • Home appliances
 If the use of the Sharp 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 Sharp product is used for equipment in responsibility of customer 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
- (4) Sharp product is designed for consumer goods and controlled as consumer goods in production and quality.
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
- (5) Please contact and consult with a Sharp sales representative if there are any question regarding interpretation of the above four paragraphs.

3. Disclaimer

The warranty period for Sharp product is one (1) year after shipment.
During the period, if there are any products problem, Sharp will repair (if applicable), replace or refund.
Except the above, both parties will discuss to cope with the problems.

The failed Sharp product after the above one (1) year period will be coped with by Sharp, provided that both parties shall discuss and determine on sharing responsibility based on the analysis results thereof subject to the above scope of warranty.

The warranty described herein is only for Sharp product itself which are purchased by or delivered to customer.
Damages arising from Sharp product malfunction or failure shall be excepted.

Sharp will not be responsible for the Sharp product due to the malfunction or failures thereof which are caused by:

- (1) storage keep trouble during the inventory in the marketing channel.
- (2) intentional act, negligence or wrong/poor handling.
- (3) equipment which Sharp products are connected to or mounted in.
- (4) disassembling, reforming or changing Sharp products.
- (5) installation problem.
- (6) act of God or other disaster (natural disaster, fire, flood, etc.)
- (7) external factors (abnormal voltage, abnormal electromagnetic wave, fire, etc.)
- (8) special environment (factory, coastal areas, hot spring area, etc.)
- (9) phenomenon which cannot be foreseen based on the practical technologies at the time of shipment.
- (10) the factors not included in the product specification sheet.

4. Please contact and consult with a Sharp sales representative for any questions about Sharp product.

1. Application

This specification applies to the outline and characteristics of OPIC photocoupler Model No. PC457L.

2. Outline

Refer to page 4.

3. Ratings and characteristics

Refer to page 5 to 7.

4. Reliability

Refer to page 8.

5. Outgoing inspection

Refer to page 9.

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 withstanding tester with zero-cross circuit shall be used.
- (3) The wave form of applied voltage shall be a sine wave.

6.2 Package specifications

Refer to page 10 and 11.

6.3 Business dealing name ("○" mark indicates business dealing name of ordered product)

Orderd product	Business dealing name	Remark
	PC457L0NIP0F	
	PC457L0YIP0F	Applied to product as an option (Attachment-2-1 to 2-3.)

6.4 This Model is approved by UL.

Approved Model No. : PC457L

UL file No. : E64380

6.5 About radiation resistant design

- (1) This product is not designed against irradiation.
- (2) This product is assembled with electrical input and output.
- (3) This product incorporates non-coherent light emitting diode.

6.6 ODS materials

- (1) This product shall not contain the following materials.
- (2) 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 Specified brominated flame retardants

Specified brominated flame retardants (PBB and PBDE) are not used in this device at all.

6.8 Compliance with each regulation

- (1) This product complies with EU RoHS Directive (2011/65/EU) and Commission Delegated Directive (EU)2015/863
- (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).

Marking Styles for the Names and Contents of the Hazardous Substances

Category	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr ⁶⁺)	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Photocoupler	○	○	○	○	○	○

