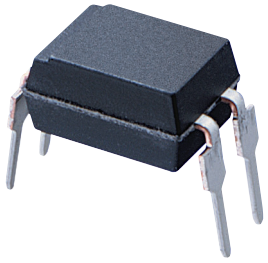
PC3ST21NSZ Series

*Non-zero cross type is also available.
(**PC3ST11NSZ Series**)

V_{DRM} : 600V, Zero cross type
DIP 4pin
Phototriac Coupler for triggering



■ Description

PC3ST21NSZ Series Phototriac Coupler include an infrared emitting diode (IRED) optically coupled to an output Phototriac.

These devices feature full wave control and are ideal isolated drivers for medium to high current Triacs.

DIP package provides 5.0kV isolation from input to output with superior commutative noise immunity.

■ Features

1. High repetitive peak off-state voltage (V_{DRM} : 600V)
2. Zero crossing functionality (V_{OX} : MAX. 20V)
3. I_{FT} ranks available (see Model Line-up section in this datasheet)
4. 4 pin DIP package
5. Superior noise immunity (dV/dt : MIN. 1 000V/μs)
6. Lead-free components are also available (see Model Line-up section in this datasheet)
7. Double transfer mold construction (Ideal for Flow Soldering)
8. 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. **3ST21**)
2. Approved by CSA, file No. CA95323 (as model No. **3ST21**)
3. Package resin : UL flammability grade (94V-0)

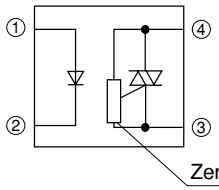
* DIN EN60747-5-2 (successor standard of DIN VDE0884) approved type is also available. (**PC3SH21YFZ Series**)

■ Applications

1. Triggering for Triacs used to switch on and off devices which require AC Loads.
   For example heaters, fans, motors, solenoids, and valves.
2. AC line control in power supply applications.

Sheet No.: D2-A07101EN
Date Mar. 31. 2004

■ Internal Connection Diagram

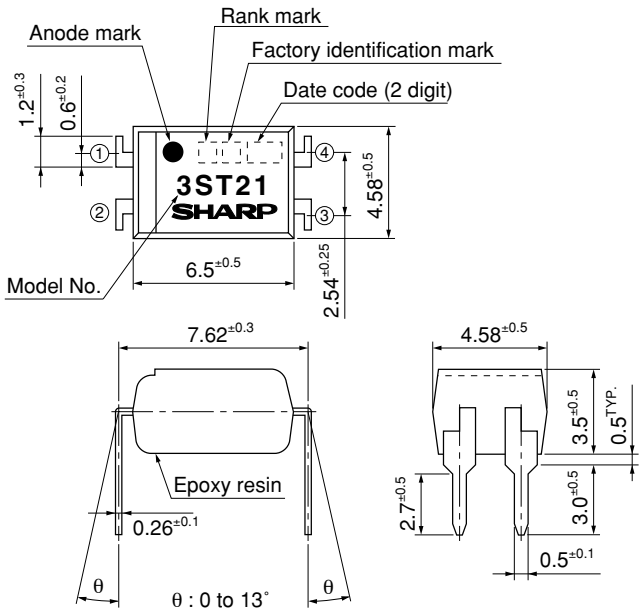


① Anode
② Cathode
③ Anode/Cathode
④ Cathode/Anode

■ Outline Dimensions

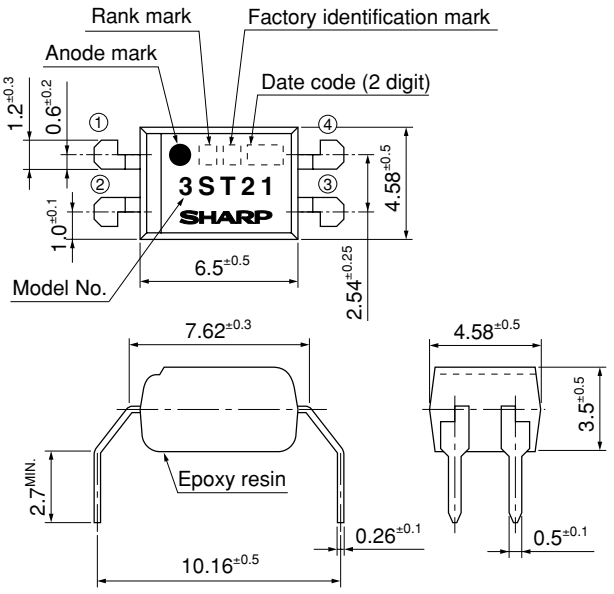
(Unit : mm)

