PR3BMF51NSLF

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

■Description

PR3BMF51NSLF Solid State Relay (SSR) is an
integration of an infrared emitting diode (IRED),
a Phototriac Detector and a main output Triac. This
device is ideally suited for controlling high voltage
AC loads with solid state reliability while providing
4kV isolation (V_{iso}(rms)) from input to output.

■Agency approvals/Compliance

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

■Features

1. Output current, I_T(rms)≤1.2A
2. Non-zero crossing functionary
3. 8 pin DIP package
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)
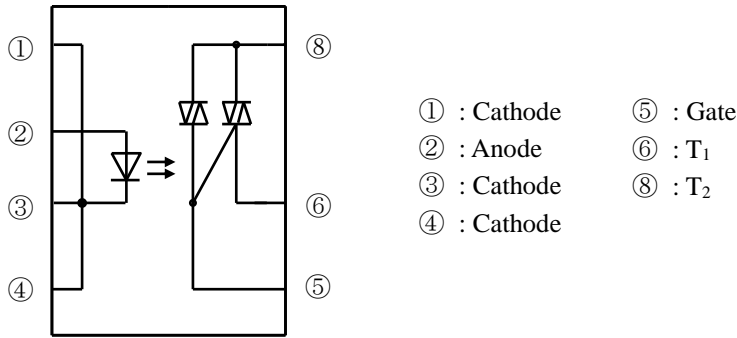8. RoHS directive compliant

■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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■Pin-Number and internal connection diagram

① : Cathode   ⑤ : Gate
② : Anode   ⑥ : T_1
③ : Cathode   ⑧ : T_2
④ : Cathode

■Outline

Marking is laser marking
*1)   2-digit number shall be marked according to OLD DIN standard.
*2)   Factory identification mark applies to the below.
    Without : SUN-S Corporation (Japan)

    ◥ : SUN-S Electronic Technology (KUNSHAN) Co. Ltd (China)
*3)   Business dealing name identification mark : ─

Pin material : Copper Alloy
Pin finish : SnCu plating (Cu : TYP. 2%)

Product mass : Approx. 0.56g	
UNIT : 1/1 mm	
Name	R3BMF5 Outline Dimensions (Business dealing name : PR3BMF51NSLF)

■Absolute maximum ratings

Ta=25°C

Parameter		Symbol	Rating	Unit
Input	Forward current *1	I_F	50	mA
	Reverse voltage	V_R	6	V
Output	RMS on-state current *1	$I_T(rms)$	1.2	A
	Peak one cycle surge current *2	Isurge	12	A
	Repetitive peak off-state voltage	V_{DRM}	600	V
	Isolation voltage *3	Viso(rms)	4.0	kV
	Operating temperature	Topr	-30 to +85	°C
	Storage temperature	Tstg	-40 to +125	°C
	Soldering temperature *4	Tsol	270	°C

*1   The derating factors of absolute maximum rating due to ambient temperature are shown in Fig.1, 2.
*2   50Hz sine wave
*3   AC for 1min, 40 to 60%RH, f=60Hz
*4   For 10s

■Electrical Characteristics

Ta=25°C

Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Input	Forward voltage	V_F	-	1.2	1.4	V	I_F=20mA
	Reverse current	I_R	-	-	10	μA	V_R=3V
Output	Repetitive peak off-state current	I_{DRM}	-	-	100	μA	$V_D=V_{DRM}$
	On-state voltage	V_T	-	-	2.5	V	I_T=1.2A
	Holding current	I_H	-	-	25	mA	V_D=6V
	Critical rate of rise of off-state voltage	dv/dt	100	-	-	V/μs	$V_D=(1/\sqrt{2})\cdot V_{DRM}$
Transfer charac-teristics	Minimum trigger current	I_{FT}	-	-	10	mA	V_D=6V, R_L=100Ω
	Isolation resistance	R_{ISO}	5×10^{10}	10^{11}	-	Ω	DC500V 40 to 60%RH
	Turn on time	t_{ON}	-	-	100	μs	V_D=6V, R_L=100Ω, I_F=20mA

