PC910L0NSZ Series

High Speed 10Mb/s, High CMR DIP 8 pin *OPIC Photocoupler

■ Description

PC910L0NSZ Series contains a LED optically coupled to an OPIC chip.

It is packaged in a 8 pin DIP.

Input-output isolation voltage(rms) is 5.0kV, High speed response (TYP. 10 Mb/s) and CMR is MIN. 10 kV/μs.

■ Features

1. DIP 8 pin package
2. Double transfer mold package (Ideal for Flow Soldering)
3. High speed response (t_{PHL} : TYP. 48 ns, t_{PLH} : TYP. 50 ns)
4. Low input current drive (I_{FHL} : MAX. 5 mA)
5. Instantaneous common mode rejection voltage (CM_H : MIN.10 kV/μs, CM_L : MIN. −10 kV/μs)
6. TTL and LSTTL compatible output
7. High isolation voltage between input and output ($V_{iso(rms)}$: 5.0 kV)

■ Agency approvals/Compliance

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **PC910L**)
2. Approved by VDE (VDE0884) (as an option), file No. 87446 (as model No. **PC910L**)
3. Package resin : UL flammability grade (94V-0)

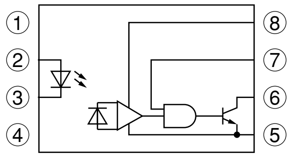
■ Applications

1. High speed interfaces for computer peripherals
2. Programmable controllers
3. 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-A05601EN
Date Nov. 28. 2003

■ Internal Connection Diagram



① NC
② Anode
③ Cathode
④ NC
⑤ GND
⑥ V_O (Open collector)
⑦ V_E (Enable)
⑧ V_{CC}

■ Truth table

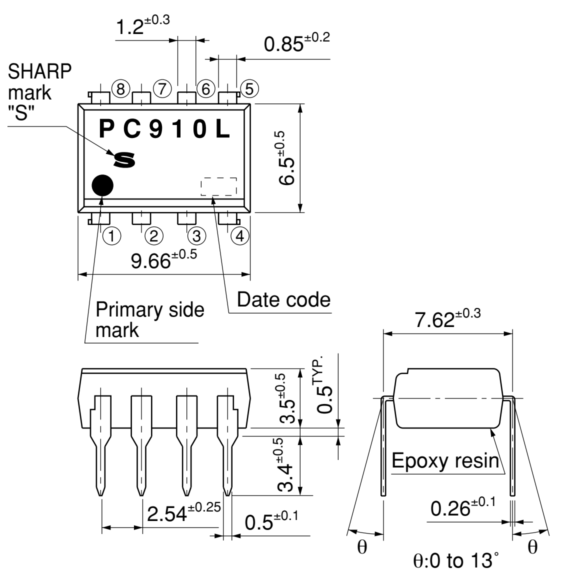
Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H

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

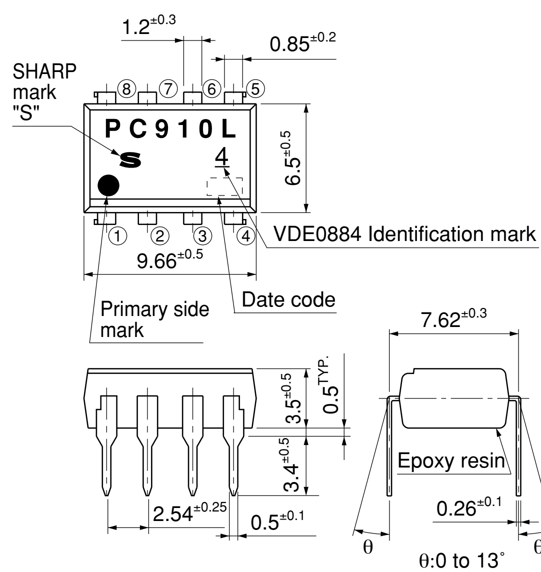
■ Outline Dimensions

(Unit : mm)

1. Through-Hole [ex. **PC910L0NSZ**]



2. Through-Hole (VDE0884 option) [ex. **PC910L0YSZ**]



Product mass : approx. 0.49g

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

Country of origin

Japan

■ Absolute Maximum Ratings

(T_a=25°C)

