PR29MF1xNSZ Series
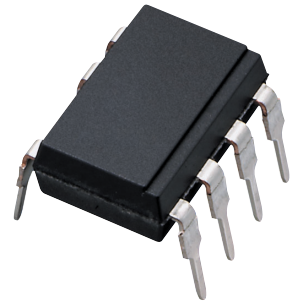# PR39MF1xNSZ Series
PR49MF11NSZ Series

*Zero cross type is also available. (**PR29MF2xNSZ Series/ PR39MF2xNSZ Series**)

I_T(rms)$\leq$0.9A, Non-Zero Cross type DIP 8pin
Triac output SSR

■ Description

　PR29MF1xNSZ Series, **PR39MF1xNSZ Series** and **PR49MF11NSZ 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)$\leq$0.9A
2. Non-zero crossing functionary
3. 8 pin DIP package (SMT gullwing also available)
4. High repetitive peak off-state voltage
   (V_{DRM} : 800V, **PR49MF11NSZ Series**)
   (V_{DRM} : 600V, **PR39MF1xNSZ Series**)
   (V_{DRM} : 400V, **PR29MF1xNSZ Series**)
5. I_{FT} ranks available (see Model Line-up in this datasheet)
6. Superior noise immunity
   (dV/dt : MIN. 100V/μs, **PR29MF1xNSZ Series** and **PR39MF1xNSZ Series**)
   (dV/dt : MIN. 50V/μs, **PR49MF11NSZ Series**)
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. Recognized by UL508 (except for **PR49MF11NSZ Series**), file No. E94758 (as model No. **R29MF1/ R39MF1**)
2. Approved by CSA 22.2 No.14 (except for **PR49MF11NSZ Series**), file No. LR63705 (as model No. **R29MF1**/**R39MF1**)
3. Optionary available VDE approved (*)(DIN EN 60747-5-2), file No.40008898 (only for **PR39MF1xNSZ Series** as model No. **R39MF1**)
4. Package resin : UL flammability grade (94V-0)

　(*) DIN EN60747-5-2 : successor standard of DIN VDE0884. Up to Date code "RD" (December 2003), approval of DIN VDE0884.
From Date code "S1" (January 2004), approval of DIN EN60747-5-2.
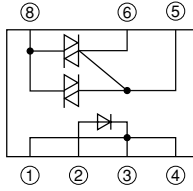
■ Applications

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.

1

■ Internal Connection Diagram

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

■ Outline Dimensions

(Unit : mm)

1. Through-Hole [ex. **PR29MF11NSZF**]

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

SHARP mark "S"

Model No.

R 2 9 M F 1

$6.5^{\pm0.5}$

CSA mark

Rank mark

Anode mark

Date code (2 digit)

Factory identification mark

$9.66^{\pm0.5}$ $7.62^{\pm0.3}$

$3.5^{\pm0.5}$

$3.25^{\pm0.5}$

$0.5^{TYP.}$

$2.54^{\pm0.25}$ $0.5^{\pm0.1}$

Epoxy resin

$0.26^{\pm0.1}$

θ   θ:0 to 13˚   θ

Product mass : approx. 0.56g

2. SMT Gullwing Lead-Form [ex. **PR29MF11NIPF**]

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

SHARP mark "S"

Model No.

R 2 9 M F 1

$6.5^{\pm0.5}$

CSA mark

Rank mark

Anode mark

Date code (2 digit)

Factory identification mark

$9.66^{\pm0.5}$ $7.62^{\pm0.3}$

$0.26^{\pm0.1}$ $0.35^{\pm0.25}$

$3.5^{\pm0.5}$

$2.54^{\pm0.25}$

$1.0^{+0.4}_{-0}$ Epoxy resin $1.0^{+0.4}_{-0}$

$10.0^{+0}_{-0.5}$

Product mass : approx. 0.54g

3. Through-Hole [ex. **PR39MF11NSZF**]

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

SHARP mark "S"

Model No.

R 3 9 M F 1

$6.5^{\pm0.5}$

CSA mark

Rank mark

Anode mark

Date code (2 digit)

Factory identification mark

$9.66^{\pm0.5}$ $7.62^{\pm0.3}$

$3.5^{\pm0.5}$

$3.25^{\pm0.5}$

$0.5^{TYP.}$

$2.54^{\pm0.25}$ $0.5^{\pm0.1}$

Epoxy resin

$0.26^{\pm0.1}$

θ   θ:0 to 13˚   θ

Product mass : approx. 0.56g

4. SMT Gullwing Lead-Form [ex. **PR39MF11NIPF**]

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

SHARP mark "S"

Model No.