1. Through-Hole [ex. **PC3ST21NSZ**]



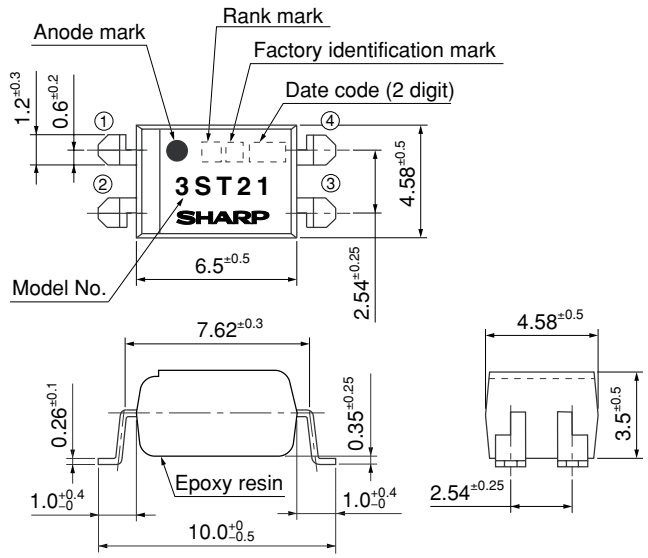
Product mass : approx. 0.23g

2. Wide Through-Hole Lead-Form [ex. **PC3ST21NFZ**]



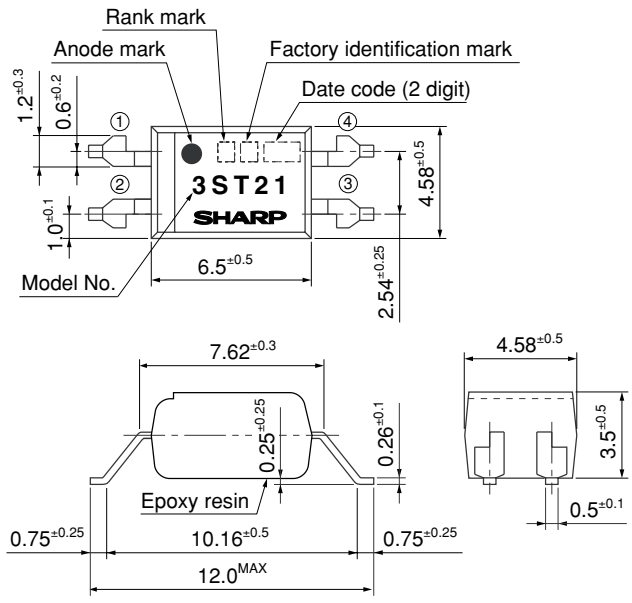
Product mass : approx. 0.23g

3. SMT Gullwing Lead-Form [ex. **PC3ST21NIP**]



Product mass : approx. 0.21g

4. Wide SMT Gullwing Lead-Form [ex. **PC3ST21NUP**]



Product mass : approx. 0.22g

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 actural status of the production.

Rank mark

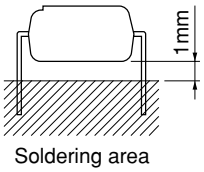
Refer to the Model Line-up table

■ Absolute Maximum Ratings

(T_a=25˚C)

Parameter		Symbol	Rating	Unit
Input	Forward current	I_F	50	mA
	Reverse voltage	V_R	6	V
Output	RMS ON-state current	I_T(rms)	0.1	A
	Peak one cycle surge current	I_{surge}	1.2 *3	A
	Repetitive peak OFF-state voltage	V_{DRM}	600	V
*1Isolation voltage		V_{iso}(rms)	5.0	kV
Operating temperature		T_{opr}	−30 to +100	˚C
Storage temperature		T_{stg}	−55 to +125	˚C
*2Soldering temperature		T_{sol}	270 *4	˚C

*1 40 to 60%RH, AC for 1minute, f=60Hz
*2 For 10s
*3 f=50Hz sine wave
*4 Lead solder plating models: 260˚C



■ Electro-optical Characteristics

(T_a=25˚C)

Parameter			Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage		V_F	I_F=20mA	–	1.2	1.4	V
	Reverse current		I_R	V_R=3V	–	–	10	μA
Output	Repentitive peak OFF-state current		I_{DRM}	V_D=V_{DRM}	–	–	1	μA
	ON-state voltage		V_T	I_T=0.1A	–	–	3.0	V
	Holding current		I_H	V_D=4V	0.1	–	3.5	mA
	Critical rate of rise of OFF-state voltage		dV/dt	V_D=1/√2 ·V_{DRM}	1 000	2 000	–	V/μs
	Zero cross voltage	Rank B	V_{OX}	I_F=15mA, Resistance load	–	–	20	V
		Rank C		I_F=8mA, Resistance load				
Transfer characteristics	Minimum trigger current	Rank B	I_{FT}	V_D=4V, R_L=100Ω	–	–	7	mA
		Rank C					5	
	Isolation resistance		R_{ISO}	DC500V,40 to 60%RH	5×10^{10}	10^{11}	–	Ω
	Turn-on time		t_{on}	V_D=4V, R_L=100Ω, I_F=20mA	–	–	50	μs

■ Model Line-up (1) (Lead-free components)