	Parameter	Symbol	Rating	Unit
Input	Forward current	I_F	20	mA
Input	Reverse voltage	V_R	5	V
Input	Power dissipation	P	40	mW
Output	Supply voltage	V_{CC}	7	V
Output	*1 Enable voltage	V_E	5.5	V
Output	High level output voltage	V_{OH}	7	V
Output	Low level output current	I_{OL}	50	mA
Output	Collector power dissipation	P_C	85	mW
	Operating temperature	T_{opr}	−40 to +85	˚C
	Storage temperature	T_{stg}	−55 to +125	˚C
	*2 Isolation voltage	$V_{iso\ (rms)}$	5.0	kV
	*3 Soldering temperature	T_{sol}	270	˚C

*1 Shall not exceed 500mV from supply voltage (V_{CC})
*2 40 to 60%RH, AC for 1minute, f=60Hz
*3 For 10s

■ Electro-optical Characteristics*4

(unles otherwise specified T_a=−40 to 85˚C)

		Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input		Forward voltage	V_F	T_a=25˚C, I_F=10mA	−	1.6	1.9	V
Input		Reverse current	I_R	T_a=25˚C, V_R=5V	−	−	10	μA
Input		Terminal capacitance	C_t	T_a=25˚C, V=0, f=1MHz	−	60	150	pF
Output		High level output voltage	I_{OH}	V_{CC}=V_O=5.5V, V_E=2.0V, I_F=250μA	−	0.02	100	μA
Output		Low level output voltage	V_{OL}	V_{CC}=5.5V, V_E=2.0V, I_F=5mA, I_{OL}=13mA	−	0.4	0.6	V
Output		High level enable current	I_{EH}	V_{CC}=5.5V, V_E=2.0V	−	−0.5	−1.6	mA
Output		Low level enable current	I_{EL}	V_{CC}=5.5V, V_E=0.5V	−	−0.7	−1.6	mA
Output		High level supply current	I_{CCH}	V_{CC}=5.5V, V_E=2.0V, I_F=0	−	5	10	mA
Output		High level supply current	I_{CCH}	V_{CC}=5.5V, V_E=0.5V, I_F=0	−	5	−	mA
Output		Low level supply current	I_{CCL}	V_{CC}=5.5V, V_E=2.0V, I_F=10mA	−	7	13	mA
Output		Low level supply current	I_{CCL}	V_{CC}=5.5V, V_E=0.5V, I_F=10mA	−	5.5	−	mA
Transfer charac-teristics		"High→Low" input threshold current	I_{FHL}	V_{CC}=5V, V_E=2.0V, V_O=0.8V, R_L=350Ω	−	2.5	5	mA
Transfer charac-teristics		Isolation resistance	R_{ISO}	T_a=25˚C, DC500V, 40 to 60%RH	5×10^{10}	10^{11}	−	Ω
Transfer charac-teristics		Floating capacitance	C_f	T_a=25˚C, V=0, f=1MHz	−	0.6	5	pF
Transfer charac-teristics	Response time	"High→Low" propagation delay time	t_{PHL}	T_a=25˚C, I_F=7.5mA, V_{CC}=5V, R_L=350Ω, C_L=15pF,	25	48	75	ns
Transfer charac-teristics	Response time	"Low→High" propagation delay time	t_{PLH}		25	50	75	ns
Transfer charac-teristics	Response time	Rise time	t_r		−	10	−	ns
Transfer charac-teristics	Response time	Fall time	t_f		−	20	−	ns
Transfer charac-teristics	Response time	*5 Distortion of pulse width	Δt_w		−	−	35	ns
Transfer charac-teristics	Response time	"High→Low" enable propagation delay time	t_{EHL}	T_a=25˚C, I_F=7.5mA, V_{CC}=5V, R_L=350Ω, C_L=15pF, V_{EH}=3V V_{EL}=0.5V	−	15	−	ns
Transfer charac-teristics	Response time	"Low→High" enable propagation delay time	t_{ELH}		−	10	−	ns
Transfer charac-teristics		Instantaneous common mode rejection voltage (High level output)	CM_H	T_a=25˚C, I_F=0, V_{CC}=5V, V_{CM}=1k$V_{(P-P)}$, R_L=350Ω, $V_{O\ (Min)}$=2V	10	20	−	kV/μs
Transfer charac-teristics		Instantaneous common mode rejection voltage (Low level output)	CM_L	T_a=25˚C, I_F=5mA, V_{CC}=5V, V_{CM}=1k$V_{(P-P)}$, R_L=350Ω, $V_{O\ (Max)}$=0.8V	−10	−20	−	kV/μs

