

SHARP

OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

SOLID STATE RELAY

MODEL No.

R39MF5

Business dealing name

	PR39MF51NIPF
	PR39MF51YIPF

Specified for

Enclosed please find copies of the Specifications which consists of 15 pages including cover.
This specification sheets and attached sheets shall be both side copy.
After confirmation of the contents, please be sure to send back ☐ 1 copies of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

DATE *Apr. 19, 2005*

BY *H. Imanaka*

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Department General Manager of
Engineering Dept., II
Opto-Electronic Devices Div.
ELECOM Group
SHARP CORPORATION

Product name : SOLID STATE RELAY

Model No. : R39MF5

(Business dealing name : PR39MF51NIPF)

(Business dealing name : PR39MF51YIPF)

1. These specification sheets include materials protected under copyright of Sharp Corporation ("Sharp"). Please do not reproduce or cause anyone to reproduce them without Sharp's consent.
2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

(Precautions)

- (1) This product is designed for use in the following application areas ;

· OA equipment	Audio visual equipment	· Home appliances
· Telecommunication equipment (Terminal)	· Measuring equipment	
· Tooling machines	· Computers	

If the use of the product in the above application areas is for equipment listed in paragraphs (2) or (3), please be sure to observe the precautions given in those respective paragraphs.

- (2) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

· Transportation control and safety equipment (aircraft, train, automobile etc.)
· Traffic signals · Gas leakage sensor breakers · Rescue and security equipment
· Other safety equipment

- (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

· Space equipment	· Telecommunication equipment (for trunk lines)
· Nuclear power control equipment	· Medical equipment

- (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

1. Application

This specification applies to the outline and characteristics of Solid State Relay (SSR),
Model No. R39MF5 (Apply line voltage 200V AC).

2. Outline

Refer to the attached sheet, page 4.

3. Ratings and characteristics

Refer to the attached sheet, page 5.

4. Reliability

Refer to the attached sheet, page 7.

5. Outgoing inspection

Refer to the attached sheet, page 8.

6. Supplement

6.1 Business dealing name

("○" mark indicates business dealing name of ordered product)

Product	Business dealing name	Remarks
	PR39MF51NIPF	
○	PR39MF51YIPF	* Applied to products as an option (Attach sheets 1-1 to 1-3)

6.2 Package specification

Refer to the attached sheet, page 9 to 11.

6.3 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.)

6.4 This product is not designed against irradiation.

This product is assembled with electrical input and output.

This product incorporates non-coherent light emitting diode.

6.5 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 : CFCs, Halon, Carbon tetrachloride, 1,1,1-Trichloroethane (Methyl chloroform)

6.6 Brominated flame retardants

Specific brominated flame retardants such as the PBBOs and PBBs are not used in this device at all.

7. Notes

7.1 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 as 2 times or more of the Maximum value of the Minimum triggering current at circuit design in consideration of 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 in consideration of the load. (Recommendable values : $R_s=47\ \Omega$, $C_s=0.022\ \mu F$)

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 ($R_s=47\ \Omega$, $C_s=0.022\ \mu F$) 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, it shall be recommended to use that the pulse width of input signal is 1ms or more.

7.2 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 doesn't occur any defect 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.

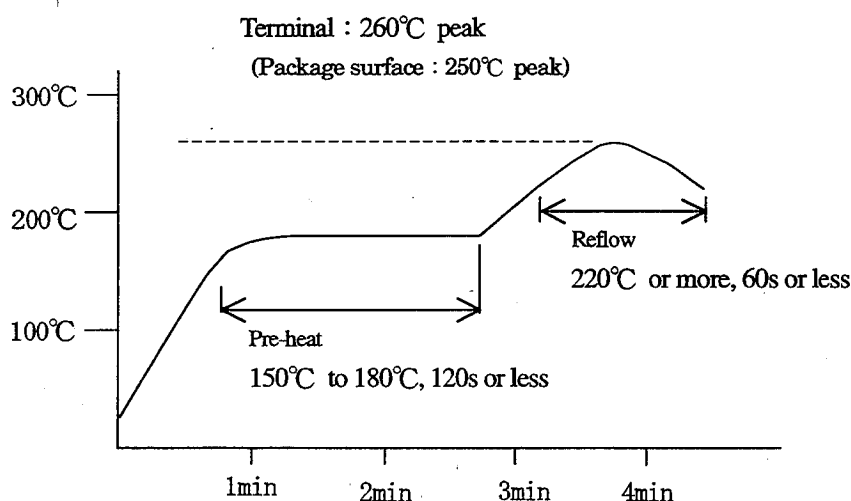
7.3 Using method

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

7.4 Precautions for Soldering

(1) In case of solder reflow

It is recommended to be done at the temperature and the time within the temperature profile as shown in the figure below.(2 times or less)