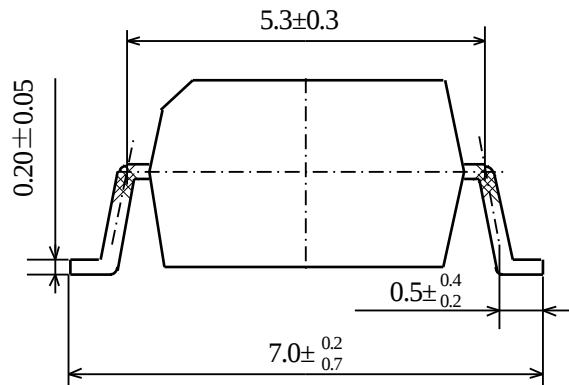
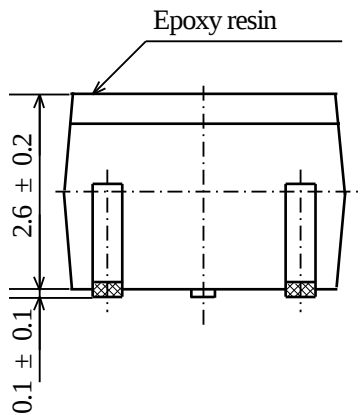
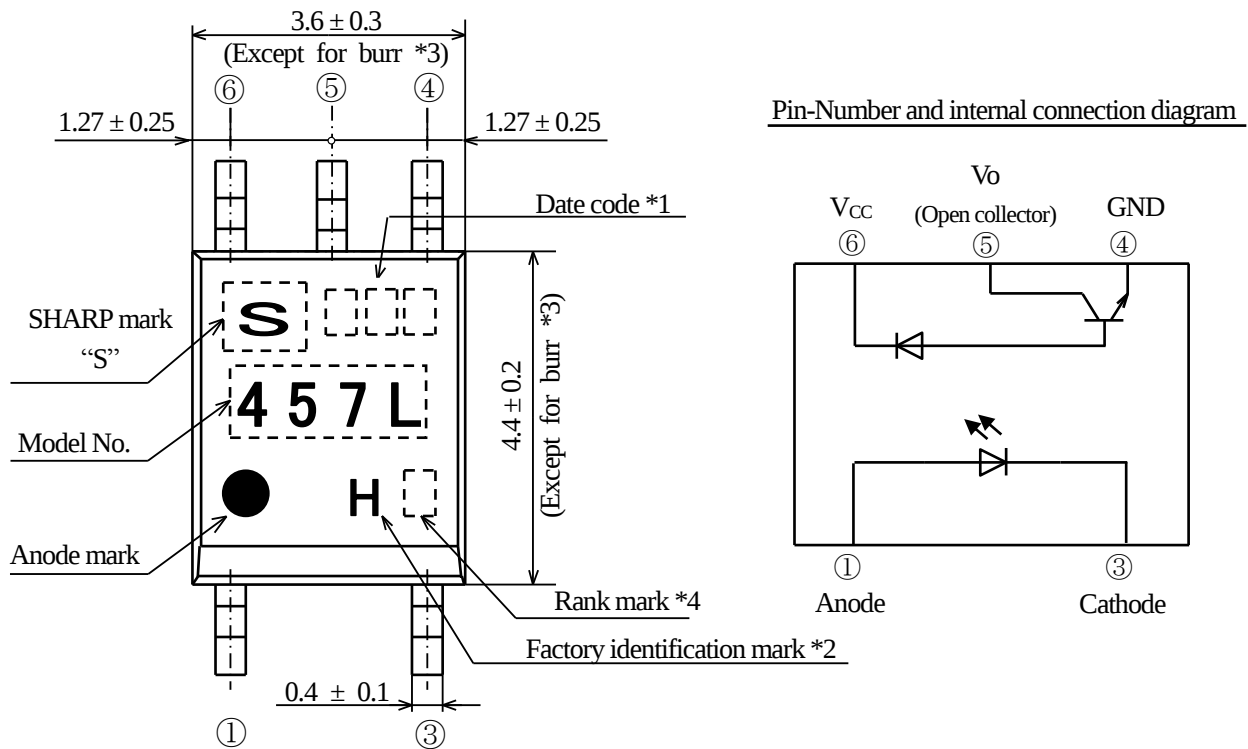
This table is prepared in accordance with the provisions of SJ/T 11364.

○：Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

7. Notes

Precautions for photocouplers：Attachment-1

2. Outline



*1 Date code : 3 digit indication according to production year, month and day

*2 Factory identification mark is as follows.

H : YONGYAO ENSEI ELECTRONICS (SHANGQIU) CO., LTD. (CHINA products)

*3 Burr of resin max. 0.2 mm

*4 Rank mark shall be or shall not be marked.

Pin material: Copper Alloy

Pin finish : Palladium (Au flash plating)

Mark : Laser marking

Product mass : Approx. 0.1g

A lead tip area and a part of a lead side area
( area) are no-plating.

UNIT : mm	
Name	PC457L Outline Dimensions (Business dealing name : PC457L0NIP0F)

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25°C

Parameter		Symbol	Rating	Unit
Input	*1 Forward current	I_F	25	mA
	Reverse voltage	V_R	5	V
	*2 Power dissipation	P	45	mW
Output	Supply voltage	V_{CC}	-0.5 to +30	V
	High level output voltage	V_O	-0.5 to 20	V
	Low level output current	I_O	8	mA
	*3 Output collector power dissipation	P_O	100	mW
	*3 Total power dissipation	P_{tot}	100	mW
	*4 Isolation voltage	$V_{iso(rms)}$	3.75	kV
	Operating temperature	T_{opr}	-55 to +85	°C
	Storage temperature	T_{stg}	-55 to +125	°C
	*5 Soldering temperature	T_{sol}	270	°C

- *1 When ambient temperature goes above 70°C, the forward current goes down at the rate of 0.46mA/°C. (Refer to Fig. 3)
- *2 When ambient temperature goes above 70°C, the power dissipation goes down at the rate of 0.82mW/°C. (Refer to Fig. 4)
- *3 When ambient temperature goes above 70°C, the power dissipation goes down at the rate of 1.8mW/°C. (Refer to Fig. 5)
- *4 AC for 1 min, 40 to 60%RH
- *5 For 10 s or less.