R 3 9 M F 1

$6.5^{\pm0.5}$

CSA mark

Rank mark

Anode mark

Date code (2 digit)

Factory identification mark

$9.66^{\pm0.5}$ $7.62^{\pm0.3}$

$0.26^{\pm0.1}$ $0.35^{\pm0.25}$

$3.5^{\pm0.5}$

$2.54^{\pm0.25}$

$1.0^{+0.4}_{-0}$ Epoxy resin $1.0^{+0.4}_{-0}$

$10.0^{+0}_{-0.5}$

Product mass : approx. 0.54g

■ Outline Dimensions

(Unit : mm)

5. Through-Hole [ex. **PR49MF11NSZF**]

SHARP mark "S"

Model No.

R 4 9 M F 1
S

Rank mark

$6.5^{\pm0.5}$

Anode mark

Date code (2 digit)

Factory identification mark

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

$9.66^{\pm0.5}$ $3.5^{\pm0.5}$ $0.5^{TYP.}$

$3.25^{\pm0.5}$ $2.54^{\pm0.25}$ $0.5^{\pm0.1}$

$7.62^{\pm0.3}$

Epoxy resin

$0.26^{\pm0.1}$

θ   θ:0 to 13˚   θ

Product mass : approx. 0.56g

6. SMT Gullwing Lead-Form [ex. **PR49MF11NIPF**]

SHARP mark "S"

Model No.

R 4 9 M F 1
S

Rank mark

$6.5^{\pm0.5}$

Anode mark

Date code (2 digit)

Factory identification mark

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

$9.66^{\pm0.5}$ $3.5^{\pm0.5}$

$2.54^{\pm0.25}$

$7.62^{\pm0.3}$ $0.35^{\pm0.25}$

$0.26^{\pm0.1}$

Epoxy resin

$1.0^{+0.4}_{-0}$ $1.0^{+0.4}_{-0}$

$10.0^{+0}_{-0.5}$
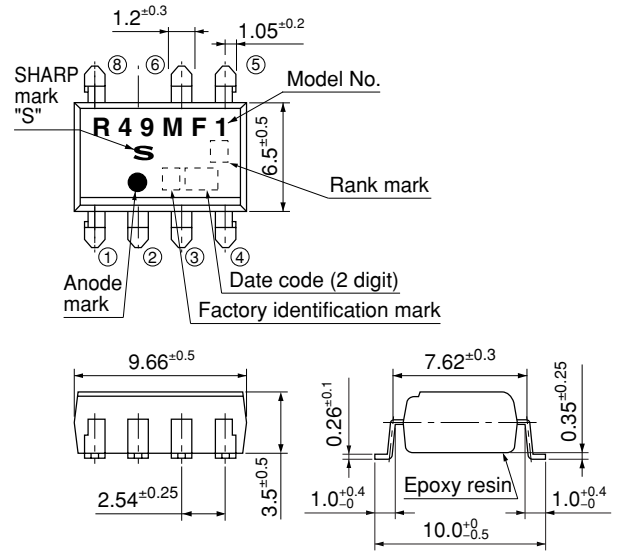
Product mass : approx. 0.54g

7. Through-Hole VDE option [ex. **PR39MF11YSZF**]

SHARP mark "S"

Model No.

R 3 9 M F 1
S 4

CSA mark

Rank mark

$6.5^{\pm0.5}$

VDE identification mark

Anode mark

Date code (2 digit)

Factory identification mark

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

$9.66^{\pm0.5}$ $3.5^{\pm0.5}$ $0.5^{TYP.}$

$3.25^{\pm0.5}$ $2.54^{\pm0.25}$ $0.5^{\pm0.1}$

$7.62^{\pm0.3}$

Epoxy resin

$0.26^{\pm0.1}$

θ   θ:0 to 13˚   θ
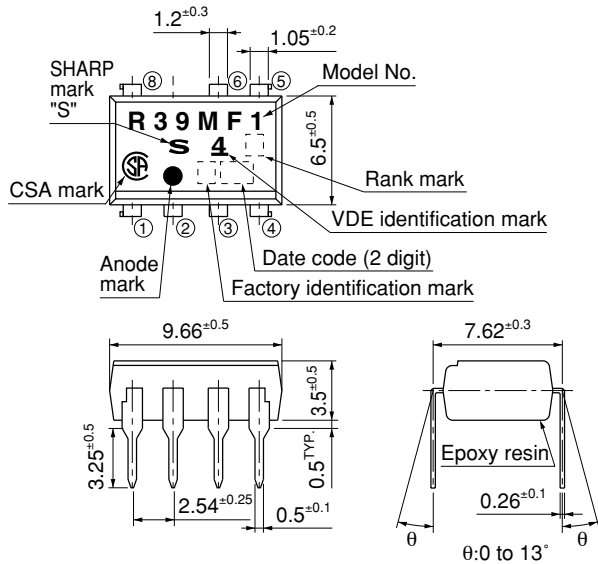
Product mass : approx. 0.56g

8. SMT Gullwing Lead-Form VDE option [ex. **PR39MF11YIPF**]

SHARP mark "S"

Model No.