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

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

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

(3) In case of hand soldering

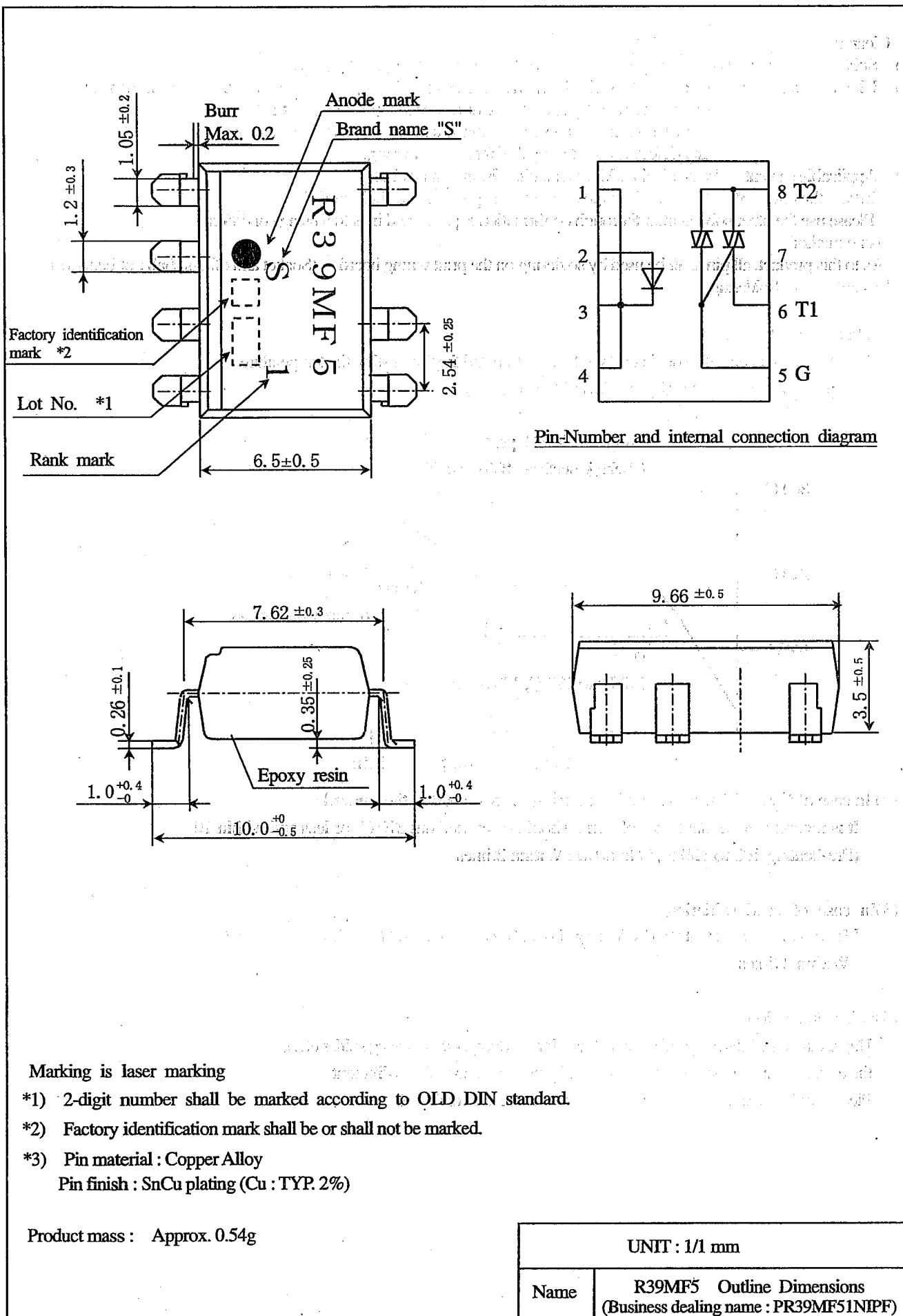
It is recommended that hand soldering should be carried out 400°C or less and within 3s.

: Within 2 times

(4) Other Precaution

Depending on equipment and soldering conditions (temperature, Using solder etc.), the effect to junction between PCB and lead pins of photocoupler is different.

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



3. Ratings and characteristics

3.1 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	$I_T(\text{rms})$	0.9	A
	Peak one cycle surge current	I_{surge}	9 (50Hz sine wave)	A
	Repetitive peak off-state voltage	V_{DRM}	600	V
	Isolation voltage *2	$V_{\text{iso}}(\text{rms})$	4.0	kV
	Operating temperature	T_{opr}	-30 to +85	°C
	Storage temperature	T_{stg}	-40 to +125	°C
	Soldering temperature	T_{sol}	270 (For 10s)	°C

*1 The derating factors of absolute maximum rating due to ambient temperature are shown in Fig.1, 2.