Fig.1   Forward current vs. ambient temperature(*1)
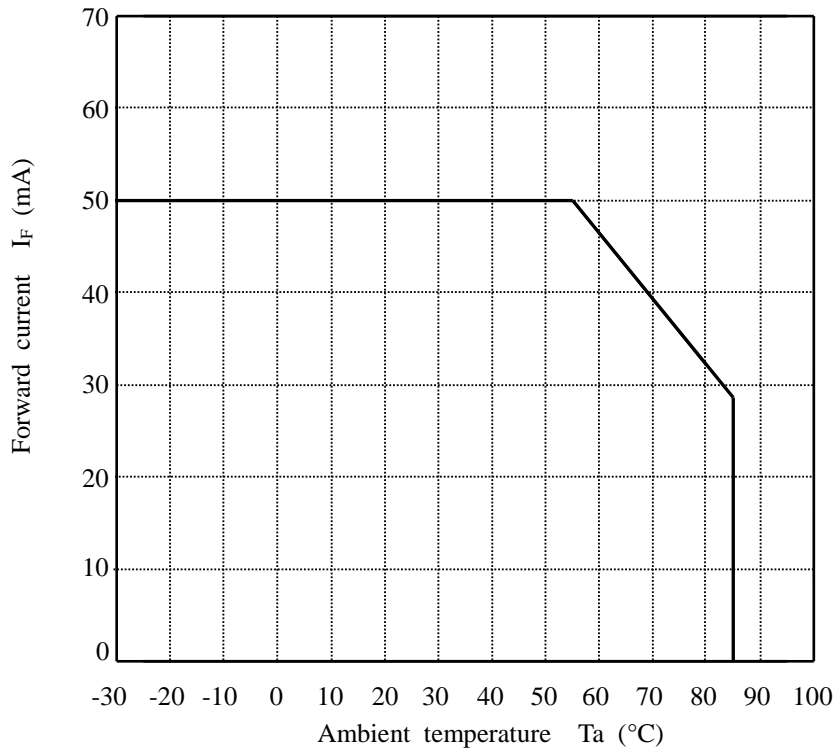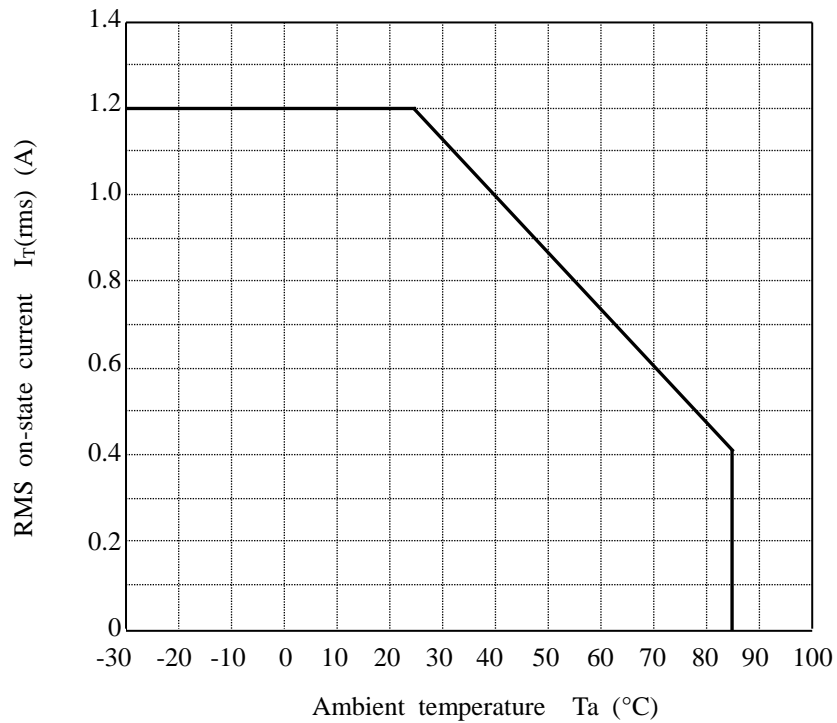

Fig.2   RMS on-state current vs. ambient temperature(*1)

*1   Mounting conditions
       No heat sink
       Paper phenol board :   100mm×100mm×1.6mm
       All pins should be installed in the print board with soldering.
       Whole solder landing dimensions :   140mm^2