3.2 Electro-optical characteristics

(Ta=25°C)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	V_F	$I_F=16\text{mA}$	-	1.7	1.95	V
	Reverse current	I_R	$V_R=5\text{V}$	-	-	10	μA
	Terminal capacitance	C_t	$V_F=0, f=1\text{MHz}$	-	60	150	pF
Output	High level output current	$I_{OH}(1)$	$I_F=0, V_{CC}=5.5\text{V}, V_O=5.5\text{V}$	-	3	500	nA
		$I_{OH}(2)$	$I_F=0, V_{CC}=15\text{V}, V_O=15\text{V}$	-	-	1.0	μA
		$I_{OH}(3)$	$T_a=0 \text{ to } 70^\circ\text{C}, I_F=0, V_{CC}=15\text{V}, V_O=15\text{V}$	-	-	50	
	High level supply current	$I_{CCH}(1)$	$I_F=0, V_{CC}=15\text{V}, V_O=\text{OPEN}$	-	0.02	1.0	μA
		$I_{CCH}(2)$	$T_a=0 \text{ to } 70^\circ\text{C}, I_F=0, V_{CC}=15\text{V}, V_O=\text{OPEN}$	-	-	2.0	
	Low level supply current	I_{CCL}	$I_F=16\text{mA}, V_{CC}=15\text{V}, V_O=\text{OPEN}$	-	120	-	μA
	Low level output voltage	V_{OL}	$I_F=16\text{mA}, V_{CC}=4.5\text{V}, I_O=2.4\text{mA}$	-	-	0.4	V
Transfer characteristics	Current transfer ratio	CTR(1)	$I_F=16\text{mA}, V_{CC}=4.5\text{V}, V_O=0.4\text{V}$	19	-	50	%
		CTR(2)	$T_a=0 \text{ to } 70^\circ\text{C}, I_F=16\text{mA}, V_{CC}=4.5\text{V}, V_O=0.4\text{V}$	15	-	-	
	*1 "H→L" propagation time	t_{PHL}	$I_F=16\text{mA}, V_{CC}=5\text{V}, R_L=1.9\text{k}\Omega$	-	0.2	0.8	μs
	*1 "L→H" propagation time	t_{PLH}		-	0.4	0.8	
	*2 Instantaneous common mode rejection voltage (High level output)	CM_H	$I_F=0, R_L=1.9\text{k}\Omega, V_{CC}=5\text{V}, V_{CM}=1.0\text{kV}_{P-P}$	15	30	-	kV/ μs
	*2 Instantaneous common mode rejection voltage (Low level output)	CM_L	$I_F=16\text{mA}, R_L=1.9\text{k}\Omega, V_{CC}=5\text{V}, V_{CM}=1.0\text{kV}_{P-P}$	-15	-30	-	kV/ μs
	Isolation resistance	R_{ISO}	DC500V, 40 to 60%RH	5×10^{10}	10^{11}	-	Ω
	Floating capacitance	C_f	$V=0, f=1\text{MHz}$	-	0.6	1.0	pF

*1 Propagation delay time : Refer to Fig. 1.

*2 Instantaneous common mode rejection voltage : Refer to Fig. 2.

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

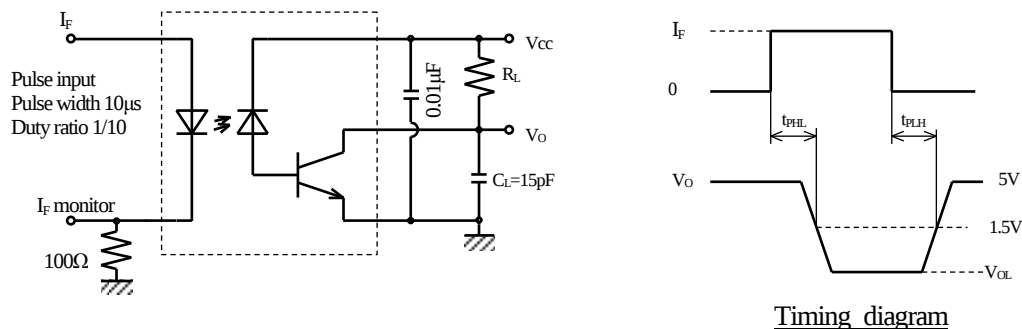
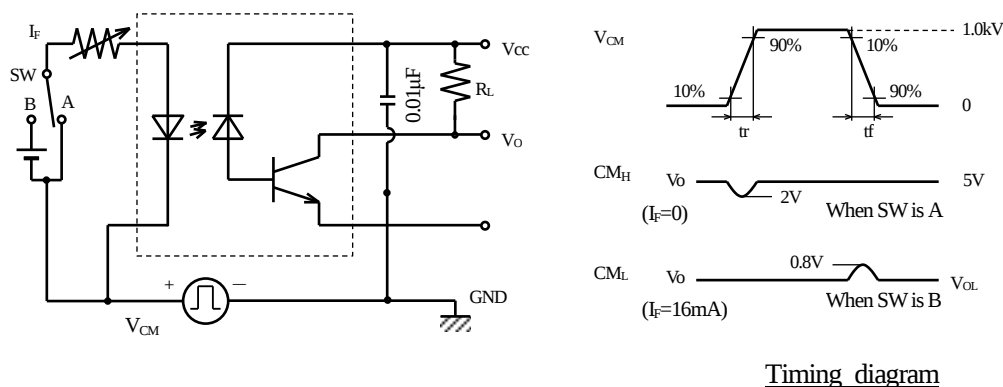
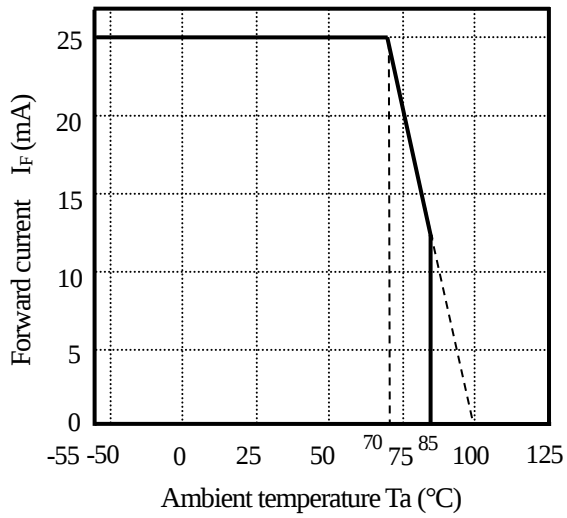