*2 AC for 1min, 40 to 60%RH, f=60Hz

3.2 Electrical characteristics

Ta=25°C

	Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Input	Forward voltage	V_F	-	1.2	1.4	V	$I_F=20\text{mA}$
	Reverse current	I_R	-	-	10	μA	$V_R=3\text{V}$
Output	Repetitive peak off-state current	I_{DRM}	-	-	100	μA	$V_D=V_{\text{DRM}}$
	On-state voltage	V_T	-	-	2.5	V	$I_T=0.9\text{A}$
	Holding current	I_H	-	-	25	mA	$V_D=6\text{V}$
	Critical rate of rise of off-state voltage	dv/dt	100	-	-	$\text{V}/\mu\text{s}$	$V_D=1/\sqrt{2} \cdot V_{\text{DRM}}$
Transfer characteristics	Minimum trigger current	I_{FT}	-	-	10	mA	$V_D=6\text{V}$, $R_L=100\Omega$
	Isolation resistance	R_{iso}	5×10^{10}	10^{11}	-	Ω	DC500V 40 to 60%RH
	Turn on time	t_{ON}	-	-	100	μs	$V_D=6\text{V}$, $R_L=100\Omega$, $I_F=20\text{mA}$

Fig.1 Forward current vs. ambient temperature

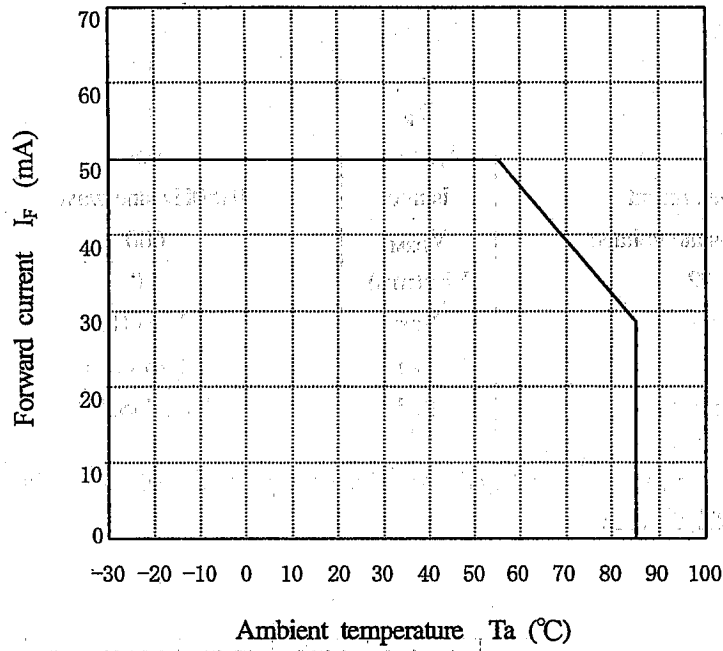
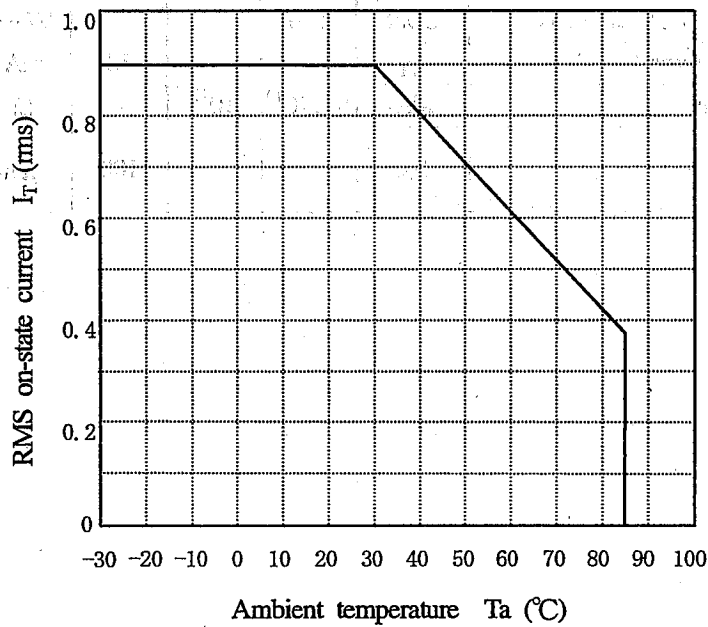


