PR3BMF51NSKF Series

I_T(rms)≤1.2A, Non-Zero Cross type DIP 8pin Triac output SSR

*Zero cross type is also available. (**PR3BMF21NSZF Series**)

■ Description

PR3BMF51NSKF 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 4kV isolation (V_{iso}(rms)) from input to output.

■ Features

1. Output current, I_T(rms)≤1.2A
2. Non-zero crossing functionary
3. 8 pin DIP package (SMT gullwing also available)
4. High repetitive peak off-state voltage (V_{DRM} : 600V)
5. Superior noise immunity (dV/dt : MIN. 100V/μs)
6. Response time, t_{on} : MAX. 100μs
7. High isolation voltage between input and output (V_{iso}(rms) : 4kV)
8. Lead free and RoHS directive compliant

■ Agency approvals/Compliance

1. Recognized by UL508 file No. E94758 (as model No. **R3BMF5**)
2. Approved by CSA 22.2 No.14, file No. LR63705 (as model No. **R3BMF5**)
3. Optionary available VDE approved (DIN EN 60747-5-2)(*), file No. 40008898 (as model No. **R3BMF5**)
4. Package resin : UL flammability grade (94V-0)

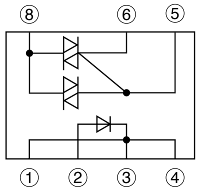
(*) DIN EN60747-5-2 : successor standard of DIN VDE0884.

■ 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.

Sheet No.: D4-A03801EN
Date Sep. 1. 2006

Internal Connection Diagram

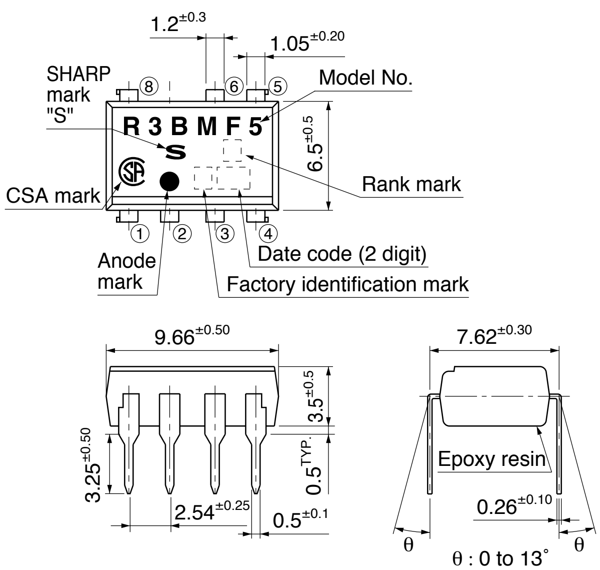


① Cathode
② Anode
③ Cathode
④ Cathode
⑤ Gate
⑥ Output (T_1)
⑧ Output (T_2)

Outline Dimensions

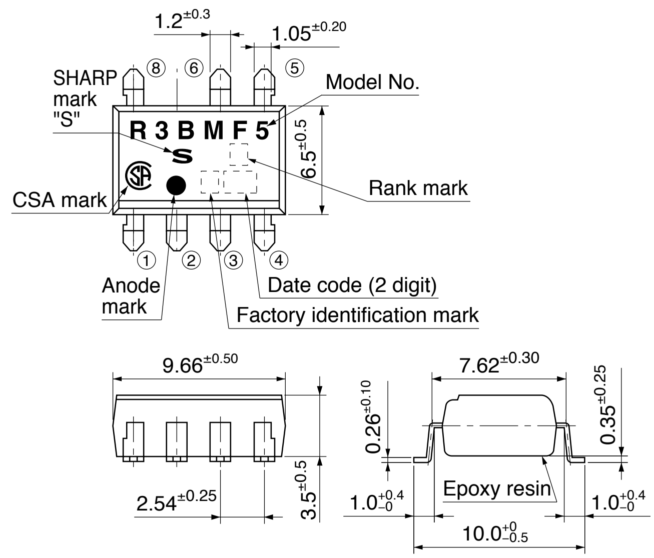
(Unit : mm)

