# PR308T11ESZ

*Zero cross type is also available. (**PR308T21ESZ**)

## $I_T$(rms)≤8A, Reinforced Insulation Type
## Non-Zero Cross type
## Low profile SIP 4pin
## Triac output SSR



## ■ Description

**PR308T11ESZ** reinforced insulation type 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 3.0kV isolation ($V_{iso}$(rms)) from input to output.

## ■ Agency approvals/Compliance

1. Recognized by UL508, file No. E94758 (as models No. **PR308T11**)
2. Approved by CSA 22.2 No.14, file No. LR63705 (as models No. **PR308T11**)
3. Approved by TÜV EN60950 (reinforced insulation), file No. R9750791 (as model No. **PR308T11**)
4. Package resin : UL flammability grade (94V-0)

## ■ Features

1. Output current, $I_T$(rms)≤8.0A
2. Non-zero crossing functionary
3. Slim 4 pin low profile SIP package
4. Reinforced insulation type (MIN. 0.4mm internal separation)
5. High repetitive peak off-state voltage ($V_{DRM}$ : 600V)
6. High isolation voltage between input and output ($V_{iso}$(rms) : 3.0kV)
7. Screw hole for heat sink

## ■ Applications

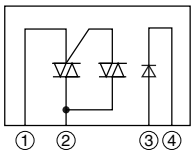
1. Isolated interface between high voltage AC devices and lower voltage DC control circuitry.
2. Switching motors, fans, heaters, solenoids, and valves.
3. Phase or power control in applications such as lighting and temperature control equipment.

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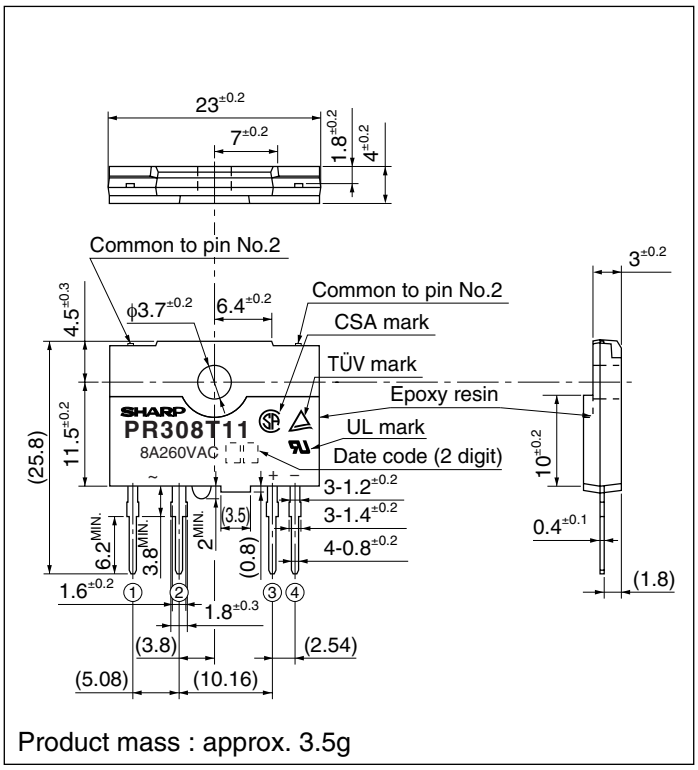
## ■ Internal Connection Diagram




① Output (Triac T1)
② Output (Triac T2)
③ Input (+)
④ Input (–)

## ■ Outline Dimensions

(Unit : mm)




Product mass : approx. 3.5g

( ) : Typical dimensions

## 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

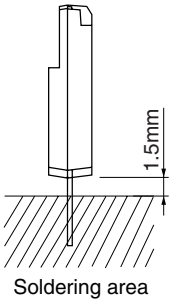
There is no rank mark indicator and currently there are no rank offered for this device.