■Supplement

●Isolation voltage shall be measured in the following method.
  (1) Short between anode and cathode on the primary side and between anode, cathode and gate on the secondary side.
  (2) The dielectric withstanding tester with zero-cross circuit shall be used.
  (3) The wave form of applied voltage shall be a sine wave.
     (It is recommended that the isolation voltage be measured in insulation oil.)
●This Model is approved by UL and CSA.
  Approved Model No. :   R3BMF5
    1. UL file No. :   E94758
    2. CSA file No. :   LR63705
       CSA approved mark " [CSA logo] " and rating shall be indicated on minimum unit package.

●This product is not designed against irradiation.
  This product is assembled with electrical input and output.
  This product incorporates non-coherent light emitting diode.
●ODS materials
  This product shall not contain the following materials.
  Also, the following materials shall not be used in the production process for this product.
  Materials for ODS : CFC_S, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methyl chloroform)
●Brominated flame retardants
  Specified brominated flame retardants (PBB and PBDE) are not used in this device at all.
●Compliance with each regulation
  1) The RoHS directive (2002/95/EC)
     This product complies with the RoHS directive (2002/95/EC).
     Object substances: mercury, lead (except for lead in high melting temperature type solders[*1] and glass of
     electronic components), cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated
     diphenyl ethers (PBDE)
      *1 : i.e. tin-lead solder alloys containing more than 85% lead
  2) Content of six substances specified in Management Methods for Control of Pollution Caused by Electronic
     Information Products Regulation (Chinese : 电子信息产品污染控制管理办法).

Category	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr^{6+})	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Solid State Relay	＊	✓	✓	✓	✓	✓

✓ : indicates that the content of the toxic and hazardous substance in all the homogeneous materials of the part is
    below the concentration limit requirement as described in SJ/T 11363-2006 standard.
＊ : indicates that the content of the toxic and hazardous substance in at least one homogeneous material of the part
    exceeds the concentration limit requirement as described in SJ/T 11363-2006 standard.
Lead in high melting temperature type solders (i.e. tin-lead solder alloys containing more than 85% lead) and glass of
electronic components (designated by "＊" in the above table) are exempt from the RoHS directive (2002/95/EC),
because there is no effective way to eliminate or substitute them by present scientific technology.

■Notes

● Circuit designing

   (1) Trigger current

      The LED used in the Solid state relay generally decreases the light emission power by operation.

      In case of long operation time, please decide I_F value so that I_F is twice or more of the Maximum value

      of the Minimum triggering current at circuit design with considering the decreases of the light emission power

      of the LED. (50%/5years)

   (2) Snubber circuit

      This device doesn't have built-in snubber circuit.

      To avoid the false operation and protect SSR, please locate the appropriate snubber circuit between output pins

      base by the load. (Recommendable values : Rs=47Ω, Cs=0.022μF)

      Particularly, in case the device is used for the load such as solenoid valves and motors, false operation may

      happen in off-state due to rapid change of voltage at output pins caused by the phase difference of load current.

      So please be sure to locate the snubber circuit (Rs=47Ω, Cs=0.022μF) and make sure the device works properly

      in actual conditions.

      In addition, the values of snubber circuit may have to be changed if necessary after tested in actual conditions.

   (3) Off-state input current

      Input current (I_F) at off-state shall be set 0.1mA or less.

   (4) Pulse drive

      In case that pulse drive is carried out, the pulse width of input signal should be 1ms or more.

   (5) If the voltage exceeding the repetitive peak off-state voltage (V_{DRM}) in the absolute maximum ratings is applied

      to the phototriac, it may cause not only faulty operation but breakdown.

      Make sure that the surge voltage exceeding V_{DRM} shall not be applied by using the varistor, CR.

● Cleaning

   (1) Solvent cleaning : Solvent temperature 45°C or less Immersion for 3 min or less

   (2) Ultrasonic cleaning : The effect to device by ultrasonic cleaning differs by cleaning bath size, ultrasonic power

                             output, cleaning time, PCB size or device mounting condition etc.

                              Please test it in actual using condition and confirm that any defect doesn't occur

                              before starting the ultrasonic cleaning.