Lead Form	Through-Hole		SMT Gullwing		Wide Through-Hole		Rank mark	I_{FT}[mA] (V_D=4V, R_L=100Ω)
Shipping Package	Sleeve 100pcs/sleeve							
DIN EN60747-5-2	—	Approved	—	Approved	—	Approved		
Model No.	PC3ST21NSZBF	—	PC3ST21NIZBF	—	PC3ST21NFZBF	—	B	MAX.7
	PC3ST21NSZCF	—	PC3ST21NIZCF	—	PC3ST21NFZCF	—	C	MAX.5

Lead Form	Wide SMT Gullwing		SMT Gullwing		Wide SMT Gullwing		Rank mark	I_{FT}[mA] (V_D=4V, R_L=100Ω)
Shipping Package	Sleeve 100pcs/sleeve		Taping 2 000pcs/reel					
DIN EN60747-5-2	—	Approved	—	Approved	—	Approved		
Model No.	PC3ST21NUZBF	—	PC3ST21NIPBF	—	PC3ST21NUPBF	—	B	MAX.7
	PC3ST21NUZCF	—	PC3ST21NIPCF	—	PC3ST21NUPCF	—	C	MAX.5

■ Model Line-up (2) (Lead solder plating components)

Lead Form	Through-Hole		SMT Gullwing		Wide Through-Hole		Rank mark	I_{FT}[mA] (V_D=4V, R_L=100Ω)
Shipping Package	Sleeve 100pcs/sleeve							
DIN EN60747-5-2	—	Approved	—	Approved	—	Approved		
Model No.	PC3ST21NSZB	—	PC3ST21NIZB	—	PC3ST21NFZB	—	B	MAX.7
	PC3ST21NSZC	—	PC3ST21NIZC	—	PC3ST21NFZC	—	C	MAX.5

Lead Form	Wide SMT Gullwing		SMT Gullwing		Wide SMT Gullwing		Rank mark	I_{FT}[mA] (V_D=4V, R_L=100Ω)
Shipping Package	Sleeve 100pcs/sleeve		Taping 2 000pcs/reel					
DIN EN60747-5-2	—	Approved	—	Approved	—	Approved		
Model No.	PC3ST21NUZB	—	PC3ST21NIPB	—	PC3ST21NUPB	—	B	MAX.7
	PC3ST21NUZC	—	PC3ST21NIPC	—	PC3ST21NUPC	—	C	MAX.5

Please contact a local SHARP sales representative to inquire about production status.

Fig.1 Forward Current vs. Ambient Temperature

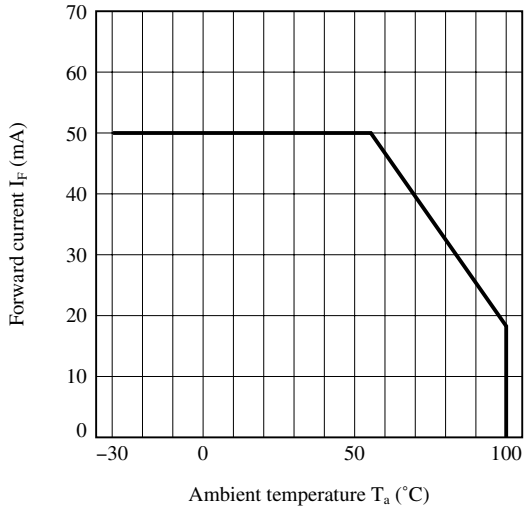


Fig.2 RMS ON-state Current vs. Ambient Temperature

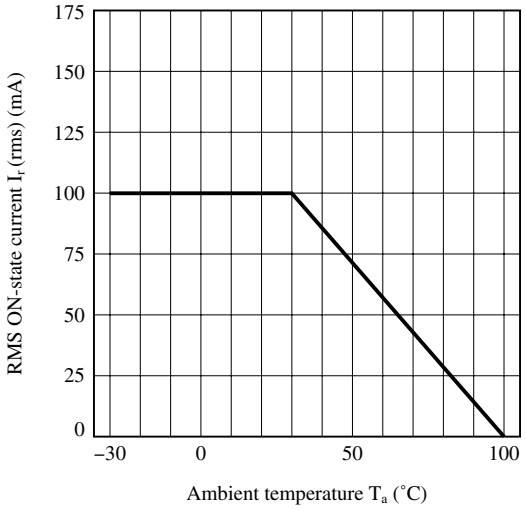


Fig.3-a Forward Current vs. Forward Voltage (Rank B)

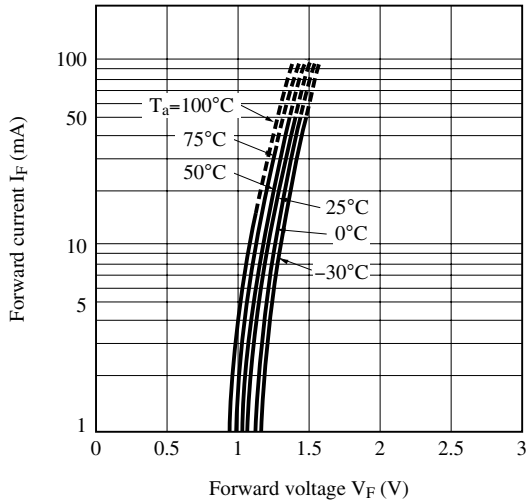


Fig.3-b Forward Current vs. Forward Voltage (Rank C)