## ■ 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) | 8 *3 | A |
| | Peak one cycle surge current | $I_{surge}$ | 80 *4 | A |
| | Repetitive peak OFF-state voltage | $V_{DRM}$ | 600 | V |
| | Non-Repetitive peak OFF-state voltage | $V_{DSM}$ | 600 | V |
| | Critical rate of rise of ON-state current | $dI_T/dt$ | 50 | A/μs |
| | Operating frequency | f | 45 to 65 | Hz |
| *1Isolation voltage | | $V_{iso}$(rms) | 3.0 | kV |
| Operating temperature | | $T_{opr}$ | −25 to +100 | °C |
| Storage temperature | | $T_{stg}$ | −30 to +125 | °C |
| *2Soldering temperature | | $T_{sol}$ | 260 | °C |

*1 40 to 60%RH, AC for 1minute, f=60Hz
*2 For 10s
*3 Refer to Fig.1, Fig.2
*4 f=50Hz sine wave, $T_j$=25°C start




## ■ Electro-optical Characteristics

($T_a$=25°C)

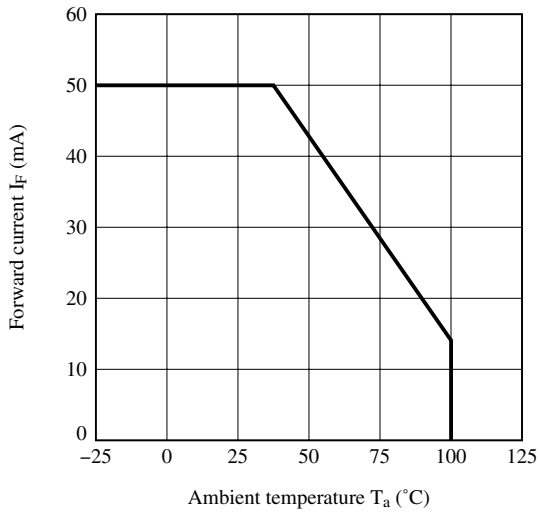
| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| Input | Forward voltage | $V_F$ | $I_F$=20mA | – | 1.2 | 1.4 | V |
| | Reverse current | $I_R$ | $V_R$=3V | – | – | 100 | μA |
| Output | Repetitive peak OFF-state current | $I_{DRM}$ | $V_D$=$V_{DRM}$ | – | – | 100 | μA |
| | ON-state voltage | $V_T$(rms) | $I_T$(rms)=2A, Resistance load, $I_F$=20mA | – | – | 1.5 | V |
| | Holding current | $I_H$ | – | – | – | 50 | mA |
| | Critical rate of rise of OFF-state voltage | dV/dt | $V_D$=2/3•$V_{DRM}$ | 30 | – | – | V/μs |
| | Critical rate of rise of OFF-state voltage at commutaion | (dV/dt)c | $T_j$=125°C, $V_D$=2/3•$V_{DRM}$, $dI_T/dt$=−4.0A/ms | 5 | – | – | V/μs |
| Transfer characteristics | Minimum trigger current | $I_{FT}$ | $V_D$=12V, $R_L$=30Ω | – | – | 10 | mA |
| | Isolation resistance | $R_{ISO}$ | DC500V, 40 to 60%RH | $10^{10}$ | – | – | Ω |
| | Turn-on time | $t_{on}$ | $V_D$(rms)=200V, AC50Hz, $I_F$=20mA | – | – | 1 | ms |
| | Turn-off time | $t_{off}$ | $I_T$(rms)=2A, Resistance load | – | – | 10 | ms |
| Thermal resistance | | $R_{th}$(j-c) | Between junction and case | – | 4.5 | – | °C/W |
| | | $R_{th}$(j-a) | Between junction and ambience | – | 40 | – | |

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

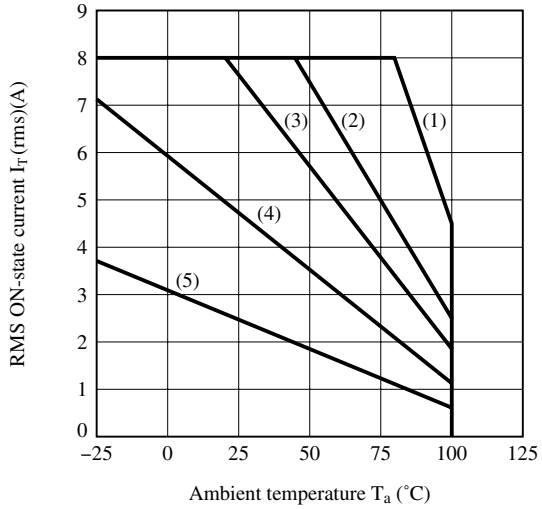
| Shipping Package | Sleeve | | $V_{DRM}$ [V] | $I_{FT}$[mA] ($V_D$=12V, $R_L$=30Ω) |
|---|---|---|---|---|
| | 25pcs/sleeve | | | |
| EN60950 (reinforced insulation) | ——— | Approved | | |
| Model No. | ——— | **PR308T11ESZ** | 600 | MAX.10 |

