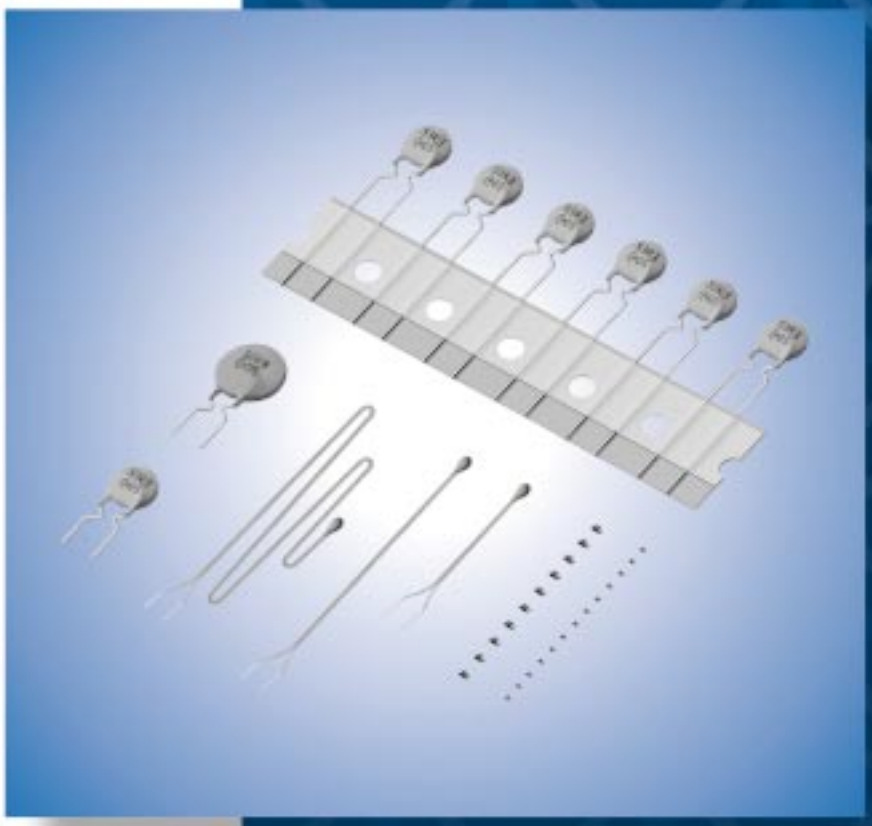
NTC/PTC Thermistors for Automotive



Innovator in Electronics

Murata Manufacturing Co., Ltd.

Cat.No.R03E-6

EU RoHS Compliant

・All the products in this catalog comply with EU RoHS.
・EU RoHS is "the European Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment."
・For more details, please refer to our website 'Murata's Approach for EU RoHS' (http://www.murata.com/info/rohs.html).

(Part Number)

NC	P	18	XH	103	J	0S	RB
❶	❷	❸	❹	❺	❻	❼	❽

❶Product ID

Product ID	
NC	NTC Thermistors Chip Type

❷Series

Code	Series
G	Conductive Glue Series
P	Plated Termination Series

❸Dimensions (L×W)

Code	Dimensions (L×W)	EIA
15	1.00×0.50mm	0402
18	1.60×0.80mm	0603

❹Temperature Characteristics

Code	Temperature Characteristics
WB	Nominal B-Constant 4050—4099K
WD	Nominal B-Constant 4150—4199K
WF	Nominal B-Constant 4250—4299K
WL	Nominal B-Constant 4450—4499K
WM	Nominal B-Constant 4500—4549K
XC	Nominal B-Constant 3100—3149K
XF	Nominal B-Constant 3250—3299K
XH	Nominal B-Constant 3350—3399K
XM	Nominal B-Constant 3500—3549K
XQ	Nominal B-Constant 3650—3699K
XV	Nominal B-Constant 3900—3949K
XW	Nominal B-Constant 3950—3999K

❺Resistance

Expressed by three figures. The unit is ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two figures.

Ex.)

Code	Resistance
102	1kΩ
103	10kΩ
104	100kΩ

❻Resistance Tolerance

Code	Resistance Tolerance
D	±0.5%
E	±3%
F	±1%
J	±5%

❼Individual Specifications

Structures and others are expressed by two figures.

Code	Individual Specifications
0S	for Automotive

❽Packaging

Code	Packaging
RB	Paper Taping 4mm Pitch (4000 pcs.)
RC	Paper Taping 2mm Pitch (10000 pcs.)

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾ ❿

❶Product ID

Product ID	
NXF	NTC Thermistors Sensor Thermo String Type

❷Individual Specifications

Code	Individual Specifications
S	for Automotive

❸Chip Dimensions

Code	Dimensions (LxT)	EIA
15	1.00 x 0.50mm	0402

❹Temperature Characteristics

Code	Temperature Characteristics
WB	Nominal B-Constant 4050–4099K
WF	Nominal B-Constant 4250–4299K
XH	Nominal B-Constant 3350–3399K

❺Resistance

Expressed by three figures. The unit is (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two figures.

Ex.

Code	Resistance
103	10kΩ
473	47kΩ
104	100kΩ

❻Resistance Tolerance

Code	Resistance Tolerance
F	±1%

❼Lead Wire Type

Code	Lead Wire Type
A	ø0.3 Copper Lead Wire with Polyurethane Coa

❽Shape of the Lead Wire Kink

Code	Shape of the Lead Wire Kink
1	The Twist of Lead Wire Type
2	Standard Type

❾Packaging

Code	Packaging
B	Bulk

❿Dimensions (Full Length)

Code	Dimensions (Full Length)
025	25mm
030	30mm
040	40mm
050	50mm
060	60mm
070	70mm
080	80mm
090	90mm
100	100mm
110	110mm
120	120mm
130	130mm
140	140mm
150	150mm

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽

❶Product ID

Product ID	
PR	PTC Thermistors Chip Type

❷Series

Code	Series
F	for Overheat Sensing

❸Dimensions (L×W)

Code	Dimensions (L×W)
18	1.60×0.80mm

❹Temperature Characteristics

Code	Temperature Characteristics-Curie Point
AR	120°C
AS	130°C
BA	110°C
BB	100°C
BC	90°C
BD	80°C
BE	70°C
BF	60°C
BG	50°C

❺Resistance

Expressed by three figures. The unit is ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two figures.

Ex.)

Code	Resistance
471	470Ω

❻Resistance Tolerance

Code	Resistance Tolerance	Sensing Temp. Tolerance
Q	Special Tolerance	±5°C
R	Special Tolerance	±3°C

❼Individual Specifications

Code	Individual Specifications
S2	for Automotive
S5	

❽Packaging

Code	Packaging
RB	Paper Taping (4mm Pitch) (4000 pcs.)

PTC Thermistors (POSISTOR®) for Overcurrent Protection Chip Type

(Part Number) **PR** **G** **21** **AR** **420** **M** **S1** **RA**

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽

❶Product ID

Product ID	
PR	PTC Thermistors Chip Type

❷Series

Code	Series
G	for Overcurrent Protection

❸Dimensions (L×W)

Code	Dimensions (L×W)
21	2.00×1.25mm

❹Temperature Characteristics

Code	Temperature Characteristics
AR	Curie Point 120°C

❺Resistance

Expressed by three-digit alphanumerics. The unit is ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two figures. If there is a decimal point, it is expressed by the capital letter "**R**." In this case, all figures are significant digits.

Ex.)

Code	Resistance
4R7	4.7Ω
420	42Ω

❻Resistance Tolerance

Code	Resistance Tolerance
M	±20%
Q	Special Tolerance

❼Individual Specifications

Ex.)

Code	Individual Specifications
S1	for Automotive

❽Packaging

Code	Packaging
RA	Embossed Taping (4mm Pitch) (4000 pcs.)
RK	Embossed Taping (4mm Pitch) (3000 pcs.)

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾

❶Product ID

Product ID	
PT	PTC Thermistors

❷Series

Code	Series
GL	for Overcurrent Protection Lead Type

❸Dimensions

Code	Dimensions
4	Nominal Body Diameter 4mm Series
5	Nominal Body Diameter 5mm Series
6	Nominal Body Diameter 6mm Series
7	Nominal Body Diameter 7mm Series
9	Nominal Body Diameter 9mm Series
A	Nominal Body Diameter 10mm Series
C	Nominal Body Diameter 12mm Series
E	Nominal Body Diameter 14mm Series

❹Individual Specifications

Code	Individual Specifications
S	for Automotive

❺Temperature Characteristics

Code	Temperature Characteristics
AR	Curie Point 120°C
AS	Curie Point 130°C

❻Resistance

Expressed by three-digit alphanumeric. The unit is ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two figures. If there is a decimal point, it is expressed by the capital letter "**R**." In this case, all figures are significant digits.

Ex.)

Code	Resistance
R22	0.22Ω
2R2	2.2Ω
220	22Ω

❼Resistance Tolerance

Code	Resistance Tolerance
K	±10%
M	±20%

❽Individual Specifications

Ex.)

Code	Individual Specifications
4B51	Lead Type, others

❾Packaging

Code	Packaging
A0	Ammo Pack
B0	Bulk

1. Zero-power Resistance of Thermistor: R

Measured by zero-power in specified ambient temperatures.

$R=R_0 \exp B (1/T-1/T_0)$ ·····(1)

R: Resistance in ambient temperature T (K)

(K: absolute temperature)

R_0: Resistance in ambient temperature T_0 (K)

B: B-constant of Thermistor

2. B-Constant

as (1) formula

$B= \ell n (R/R_0) / (1/T-1/T_0)$ ·····(2)

3. Thermal Dissipation Constant

When electric power P (mW) is spent in ambient temperature T_1 and thermistor temperature rises T_2, the formula is as follows;

$P=C (T_2-T_1)$ ·····(3)

C: Thermal dissipation constant (mW/°C)

Thermal dissipation constant varies with dimensions, measurement conditions, etc.

4. Thermal Time Constant

Period in which Thermistor's temperature will change 63.2% of its temperature difference from ambient temperature T_0 (°C) to T_1 (°C).

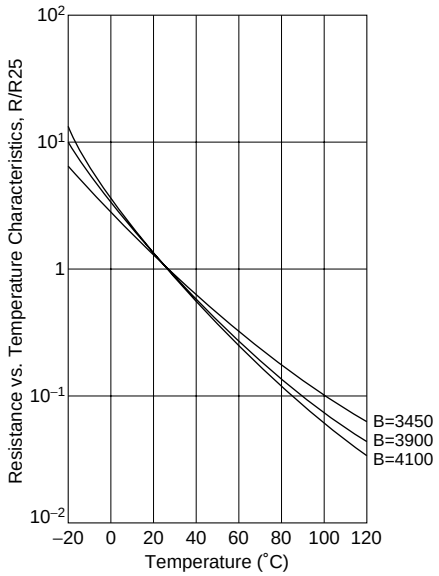
5. Rated Electric Power

Shows necessary electric power for Thermistor's temperature to rise 100˚C by self heating in ambient temperature 25˚C.

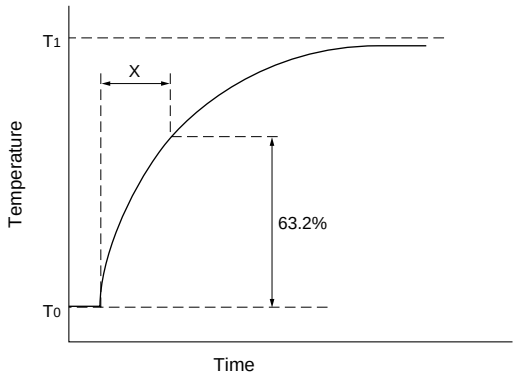
6. Permissive Operating Current

It is possible to keep Thermistor's temperature rising max. 1˚C.

Resistance vs. Temperature



Thermal Time Constant



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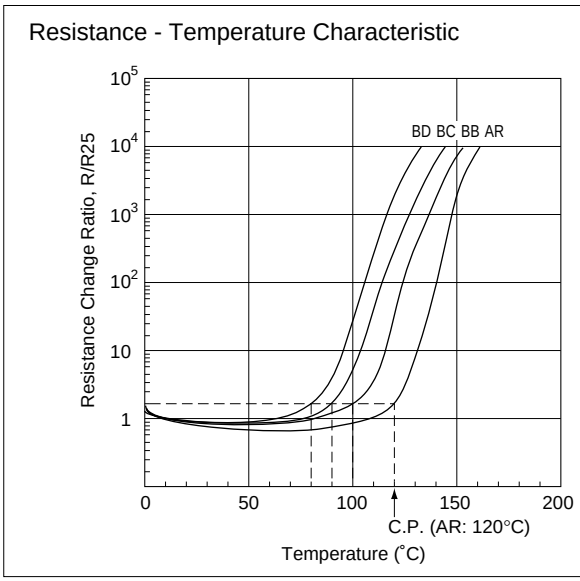
POSISTOR® has three main characteristics.

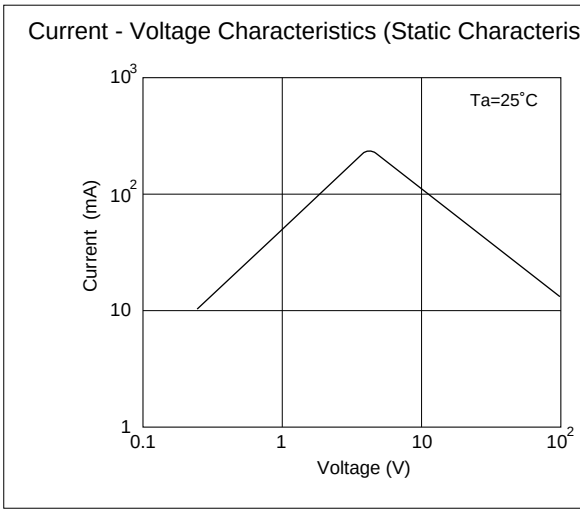
1. Resistance - Temperature Characteristics

Although there is a negligible difference between the normal and "Curie Point" temperature, POSISTOR® shows almost constant resistance - temperature characteristics. Yet they have resistance - temperature characteristics that cause resistance to sharply increase when the temperature exceeds the Curie Point.
The Curie Point (C.P.) is defined as the temperature at which the resistance value is twice the one at 25 °C.



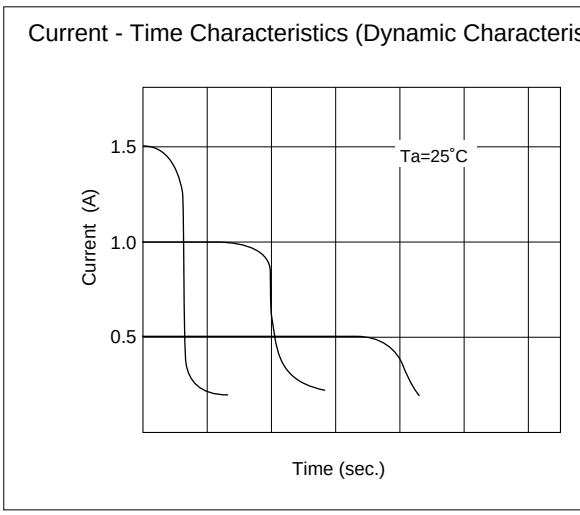
2. Current - Voltage Characteristics (Static Characteristics)

This shows the relation between applied voltage when voltage applied to POSISTOR® causes balancing of inner heating and outer thermal dissipation and stabilized current. This has both a maximum point of current and constant output power.

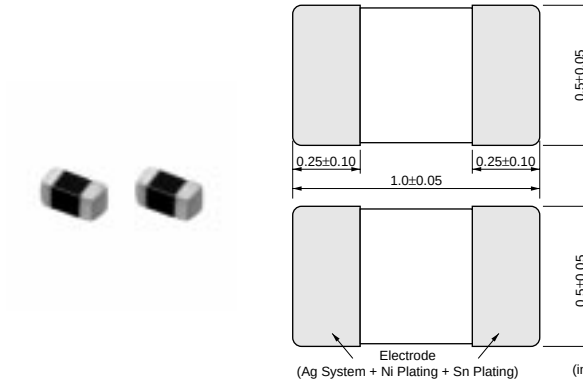


3. Current - Time Characteristics (Dynamic Characteristics)

This shows the relation between current and time before inner heating and outer thermal dissipation arrive at equilibrium state. This features having large initial current and abruptly continuous attenuating portion.



0402/0603 sized Chip NTC Thermistors have Ni barrier termination, provide excellent solderability and offer high stability in environment due to unique inner construction.



■ Features

1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-constant
4. Reflow soldering possible
5. Lead is not contained in the product
6. NCP series are recognized by UL/cUL. (UL1434, File No.E137188)

■ Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits

Operating Temperature Range: -40°C to +150°C

Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Di Constan (mW/
NCP15XW152□0SRC	1.5k	3950 ±3%	3982	3987	3998	0.81	100	1
NCP15XW222□0SRC	2.2k	3950 ±3%	3982	3987	3998	0.67	100	1
NCP15XW332□0SRC	3.3k	3950 ±3%	3982	3987	3998	0.55	100	1
NCP15XW472□0SRC	4.7k	3950 ±3%	3982	3987	3998	0.46	100	1
NCP15XW682□0SRC	6.8k	3950 ±3%	3982	3987	3998	0.38	100	1
NCP15XH103D0SRC	10k ±0.5%	3380 ±0.7%	3428	3434	3455	0.31	100	1
NCP15XH103F0SRC	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCP15XH103□0SRC	10k	3380 ±1%	3428	3434	3455	0.31	100	1
NCP15XV103□0SRC	10k	3900 ±3%	3930	3934	3944	0.31	100	1
NCP15XW153□0SRC	15k	3950 ±3%	3982	3987	3998	0.25	100	1
NCP15XW223□0SRC	22k	3950 ±3%	3982	3987	3998	0.21	100	1
NCP15WL223□0SRC	22k	4485 ±1%	4537	4543	4557	0.21	100	1
NCP15WB333□0SRC	33k	4050 ±3%	4101	4108	4131	0.17	100	1
NCP15WL333□0SRC	33k	4485 ±1%	4537	4543	4557	0.17	100	1
NCP15WB473D0SRC	47k ±0.5%	4050 ±0.5%	4101	4108	4131	0.14	100	1
NCP15WB473F0SRC	47k ±1%	4050 ±1%	4101	4108	4131	0.14	100	1
NCP15WB473□0SRC	47k	4050 ±1%	4101	4108	4131	0.14	100	1
NCP15WL473□0SRC	47k	4485 ±1%	4537	4543	4557	0.14	100	1
NCP15WD683□0SRC	68k	4150 ±3%	4201	4209	4232	0.12	100	1
NCP15WL683□0SRC	68k	4485 ±1%	4537	4543	4557	0.12	100	1
NCP15WF104D0SRC	100k ±0.5%	4250 ±0.5%	4303	4311	4334	0.10	100	1
NCP15WF104F0SRC	100k ±1%	4250 ±1%	4303	4311	4334	0.10	100	1
NCP15WF104□0SRC	100k	4250 ±1%	4303	4311	4334	0.10	100	1
NCP15WL104□0SRC	100k	4485 ±1%	4537	4543	4557	0.10	100	1
NCP15WL154□0SRC	150k	4485 ±1%	4537	4543	4557	0.08	100	1
NCP15WM154□0SRC	150k	4500 ±3%	4571	4582	4614	0.08	100	1

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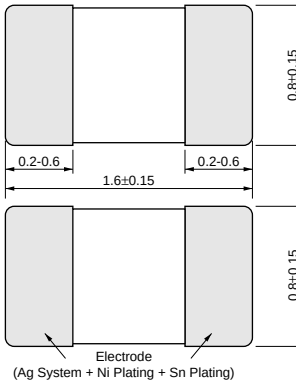
A blank column is filled with resistance tolerance codes (E: ±3%, J: ±5%).
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.

Operating Temperature Range: -40°C to +125°C

Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Di Constan (mW/
NCP15XC220□0SRC	22	3100 ±3%	3126	3128	3136	6.70	100	1
NCP15XC330□0SRC	33	3100 ±3%	3126	3128	3136	5.50	100	1
NCP15XC470□0SRC	47	3100 ±3%	3126	3128	3136	4.60	100	1
NCP15XC680□0SRC	68	3100 ±3%	3126	3128	3136	3.80	100	1
NCP15XF101□0SRC	100	3250 ±3%	3282	3284	3296	3.10	100	1
NCP15XF151□0SRC	150	3250 ±3%	3282	3284	3296	2.50	100	1
NCP15XM221□0SRC	220	3500 ±3%	3539	3545	3560	2.10	100	1
NCP15XM331□0SRC	330	3500 ±3%	3539	3545	3560	1.70	100	1
NCP15XQ471□0SRC	470	3650 ±2%	3688	3693	3706	1.40	100	1
NCP15XQ681□0SRC	680	3650 ±3%	3688	3693	3706	1.20	100	1
NCP15XQ102□0SRC	1.0k	3650 ±2%	3688	3693	3706	1.00	100	1
NCP15XM472□0SRC	4.7k	3500 ±2%	3539	3545	3560	0.46	100	1

A blank column is filled with resistance tolerance codes (E: ±3%, J: ±5%).
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.

0402/0603 sized Chip NTC Thermistors have Ni barrier termination, provide excellent solderability and offer high stability in environment due to unique inner construction.



■ Features

1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-constant
4. Flow/Reflow soldering possible
5. Lead is not contained in the product
6. NCP series are recognized by UL/cUL. (UL1434, File No.E137188)

■ Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits

Operating Temperature Range: -40°C to +150°C

Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Di Constan (mW/
NCP18XF101□0SRB	100	3250 ±3%	3282	3284	3296	3.10	100	1
NCP18XF151□0SRB	150	3250 ±3%	3282	3284	3296	2.50	100	1
NCP18XQ471□0SRB	470	3650 ±2%	3688	3693	3706	1.40	100	1
NCP18XQ681□0SRB	680	3650 ±3%	3688	3693	3706	1.20	100	1
NCP18XQ102□0SRB	1.0k	3650 ±2%	3688	3693	3706	1.00	100	1
NCP18XW152□0SRB	1.5k	3950 ±3%	3982	3987	3998	0.81	100	1
NCP18XW222□0SRB	2.2k	3950 ±3%	3982	3987	3998	0.67	100	1
NCP18XW332□0SRB	3.3k	3950 ±3%	3982	3987	3998	0.55	100	1
NCP18XW472□0SRB	4.7k	3950 ±3%	3982	3987	3998	0.46	100	1
NCP18XW682□0SRB	6.8k	3950 ±3%	3982	3987	3998	0.38	100	1
NCP18XH103D0SRB	10k ±0.5%	3380 ±0.7%	3428	3434	3455	0.31	100	1
NCP18XH103F0SRB	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCP18XH103□0SRB	10k	3380 ±1%	3428	3434	3455	0.31	100	1
NCP18XV103□0SRB	10k	3900 ±3%	3930	3934	3944	0.31	100	1
NCP18XW153□0SRB	15k	3950 ±3%	3982	3987	3998	0.25	100	1
NCP18XW223□0SRB	22k	3950 ±3%	3982	3987	3998	0.21	100	1
NCP18WB333□0SRB	33k	4050 ±3%	4101	4108	4131	0.17	100	1
NCP18WB473D0SRB	47k ±0.5%	4030 ±0.5%	4101	4108	4131	0.14	100	1
NCP18WB473F1SRB	47k ±1%	4050 ±1.5%	4101	4108	4131	0.14	100	1
NCP18WB473□0SRB	47k	4050 ±2%	4101	4108	4131	0.14	100	1
NCP18WD683□0SRB	68k	4150 ±3%	4201	4209	4232	0.12	100	1
NCP18WF104D0SRB	100k ±0.5%	4200 ±0.5%	4255	4260	4282	0.10	100	1
NCP18WF104F3SRB	100k ±1%	4200 ±1%	4255	4260	4282	0.10	100	1
NCP18WF104□0SRB	100k	4250 ±2%	4303	4311	4334	0.10	100	1
NCP18WM154□0SRB	150k	4500 ±3%	4571	4582	4614	0.08	100	1
NCP18WM224□0SRB	220k	4500 ±3%	4571	4582	4614	0.06	100	1

Continued on the following pa

Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.