Fig.2 RMS on-state current vs. ambient temperature



4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

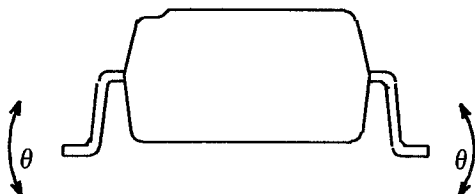
LTPD : 10 or 20

Test Items	Test Conditions *1	Failure Judgement Criteria	Samples (n)
			Defective(C)
Solderability *2	245±3°C, 5s	—————	n=11, C=0
Soldering heat	(Flow soldering) 270°C, 10 s	$V_F > U \times 1.2$ $V_T > U \times 1.2$ $I_{FT} > U \times 1.3$ $I_R > U \times 2.0$ $I_{DRM} > U \times 2.0$ U : Upper specification limit	n=11, C=0
	(Soldering by hand) 400°C, 3 s		n=11, C=0
Terminal strength (Tension)	Weight : 5N 5 s/each terminal		n=11, C=0
Terminal strength (Bending) *3	Weight : 2.5N 2 times/each terminal		n=11, C=0
Mechanical shock	15km/s ² , 0.5ms 3 times/±X, ±Y, ±Z direction		n=11, C=0
Variable frequency vibration	100 to 2000 to 100Hz/4min 200m/s ² 4 times/ X, Y, Z direction		n=11, C=0
Temperature cycling	1 cycle -40°C to +125°C (30min) (30min) 20 cycles test, Without Road		n=22, C=0
High temp. and high humidity storage	+60°C, 90%RH, 500h		n=22, C=0
High temp. storage	+125°C, 1000h		n=22, C=0
Low temp. storage	-40°C, 1000h		n=22, C=0
Operation life	I _F =50mA, I _{T(rms)} =0.9A Ta=25°C, 1000h		n=22, C=0

*1 Test method, conforms to EIAJ ED 4701.

*2 Solder shall adhere at the area of 95% or more of immersed portion of lead,
and pin hole or other holes shall not be concentrated on one portion.

*3 Terminal bending direction is shown below.



5. Outgoing inspection

5.1 Inspection items

(1) Electrical characteristics

V_F , I_R , I_{DRM} , V_T , I_{FT} , R_{ISO} , V_{ISO}

(2) Appearance

5.2 Sampling method and Inspection level

A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

Defect	Inspection item	AQL (%)
Major defect	Electrical characteristics Unreadable marking	0.065
Minor defect	Appearance defect except the above mentioned.	0.25

6.2 Package specifications

6.2.1 Taping conditions

(1) Tape structure and Dimensions (Refer to the attached sheet, Page 10)

The carrier tape has the heat pressed structure of PS material carries tape and three layers cover tape (PET material base).

(2) Reel structure and Dimensions (Refer to the attached sheet, Page 11)

The taping reel shall be of plastic (PS material) with its dimensions as shown in the attached drawing.

(3) Direction of product insertion (Refer to the attached sheet, Page 11)

Product direction in carrier tape shall direct to the anode mark at the hole side on the tape.

(4) The cover tape and carrier tape in one reel shall be jointless.

(5) To repair taped failure devices cutting a bottom of carrier tape with a cutter, and after replacing to good devices, the cut portion shall be sealed with adhesive tape.

6.2.2 Adhesiveness of cover tape

The exfoliation force between carrier tape and cover tape shall be 0.2N to 0.7N for the angle 160° to 180° .

6.2.3 Rolling method and quantity

Wind the tape back on the reel so that the cover tape will be outside the tape.

Attach more than 20cm of blank tape to the trailer and the leader of the tape and fix the both ends with adhesive tape.

One reel shall contain 1000pcs.

6.2.4 Outer packing appearance (Refer to attached sheet, Page 11)

6.2.5 Marking

The outer packaging case shall be marked with following information.