   (3) Applicable solvent : Ethyl alcohol, Methyl alcohol, Isopropyl alcohol

      In case the other solvent is used, there are cases that the packaging resin is eroded.

      Please use the other solvent after thorough confirmation is performed in actual using condition.

● Using method

  As to this product, all pin shall be used by soldering on the print wiring board. (Socket and others shall not be used.)

● Precautions for Soldering

   (1) In case of flow soldering (Avoid immersing the resin part in the solder.)

      It is recommended that flow soldering be carried out at 270°C or less and within 10s

      (Pre-heating:100 to 150°C, 30 to 80s) : Within 2 times

   (2) In case of hand soldering

      It is recommended that hand soldering be carried out at 400°C or less and within 3s: Within 2 times

   (3) Other precautions

      Depending on equipment and soldering conditions (temperature, Using solder etc.),

      the effect to junction between PCB and lead pins of the device is different.

      Please confirm that there is no problem on the actual use conditions

■Package specification

●Package materials

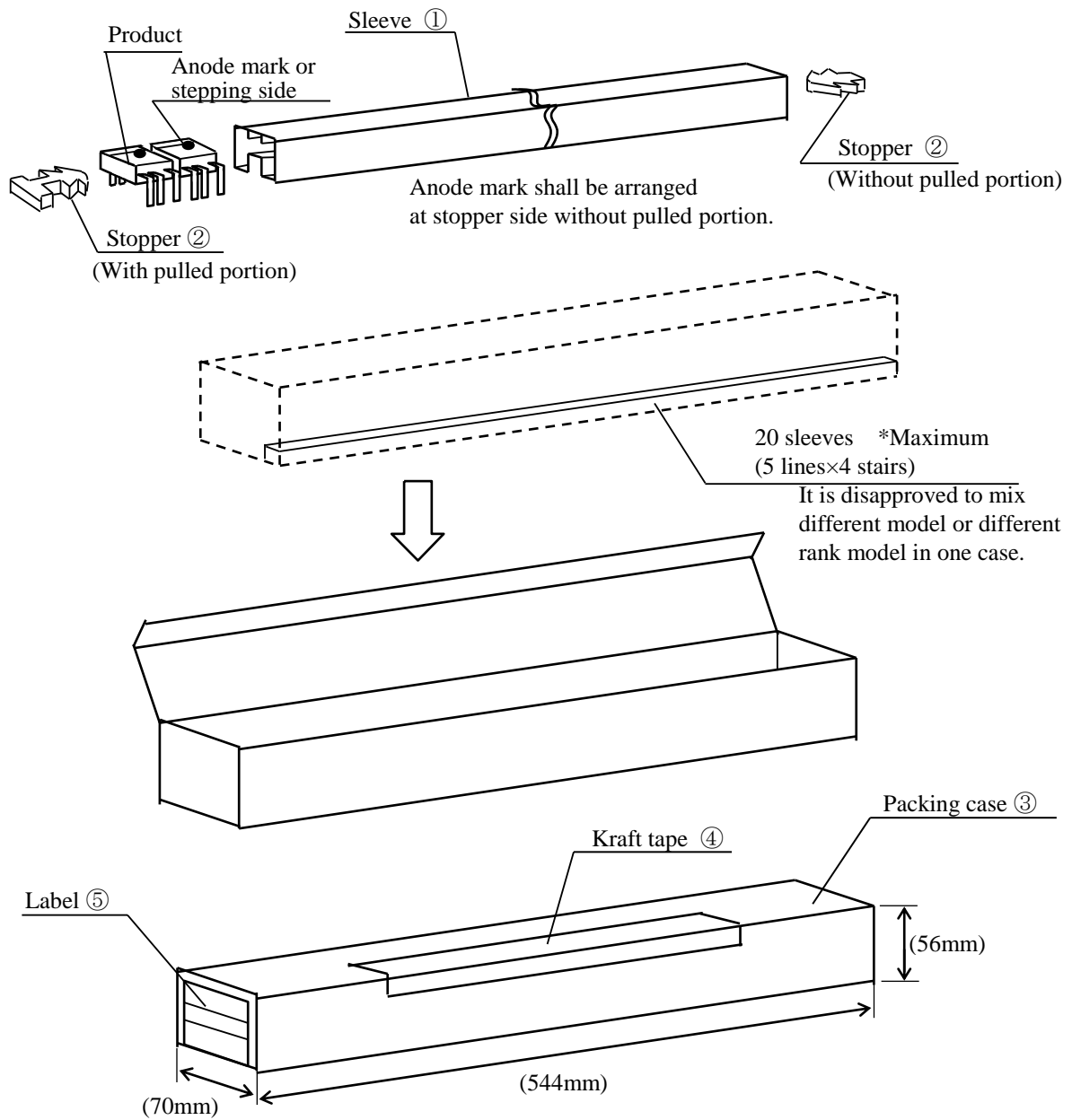| No.	Name	Materials	Purposes
①	Sleeve	HIPS or ABS with preventing static electricity	Products packaged
②	Stopper	Styrene-Elastomer	Products fixed
③	Packing case	Corrugated cardboard	Sleeve packaged
④	Kraft tape	Paper	Lid of packaged case fixed
⑤	Label	Paper	Model No. (Business dealing name), Lot No. Quantity, Country of origin, Company name and Inspection date specified

