PC1231xNSZ Series

DIP 4pin Reinforced Insulation Type, High CMR, Low Input Current Photocoupler

■ Description

PC1231xNSZ Series contains an IRED optically coupled to a phototransistor.

It is packaged in a 4-pin DIP, available in wide-lead spacing option and SMT gullwing lead-form option.

Input-output isolation voltage(rms) is 5.0kV.

CTR is 50% to 400% at input current of 0.5mA.

■ Features

1. 4pin DIP package
2. Double transfer mold package (Ideal for Flow Soldering)
3. Low input current type (I_F=0.5mA)
4. High resistance to noise due to high common rejection voltage (CMR : MIN. 10kV/μs)
5. Reinforced insulation type (Isolation distance : MIN. 0.4mm)
6. Long creepage distance type (wide lead-form type only : MIN. 8mm)
7. High isolation voltage between input and output ($V_{iso(rms)}$: 5.0kV)

■ Agency approvals/Compliance

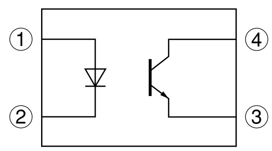
1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. **PC1231**)
2. Approved by BSI, BS-EN60065, file No. 7087, BS-EN60950, file No. 7409, (as model No. **PC1231**)
3. Package resin : UL flammability grade (94V-0)
4. Approved by SEMCO, EN60065, EN60950, file No. 9933036 (as model No. **PC1231**)
5. Approved by DEMCO, EN60065, EN60950, file No. 99-03814 (as model No. **PC1231**)
6. Approved by NEMKO, EN60065, EN60950, file No. P99102251 (as model No. **PC1231**)
7. Approved by FIMKO, EN60065, EN60950, file No. 13986 (as model No. **PC1231**)
8. Recognized by CSA file No. CA095323 (as model No. **PC1231**)
9. Approved by VDE, VDE0884 (as an option) file No. 83601, No. 134349 or No. 40005304(as model No. **PC1231**)

■ Applications

1. Primary to secondary isolation in switch mode power supply
2. Noise suppression in switching circuit
3. Signal transmission between circuits of different potentials and impedances
4. Over voltage detection

Sheet No.: D2-A02902EN
Date Oct. 31. 2003

■ Internal Connection Diagram

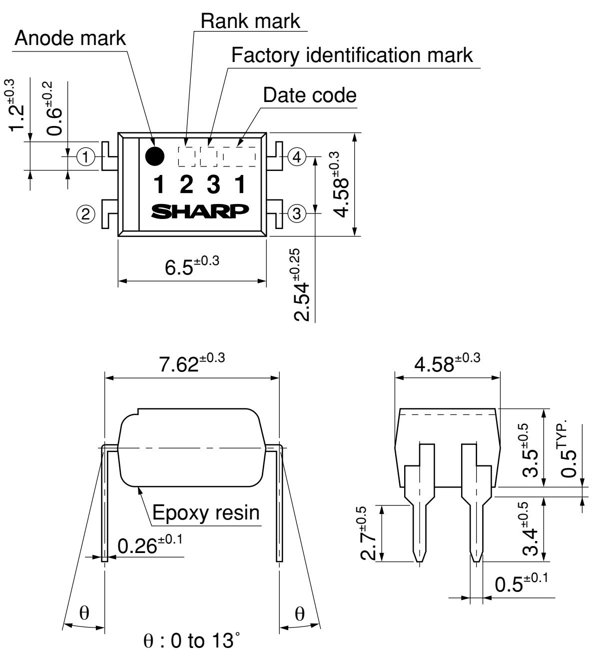


① Anode
② Cathode
③ Emitter
④ Collector

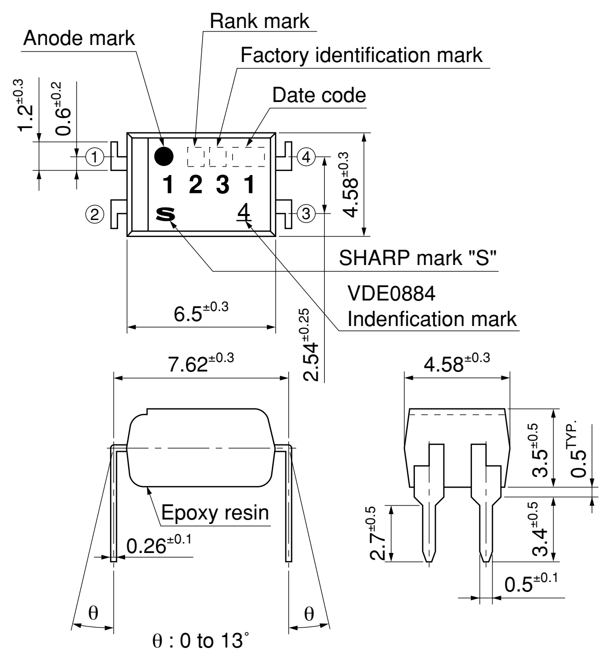
■ Outline Dimensions

(Unit : mm)

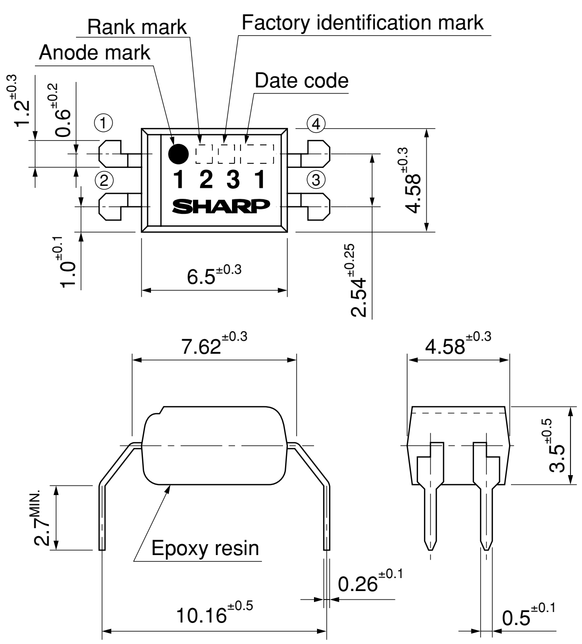
1. Through-Hole [ex. **PC1231xNSZ**]



