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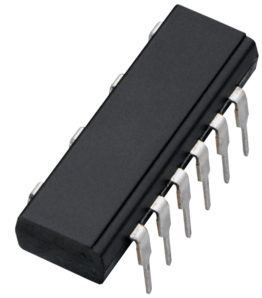
PR21HD22NSZ Series
PR31HD22NSZ Series

I_T(rms)≤1.5A, Low trigger current
Zero Cross type
DIP 16pin
Triac output SSR



■ Description

PR21HD22NSZ Series and **PR31HD22NSZ Series** Solid State Relays (SSR) are an integration of an infrared emitting diode (IRED), a Phototriac Detector and a main output Triac. These devices are ideally suited for controlling high voltage AC loads with solid state reliability while providing 4.0kV isolation (V_{iso}(rms)) from input to output.

■ Features

1. Output current, I_T(rms)≤1.5A
2. Zero crossing functionary
3. 16 pin DIP package
4. Low minimum trigger current (I_{FT} : MAX.5mA)
5. High repetitive peak off-state voltage
   (V_{DRM} : 600V, **PR31HD22NSZ Series**)
   (V_{DRM} : 400V, **PR21HD22NSZ Series**)
6. Superior noise immunity (dV/dt : MIN. 100V/μs)
7. Response time, t_{on} : MAX. 100μs
8. Lead-free terminal components are also available (see Model Line-up section in this datasheet)
9. High isolation voltage between input and output (V_{iso}(rms) : 4.0kV)

■ Agency approvals/Compliance

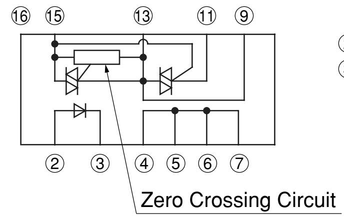
1. Package resin : UL flammability grade (94V-0)

■ Applications

1. Isolated interface between high voltage AC devices and lower voltage DC control circuitry.
2. Switching motors, fans, heaters, solenoids, and valves.
3. Power control in applications such as lighting and temperature control equipment.

