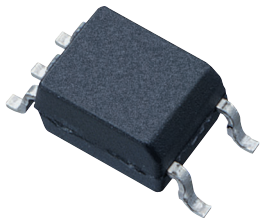
PC411L0NIP Series

High Speed 15Mb/s, High CMR Mini-flat Package *OPIC Photocoupler



■ Description

PC411L0NIP Series contains a LED optically coupled to an OPIC.

It is packaged in a 5 pin mini-flat.

Input-output isolation voltage(rms) is 3.75 kV.

High speed response (TYP. 15 Mb/s) and CMR is MIN. 15 kV/μs.

■ Features

1. 5 pin Mini-flat package
2. Double transfer mold package (Ideal for Flow Soldering)
3. High noise immunity due to high instantaneous common mode rejection voltage (CM_H : MIN. 15 kV/μs, CM_L : MIN. −15 kV/μs)
4. High speed response (t_{PHL} : TYP. 27 ns, t_{PLH} : TYP. 35 ns)
5. Isolation voltage between input and output ($V_{iso(rms)}$: 3.75 kV)

■ Agency approvals/Compliance

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **PC411L**)
2. Approved by VDE (VDE0884) (as an option), file No. 5911UG (as model No. **PC411L**)
3. Package resin : UL flammability grade (94V-0)

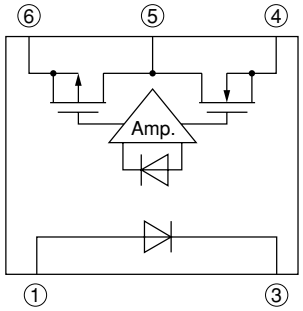
■ Applications

1. Programmable controller
2. Inverter

* "OPIC"(Optical IC) is a trademark of the SHARP Corporation. An OPIC consists of a light-detecting element and a signal-processing circuit integrated onto a single chip.

Sheet No.: D2-A04901EN
Date Nov. 28. 2003

■ Internal Connection Diagram



① Anode
③ Cathode
④ GND
⑤ V_O
⑥ V_{CC}

■ Truth table

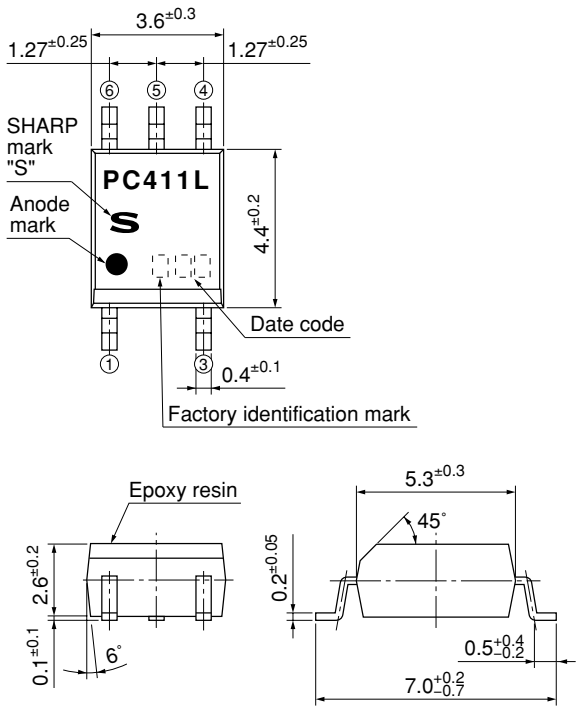
Input	LED	output
H	ON	L
L	OFF	H

L : Logic (0)
H : Logic (1)