1. Through-Hole [ex. **PR3BMF51NSKF**]



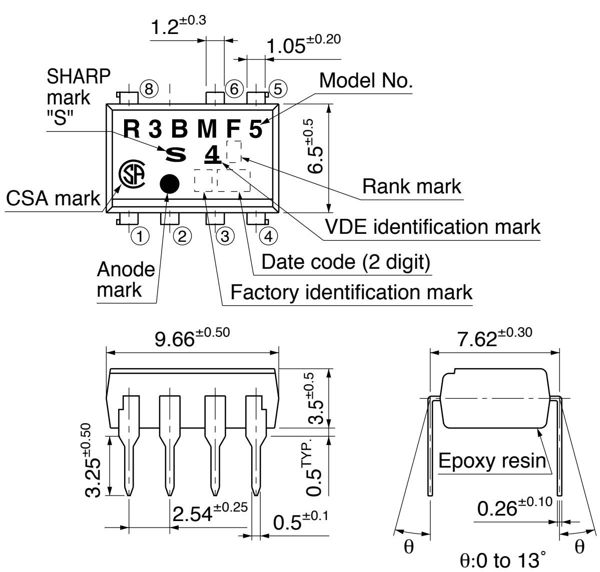
Product mass : approx. 0.56g

2. SMT Gullwing Lead-Form [ex. **PR3BMF51NIPF**]



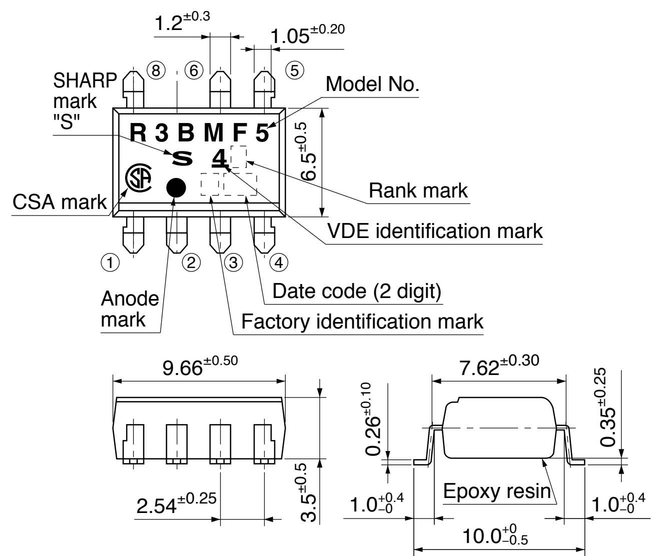
Product mass : approx. 0.54g

3. Through-Hole VDE option [ex. **PR3BMF51YSKF**]



Product mass : approx. 0.56g

4. SMT Gullwing Lead-Form VDE option [ex. **PR3BMF51YIPF**]



Product mass : approx. 0.54g

Plating material : SnCu (Cu : TYP. 2%)

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

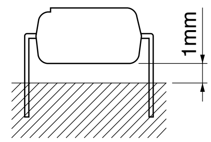
Please refer to the Model Line-up table.

■ 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)	1.2*3	A
	Peak one cycle surge current	I_{surge}	12*4	A
	Repetitive peak OFF-state voltage	V_{DRM}	600	V
*1 Isolation voltage		V_{iso}(rms)	4	kV
Operating temperature		T_{opr}	−30 to +105	˚C
Storage temperature		T_{stg}	−40 to +125	˚C
*2 Soldering temperature		T_{sol}	270	˚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



Soldering area

■ Electro-optical Characteristics

(T_a=25˚C)

Parameter		Symbol	Condition	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}	–	–	100	μA
	ON-state voltage	V_T	I_T=1.2A	–	–	2.5	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
Transfer charac-teristics	Minimum trigger current	I_{FT}	V_D=6V, R_L=100Ω	–	–	10	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=20mA	–	–	100	μs

■ Model Line-up

Lead Form	Through-Hole		SMT Gullwing		V_{DRM} [V]	Rank mark	I_{FT}[mA] (V_D=6V, R_L=100Ω)
Shipping Package	Sleeve		Taping				
	50 pcs/sleeve		1 000 pcs/reel				
DIN EN60747-5-2	——	Approved	——	Approved			
Model No.	**PR3BMF51NSKF**	**PR3BMF51YSKF**	**PR3BMF51NIPF**	**PR3BMF51YIPF**	600	1	MAX.10