R 3 9 M F 1
S 4

CSA mark

Rank mark

$6.5^{\pm0.5}$

VDE identification mark

Anode mark

Date code (2 digit)

Factory identification mark

$1.2^{\pm0.3}$ $1.05^{\pm0.2}$

$9.66^{\pm0.5}$ $3.5^{\pm0.5}$

$2.54^{\pm0.25}$

$7.62^{\pm0.3}$ $0.35^{\pm0.25}$

$0.26^{\pm0.1}$

Epoxy resin

$1.0^{+0.4}_{-0}$ $1.0^{+0.4}_{-0}$

$10.0^{+0}_{-0.5}$
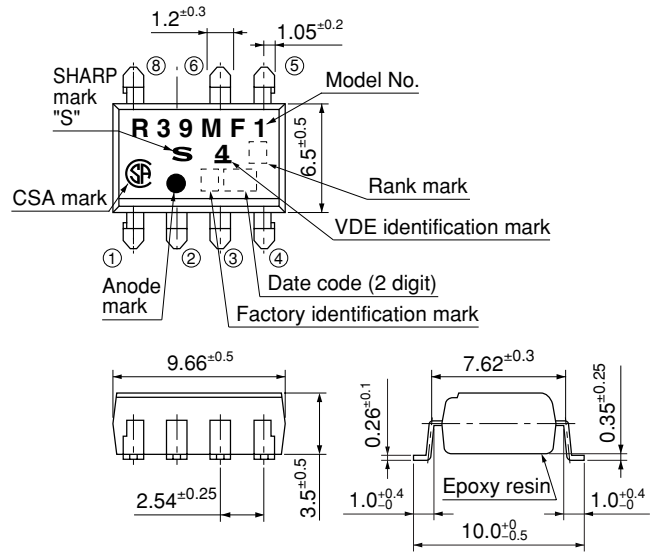
Product mass : approx. 0.54g

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.

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■ Absolute Maximum Ratings

(Ta=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		$I_T(rms)$	0.9 *3	A
	Peak one cycle surge current		I_{surge}	9 *4	A
	Repetitive peak OFF-state voltage	**PR29MF1xNSZ**	V_{DRM}	400	V
		PR39MF1xNSZ		600	
		PR49MF11NSZ		800	
*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}	270 *5	˚C
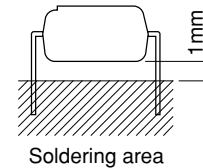
*1 40 to 60%RH, AC for 1minute, f=60Hz
*2 For 10s
*3 Refer to Fig.1, Fig.2
*4 f=50Hz sine wave
*5 Lead solder plating models : 260˚C

Soldering area

■ Electro-optical Characteristics

(Ta=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=0.9A	–	–	3.0	V
	Holding current	**PR29MF1xNSZ**	I_H	V_D=6V	–	–	25	mA
		PR39MF1xNSZ			–	–		
		PR49MF11NSZ			–	–	50	
	Critical rate of rise of OFF-state voltage	**PR29MF1xNSZ**	dV/dt	V_D=1/√2 ·V_{DRM}	100	–	–	V/μs
		PR39MF1xNSZ				–	–	
		PR49MF11NSZ			50	–	–	
Transfer characteristics	Minimum trigger current	Rank 1	I_{FT}	V_D=6V, R_L=100Ω	–	–	10	mA
		Rank 2			–	–	5	
	Isolation resistance		R_{ISO}	DC500V,40 to 60%RH	5×10^{10}	10^{11}	–	Ω
	Turn-on time	Rank 1	t_{on}	I_F=20mA, V_D=6V, R_L=100Ω	–	–	100	μs
		Rank 2		I_F=10mA, V_D=6V, R_L=100Ω				

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

Lead Form	Through-Hole		SMT Gullwing		V_{DRM} [V]	Rank mark	I_{FT}[mA] (V_D=6V, R_L=100Ω)
Shipping Package	Sleeve		Taping				
	50pcs/sleeve		1 000pcs/reel				
DIN EN60747-5-2	——	Approved	——	Approved			
Model No.	PR49MF11NSZF	——	PR49MF11NIPF	——	800	1	MAX.10
	PR39MF11NSZF	PR39MF11YSZF	PR39MF11NIPF	PR39MF11YIPF	600	1	MAX.10
	PR39MF12NSZF	PR39MF12YSZF	PR39MF12NIPF	PR39MF12YIPF		2	MAX.5
	PR29MF11NSZF	——	PR29MF11NIPF	——	400	1	MAX.10
	PR29MF12NSZF	——	PR29MF12NIPF	——		2	MAX.5