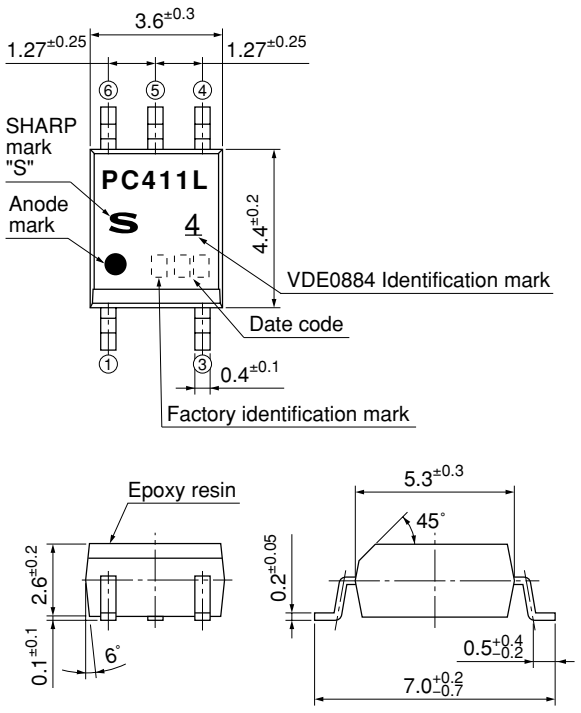
■ Outline Dimensions

(Unit : mm)

1. Mini-flat Package [ex. **PC411L0NIP**]



2. Mini-flat Package (VDE0884 option)
[ex. **PC411L0YIP**]



Product mass : approx. 0.1g

Date code (2 digit)

1st digit				2nd digit	
Year of production				Month of production	
A.D.	Mark	A.D	Mark	Month	Mark
1990	A	2002	P	January	1
1991	B	2003	R	February	2
1992	C	2004	S	March	3
1993	D	2005	T	April	4
1994	E	2006	U	May	5
1995	F	2007	V	June	6
1996	H	2008	W	July	7
1997	J	2009	X	August	8
1998	K	2010	A	September	9
1999	L	2011	B	October	O
2000	M	2012	C	November	N
2001	N	⋮	⋮	December	D

repeats in a 20 year cycle

Factory identification mark

Factory identification Mark	Country of origin
no mark	Japan
■	
◢	Indonesia
▽	Philippines
◥	China

* This factory marking is for identification purpose only.
Please contact the local SHARP sales representative to see the actual status of the production.

■ Absolute Maximum Ratings

(T_a=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}	0 to +6.0	V
	Output voltage	V_O	−0.5 to +5.5	V
	Output current	I_O	2	mA
Operating temperature		T_{opr}	−40 to +85	˚C
Storage temperature		T_{stg}	−55 to +125	˚C
*2 Isolation voltage		$V_{iso\ (rms)}$	3.75	kV
*3 Soldering temperature		T_{sol}	270	˚C

*1 When ambient temperature goes above 70˚C, the power dissipation goes down at 0.6mA/˚C. (Fig.3)
*2 40 to 60 %RH, AC for 1minute
*3 For 10s

■ Electro-optical Characteristics*4

(Unless otherwise specified T_a=−40 to 85˚C, V_{CC}=4.5 to 5.5V, TYP. at T_a=25˚C, V_{CC}=5V)

	Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage		V_F	T_a=25˚C, I_F=12mA	1.4	1.6	1.95	V
	Reverse current		I_R	T_a=25˚C, V_R=5V	–	–	10	μA
	Terminal capacitance		C_t	T_a=25˚C, V=0, f=1MHz	–	60	150	pF
Output	High level output voltage		V_{OH}	I_F=0, I_O=−20μA	4	5	–	V
	Low level output voltage		V_{OL}	I_F=12mA, I_O=20μA	–	1.5	100	mV
	Low level supply current		I_{CCL}	I_F=12mA	–	2.1	14.0	mA
	High level supply current		I_{CCH}	I_F=0	–	2.6	11.0	mA
Transfer characteristics	"High→Low" input threshold current		I_{FHL}	V_O=2.5V	–	3.5	6.0	mA
	Isolation resistance		R_{ISO}	T_a=25˚C, DC500V, 40 to 60%RH	5×10^{10}	10^{11}	–	Ω
	Floating capacitance		C_f	T_a=25˚C, V=0V, f=1MHz	–	0.6	1.0	pF
	Response time	"High→Low" propagation delay time	t_{PHL}	I_F=12mA, C_L=15pF CMOS Logic level t_r=t_f<1ns, Pulse width 100ns Duty=50%	20	27	60	ns
		"Low→High" propagation delay time	t_{PLH}		13	35	60	
		*5 Distortion of pulse width	Δt_W		0	8	30	
		Propagation delay skew	T_{PSK}		–	–	40	
		Rise time	t_r		–	4	–	
		Fall time	t_f		–	3	–	
	Instantaneous common mode rejection voltage (High level output)		CM_H	T_a=25˚C, I_F=0, V_{CM}=1.0kV(P-P)	15	20	–	kV/μs
	Instantaneous common mode rejection voltage (Low level output)		CM_L	T_a=25˚C, I_F=12mA, V_{CM}=1.0kV(P-P)	−15	−20	–	