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

Fig.1 Forward Current vs. Ambient Temperature

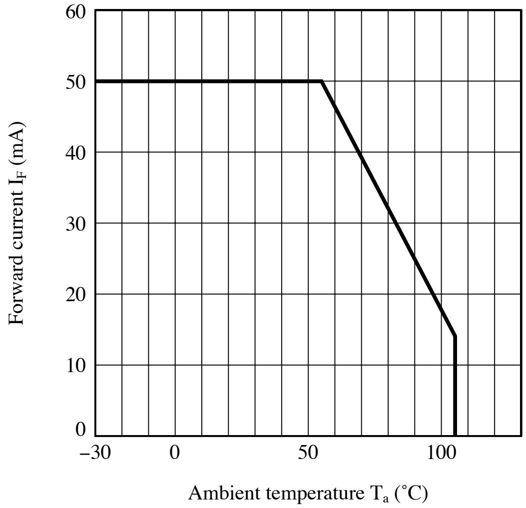


Fig.2 RMS ON-state Current vs. Ambient Temperature

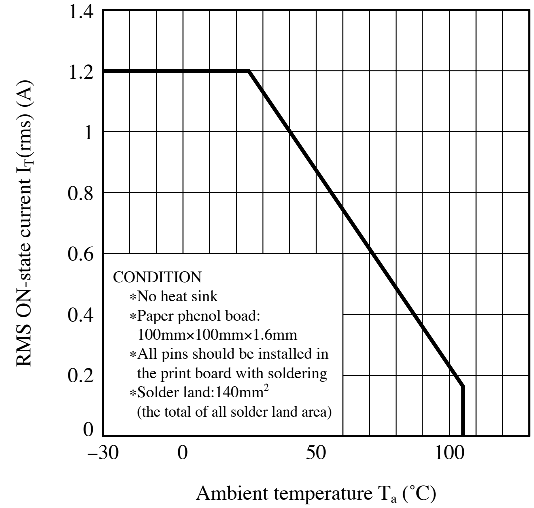


Fig.3 Forward Current vs. Forward Voltage

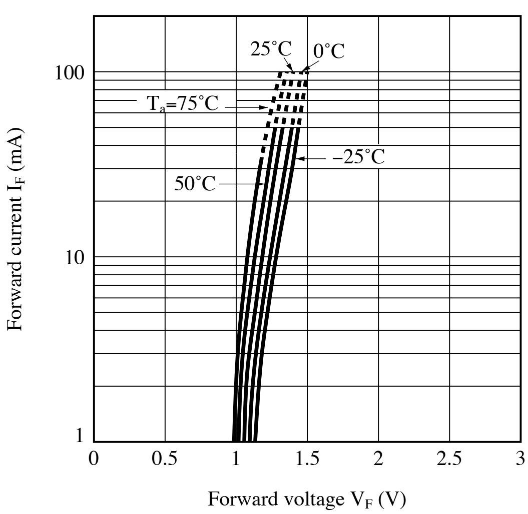


Fig.4 Minimum Trigger Current vs. Ambient Temperature

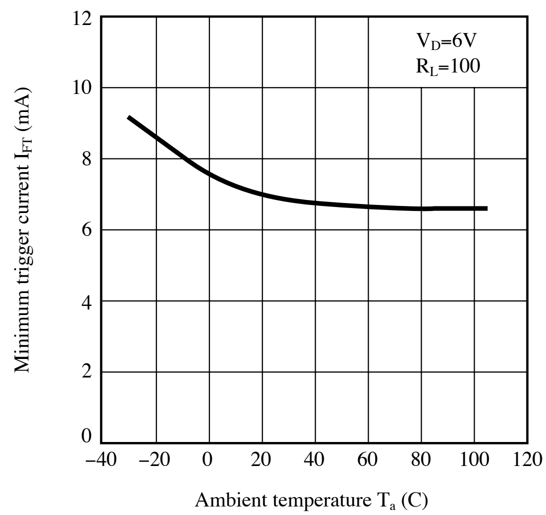


Fig.5 ON-state Voltage vs. Ambient Temperature

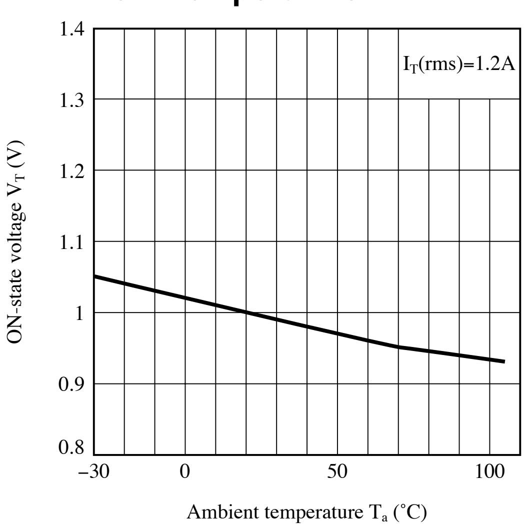


Fig.6 Relative Holding Current vs. Ambient Temperature

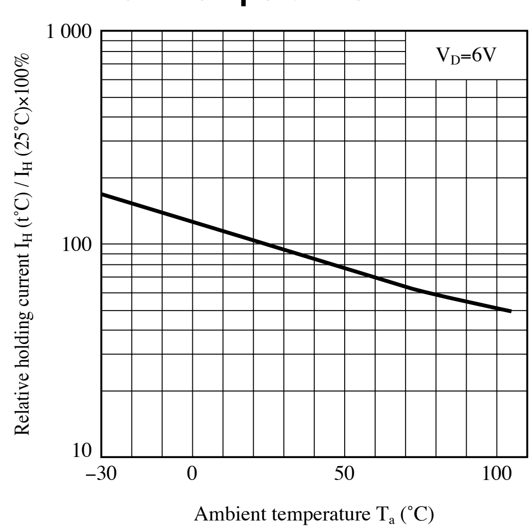


Fig.7 ON-state Current vs. ON-state Voltage

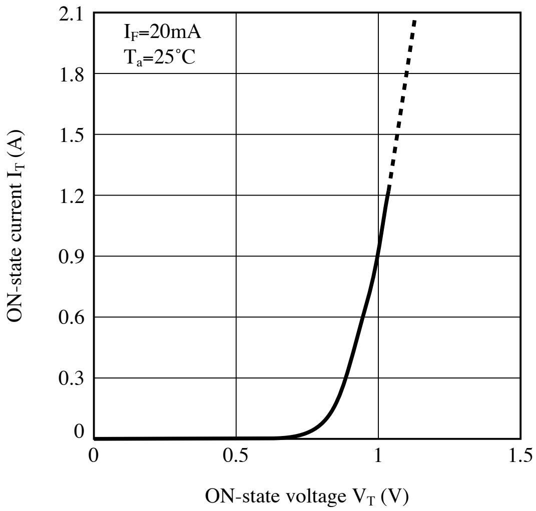
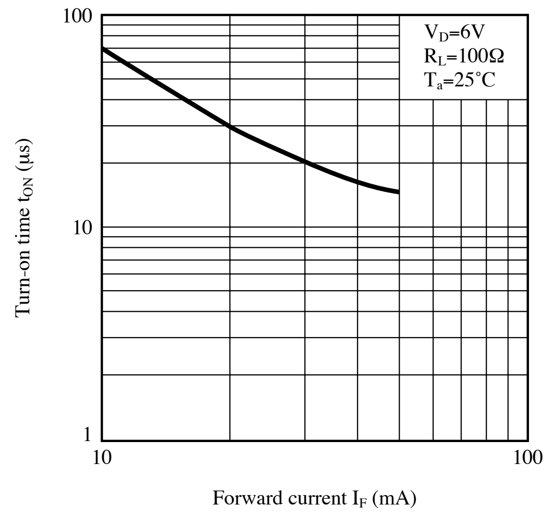


Fig.8 Turn-on Time vs. Forward Current



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

■Design Considerations

● Recommended Operating Conditions

Parameter		Symbol	Condition	MIN.	MAX.	Unit
Input	Input signal current at ON state	I_F(ON)	–	20	25	mA
	Input signal current at OFF state	I_F(OFF)	–	0	0.1	mA
Output	Load supply voltage	V_{OUT}(rms)	–	–	240	V
	Load supply current	I_{OUT}(rms)	Locate snubber circuit between output terminals (Cs=0.022μF, Rs=47Ω)	–	I_T(rms)× 80%(*)	A
	Frequency	f	–	50	60	Hz
Operating temperature		T_{opr}	–	–20	80	˚C

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

● Degradation

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 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.