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

## Fig.1 Forward Current vs. Ambient Temperature

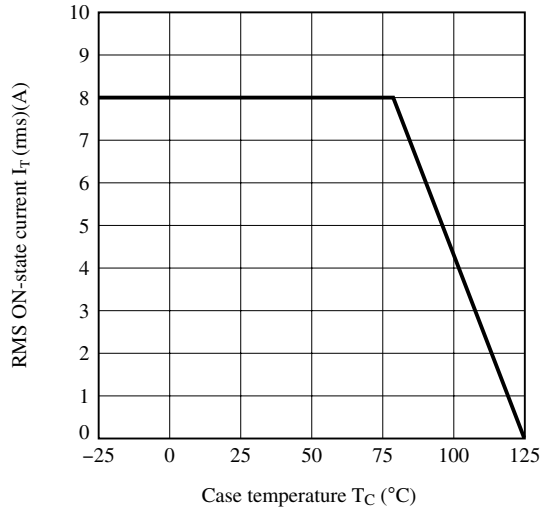



## Fig.2 RMS ON-state Current vs. Ambient Temperature

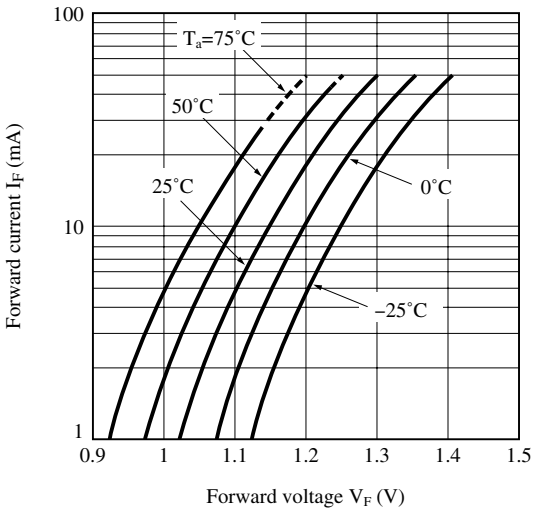



(1) With infinite heat sink
(2) With heat sink (200×200×2mm Al plate)
(3) With heat sink (100×100×2mm Al plate)
(4) With heat sink (50×50×2mm Al plate)
(5) Without heat sink
(Note) In natural cooling condition, please locate Al plate vertically, spread the thermal conductive silicone grease on the touch surface of the device and tighten up the device in the center of Al plate at the torque of 0.4N•m.

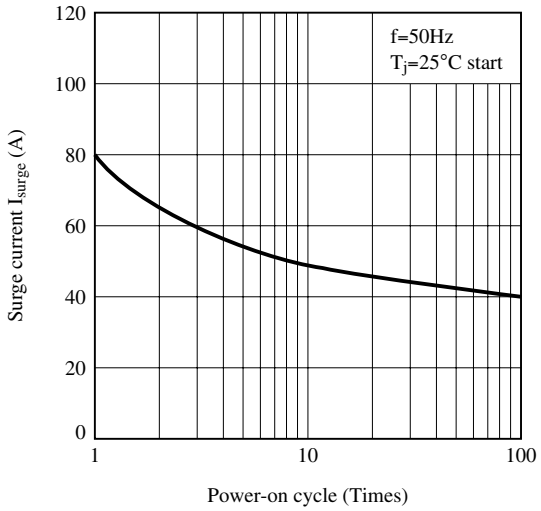
## Fig.3 RMS ON-state Current vs. Case Temperature