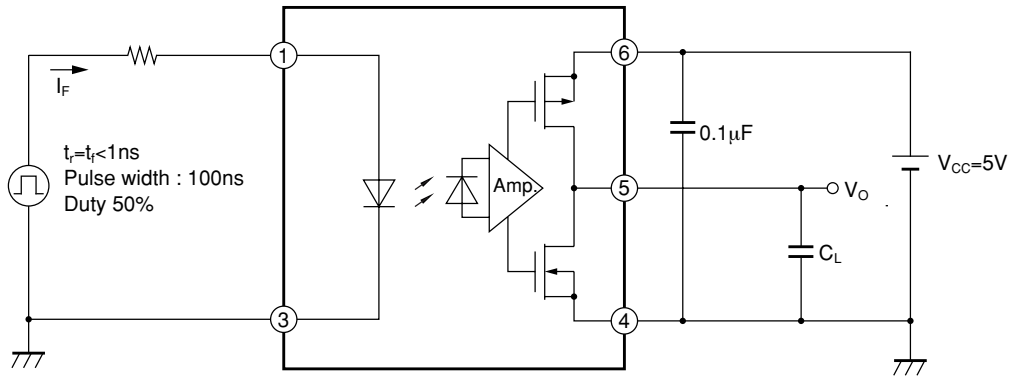
*4 It shall connect a by-pass capacitor of 0.01 μF or more between V_{CC} (pin⑥) and GND (pin④) near the device. when it measures the transfer characteristics and the output side characteristics.
*5 Distortion of pulse width $\Delta tw = | t_{PHL} - t_{PLH} |$

■ Model Line-up

Package	Taping	
	3 000 pcs/reel	
VDE0884	———	Approved
Model No.	**PC411L0NIP**	**PC411L0YIP**

Please contact a local SHARP sales representative to inquire about production status and Lead-Free options.

Fig.1 Test Circuit for Propagation Delay Time and Rise Time, Fall Time



✻C_L : Includes the probe and wiring capacitance.

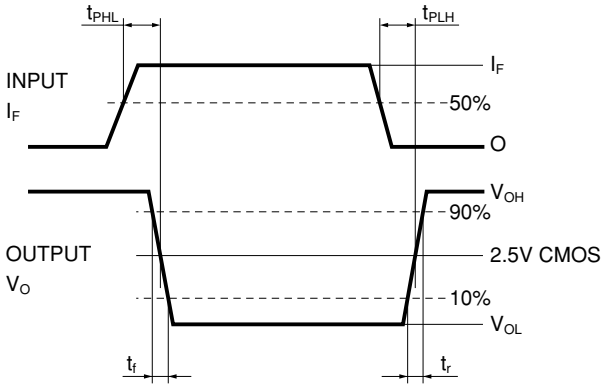
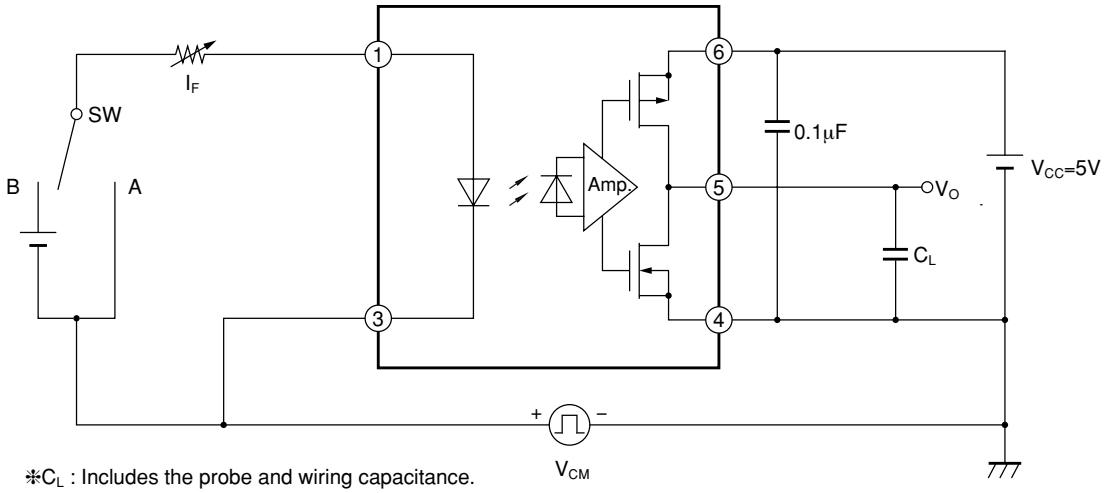