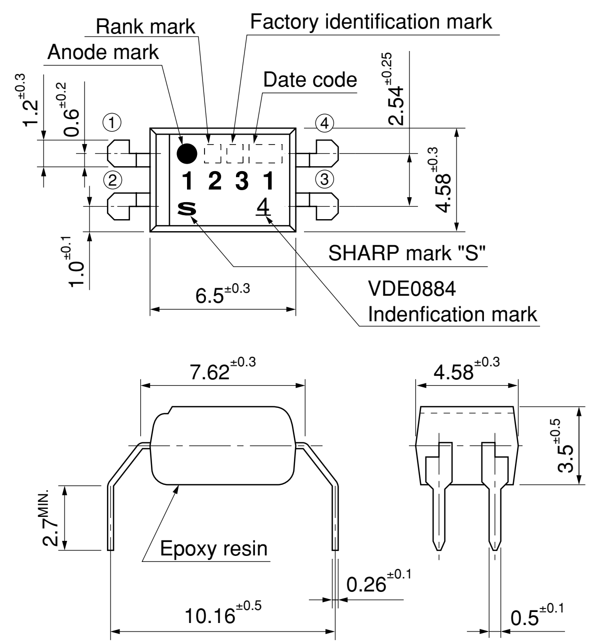
2. Through-Hole [ex. **PC1231xYSZ**]



3. Wide Through-Hole Lead-Form [ex. **PC1231xNFZ**]



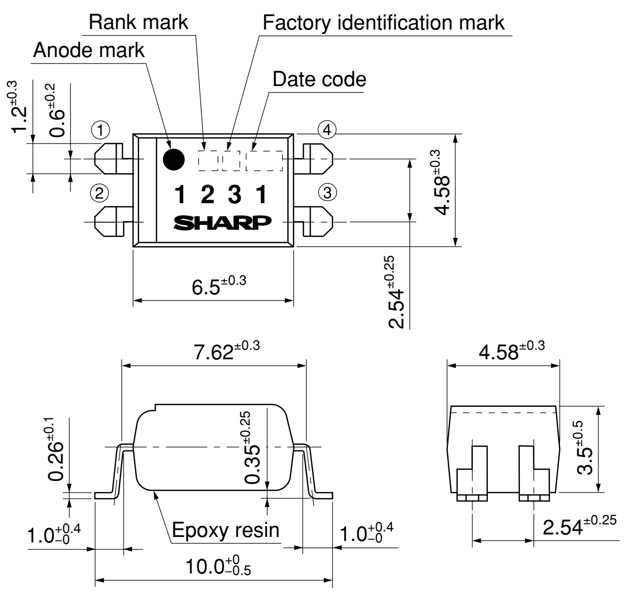
4. Wide Through-Hole Lead-Form [ex. **PC1231xYFZ**]



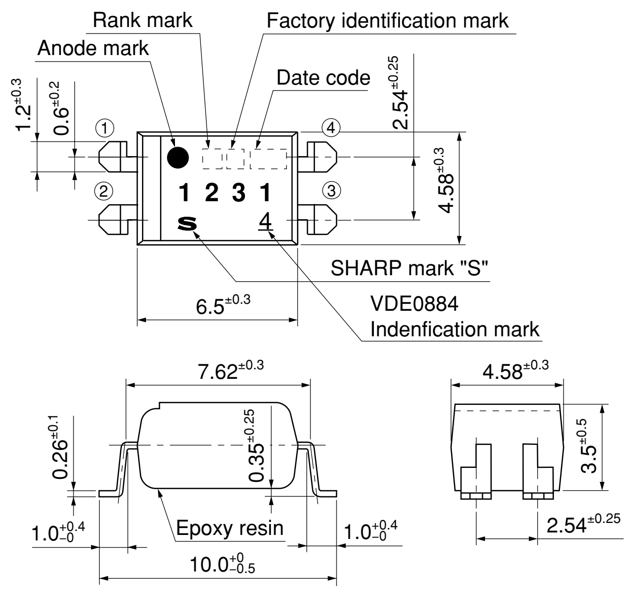
Product mass : approx. 0.18g

(Unit : mm)

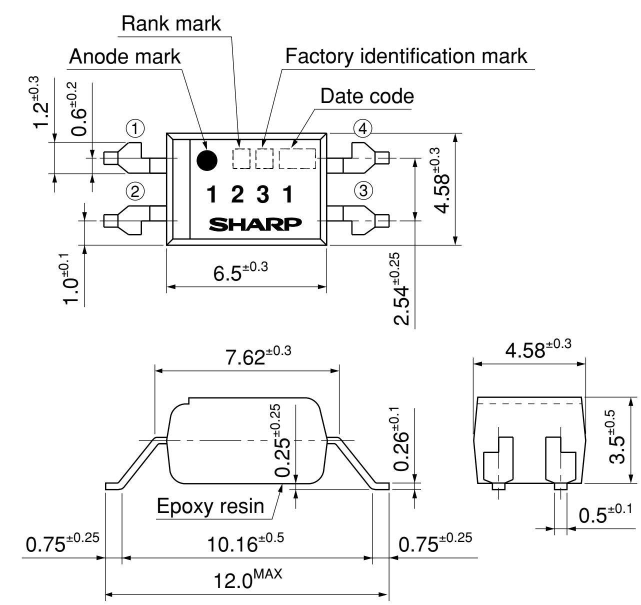
5. SMT Gullwing Lead-Form [ex. **PC1231xNIP**]