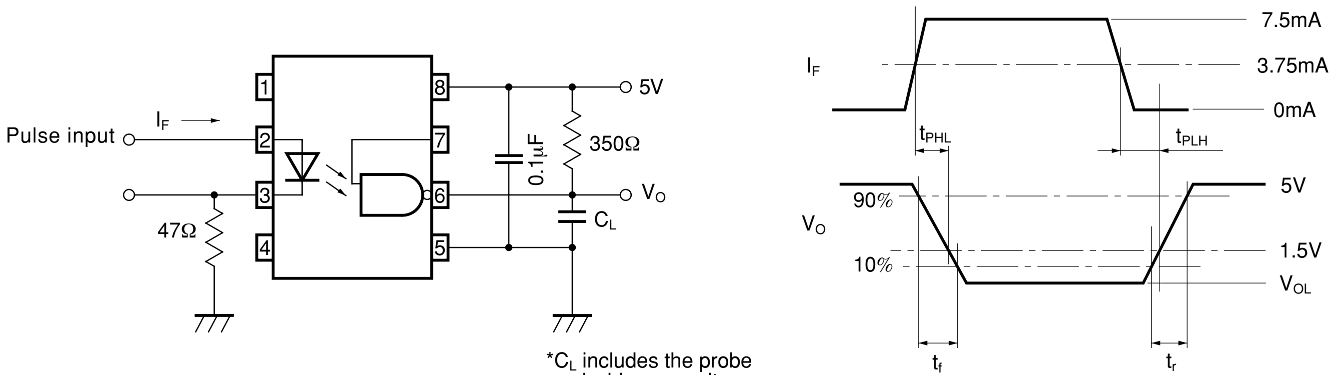
*4 It shall connect a by-pass capacitor of 0.01μF or more between V_{CC} (pin ⑧) and GND (pin ⑤) near the device, when it measures the transfer characteristics and the output side characteristics
*5 Distortion of pulse width $\Delta t_w = |t_{PHL} - t_{PLH}|$

■ Model Line-up

Lead Form	Through-Hole	
Package	Sleeve	
	50pcs/sleeve	
VDE0884	———	Approved
Model No.	**PC910L0NSZ**	**PC910L0YSZ**

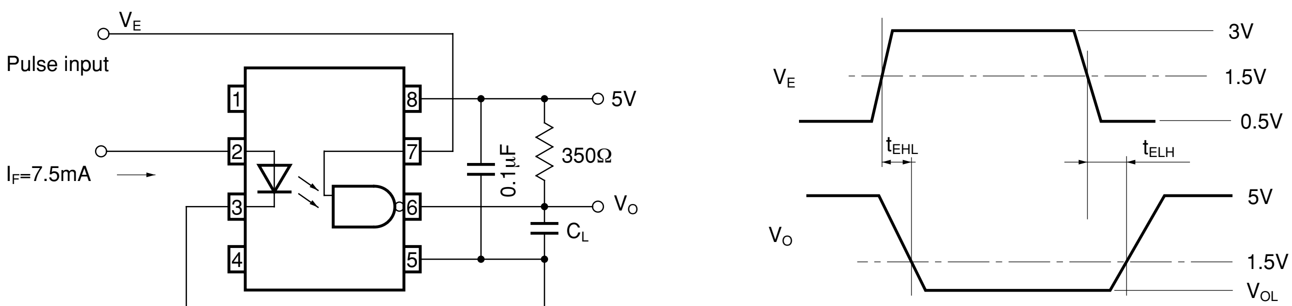
Please contact a local SHARP sales representative to inquire about production status and Lead-Free options.