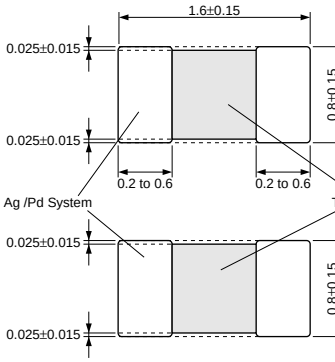
Operating Temperature Range: -40°C to +125°C

Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Di Constan (mW
NCP18XM221□0SRB	220	3500 ±3%	3539	3545	3560	2.10	100	1
NCP18XM331□0SRB	330	3500 ±3%	3539	3545	3560	1.70	100	1
NCP18XM472□0SRB	4.7k	3500 ±2%	3539	3545	3560	0.46	100	1

A blank column is filled with resistance tolerance codes (E: ±3%, J: ±5%).

Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.

NCG18, 0603 sized Chip NTC Thermistor enables conductive glue mounting.



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■ Features

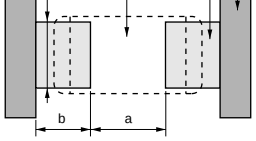
1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-constant
4. Glue mounting possible
5. Lead is not contained in the product

■ Applications

1. Various engine control units
2. ABS control unit
3. High power devices (IGBT)
4. Various circuits requiring low temperature mounting below solder melting point.
5. Temperature compensation for various circuits requiring high temperature.

Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Di Constan (mW/
NCG18XH103F0SRB	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCG18WF104F0SRB	100k ±1%	4200 ±1%	4255	4260	4282	0.10	100	1

Operating Temperature Range: -55°C to +150°C
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.



(in mm)

Part Number	Mounting Methods	Dimensions (mm)			
		Chip (L×W)	a	b	c
NCP15	Reflow Soldering	1.0×0.5	0.4	0.4-0.5	0.5
NCP18	Flow Soldering	1.6×0.8	0.6-1.0	0.8-0.9	0.6-0.8
	Reflow Soldering		0.6-0.8	0.6-0.7	0.6-0.8
NCG18	Conductive Glue	1.6×0.8	0.6	0.6	1.0

Part Number	NCP18XF101	NCP18XF151	NCP18XQ471	NCP18XQ681	NCP18XQ102	NCP□□XW152	NCP□□XW222	NCP□□X
Resistance	100Ω	150Ω	470Ω	680Ω	1.0kΩ	1.5kΩ	2.2kΩ	3.3k
B-Constant	3250K	3250K	3650K	3650K	3650K	3950K	3950K	3950
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistanc
−40	1824.175	2736.262	11822.473	17104.854	25.154	51.791	75.961	113.9
−35	1390.685	2086.028	8767.745	12685.248	18.655	37.172	54.520	81.77
−30	1070.653	1605.979	6570.224	9505.855	13.979	27.005	39.607	59.41
−25	831.138	1246.708	4971.784	7193.219	10.578	19.843	29.103	43.65
−20	650.960	976.440	3796.933	5493.436	8.079	14.728	21.601	32.40
−15	514.441	771.661	2923.400	4229.599	6.220	11.044	16.198	24.29
−10	409.700	614.550	2269.599	3283.675	4.829	8.362	12.264	18.39
−5	328.877	493.315	1775.225	2568.411	3.777	6.389	9.370	14.05
0	265.759	398.639	1399.050	2024.158	2.977	4.922	7.219	10.82
5	215.785	323.677	1110.220	1606.275	2.362	3.825	5.609	8.41
10	176.395	264.592	887.257	1283.691	1.888	2.994	4.391	6.58
15	145.161	217.742	713.463	1032.245	1.518	2.361	3.463	5.19
20	120.152	180.228	577.375	835.351	1.229	1.876	2.751	4.12
25	100.000	150.000	470.000	680.000	1.000	1.500	2.200	3.30
30	83.669	125.503	384.800	556.733	0.819	1.207	1.771	2.65
35	70.361	105.541	316.757	458.287	0.674	0.978	1.434	2.15
40	59.456	89.184	262.177	379.320	0.558	0.797	1.169	1.75
45	50.470	75.705	218.069	315.504	0.464	0.653	0.958	1.43
50	43.029	64.543	182.297	263.749	0.388	0.538	0.789	1.18
55	36.830	55.246	153.150	221.579	0.326	0.446	0.654	0.98
60	31.649	47.473	129.249	186.998	0.275	0.371	0.545	0.81
65	27.364	41.045	109.551	158.499	0.233	0.311	0.456	0.68
70	23.756	35.634	93.281	134.960	0.199	0.261	0.383	0.57
75	20.651	30.976	79.750	115.383	0.170	0.221	0.324	0.48
80	18.011	27.016	68.446	99.029	0.146	0.187	0.275	0.41
85	15.800	23.700	58.996	85.356	0.126	0.160	0.234	0.35
90	13.908	20.862	51.036	73.839	0.109	0.137	0.200	0.30
95	12.263	18.394	44.332	64.140	0.094	0.117	0.172	0.25
100	10.844	16.265	38.640	55.905	0.082	0.101	0.149	0.22
105	9.622	14.434	33.790	48.888	0.072	0.088	0.129	0.19
110	8.563	12.844	29.664	42.918	0.063	0.076	0.112	0.16
115	7.648	11.472	26.123	37.795	0.056	0.067	0.098	0.14
120	6.850	10.275	23.091	33.409	0.049	0.058	0.085	0.12
125	6.162	9.243	20.472	29.618	0.044	0.051	0.075	0.11
130	5.557	8.336	18.200	26.332	0.039	0.045	0.066	0.09
135	5.025	7.537	16.225	23.475	0.035	0.040	0.059	0.08
140	4.554	6.832	14.502	20.982	0.031	0.035	0.052	0.07
145	4.138	6.206	13.007	18.819	0.028	0.032	0.046	0.06
150	3.768	5.561	11.696	16.922	0.025	0.028	0.041	0.06

Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

Continued on the following pa

Part Number	NCP□□XW472	NCP□□XW682	NCP□□XH103D	NCP□□XH103	NCP□□XV103	NCP□□XW153	NCP□□XW223	NCP15W
Resistance	4.7kΩ	6.8kΩ	10kΩ±0.5%	10kΩ	10kΩ	15kΩ	22kΩ	22k
B-Constant	3950K	3950K	3380K±0.7%	3380K	3900K	3950K	3950K	4485
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistanc
−40	162.279	234.787	197.390	195.652	328.996	517.912	759.605	1073.4
−35	116.474	168.515	149.390	148.171	237.387	371.724	545.196	753.9
−30	84.615	122.422	114.340	113.347	173.185	270.048	396.070	535.0
−25	62.173	89.953	88.381	87.559	127.773	198.426	291.025	383.5
−20	46.147	66.766	68.915	68.237	95.327	147.278	216.008	277.6
−15	34.604	50.066	54.166	53.650	71.746	110.439	161.977	202.8
−10	26.200	37.906	42.889	42.506	54.564	83.617	122.638	149.4
−5	20.018	28.963	34.196	33.892	41.813	63.888	93.702	111.0
0	15.423	22.313	27.445	27.219	32.330	49.221	72.191	83.2
5	11.984	17.338	22.165	22.021	25.194	38.245	56.093	62.8
10	9.380	13.571	18.010	17.926	19.785	29.936	43.907	47.8
15	7.399	10.705	14.720	14.674	15.651	23.613	34.633	36.6
20	5.877	8.503	12.099	12.081	12.468	18.756	27.509	28.3
25	4.700	6.800	10.000	10.000	10.000	15.000	22.000	22.0
30	3.783	5.474	8.309	8.315	8.072	12.074	17.709	17.2
35	3.064	4.434	6.939	6.948	6.556	9.780	14.344	13.5
40	2.497	3.613	5.824	5.834	5.356	7.969	11.688	10.7
45	2.046	2.961	4.911	4.917	4.401	6.531	9.578	8.56
50	1.686	2.440	4.160	4.161	3.635	5.382	7.894	6.87
55	1.397	2.022	3.539	3.535	3.019	4.459	6.540	5.54
60	1.164	1.683	3.024	3.014	2.521	3.713	5.446	4.49
65	0.974	1.409	2.593	2.586	2.115	3.108	4.559	3.66
70	0.819	1.185	2.233	2.228	1.781	2.613	3.832	3.00
75	0.692	1.001	1.929	1.925	1.509	2.208	3.239	2.47
80	0.587	0.849	1.673	1.669	1.284	1.873	2.748	2.05
85	0.500	0.724	1.455	1.452	1.097	1.597	2.342	1.70
90	0.428	0.620	1.270	1.268	0.941	1.367	2.004	1.42
95	0.368	0.532	1.112	1.110	0.810	1.174	1.722	1.19
100	0.318	0.459	0.976	0.974	0.701	1.013	1.486	1.00
105	0.275	0.398	0.860	0.858	0.608	0.878	1.287	0.85
110	0.239	0.346	0.759	0.758	0.530	0.763	1.119	0.72
115	0.208	0.302	0.673	0.672	0.463	0.665	0.975	0.61
120	0.182	0.264	0.598	0.596	0.406	0.582	0.854	0.52
125	0.160	0.232	0.532	0.531	0.358	0.511	0.750	0.45
130	0.141	0.204	0.476	0.474	0.316	0.451	0.661	0.39
135	0.125	0.181	0.426	0.424	0.280	0.399	0.585	0.33
140	0.111	0.160	0.383	0.381	0.249	0.354	0.519	0.29
145	0.099	0.143	0.344	0.342	0.222	0.315	0.462	0.25
150	0.088	0.127	0.311	0.309	0.198	0.281	0.412	0.22

Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

Continued on the following pa

Part Number	NCP□□WB333	NCP15WL333	NCP15WB473D	NCP18WB473D	NCP□□WB473	NCP15WL473	NCP□□WD683	NCP15W
Resistance	33kΩ	33kΩ	47kΩ±0.5%	47kΩ±0.5%	47kΩ	47kΩ	68kΩ	68k
B-Constant	4050K	4485K	4050K±0.5%	4030K±0.5%	4050K	4485K	4150K	4485
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistanc
−40	1227.263	1610.154	1690.586	1743.085	1747.920	2293.249	2735.359	3317.8
−35	874.449	1130.850	1215.318	1241.814	1245.428	1610.605	1937.391	2330.2
−30	630.851	802.609	882.908	896.201	898.485	1143.110	1389.345	1653.8
−25	460.457	575.385	647.911	654.460	655.802	819.487	1008.014	1185.6
−20	339.797	416.464	480.069	483.172	483.954	593.146	738.978	858.1
−15	253.363	304.219	359.009	360.367	360.850	433.281	547.456	626.8
−10	190.766	224.193	270.868	271.363	271.697	319.305	409.600	461.9
−5	144.964	166.623	206.113	206.204	206.463	237.312	309.217	343.3
0	111.087	124.850	158.126	158.051	158.214	177.816	235.606	257.2
5	85.842	94.287	122.267	122.145	122.259	134.287	180.980	194.2
10	66.861	71.747	95.256	95.145	95.227	102.184	140.139	147.8
15	52.470	54.996	74.754	74.676	74.730	78.327	109.344	113.3
20	41.471	42.455	59.075	59.038	59.065	60.467	85.929	87.48
25	33.000	33.000	47.000	47.000	47.000	47.000	68.000	68.00
30	26.430	25.822	37.636	37.667	37.643	36.776	54.167	53.20
35	21.298	20.335	30.326	30.381	30.334	28.962	43.421	41.90
40	17.266	16.115	24.583	24.654	24.591	22.952	35.016	33.20
45	14.076	12.849	20.043	20.124	20.048	18.301	28.406	26.47
50	11.538	10.306	16.433	16.518	16.433	14.679	23.166	21.23
55	9.506	8.317	13.545	13.631	13.539	11.845	18.997	17.13
60	7.870	6.748	11.223	11.306	11.209	9.610	15.657	13.90
65	6.549	5.504	9.345	9.424	9.328	7.839	12.967	11.34
70	5.475	4.513	7.818	7.892	7.798	6.427	10.794	9.29
75	4.595	3.718	6.571	6.639	6.544	5.296	9.021	7.66
80	3.874	3.078	5.548	5.609	5.518	4.384	7.575	6.34
85	3.282	2.560	4.704	4.759	4.674	3.646	6.387	5.27
90	2.789	2.139	4.004	4.054	3.972	3.046	5.407	4.40
95	2.379	1.794	3.422	3.468	3.388	2.555	4.598	3.69
100	2.038	1.511	2.936	2.977	2.902	2.152	3.922	3.11
105	1.751	1.278	2.528	2.566	2.494	1.820	3.359	2.63
110	1.509	1.085	2.184	2.220	2.150	1.546	2.887	2.23
115	1.306	0.925	1.893	1.927	1.860	1.318	2.489	1.90
120	1.134	0.792	1.646	1.679	1.615	1.128	2.155	1.63
125	0.987	0.681	1.436	1.468	1.406	0.970	1.870	1.40
130	0.862	0.587	1.256	1.288	1.227	0.836	1.629	1.20
135	0.755	0.508	1.102	1.133	1.075	0.724	1.423	1.04
140	0.663	0.441	0.969	0.999	0.945	0.628	1.247	0.90
145	0.584	0.384	0.854	0.884	0.831	0.546	1.096	0.79
150	0.516	0.335	0.755	0.783	0.735	0.477	0.966	0.69

Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

Continued on the following pa

Part Number	NCP15WF104D	NCP18WF104D	NCP18WF104F	NCP□□WF104	NCP15WL104	NCP15WL154	NCP□□WM154	NCP□□V
Resistance	100kΩ±0.5%	100kΩ±0.5%	100kΩ±1%	100kΩ	100kΩ	150kΩ	150kΩ	220k
B-Constant	4250K±0.5%	4200K±0.5%	4200K±1%	4250K	4485K	4485K	4500K	4500
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistanc
−40	4221.283	4205.686	4205.686	4397.119	4879.254	7318.881	7899.466	11585.
−35	2995.044	2966.436	2966.436	3088.599	3426.818	5140.228	5466.118	8016.9
−30	2146.996	2118.789	2118.789	2197.225	2432.149	3648.224	3834.499	5623.9
−25	1554.599	1531.319	1531.319	1581.881	1743.590	2615.385	2720.523	3990.1
−20	1136.690	1118.422	1118.422	1151.037	1262.012	1893.018	1951.216	2861.7
−15	839.019	825.570	825.570	846.579	921.875	1382.813	1415.565	2076.1
−10	624.987	615.526	615.526	628.988	679.373	1019.059	1036.984	1520.9
−5	469.678	463.104	463.104	471.632	504.919	757.379	767.079	1125.0
0	355.975	351.706	351.706	357.012	378.333	567.499	572.667	839.9
5	272.011	269.305	269.305	272.500	285.717	428.575	431.264	632.5
10	209.489	207.891	207.891	209.710	217.414	326.121	327.405	480.1
15	162.559	161.722	161.722	162.651	166.654	249.981	250.538	367.4
20	127.057	126.723	126.723	127.080	128.653	192.979	193.166	283.3
25	100.000	100.000	100.000	100.000	100.000	150.000	150.000	220.0
30	79.222	79.439	79.439	79.222	78.247	117.370	117.281	172.0
35	63.167	63.509	63.509	63.167	61.622	92.433	92.293	135.3
40	50.677	51.084	51.084	50.677	48.835	73.252	73.090	107.1
45	40.904	41.336	41.336	40.904	38.937	58.406	58.240	85.41
50	33.195	33.628	33.628	33.195	31.231	46.846	46.665	68.44
55	27.091	27.510	27.510	27.091	25.202	37.803	37.605	55.15
60	22.224	22.621	22.621	22.224	20.448	30.671	30.453	44.66
65	18.323	18.692	18.692	18.323	16.679	25.018	24.804	36.37
70	15.184	15.525	15.525	15.184	13.675	20.513	20.293	29.76
75	12.635	12.947	12.947	12.635	11.268	16.902	16.679	24.46
80	10.566	10.849	10.849	10.566	9.329	13.993	13.776	20.20
85	8.873	9.129	9.129	8.873	7.758	11.638	11.428	16.76
90	7.481	7.713	7.713	7.481	6.481	9.721	9.520	13.96
95	6.337	6.546	6.546	6.337	5.437	8.155	7.966	11.68
100	5.384	5.572	5.572	5.384	4.580	6.869	6.688	9.80
105	4.594	4.764	4.764	4.594	3.873	5.810	5.639	8.27
110	3.934	4.087	4.087	3.934	3.289	4.933	4.772	6.99
115	3.380	3.518	3.518	3.380	2.804	4.206	4.052	5.94
120	2.916	3.040	3.040	2.916	2.400	3.601	3.454	5.06
125	2.522	2.634	2.634	2.522	2.064	3.096	2.955	4.33
130	2.190	2.290	2.290	2.190	1.778	2.667	2.536	3.71
135	1.907	1.998	1.998	1.907	1.540	2.310	2.182	3.20
140	1.665	1.748	1.748	1.665	1.336	2.004	1.884	2.76
145	1.459	1.533	1.533	1.459	1.162	1.743	1.632	2.39
150	1.282	1.349	1.349	1.282	1.014	1.521	1.418	2.07

Detailed Resistance-Temperature Tables are downloadable from the following URL.
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Continued on the following pa

Part Number	NCP□□WM474
Resistance	470kΩ
B-Constant	4500K
Temp. (°C)	Resistance (kΩ)
−40	24751.661
−35	17127.169
−30	12014.762
−25	8524.305
−20	6113.811
−15	4435.437
−10	3249.216
−5	2403.515
0	1794.358
5	1351.294
10	1025.870
15	785.018
20	605.252
25	470.000
30	367.480
35	289.186
40	229.014
45	182.485
50	146.215
55	117.828
60	95.420
65	77.718
70	63.584
75	52.260
80	43.166
85	35.808
90	29.828
95	24.961
100	20.955
105	17.668
110	14.951
115	12.695
120	10.824
125	9.259
130	7.945
135	6.837
140	5.904
145	5.113
150	4.442

Part Number	NCP15XC220	NCP15XC330	NCP15XC470	NCP15XC680	NCP15XF101	NCP15X
Resistance	22Ω	33Ω	47Ω	68Ω	100Ω	150
B-Constant	3100K	3100K	3100K	3100K	3250K	3250
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistan
−40	355.823	533.734	760.166	1099.815	1824.175	2736.
−35	273.975	410.962	585.310	846.832	1390.685	2086.
−30	213.003	319.504	455.051	658.372	1070.653	1605.
−25	166.943	250.415	356.652	516.007	831.138	1246.
−20	131.997	197.996	281.994	407.991	650.960	976.4
−15	105.318	157.978	224.998	325.529	514.441	771.6
−10	84.670	127.005	180.886	261.707	409.700	614.5
−5	68.628	102.942	146.614	212.123	328.877	493.3
0	55.981	83.972	119.596	173.033	265.759	398.6
5	45.859	68.789	97.972	141.747	215.785	323.6
10	37.819	56.728	80.794	116.894	176.395	264.5
15	31.396	47.094	67.073	97.042	145.161	217.7
20	26.211	39.317	55.997	81.016	120.152	180.2
25	22.000	33.000	47.000	68.000	100.000	150.0
30	18.560	27.840	39.651	57.368	83.669	125.5
35	15.735	23.603	33.616	48.636	70.361	105.5
40	13.403	20.104	28.633	41.426	59.456	89.1
45	11.462	17.193	24.487	35.428	50.470	75.7
50	9.842	14.763	21.026	30.421	43.029	64.5
55	8.488	12.732	18.133	26.235	36.830	55.2
60	7.348	11.022	15.698	22.712	31.649	47.4
65	6.399	9.598	13.670	19.778	27.364	41.0
70	5.595	8.392	11.952	17.293	23.756	35.6
75	4.896	7.345	10.461	15.134	20.651	30.9
80	4.299	6.448	9.184	13.288	18.011	27.0
85	3.795	5.692	8.107	11.729	15.800	23.7
90	3.360	5.040	7.179	10.386	13.908	20.8
95	2.983	4.474	6.373	9.220	12.263	18.3
100	2.656	3.983	5.673	8.208	10.844	16.2
105	2.367	3.551	5.057	7.317	9.622	14.4
110	2.116	3.173	4.520	6.539	8.563	12.8
115	1.901	2.851	4.060	5.874	7.648	11.4
120	1.712	2.568	3.657	5.291	6.850	10.2
125	1.543	2.314	3.296	4.768	6.162	9.24

Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

Continued on the following pa

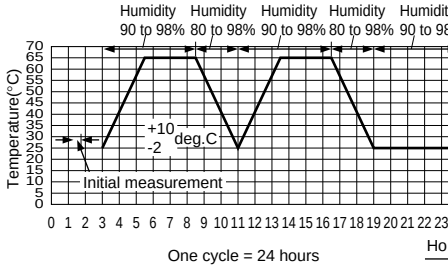
Part Number	NCP□□XM221	NCP□□XM331	NCP15XQ471	NCP15XQ681	NCP15XQ102	NCP□□XM472
Resistance	220Ω	330Ω	470Ω	680Ω	1.0kΩ	4.7kΩ
B-Constant	3500K	3500K	3650K	3650K	3650K	3500K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (kΩ)	Resistance (kΩ)
−40	4947.904	7421.856	11822.473	17104.854	25.154	105.705
−35	3703.755	5555.632	8767.745	12685.248	18.655	79.126
−30	2798.873	4198.309	6570.224	9505.855	13.979	59.794
−25	2135.887	3203.831	4971.784	7193.219	10.578	45.630
−20	1645.037	2467.555	3796.933	5493.436	8.079	35.144
−15	1278.034	1917.051	2923.400	4229.599	6.220	27.303
−10	1000.620	1500.930	2269.599	3283.675	4.829	21.377
−5	789.612	1184.418	1775.225	2568.411	3.777	16.869
0	627.752	941.628	1399.050	2024.158	2.977	13.411
5	502.474	753.711	1110.220	1606.275	2.362	10.735
10	405.010	607.514	887.257	1283.691	1.888	8.653
15	328.480	492.720	713.463	1032.245	1.518	7.018
20	268.044	402.066	577.375	835.351	1.229	5.726
25	220.000	330.000	470.000	680.000	1.000	4.700
30	181.576	272.365	384.800	556.733	0.819	3.879
35	150.668	226.002	316.757	458.287	0.674	3.219
40	125.681	188.521	262.177	379.320	0.558	2.685
45	105.336	158.004	218.069	315.504	0.464	2.250
50	88.717	133.076	182.297	263.749	0.388	1.895
55	75.059	112.588	153.150	221.579	0.326	1.604
60	63.777	95.666	129.249	186.998	0.275	1.363
65	54.415	81.622	109.551	158.499	0.233	1.163
70	46.631	69.946	93.281	134.960	0.199	0.996
75	40.115	60.172	79.750	115.383	0.170	0.857
80	34.637	51.955	68.446	99.029	0.146	0.740
85	30.013	45.019	58.996	85.356	0.126	0.641
90	26.110	39.165	51.036	73.839	0.109	0.558
95	22.790	34.186	44.332	64.140	0.094	0.487
100	19.957	29.935	38.640	55.905	0.082	0.426
105	17.541	26.312	33.790	48.888	0.072	0.375
110	15.453	23.180	29.664	42.918	0.063	0.330
115	13.663	20.494	26.123	37.795	0.056	0.292
120	12.114	18.171	23.091	33.409	0.049	0.259
125	10.778	16.168	20.472	29.618	0.044	0.230

Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

Continued on the following pa

Part Number	NCG18XH103	NCG18WF104
Resistance	10kΩ	100kΩ
B-Constant	3380K	4200K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)
−55	481.258	13019.2917
−50	352.304	8807.8909
−45	261.060	6042.9955
−40	195.661	4205.6861
−35	148.177	2966.4355
−30	113.351	2118.7894
−25	87.562	1531.3193
−20	68.239	1118.4222
−15	53.651	825.5695
−10	42.507	615.5264
−5	33.893	463.1041
0	27.219	351.7064
5	22.021	269.3046
10	17.926	207.8907
15	14.674	161.7224
20	12.081	126.7225
25	10.000	100.0000
30	8.315	79.4390
35	6.948	63.5094
40	5.834	51.0835
45	4.917	41.3360
50	4.161	33.6281
55	3.535	27.5103
60	3.014	22.6211
65	2.586	18.6920
70	2.228	15.5246
75	1.925	12.9466
80	1.669	10.8488
85	1.452	9.1290
90	1.268	7.7128
95	1.110	6.5455
100	0.974	5.5722
105	0.858	4.7638
110	0.758	4.0868
115	0.672	3.5178
120	0.596	3.0403
125	0.531	2.6336
130	0.474	2.2902
135	0.424	1.9976
140	0.381	1.7475
145	0.342	1.5332
150	0.309	1.3491

Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

No.	AEC-Q200 Test Item	Specifications	AEC-Q200 Test Methods
1	Pre- and Post-Stress Electrical Test	-	
2	High Temperature Exposure (Storage)	(*1) •Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Leave continuously according to the following table for 1000 hours. Operating Temp. Range: -40 to +150°C Type: 150±3 Operating Temp. Range: -40 to +125°C Type: 125±3 Measurement at 24±2 hours after test condition.
3	Temperature Cycling	•Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Perform 1000 cycles according to the four heat treatments listed in the following table. Step 1: -55+0/-3, 15±3 Step 2: Room Temp., 1 Step 3: 125+3/-0, 15±3 Step 4: Room T, 1 Measurement at 24±2 hours after test condition.
4	Moisture Resistance	•Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Apply the 24-hour heat (25 to 65 °C) and humidity (80 to 9 treatment shown below, 10 consecutive times.  Measurement at 24±2 hours after test condition.
5	Biased Humidity	(*2) •Resistance(R_{25}) change should be less than ±10%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	85±2 °C, 85%RH in air for 1000 hours with Permissive Operating Current. Measurement at 24±2 hours after test condition.
6	Operational Life	•Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	85±3 °C in air for 1000 hours with Permissive Operating Current. Measurement at 24±2 hours after test condition.
7	External Visual	No defects of abnormalities.	Visual Inspection.
8	Physical Dimension	Within the specified dimensions.	Using calipers
9	Terminal Strength (Leaded)	N/A	
10	Resistance to Solvents	•Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits.
11	Mechanical Shock	•Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Per MIL-STD-202 Method 213 Test Condition F 1500g's, 0.5ms, In 3 directions perpendicularly intersectin each other (total 18 times).
12	Vibration	(*1) •Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Simple harmonic motion between 10Hz to 2.0k Hz and ba 10 Hz of max. amplitude 1.5mm for 20 minutes. This moti should be applied 12 times in each of 3 mutually perpend directions (total of 36 times).
13	Resistance to Soldering Heat	(*1) •Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	Per MIL-STD-202 Method 210 Test Condition B, 260 °C for 10 +/-1 seconds

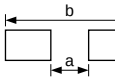
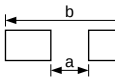
• The Test Condition specification (*1,*2) is applied to the follow P/N.

P/N: NCP15XH103**SR*, NCP15WL223**SR*, NCP15WL333**SR*, NCP15WL473**SR*, NCP15WL683**SR*, NCP15WL104**SR*, NCP15WL154**SR*, NCP15WB473**SR*, NCP15WF104**SR*, NCP18XH103**SR*

(*1) Resistance(R_{25}) change should be less than 1%
B-constant($B_{25/50}$) change should be less than 1%

(*2) Resistance(R_{25}) change should be less than 5%
B-constant($B_{25/50}$) change should be less than 1%

Continued on the following pa

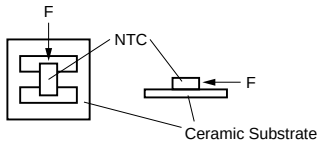
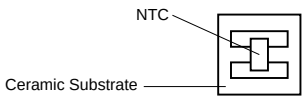
<table>
<tr><td>14</td><td>Thermal Shock</td><td>•Resistance(R_{25}) change should be less than ±5%.
•B-constant($B_{25/50}$) change should be less than ±2%.
•No visible damage.</td><td>Perform 300 cycles according to the two heat treatments in the following table. (Maximum transfer time is 20 secon
<table><tr><th>Step</th><th>1</th><th>2</th></tr><tr><td>Temp. (°C)</td><td>-55+0/-3</td><td>125+3/-0</td></tr><tr><td>Time (min.)</td><td>15±3</td><td>15±3</td></tr></table>
Measurement at 24±2 hours after test condition.</td></tr>
<tr><td>15</td><td>ESD</td><td>•Resistance(R_{25}) change should be less than ±5%.
•B-constant($B_{25/50}$) change should be less than ±2%.
•No visible damage.</td><td>Per AEC-Q200-002</td></tr>
<tr><td>16</td><td>Solderability</td><td>Minimum 95% of the whole electrode surface should be covered with solder.</td><td>Per J-STD-002
SMD b) Method B @ 215 °C category 3.</td></tr>
<tr><td>17</td><td>Electrical Characterization</td><td>Within the specified tolerance.</td><td>Resistance at 25 °C.
B-constant (B25-50)</td></tr>
<tr><td>18</td><td>Flammability</td><td colspan="2">N/A</td></tr>
<tr><td>19</td><td>Board Flex</td><td>(*1)
•Resistance(R_{25}) change should be less than ±5%.
•B-constant($B_{25/50}$) change should be less than ±2%.
•No visible damage.</td><td>Per AEC-Q200-005
Bend the board 2.0mm for 60 seconds.
Use the follow land size.
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>NCP15****SRC</td><td>0.4</td><td>1.2</td><td>0.5</td></tr><tr><td>NCP18****SRB</td><td>0.6</td><td>1.8</td><td>0.6</td></tr></table>(in mm)
  </td></tr>
<tr><td>20</td><td>Terminal Strength (SMD)</td><td>(*1)
•Resistance(R_{25}) change should be less than ±5%.
•B-constant($B_{25/50}$) change should be less than ±2%.
•No visible damage.</td><td>Per AEC-Q200-006
Apply a *17.7N force to the side of device for 60 seconds.
Use follow land size.
*4.9N (NCP15****SRC)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>NCP15****SRC</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>NCP18****SRB</td><td>1.0</td><td>3.0</td><td>1.2</td></tr></table>(in mm)
  </td></tr>
</table>

• The Test Condition specification (*1,*2) is applied to the follow P/N.

P/N: NCP15XH103**SR*, NCP15WL223**SR*, NCP15WL333**SR*, NCP15WL473**SR*, NCP15WL683**SR*, NCP15WL104**SR*, NCP15WL154**SR*, NCP15WB473**SR*, NCP15WF104**SR*, NCP18XH103**SR*

(*1) Resistance(R_{25}) change should be less than 1%
B-constant($B_{25/50}$) change should be less than 1%

(*2) Resistance(R_{25}) change should be less than 5%
B-constant($B_{25/50}$) change should be less than 1%

<table>
<tr><th>No.</th><th>Item</th><th>Rating value</th><th>Method of Examination</th></tr>
<tr><td>1</td><td>Dry Heat</td><td>· Resistance (R_{25}) change should be less than ±3%
· B-constant ($B_{25\text{-}50}$) change should be less than ±1%
· No visible damage.</td><td>150±3°C in air, for 1000 +48/-0 hours without loading.</td></tr>
<tr><td>2</td><td>Cold</td><td>· Resistance (R_{25}) change should be less than ±1%
· B-constant ($B_{25\text{-}50}$) change should be less than ±1%
· No visible damage.</td><td>-40±3°C in air, for 1000 +48/-0 hours without loading.</td></tr>
<tr><td>3</td><td>Damp Heat</td><td rowspan="4">· Resistance (R_{25}) change should be less than ±3%
· B-constant ($B_{25\text{-}50}$) change should be less than ±1%
· No visible damage.</td><td>60±2°C, 90 to 95%RH in air, for 1000 +48/-0 hours without loading.</td></tr>
<tr><td>4</td><td>High Temperature Load</td><td>150±3°C in air, with Permissive Operating Current (D.C. 0.31mA) for 1000 +48/-0 hours.</td></tr>
<tr><td>5</td><td>High Temperature Humidity Load</td><td>85±2°C, 85%RH in air, with Permissive Operating Current (D.C. 0.31mA) for 1000 +48/-0 hours.</td></tr>
<tr><td>6</td><td>Thermal Shock</td><td>1000 cycles of the following sequence without loading.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (minute)</th></tr>
<tr><td>1</td><td>-55+0/-3</td><td>15</td></tr>
<tr><td>2</td><td>+150+3/-0</td><td>15</td></tr>
</table></td></tr>
<tr><td>7</td><td>Robustness of Electrode</td><td>· No peeling of the electrodes.</td><td>Mount NTC Thermistor with conductive glue on Ceramic substrate, and apply 4.90N of force as shown below.:
 
</td></tr>
<tr><td>8</td><td>Vibration Resistant</td><td>· Resistance (R_{25})
change should be less than ±1%
· B-constant ($B_{25\text{-}50}$)
change should be less than ±1%
· No visible damage.</td><td>Solder NTC Thermistor on the Glass Epoxy PCB as show below.
Frequency: 10Hz to 2000Hz to 10Hz (20min.)
Max. amplitude: 3.0mm
Vibrated for a period of 4hrs. in three (3) directions perpendicularly intersecting each other (for total of 12hrs.)
 
</td></tr>
</table>

· NTC Thermistor should be mounted on the Ceramic substrate with "Standard Land Dimensions" by our recommendable conductive glue (PC3000: Manufactured by Heraeus) and be tested. Thickness of the conductive glue screening should be 50μm.
· R_{25} means the zero-power resistance at 25°C.
· $B_{25\text{-}50}$ is calculated by the zero-power resistances of NTC Thermistor at 25°C and at 50°C.
· After each test, NTC Thermistor should be kept for 1 hour at room temperature (normal humidity and normal atmospheric pressure). Then the resistances (R_{25} and R_{50}) should be measured and the appearance should be visually examined.
· In the case that of R_{25} or $B_{25\text{-}50}$ changes are greater than the specified value due to the method of mounting with conductive glue, these specifications should be judged by an evaluation with the chip only (not mounting).

This product is designed for application in an ordinary environment (normal room temperature, humidity and atmospheric pressure).
Do not use under the following conditions because all of these factors can deteriorate the product characteristics or cause failures and burn-out.

1. Corrosive gas or deoxidizing gas
   (Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
2. Volatile or flammable gas
3. Dusty conditions
4. Under vacuum, or under high or low pressure
5. Wet or humid locations
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

■ ⚠Caution (Other)

Be sure to provide an appropriate fail-safe function on your product to prevent secondary damages that may be caused by the abnormal function or the failure of our product.

■ Notice (Storage and Operating Conditions)

To keep the mounting nature of product from declining, the following storage conditions are recommended.

1. Storage condition:
   Temperature -10 to +40°C
   Humidity less than 75%RH (not dewing condition)
2. Storage term:
   Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Storage place:
   Do not store this product in corrosive gas (Sulfuric acid gas, Chlorine gas, etc.) or in direct sunlight.

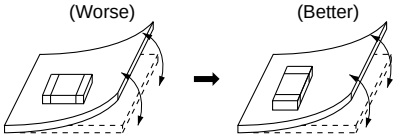
■ Notice (Rating)

Use this product within the specified temperature range.
Higher temperature may cause deterioration of the characteristics or the material quality of this product.

1. Mounting Position

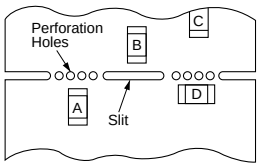
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

Component Direction



Locate this product horizontal to direction in which stress acts.

Mounting Close to Board Separation Line



Keep this product on t
PC Board away from t
Separation Line.
Worst ← A-B-C-D → E

2. Allowable Soldering Temperature and Time

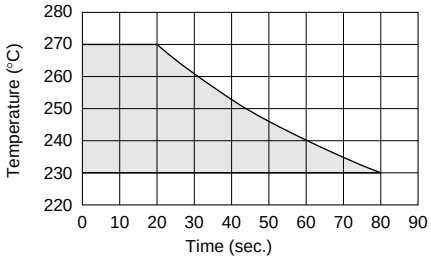
(a) Solder within the temperature and time combinations, indicated by the slanted lines in the following graphs.

(b) Excessive soldering conditions may cause dissolution of metalization or deterioration of solder-wetting on the external electrode.

(c) In the case of repeated soldering, the accumulated soldering time should be within the range shown in the following figures. (For example, Reflow peak temperature: 260°C, twice -> The total accumulated soldering time at 260°C is within 30 seconds.)

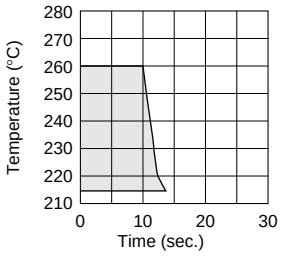
NCP15 Series

Allowable Reflow Soldering Temp. and Time

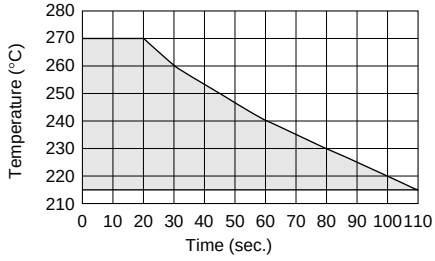


NCP18 Series

Allowable Flow Soldering Temp. and Time



Allowable Reflow Soldering Temp. and Time



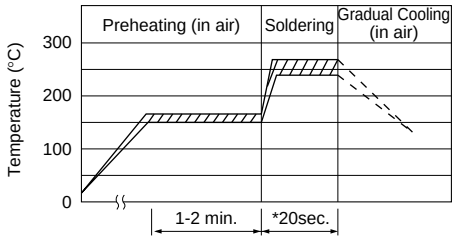
Continued on the following pa

(a) Insufficient preheating may cause a crack on the ceramic body. The difference between preheating temperature and maximum temperature in the profile shall be 100 °C.
(b) Rapid cooling by dipping in solvent or by other means is not recommended.

* In the case of repeated soldering, the accumulated soldering time should be within the range shown in "2. Allowable Soldering Temperature and Time."

NCP15 Series

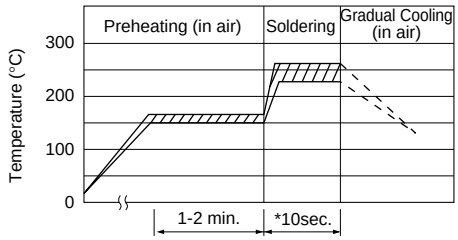
Reflow Soldering Conditions



Preheating: 160±10°C, 1-2 min.
Soldering: 240-270°C, 20sec.

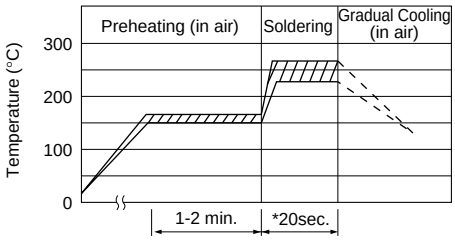
NCP18 Series

Flow Soldering Conditions



Preheating: 160±10°C, 1-2 min.
Soldering: 230-260°C, 10sec.

Reflow Soldering Conditions



Preheating: 160±10°C, 1-2 min.
Soldering: 230-270°C, 20sec.

4. Solder and Flux

(1) Solder and Paste

(a) Reflow Soldering: NCP15/NCP18 Series

Use RA/RMA type or equivalent type of solder paste. For your reference, we are using the solder paste below for any internal tests of this product.

•RMA9086 90-4-M20 (Sn:Pb=63wt%:37wt%)
(Manufactured by Alpha Metals Japan Ltd.)

•M705-221BM5-42-11
(Sn:Ag:Cu=96.5wt%:3.0wt%:0.5wt%)
(Manufactured by Senju Metal Industry Co., Ltd.)

(b) Flow Soldering: NCP18 Series

We are using the following solder paste for any internal tests of this product.

•Sn:Pb=63wt%:37wt%

•Sn:Ag:Cu=96.5wt%:3.0wt%:0.5wt%

(2) Flux

Use rosin type flux in the soldering process.
If the flux below is used, some problems might be caused in the product characteristics and reliabilit
Please do not use these types of flux.

• Strong acidic flux (with halide content exceeding 0.1wt%).
• Water-soluble flux
(*Water-soluble flux can be defined as non-rosin flux including wash-type flux and non-wash-type

5. Cleaning Conditions

For removing the flux after soldering, observe the following points in order to avoid deterioration of the characteristics or any change of the external electrodes' quality.

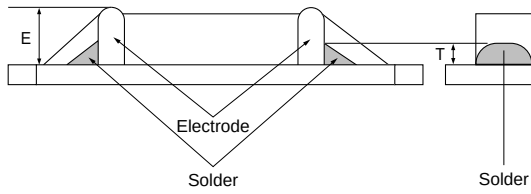
• Please keep mounted parts and the substrate from an occurrence of resonance in ultrasonic cleaning.
• Please do not clean the products in the case of using a non-washed type flux.

	NCP15	NCP18
Solvent	Isopropyl Alcohol	Isopropyl Alcohol
Dipping Cleaning	Less than 5 minutes at room temp. or less than 2 minutes at 40°C max.	Less than 5 minut room temp. or less 2 minutes at 40°C
Ultrasonic Cleaning	Less than 5 minutes 20W/ℓ Frequency of 28 to 40kHz.	Less than 1 minute 20W/ℓ Frequency several 10 to 100k
Drying	After cleaning, promptly dry this product.	

Continued on the following pa

● The amount of solder is critical. Standard height of fillet is shown in the table below.
● Too much soldering may cause mechanical stress, resulting in cracking, mechanical and/or electronic damage.

Reference: Optimum Solder Amount



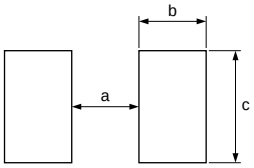
Part Number	The Solder Paste Thickness	T
NCP15	150µm	1/3E≦T≦E
NCP18	200µm	0.2mm≦T≦E

7. Adhesive Application and Curing
● Thin or insufficient adhesive may result in loose component contact with land during flow soldering.
● Low viscosity adhesive causes chips to slip after mounting.

■ Notice (Mounting) NCG18 Series

In your mounting process, observe the following points in order to avoid deterioration of the characteristics or destruction of this product. The mounting quality of this product may also be affected by the mounting conditions, shown in the points below.

1. Recommendable Land Size
Too small a land size parameter 'a' may cause an electric short mode of this product by conductive glue expanding on the surface of this product on mounting.

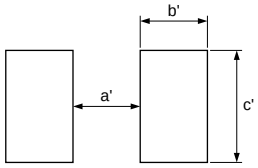


	a	b	c
Land pad size	0.6	0.6	1.0

(in mm)

2. Recommendable Conductive Glue
· PC3000 (Manufactured by Heraeus)

3. Screening Conditions of Conductive glue
(1) Recommendable Screening Size



	a'	b'
Land pad size	0.65	0.55

(2) Recommendable thickness of conductive glue screening shall be 50µm.

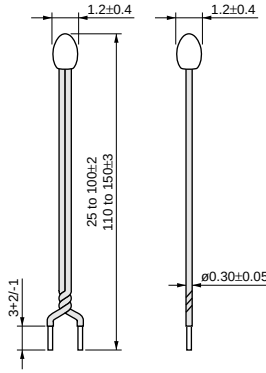
(3) Too much conductive glue gives an electric shor mode of this product by conductive glue expandi the surface of this product on mounting.

4. There is a possibility of unexpected failure in your mounting process, caused by mounting conditions. Please evaluate whether this product is correctly mounted under your mounting conditions.

■ Notice (Handling)

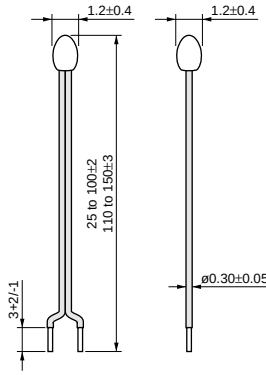
The ceramic of this product is fragile, and care must be taken not to load an excessive press - force or to give a shock at handling.
Such forces may cause cracking or chipping.

This product is a small flexible lead type NTC Thermistor with a small head and a thin lead wire.



The full length 25mm, 30 to 150mm interval 10mm.

NXFS15_1B Type (twist)



The full length 25mm, 30 to 150mm interval 10mm.

NXFS15_2B Type (without twist)

■ Features

1. High accuracy and high sensibility temperature sensing is available in a small and highly accurate NTC Thermistor.
2. Narrow space temperature sensing is available from the small sensing head and the thin lead wire.
3. Flexibility and a wide variety of lengths (25 mm to 150mm) enables the design of flexible temperature sensing architectures.
4. This product is compatible with our 0402 (EIA) size chip Thermistor.
5. Excellent long-time aging stability
6. This is a halogen-free product.*
   * Cl= max.900ppm,
   Br=max.900ppm and Cl+Br=max.1500ppm
7. Lead is not contained in the product.

■ Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits

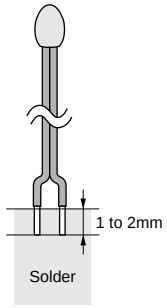
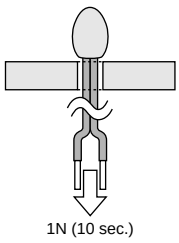
Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Operating Current for Sensor (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)	The
NXFS15XH103FA□B□□□	10k ±1%	3380 ±1%	3423	3431	3452	0.12	7.5	1.5	
NXFS15WB473FA□B□□□	47k ±1%	4050 ±1%	4091	4097	4114	0.06	7.5	1.5	
NXFS15WF104FA□B□□□	100k ±1%	4250 ±1%	4303	4311	4334	0.04	7.5	1.5	

□ is filled with lead shape (1: twist, 2: without twist).
□□□ is filled with total-length codes. (25mm, 30-150mm interval 10mm, ex. 050=50mm)
Operating Current for Sensor raises Thermistor's temperature by 0.1°C.
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 5°C by self heating at 25°C in still air.
Operating Temperature Range: -40°C to +150°C

Resistance	10kΩ	47kΩ	100kΩ
B-Constant	3380K	4050K	4250K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
−40	197.388	1690.59	4221.28
−35	149.395	1215.32	2995.04
−30	114.345	882.908	2147.00
−25	88.381	647.911	1554.60
−20	68.915	480.069	1136.69
−15	54.166	359.009	839.019
−10	42.889	270.868	624.987
−5	34.196	206.113	469.678
0	27.445	158.126	355.975
5	22.165	122.267	272.011
10	18.010	95.256	209.489
15	14.720	74.754	162.559
20	12.099	59.075	127.057
25	10.000	47.000	100.000
30	8.309	37.636	79.222
35	6.939	30.326	63.167
40	5.824	24.583	50.677
45	4.911	20.043	40.904
50	4.160	16.433	33.195
55	3.539	13.545	27.091
60	3.024	11.223	22.224
65	2.593	9.345	18.323
70	2.233	7.818	15.184
75	1.929	6.571	12.635
80	1.673	5.548	10.566
85	1.455	4.704	8.873
90	1.270	4.004	7.481
95	1.112	3.422	6.337
100	0.976	2.936	5.384
105	0.860	2.528	4.594
110	0.759	2.184	3.934
115	0.673	1.893	3.380
120	0.598	1.646	2.916
125	0.532	1.436	2.522
130	0.476	1.256	2.190
135	0.426	1.102	1.907
140	0.383	0.969	1.665
145	0.344	0.854	1.459
150	0.311	0.755	1.282

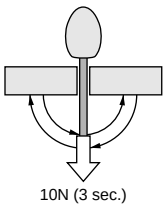
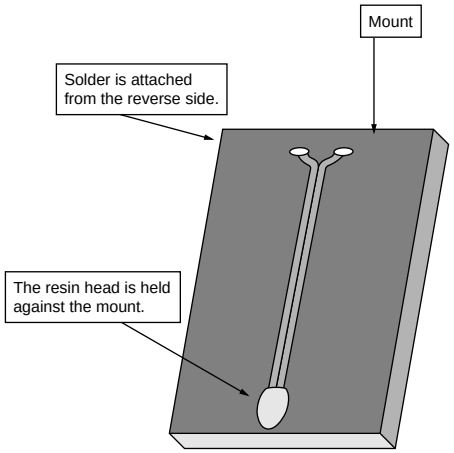
Detailed Resistance - Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

muRata

1	High Temperature Storage Test 1	· Resistance (R25°C) fluctuation rate: less than ±1%. · B-Constant (B25/50°C) fluctuation rate: less than ±1%.	125±2°C in air, for 1000 +48/-0 hours without loading.
2	Low Temperature Storage Test		-40 +0/-3°C in air, for 1000 +48/-0 hours without loading.
3	High Temperature Storage Test 2	· Resistance (R25°C) fluctuation rate: less than ±5%. · B-Constant (B25/50°C) fluctuation rate: less than ±2%.	150±2°C in air, for 1000 +48/-0 hours without loading.
4	High Temperature Load		150±2°C in air, with 'Operating Current for Sensor' for 100 +48/-0 hrs.
5	Humidity Storage Test	· Resistance (R25°C) fluctuation rate: less than ±2%. · B-Constant (B25/50°C) fluctuation rate: less than ±1%.	85±2°C, 85%RH in air, for 1000 +48/-0 hours without load
6	High Humidity Load test		85±2°C , 85%RH in air with 'Operating Current for Sensor 1000 +48/-0 hours.
7	Thermal Shock	· Resistance (R25°C) fluctuation rate: less than ±3%. · B-Constant (B25/85°C) fluctuation rate: less than ±1%.	-55 +0/-3°C, 30 minutes in air +150 +3/-0°C, 30 minutes in air (1 cycle) Continuous 1000 cycles, without loading.
8	Temperature Cycle		-55 +0/-3°C, 30 minutes in air +25±2°C, 10 to 15 minutes in air +125 +3/-0°C, 30 minutes in air +25 +2/-0°C, 10 to 15 minutes in air (1 cycle) Continuous 1000 cycles, without loading.
9	Insulation Break - down Voltage	· No damage electrical characteristics on DC100 V, 1 min.	2mm length of coating resin from the top of Thermistor is dipped into beads of lead (Pb), and DC100V is applied to between beads of lead (Pb) and lead wire for 1 minute.
10	Resistance to Soldering Heat	· Resistance (R25°C) fluctuation rate: less than ±1%. · B-Constant (B25/50°C) fluctuation rate: less than ±1%.	Both lead wires are dipped into 350±10°C solder for 3.5±0 seconds, or 260±5°C solder for 10±1 seconds according Fig-1 (solder <JIS Z 3282 H60A>).  Fig-1
11	Solderability	· More than 90% of lead wire surface shall be covered by solder.	Both lead wires are dipped into flux (25wt% Colophony <J 5902> isopropyl alcohol <JIS K 8839>) for 5 to 10 second Then both lead wires are dipped into 235±5°C solder <JIS Z 3282 H60A> for 2±0.5 seconds according to Fig-1
12	Lead Wire Pull Strength	· Resistance (R25°C) fluctuation rate: less than ±1%. · B-Constant (B25/50°C) fluctuation rate: less than ±1%.	The lead wire shall be inserted in a ø1.0mm hole until res contacts with a substrate as shown in Fig-2. And 1N force 10 seconds shall be applied to the lead wire.  Fig-2

* · R25 is zero-power resistance at 25°C.
· B25/50 is calculated by zero-power resistance of Thermistor in 25°C -50°C.
· After each test, NTC Thermistor should be kept for 1 hour at room temperature (normal humidity and normal atmospheric pressure).

Continued on the following pa

13	Lead Wire Bending Strength	· Lead wire does not break.	Hold the lead wires as in Fig-3. Bend by 90 degrees and a bend back to the initial position. Then bend to the other si 90 degrees and again bend back to the initial position. Aft bending process, 10N force for 3 seconds shall be applie the lead wire.  Fig-3
14	Free Fall	· Resistance (R25°C) fluctuation rate: less than ±1%. · B-Constant (B25/50°C) fluctuation rate: less than ±1%. · No visible damage at resin part.	NTC Thermistor shall be dropped without any force onto concrete floor from 1 meter height one time.
15	Vibration		NTC Thermistor shall be fixed to the vibration test equipm as shown below. Frequency: 10Hz to 2000Hz to 10Hz (20min.) Max. amplitude: 3.0mm Vibrated for a period of 2hrs. in three (3) directions perpendicularly intersecting each other (for total of 6hrs.) 

* · R25 is zero-power resistance at 25°C.
· B25/50 is calculated by zero-power resistance of Thermistor in 25°C -50°C.
· After each test, NTC Thermistor should be kept for 1 hour at room temperature (normal humidity and normal atmospheric pressure).

This product is designed for application in an ordinary environment (normal room temperature, humidity and atmospheric pressure).
Do not use under the following conditions because all of these factors can deteriorate the product characteristics or cause failures and burn-out.

1. Corrosive gas or deoxidizing gas
   (Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
2. Volatile or flammable gas
3. Dusty conditions
4. Under vacuum, or under high or low pressure
5. Wet or humid locations
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

■ ⚠Caution (Other)

Be sure to provide an appropriate fail-safe function on your product to prevent secondary damages that may be caused by the abnormal function or the failure of our product.

■ Notice (Storage and Operating Conditions)

To keep solderability of product from declining, the following storage conditions are recommended.

1. Storage condition:
   Temperature -10 to +40°C
   Humidity less than 75%RH (not dewing condition)
2. Storage term:
   Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Storage place:
   Do not store this product in corrosive gas (Sulfuric acid gas, Chlorine gas, etc.) or in direct sunlight.

■ Notice (Rating)

Use this product within the specified temperature range.
Higher temperature may cause deterioration of the characteristics or the material quality of this product.

■ Notice (Soldering and Mounting)

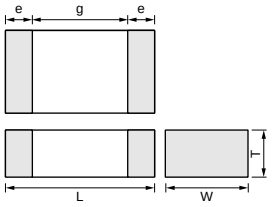
Please note as shown below when you mount this product.

1. Do not melt solder in the resin head when you solder this product. If you do so, it has a possibility of wire break, electric short mode failure and wire coating break.
   In case you cut the lead wire of this product less than 20mm from the resin head, the heat of the melted solder at the lead wire edge is propagated easily to the resin head along the lead wire.
2. Do not touch the resin head directly with the soldering i
   It may cause the melting of solder in the resin head.
3. Do not separate the parallel lead wires 10mm or less from the resin head, when you separate parallel lead wires.
4. If you mold this product by resin, please evaluate the quality of this product before you use it.
5. Do not bend the lead wire radius 1mm or less when you bend the lead wire.

■ Notice (Handling)

The ceramic of this product is fragile, and care must be taken not to load an excessive press - force or to give a shock at handling.
Such forces may cause cracking or chipping.

This chip "POSISTOR" is an SMD type for overheat sensing in power transistors, power diodes and power ICs in hybrid circuits.



■ Features

1. The SMD type's small size and light weight are helpful in miniaturizing the circuit.
2. Excellent thermal response.
3. Elements of solid-state construction provide excellent mechanical vibration and impact resistance.
4. Contactless operation provides prolonged service life and noiseless operation.
5. Lead is not contained in the terminations.

Part Number	Dimensions (mm)			
	L	W	T	e
PRF18_RB	1.6±0.15	0.8±0.15	0.8±0.15	0.1 to 0.6

Chip Type 0603 (1608) Size

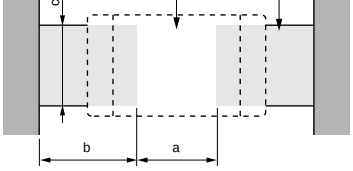
Part Number	Sensing Temperature (at 4.7k ohm) (°C)	Sensing Temperature (at 47k ohm) (°C)	Maximum Voltage (V)	Resistance (at 25°C) (ohm)
PRF18AS471QS5RB	145 ±5°C	-	32	470 ±50%
PRF18AR471QS5RB	135 ±5°C	150 ±7°C	32	470 ±50%
PRF18BA471QS5RB	125 ±5°C	140 ±7°C	32	470 ±50%
PRF18BB471QS5RB	115 ±5°C	130 ±7°C	32	470 ±50%
PRF18BC471QS5RB	105 ±5°C	120 ±7°C	32	470 ±50%
PRF18BD471QS5RB	95 ±5°C	110 ±7°C	32	470 ±50%
PRF18BE471QS5RB	85 ±5°C	100 ±7°C	32	470 ±50%
PRF18BF471QS5RB	75 ±5°C	90 ±7°C	32	470 ±50%
PRF18BG471QS5RB	65 ±5°C	80 ±7°C	32	470 ±50%

This product is applied to flow/reflow soldering.
Operating Temperature Range: -40°C to +150°C

Chip Tight Tolerance Type 0603 (1608) Size

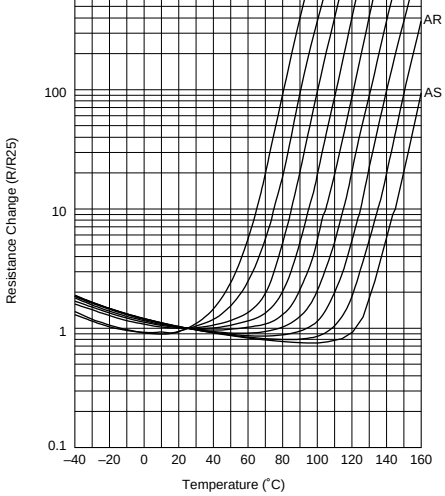
Part Number	Sensing Temperature (at 4.7k ohm) (°C)	Sensing Temperature (at 47k ohm) (°C)	Maximum Voltage (V)	Resistance (at 25°C) (ohm)
PRF18BB471RS5RB	115 ±3°C	130 ±7°C	32	470 ±50%
PRF18BC471RS5RB	105 ±3°C	120 ±7°C	32	470 ±50%
PRF18BD471RS5RB	95 ±3°C	110 ±7°C	32	470 ±50%
PRF18BE471RS5RB	85 ±3°C	100 ±7°C	32	470 ±50%
PRF18BF471RS5RB	75 ±3°C	90 ±7°C	32	470 ±50%
PRF18BG471RS5RB	65 ±3°C	80 ±7°C	32	470 ±50%

This product is applied to flow/reflow soldering.
Operating Temperature Range: -40°C to +150°C

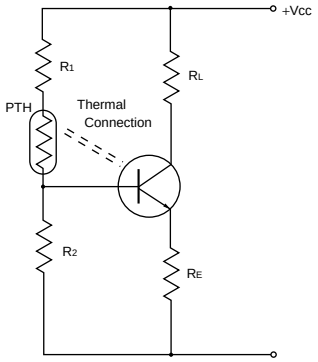


(in mm)

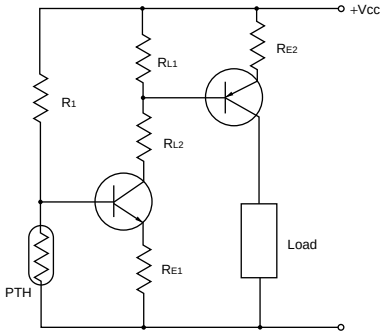
Part Number	Soldering Methods	Dimensions (mm)			
		Chip (L×W)	a	b	c
PRF18	Flow Soldering	1.6×0.8	0.6-1.0	0.8-0.9	0.6-0.8
	Reflow Soldering		0.6-0.8	0.6-0.7	0.6-0.8



■ Overheat Protection Circuit

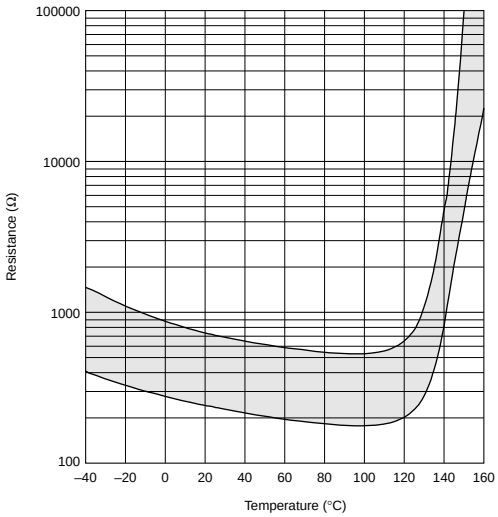


■ Overheat Sensing Circuit

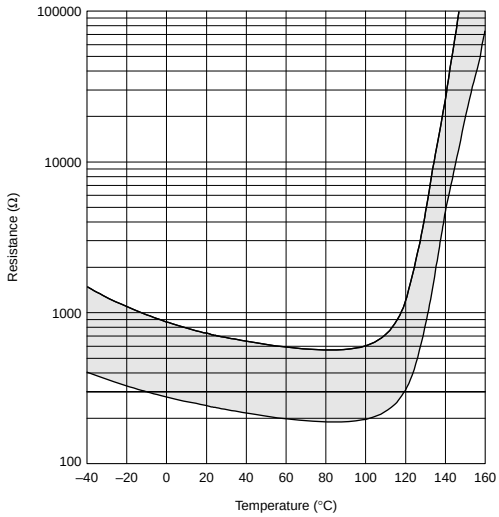


■ Resistance - Temperature Characteristics Range (Ref. Only)

PRF18AS471QS5RB



PRF18AR471QS5RB



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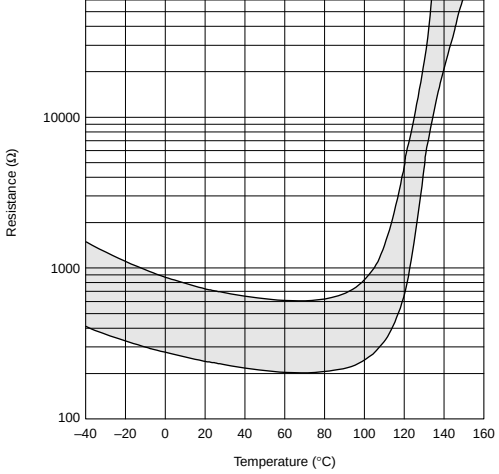
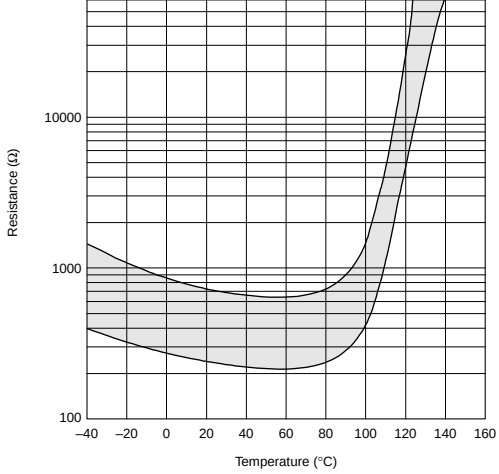
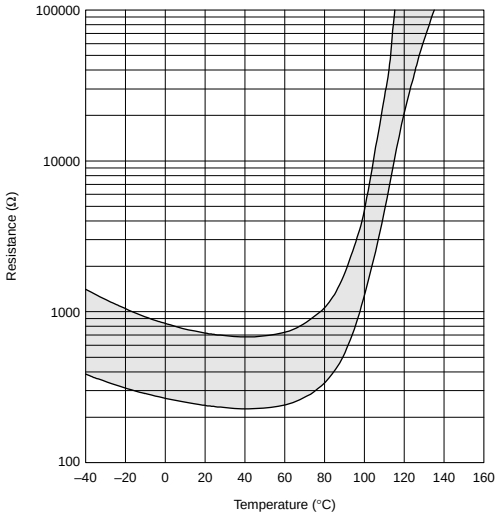
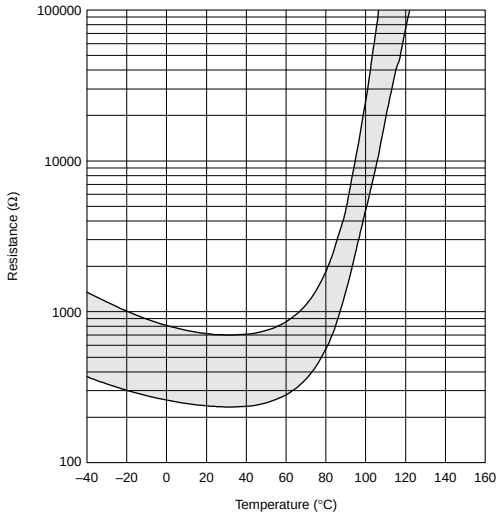




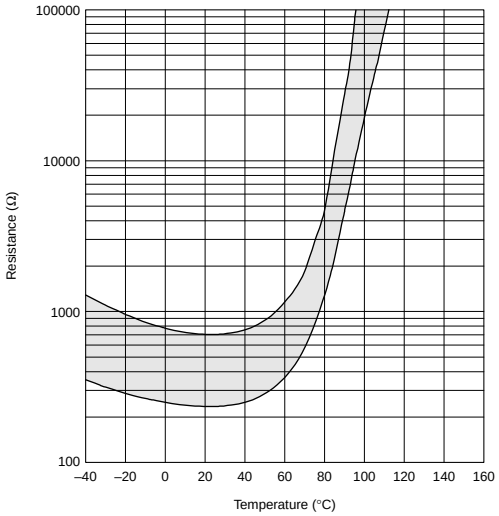
PRF18BC471QS5RB



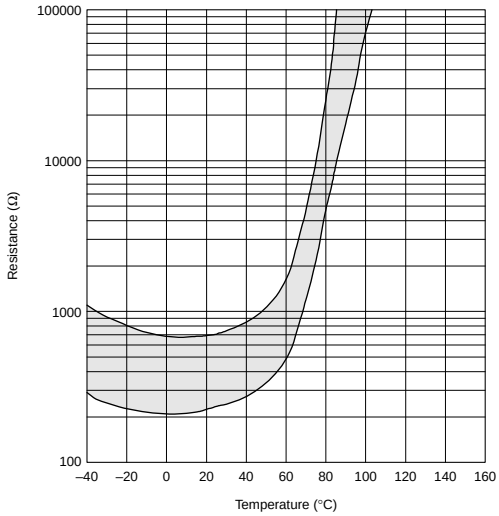
PRF18BD471QS5RB



PRF18BE471QS5RB



PRF18BF471QS5RB



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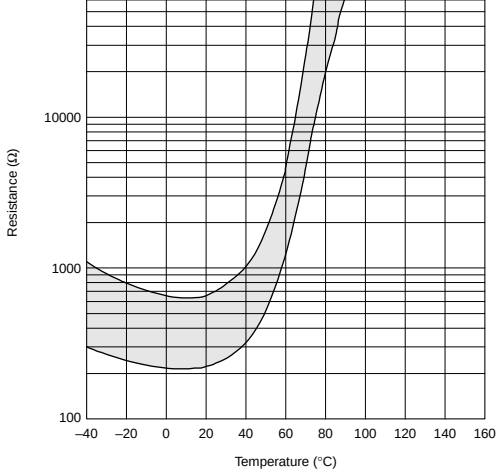
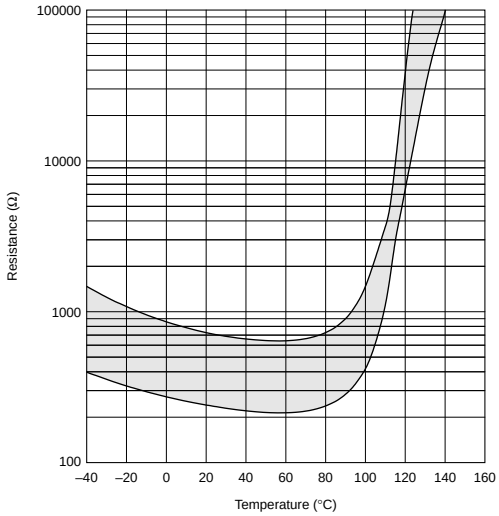


■ Resistance - Temperature Characteristics Range (Ref. Only) Tight Tolerance Type

5

PRF18BB471RS5RB



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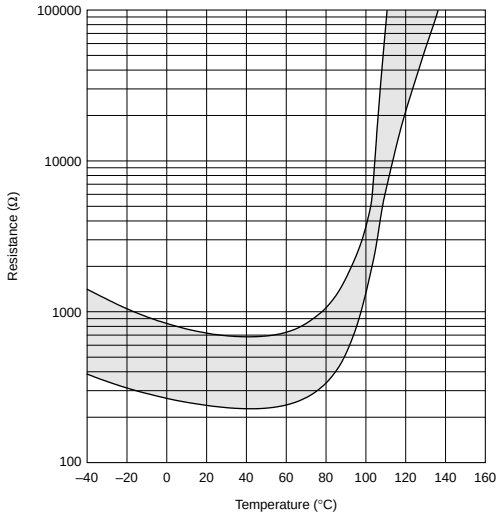

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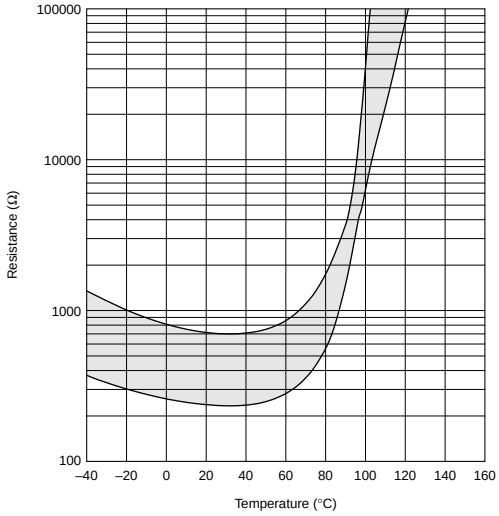

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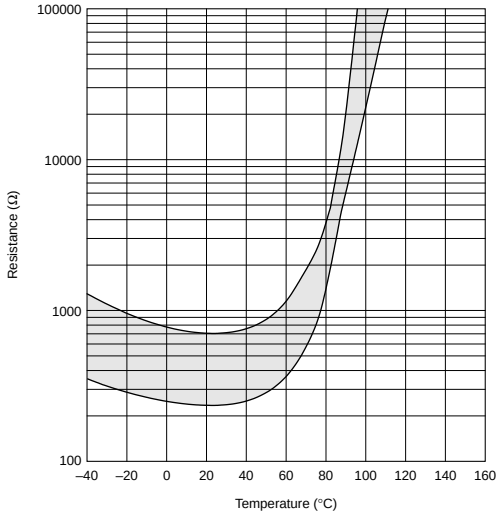