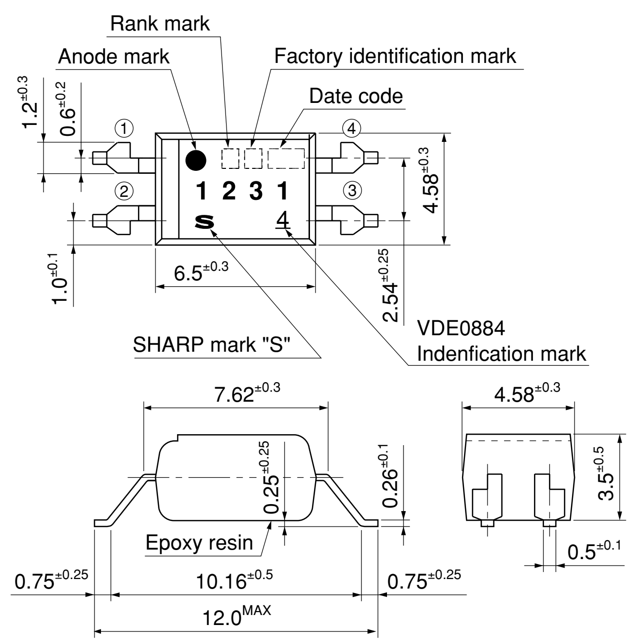
6. SMT Gullwing Lead-Form [ex. **PC1231xYIP**]



7. Wide SMT Gullwing Lead-Form [ex. **PC1231xNUP**]



8. Wide SMT Gullwing Lead-Form [ex. **PC1231xYUP**]



Product mass : approx. 0.18g

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.

Rank mark

Refer to the Model Line-up table

■ Absolute Maximum Ratings

(T_a=25˚C)

Parameter		Symbol	Rating	Unit
Input	Forward current	I_F	10	mA
	*1 Peak forward current	I_{FM}	200	mA
	Reverse voltage	V_R	6	V
	Power dissipation	P	15	mW
Output	Collector-emitter voltage	V_{CEO}	70	V
	Emitter-collector voltage	V_{ECO}	6	V
	Collector current	I_C	50	mA
	Collector power dissipation	P_C	150	mW
Total power dissipation		P_{tot}	170	mW
*2 Isolation voltage		$V_{iso\ (rms)}$	5.0	kV
Operating temperature		T_{opr}	−30 to +100	˚C
Storage temperature		T_{stg}	−55 to +125	˚C
*3 Soldering temperature		T_{sol}	260	˚C

*1 Pulse width≤100µs, Duty ratio : 0.001
*2 40 to 60%RH, AC for 1 minute, f=60Hz
*3 For 10s

■ Electro-optical Characteristics

(T_a=25˚C)

Parameter			Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage		V_F	I_F=10mA	–	1.2	1.4	V
	Reverse current		I_R	V_R=4V	–	–	10	µA
	Terminal capacitance		C_t	V=0, f=1kHz	–	30	250	pF
Output	Collector dark current		I_{CEO}	V_{CE}=50V, I_F=0	–	–	100	nA
	Collector-emitter breakdown voltage		BV_{CEO}	I_C=0.1mA, I_F=0	70	–	–	V
	Emitter-collector breakdown voltage		BV_{ECO}	I_E=10µA, I_F=0	6	–	–	V
Transfer charac-teristics	Collector current		I_C	I_F=0.5mA, V_{CE}=5V	0.25	–	2.0	mA
	Collector-emitter saturation voltage		$V_{CE\ (sat)}$	I_F=10mA, I_C=1mA	–	–	0.2	V
	Isolation resistance		R_{ISO}	DC500V, 40 to 60%RH	5×10^{10}	1×10^{11}	–	Ω
	Floating capacitance		C_f	V=0, f=1MHz	–	0.6	1.0	pF
	Response time	Rise time	t_r	V_{CE}=2V, I_C=2mA, R_L=100Ω	–	4	18	µs
		Fall time	t_f		–	3	18	µs
	Common mode rejection voltage		CMR	V_{CM}=1.5kV(peak), I_F=0 R_L=470Ω, V_{CC}=9V, V_{np}=100mV	10	–	–	kV/µs

■ Model Line-up

Lead Form	Trough-Hole		Wide Trough-Hole		SMT Gullwing		Wide SMT Gullwing		Rank mark	I_C [mA] (I_F=0.5mA, V_{CE}=5V, T_a=25˚C)
Package	Sleeve				Taping					
	100pcs/sleeve				2000pcs/reel					
VDE0884	−	Approved	−	Approved	−	Approved	−	Approved	−	
Model No.	PC12310NSZ	PC12310YSZ	PC12310NFZ	PC12310YFZ	PC12310NIP	PC12310YIP	PC12310NUP	PC12310YUP	with or without	0.25 to 2.0
	PC12311NSZ	PC12311YSZ	PC12311NFZ	PC12311YFZ	PC12311NIP	PC12311YIP	PC12311NUP	PC12311YUP	A	0.5 to 1.25