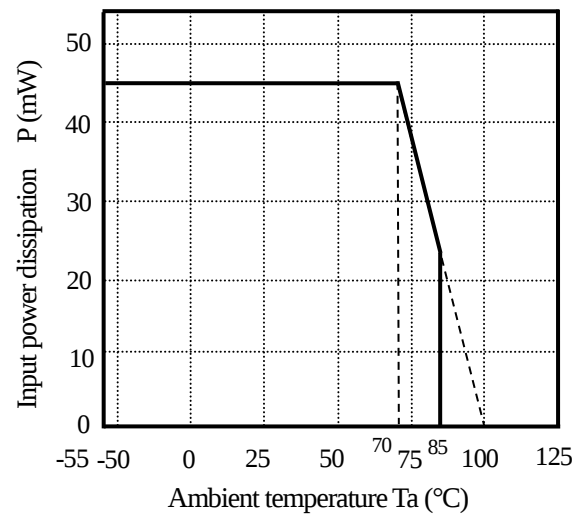
Fig. 2 CM_H, CM_L test circuit



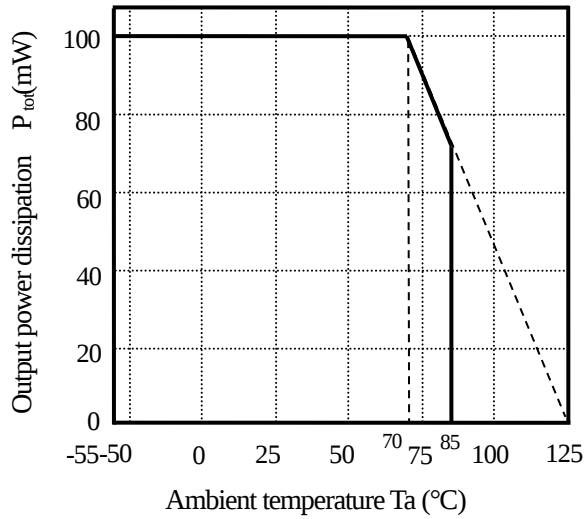
(Fig. 3) Forward current vs.
Ambient temperature



(Fig. 4) Input power dissipation
vs. Ambient temperature



(Fig. 5) Output power dissipation
vs. Ambient temperature



(Note) The total power dissipation (P_{tot}) decreases of the ratio of 1.8mW/°C at ambient temperature 70°C or more. (Refer to Fig. 5)

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, 3 s	*2	n=11, C=0
Soldering heat *3	(Flow soldering) 270°C, 10 s	$V_F > U \times 1.2$ $I_R > U \times 2$ $I_{OH}(2) > U \times 2$ $I_{CCH}(1) > U \times 2$ $CTR(1) < L \times 0.7$ U : Upper specification limit L : Lower specification limit	n=11, C=0
	(Soldering by hand) 400°C, 3 s		n=11, C=0
Terminal strength (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	-55°C, 1000h		n=22, C=0
Operation life	I _F =20mA, P _{tot} =100mW, T _a =25°C, 1000h		n=22, C=0

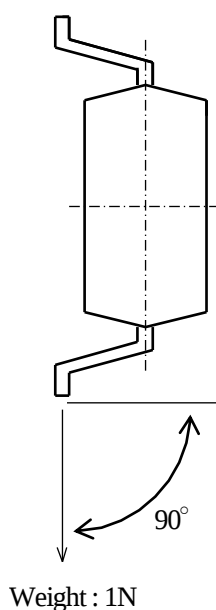
*1 Test method, conforms to EIAJ ED 4701.

*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 It is evaluated due to the temperature profile in attachment-1.

*4 Terminal bending direction is shown below.

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



※ These test results are sampling examples from a specific lot for reference purpose only, and do not constitute any warranty or assurance in connection with the products.

5. Outgoing inspection

5.1 Inspection items

(1) Electrical characteristics

V_F , I_R , V_{OL} , $I_{CCH}(1)$, $I_{OH}(2)$, $CTR(1)$, 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

6.3 Package specifications

6.3.1 Taping conditions

(1) Tape structure and Dimensions (Refer to below.)

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 page 11.)

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

(3) Direction of product insertion (Refer to page 11.)

(4) Joint of tape

The cover tape and carrier tape in one reel shall be joint less.

(5) To repair failure - taped devices, cutting a bottom of carrier tape with a cutter.

After replacing the cut portion shall be sealed with adhesive tape.

6.3.2 Adhesiveness of cover tape

- The exfoliation force between carrier tape and cover tape shall be 0.2N to 0.7N for the angle 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 basically shall contain 3,000pcs.