* Model No. * (Business dealing name) * lot No. * quantity * country of origin

* Company name * inspection date specified

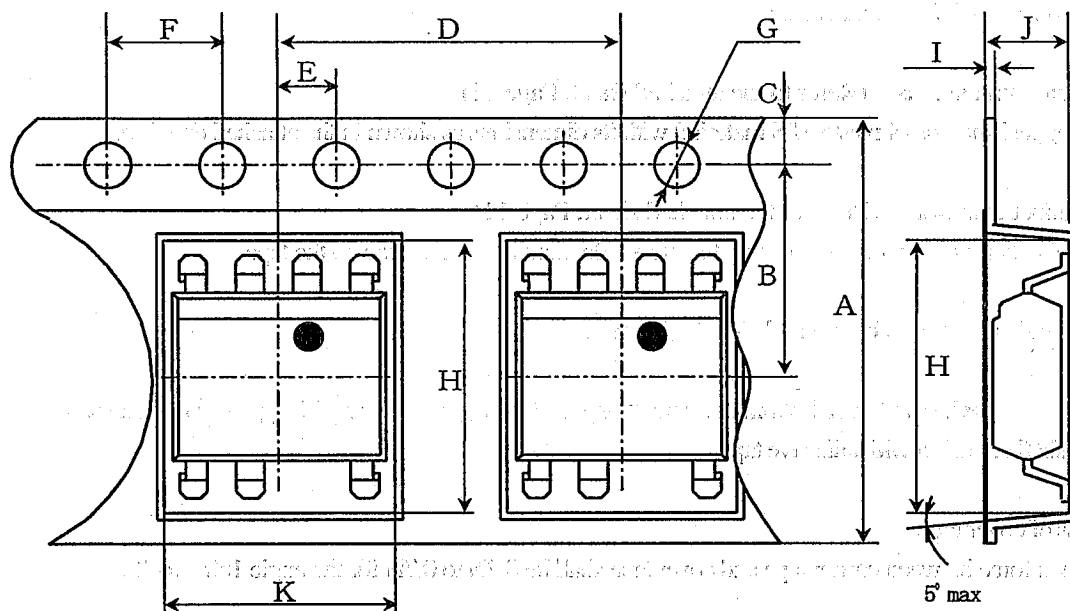
6.2.6 Storage condition

Taped products shall be stored at the temperature 5 to 30°C and the humidity lower than 70%RH.

6.2.7 Safety protection during shipping

There shall be no deformation of component or degradation of electrical characteristics due to shipping.

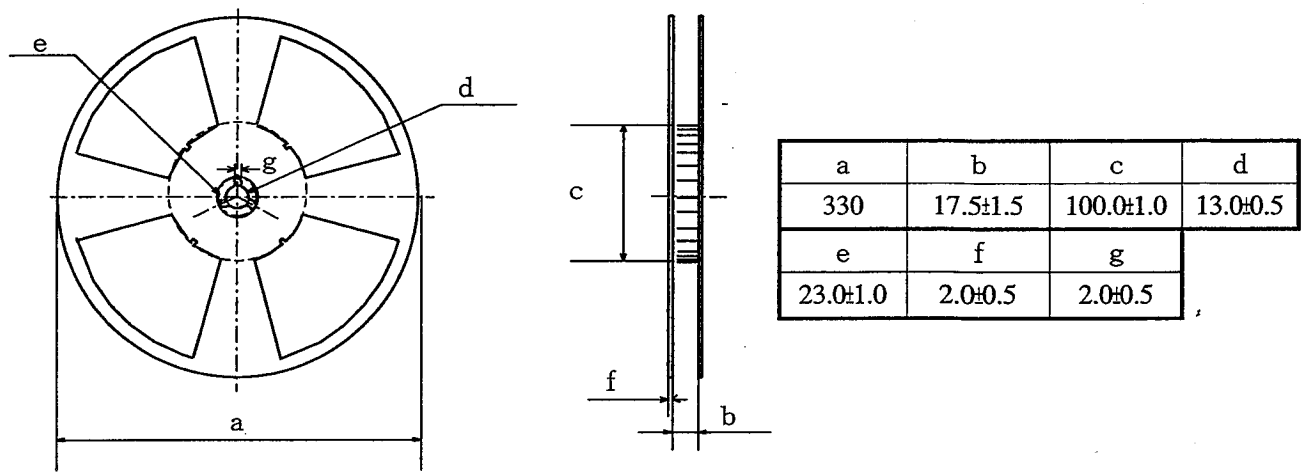
○Carrier tape structure and Dimensions



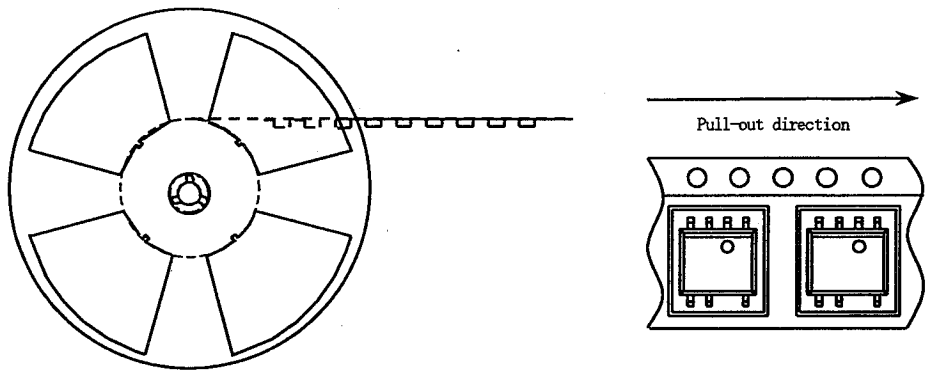
○Dimensions list (Unit : mm)

A	B	C	D	E	F	G	H
16.0±0.3	7.5±0.1	1.75±0.10	12.0±0.1	2.0±0.1	4.0±0.1	φ 1.5 ^{+0.1} ₋₀	10.4±0.1
I	J	K					
0.40±0.05	4.2±0.1	10.2±0.1					