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

Fig.1 Test Circuit for Common Mode Rejection Voltage

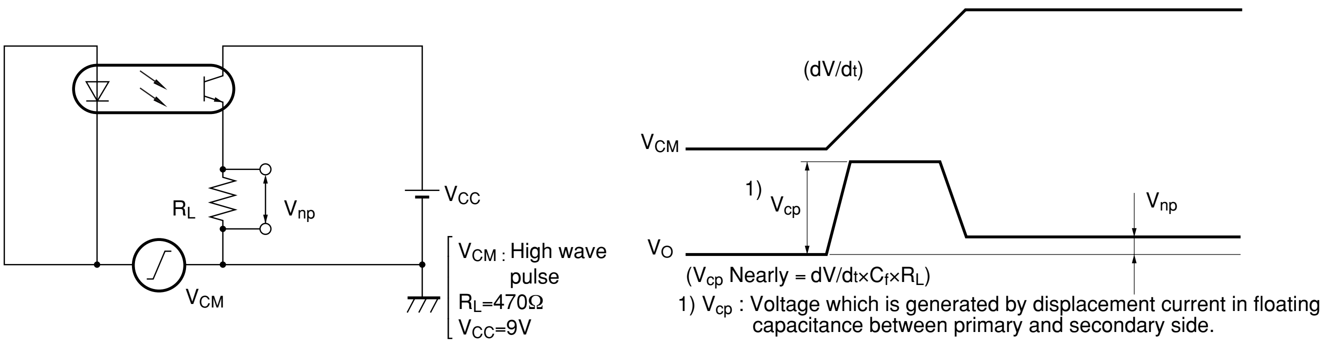


Fig.2 Forward Current vs. Ambient Temperature

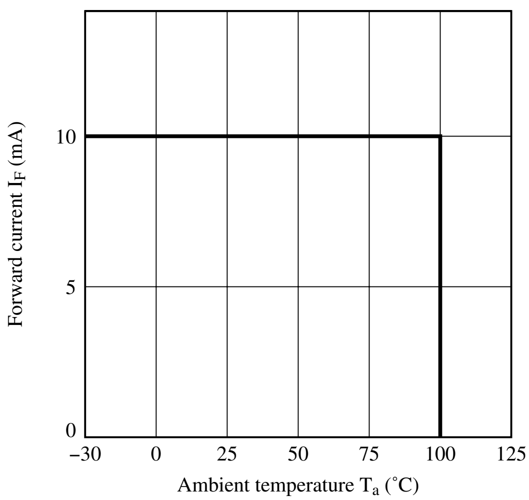


Fig.3 Diode Power Dissipation vs. Ambient Temperature

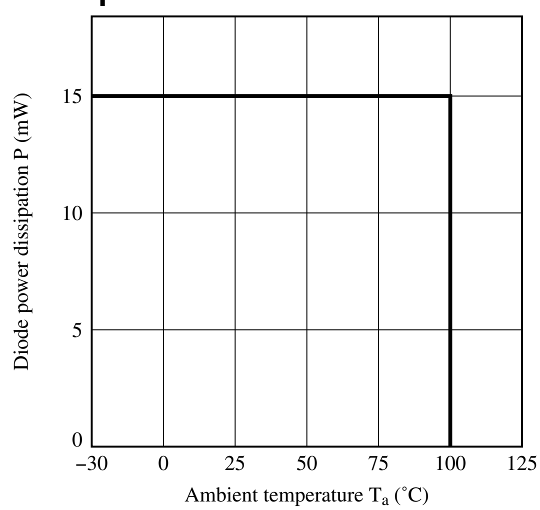


Fig.4 Collector Power Dissipation vs. Ambient Temperature

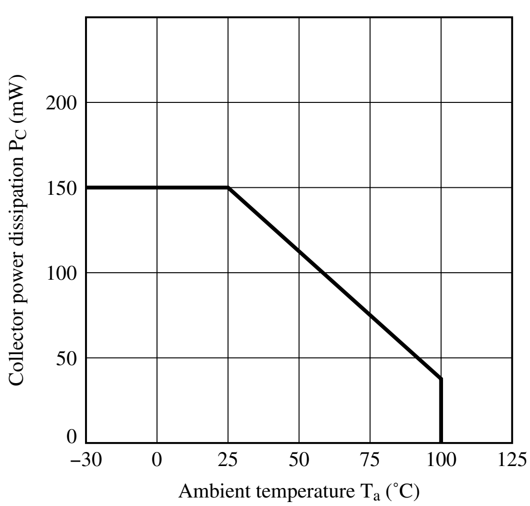


Fig.5 Total Power Dissipation vs. Ambient Temperature

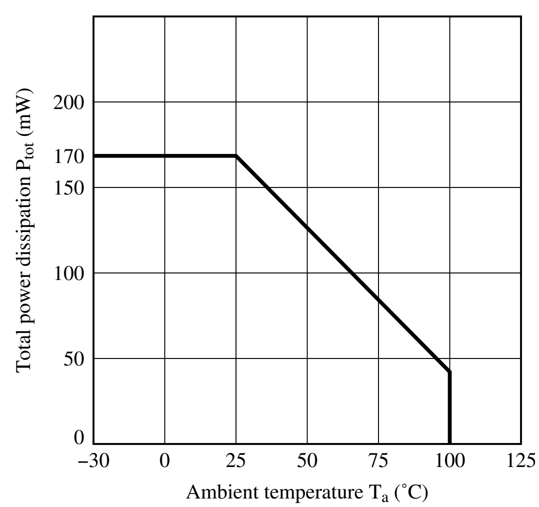


Fig.6 Peak Forward Current vs. Duty Ratio

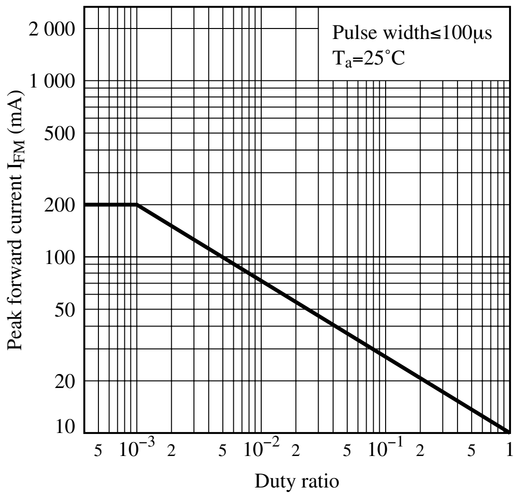


Fig.7 Forward Current vs. Forward Voltage

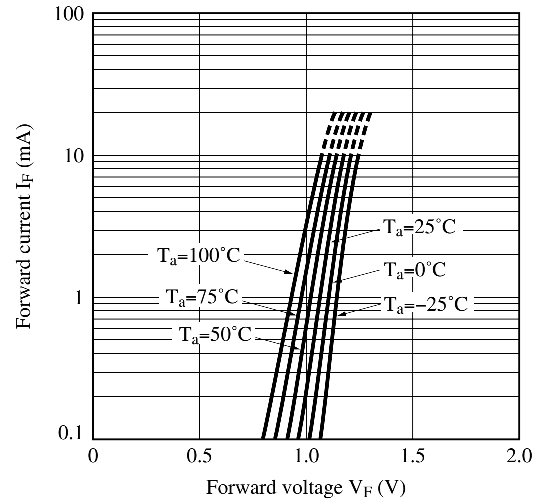