6.3.4 Outer packing appearance (Refer to page 11.)

6.3.5 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

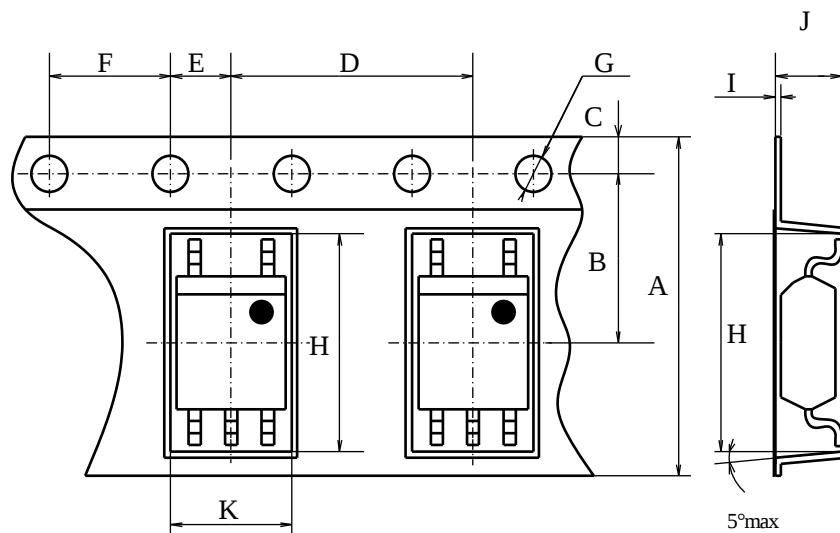
6.3.6 Storage condition

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

6.3.7 Safety protection during shipping

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

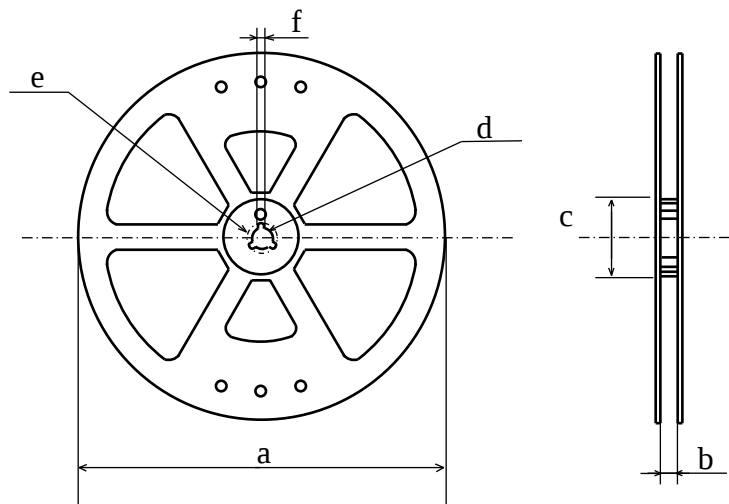
Carrier tape structure and Dimensions



Dimensions list (Unit : mm)

A	B	C	D	E	F	G	H	I	J	K
±0.3	±0.05	±0.10	±0.1	±0.05	±0.1	+0.1 -0.0	±0.1	±0.05	±0.1	±0.1
12.0	5.50	1.75	8.0	2.00	4.0	φ1.5	7.4	0.30	3.1	4.0