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

Lead Form	Through-Hole		SMT Gullwing		V_{DRM} [V]	Rank mark	I_{FT}[mA] (V_D=6V, R_L=100Ω)
Shipping Package	Sleeve		Taping				
	50pcs/sleeve		1 000pcs/reel				
DIN EN60747-5-2	——	Approved	——	Approved			
Model No.	PR49MF11NSZ	——	——	——	800	1	MAX.10
	PR39MF11NSZ	PR39MF11YSZ	——	——	600	1	MAX.10
	PR39MF12NSZ	PR39MF12YSZ	——	——		2	MAX.5
	PR29MF11NSZ	——	——	——	400	1	MAX.10
	PR29MF12NSZ	——	——	——		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
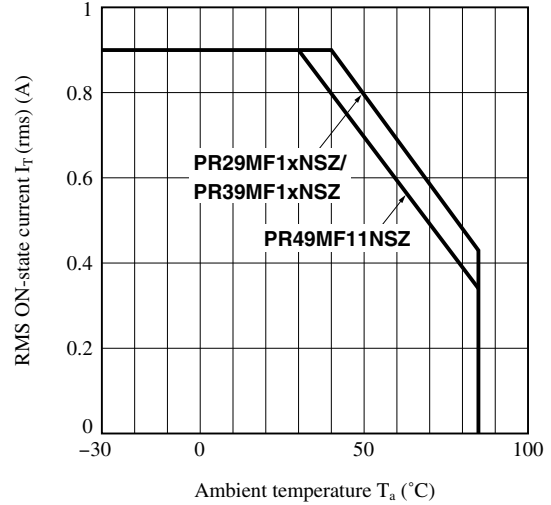

Forward current I_F (mA) vs. Ambient temperature T_a (°C)
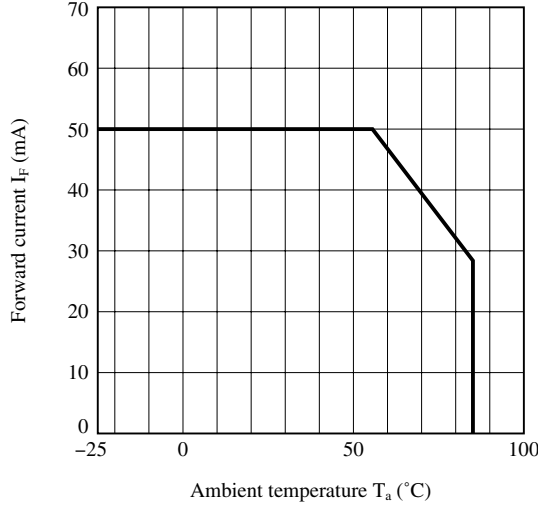
Fig.2 RMS ON-state Current vs. Ambient Temperature

RMS ON-state current I_T (rms) (A) vs. Ambient temperature T_a (°C)

PR29MF1xNSZ/
PR39MF1xNSZ

PR49MF11NSZ

Fig.3-a Forward Current vs. Forward Voltage (Rank 1)

Forward current I_F (mA) vs. Forward voltage V_F (V)

25°C   0°C
T_a=75°C
−25°C
50°C
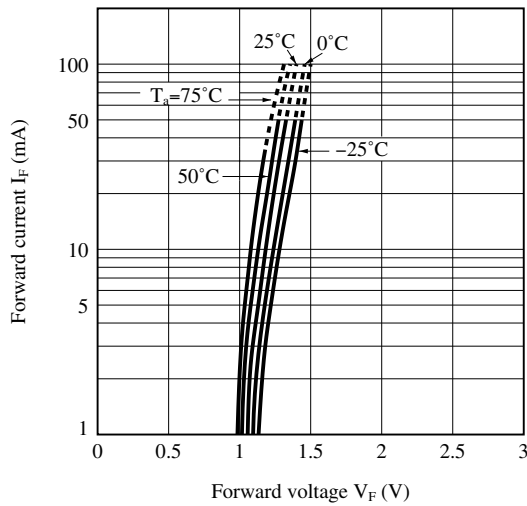
Fig.3-b Forward Current vs. Forward Voltage (Rank 2)

Forward current I_F (mA) vs. Forward voltage V_F (V)