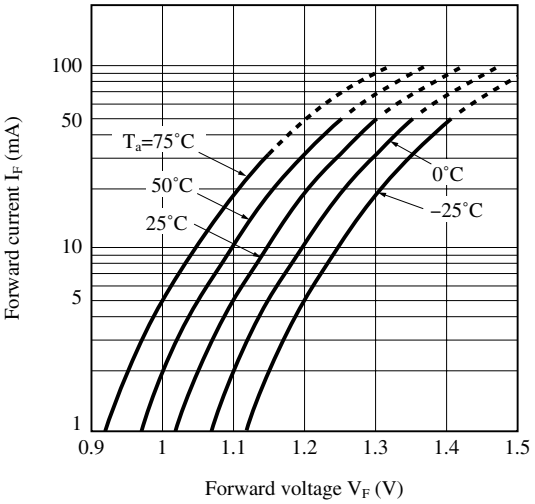


Fig.4-a Minimum Trigger Current vs. Ambient Temperature (Rank B)

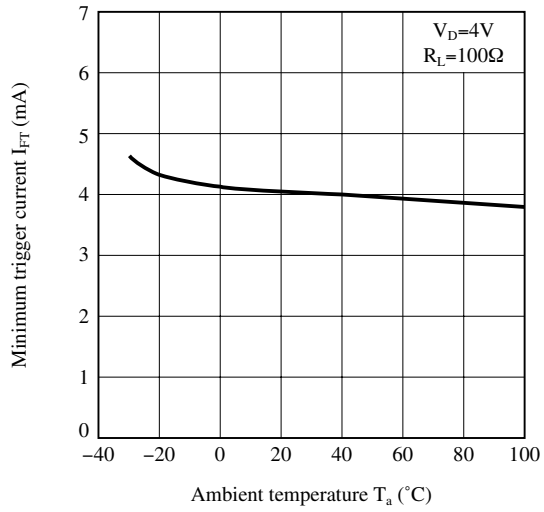


Fig.4-b Minimum Trigger Current vs. Ambient Temperature (Rank C)