Sheet No.: D4-A01401EN
Date Mar. 31. 2004

■ Internal Connection Diagram



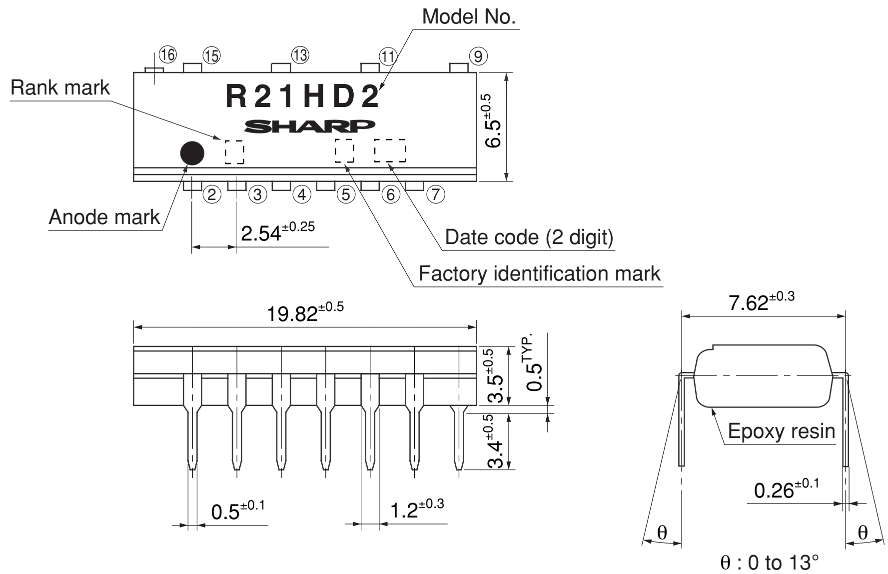
② Anode
③ Cathode

⑪ Output (T_1)
⑨, ⑬ Output (T_2)
⑮ Gate
⑯ NC

■ Outline Dimensions

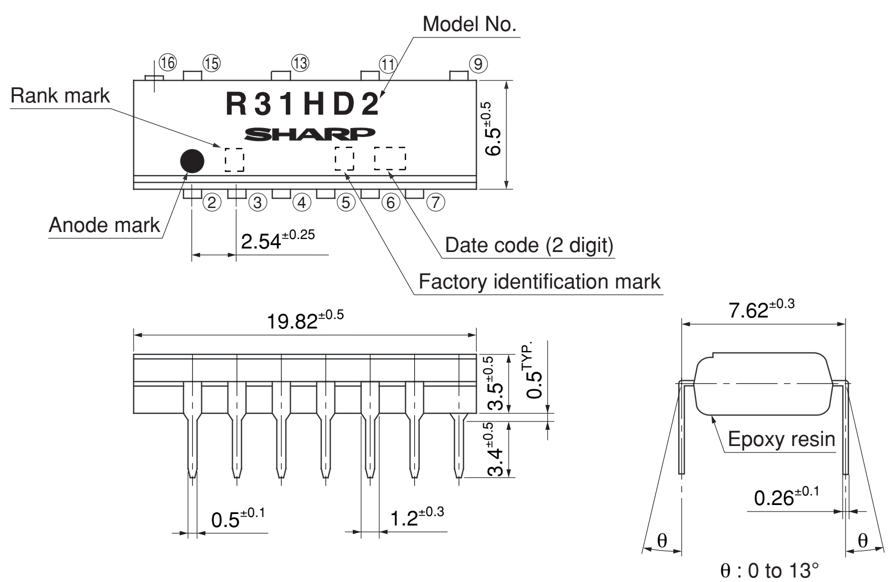
(Unit : mm)

1. Through-Hole [ex. **PR21HD22NSZF**]



Product mass : approx.1.22g

2. Through-Hole [ex. **PR31HD22NSZF**]



Product mass : approx. 1.22g

(Note) To radiate the heat, solder the lead pins ④ to ⑦, ⑨ on the pattern of the PCB without using a socket such that there is no open pin left.

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
■	

* 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

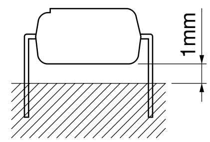
Please refer to the Model Line-up table.

■ Absolute Maximum Ratings

(T_a=25˚C)

Parameter			Symbol	Rating	Unit
Input	Forward current		I_F	50 *3	mA
	Reverse voltage		V_R	6	V
Output	RMS ON-state current		I_T(rms)	1.5 *3	A
	Peak one cycle surge current		I_{surge}	15 *4	A
	Repetitive peak OFF-state voltage	PR21HD22NSZ	V_{DRM}	400	V
		PR31HD22NSZ		600	
*1Isolation voltage			V_{iso}(rms)	4.0	kV
Operating temperature			T_{opr}	−25 to +85	˚C
Storage temperature			T_{stg}	−40 to +125	˚C
*2Soldering temperature			T_{sol}	260	˚C

*1 40 to 60%RH, AC for 1minute, f=60Hz
*2 For 10s
*4 Refer to Fig.1, Fig.2
*4 f=50Hz sine wave



Soldering area

■ 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	Repetitive peak OFF-state current		I_{DRM}	V_D=V_{DRM}	–	–	100	μA
	ON-state voltage		V_T	I_T=1.5A	–	–	1.7	V
	Holding current		I_H	V_D=6V	–	–	25	mA
	Critical rate of rise of OFF-state voltage		dV/dt	$V_D=1/\sqrt{2} \cdot V_{DRM}$	100	–	–	V/μs
	Zero cross voltage		V_{OX}	I_F=10mA, Resistance load	–	–	35	V
Transfer charac-teristics	Minimum trigger current	Rank 2	I_{FT}	V_D=6V, R_L=100Ω	–	–	5	mA
	Isolation resistance		R_{ISO}	DC500V,40 to 60%RH	5×10^{10}	10^{11}	–	Ω
	Turn-on time		t_{on}	V_D=6V, R_L=100Ω, I_F=10mA	–	–	100	μs