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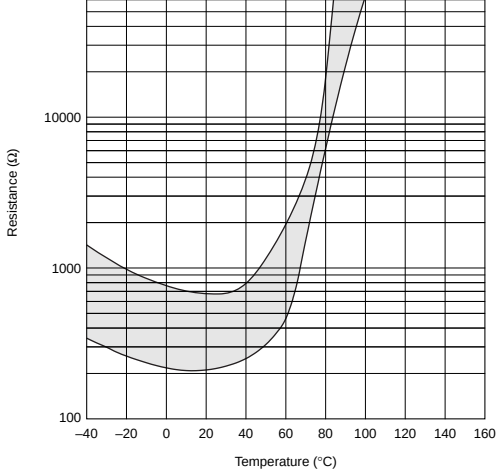
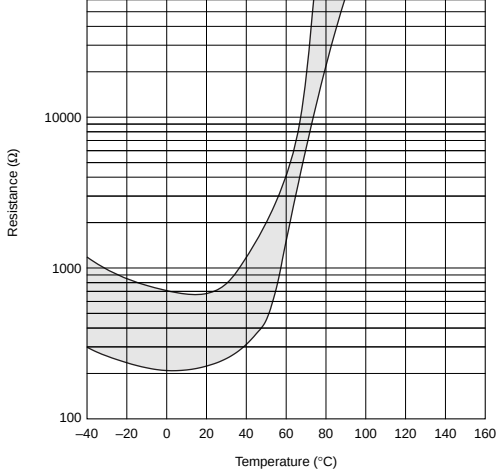
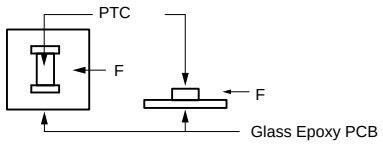
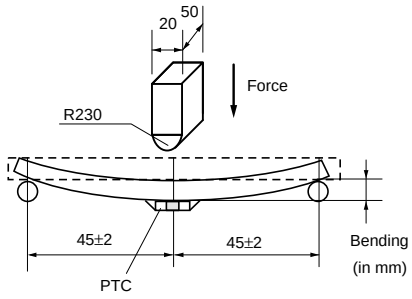




1	Resistance Value (at 25°C)	The resistance value should be within the specified tolerance.	After applying maximum operating voltage for 3 minutes a leaving for 2 hours at 25°C, measure by applying voltage less than 1.5VDC (by a direct current of less than 10mA).
2	Adhesive Strength	There is no sign of electrode detachment.	EIAJ ET-7403 term 9 Prepare soldered PTC to PCB *1 and add the force of 5.0 the direction shown below. (PTC=POSISTOR®) 
3	Vibration Resistance	There is no abnormal appearance after the test. Resistance change is less than ±20%. *2	Solder PTC to PCB *1 Vibration: 10-2000-10Hz (20 minutes) Max. Amplitude: 3.0mm Vibrate for 4 hours in each of 3 mutually perpendicular pla for a total of 12 hours. This test condition is according to " STD-202G Method 204D."
4	Resistance to Bending of Substance	There is no abnormal appearance after the test. Resistance change is less than ±20%. *2	Solder PTC on Test Board *1, and apply force on back sid Test Board shown below: Bending Speed: 1.0mm/s Bending Strength: 2.0mm Hold Time: 5±1 seconds Board Dimension: 100x40x1.6t mm Board Material: Glass Epoxy 
5	Solderability	Min. 95% electrode is covered with new solder. Resistance change is less than ±20%. *2	· Solder Temp.: 230±5°C · Solder: Sn63%/Pb37% (or 60%/40%) · Soaking Time: 3±0.3 secs. · Soaking Position: Until a whole electrode is soaked. This test condition is according to "IEC 60068-2-58 (2004
6	Soldering Heat Resistance	There is no abnormal appearance after the test. Resistance change is less than ±20%. *2	· Solder Temp.: 260±5°C · Solder: Sn63%/Pb37% (or 60%/40%) · Flux: Containing less than 0.2wt% of chlorine. · Soaking Time: 10±1 secs. · Soaking Position: Until a whole electrode is soaked. · Preheating: 150±5°C 3 mins This test condition is according to "IEC 60068-2-58 (2004

*1 Above-mentioned soldering is done under the following conditions at our site.
- Glass-epoxy PC board
- Standard land dimension
- Standard solder paste
- Standard solder profile

Above conditions are defined in Notice.

*2 Measure resistance after the test by applying voltage of less than 1.5VDC by a direct current of less than 10mA after product is left at 25±2°C for 2 h

Continued on the following pa

<table>
<tr><td>7</td><td>Dry Heat Resistance</td><td rowspan="7">There is no abnormal appearance after the test.
Resistance change is less than ±20%. *2
<Tight Tolerance Type>
Sensing temp. change is less than ±1°C.</td><td>Solder PTC to PCB *1
+150±3°C leave for 1000±12 hours</td></tr>
<tr><td>8</td><td>Cold Resistance</td><td>Solder PTC to PCB
-40±3°C leave for 1000±12 hours</td></tr>
<tr><td>9</td><td>Damp Heat Resistance</td><td>Solder PTC to PCB *1
+85±3°C 80-85%RH leave for 1000±12 hours</td></tr>
<tr><td>10</td><td>Thermal Shock 1 *3</td><td>Solder PTC to PCB *1
Test Cycle: 300 cycles
<table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (minute)</th></tr><tr><td>1</td><td>-55+0, -3</td><td>30</td></tr><tr><td>2</td><td>+150+3, -0</td><td>30</td></tr></table></td></tr>
<tr><td>11</td><td>Thermal Shock 2 *3</td><td>Solder PTC to PCB *1
Test Cycle: 1000 cycles
<table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (minute)</th></tr><tr><td>1</td><td>-55+0, -3</td><td>30</td></tr><tr><td>2</td><td>+125+3, -0</td><td>30</td></tr></table></td></tr>
<tr><td>12</td><td>High Temperature Humidity Load</td><td>Solder PTC to PCB *1
85±3°C, 80-85%RH (in air), load max. operating voltage f
1000±12 hours</td></tr>
<tr><td>13</td><td>High Temperature Load</td><td>Solder PTC to PCB *1
85±3°C (in air), load max. operating voltage for 1000±12 h</td></tr>
</table>

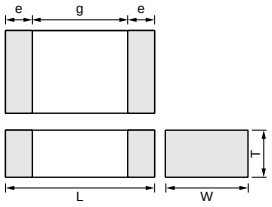
*1 Above-mentioned soldering is done under the following conditions at our site.
- Glass-epoxy PC board
- Standard land dimension
- Standard solder paste
- Standard solder profile

Above conditions are defined in Notice.

*2 Measure resistance after the test by applying voltage of less than 1.5VDC by a direct current of less than 10mA after product is left at 25±2°C for 2 h

*3 We cannot guarantee the resistance change in Thermal Shock (No.10, 11) in a case of defective mounting.

Overcurrent Protection device with resettable function suitable for current limiting resistor.
This product is a chip type PTC thermistor for overcurrent protection that is suitable for the following.
•Countermeasure for short circuit testing
•Current limiting resistor



Part Number	Dimensions (mm)			
	L	W	T	e
PRG21_RA	2.0±0.2	1.25±0.2	0.9±0.2	0.2 min.
PRG21_RK	2.0±0.2	1.25±0.2	1.25±0.2	0.2 min.

■ Features

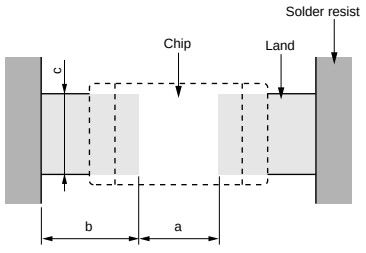
1. Rapid operation to protect the circuit in an overcurrent condition abnormality such as a short circuit.
   By removing the overcurrent condition, these products automatically return to the initial condition and can be used repeatedly.
2. Suitable for countermeasure to short circuit test in safety standard.
3. Stable resistance after operation due to ceramic PTC.
4. Similar size (0603 size) is possible due to the large capacity for electric power.
5. Possible to use these products as current limiting resistors with overcurrent protection functions
6. The SMD type's small size and light weight are helpful in miniaturizing the circuit.

6

Part Number	Max. Voltage (V)	Hold Current (at +105°C) (mA)	Hold Current (at +85°C) (mA)	Hold Current (at +25°C) (mA)	Trip Current (at +25°C) (mA)	Trip Current (at -40°C) (mA)	Max. Current (mA)	Resist (at +2 (oh
PRG21AR4R7MS2RA	16	75	110	205	390	525	4260	4.7 ±2
PRG21AR220MS1RK	16	25	45	75	195	250	900	22 ±2
PRG21AR420MS1RA	20	15	25	54	102	130	590	42 ±2

Maximum Current shows typical capacities at which the transformer can be used.
Operating Temperature Range: -40°C to +105°C

■ Standard Land Pattern Dimensions

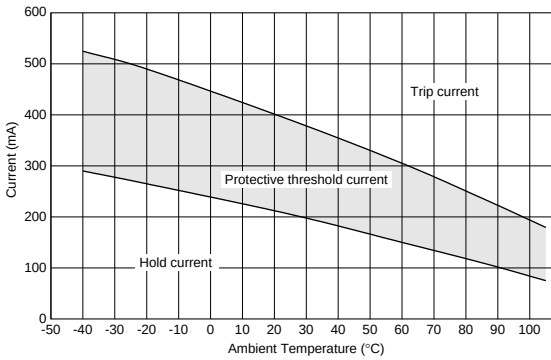


(in mm)

Part Number	Soldering Methods	Dimensions (mm)			
		Chip (L×W)	a	b	c
PRG21	Reflow Soldering	2.0×1.25	1.0-1.2	0.5-0.7	1.0-1.2

■ Protective Threshold Current Range

PRG21AR4R7MS2RA



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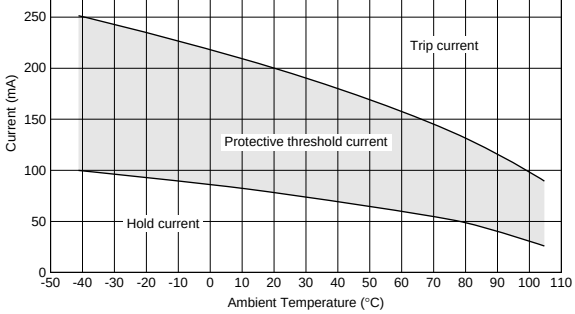
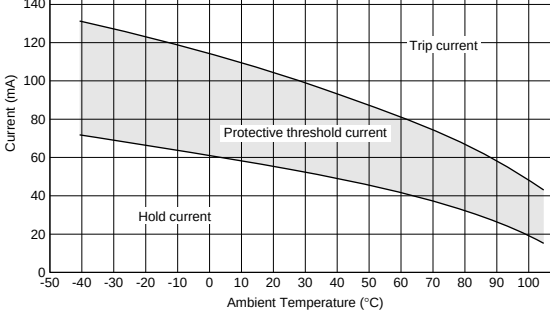
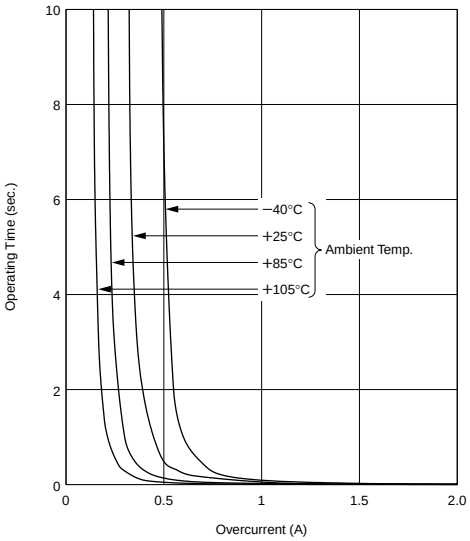


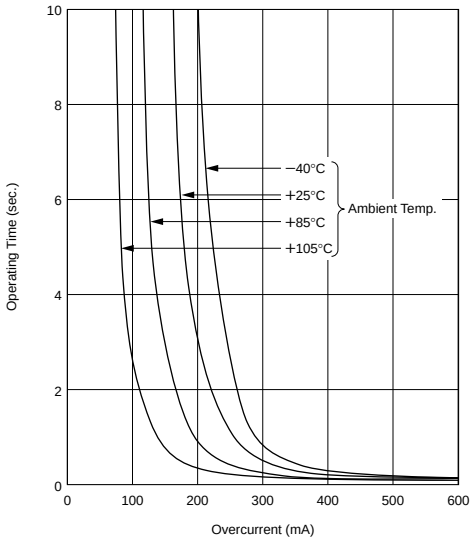


■ Operating Time (Typical Curve)

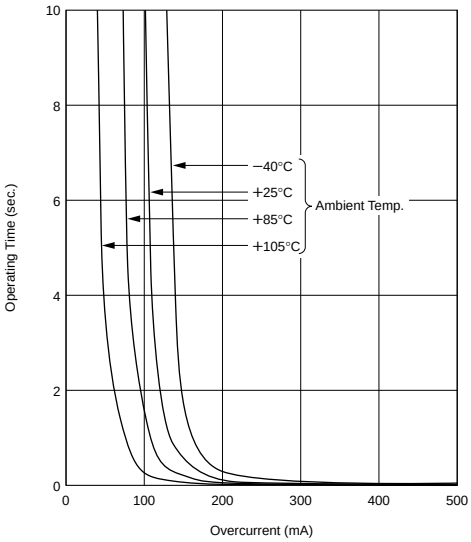
PRG21AR4R7MS2RA

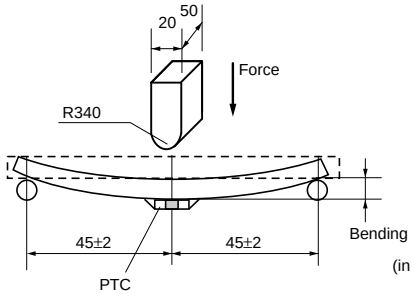


PRG21AR220MS1RK



PRG21AR420MS1RA



No.	Item	Rating Value	Menthon of Examination
1	Operating Temp. Range	-40 to +105°C	Temperature range that permit to apply max. voltage to t Posistor®.
2	Storage Temp. Range	-40 to +125°C	Temperature range that permit to leaving without applyin power to the Posistor®.
3	Resistance Value at 25°C	Within the specified range.	It is measured by below flow. 1) Applied max. voltage for 3min. 2) Storage 2hrs in room temperature 3) Measured by four-terminal method with less than 10mA (DC 0.1V)
4	Shear Test	• Resistance (R25) change: Less than ±20% *1 • Appearance: No defects or abnormalities	Reference standard: IEC 60068-2-21 (1999) • Solder PTC to PCB *2 • Test board: Grass-Epoxy test board (FR-4) with our sta land size • Pushing force: 10N • Keep time: 10±1 sec.
5	Vibration		Reference standard: IEC 60068-2-6 (1995) • Solder PTC to PCB *2 • Frequency range: 10 to 55Hz • Amplitude: 1.5mm • Sweep rate: 1 octave/min. • Direction: X-Y-Z (3 direction) • 24 cycles in each axis
6	Bending Test		Reference standard: IEC 60068-2-21 (1999) • Solder PTC to PCB *2 Board dimension: 100×40×1.6tmm (Grass epoxy board) • Bending speed: 1.0mm/s • Bending depth: 1.5mm • Keep time: 5±1 sec. 
7	Solderability	Wetting of soldering area: ≧75%	Reference standard: IEC 60068-2-58 (2004) •Solder: Sn-3.0Ag-0.5Cu •Solder temp.: 245±5°C •Immersion time: 3±0.3s

*1: The resistance value after the test is measured by 4-terminal method with less than 10mA (DC0.1V), after storage in 25±2°C for 2hrs.
*2: Above-mentioned soldering is done following condition at our side.
- Glass-epoxy PC board
- Standard land dimension
- Standard solder paste
- Standard solder profile

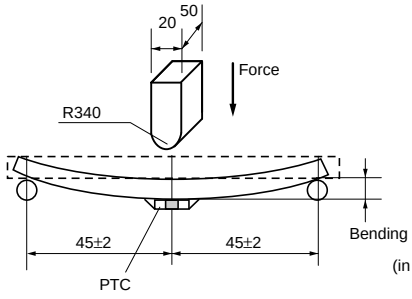
Above conditions are defined in Notice.

Continued on the following pa

<table>
<tr><td>8</td><td>Resistance to Soldering Heat</td><td rowspan="7">• Resistance (R25) change: Less than ±20% *1
• Appearance: No defects or abnormalities</td><td>Reference standard: IEC 60068-2-58 (2004)
[Reflow Method]
• Solder: Sn-3.0Ag-0.5Cu
• Preheat: +150 to +180°C, 120±5s
• Peak temp.: 260±5°C
• Soldering time: >220°C, 60 to 90s
• Reflow cycle: 2 times
• Test board: Grass-Epoxy test board (FR-4) with our star
land size</td></tr>
<tr><td>9</td><td>High Temperature Storage</td><td>Reference standard: IEC 60068-2-2 (2007)
• Solder PTC to PCB *2
• +125±2°C
• 1000+48/-0 hrs.</td></tr>
<tr><td>10</td><td>Low Temperature Storage</td><td>Reference standard: IEC 60068-2-1 (2007)
• Solder PTC to PCB *2
• -40±3°C
• 1000+48/-0 hrs.</td></tr>
<tr><td>11</td><td>Damp Heat, Steady State</td><td>Reference standard: IEC 60068-2-67 (1995)
• Solder PTC to PCB *2
• +85±2°C, 85±5%RH
• 1000+48/-0 hrs.</td></tr>
<tr><td>12</td><td>Thermal Shock *3</td><td>Reference standard: IEC 60068-2-14 (2009)
[Test Na]
• Solder PTC to PCB *2
• Transport time: <10 sec.
• Test condition: See below table
<table>
<tr><th>Step</th><th>Condition</th><th>Soaking Time</th></tr>
<tr><td>1</td><td>-40±3°C</td><td>30 min.</td></tr>
<tr><td>2</td><td>+125±2°C</td><td>30 min.</td></tr>
</table>
• Test cycle: 1000cycles</td></tr>
<tr><td>13</td><td>High Temperature Load</td><td>Reference standard: IEC 60068-2-2 (2007)
• Solder PTC to PCB *2
• +105±2°C
• Applied max. voltage
• 1000+48/-0 hrs.</td></tr>
<tr><td>14</td><td>Damp Heat Load</td><td>Reference standard: IEC 60068-2-67 (1995)
• Solder PTC to PCB *2
• +85±2°C, 85±5%RH
• Applied max. voltage
• 1000+48/-0 hrs.</td></tr>
</table>

*1: The resistance value after the test is measured by 4-terminal method with less than 10mA (DC0.1V), after storage in 25±2°C for 2hrs.
*2: Above-mentioned soldering is done following condition at our side.
- Glass-epoxy PC board
- Standard land dimension
- Standard solder paste
- Standard solder profile

Above conditions are defined in Notice.
*3: We cannot guarantee the resistance change in Thermal Shock in a case of defective mounting.

No.	Item	Rating Value	Menthon of Examination
1	Operating Temp. Range	-40 to +105°C	Temperature range that permit to apply max. voltage to t Posistor®.
2	Storage Temp. Range	-40 to +125°C	Temperature range that permit to leaving without applyin power to the Posistor®.
3	Resistance Value at 25°C	Within the specified range.	It is measured by below flow. 1) Applied max. voltage for 3min. 2) Storage 2hrs in room temperature 3) Measured by four-terminal method with less than 10mA (DC 1.5V)
4	Shear Test	• Resistance (R25) change: Less than ±20% *1 • Appearance: No defects or abnormalities	Reference standard: IEC 60068-2-21 (1999) • Solder PTC to PCB *2 • Test board: Grass-Epoxy test board (FR-4) with our sta land size • Pushing force: 5N • Keep time: 10+/-1 sec.
5	Vibration		Reference standard: MIL-STD-202G Method 204D (2002 • Solder PTC to PCB *2 • Frequency range: 10 to 2kHz • Amplitude: 3.0mm • Sweep rate: 1 octave/min. • Direction: X-Y-Z (3 direction) • 10 cycles in each axis
6	Bending Test		Reference standard: IEC 60068-2-21 (1999) • Solder PTC to PCB *2 Board dimension: 100×40×1.6tmm (Grass epoxy board) • Bending speed: 1.0mm/s • Bending depth: 2.0mm • Keep time: 5±1 sec. 
7	Solderability	Wetting of soldering area: ≧75%	Reference standard: IEC 60068-2-58 (2004) • Solder: Sn-3.0Ag-0.5Cu • Solder temp.: 245±5°C • Immersion time: 3±0.3s

*1: The resistance value after the test is measured by 4-terminal method with less than 10mA (DC0.1V), after storage in 25±2°C for 2hrs.
*2: Above-mentioned soldering is done following condition at our side.
- Glass-epoxy PC board
- Standard land dimension
- Standard solder paste
- Standard solder profile

Above conditions are defined in Notice.

Continued on the following pa

<table>
<tr><td>8</td><td>Resistance to Soldering Heat</td><td rowspan="7">• Resistance (R25) change: Less than ±20% *1
• Appearance: No defects or abnormalities</td><td>Reference standard: IEC 60068-2-58 (2004)
[Reflow Method]
• Solder: Sn-3.0Ag-0.5Cu
• Preheat: +150 to +180°C, 120±5s
• Peak temp.: 260±5°C
• Soldering time: >220°C, 60 to 90s
• Reflow cycle: 2 times
• Test board: Grass-Epoxy test board (FR-4) with our star
land size</td></tr>
<tr><td>9</td><td>High Temperature Storage</td><td>Reference standard: IEC 60068-2-2 (2007)
• Solder PTC to PCB *2
• +125±2°C
• 1000+48/-0 hrs.</td></tr>
<tr><td>10</td><td>Low Temperature Storage</td><td>Reference standard: IEC 60068-2-1 (2007)
• Solder PTC to PCB *2
• -40±3°C
• 1000+48/-0 hrs.</td></tr>
<tr><td>11</td><td>Damp Heat, Steady State</td><td>Reference standard: IEC 60068-2-67 (1995)
• Solder PTC to PCB *2
• +85±2°C, 85±5%RH
• 1000+48/-0 hrs.</td></tr>
<tr><td>12</td><td>Thermal Shock *3</td><td>Reference standard: IEC 60068-2-14 (2009)
[Test Na]
• Solder PTC to PCB *2
• Transport time: <10 sec.
• Test condition: See below table
<table>
<tr><th>Step</th><th>Condition</th><th>Soaking Time</th></tr>
<tr><td>1</td><td>-55±3°C</td><td>30 min.</td></tr>
<tr><td>2</td><td>+125±2°C</td><td>30 min.</td></tr>
</table>
• Test cycle: 1000 cycles</td></tr>
<tr><td>13</td><td>High Temperature Load</td><td>Reference standard: IEC 60068-2-2 (2007)
• Solder PTC to PCB *2
• +105+/-2°C
• Applied max. voltage
• 1000+48/-0 hrs.</td></tr>
<tr><td>14</td><td>Damp Heat Load</td><td>Reference standard: IEC 60068-2-67 (1995)
• Solder PTC to PCB *2
• +85±2°C, 85±5%RH
• Applied max. voltage
• 1000+48/-0 hrs.</td></tr>
</table>

*1: The resistance value after the test is measured by 4-terminal method with less than 10mA (DC0.1V), after storage in 25±2°C for 2hrs.
*2: Above-mentioned soldering is done following condition at our side.
- Glass-epoxy PC board
- Standard land dimension
- Standard solder paste
- Standard solder profile

Above conditions are defined in Notice.
*3: We cannot guarantee the resistance change in Thermal Shock in a case of defective mounting.

