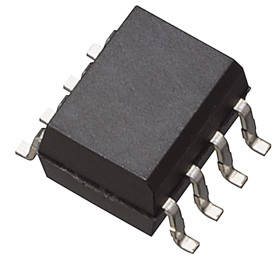
PC4D10SNIP0F Series

High Speed 10Mb/s, High CMR Mini-flat 2-channel Package *OPIC Photocoupler



■ Description

PC4D10SNIP0F Series contains a LED optically coupled to an OPIC.

It is packaged in a 8 pin mini-flat (2-ch output).

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

High speed response (TYP. 10Mb/s) and CMR is MIN. 10kV/μs.

■ Features

1. 2-ch output, 8 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. 10kV/μs, CM_L : MIN. −10kV/μs)
4. High speed response (t_{PHL} : TYP. 50ns, t_{PLH} : TYP. 48ns)
5. Isolation voltage between input and output ($V_{iso(rms)}$: 3.75kV)
6. RoHS driective compliant

■ Agency approvals/Compliance

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **PC4D10S**)
2. Approved by VDE, DIN EN60747-5-2(*) (as an option), file No. 40009162 (as model No. **PC4D10S**)
3. Package resin : UL flammability grade (94V-0))

(*) DIN EN60747-5-2 : successor standard of DIN VDE0884.

■ 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.

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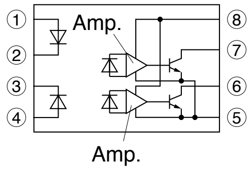
Sheet No.: D2-A09201FEN
Date Sep. 1. 2006