Fig.8 Current Transfer Ratio vs. Forward Current

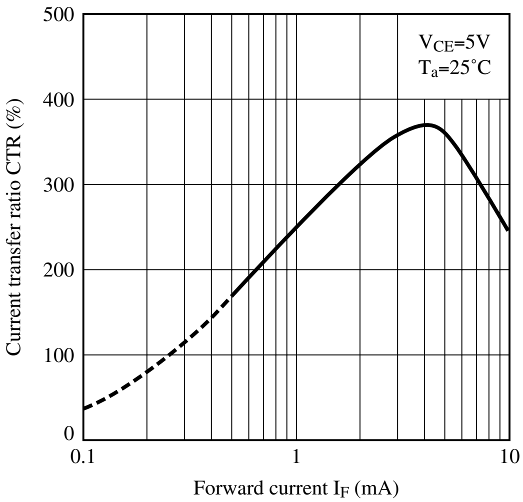


Fig.9 Collector Current vs. Collector-emitter Voltage

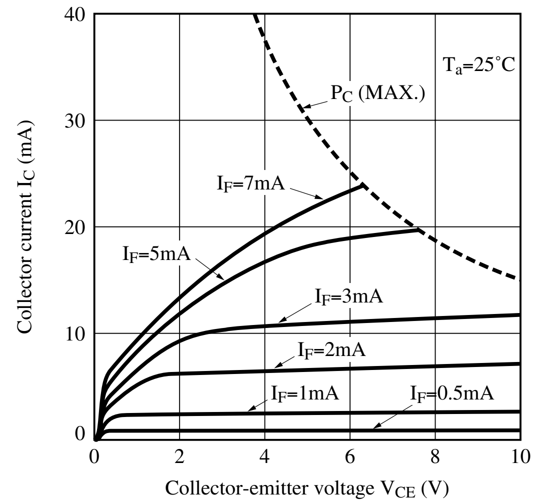


Fig.10 Relative Current Transfer Ratio vs. Ambient Temperature

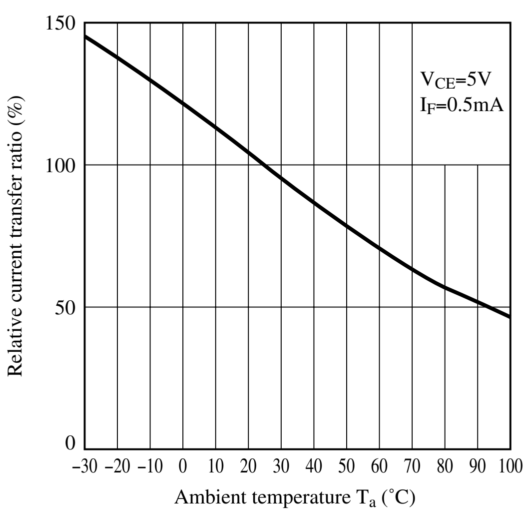


Fig.11 Collector - emitter Saturation Voltage vs. Ambient Temperature

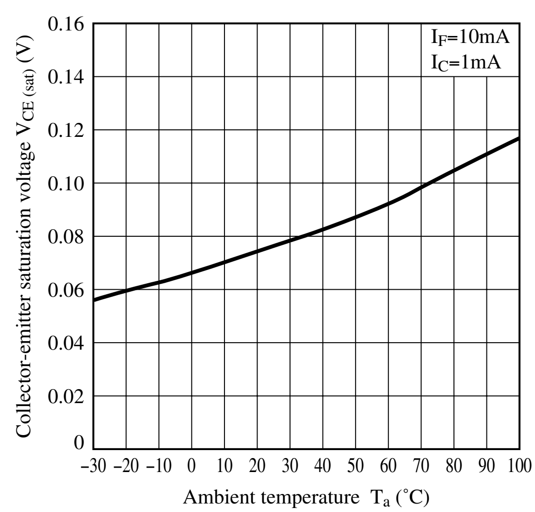


Fig.12 Collector Dark Current vs. Ambient Temperature

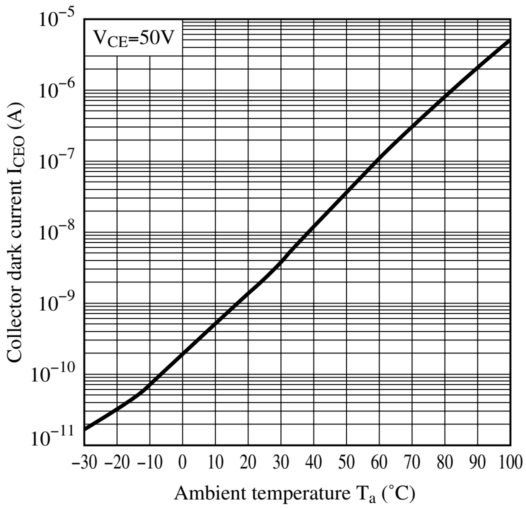


Fig.13 Response Time vs. Load Resistance

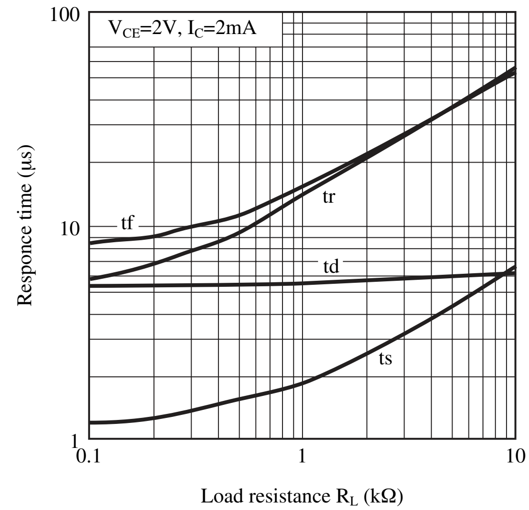
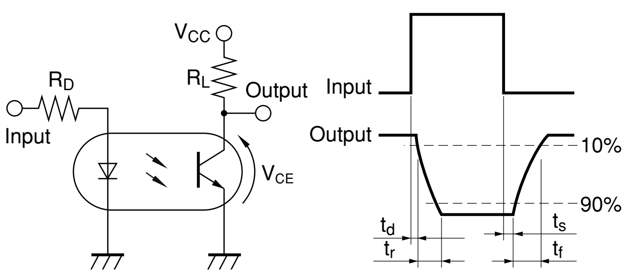


Fig.14 Test Circuit for Response Time



Please refer to the conditions in Fig.13.