T_a=75°C
50°C
25°C
0°C
−25°C
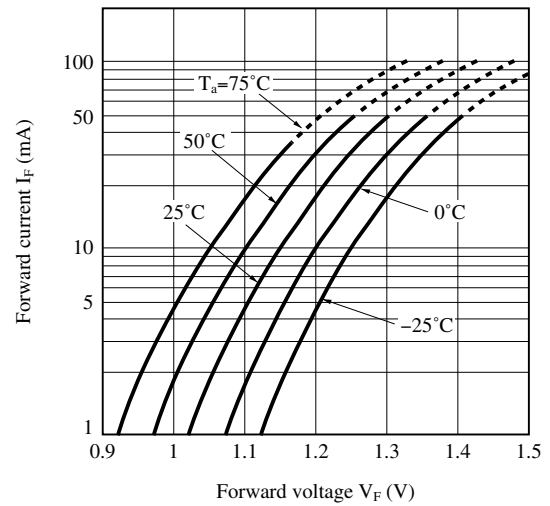
Fig.4-a Minimum Trigger Current vs. Ambient Temperature (Rank 1)

Minimum trigger current I_{FT} (mA) vs. Ambient temperature T_a (°C)

PR29MF11NSZ
PR39MF11NSZ
PR49MF11NSZ

V_D=6V
R_L=100Ω
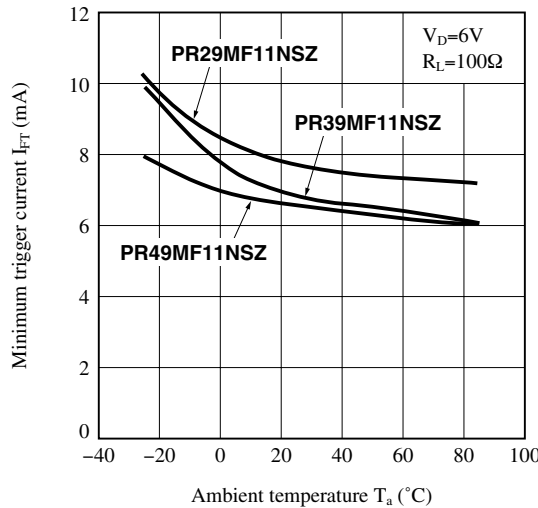
Fig.4-b Minimum Trigger Current vs. Ambient Temperature (Rank 2)

Minimum trigger current I_{FT} (mA) vs. Ambient temperature T_a (°C)

V_D=6V
R_L=100Ω

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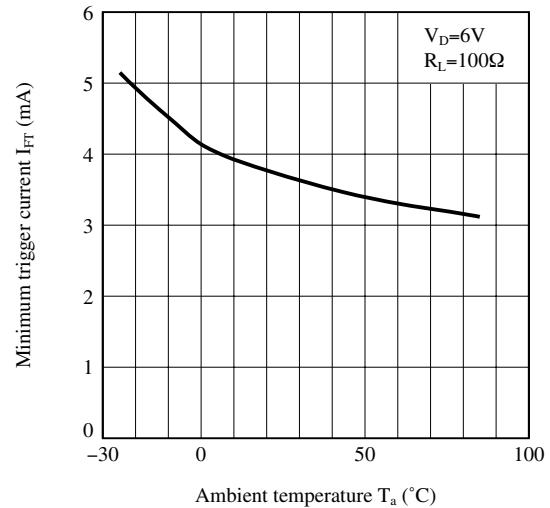
Fig.5 ON-state Voltage vs. Ambient Temperature

I_T=0.9A

ON-state voltage V_T (V)

PR49MF11NSZ

PR29MF1xNSZ/
PR39MF1xNSZ

Ambient temperature T_a (°C)
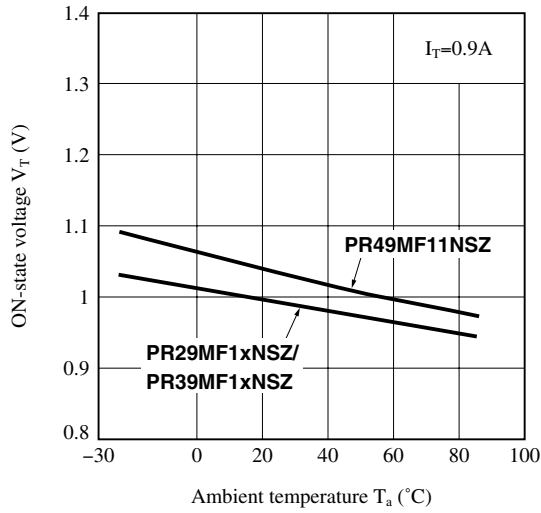
Fig.6 Relative Holding Current vs. Ambient Temperature

V_D=6V

Relative holding current I_H (t°C) / I_H (25°C×100%)