Fig.2 Test Circuit for Instantaneous Common Mode Rejection Voltage



✻C_L : Includes the probe and wiring capacitance.

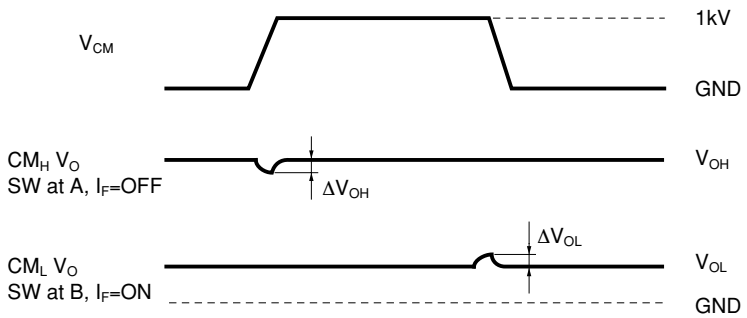


Fig.3 Forward Current vs. Ambient Temperature

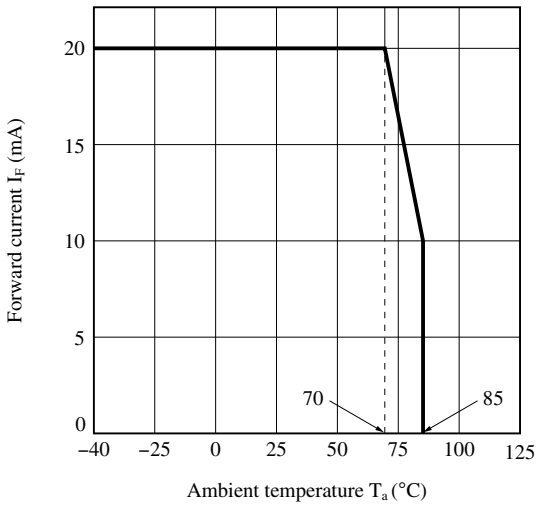


Fig.4 Forward Current vs. Forward Voltage

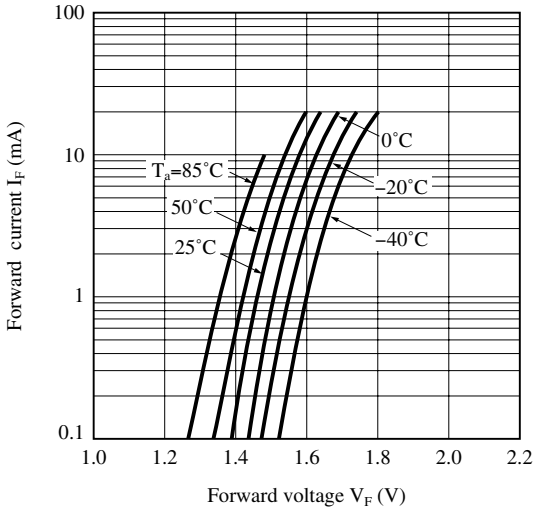


Fig.5 Input Threshold Current vs. Ambient Temperature

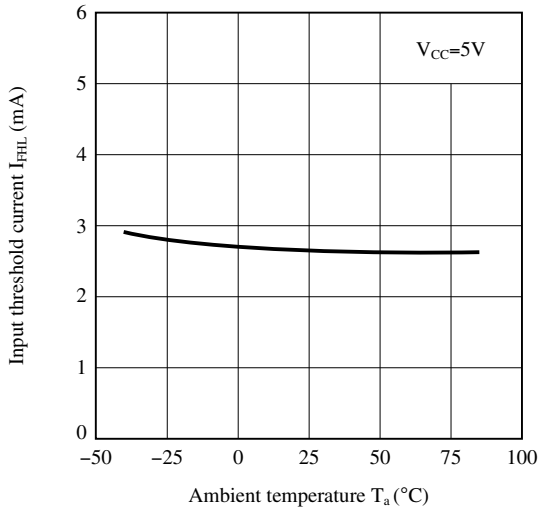


Fig.6 High Level Supply Current vs. Ambient Temperature

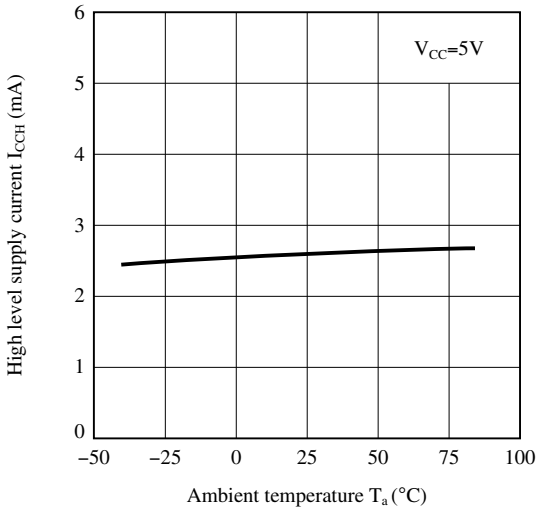


Fig.7 Low Level Supply Current vs. Ambient Temperature

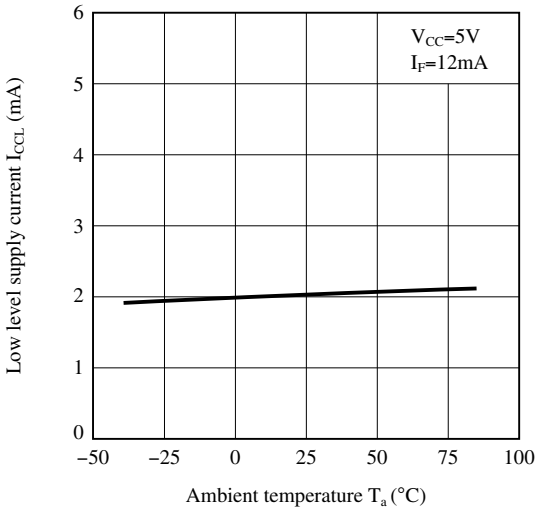


Fig.8 Propagation Delay Time vs. Input Current

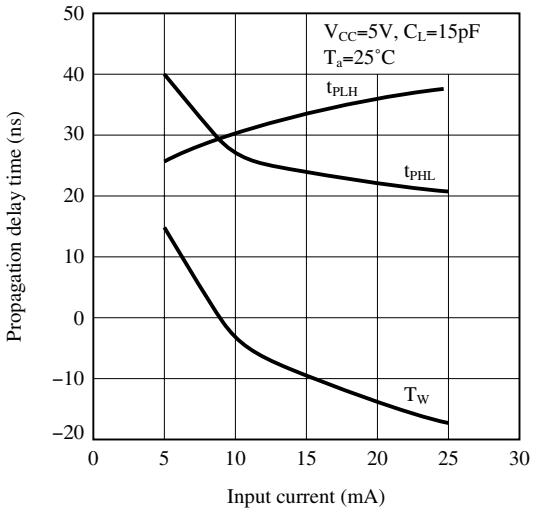


Fig.9 High-Level Output Voltage vs. Ambient Temperature

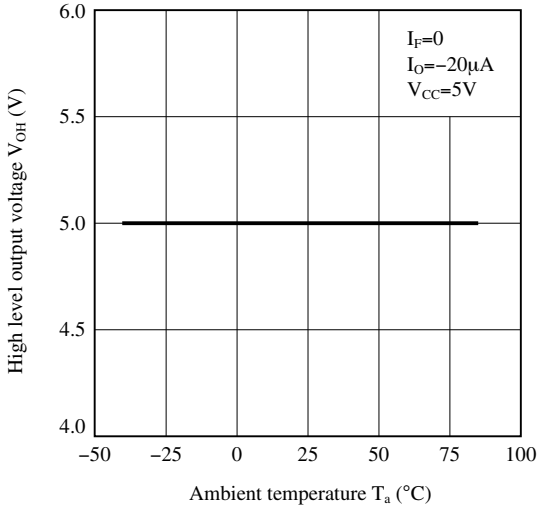
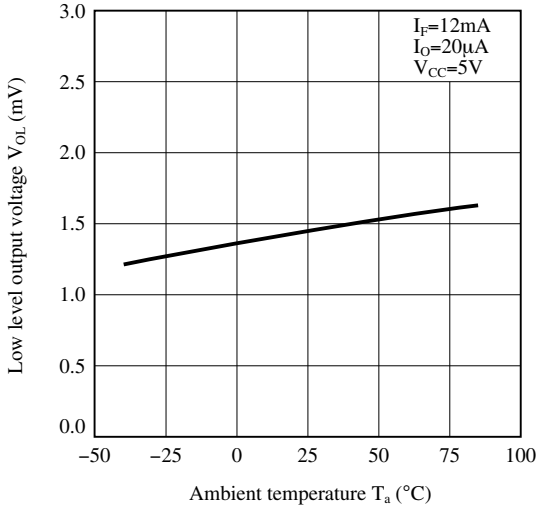


Fig.10 Low Level Output Voltage vs. Ambient Temperature