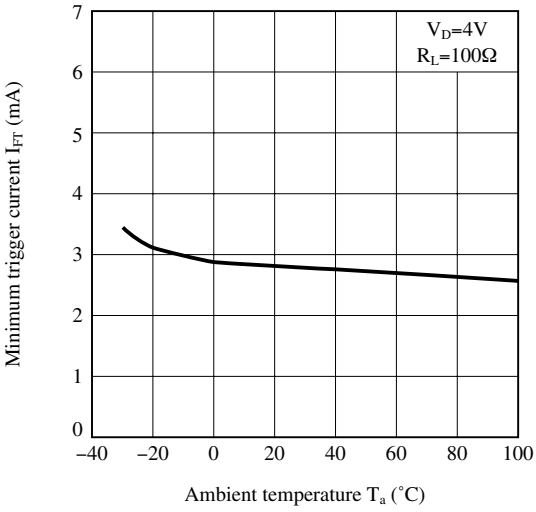


Fig.5 Relative Repetitive Peak OFF-state Voltage vs. Ambient Temperature

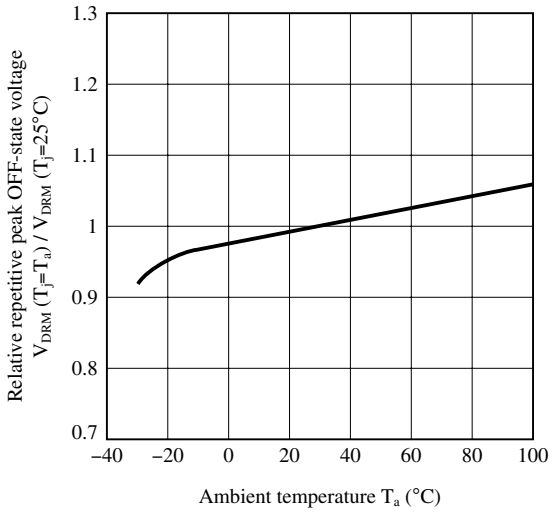


Fig.6 ON-state Voltage vs. Ambient Temperature

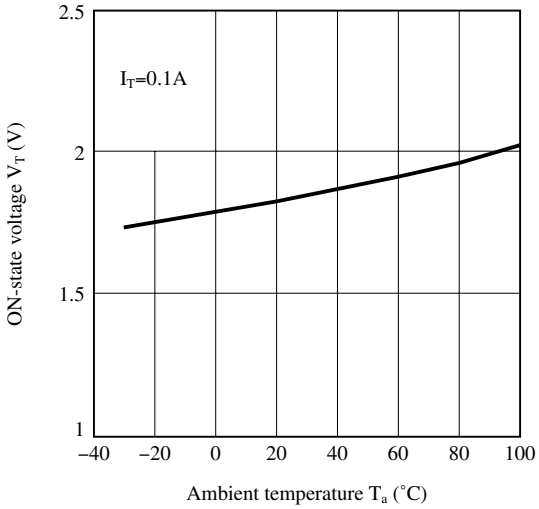


Fig.7 Holding Current vs. Ambient Temperature

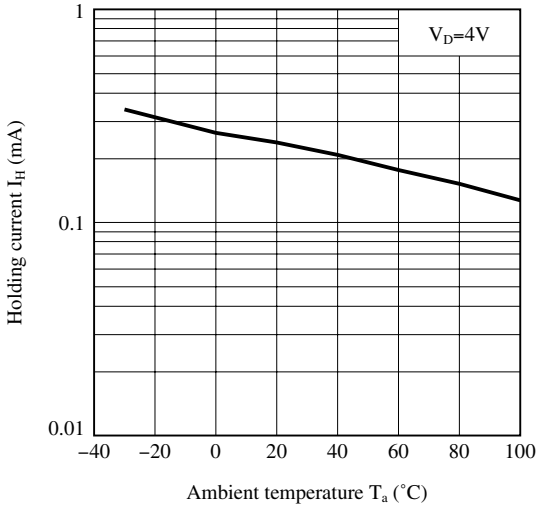


Fig.8 Repetitive Peak OFF-state Current vs. Ambient Temperature

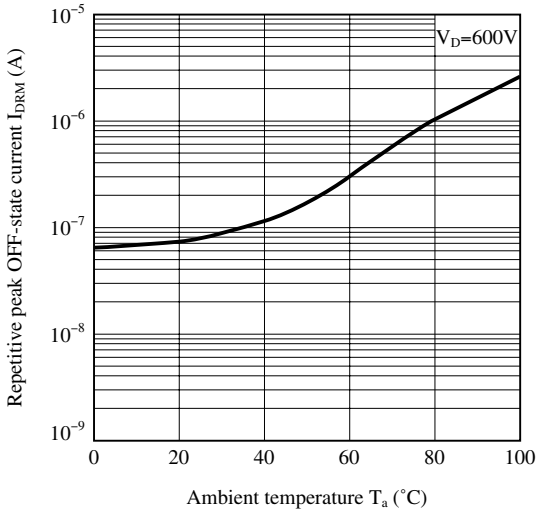


Fig.9-a Zero-cross Voltage vs. Ambient Temperature (Rank B)

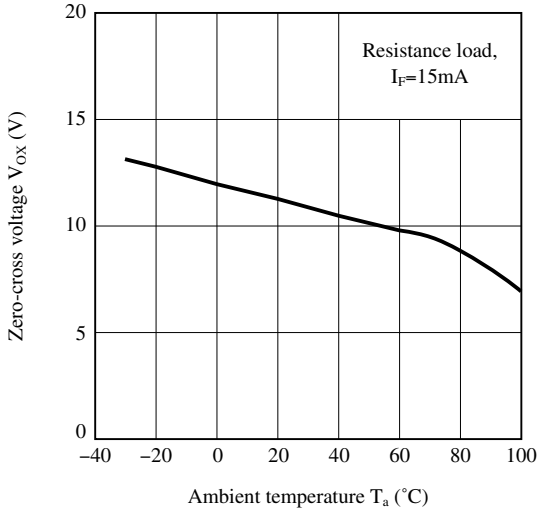
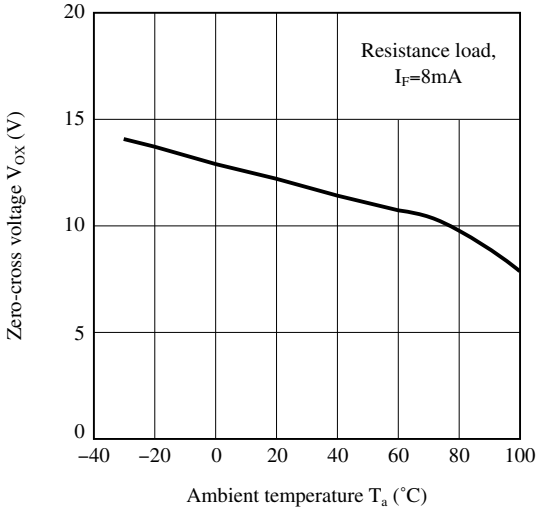


Fig.9-b Zero-cross Voltage vs. Ambient Temperature (Rank C)



Remarks : Please be aware that all data in the graph are just for reference.

■ Design Considerations

● Design guide

In order for the Phototriac to turn off, the triggering current (I_F) must be 0.1mA or less.