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

Lead Form	Through-Hole	V_{DRM} [V]	Rank mark	I_{FT}[mA] (V_D=6V, R_L=100Ω)
Shipping Package	Sleeve			
	25pcs/sleeve			
Model No.	**PR21HD22NSZF**	400	2	MAX.5
	PR31HD22NSZF	600	2	MAX.5

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

Lead Form	Through-Hole	V_{DRM} [V]	Rank mark	I_{FT}[mA] (V_D=6V, R_L=100Ω)
Shipping Package	Sleeve			
	25pcs/sleeve			
Model No.	**PR21HD22NSZ**	400	2	MAX.5
	PR31HD22NSZ	600	2	MAX.5

Please contact a local SHARP sales representative to see the actual status of the production.

Fig.1 Forward Current vs. Ambient Temperature

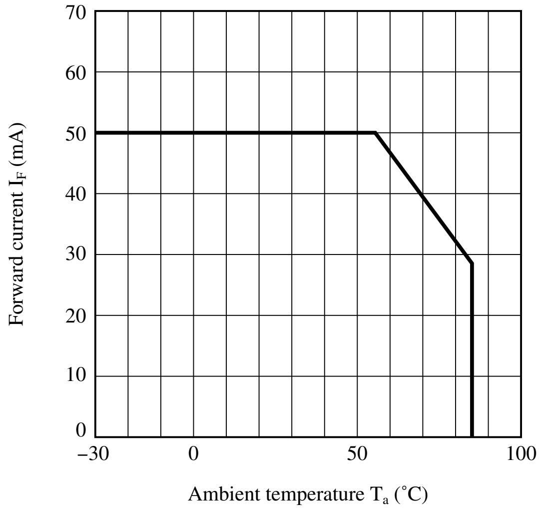


Fig.2 RMS ON-state Current vs. Ambient Temperature

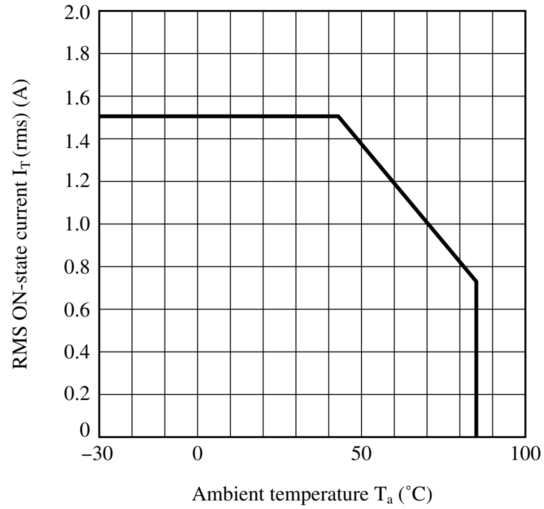


Fig.3 Forward Current vs. Forward Voltage

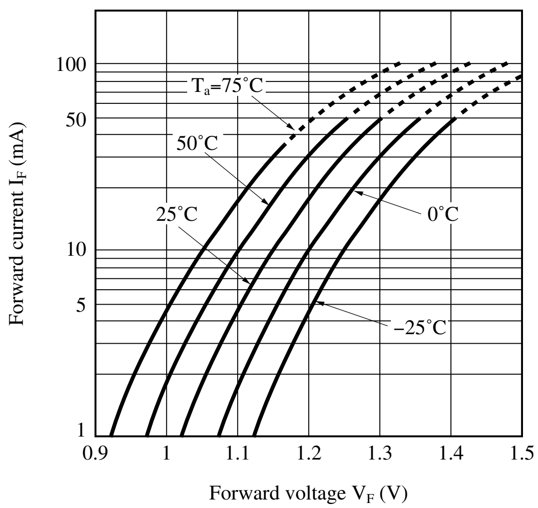


Fig.4 Minimum Trigger Current vs. Ambient Temperature