●Package method
 (1) MAX. 50pcs. of products shall be packaged in a sleeve ① and both of sleeve edges shall be fixed by stoppers ②.
 (2) MAX. 20 sleeves (Product : 1000pcs) above shall be packaged in a packing case ③.
 (3) The label ⑤ shall be put on the side of the packing case.
 (4) Case shall be closed with the lid and enclosed with kraft tape ④.

●Sleeve outline dimensions

(Unit : mm)
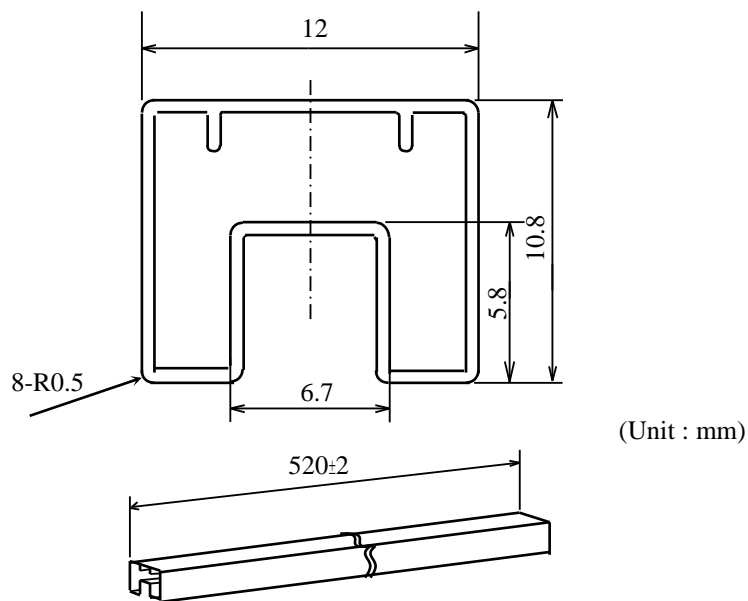
Note 1) Thickness : 0.5±0.2mm
 2) Process with applying antistatic treatment.
 3) Unless otherwise specified tolerances shall be ±0.5mm.
  (However except for deformation due to the rubber stopper in sleeve.)

● Packaging case outline dimensions

Product

Anode mark or
stepping side

Sleeve ①

Stopper ②
(Without pulled portion)

Anode mark shall be arranged
at stopper side without pulled portion.

Stopper ②
(With pulled portion)

20 sleeves   *Maximum
(5 lines×4 stairs)

It is disapproved to mix
different model or different
rank model in one case.

Kraft tape ④

Packing case ③

Label ⑤

(56mm)

(544mm)

(70mm)

Regular packing mass : Approx.970g
(   ) : Reference dimensions

(Attachment-1-1)

●This specification shall be applied to Solid State Relay (SSR), Model No. R3BMF5 series as an option.