This product is designed for application in an ordinary environment (normal room temperature, humidity and atmospheric pressure). Do not use under the following conditions because all of these factors can deteriorate the characteristics or cause product failure and burn-out.

1. Corrosive gas or deoxidizing gas (Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
2. Volatile or flammable gas
3. Dusty conditions
4. Under vacuum, or under high or low pressure
5. Wet or humid conditions
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

■ ⚠Caution (Other)

Be sure to provide an appropriate fail-safe function on your product to prevent secondary damage that may be caused by the abnormal function or the failure of our product.

■ Notice (Storage and Operating Conditions)

To keep solderability of product from declining, the following storage conditions are recommended.

1. Storage condition:
   Temperature -10 to +40°C
   Humidity less than 75%RH (not dewing condition)
2. Storage term:
   Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Handling after unpacking:
   After unpacking, promptly reseal this product or store it in a sealed container with a drying agent.
4. Storage place:
   Do not store this product in corrosive gas (Sulfuric acid, Chlorine, etc.) or in direct sunlight.

1. Solder and Flux

(1) Solder Paste

(a) Flow Soldering: Use Sn:Pb=60:40wt%, Sn:Pb=63:37wt%, Sn:Ag:Cu=96.5:3.0:0.5wt% or equivalent type of solder.

(b) Reflow Soldering: Use Sn:Pb=60:40wt%, Sn:Pb=63:37wt%, Sn:Ag:Cu=96.5:3.0:0.5wt% or equivalent type of solder paste.
For your reference, we are using "63Sn/37Pb RMA9086 90-3-M18," manufactured by Alpha Metals Japan Ltd., "96.5Sn/3.0Ag/0.5Cu M705-GRN360-K2-V," manufactured by Senju Metal Industry Co., Ltd. for any internal tests of this product.

(2) Flux

Use rosin type flux in the soldering process.
If the flux below is used, some problems might be caused in the product characteristics and reliability.
Please do not use these types of flux.

- Strong acidic flux (with halide content exceeding 0.2wt%).
- Water-soluble flux
(*Water-soluble flux can be defined as non-rosin flux including wash-type flux and non-wash-type

2. Cleaning Conditions and Drying

To remove the flux after soldering, observe the following points in order to avoid deterioration of the characteristics or any change to the external electrodes' quality.

(1) Cleaning Conditions

Solvent	Dipping Cleaning	Ultrasonic Cleaning
2-propanol	Less than 5 minutes at room temp. or Less than 2 minutes at 40˚C max.	Less than 1 minute 20W/L Frequency of several 10kHz to 100kHz.

A sufficient cleaning should be applied to remove flux completely.

(2) Drying

After cleaning, promptly dry this product.

3. Soldering Conditions

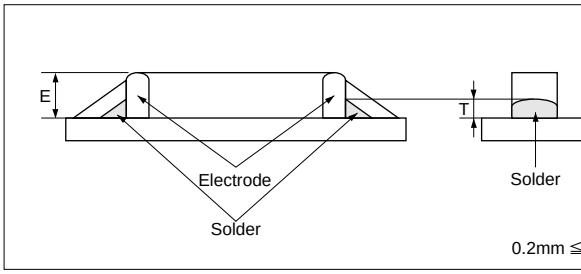
In your mounting process, observe the following points in order to avoid deterioration of the characteristics or destruction of this product. The mounting quality of this product may also be affected by the mounting conditions, shown in the points below.

(1) Printing Conditions of Solder Paste

(a) Recommended thickness of solder paste printing should be from 0.15 to 0.20mm.

(b) After soldering, the solder fillet should be a height from 0.2 mm to the thickness of this product (see the figure at right).

(c) Too much solder result in excessive mechanical stress on this product. Such stress may cause cracking or other mechanical damage. Also, it can destroy the electrical performance of this product.

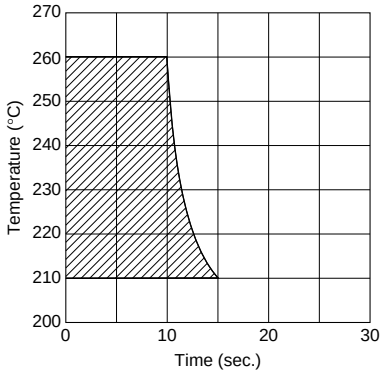


Continued on the following pa

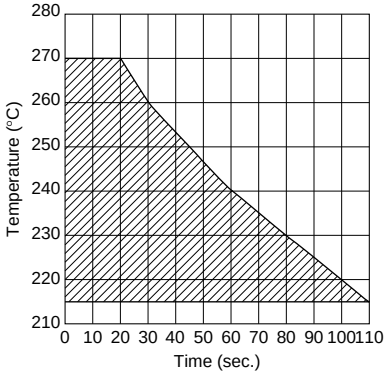
(a) If insufficient adhesive is applied, or if the adhesive is not sufficiently hardened, this product may have a loose contact with the land, during flow soldering.
(b) Too low viscosity of adhesive causes this product to slip on the board, after mounting.

(a) Solder within the temperature and time combinations, indicated by the slanted lines in t following graphs.
(b) Excessive soldering conditions may cause dissolution of metallization or deterioration of so wetting on the external electrode.
(c) In the case of repeated soldering, the accumul soldering time should be within the range shown the figures below. (For example, Reflow peak temperature: 260°C, twice -> The accumulated soldering time at 260°C is within 30sec.)

Allowable Flow Soldering Temp. and Time

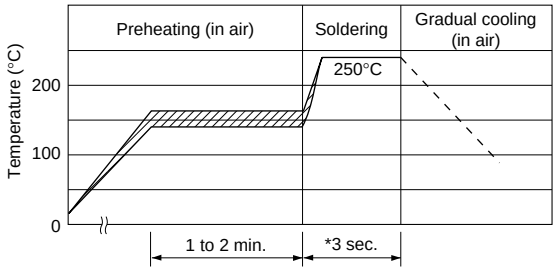


Allowable Reflow Soldering Temp. and Time



(4) Recommendable Temperature Profile for Soldering
(a) Insufficient preheating may cause a crack on the ceramic body. The difference between preheating temperature and maximum temperature in the profile should be 100°C.
(b) Rapid cooling by dipping in solvent or by other means is not recommended.

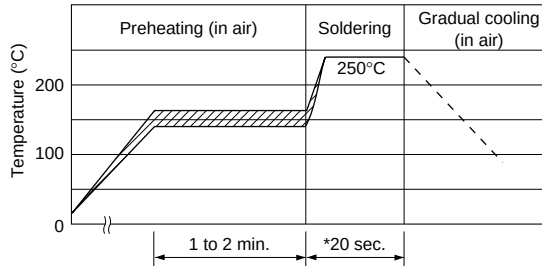
Flow Soldering Conditions



Preheating: 150±10°C, 1-2 minutes.
Soldering: 250°C, 3 sec.

* In the case of repeated soldering, the accumulated soldering time should be within the range shown in "(3) Allowable Soldering Temperature and Time."

Reflow Soldering Conditions



Preheating: 150±10°C, 1-2 minutes.
Soldering: 250°C, 20 sec.

* In the case of repeated soldering, the accumulated solde time should be within the range shown in "(3) Allowable Soldering Temperature and Time."

(5) There may be a risk of unexpected failures (tombstone, insufficient solder-wetting, etc.) in the mounting process caused by mounting conditions. Please make sure that this product is correctly mounted under the specified mounting conditions.

1. Solder and Flux

(1) Solder Paste

Use solder paste Sn:Pb=63:37wt%.

For your reference, we are using

63Sn/37Pb RMA9086 90-3-M18,

manufactured by Alpha Metals Japan Ltd.

96.5Sn/3.0Ag/0.5Cu M705-GRN360-K2-V,

manufactured by Senju Metal Industry Co., LTD for any internal tests of this product.

(2) Flux

Use rosin type flux in the soldering process.

If the flux below is used, some problems might be caused in the product characteristics and reliabilit

Please do not use these types of flux.

- Strong acidic flux (with halide content exceeding 0.2wt%).
- Water-soluble flux

(*Water-soluble flux can be defined as non-rosin flux including wash-type flux and non-wash-type

2. Cleaning Conditions

To remove the flux after soldering, observe the following points in order to avoid deterioration of the characteristics or any change to the external electrodes' quality.

Solvent	Dipping Cleaning	Ultrasonic Cleaning	Drying
2-propanol	Less than 5 minutes at room temp. or Less than 2 minutes at 40˚C max.	Less than 1 minute 20W/L Frequency of several 10kHz to 100kHz.	After cleaning, promptly dry this product.

A sufficient cleaning should be applied to remove flux completely.

3. Soldering Conditions

In your mounting process, observe the following points in order to avoid deterioration of the characteristics or destruction of this product. The mounting quality of this product may also be affected by the mounting conditions, shown in the points below.

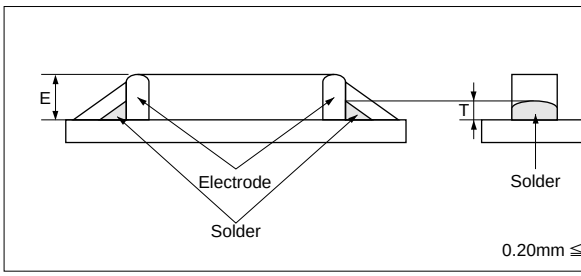
This product is for reflow soldering only. Flow soldering should not be allowed.

(1) Printing Conditions of Solder Paste

(a) Standard thickness of solder paste printing should be from 0.15 to 0.20 mm.

(b) After soldering, the solder fillet should be a height from 0.20 mm to the thickness of this product (see the figure at right).

(c) Too much solder result in excessive mechanical stress on this product. Such stress may cause cracking or other mechanical damage. Also, it can destroy the electrical performance of this product.



Continued on the following pa

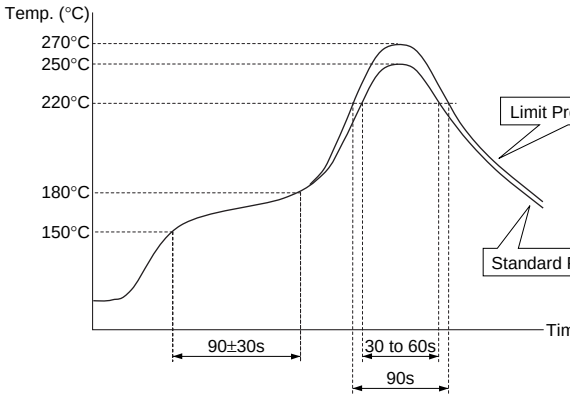
The following figure and table show our recommended reflow profile.

(a) Insufficient preheating may cause a crack on ceramic body. The temperature difference between preheat and peak should be control within 100°C to prevent this.

(b) Excessive soldering conditions may cause dissolution of metallization or deterioration of solder-wetting on the external electrode.

(c) Rapid cooling by dipping in solvent or by other means is not recommended.

(d) Please evaluate it on your condition if you will do mounting using not applying condition to the above-mentioned.



	Standard Profile	Limit Profi
Preheat	150 to 180°C, 90±30s	
Soldering Time (≧220°C)	30 to 60s	90s
Peak Temp.	250°C	270°C
Reflow Cycle	Max. 2 times	Max. 2 time

(3) There may be a risk of unexpected failures (tombstone, insufficient solder-wetting, etc.) in the mounting process, caused by the mounting conditions. Please make sure that this product is correctly mounted under specified mounting conditions.

1. Solder and Flux

(1) Solder Paste

Use solder paste Sn:Pb=63:37wt%.

For your reference, we are using

63Sn/37Pb RMA9086 90-3-M18,

manufactured by Alpha Metals Japan Ltd.

96.5Sn/3.0Ag/0.5Cu M705-GRN360-K2-V,

manufactured by Senju Metal Industry Co., LTD for any internal tests of this product.

(2) Flux

Use rosin type flux in the soldering process.

If the flux below is used, some problems might be caused in the product characteristics and reliabilit

Please do not use these types of flux.

- Strong acidic flux (with halide content exceeding 0.2wt%).
- Water-soluble flux

(*Water-soluble flux can be defined as non-rosin flux including wash-type flux and non-wash-type

2. Cleaning Conditions

To remove the flux after soldering, observe the following points in order to avoid deterioration of the characteristics or any change to the external electrodes' quality.

Solvent	Dipping Cleaning	Ultrasonic Cleaning	Drying
2-propanol	Less than 5 minutes at room temp. or Less than 2 minutes at 40˚C max.	Less than 1 minute 20W/L Frequency of several 10kHz to 100kHz.	After cleaning, promptly dry this product.

A sufficient cleaning should be applied to remove flux completely.

3. Soldering Conditions

In your mounting process, observe the following points in order to avoid deterioration of the characteristics or destruction of this product. The mounting quality of this product may also be affected by the mounting conditions, shown in the points below.

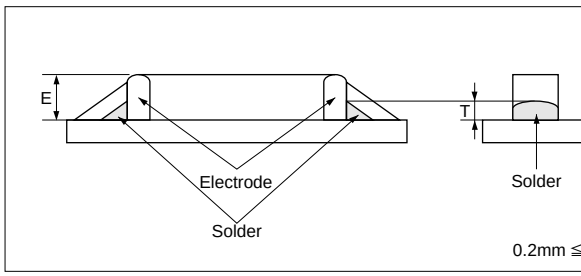
This product is for reflow soldering only. Flow soldering should not be allowed.

(1) Printing Conditions of Solder Paste

(a) Standard thickness of solder paste printing should be from 0.15 to 0.20 mm.

(b) After soldering, the solder fillet should be a height from 0.2 mm to the thickness of this product (see the figure at right).

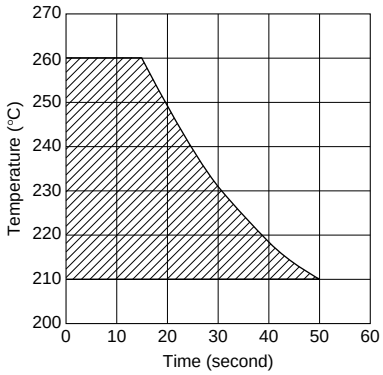
(c) Too much solder result in excessive mechanical stress to this product. Such stress may cause cracking or other mechanical damage. Also, it can destroy the electrical performance of this product.



Continued on the following p

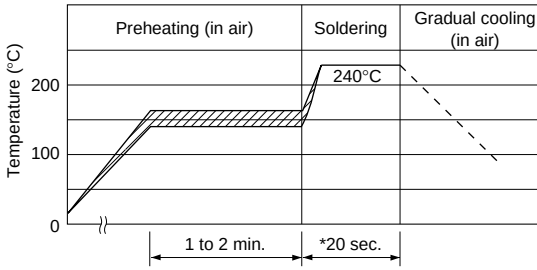
(a) Solder within the temperature and time combinations, indicated by the slanted lines in the graphs at right.
(b) Excessive soldering conditions may cause dissolution of metallization or deterioration of solder-wetting on the external electrode.
(c) In the case of repeated soldering, the accumulated soldering time should be within the range shown at right. (For example, Reflow peak temperature: 260°C, twice → The accumulated soldering time at 260°C is within 15sec.)

Allowable Reflow Soldering Temp. and Time



(3) Standard Temperature Profile for Soldering
(a) Insufficient preheating may cause a crack on the ceramic body. The difference between preheating temperature and maximum temperature in the profile should be 100℃.
(b) Rapid cooling by dipping in solvent or by other means is not recommended.

Reflow Soldering Conditions



Preheating: 150±10°C, 1 to 2 minutes
Soldering: 240°C, 20 sec.

* In the case of repeated soldering, the accumulated solde time should be within the range shown in "(2) Allowable Soldering Temperature and Time."

(4) There may be a risk of unexpected failures (tombstone, insufficient solder-wetting, etc.) in the mounting process, caused by the mounting conditions. Please make sure that this product is correctly mounted under the specified mounting conditions.

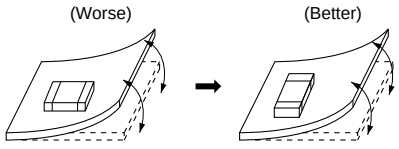
1. Do not give this product a strong press-force or a mechanical shock, because such mechanical forces may cause cracking or chipping of this ceramic product.

2. Rapid cooling or heating during soldering is not recommended such treatment may destroy the element.

3. Resin coating
   Please select a resin material with minimum hardness. The shrinkage of the resin at heat treatment should be much less in order not to apply much stress to the product.

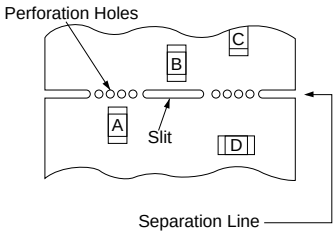
4. Location on Printed Circuit Board (PC Board)
   Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

Component Direction



Locate chip horizontal to direction in which stress acts

Chip Mounting Close to Board Separation Point

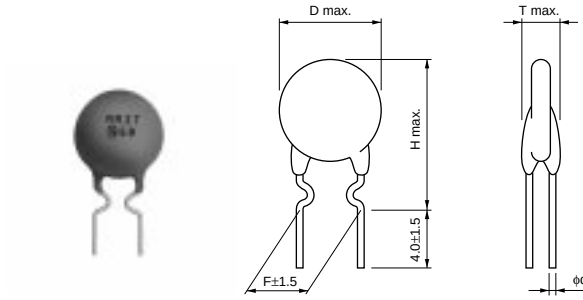


Put this product o PC Board near th not near the Perforation Holes Keep this product the PC Board awa from the Separati Line.

Worst A-C-B-D B

16V Series

This low-voltage, low-resistance type "POSISTOR" is a circuit protector whose resistance value in normal operation is very low and in abnormal situations such as motor lock or short circuit, will be increased to restrain over current. This "POSISTOR" is most suitable for low-voltage circuits and motor protection for automotive grade applications.



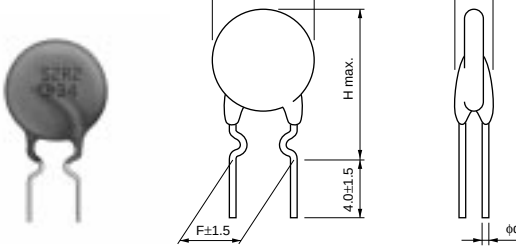
■ Features

1. Best suited to meet the requirements for power supply and motor protection. Error-free operation is assured by rush current.
2. Circuit is protected until current is turned off.
3. Restores the original low resistance value automatically once the overload is removed.
4. Non-contact design leads to long life and no noise. Durable and strong against mechanical vibration and shock because it is a solid element.
5. Lead (Pb) is not contained in the terminations.

Part Number	Max. Voltage (V)	Hold Current (at +85°C) (mA)	Hold Current (at +25°C) (mA)	Trip Current (at +25°C) (mA)	Trip Current (at -30°C) (mA)	Max. Current (A)	Resistance (at +25°C) (ohm)	Body Diameter (D)(mm)	Thickness (T) (mm)	Height (H) (mm)	Lead Space (F)(mm)	D (ph
PTGL5SAR1R0M1B51B0	16	252	470	880	1095	2.0	1.0 ±20%	6.0	3.5	9.5	5.0	
PTGL6SAR0R8M1B51B0	16	274	505	955	1193	3.0	0.8 ±20%	6.5	3.5	10.0	5.0	
PTGL7SARR47M1B51B0	16	376	705	1310	1634	5.0	0.47 ±20%	7.5	3.5	12.0	5.0	
PTGL9SARR33M1B51B0	16	466	875	1625	2026	7.0	0.33 ±20%	9.0	3.5	14.0	5.0	
PTGLASARR27M1B51B0	16	545	1025	1900	2369	8.0	0.27 ±20%	10.1	3.5	15.0	5.0	
PTGLCSAR0R2M1B51B0	16	692	1300	2410	3006	9.0	0.2 ±20%	11.3	3.5	16.0	5.0	
PTGLESARR15M1B51B0	16	820	1545	2855	3561	10	0.15 ±20%	13.5	3.5	18.5	5.0	

Maximum Current shows typical capacities at which the transformer can be used.
Operating Temperature Range: -30°C to +85°C
Taping type of part numbers with "A0" is available (except PTGLESARR15M1B51B0).

as automotive grade can be used with a wide temperature range. This product is suitable for short-protection and current limiting resistance on power supply equipment.

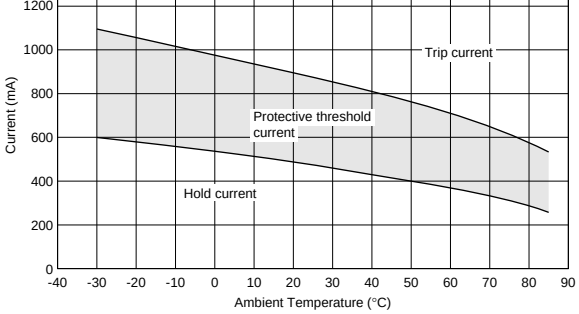


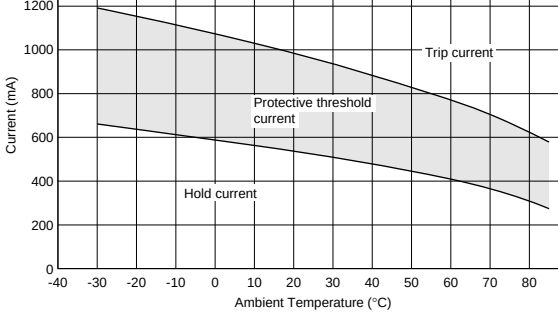
■ Features

1. Useful protective threshold current range with a wide temperature range.
2. Small fluctuation in the circuit due to resistance tolerance +/-10%.
3. Quick operating time due to small size compared with conventional products.
4. Best suited to meet the requirements of power supply and motor protector. Error-free operation is assured by rush current.
5. Circuit is protected until current is turned off.
6. Restores the original low resistance value automatically once the overload is removed.
7. Non-contact design leads to long life and no noise. Durable and strong against mechanical vibration and shock because it is a solid element.
8. Lead (Pb) is not contained in the terminations.