Fig.15 Frequency Response

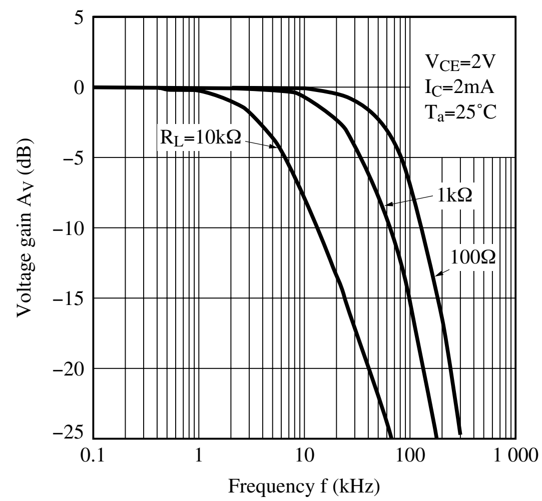
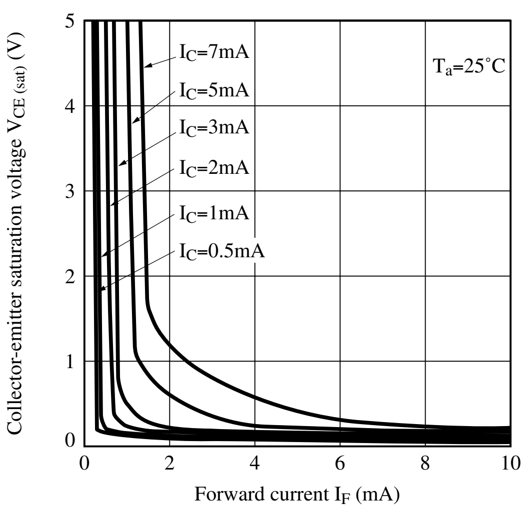


Fig.16 Collector-emitter Saturation Voltage vs. Forward Current



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

■ Design Considerations

● Design guide

While operating at I_F<0.5mA, CTR variation may increase.
Please make design considering this fact.

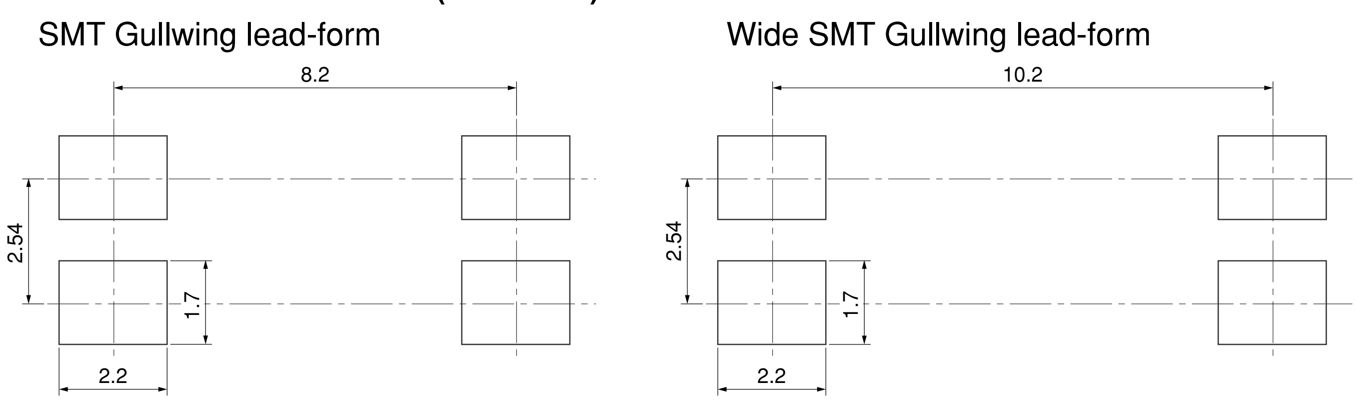
In case that some sudden big noise caused by voltage variation is provided between primary and secondary terminals of photocoupler some current caused by it is floating capacitance may be generated and result in false operation since current may go through IRED or current may change.
If the photocoupler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

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

● Degradation

In general, the emission of the IRED used in photocouplers will degrade over time.
In the case of long term operation, please take the general IRED degradation (50% degradation over 5years) into the design consideration.

● Recommended Foot Print (reference)



(Unit : mm)

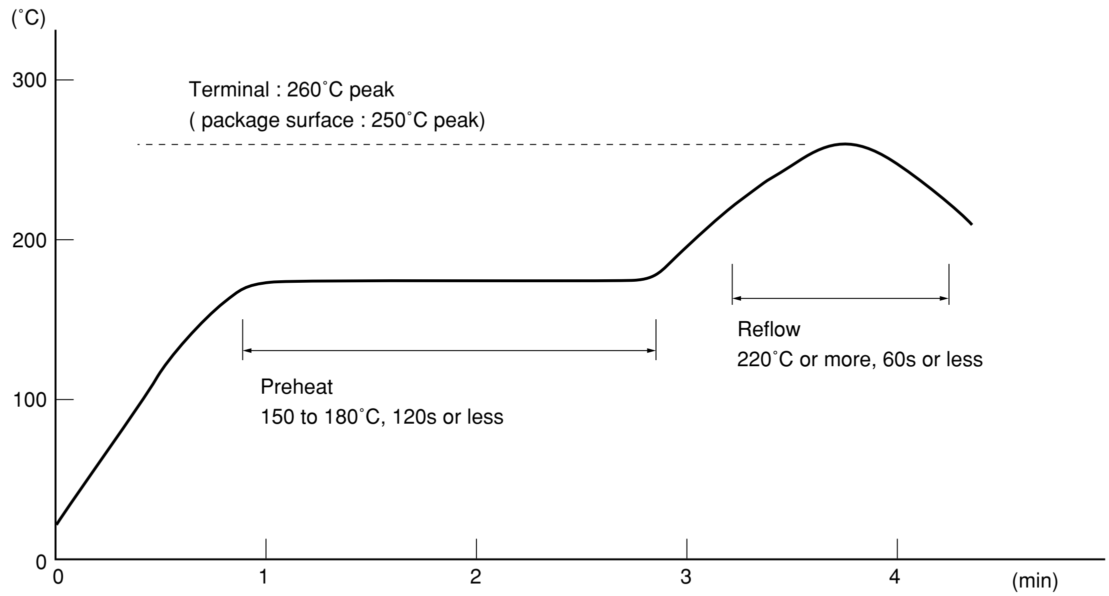
☆ For additional design assistance, please review our corresponding Optoelectronic Application Notes.