Remarks : Please be aware that all data in the graph are just for reference and not for guarantee.

■ Design Considerations

● Recommended operating conditions

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward current	I_F	10	–	16	mA
Supply voltage	V_{CC}	4.5	5	5.5	V
Operating temperature	T_{opr}	–40	–	70	°C

● Notes about static electricity

Transistor of detector side in bipolar configuration may be damaged by static electricity due to its minute design.
When handling these devices, general countermeasure against static electricity should be taken to avoid breakdown of devices or degradation of characteristics.

● Design guide

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.

In case that some sudden big noise caused by voltage variation is provided between primary and secondary terminals of photocoupler some current caused by it is floating capacitance may be generated and result in false operation since current may go through LED or current may change.
If the photocoupler may be used under the circumstances where noise will be generated we recommend to use the bypass capacitors at the both ends of LED.

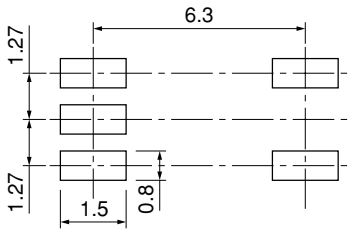
The detector which is used in this device, has parasitic diode between each pins and GND.
There are cases that miss operation or destruction possibly may be occurred if electric potential of any pin becomes below GND level even for instant.
Therefore it shall be recommended to design the circuit that electric potential of any pin does not become below GND level.

This product is not designed against irradiation and incorporates non-coherent LED.

● Degradation

In general, the emission of the LED used in photocouplers will degrade over time.
In the case of long term operation, please take the general LED degradation (50% degradation over 5years) into the design consideration.
Please decide the input current which become 2times of MAX. I_{FHL}.