Please refrain from using these devices in a direct drive configuration. These Phototriac Coupler are intended to be used as triggering device for main Triacs. Please ensure that the output rating of these devices will be sufficient for triggering the main output Triac of your choice. Failure to do may result in malfunctions.

For applications with inductive loads such as motors,please use caution in utilizing a zero crossing type Phototraiac Coupler as this may cause undesired operations due to the phase difference between voltage and current of load.

For designs that will experience excessive noise or sudden changes in load voltage, please include an appropriate snubber circuit as shown in the below circuit. Please keep in mind the Sharp Phototriac Coupler incorporate superrior dV/dt ratings which can eliminate the need for a snubber circuit.

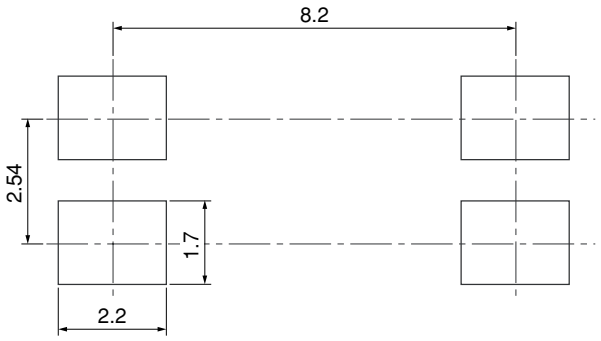
For over voltage protection, a Varistor may be used.

● Degradation

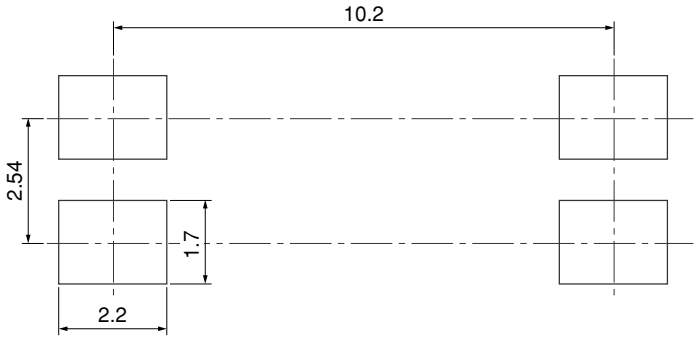
In general, the emission of the IRED used in Phototriac Couplers will degrade over time.
In the case where long term operation and / or constant extreme temperature fluctuations will be applied to the devices, please allow for a worst case scenario of 50% degradation over 5years.
Therefore in order to maintain proper operation, a design implementing these Phototriac Couplers should provide at least twice the minimum required triggering current from initial operation.

● Recommended Foot Print (reference)

SMT Gullwing Lead-form

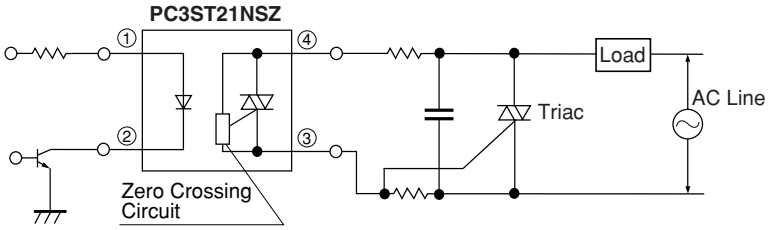


Wide SMT Gullwing Lead-form



(Unit : mm)

● Standard Circuit (Medium/High Power Triac Drive Circuit)



Note) Please add the snubber circuit according to a condition.
Any snubber or varistor used for the above mentioned scenarios should be located as close to the main output triac as possible.

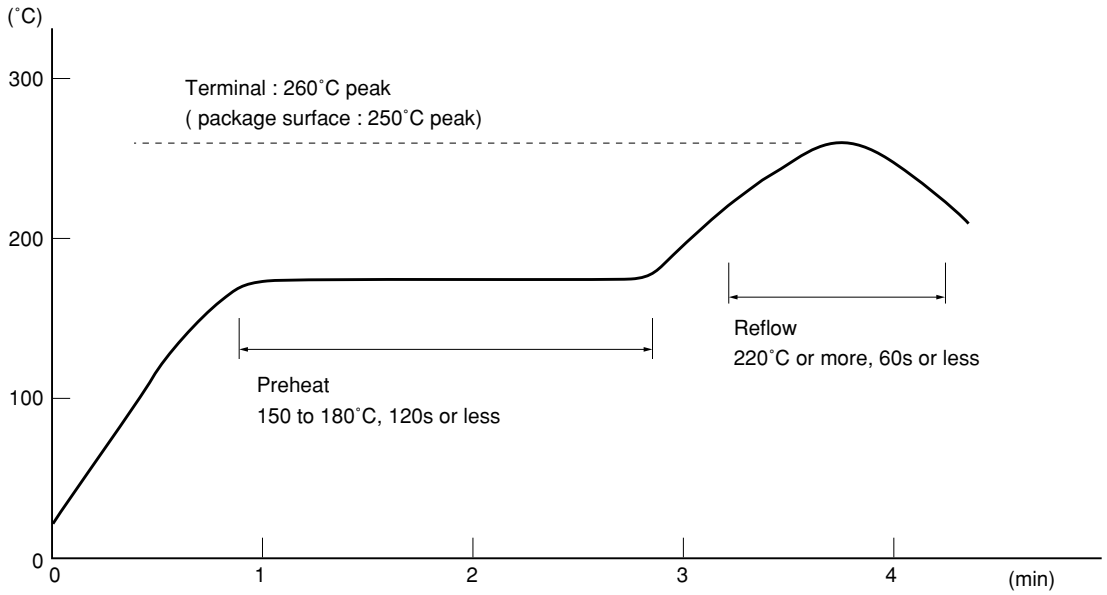
☆ For additional design assistance, please review our corresponding Optoelectronic Application Notes.