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

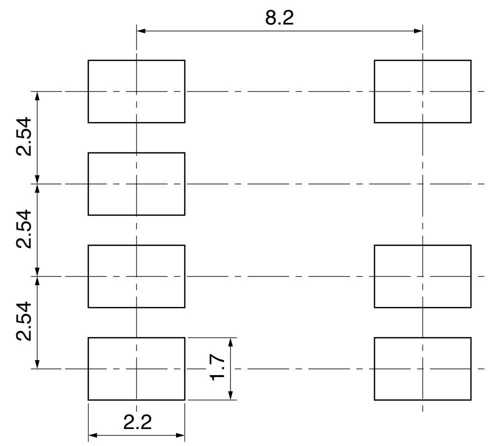
All pins shall be used by soldering on the board. (Socket and others shall not be used.)

● 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.

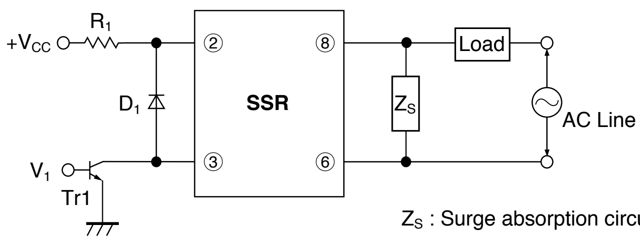
● Recommended Foot Print (reference)

SMT Gullwing Lead-form



(Unit : mm)

● Standard Circuit



Z_S : Surge absorption circuit (Snubber)

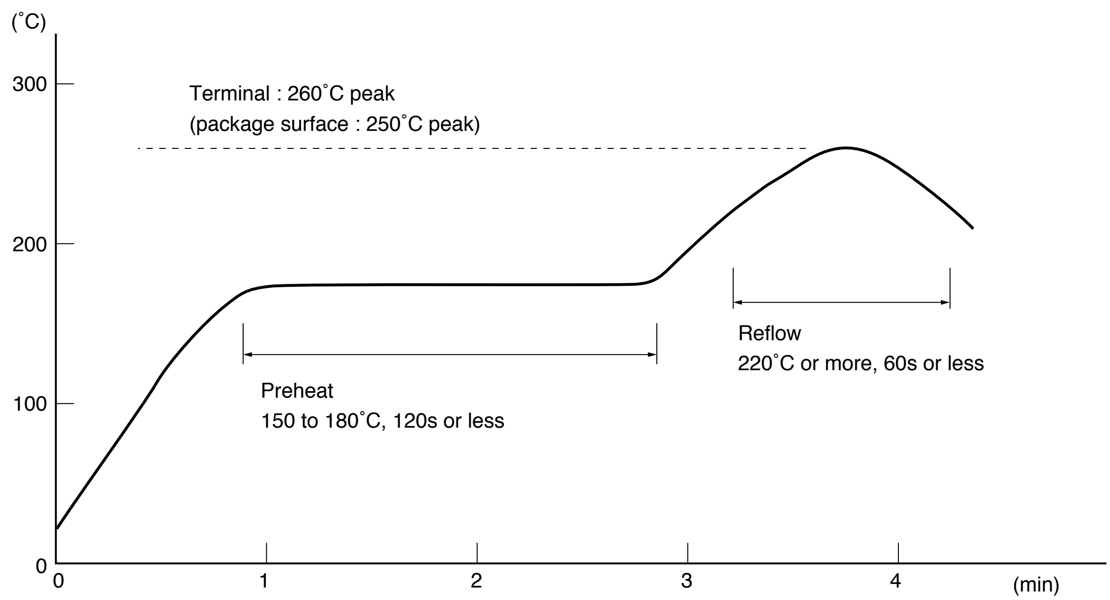
☆ For additional design assistance, please review our corresponding Optoelectronic Application Notes.

■ 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 (No Solder bathing)

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 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 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).

  (*) High melting temperature type solders (i.e. tin-lead solder alloys containing more than 85% lead) is exempted from the requirements.