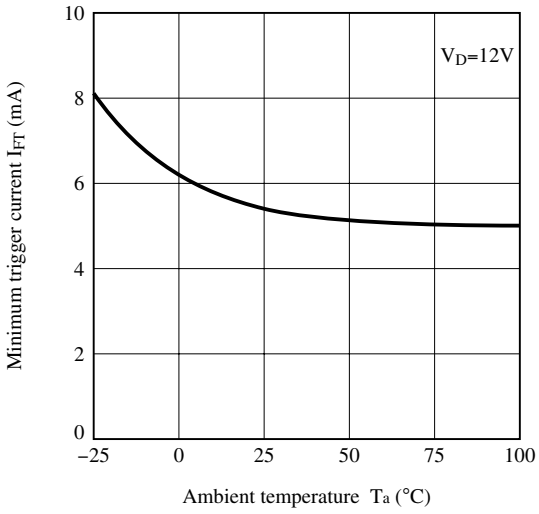

## Fig.4 Forward Current vs. Forward Voltage



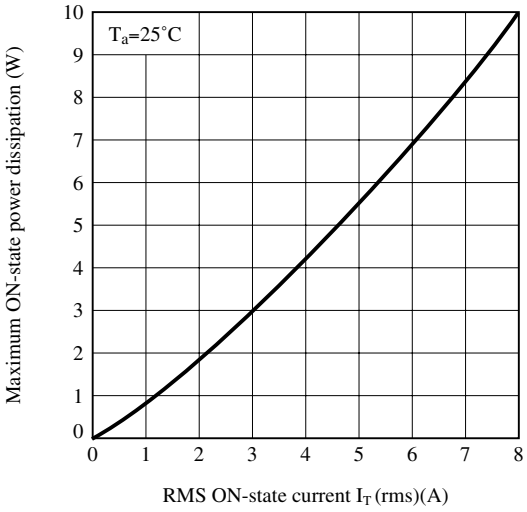
## Fig.5 Surge Current vs. Power-on Cycle



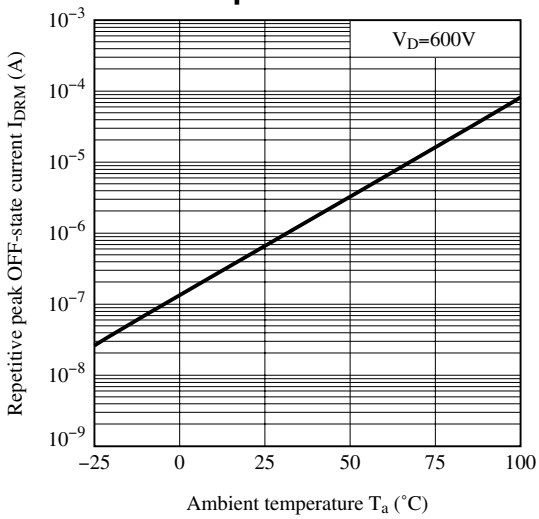

## Fig.6 Minimum Trigger Current vs. Ambient Temperature




## Fig.7 Maximum ON-state Power Dissipation vs. RMS ON-state Current




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




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

## ■ Design Considerations

### ● Recommended Operating Conditions

| Parameter | | Symbol | Conditions | MIN. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Input | Input signal current at ON state | $I_F$(ON) | – | 20 | 30 | mA |
| | Input signal current at OFF state | $I_F$(OFF) | – | 0 | 0.1 | mA |
| Output | Load supply voltage | $V_{OUT}$(rms) | – | 80 | 240 | V |
| | Load supply current | $I_{OUT}$(rms) | Locate snubber circuit between output terminals (Cs=0.022μF, Rs=47Ω) | 0.1 | $I_T$(rms) ×80%(*) | mA |
| | Frequency | f | – | 47 | 63 | Hz |
| Operating temperature | | $T_{opr}$ | – | −20 | 80 | ˚C |

(*) 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.

In phase control applications or where the SSR is being by a pulse signal, please ensure that the pulse width is a minimum of 1ms.

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 vales 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 solenoids.
Following the procedure outlined above should provide sufficient results.

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

The load current should be within the bounds of derating curve. (Refer to Fig.2)
Also, please use the optional heat sink when necessary.

In case the optional heat sink is used and the isolation voltage between the device and the optional heat sink is needed, please locate the insulation sheet between the device and the heat sink.

When the optional heat sink is equipped, please set up the M3 screw-fastening torque at 0.3 to 0.5N•m.
In order to dissipate the heat generated from the inside of device effectively, please follow the below suggestions.