■ 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 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

1. Through-Hole

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

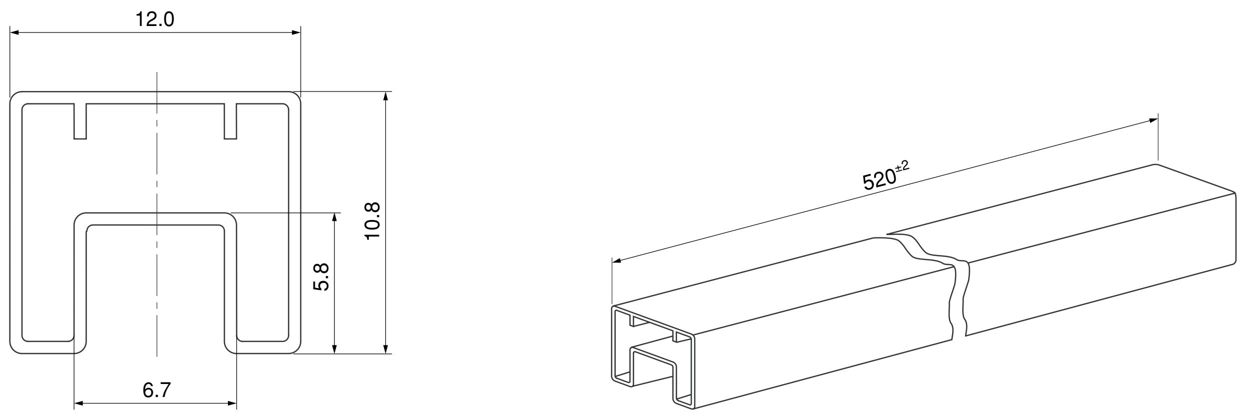
Package method

MAX. 100pcs 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 anode mark on the tabless stopper side.

MAX. 20 sleeves in one case.

Sleeve outline dimensions



(Unit : mm)

2. Wide Through-Hole

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

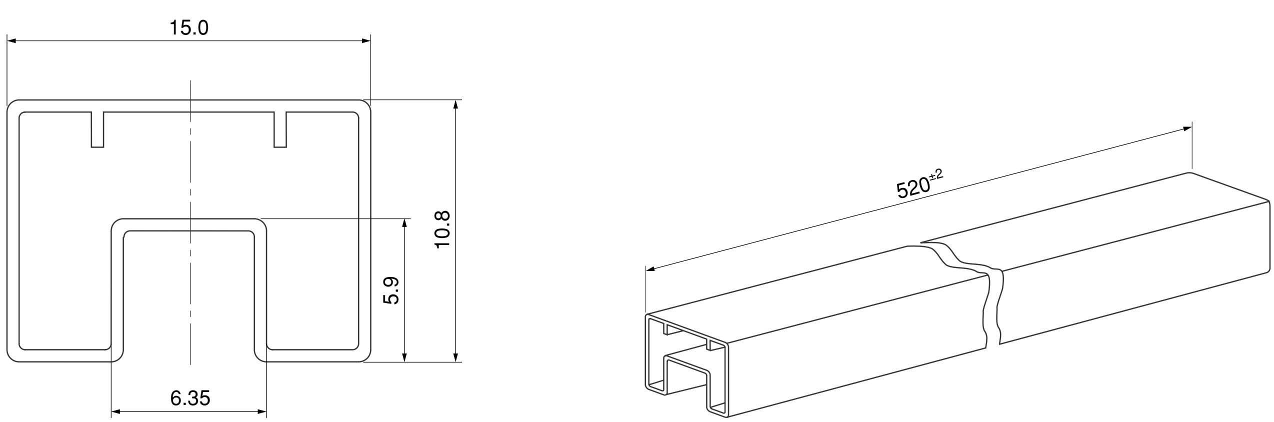
Package method

MAX. 100pcs 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 anode mark on the tabless stopper side.

MAX. 20 sleeves in one case.

Sleeve outline dimensions



(Unit : mm)

● Tape and Reel package

1. SMT Gullwing

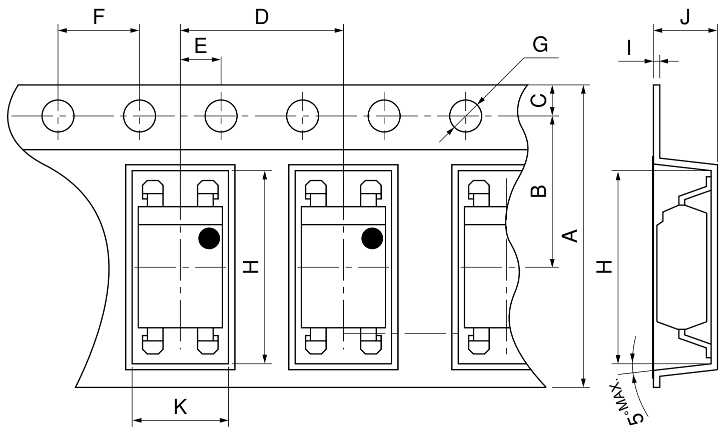
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