● Recommended Foot Print (reference)



(Unit : mm)

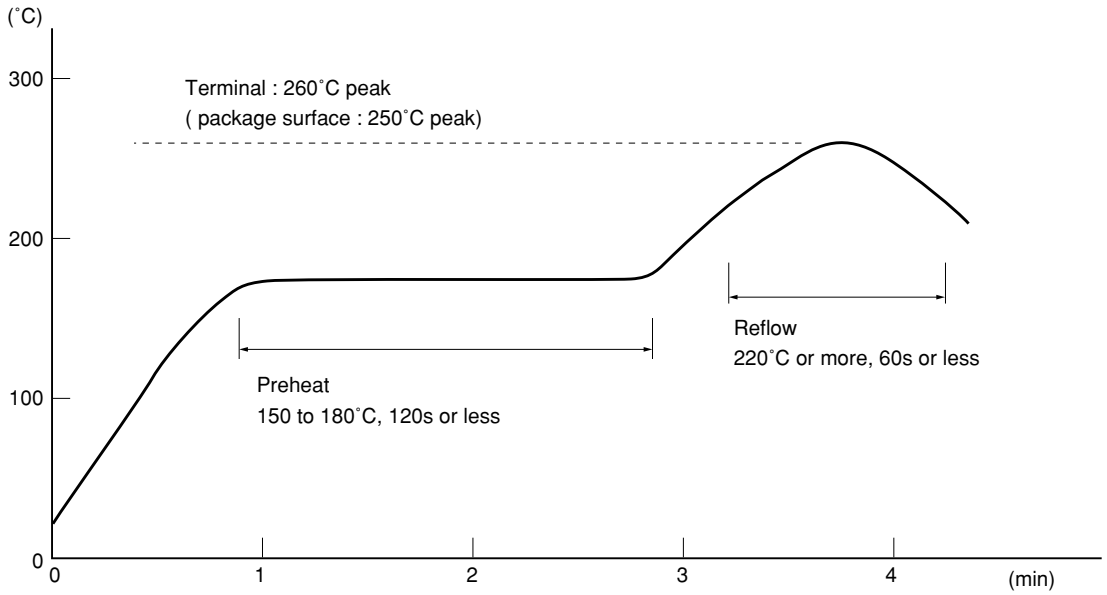
☆ For additional design assistance, please review our corresponding Optoelectronic Application Notes.

■ Manufacturing Guidelines

● Soldering Method

Reflow Soldering:

Reflow soldering should follow the temperature profile shown below.
Soldering should not exceed the curve of temperature profile and time.
Please don't solder more than twice.



Flow Soldering :

Due to SHARP's double transfer mold construction submersion in flow solder bath is allowed under the below listed guidelines.

Flow soldering should be completed below 260˚C and within 10s.
Preheating is within the bounds of 100 to 150˚C and 30 to 80s.
Please don't solder more than twice.

Hand soldering

Hand soldering should be completed within 3s when the point of solder iron is below 400˚C.
Please don't solder more than twice.

Other notices

Please test the soldering method in actual condition and make sure the soldering works fine, since the impact on the junction between the device and PCB varies depending on the tooling and soldering conditions.

● Cleaning instructions

Solvent cleaning:

Solvent temperature should be 45˚C or below Immersion time should be 3minutes or less

Ultrasonic cleaning:

The impact on the device varies depending on the size of the cleaning bath, ultrasonic output, cleaning time, size of PCB and mounting method of the device.

Therefore, please make sure the device withstands the ultrasonic cleaning in actual conditions in advance of mass production.

Recommended solvent materials:

Ethyl alcohol, Methyl alcohol and Isopropyl alcohol

In case the other type of solvent materials are intended to be used, please make sure they work fine in actual using conditions since some materials may erode the packaging resin.

● Presence of ODC

This product shall not contain the following materials.

And they are not used in the production process for this device.