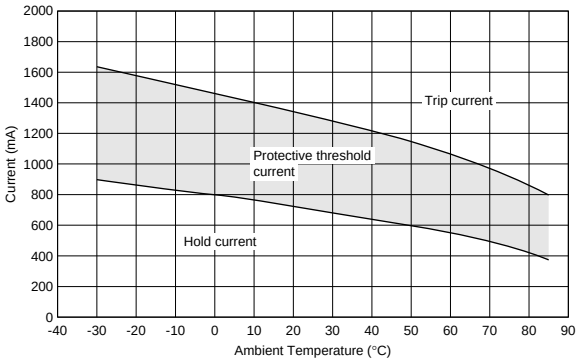
Part Number	Max. Voltage (V)	Hold Current (at +105°C) (mA)	Hold Current (at +85°C) (mA)	Hold Current (at +25°C) (mA)	Trip Current (at +25°C) (mA)	Trip Current (at -40°C) (mA)	Max. Current (A)	Resistance (at +25°C) (ohm)	Body Diameter (D)(mm)	Thickness (T) (mm)	Height (H) (mm)	Lead Space (F)(mm)	(p
PTGL4SAS100K2N51B0	30	65	92	154	205	261	1.5	10 ±10%	4.5	3.5	9.5	5.0	
PTGL4SAS100K2B51B0	30	89	127	212	282	359	2.0	10 ±10%	4.5	3.5	9.5	5.0	
PTGL5SAS3R9K2B51B0	30	143	204	340	452	576	3.5	3.9 ±10%	5.5	3.5	10.5	5.0	
PTGL7SAS2R7K2B51B0	30	179	255	425	565	720	4.5	2.7 ±10%	7.3	3.5	12.3	5.0	
PTGL7SAS1R8K2B51B0	30	223	319	532	708	902	5.0	1.8 ±10%	7.3	3.5	12.3	5.0	
PTGL9SAS1R2K2B51B0	30	296	422	704	936	1193	6.0	1.2 ±10%	9.3	3.5	14.3	5.0	
PTGLCSAS0R8K2B51B0	30	364	520	867	1153	1470	7.0	0.8 ±10%	11.5	3.5	16.5	5.0	
PTGL4SAS100K3B51B0	51	89	128	213	283	361	1.0	10 ±10%	4.5	3.5	9.5	5.0	
PTGL5SAS6R8K3B51B0	51	105	149	249	331	422	1.5	6.8 ±10%	5.5	3.5	10.5	5.0	
PTGL7SAS3R3K3B51B0	51	163	233	389	517	659	3.0	3.3 ±10%	7.3	3.5	12.3	5.0	
PTGL9SAS2R2K3B51B0	51	219	313	522	694	885	4.0	2.2 ±10%	9.3	3.5	14.3	5.0	
PTGLCSAS1R2K3B51B0	51	315	449	749	996	1270	5.0	1.2 ±10%	11.5	3.5	16.5	5.0	
PTGL4SAS220K4N51B0	60	47	67	112	149	190	1.0	22 ±10%	4.5	3.5	9.5	5.0	
PTGL4SAS220K4B51B0	60	61	87	145	193	246	1.0	22 ±10%	4.5	3.5	9.5	5.0	
PTGL5SAS100K4B51B0	60	90	129	215	286	364	1.5	10 ±10%	5.5	3.5	10.5	5.0	
PTGL7SAS5R6K4N51B0	60	99	142	236	314	400	2.2	5.6 ±10%	7.3	3.5	12.3	5.0	
PTGL7SAS5R6K4B51B0	60	122	174	290	386	492	3.0	5.6 ±10%	7.3	3.5	12.3	5.0	
PTGL9SAS3R3K4B51B0	60	177	253	421	560	714	4.0	3.3 ±10%	9.3	3.5	14.3	5.0	
PTGLCSAS2R2K4B51B0	60	234	334	556	739	942	5.0	2.2 ±10%	11.5	3.5	16.5	5.0	
PTGL4SAS560K6B51B0	140	39	56	94	125	159	0.5	56 ±10%	4.5	4.5	9.5	5.0	
PTGL5SAS270K6B51B0	140	56	80	134	178	227	1.0	27 ±10%	5.5	4.5	10.5	5.0	
PTGL7SAS150K6B51B0	140	79	112	187	249	317	1.5	15 ±10%	7.3	4.5	12.3	5.0	
PTGL9SAS120K6B51B0	140	102	146	244	324	413	2.0	12 ±10%	9.3	4.5	14.3	5.0	
PTGL9SAS7R6K6B51B0	140	121	172	287	382	486	2.2	7.6 ±10%	9.3	4.5	14.3	5.0	
PTGLCSAS4R7K6B51B0	140	165	236	393	523	666	3.5	4.7 ±10%	11.5	4.5	16.5	5.0	

Maximum Current shows typical capacities at which the transformer can be used.
Operating Temperature Range: -40°C to +125°C
Taping type of part numbers with "A0" is available.

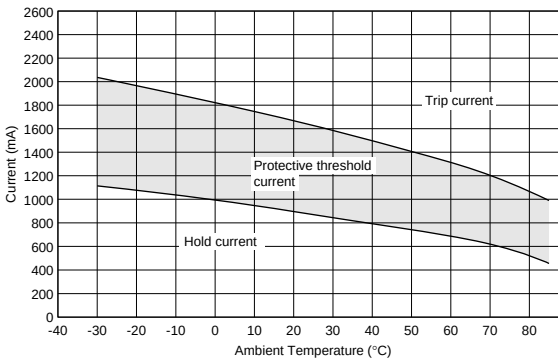




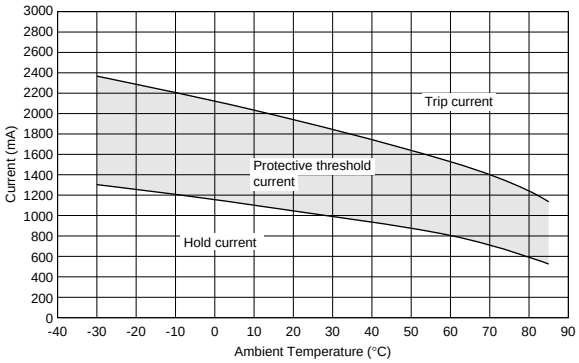
PTGL7SARR47M1B51B0



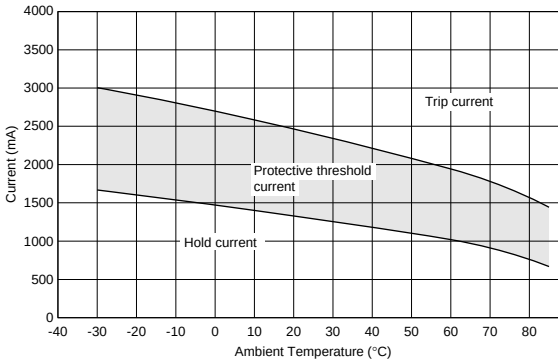
PTGL9SARR33M1B51B0



PTGLASARR27M1B51B0



PTGLCSAR0R2M1B51B0



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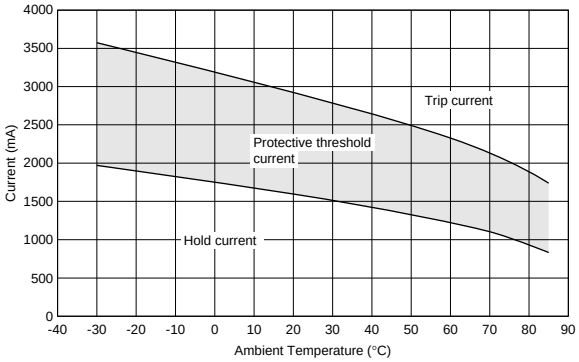
■ Protective Threshold Current Range (30V Ser

PTGLESARR15M1B51B0



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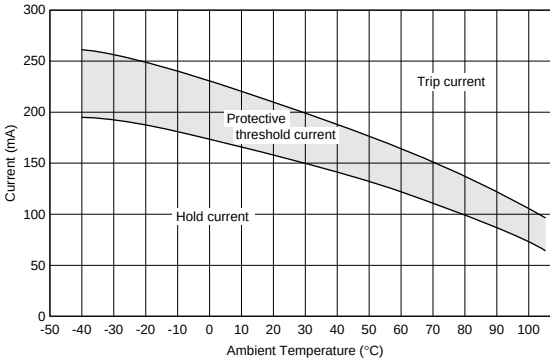

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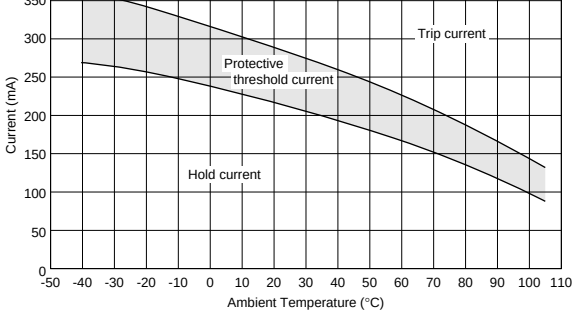

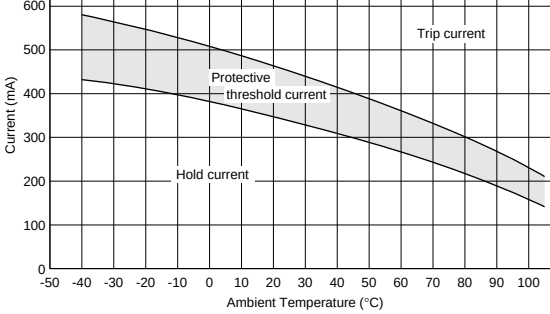

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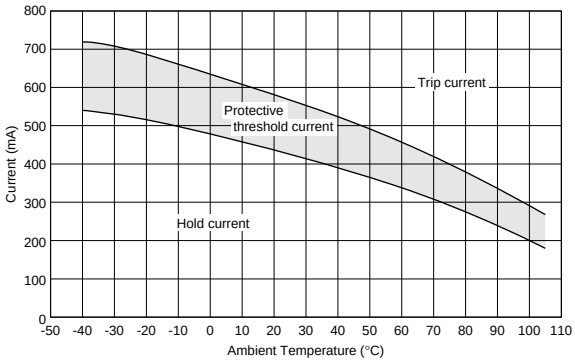

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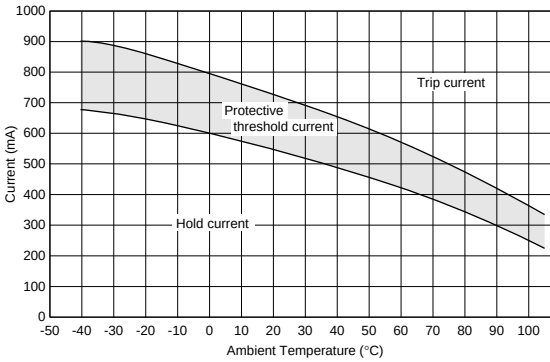

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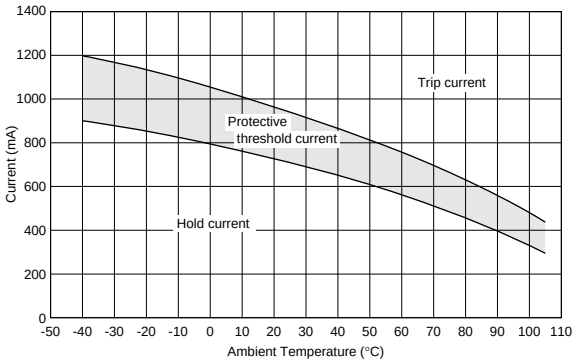

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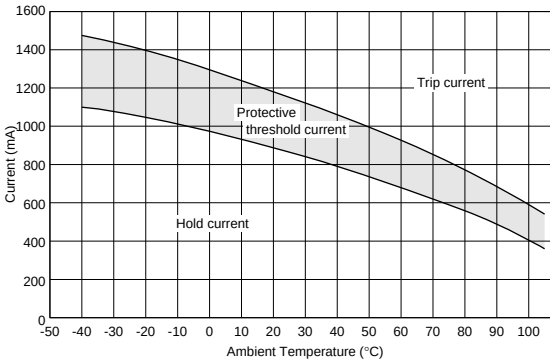

■ Protective Threshold Current Range (51V Series)

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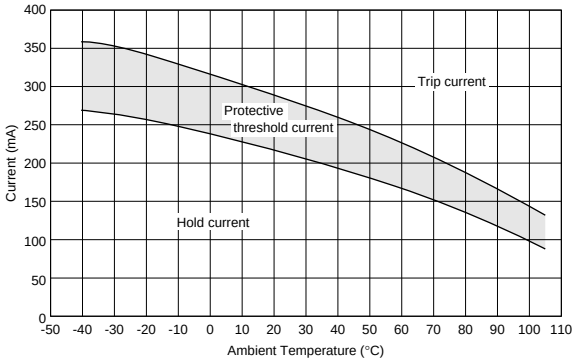

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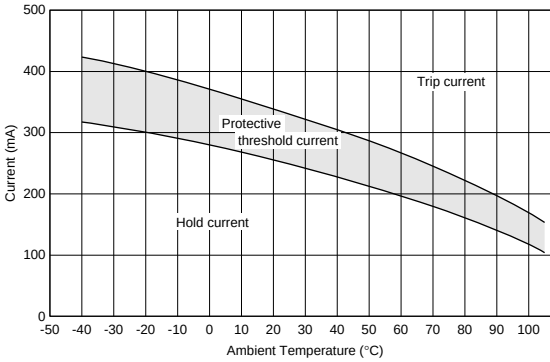

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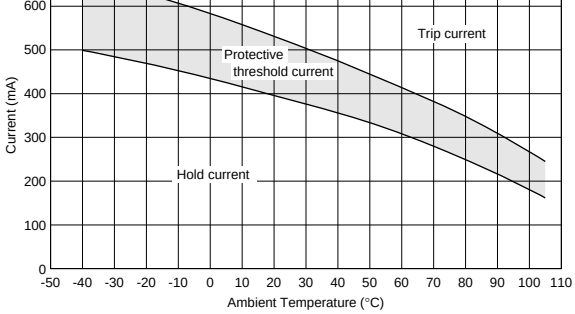
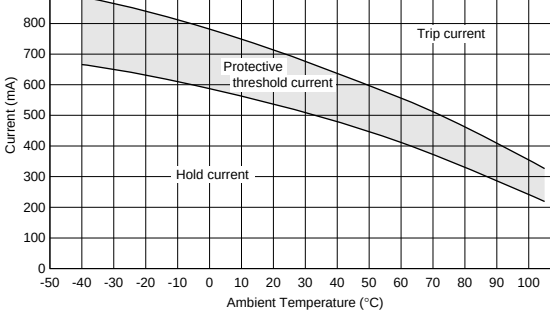
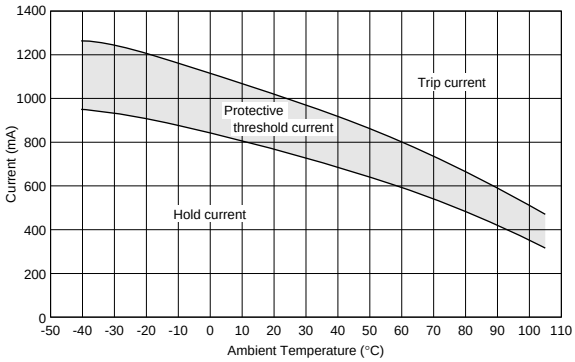




■ Protective Threshold Current Range (60V Ser

PTGLCSAS1R2K3B51B0



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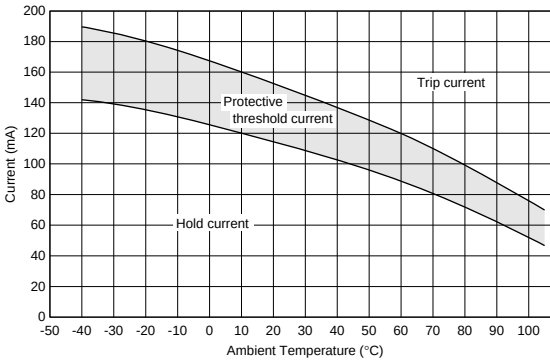

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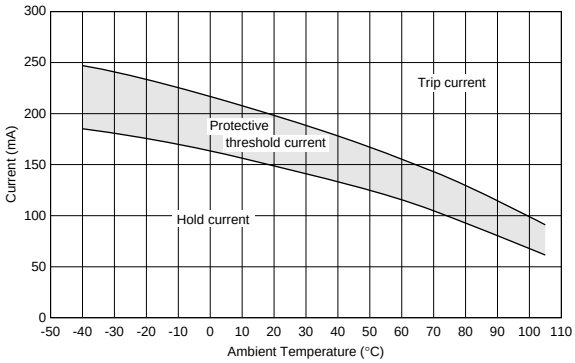

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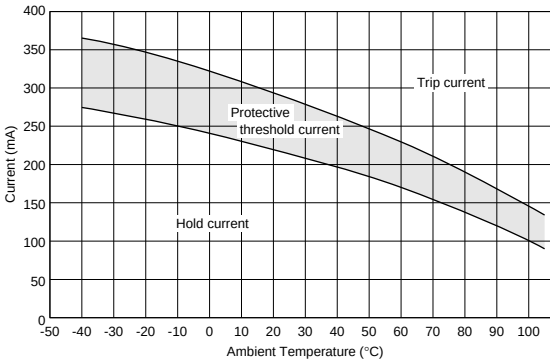

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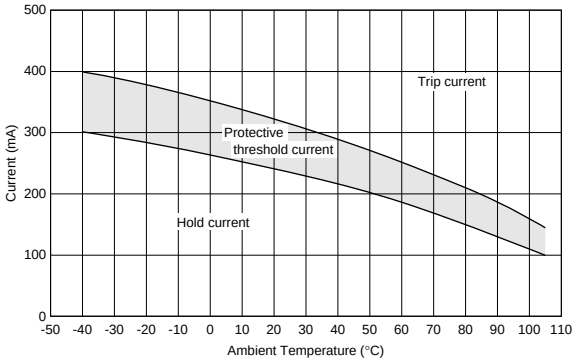

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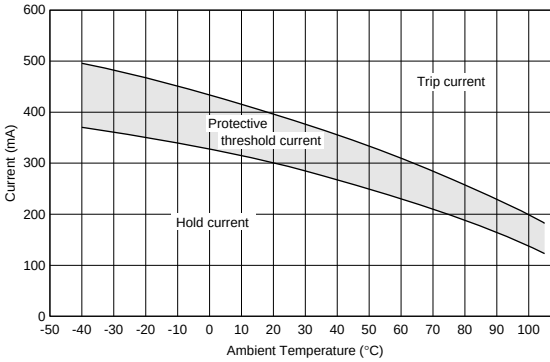

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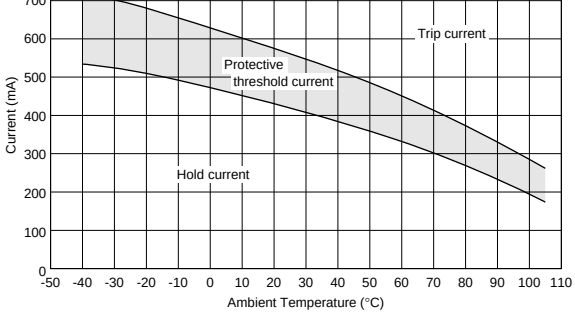

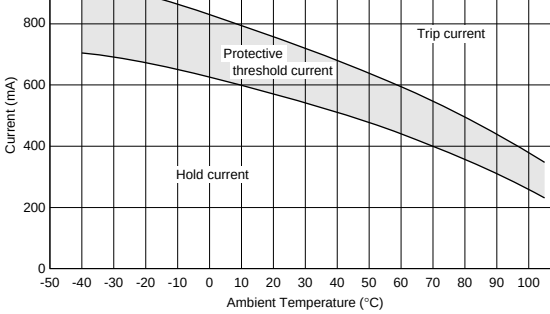

■ Protective Threshold Current Range (140V Series)

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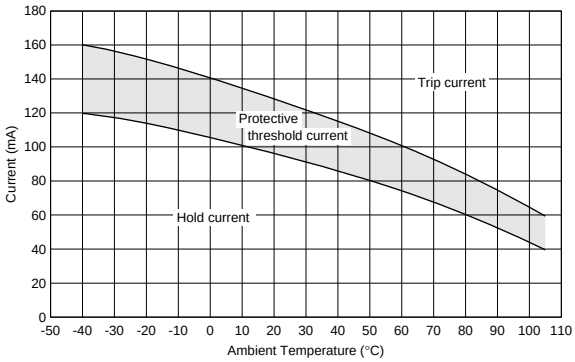

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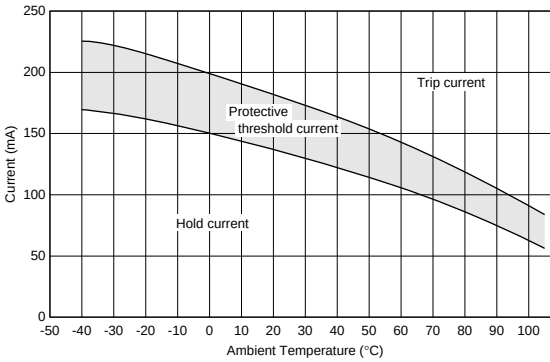

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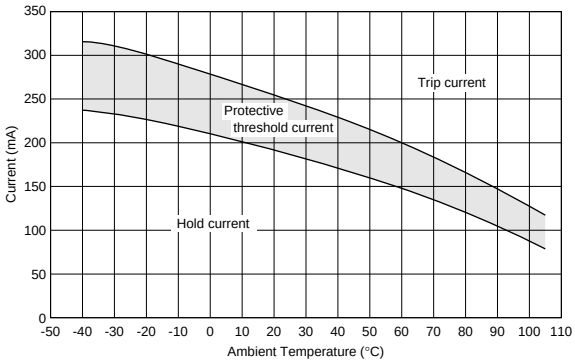
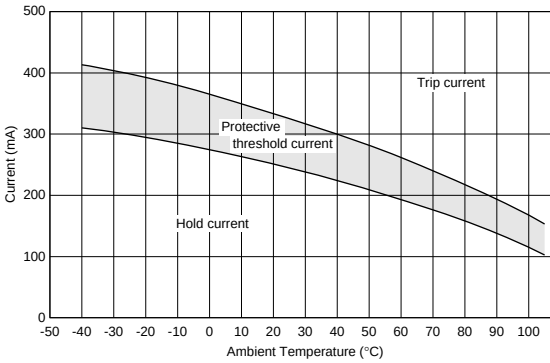


PTGL9SAS120K6B51B0



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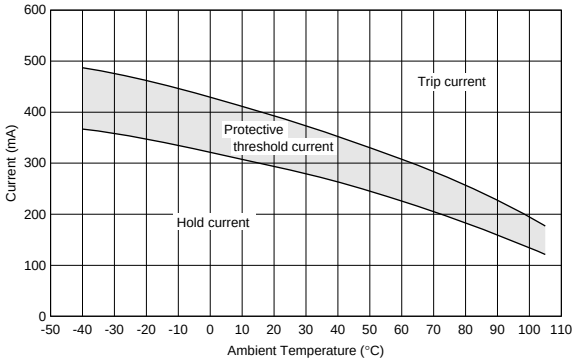

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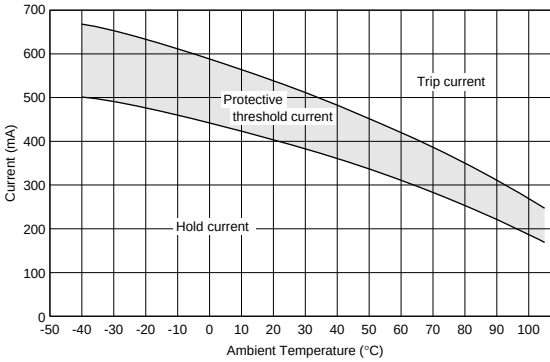

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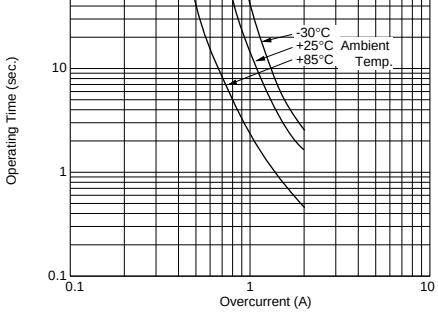