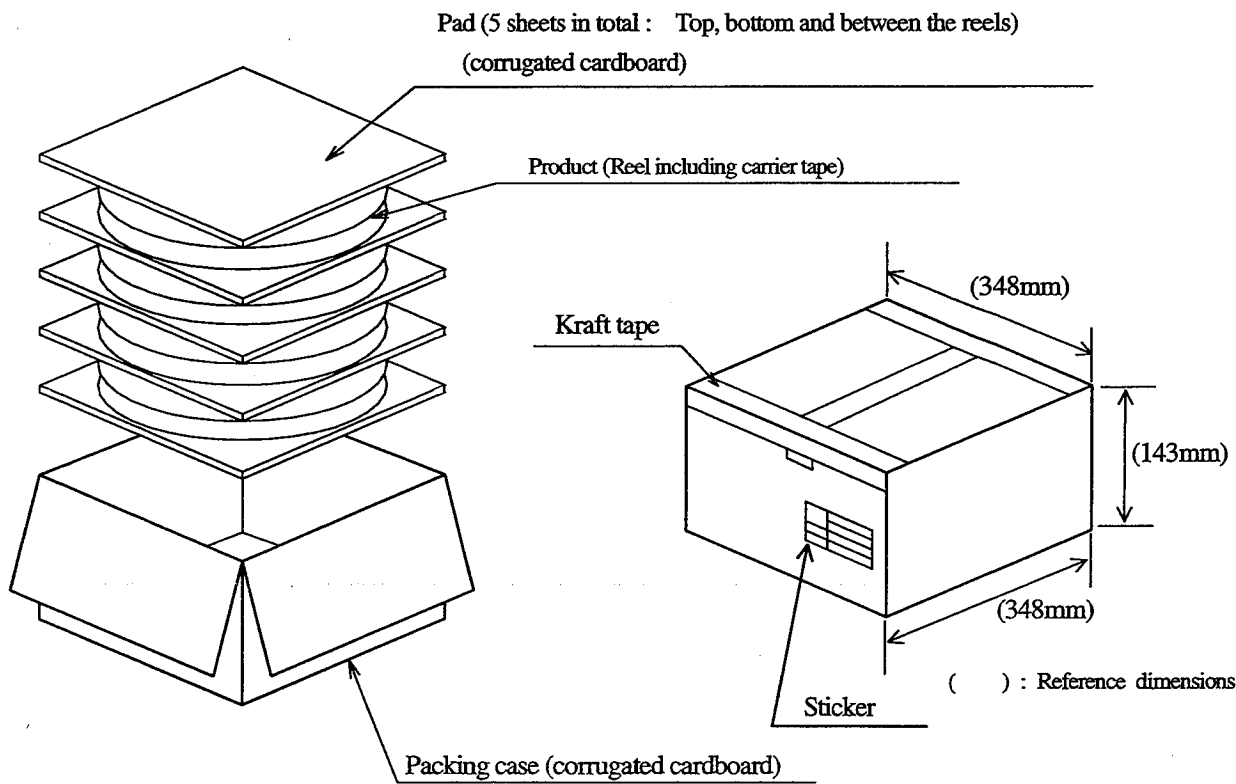
○Reel structure and Dimensions



○Direction of product insertion



○Outer packing appearance



1. This specification shall be applied to Solid State Relay (SSR), Model No. R39MF5 series as an option.

2. Applicable Models (Business dealing name)

PR39MF51YIPF

3. The relevant models are the models Approved by VDE according to DIN EN 60747-5-2

VDE approved No. : 40011197

Approved Model No. : R39MF5

- Operating isolation voltage $U_{IORM(Peak)}$: 890V
- Transient voltage $U_{TR(Peak)}$: 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) : 2700mW (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 "  " is printed on minimum unit package.

4. Outline Refer to the attachment-1-2.

5. Isolation specification according to EN 60747-5-2

Parameter	Symbol	Condition	Rating	Unit	Remark
Class of environmental test	-	-	30/100/21	-	
Pollution	-	-	2	-	
Maximum operating isolation voltage	$U_{IORM(PEAK)}$	-	890	V	Refer to the Diagram 1, 2 (Attachement-1-3)
Partial discharge test voltage (Between input and output)					
Diagram 1	$U_{pr(PEAK)}$	$t_p=10s, q_c<5pC$	1340	V	
Diagram 2		$t_p=1s, q_c<5pC$	1670	V	
Maximum over-voltage	$U_{IOTM(PEAK)}$	$t_{INI}=60s$	7100	V	Refer to the Fig. 3, 4 (Attachement-1-3)
Safety maximum ratings					
1) Case temperature	Tsi	$I_F=0, P_C=0$	150	°C	
2) Input current	Isi	$P_C=0$	200	mA	
3) Electric power (Output or Total power dissipation)	Psi	-	2700	mW	
Isolation resistance (Test voltage between input and output ; DC500V)	R_{ISO}	$T_a=T_{si}$	MIN. 10^9	Ω	
		$T_a=T_{opr(MAX)}$	MIN. 10^{11}		
		$T_a=25^\circ C$	MIN. 10^{12}		