Regulation substances : CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform)

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

■ Package specification

● Tape and Reel package

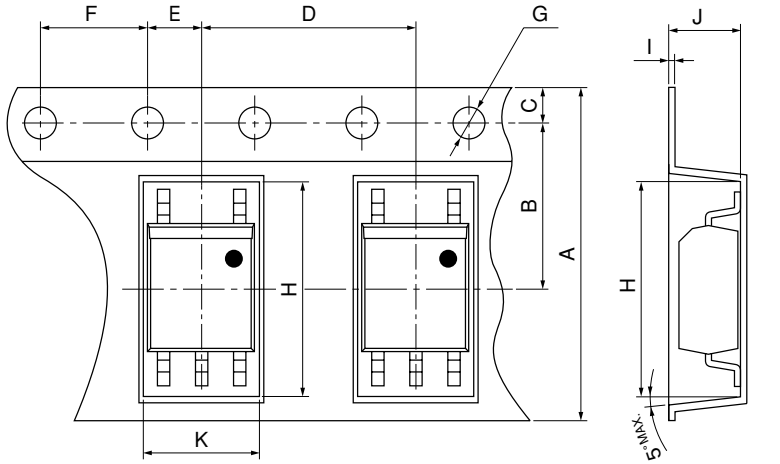
Package materials

Carrier tape : A-PET (with anti-static material)

Cover tape : PET (three layer system)

Reel : PS

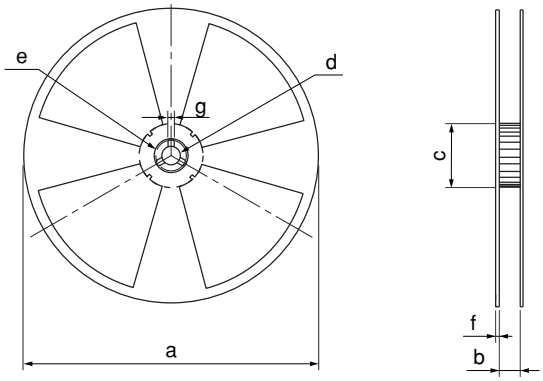
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$12.0^{\pm0.3}$	$5.5^{\pm0.1}$	$1.75^{\pm0.1}$	$8.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi1.5^{+0.1}_{-0}$
H	I	J	K			
$7.4^{\pm0.1}$	$0.3^{\pm0.05}$	$3.1^{\pm0.1}$	$4.0^{\pm0.1}$			

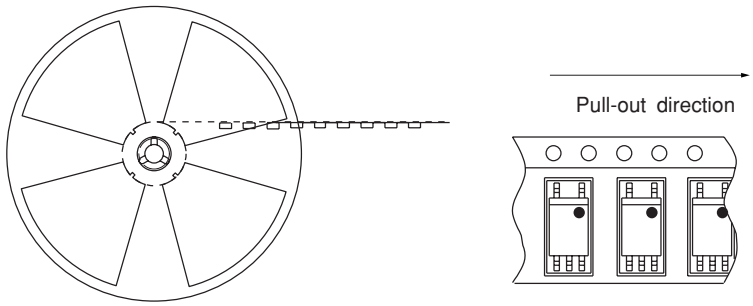
Reel structure and Dimensions



Dimensions List (Unit : mm)

a	b	c	d
370	$13.5^{\pm1.5}$	$80^{\pm1.0}$	$13^{\pm0.5}$
e	f	g	
$21^{\pm1.0}$	$2.0^{\pm0.5}$	$2.0^{\pm0.5}$	

Direction of product insertion



[Packing : 3 000pcs/reel]

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(i) The devices in this publication are designed for use in general electronic equipment designs such as:

--- Personal computers
--- Office automation equipment
--- Telecommunication equipment [terminal]
--- Test and measurement equipment
--- Industrial control
--- Audio visual equipment
--- Consumer electronics

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:

--- Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
--- Traffic signals
--- Gas leakage sensor breakers
--- Alarm equipment
--- Various safety devices, etc.

(iii) SHARP devices shall not be used for or in connection with equipment that requires an extremely high level of reliability and safety such as:

--- Space applications
--- Telecommunication equipment [trunk lines]
--- Nuclear power control equipment
--- Medical and other life support equipment (e.g., scuba).

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