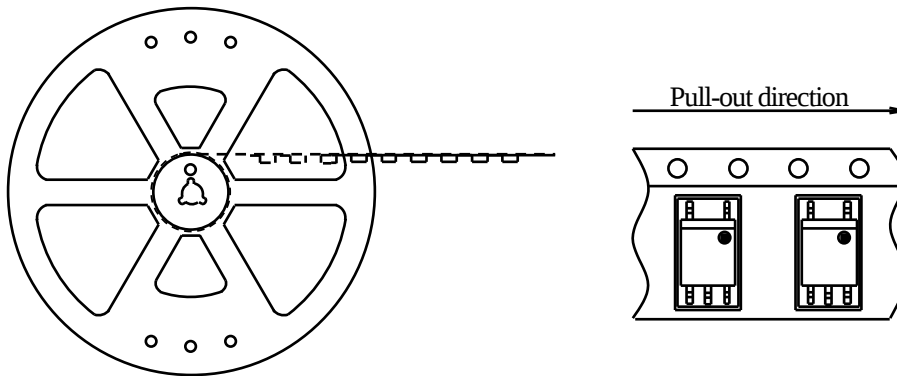
Reel structure and Dimensions



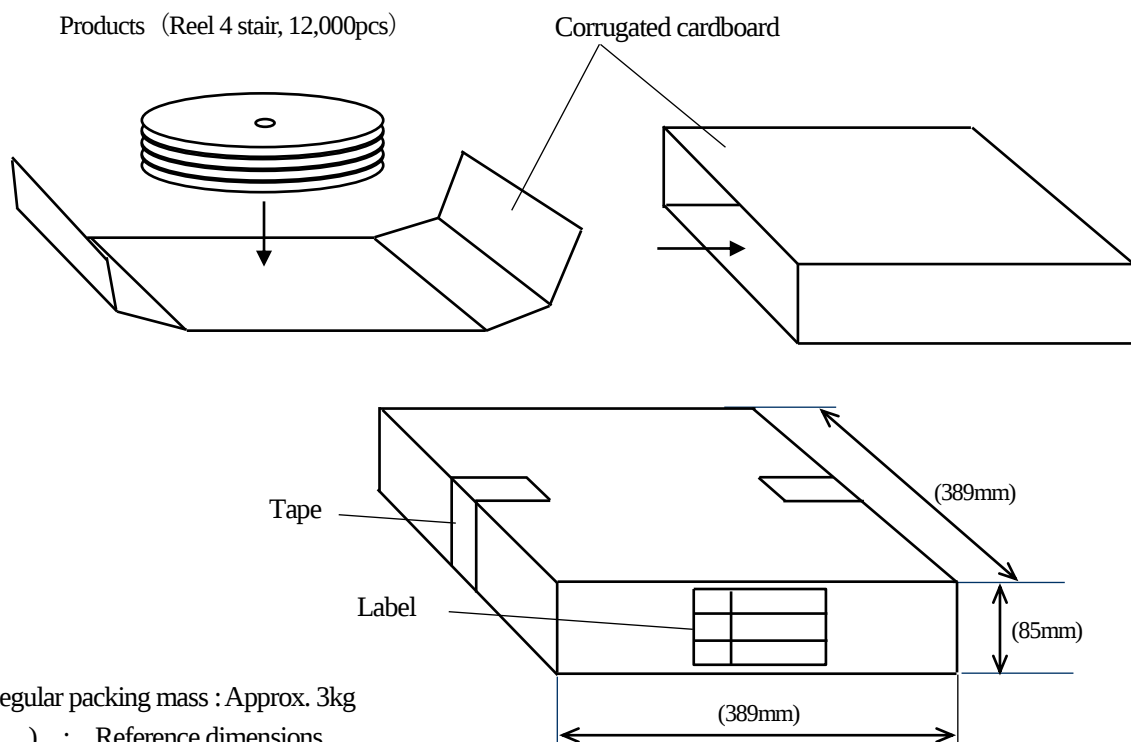
Dimensions list (Unit : mm)

a	b	c
(380)	13.4±1.0	φ80.0±1.0
d	e	f
φ13.0±0.2	φ21.0±0.8	2.0±0.5

Direction of product insertion



Outer packing appearance



Regular packing mass : Approx. 3kg
() : Reference dimensions

Precautions for Photocouplers

1. Recommended operating conditions

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward current	I_F	7	-	16	mA
Supply voltage	V_{CC}	-	5	-	V
Operating temperature	T_{opr}	0	-	+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

- (1) In order to stabilize power supply line, we should certainly recommend to connect a by-pass capacitor of 0.01μF or more between V_{CC} and GND near the device.
- (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 due to 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.
- (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) The LED used in the Photocoupler generally decreases the light emission power by operation.
In case of long operation time, please design the circuit in consideration of the decreases of the light emission power of the LED. (50%/5years)

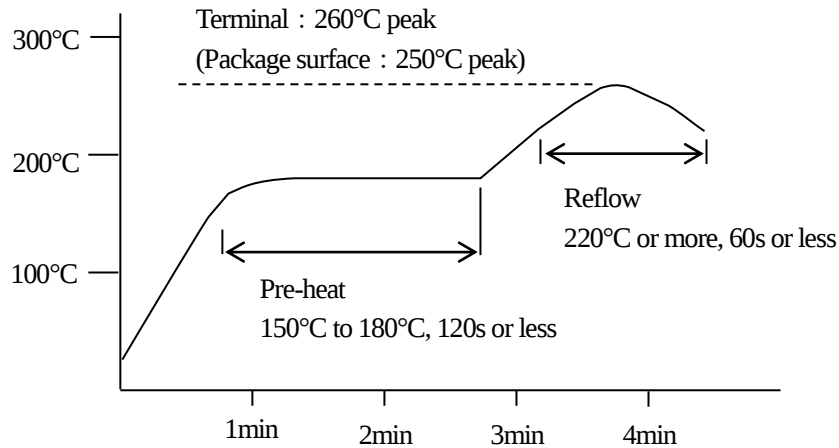
5. Precautions for Soldering

(1) In the case of flow soldering (Whole dipping is possible.)

It is recommended that flow soldering should be at 260°C or less for 10 s or less (Pre-heating : 100°C to 150°C, 30 s to 80 s). (2 times or less)

(2) If solder reflow:

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



(3) In the case of hand soldering

What is done on the following condition is recommended. (2 times or less)

Soldering iron temperature : 400°C or less

Time : 3s or less

(4) Other precautions

Depending on equipment and soldering conditions (temperature, Using solder etc.), the effect to the device and the PCB is different. Please confirm that there is no problem on the actual use conditions in advance.

1. This specification shall be applied to photocoupler, Model No. PC457L as an option.
2. Applicable Models (Business dealing name)
PC457L0YIP0F
3. The relevant models are the models approved by VDE according to DIN EN 60747-5-5. (Under preparation)
Approved Model No. : PC457L
VDE approved No. : 40009162 (According to the specification DIN EN60747-5-5)

- Operating isolation voltage V_{IORM} : 570V_(Peak)
- Transient voltage : 6400V_(Peak)
- Pollution : 2
- Clearances distance (Between input and output) : 4.0mm (MIN.)
- Creepage distance (Between input and output) : 4.0mm (MIN.)
- Tracking-proof : CTI 175
- 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 "  " is printed on minimum unit package.