■ Internal Connection Diagram



① Anode 1
② Cathode 1
③ Cathode 2
④ Anode 2
⑤ GND
⑥ V_{O2}
⑦ V_{O1}
⑧ V_{CC}

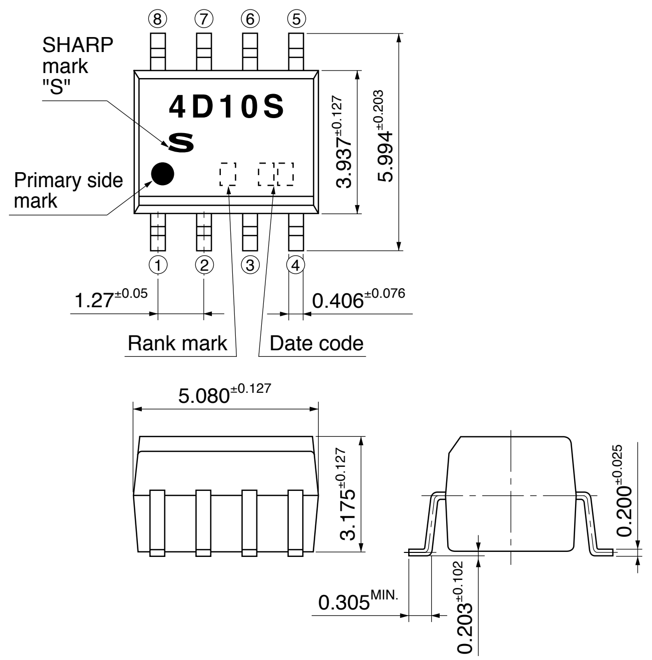
■ Truth table

Channel	Input	LED	Output
1	H	ON	L
	L	OFF	H
2	H	ON	L
	L	OFF	H

■ Outline Dimensions

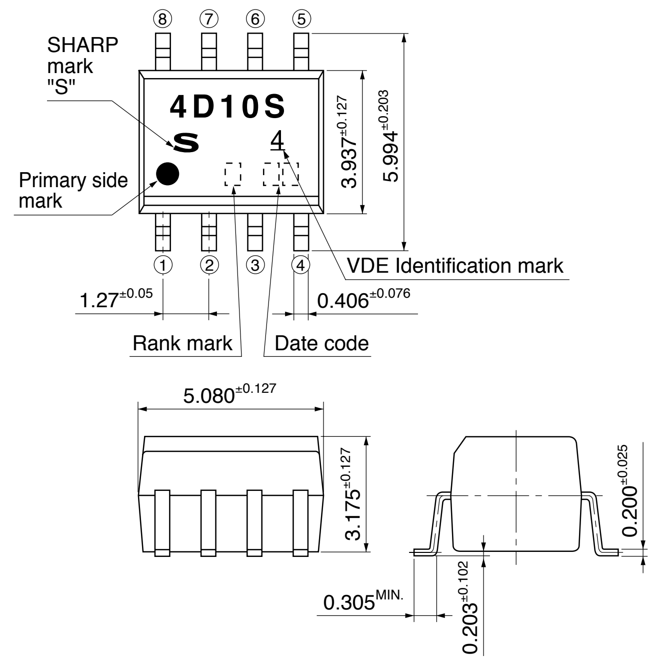
(Unit : mm)

1. Mini-flat Package [ex. **PC4D10SNIP0F**]



Product mass : approx. 0.15g

2. Mini-flat Package (VDE option) [ex. **PC4D10SYIP0F**]



Product mass : approx. 0.15g

Plating material : Pd (Au flush)

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

Rank mark

With or without.

■ Absolute Maximum Ratings

(T_a=25˚C)

Parameter		Symbol	Rating	Unit
Input	*1 Forward current	I_F	20	mA
Input	Reverse voltage	V_R	5	V
Input	Power dissipation	P_1	40	mW
Output	Supply voltage	V_{CC}	7	V
Output	Output collector voltage	V_O	7	V
Output	Output collector current	I_O	50	mA
Output	*1 Output collector power dissipation	P_C	60	mW
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 No delating required up to 85˚C
*2 40 to 60%RH, AC for 1minute, f=60Hz
*3 For 10s