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



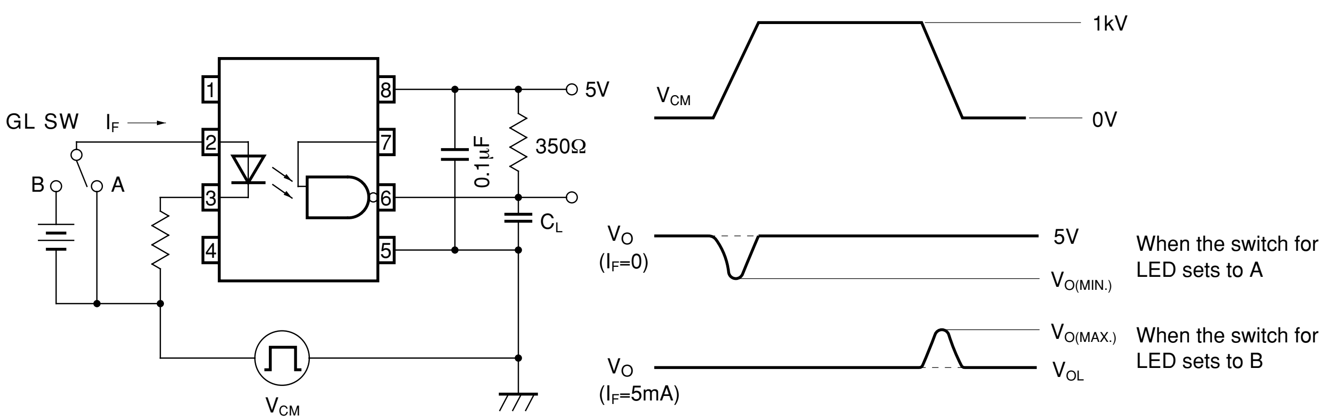
*CL includes the probe and wiring capacitance.

Fig.2 Test Circuit for Enable Propagation Delay Time



*CL includes the probe and wiring capacitance.

Fig.3 Test Circuit for Instantaneous Common Mode Rejection Voltage



*CL includes the probe and wiring capacitance.