REG 5911

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

5. Isolation specification according to EN60747-5-5

Parameter	Symbol	Condition	Rating	Unit	Remark
Class of environmental test	-	-	55/100/21	-	
Pollution	-	-	2	-	
Maximum operating isolation voltage	V_{IORM} (PEAK)	-	570	V	Refer to the Diagram 1, 2 (Attachement-2-3)
Partial discharge test voltage (Between input and output)					
Diagram 1	V_m	$t_m=10s, q_c \leq 5pC$	920	V	
Diagram 2	(PEAK)	$t_m=1s, q_c \leq 5pC$	1070	V	
Maximum over-voltage	$V_{ini,a}$ (PEAK)	$t_{INI}=60s$	6400	V	Refer to Fig. 6, 7 (Attachement-2-3)
Safety maximum ratings					
1) Case temperature	T_{si}	$I_F=0, P_C=0$	150	°C	
2) Input current	I_{si}	$P_C=0$	120	mA	
3) Electric power (Output or Total power dissipation)	P_{si}	-	240	mW	
Isolation resistance (Test voltage between input and output ; DC500V)	R_{ISO}	$T_a=T_{si}$	MIN. 10^9	Ω	
		$T_a=100^\circ C$	MIN. 10^{11}		
		$T_a=25^\circ C$	MIN. 10^{12}		

6. Precautions in performing isolation test

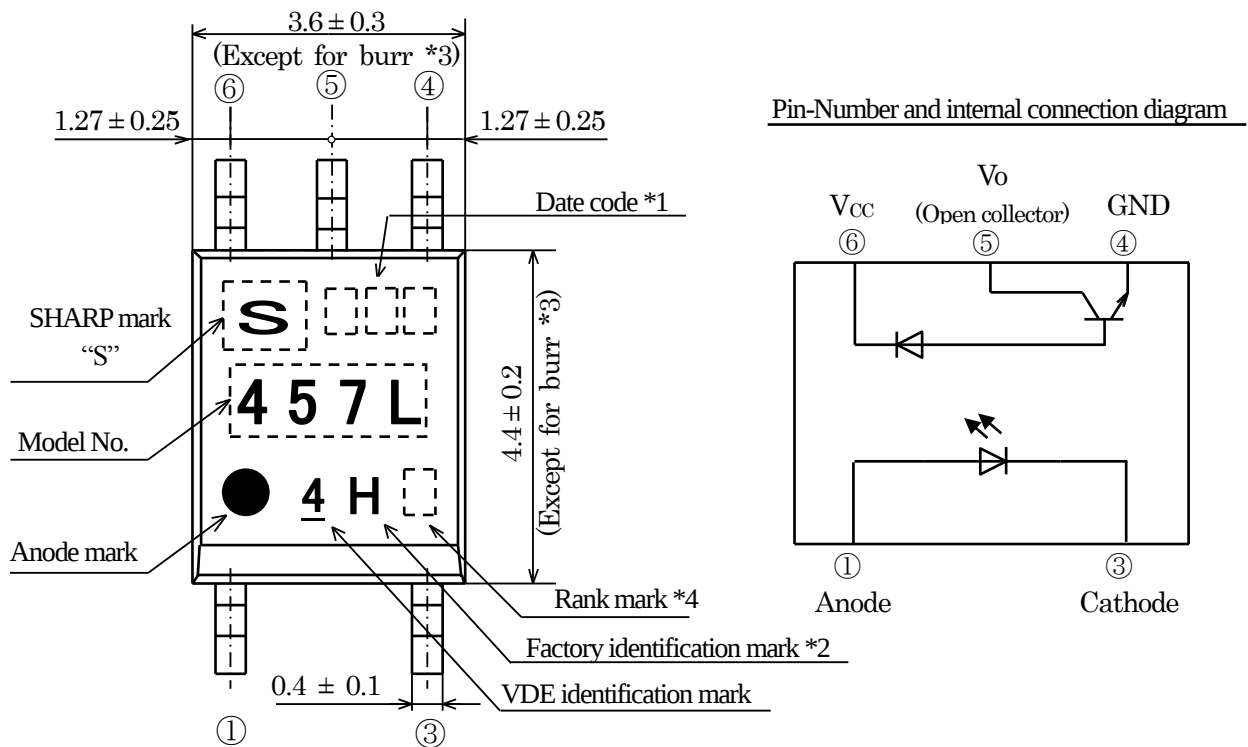
6.1 Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-5

6.2 Please don't carry out isolation test (V_{iso}) over $V_{ini,a}$.

This product deteriorates isolation characteristics by partial discharge due to applying high voltage.

And there is possibility that partial discharge occurs in operating isolation voltage. (V_{IORM}).

4. Outline



*1 Date code : 3 digit indication according to production year, month and day

*2 Factory identification mark is as follows.

H : YONGYAO ENSEI ELECTRONICS (SHANGQIU) CO., LTD. (CHINA products)

*3 Burr of resin max. 0.2 mm

*4 Rank mark shall be or shall not be marked.