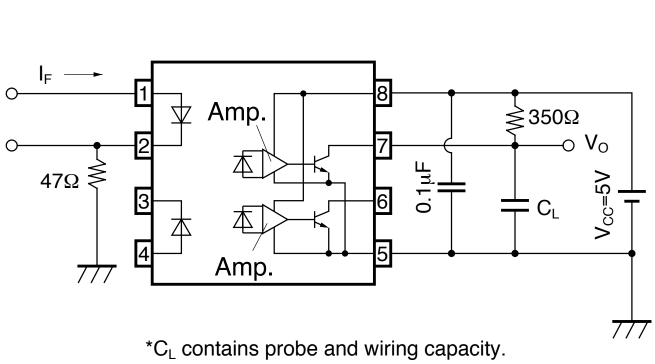
■ Electro-optical Characteristics

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

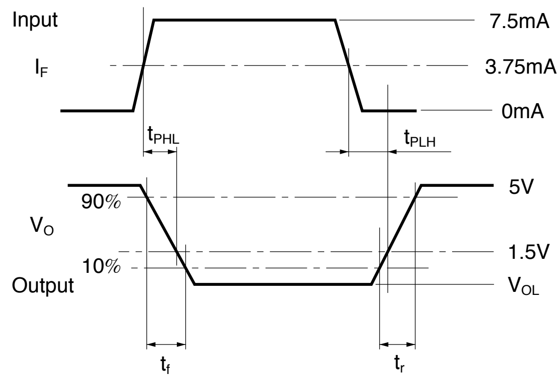
		Parameter	Symbol	Condition		MIN.	TYP.*4	MAX.	Unit
Input		Forward voltage	V_F	T_a=25˚C, I_F=10mA		1.4	1.5	1.75	V
Input		Forward voltage	V_F	I_F=10mA		1.3	–	1.8	V
Input		Reverse current	I_R	T_a=25˚C, V_R=5V		–	–	10	μA
Input		Terminal capacitance	C_t	Ta=25˚C, V=0, f=1MHz		–	60	150	pF
*5 Output		Low level output voltage	V_{OL}	I_{OL}=13mA, V_{CC}=5.5V, V_E=2V, I_F=5mA		–	0.4	0.6	V
*5 Output		High level output current	I_{OH}	V_{CC}=V_O=5.5V, I_F=250μA		–	0.02	100	μA
*5 Output		Low level supply current	I_{CCL}	V_{CC}=5.5V, I_F=10mA		–	13	21	mA
*5 Output		High level supply current	I_{CCH}	V_{CC}=5.5V, I_F=0		–	10	15	mA
*5 Transfer characteristics		"High→Low" input threshold current	I_{FHL}	V_{CC}=5V, V_O=0.6V, R_L=350Ω		–	2.5	5	mA
*5 Transfer characteristics		Isolation resistance	R_{ISO}	T_a=25˚C, DC500V, 40 to 60%RH		5×10^{10}	10^{11}	–	Ω
*5 Transfer characteristics		Floating capacitance	C_f	T_a=25˚C, V=0, f=1MHz		–	0.6	–	pF
*5 Transfer characteristics	Response time	"High→Low" propagation delay time	t_{PHL}	V_{CC}=5V, I_F=7.5mA, R_L=350W, C_L=15pF		–	–	100	ns
*5 Transfer characteristics	Response time	"High→Low" propagation delay time	t_{PHL}		T_a=25˚C	25	48	75	ns
*5 Transfer characteristics	Response time	"Low→High" propagation delay time	t_{PLH}			–	–	100	ns
*5 Transfer characteristics	Response time	"Low→High" propagation delay time	t_{PLH}		T_a=25˚C	25	50	75	ns
*5 Transfer characteristics	Response time	*6 Distortion of pulse width	Δt_W			–	3.5	35	ns
*5 Transfer characteristics	Response time	Rise time	t_r			–	20	–	ns
*5 Transfer characteristics	Response time	Fall time	t_f			–	10	–	ns
*5 Transfer characteristics	Response time	Propagation delay skew	t_{PSK}			–	–	40	ns
*5 Transfer characteristics		Instantaneous common mode rejection voltage (High level output)	CM_H	I_F=0, $V_{O(Min)}$=2V,	T_a=25˚C, V_{CC}=5V, V_{CM}=1kV$_{(P-P)}$, R_L=350Ω	10	20	–	kV/μs
*5 Transfer characteristics		Instantaneous common mode rejection voltage (Low level output)	CM_L	I_F=7.5mA, $V_{O(MAX)}$=0.8V		−10	−20	–	kV/μs

*4 All typical values at V_{CC}=5V, T_a=25˚C
*5 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
*6 Distortion of pulse width Δ_{tw}= | t_{PHL}−t_{PLH} |

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

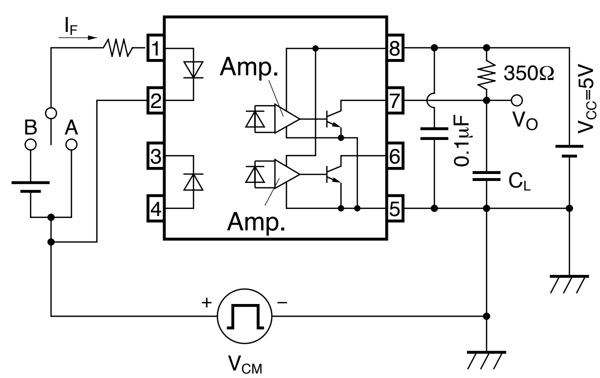


*C_L contains probe and wiring capacity.

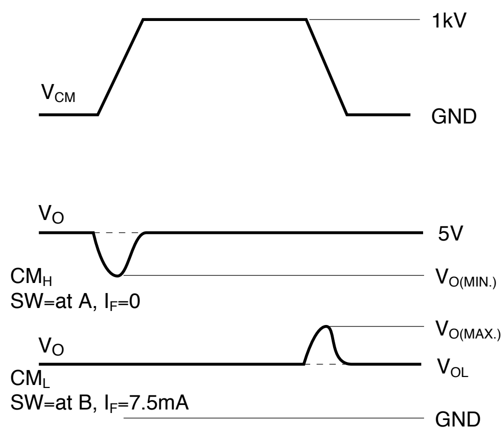


Timing diagram

Fig.2 Test Circuit for Instantaneous Common Mode Rejection Voltage



*C_L contains probe and wiring capacity.