Ambient temperature T_a (°C)
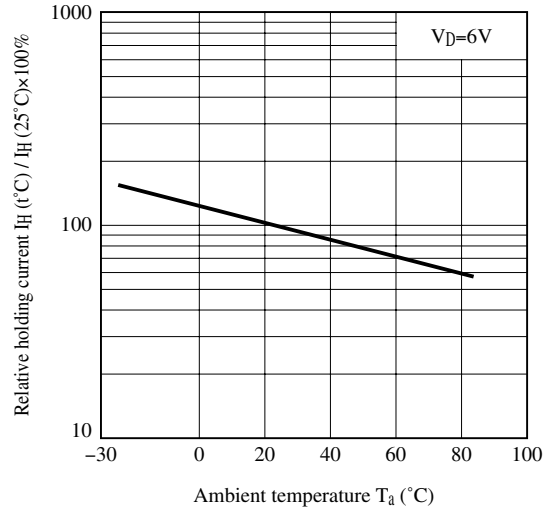
Fig.7 ON-state Current vs. ON-state Voltage

I_F=20mA
T_a=25°C

ON-state current I_T (A)

PR29MF1xNSZ/
PR39MF1xNSZ

PR49MF11NSZ

ON-state voltage V_T (V)
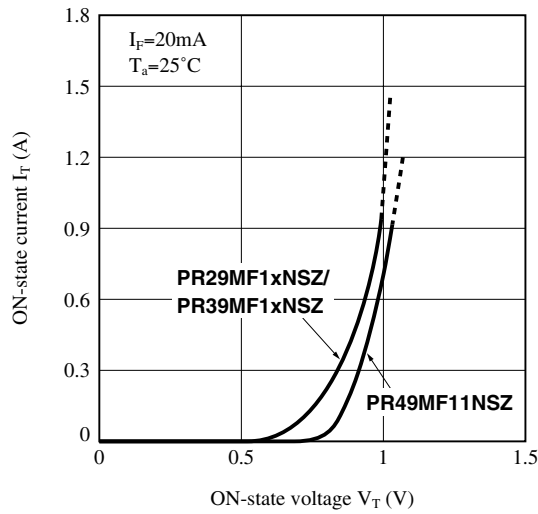
Fig.8-a Turn-on Time vs. Forward Current (Rank 1)

V_D=6V
R_L=100Ω
T_a=25°C

Turn-on time t_{ON} (µs)

PR49MF11NSZ

PR39MF11NSZ

PR29MF11NSZ

Forward current I_F (mA)
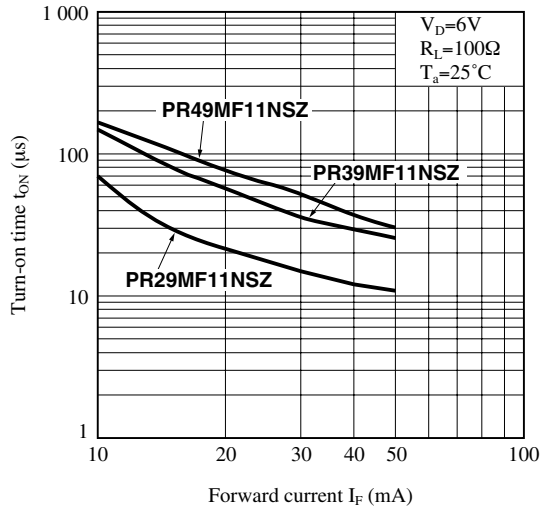
Fig.8-b Turn-on Time vs. Forward Current (Rank 2)

V_D=6V
R_L=100Ω
T_a=25°C

Turn-on time t_{ON} (µs)

Forward current I_F (mA)
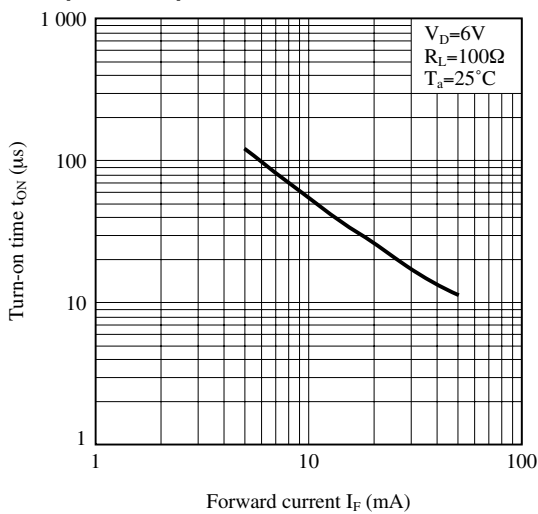
Remarks : Please be aware that all data in the graph are just for reference.