Fig.4 Forward Current vs. Ambient Temperature

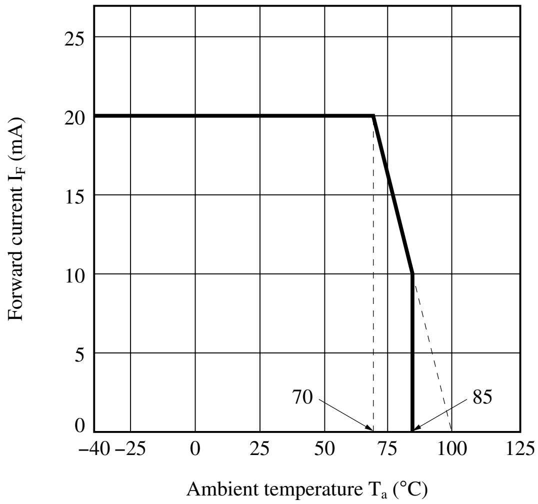


Fig.5 Collector Power Dissipation vs. Ambient Temperature

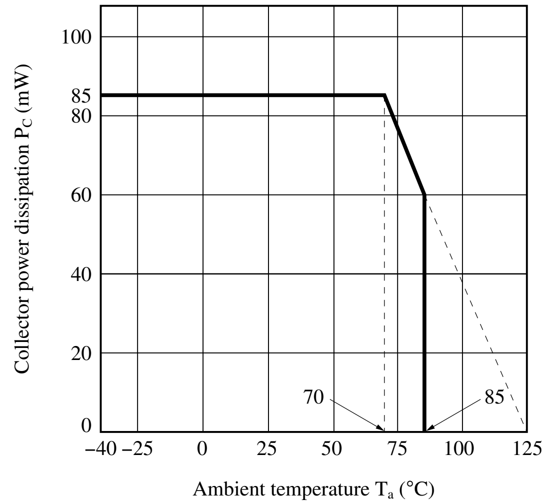


Fig.6 Forward Current vs. Forward Voltage

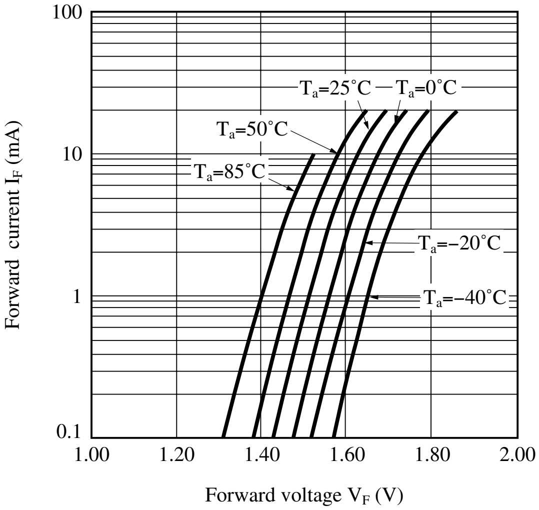


Fig.7 High Level Output Current vs. Ambient Temperature

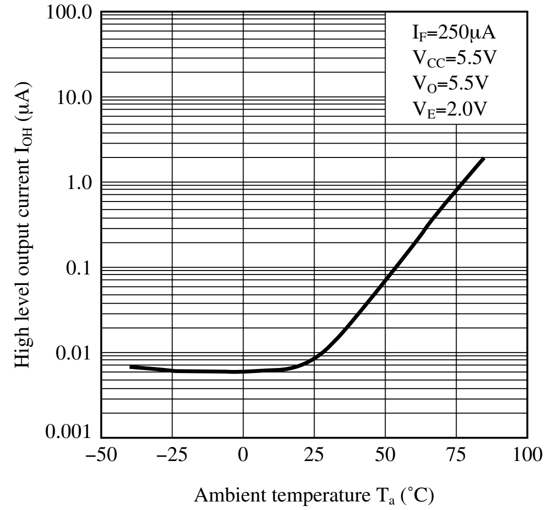


Fig.8 Low Level Output Voltage vs. Ambient Temperature

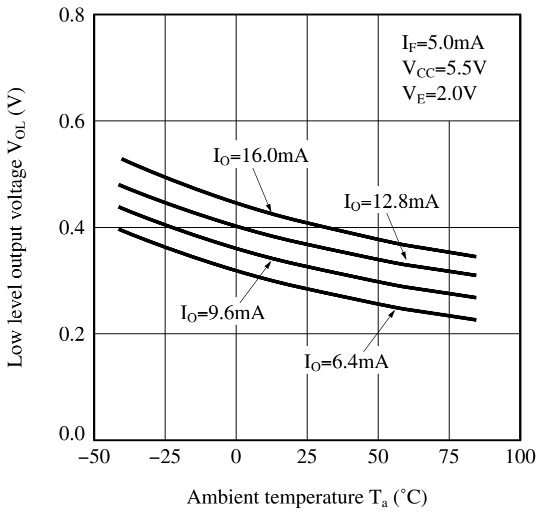


Fig.9 Input Threshold Current vs. Ambient Temperature

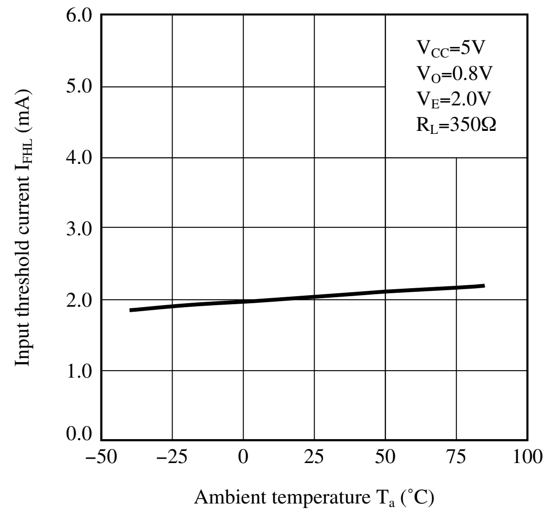


Fig.10 Output Voltage vs. Forward Current

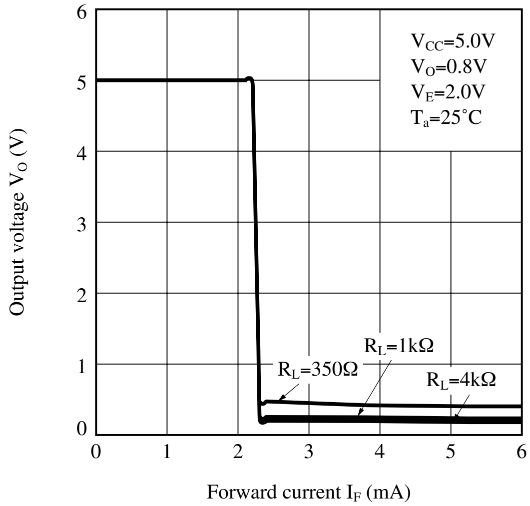


Fig.11 Propagation Delay Time vs. Forward Current

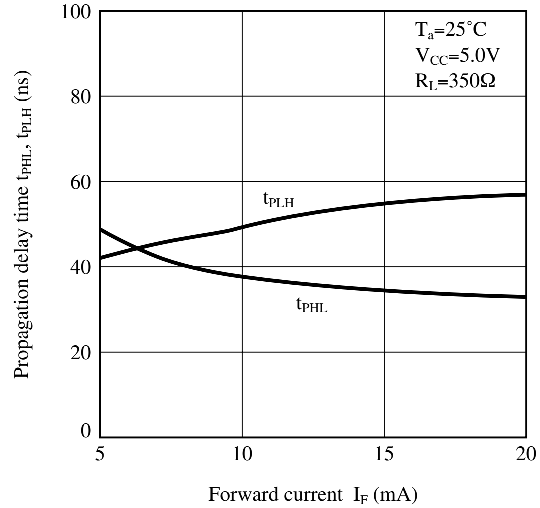
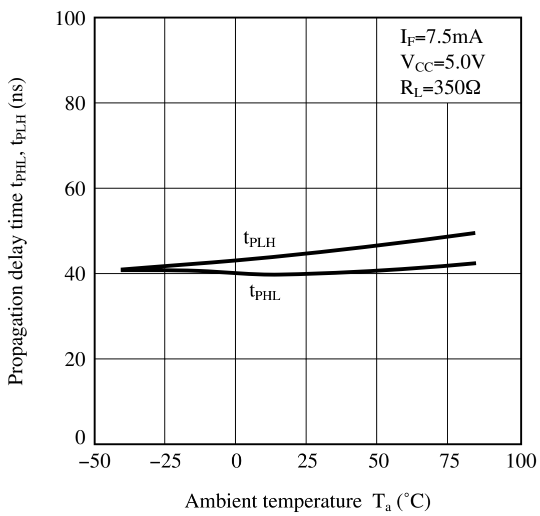


Fig.12 Propagation Delay Time vs. Ambient Temperature



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
Low level input current	I_{FL}	0	–	250	μA
High level input current	I_{FH}	8	–	15	mA
High level enable input voltage	V_{EH}	2.0	–	V_{CC}	V