●Applicable Models (Business dealing name)
   PR3BMF51YSLF

●The relevant models are the models Approved by VDE according to DIN EN 60747-5-5
   VDE approved No. : 40008898

      Approved Model No. : R3BMF5
         ・Operating isolation voltage $V_{IORM (Peak)}$:   890V
         ・Transient voltage $_{(Peak)}$:   7100V
         ・Pollution :   2
         ・Clearances distance (Between input and output) :   6.4mm (MIN.)
         ・Creepage distance (Between input and output) :   6.4mm (MIN.)
         ・Isolation thickness between input and output   :   0.15mm (MIN.)
         ・Tracking-proof :   CTI 175
         ・Safety limit values   Current (Isi) :   200mA (Diode side)
                                   Power (Psi) : 3600mW (Triac side)

                                   Temperature (Tsi) :   150°C
      In order to keep safety electric isolation of photocoupler, please set the protective circuit to keep within safety limit values when the actual application equipment troubled.
         ・Indication of VDE approval "   ⟨V DE⟩   " is printed on minimum unit package.

●Outline   Refer to the attachment-1-2.

●Isolation specification according to EN 60747-5-5

| Parameter	Symbol	Condition	Rating	Unit	Remark
Class of environmental test	-	-	30/100/21	-	
Pollution	-	-	2	-	
Maximum operating isolation voltage	$V_{IORM(PEAK)}$	-	890	V	
Partial discharge test voltage (Between input and output)					
Diagram 1	$V_{m(PEAK)}$	t_m=10s, qc<5pC	1340	V	Refer to the Diagram 1, 2 (Attachement-1-3)
Diagram 2		t_{st1}=1s, qc<5pC	1670	V	
Maximum over-voltage	$V_{ini,a(PEAK)}$	t_{ini}=60s	7100	V	
Safety maximum ratings					
1) Case temperature	Tsi	I_F=0, P_C=0	150	°C	Refer to the Fig. 3, 4 (Attachement-1-3)
2) Input current	Isi	P_C=0	200	mA	
3) Electric power (Output or Total power dissipation)	Psi	-	3600	mW	
Isolation resistance (Test voltage between input and output ; DC500V)	R_{ISO}	T_{amb}=Tsi	MIN. 10^9	Ω	
		T_{amb}=Topr (MAX)	MIN. 10^{11}		
		T_{amb}=25°C	MIN. 10^{12}		

●Precautions in performing isolation test
 1) Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-5.
 2) Please don't carry out isolation test (Viso) over $V_{ini,a}$.
    This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. $V_{ini,a}$).
    And there is possibility that partial discharge occurs in operating isolation voltage (V_{IORM}).

(Attachment-1-2)

● Pin-Number and internal connection diagram

① : Cathode   ⑤ : Gate
② : Anode   ⑥ : T_1
③ : Cathode   ⑧ : T_2
④ : Cathode
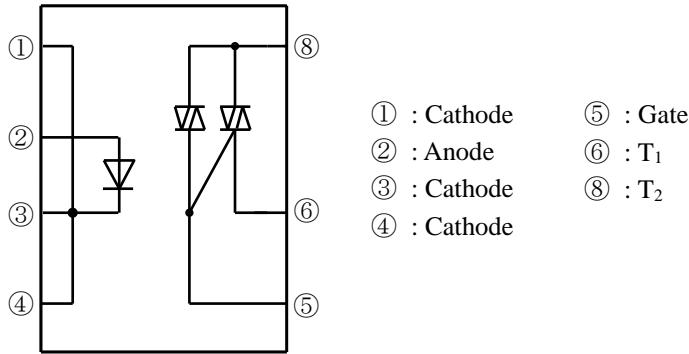
● Outline

Burr Max. 0.2
Brand name "S"
Anode mark
Factory identification mark *2
Date code *1
"L" identification mark
Rank mark
VDE identification mark
Epoxy resin
θ:0～13°