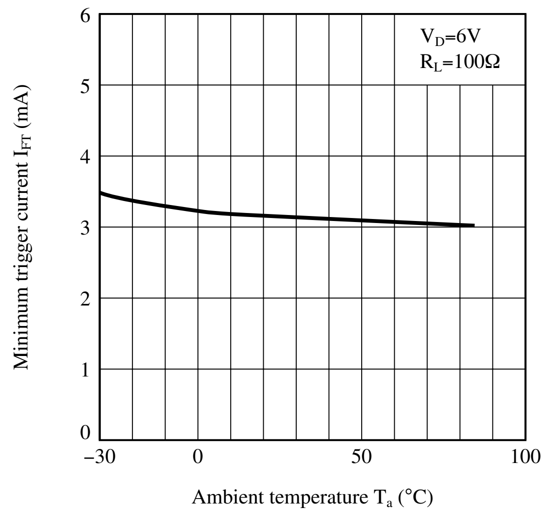


Fig.5 ON-state Voltage vs. Ambient Temperature

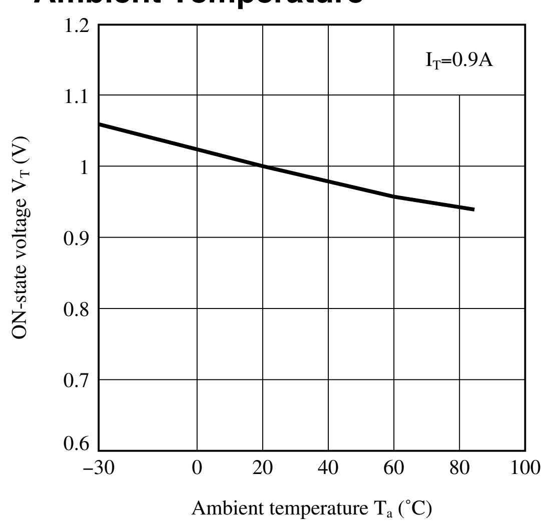


Fig.6 Relative Holding Current vs. Ambient Temperature

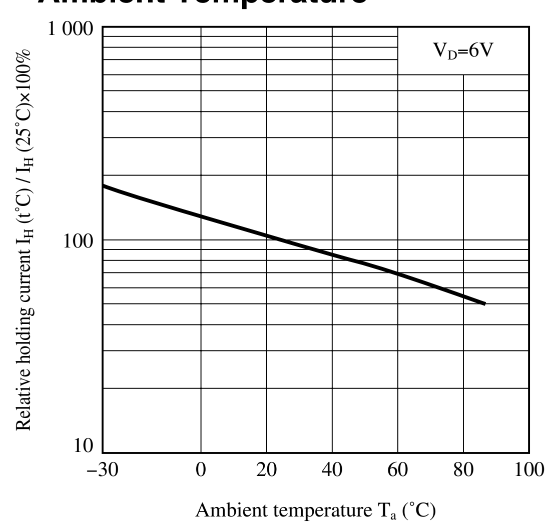


Fig.7 Zero-cross Voltage vs. Ambient Temperature

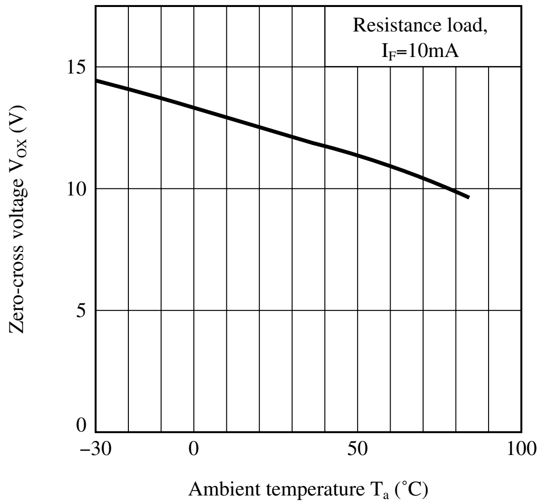


Fig.8 ON-state Current vs. ON-state Voltage

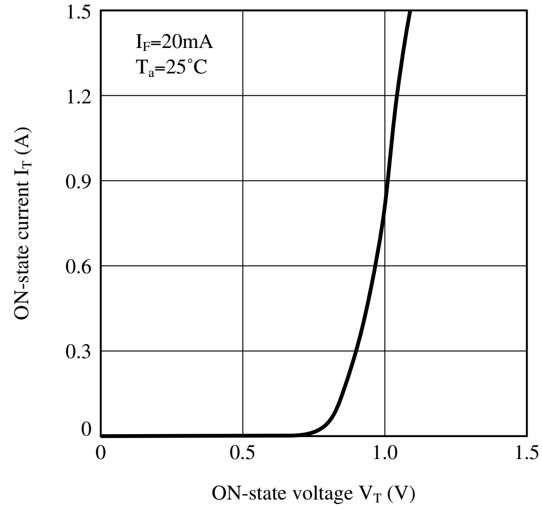
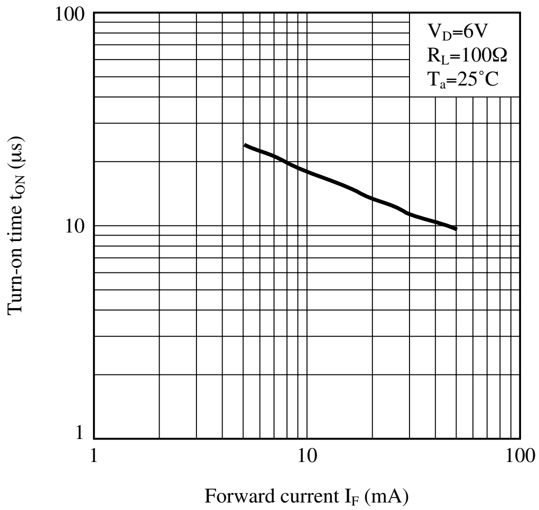


Fig.9 Turn-on Time vs. Forward Current



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

■ Design Considerations

● Recommended Operating Conditions

<table>
<tr><th colspan="3">Parameter</th><th>Symbol</th><th>Conditions</th><th>MIN.</th><th>MAX.</th><th>Unit</th></tr>
<tr><td rowspan="2">Input</td><td colspan="2">Input signal current at ON state</td><td>I_F(ON)</td><td>–</td><td>10</td><td>15</td><td>mA</td></tr>
<tr><td colspan="2">Input signal current at OFF state</td><td>I_F(OFF)</td><td>–</td><td>0</td><td>0.1</td><td>mA</td></tr>
<tr><td rowspan="4">Output</td><td rowspan="2">Load supply voltage</td><td>PR21HD22NSZ</td><td rowspan="2">V_{OUT}(rms)</td><td rowspan="2">–</td><td rowspan="2">–</td><td>120</td><td rowspan="2">V</td></tr>
<tr><td>PR31HD22NSZ</td><td>240</td></tr>
<tr><td colspan="2">Load supply current</td><td>I_{OUT}(rms)</td><td>Locate snubber circuit between output terminals (Cs=0.022μF, Rs=47Ω)</td><td>–</td><td>I_T(rms)×80%(*)</td><td>mA</td></tr>
<tr><td colspan="2">Frequency</td><td>f</td><td>–</td><td>50</td><td>60</td><td>Hz</td></tr>
<tr><td colspan="3">Operating temperature</td><td>T_{opr}</td><td>–</td><td>–20</td><td>80</td><td>˚C</td></tr>
</table>

(*) See Fig.2 about derating curve (I_T(rms) vs. ambient temperature).