Timing diagram

Fig.3 Forward Current vs. Ambient Temperature

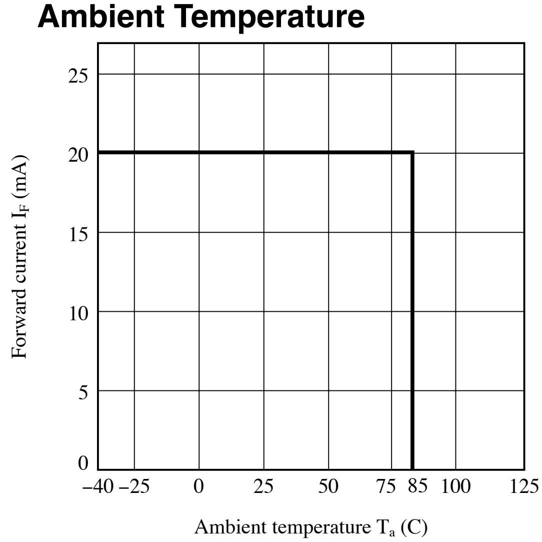


Fig.4 Output Collector Power Dissipation vs. Ambient Temperature

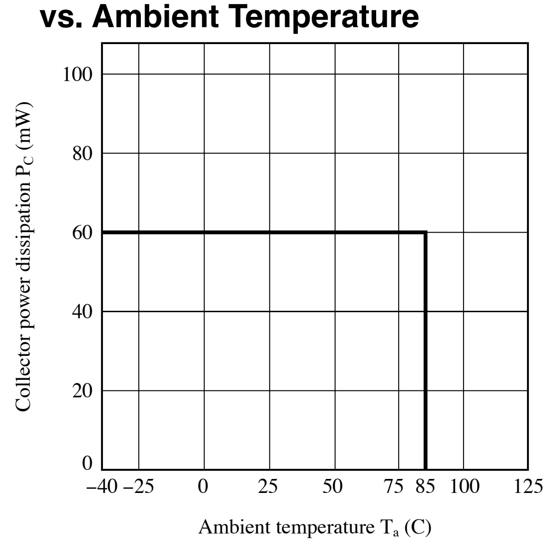


Fig.5 Forward Current vs. Forward Voltage

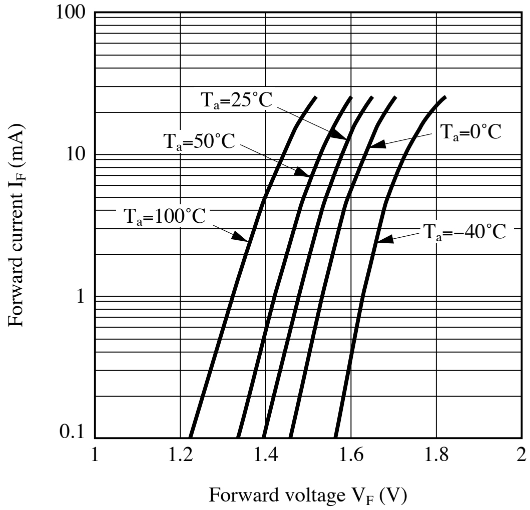


Fig.6 High Level Output Current vs. Ambient Temperature

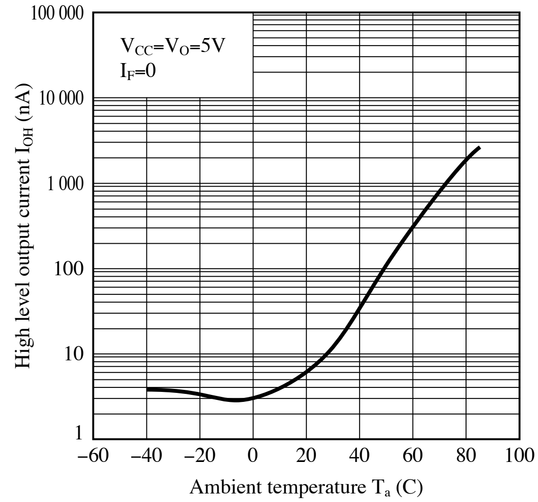


Fig.7 Low Level Output Voltage vs. Ambient Temperature

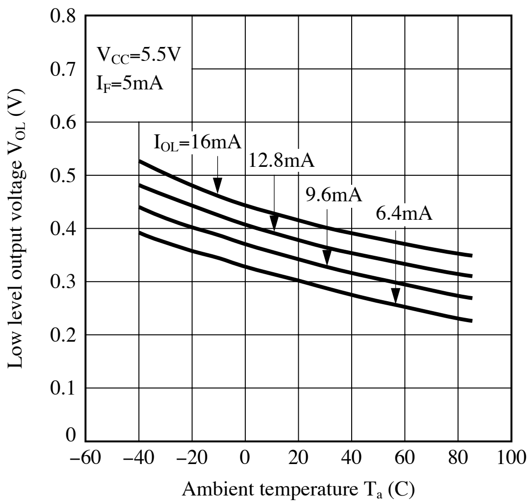


Fig.8 Output Voltage vs. Forward Current

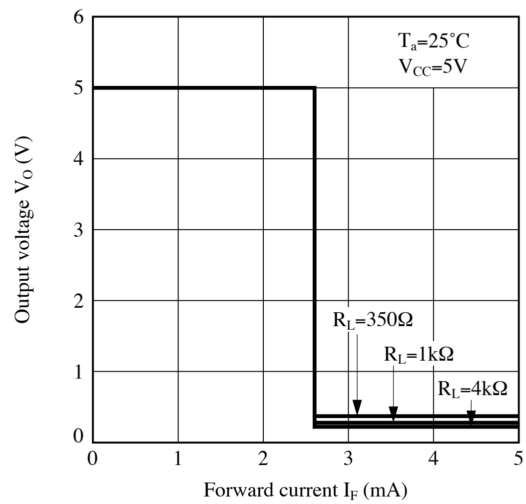


Fig.9 Input Threshold Current vs. Ambient Temperature

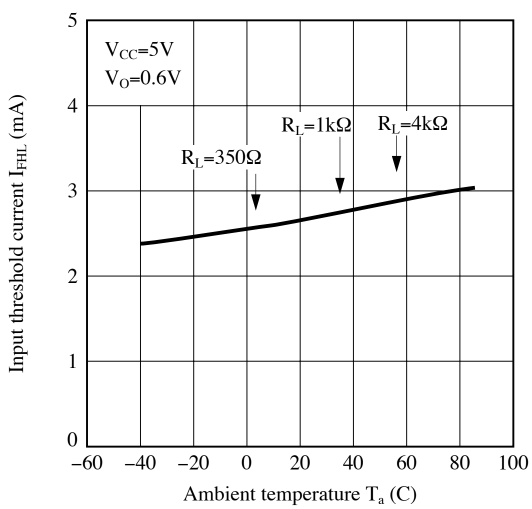