Pin material: Copper Alloy

Pin finish : Palladium (Au flash plating)

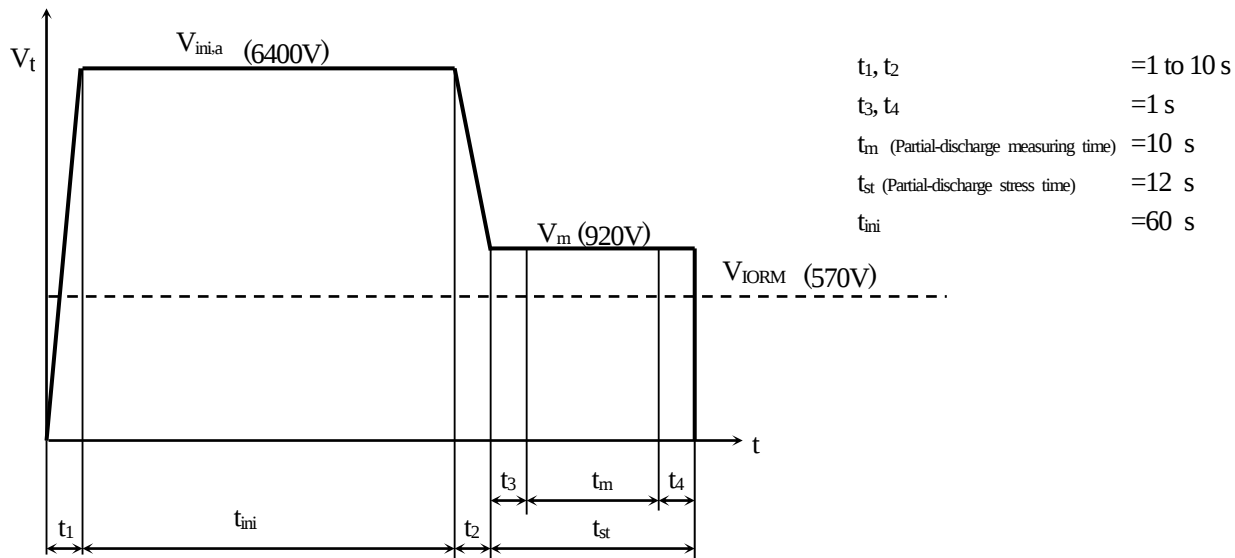
Mark : Laser marking

Product mass : Approx. 0.1g

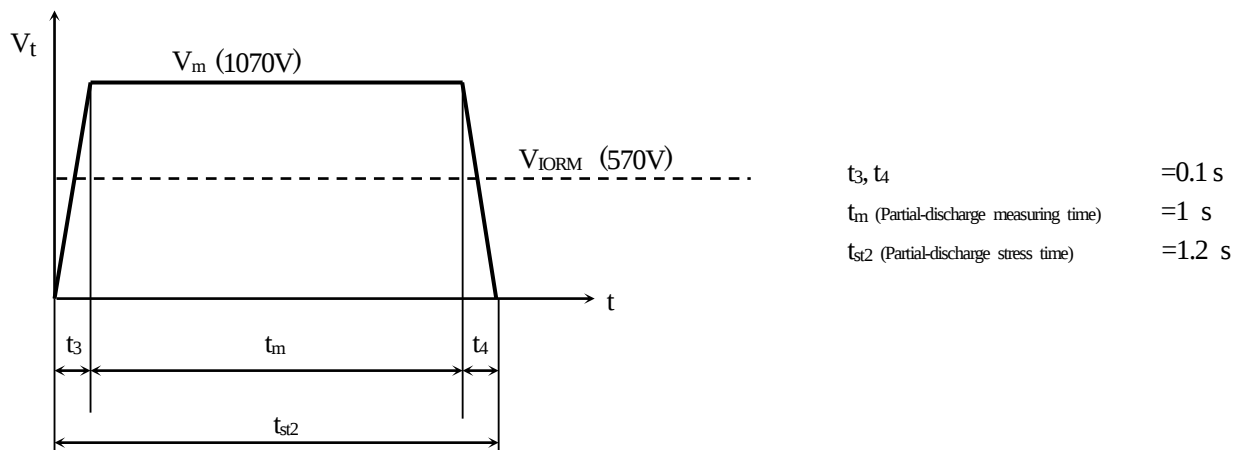
A lead tip area and a part of a lead side area
( area) are no-plating.

UNIT : mm	
Name	PC457L Outline Dimensions (Business dealing name : PC457L0YIP0F)

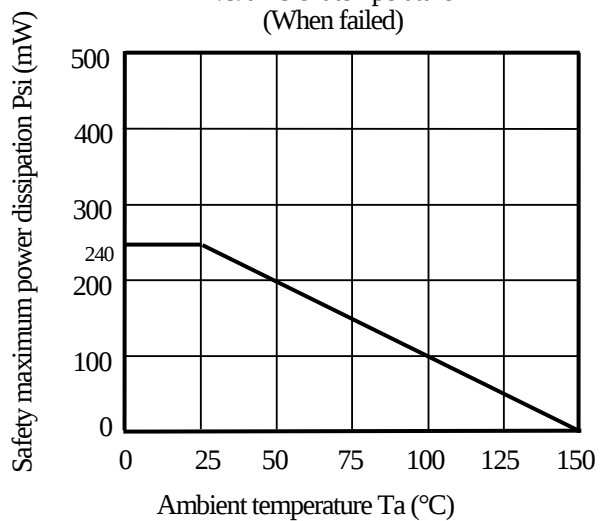
Method of Diagram 1: Breakdown test (Apply to type test and sampling test)



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



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



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