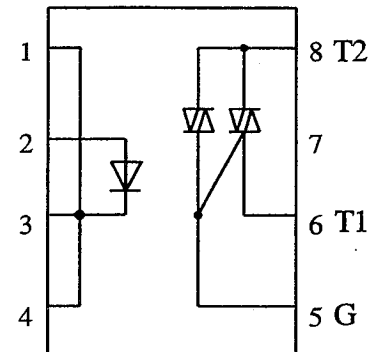
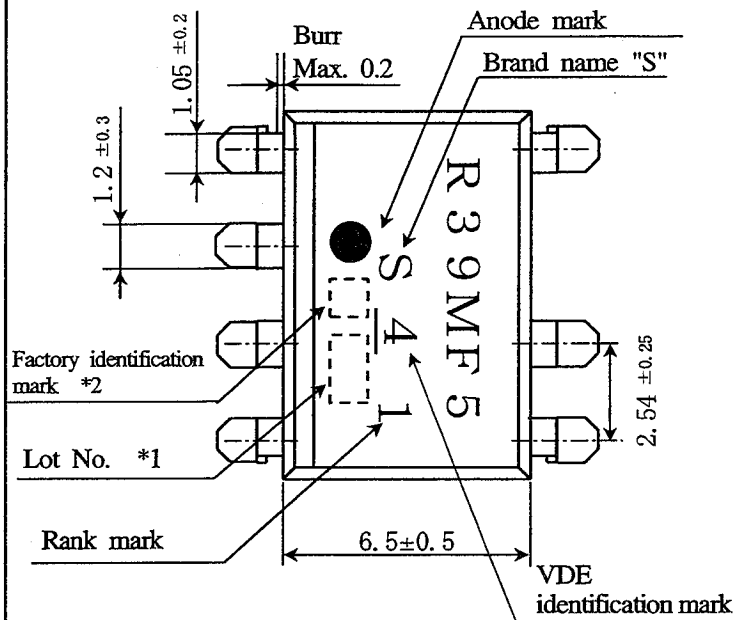
6. Precautions in performing isolation test

6.1 Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-2.

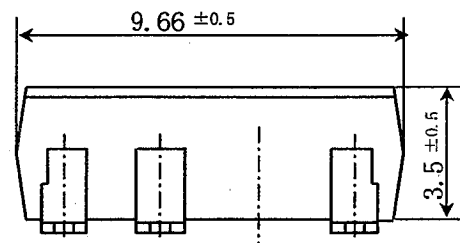
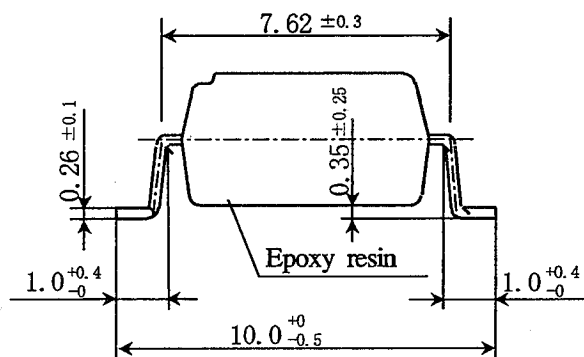
6.2 Please don't carry out isolation test (Viso) over U_{IOTM} .

This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. U_{IOTM}).

And there is possibility that this product occurs partial discharge in operating isolation voltage (U_{IORM}).



Pin-Number and internal connection diagram



Marking is laser marking

*1) 2-digit number shall be marked according to OLD DIN standard.

*2) Factory identification mark shall be or shall not be marked.