Fig.10 Propagation Delay Time vs. Forward Current

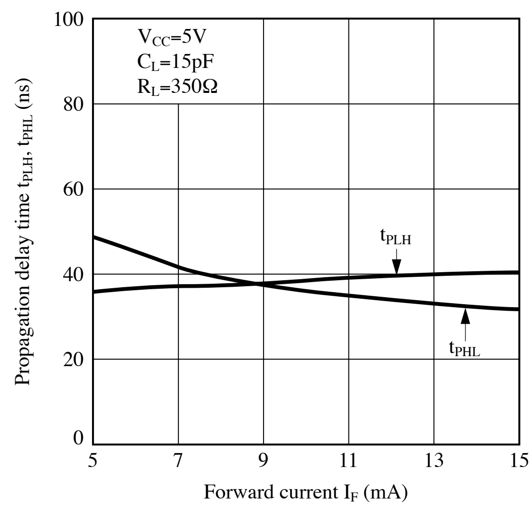


Fig.11-a Propagation Delay Time vs. Ambient Temperature

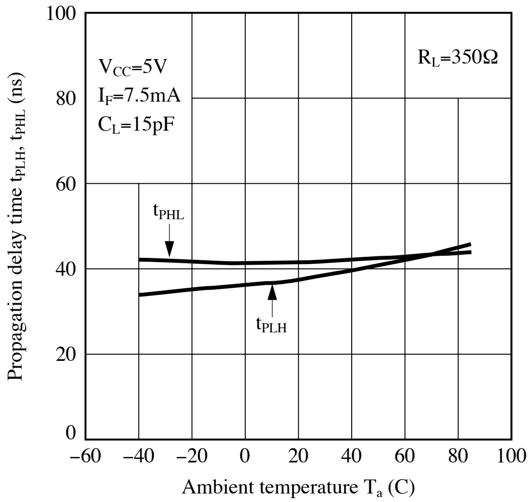


Fig.11-b Propagation Delay Time vs. Ambient Temperature

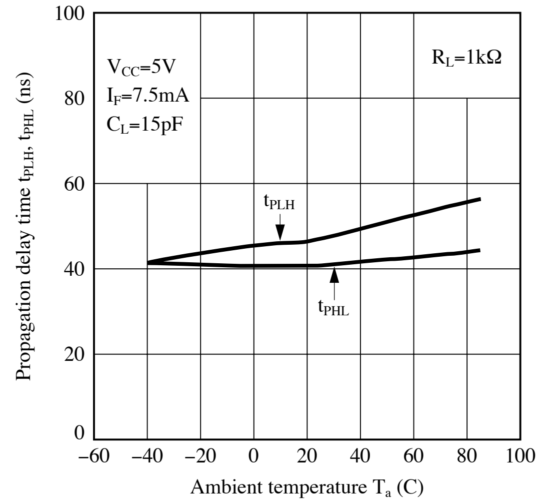


Fig.11-c Propagation Delay Time vs. Ambient Temperature

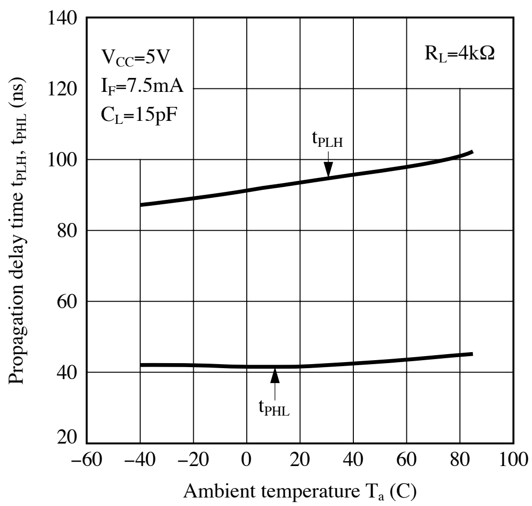


Fig.12 Pulse width Distortion vs. Ambient Temperature

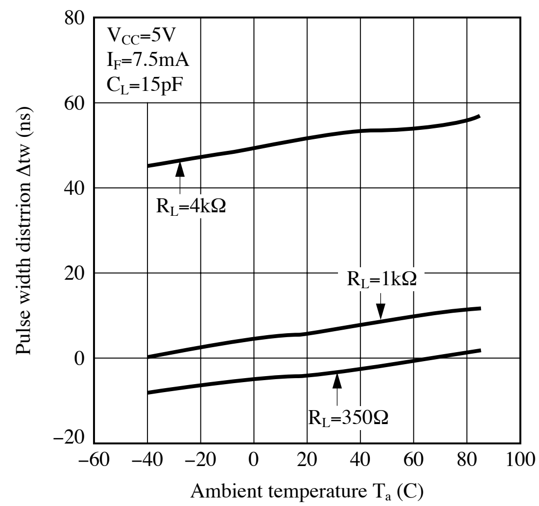
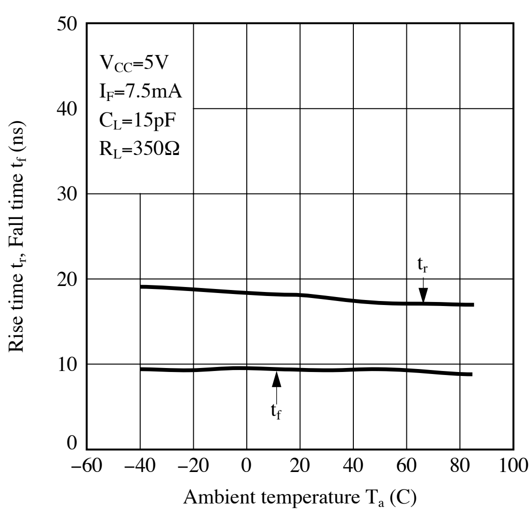


Fig.13 Rise Time / Fall Time vs. Ambient Temperature



Remarks : Please be aware that all data in the graph are just for reference and anot 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