Reel : PS

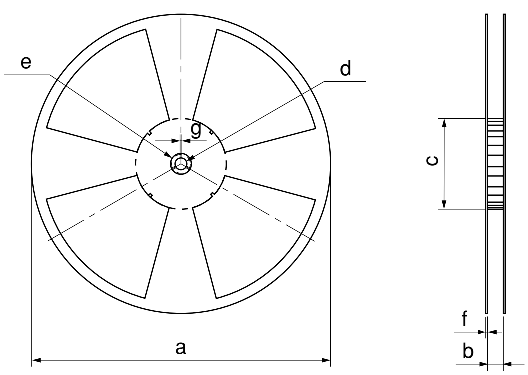
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$16.0^{\pm0.3}$	$7.5^{\pm0.1}$	$1.75^{\pm0.1}$	$8.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi 1.5^{+0.1}_{-0}$
H	I	J	K			
$10.4^{\pm0.1}$	$0.4^{\pm0.05}$	$4.2^{\pm0.1}$	$5.1^{\pm0.1}$			

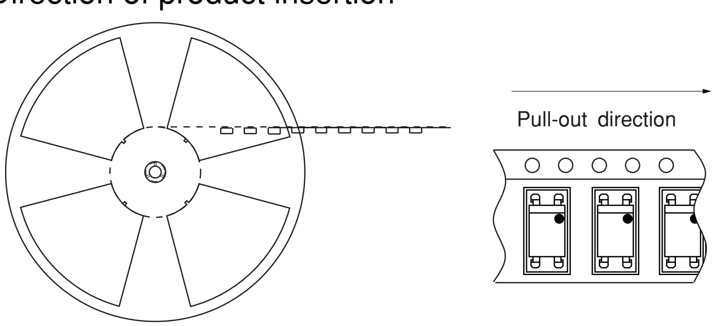
Reel structure and Dimensions



Dimensions List (Unit : mm)

a	b	c	d
330	$17.5^{\pm1.5}$	$100^{\pm1.0}$	$13^{\pm0.5}$
e	f	g	
$23^{\pm1.0}$	$2.0^{\pm0.5}$	$2.0^{\pm0.5}$	

Direction of product insertion



[Packing : 2 000pcs/reel]

2. Wide SMT Gullwing

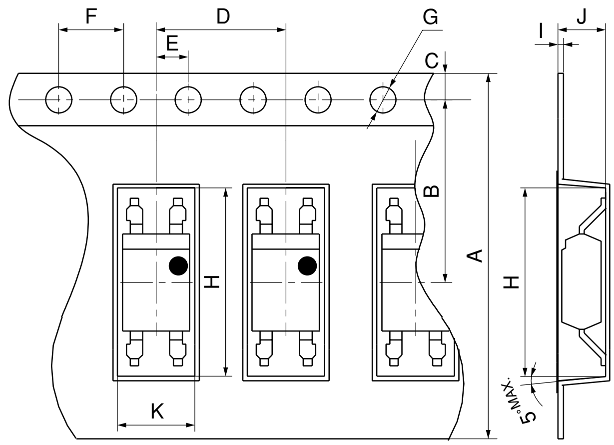
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

Reel : PS

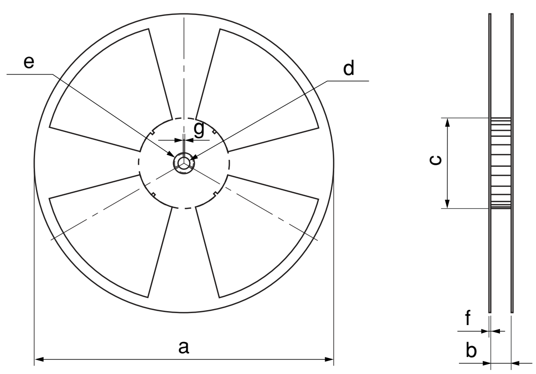
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$24.0^{\pm0.3}$	$11.5^{\pm0.1}$	$1.75^{\pm0.1}$	$8.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi 1.5^{+0.1}_{-0}$
H	I	J	K			
$12.4^{\pm0.1}$	$0.4^{\pm0.05}$	$4.1^{\pm0.1}$	$5.1^{\pm0.1}$			

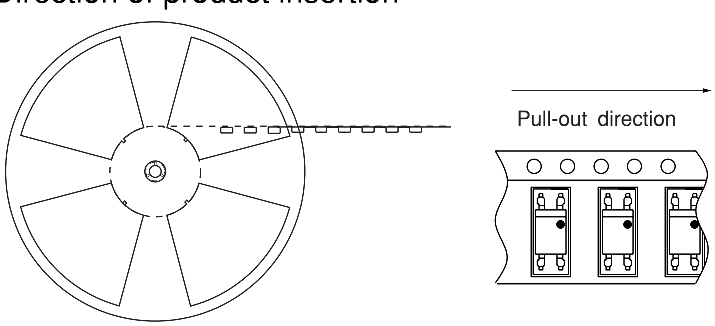
Reel structure and Dimensions



Dimensions List (Unit : mm)

a	b	c	d
330	$22.5^{\pm1.5}$	$100^{\pm1.0}$	$13^{\pm0.5}$
e	f	g	
$23^{\pm1.0}$	$2.0^{\pm0.5}$	$2.0^{\pm0.5}$	

Direction of product insertion



[Packing : 2 000pcs/reel]

■ Important Notices

· The circuit application examples in this publication are provided to explain representative applications of SHARP devices and are not intended to guarantee any circuit design or license any intellectual property rights. SHARP takes no responsibility for any problems related to any intellectual property right of a third party resulting from the use of SHARP's devices.

· Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device. SHARP reserves the right to make changes in the specifications, characteristics, data, materials, structure, and other contents described herein at any time without notice in order to improve design or reliability. Manufacturing locations are also subject to change without notice.

· Observe the following points when using any devices in this publication. SHARP takes no responsibility for damage caused by improper use of the devices which does not meet the conditions and absolute maximum ratings to be used specified in the relevant specification sheet nor meet the following conditions:

(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).

· If the SHARP devices listed in this publication fall within the scope of strategic products described in the Foreign Exchange and Foreign Trade Law of Japan, it is necessary to obtain approval to export such SHARP devices.

· Contact and consult with a SHARP representative if there are any questions about the contents of this publication.