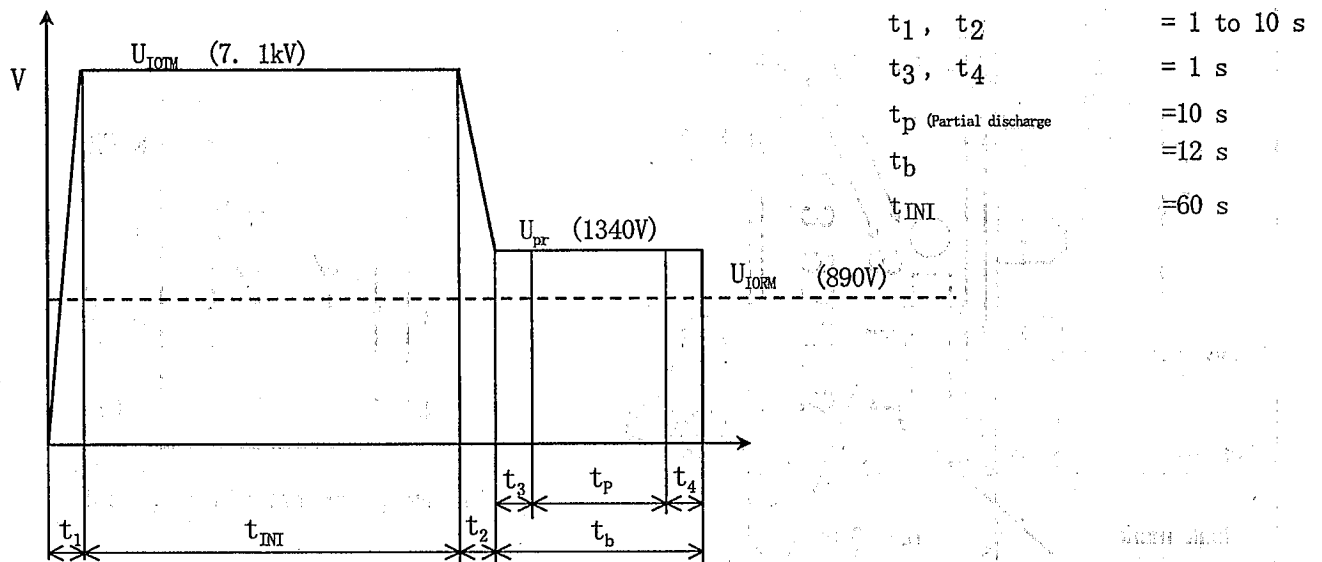
*3) Pin material : Copper Alloy

Pin finish : SnCu plating (Cu : TYP. 2%) Product mass : Approx. 0.54g

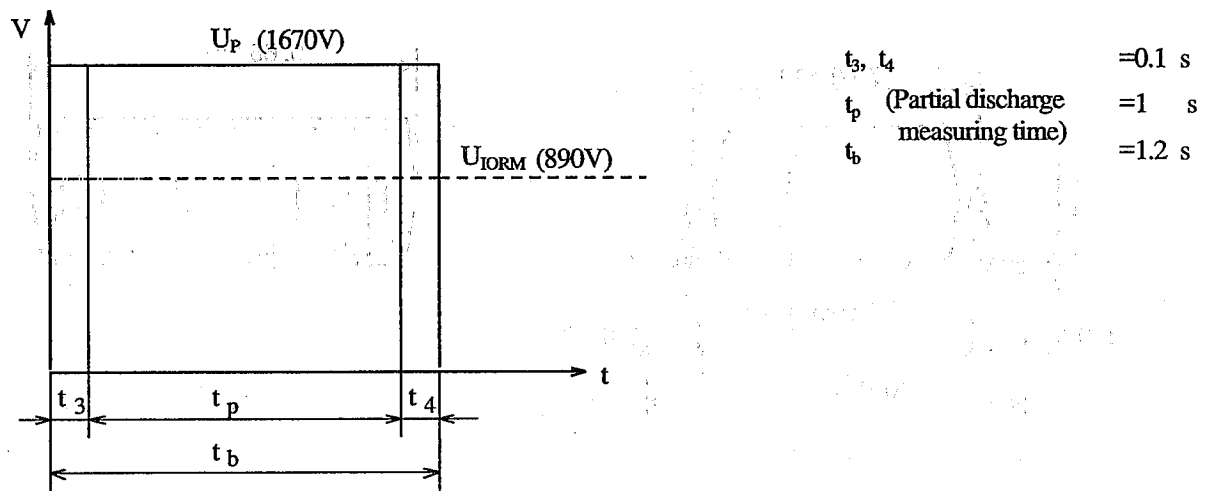
Product mass : Approx. 0.54g

UNIT : 1/1 mm	
Name	R39MF5 Outline Dimensions (Business dealing name : PR39MF51YIPF)

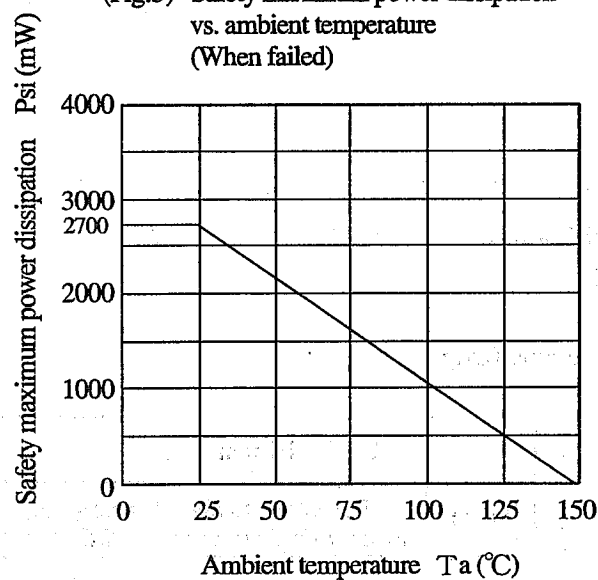
Method of Diagram 1: Breakdown test (Apply to tape test and sampling test)



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



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



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