■ 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 or SMT Gullwing

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

Package method

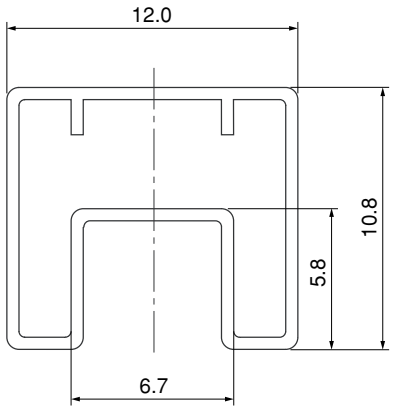
MAX. 100pcs of products shall be packaged in a sleeve.

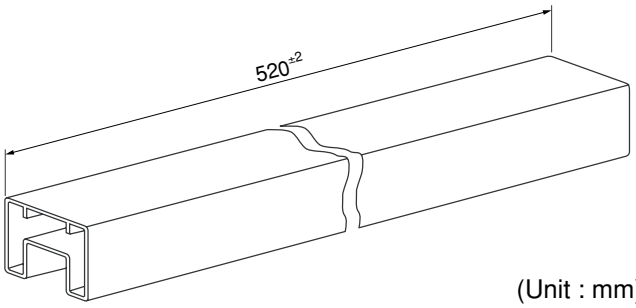
Both ends shall be closed by tabbed and tabless stoppers.

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 or Wide SMT Gullwing

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

Package method

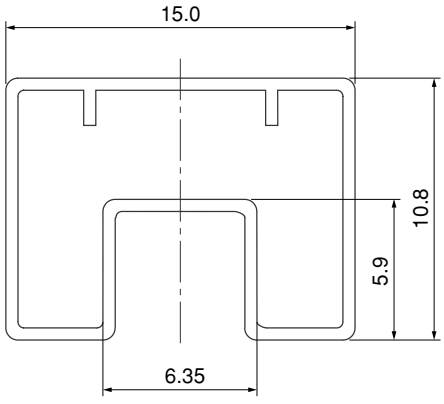
MAX. 100pcs of products shall be packaged in a sleeve.

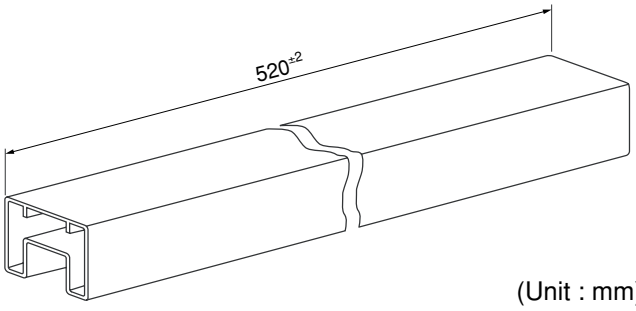
Both ends shall be closed by tabbed and tabless stoppers.

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

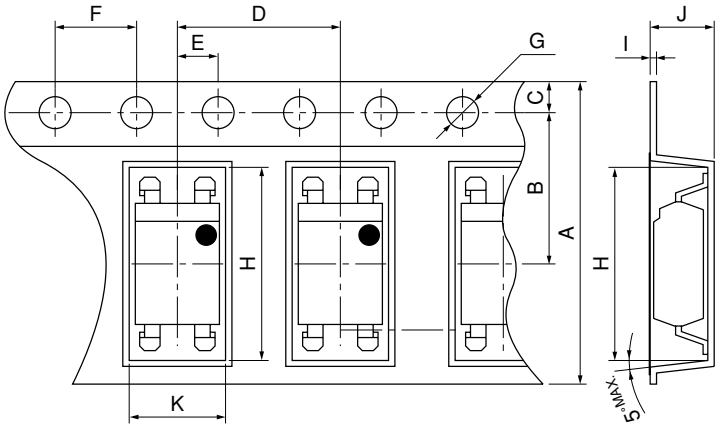
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