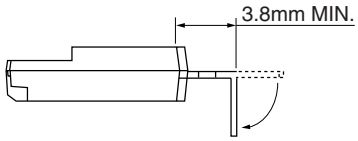
(a) Make sure there are no warps or bumps on the heat sink, insulation sheet and device surface.
(b) Make sure there are no metal dusts or burrs attached onto the heat sink, insulation sheet and device surface.
(c) Make sure silicone grease is evenly spread out on the heat sink, insulation sheet and device surface.

Silicone grease to be used is as follows;
1) There is no aged deterioration within the operating temperature ranges.
2) Base oil of grease is hardly separated and is hardly permeated in the device.
3) Even if base oil is separated and permeated in the device, it should not degrade the function of a device.

Recommended grease : G-746 (Shin-Etsu Chemical Co., Ltd.)
: G-747 (Shin-Etsu Chemical Co., Ltd.)
: SC102 (Dow Corning Toray Silicone Co., Ltd.)

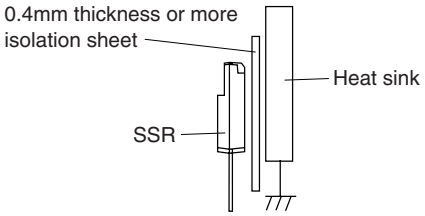
In case the optional heat sink is screwed up, please solder after screwed.

In case of the lead frame bending, please keep the following minimum distance and avoid any mechanical stress between the base of terminals and the molding resin.

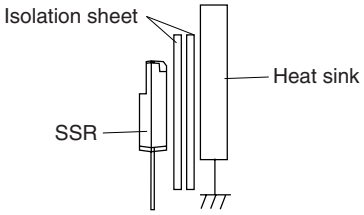



Some of AC electromagnetic counters or solenoids have built-in rectifier such as the diode.
In this case, please use the device carefully since the load current waveform becomes similar with rectangular waveform and this results may not make a device turn off.

Example how to equip optional heat sink for reinforced isolation
(a) Case of the use of isolation sheet whose thickness is 0.4mm or more ($V_{iso}$ : 3kV or more)




(b) Case of the use of double isolation sheet ($V_{iso}$ : each 3kV or more)

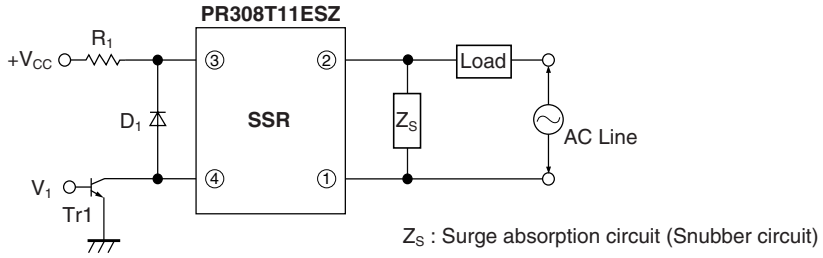



Please keep 5mm distance as minimum between naked metal portion of SSR and heat sink, and also between naked metal portion of SSR and bis/nut/washer.
However, please avoid the natural rubber for isolation sheet.

## ● 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




$Z_S$ : Surge absorption circuit (Snubber circuit)

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

## ■ Manufacturing Guidelines

### ● Soldering Method

#### Flow Soldering (No solder bathing)

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.

#### 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

Stopper : Olefine-Elastomer

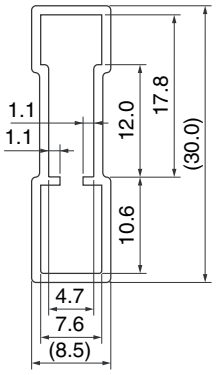
Package method

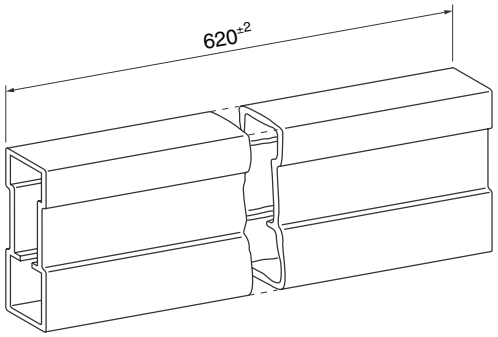
MAX. 25pcs of products shall be packaged in a sleeve.

Both ends shall be closed by stoppers.

MAX. 20 sleeves in one case.

Sleeve outline dimensions




(Unit : mm)

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--- 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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