Marking is laser marking
*1) 2-digit number shall be marked according to OLD DIN standard.
*2) Factory identification mark applies to the below.
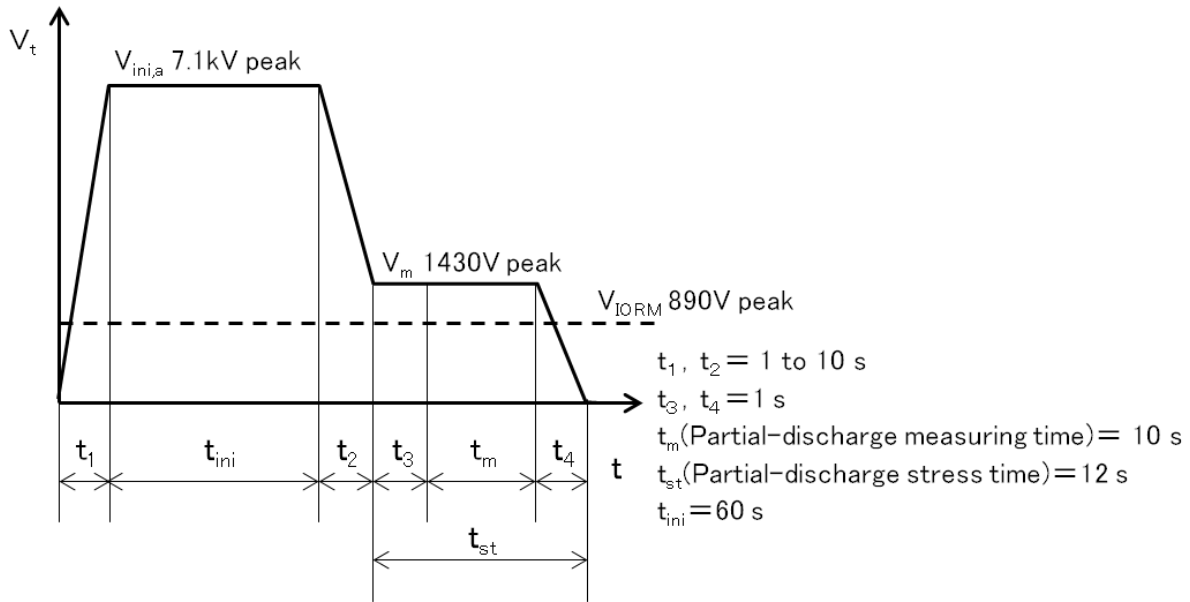   Without : SUN-S Corporation (Japan)
              : SUN-S Electronic Technology (KUNSHAN) Co. Ltd (China)

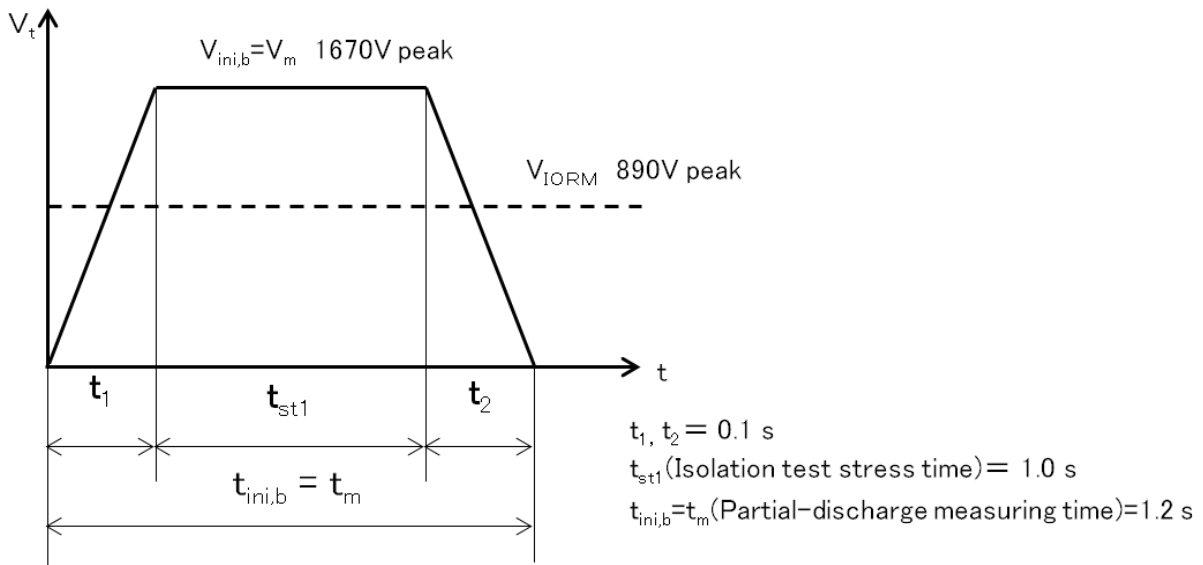*3) Pin material : Copper Alloy
     Pin finish : SnCu plating (Cu : TYP. 2%)
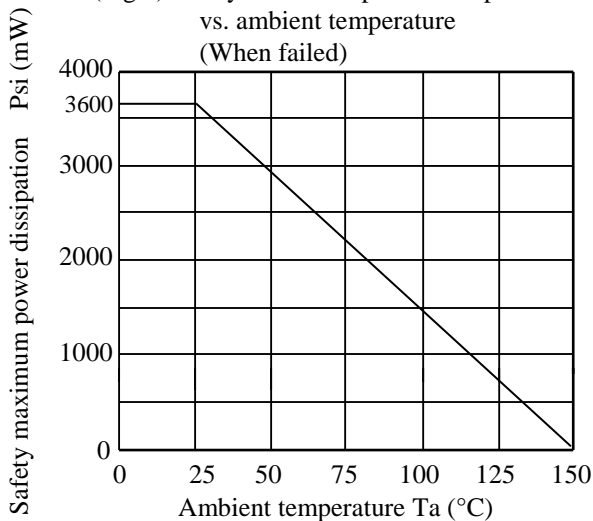
Product mass : Approx. 0.56g		
	UNIT : 1/1 mm	
Name	R3BMF5 Outline Dimensions (Business dealing name : PR3BMF51YSLF)	