Reel : PS

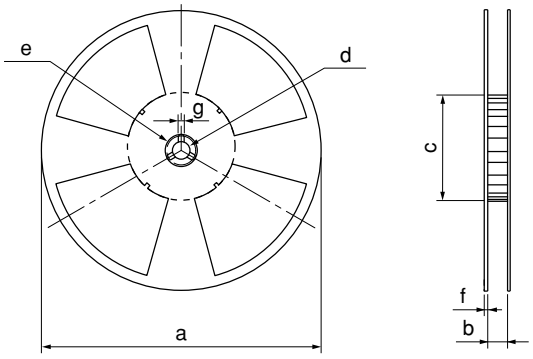
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$16.0^{\pm0.3}$	$7.5^{\pm0.1}$	$1.75^{\pm0.1}$	$8.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi1.5^{+0.1}_{-0}$
H	I	J	K			
$10.4^{\pm0.1}$	$0.4^{\pm0.05}$	$4.2^{\pm0.1}$	$5.1^{\pm0.1}$			

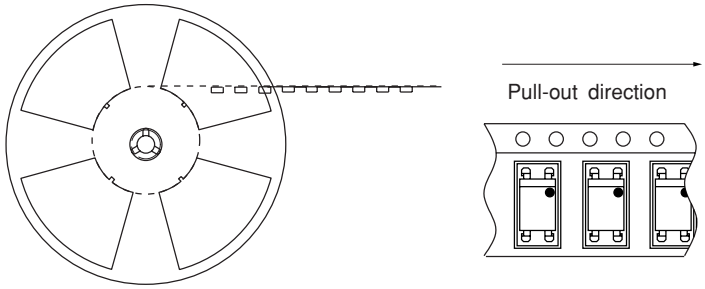
Reel structure and Dimensions



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

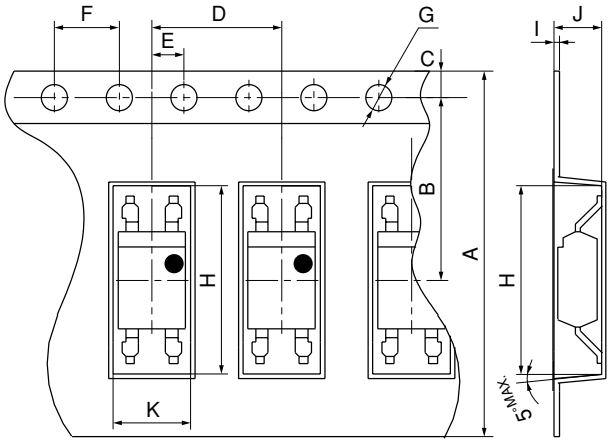
Package materials

Carrier tape : PS

Cover tape : PET (three layer system)

Reel : PS

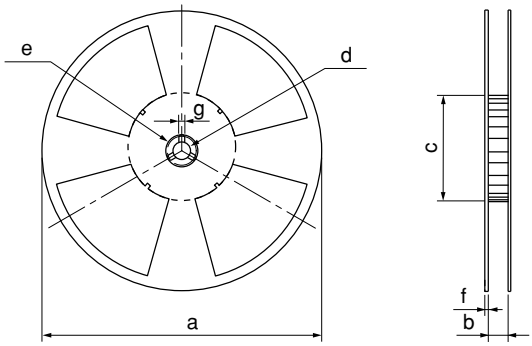
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$24.0^{\pm0.3}$	$11.5^{\pm0.1}$	$1.75^{\pm0.1}$	$8.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi1.5^{+0.1}_{-0}$
H	I	J	K			
$12.4^{\pm0.1}$	$0.4^{\pm0.05}$	$4.1^{\pm0.1}$	$5.1^{\pm0.1}$			

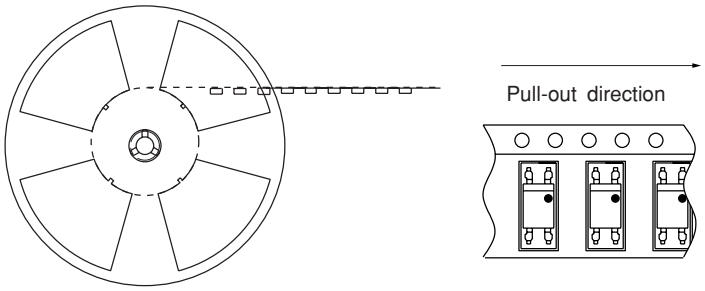
Reel structure and Dimensions



Dimensions List (Unit : mm)

a	b	c	d
330	$25.5^{\pm1.5}$	$100^{\pm1.0}$	$13^{\pm0.5}$
e	f	g	
$23^{\pm1.0}$	$2.0^{\pm0.5}$	$2.0^{\pm0.5}$	

Direction of product insertion



[Packing : 2 000pcs/reel]

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--- Telecommunication equipment [terminal]
--- Test and measurement equipment
--- Industrial control
--- Audio visual equipment
--- Consumer electronics

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--- Traffic signals
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--- Alarm equipment
--- Various safety devices, etc.

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