Supply voltage	V_{CC}	4.5	–	5.5	V
Fan out (TTL load)	N	–	–	5	–
Output pull-up resitor	R_L	330	–	4 000	Ω
Operating temperature	T_{opr}	–40	–	+85	˚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.

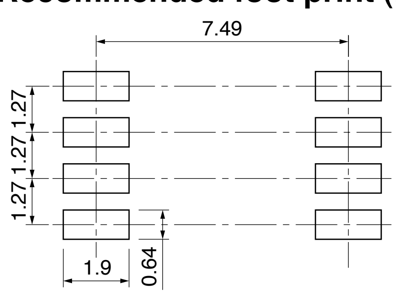
The detector which is used in this device, has parasitic diode between each pins and GND.
There are cases that miss operation or destruction possibly may be occurred if electric potential of any pin becomes below GND level even for instant.
Therefore it shall be recommended to design the circuit that 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 5 years) into the design consideration.
Please decide the input current which become 2 times of MAX. I_{FHL}.

● Recommended foot print (reference)



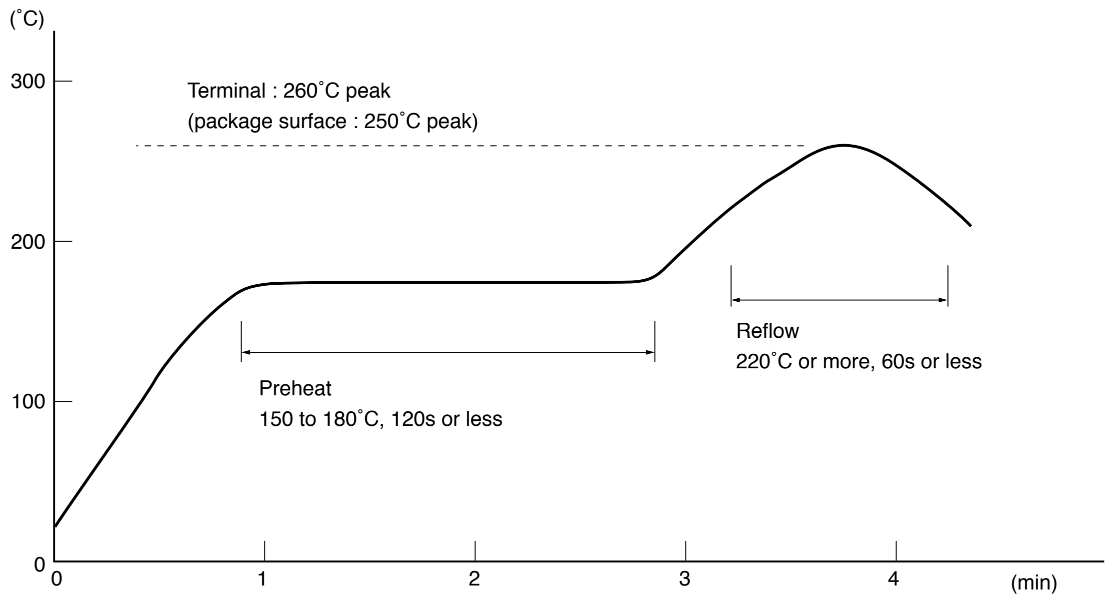
(Unit : mm)

■ 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 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 notice

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 3 minutes 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 product.
Regulation substances : CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform)

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

This product shall not contain the following materials banned in the RoHS Directive (2002/95/EC).