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■ Design Considerations

● Recommended Operating Conditions

Parameter			Symbol	Conditions	MIN.	MAX.	Unit
Input	Input signal current at ON state	Rank 1	I_F(ON)	–	20	25	mA
		Rank 2			10	15	
	Input signal current at OFF state		I_F(OFF)	–	0	0.1	mA
Output	Load supply voltage	PR29MF1xNSZ	V_{OUT}(rms)	–	–	120	V
		PR39MF1xNSZ				240	
		PR49MF11NSZ				300	
	Load supply current	PR29MF1xNSZ	I_{OUT}(rms)	Locate snubber circuit between output terminals (Cs=0.022µF, Rs=47Ω)	–	I_T(rms)×80%(∗)	mA
		PR39MF1xNSZ					
		PR49MF11NSZ			100		
	Frequency		f	–	50	60	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 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**
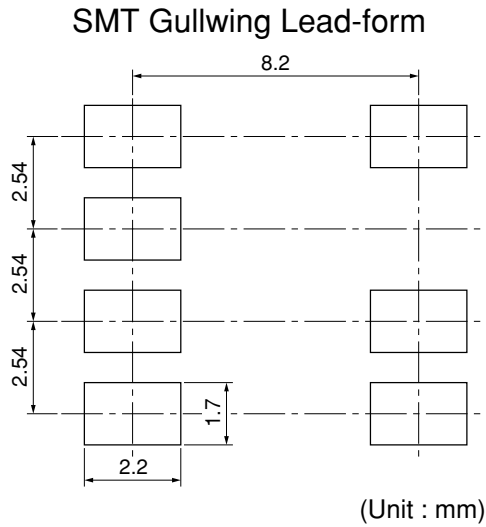
Z_S : Surge absorption circuit (Snubber circuit)
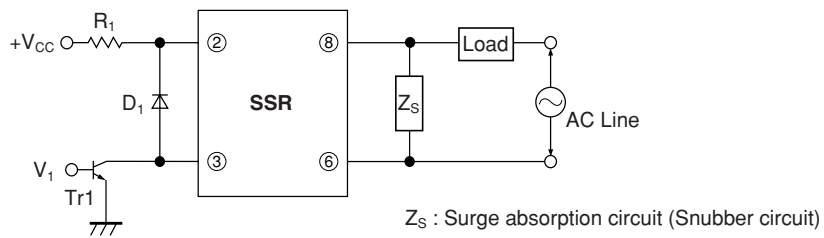
☆ For additional design assistance, please review our corresponding Optoelectronic Application Notes.

■ 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.
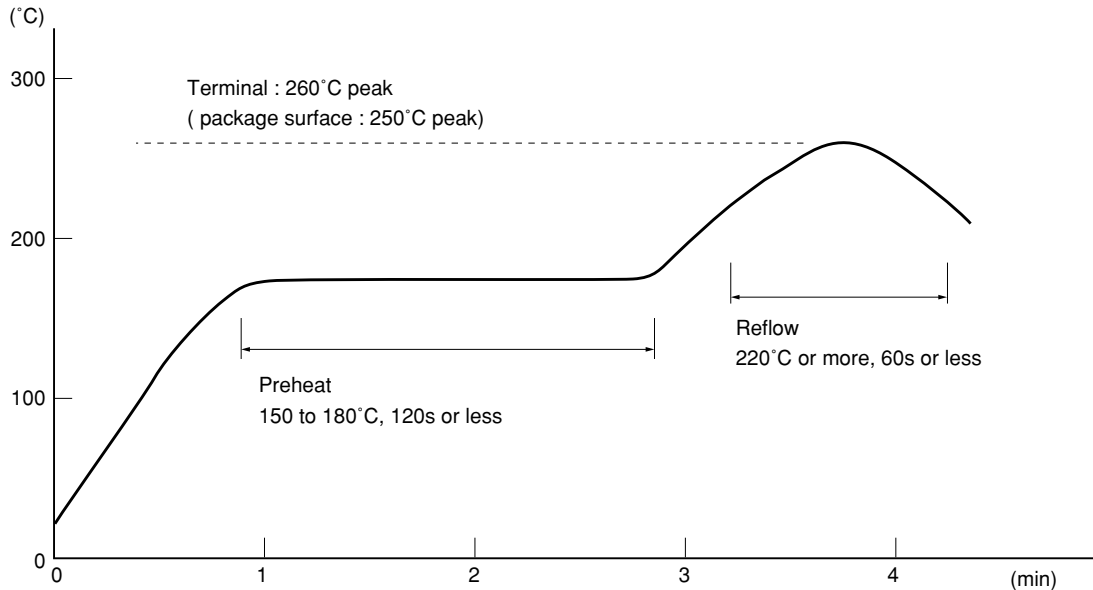
Flow Soldering :

    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 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.