Low level enable input voltage	V_{EL}	0	–	0.8	V
Supply voltage	V_{CC}	4.5	–	5.5	V
Fan out (TTL load)	N	–	–	8	–
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}.

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

■ Manufacturing Guidelines

● Soldering Method

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 270˚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

● Sleeve package

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

Package method

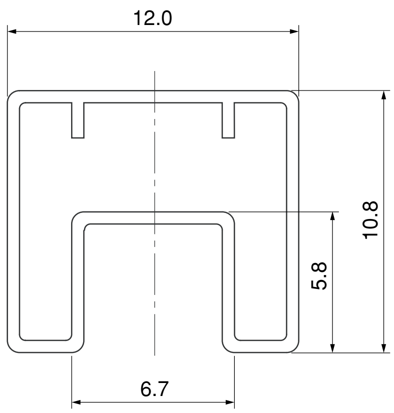
MAX. 50 pcs. of products shall be packaged in a sleeve.

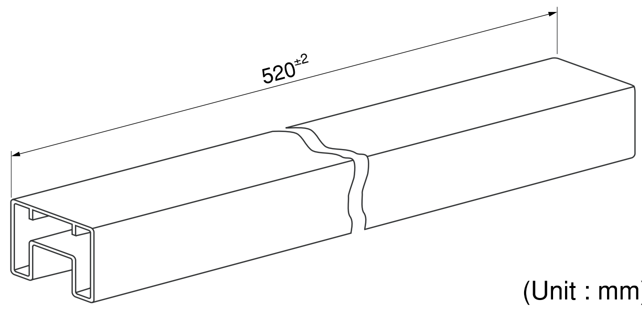
Both ends shall be closed by tabbed and tabless stoppers.

The product shall be arranged in the sleeve with its primary side mark on the tabless stopper side.

MAX. 20 sleeves in one case.

Sleeve outline dimensions





(Unit : mm)

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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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