- •Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE).

● Tape and Reel package

SMT Gullwing

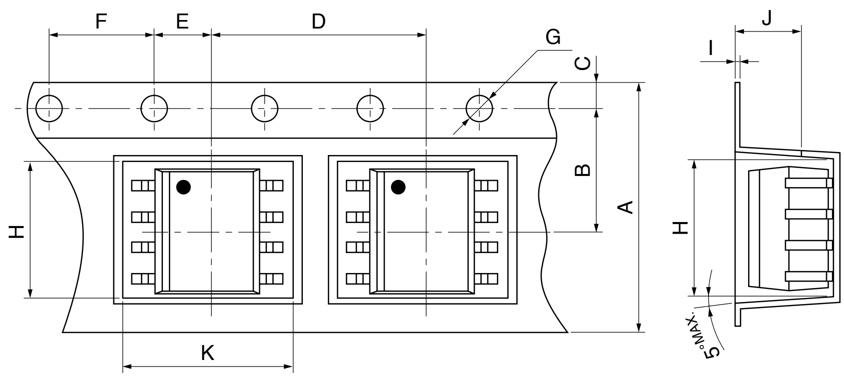
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

Reel : PS

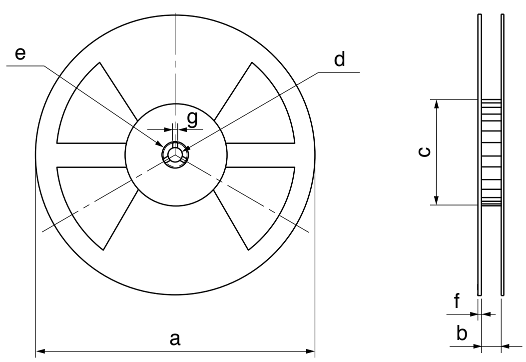
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$12.0^{\pm0.3}$	$5.50^{\pm0.05}$	$1.75^{\pm0.10}$	$8.0^{\pm0.1}$	$2.00^{\pm0.05}$	$4.0^{\pm0.1}$	$\phi1.55^{\pm0.05}$
H	I	J	K			
$5.4^{\pm0.1}$	$0.30^{\pm0.05}$	$3.7^{\pm0.1}$	$6.3^{\pm0.1}$			

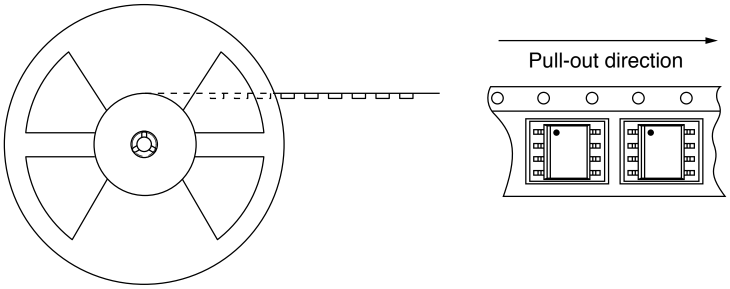
Reel structure and Dimensions



Dimensions List (Unit : mm)

a	b	c	d
$\phi330$	$13.5^{\pm1.5}$	$\phi100^{\pm1}$	$\phi13.0^{\pm0.2}$
e	f	g	
$\phi21.0^{\pm0.8}$	$2.0^{TYP.}$	$2.0^{\pm0.5}$	

Direction of product insertion



[Packing : 1 500pcs/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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