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■ Package specification

● Sleeve package
Through-Hole

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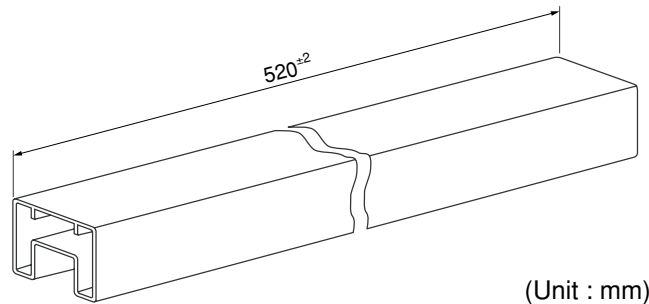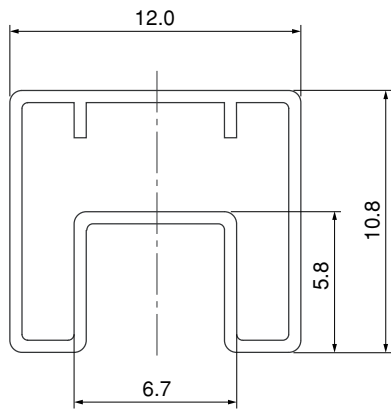Stopper : Styrene-Elastomer

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)
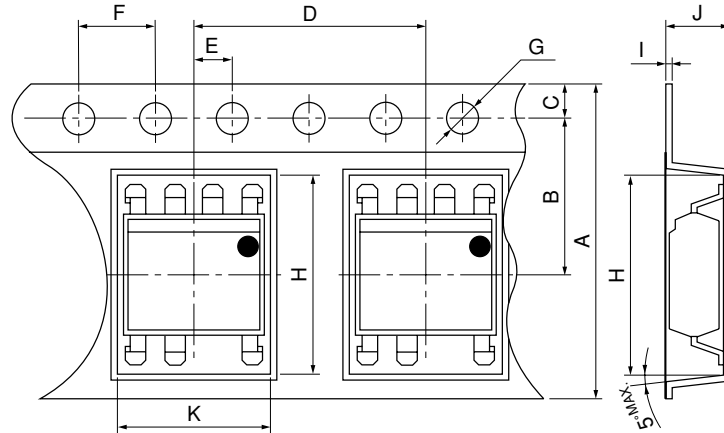
● Tape and Reel package
SMT Gullwing

Package materials

  Carrier tape : A-PET (with anti-static material)
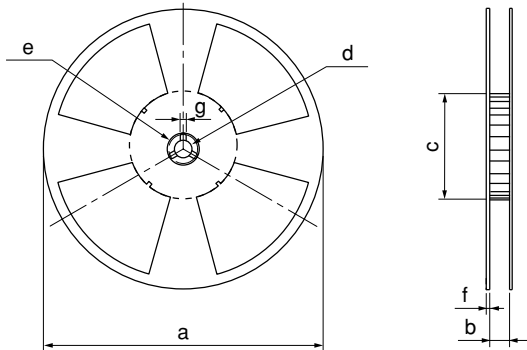
  Cover tape : PET (three layer system)

  Reel : PS

Carrier tape structure and Dimensions

Dimensions List   (Unit : mm)

A	B	C	D	E	F	G
$16.0^{\pm0.3}$	$7.5^{\pm0.1}$	$1.75^{\pm0.1}$	$12.0^{\pm0.1}$	$2.0^{\pm0.1}$	$4.0^{\pm0.1}$	$\phi1.5^{+0.1}_{-0}$
H	I	J	K			
$10.4^{\pm0.1}$	$0.4^{\pm0.05}$	$4.2^{\pm0.1}$	$10.2^{\pm0.1}$			

Reel structure and Dimensions

Dimensions List   (Unit : mm)

a	b	c	d
330	$17.5^{\pm1.5}$	$100^{\pm1.0}$	$13^{\pm0.5}$
e	f	g	
$23^{\pm1.0}$	$2.0^{\pm0.5}$	$2.0^{\pm0.5}$	

Direction of product insertion

Pull-out direction
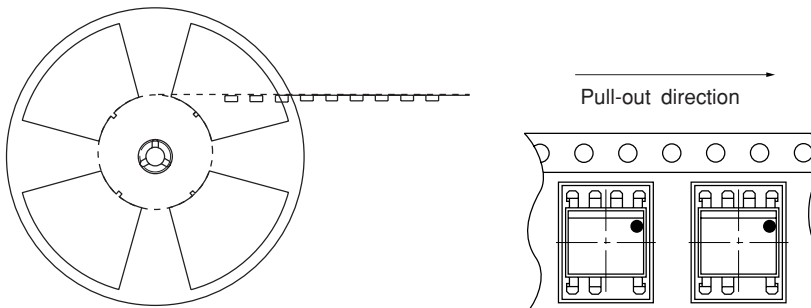
[Packing : 1 000pcs/reel]

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