● Design guide

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

Particular attention needs to be paid when utilizing SSRs that incorporate zero crossing circuitry.
If the phase difference between the voltage and the current at the output pins is large enough, zero crossing type SSRs cannot be used. The result, if zero crossing SSRs are used under this condition, is that the SSR may not turn on and off irregardless of the input current. In this case, only a non zero cross type SSR should be used in combination with the above mentioned snubber circuit selection process.

When the input current (I_F) is below 0.1mA, the output Triac will be in the open circuit mode. However, if the voltage across the Triac, V_D, increases faster than rated dV/dt, the Triac may turn on. To avoid this situation, please incorporate a snubber circuit. Due to the many different types of load that can be driven, we can merely recommend some circuit values to start with : Cs=0.022μF and Rs=47Ω. The operation of the SSR and snubber circuit should be tested and if unintentional switching occurs, please adjust the snubber circuit component values accordingly.

When making the transition from On to Off state, a snubber circuit should be used ensure that sudden drops in current are not accompanied by large instantaneous changes in voltage across the Triac.
This fast change in voltage is brought about by the phase difference between current and voltage.
Primarily, this is experienced in driving loads which are inductive such as motors and solenods.
Following the procedure outlined above should provide sufficient results.

For over voltage protection, a Varistor may be used.

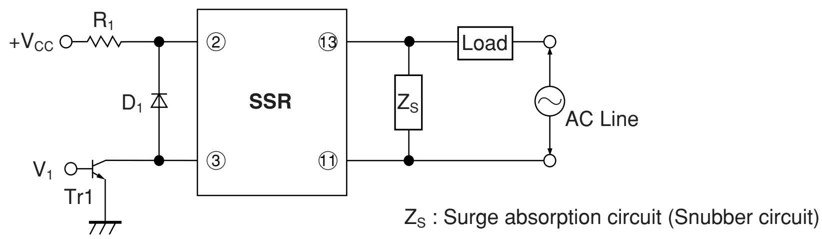
Any snubber or Varistor used for the above mentioned scenarios should be located as close to the main output triac as possible.

All pins shall be used by soldering on the board. (Socket and others shall not be used.)

● Degradation

In general, the emission of the IRED used in SSR 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 SSRs should provide at least twice the minimum required triggering current from initial operation.

● Standard Circuit



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

■ Manufacturing Guidelines

● Soldering Method

Flow Soldering :

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 solder within one time.

Hand soldering

Hand soldering should be completed within 3s when the point of solder iron is below 400˚C.
Please solder within one time.

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

Through-Hole

Package materials

Sleeve : HIPS (with anti-static material)

Stopper : Styrene-Elastomer

Package method

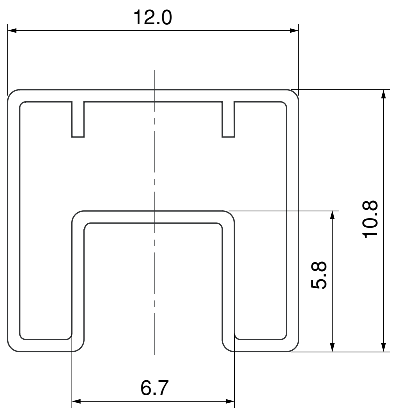
MAX. 25pcs of products shall be packaged in a sleeve.

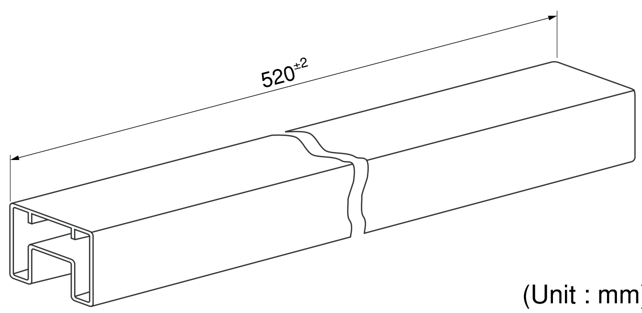
Both ends shall be closed by tabbed and tabless stoppers.

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)

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--- 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.

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

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