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(Attachment-1-3)

Method of Diagram 1:   Breakdown test (Apply to type test and sampling test)

V_t

$V_{ini,a}$ 7.1kV peak

V_m 1430V peak

V_{IORM} 890V peak

t_1 t_{ini} t_2 t_3 t_m t_4 t

t_{st}

t_1, t_2 = 1 to 10 s
t_3, t_4 = 1 s
t_m(Partial-discharge measuring time)= 10 s
t_{st}(Partial-discharge stress time)=12 s
t_{ini}=60 s

Method of Diagram 2:   Non breakdown test (Apply to all device test)

V_t

$V_{ini,b}$=V_m 1670V peak

V_{IORM} 890V peak

t_1 t_{st1} t_2 t

$t_{ini,b}$ = t_m

t_1, t_2 = 0.1 s
t_{st1}(Isolation test stress time)= 1.0 s
$t_{ini,b}$=t_m(Partial-discharge measuring time)=1.2 s

(Fig.3) Safety maximum power dissipation
vs. ambient temperature
(When failed)

(Fig.4) Safety maximum forward current
vs. ambient temperature
(When failed)

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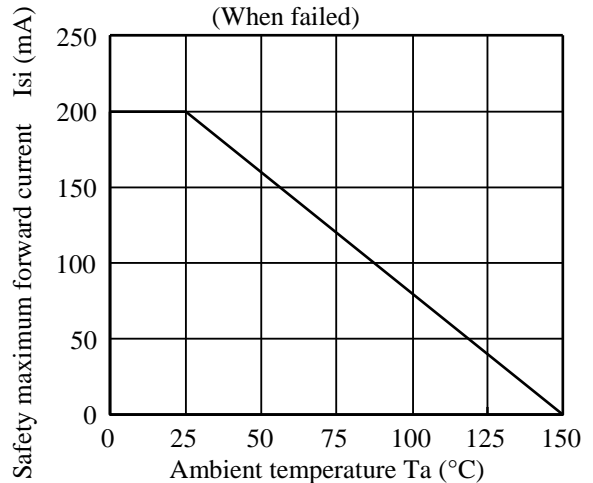
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--- Telecommunication equipment [terminal]
--- Test and measurement equipment
--- Industrial control
--- Audio visual equipment
--- Consumer electronics
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--- Traffic signals
--- Gas leakage sensor breakers
--- Alarm equipment
--- Various safety devices, etc.
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