■ Package specification

● Sleeve package

Through-Hole

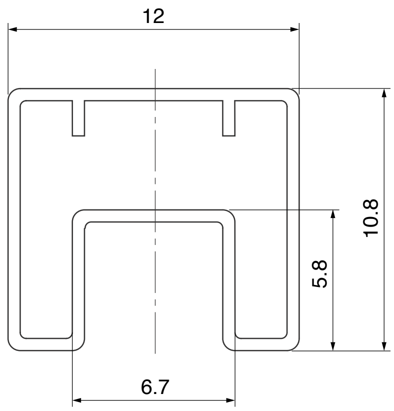
Package materials

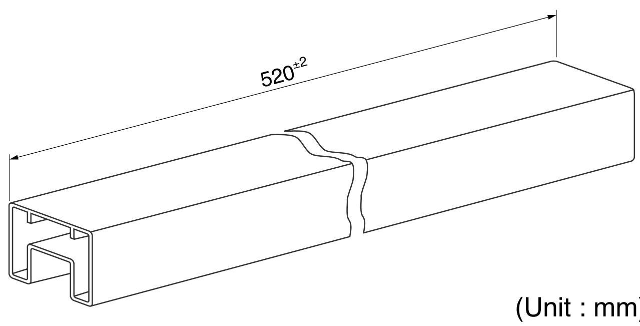
Sleeve : HIPS (with anti-static material)
Stopper : Styrene-Elastomer

Package method

MAX. 50pcs 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

SMT Gullwing

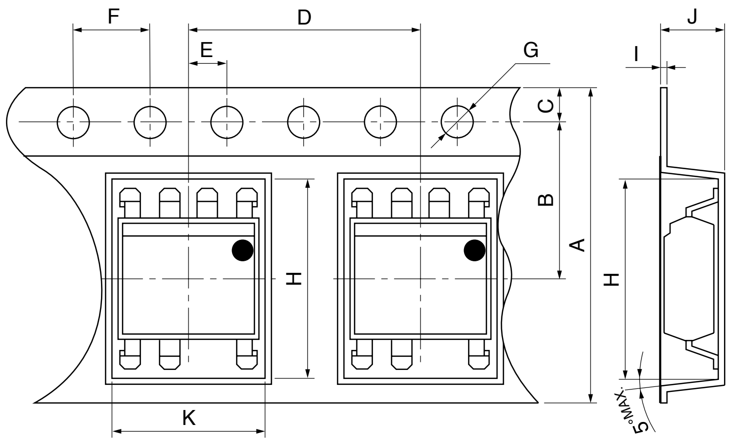
Package materials

Carrier tape : A-PET (with anti-static material)

Cover tape : PET (three layer system)

Reel : PS

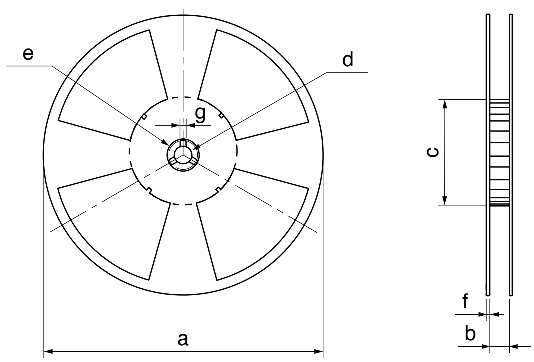
Carrier tape structure and Dimensions



Dimensions List (Unit : mm)

A	B	C	D	E	F	G
$16.0^{\pm0.3}$	$7.5^{\pm0.1}$	$1.75^{\pm0.10}$	$12.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi1.5^{+0.1}_{-0}$
H	I	J	K			
$10.4^{\pm0.1}$	$0.40^{\pm0.05}$	$4.2^{\pm0.1}$	$10.2^{\pm0.1}$			

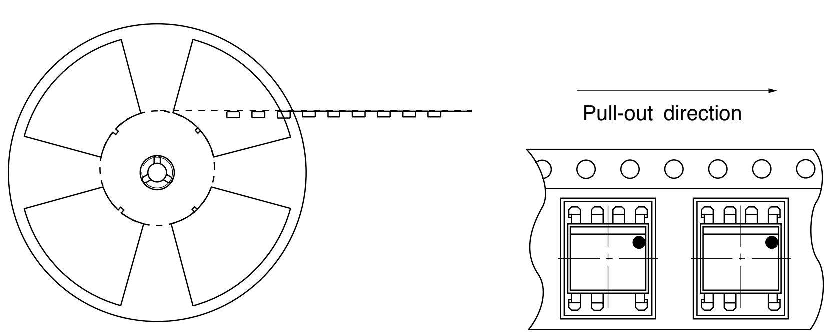
Reel structure and Dimensions



Dimensions List (Unit : mm)

a	b	c	d
$\phi330$	$17.5^{\pm1.5}$	$\phi100^{\pm1}$	$\phi13.0^{\pm0.5}$
e	f	g	
$\phi23^{\pm1}$	$2.0^{\pm0.5}$	$2.0^{\pm0.5}$	

Direction of product insertion



[Packing : 1 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).

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