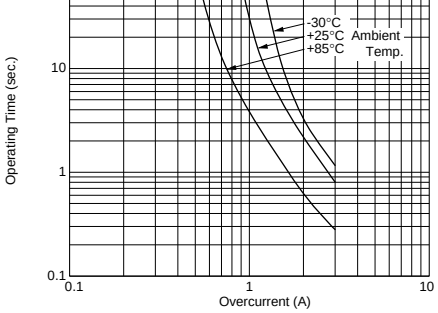

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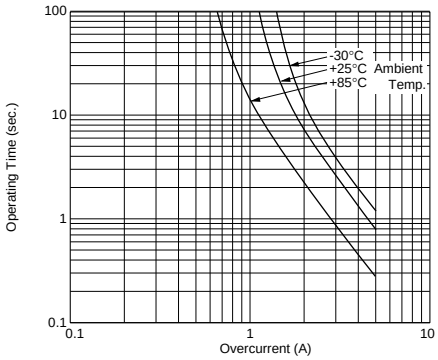

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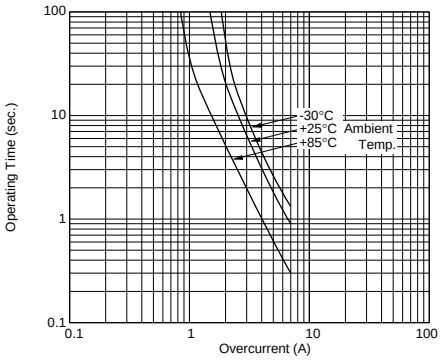

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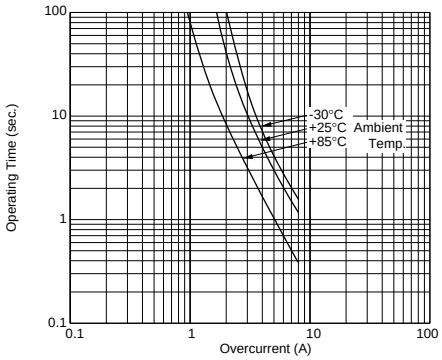

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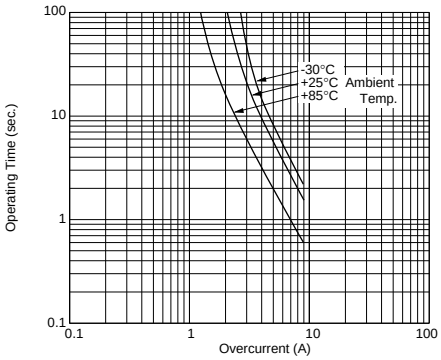

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■ Operating Time (Typical Curve) (30V Series)

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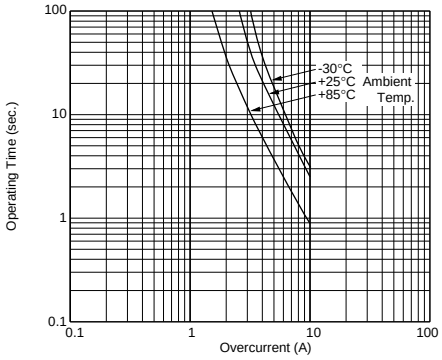

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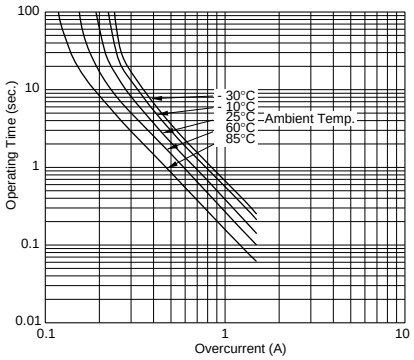

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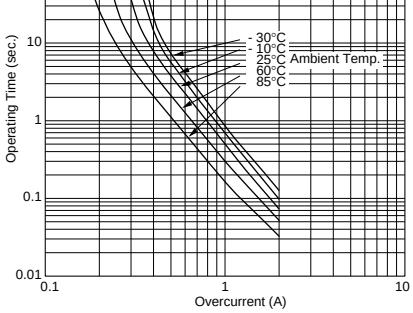

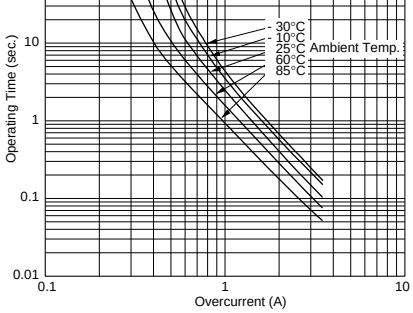

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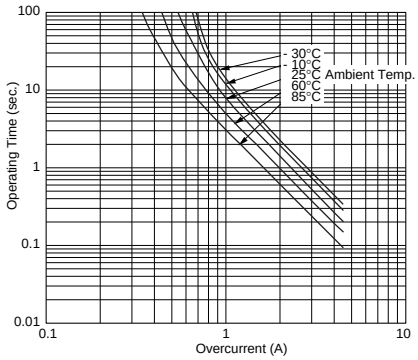

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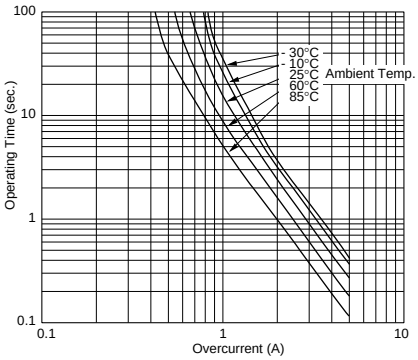

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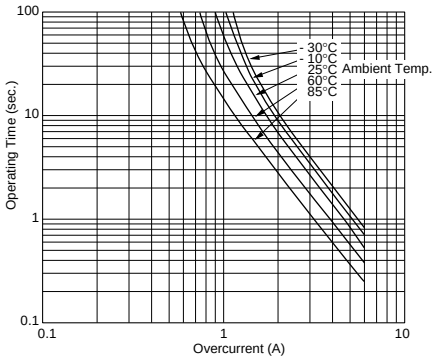
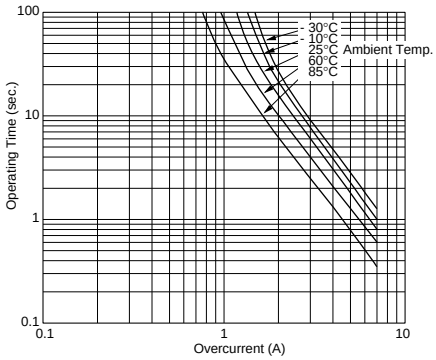


PTGLCSAS0R8K2B51B0



■ Operating Time (Typical Curve) (51V Series)

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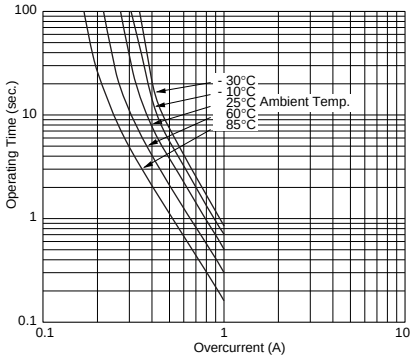

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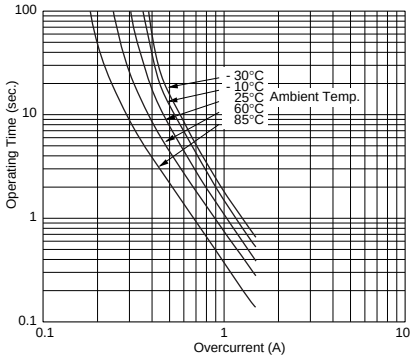

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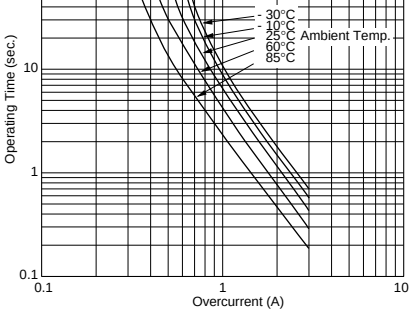

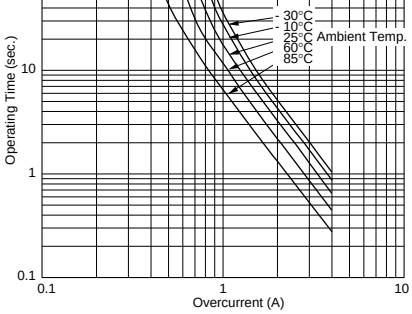

■ Operating Time (Typical Curve) (60V Series)

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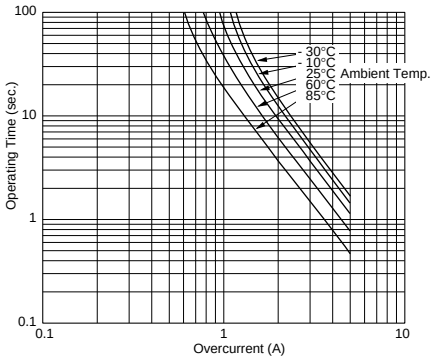

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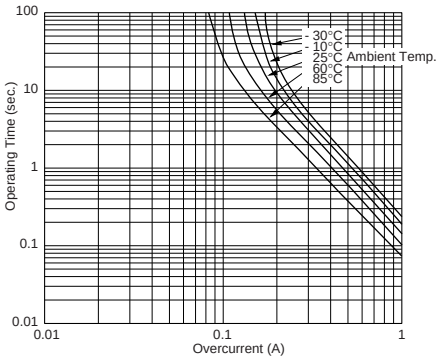

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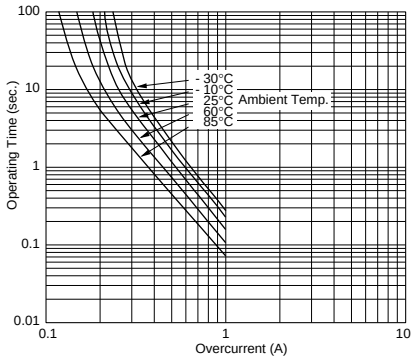

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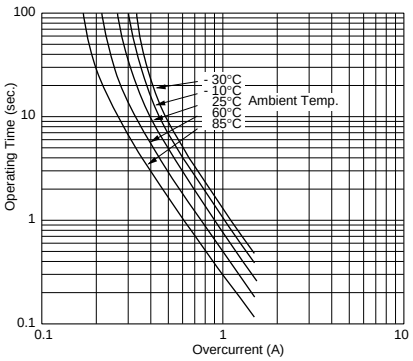

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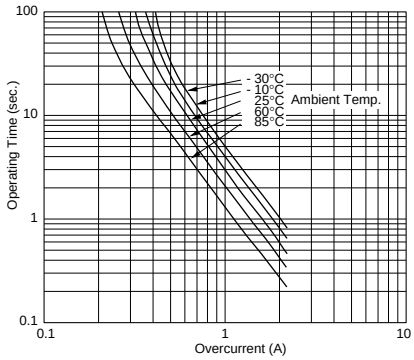

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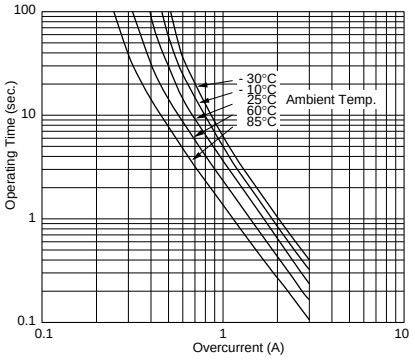

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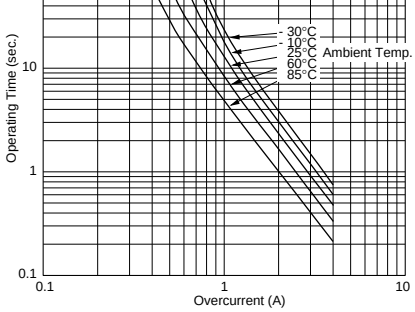

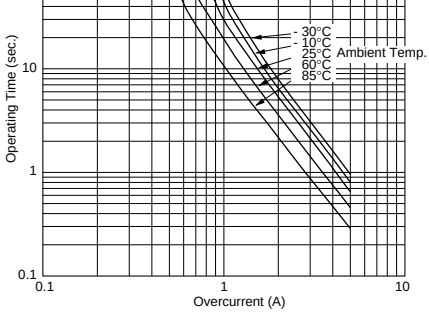

■ Operating Time (Typical Curve) (140V Series)

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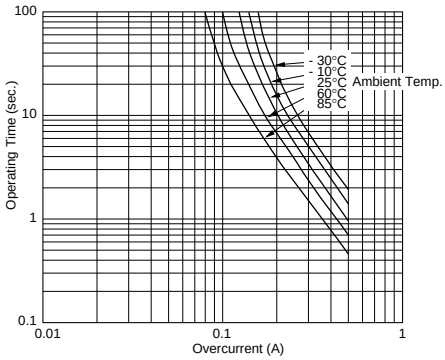

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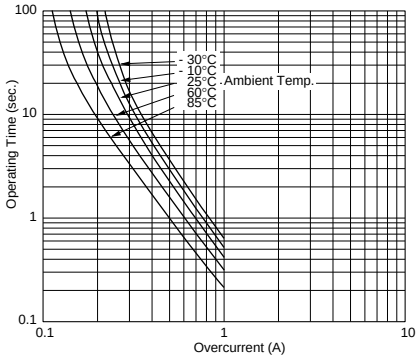

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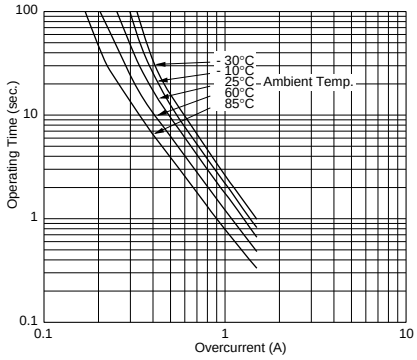

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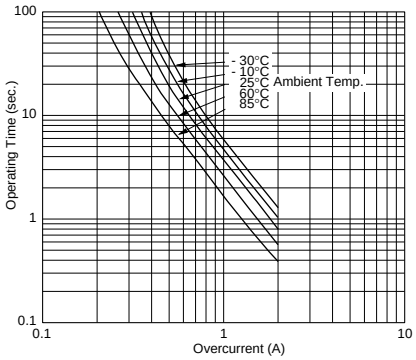

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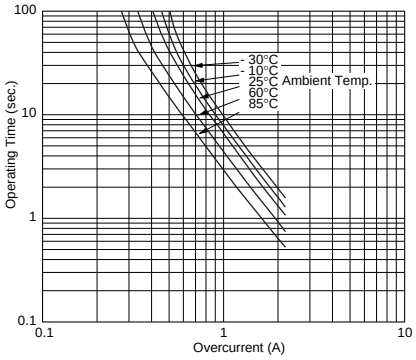
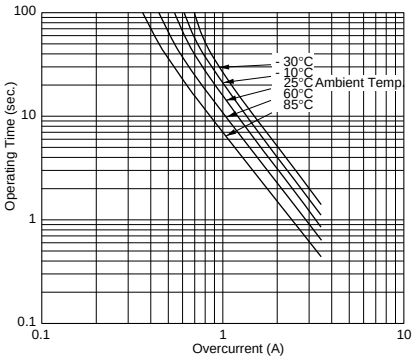
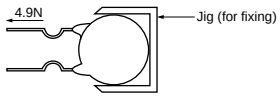
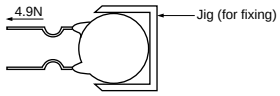


PTGLCSAS4R7K6B51B0



No.	Item	Rating Value	Method of Examination
1	Operating Temperature	-30 to +85°C	The temperature range with maximum voltage applied to POSISTOR®.
2	Resistance (R25)	Satisfies specification	Resistance value is measured by applying voltage under 1.5Vdc (by a direct current of less than 10mA) at 25°C. (B must be measured after maximum voltage is applied 180 seconds and then is left for 2 hours at 25°C.)
3	Withstanding Voltage	No damage	We apply AC voltage 110% that of the maximum voltage POSISTOR® by raising voltage gradually for 180±5 secon 25°C. (A protective resistor is to be connected in series, a the inrush current through POSISTOR® must be limited b maximum rated value.)
4	Protective Threshold Current	Satisfies ratings (Trip Current, Non-operating Current)	Maximum current is measured in this examination. Voltag applied to POSISTOR® in 3-minute steps still air. Stable current is measured at each step.
5	Tensile Strength of Lead Wire Terminal	No damage	The load is gradually applied to each terminal of POSIST until the force of 4.9N in the axial direction with fixing POSISTOR®'s body itself by a jig and this load is being k 10 seconds. 
6	Bending Strength of Lead Wire Terminal	Lead wire does not come off	POSISTOR® is held so that it is perpendicular to the lead with 2.45N in the axial direction of the lead wire. The lead is slowly bent to 90° and returned; then it is slowly bent in opposite direction and returned to original state.
7	Solderability	Solder is applied around the lead wire covering 3/4 or more of the circumference without a gap in the axial direction.	The lead wire of POSISTOR® is soaked in an Isopropyl A (JIS K 8839) solution (about 25wt%) of colophony (JIS K for 5-10 seconds. Then, each lead wire is soaked in molte solder (JIS Z 3282 H60A) at 235±5°C from the bottom to point of 2.0-2.5mm for 2±0.5 seconds.
8	Terminal Durability of Soldering	ΔR/R25≦±15%	The lead wire of POSISTOR® is soaked in molten solder 3282 H60A) at 350±10°C from the bottom to a point of 2.0 2.5mm for 3.5±0.5 seconds. After the device is left at room temperature (25°C) for 24± hours, the resistance is measured.
9	Heat Resistant	ΔR/R25≦±20% No damage about marking	In an 85±3°C chamber, POSISTOR® is applied max. volt for 1.5 hr on and 0.5 hr off. This cycle is repeated for 500 hours, and after the device is left at room temperature (25 for 1 hour, the resistance measurement is performed. (A protective resistance is to be connected in series and the inrush current through POSISTOR® must be limited belov max. rated value.)
10	Resistance to Damp Heat	ΔR/R25≦±20% No damage about marking	POSISTOR® is set in an environmental chamber at 40±2 and 90% to 95% humidity, for 500±4 hours. Then, after the device is left at room temperature (25°C) f 1 hour, the resistance measurement is performed.

No.	Item	Rating Value	Method of Examination
1	Operating Temperature 1	-30 to +125°C	The temperature range with maximum voltage applied to POSISTOR®.
2	Operating Temperature 2	-40 to +125°C	The temperature range with the following voltage applied the POSISTOR®. <applied voltage> 30V and 51V series: max. 16V, 60V series: max. 30V, 140 series: max. 140V
3	Resistance (R25)	Satisfies ratings	Resistance value is measured by applying voltage under 1.0Vdc (by a direct current of less than 10mA) at 25°C. (B must be measured after it is applied maximum voltage for seconds and then is left for 2 hours at 25°C.)
4	Withstanding Voltage	No damage	We apply AC voltage 120% that of the maximum voltage POSISTOR® by raising voltage gradually for 180±5 secon 25°C. (A protective resistor is to be connected in series, a the inrush current through POSISTOR® must be limited b max. rated value.)
5	Protective Threshold Current	Satisfies ratings (Trip Current, Non-operating Current)	Maximum current is measured in this examination. Voltag applied to POSISTOR® in 3-minute steps still air based o "Protective Threshold Current Test Conditions" shown in page. Stable current is measured at each step.
6	Tensile Strength of Lead Wire Terminal	No damage	The load is gradually applied to each terminal of POSIST until the force of 4.9N in the axial direction with fixing POSISTOR®'s body itself by a jig and this load is being k 10 seconds. 
7	Bending Strength of Lead Wire Terminal	Lead wire does not come off	POSISTOR® is held so that it is perpendicular to the lead with 2.45N in the axial direction of the lead wire. The lead is slowly bent to 90° and returned; then it is slowly bent in opposite direction and returned to original state.
8	Solderability	Solder is applied around the lead wire covering 3/4 or more of the circumference without a gap in the axial direction.	The lead wire of POSISTOR® is soaked in an Isopropyl A (JIS K 8839) solution (about 25wt%) of colophony (JIS K for 5-10 sec. Then, each lead wire is soaked in molten so (JIS Z 3282 H60A) at 235±5°C from the bottom to a point 2.0-2.5mm for 2±0.5 seconds.
9	Terminal Durability of Soldering	ΔR/R25≦±15%	The lead wire of POSISTOR® is soaked in molten solder 3282 H60A) at 350±10°C from the bottom to a point of 2.0 2.5mm for 3.5±0.5 sec. After the device is left at room temperature (25°C) for 24± hours, the resistance is measured.
10	Vibration Resistant	ΔR/R25≦±20%	Acceleration: 98m/s² (10G) Width: 1.5mm Vibration: 10-500-10Hz Vibrate for 11 minutes × 24 cycles in each of 3 mutually perpendicular planes for a total of 13.5 hours.
11	Heat Resistant	ΔR/R25≦±20%	POSISTOR® is set in an environmental chamber at 125± for 1000±12 hours. After the device is left at room temper (25°C) for one hour, the resistance measurement is perfo
12	Cold Resistant	ΔR/R25≦±20%	POSISTOR® is set in an environmental chamber at -40±3 for 1000±12 hours. After the device is left at room temper (25°C) for one hour, the resistance measurement is perfo
13	Resistance to Damp Heat	ΔR/R25≦±20%	POSISTOR® is set in an environmental chamber at 85±3 and 80-85% humidity for 1000±12 hours. After the device at room temperature (25°C) for one hour, the resistance measurement is performed.

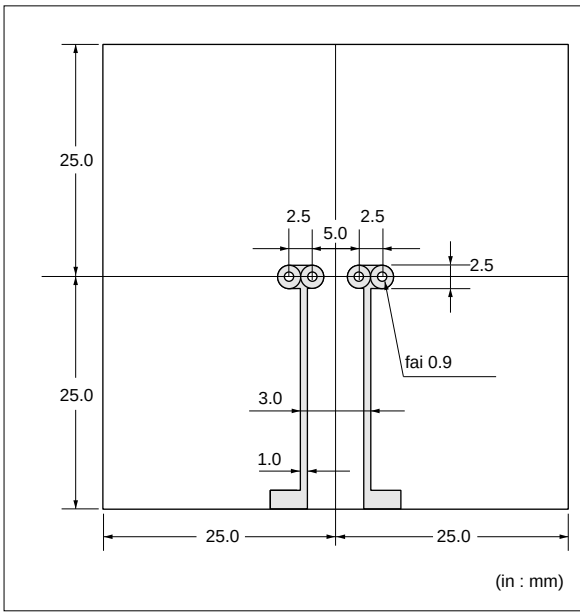
Continued on the following pa

(1) Substrate

Materials: Phenol

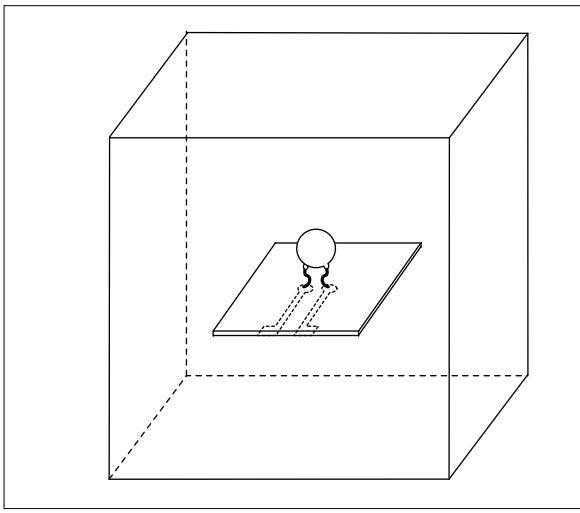
Size: 50x50xt1.6mm

Land Pattern: Cu land without through hole



(2) Measurement condition

Solder POSISTOR® on the substrate, then put a cover (150mm cubed) surround POSISTOR® to prevent flow of wind.



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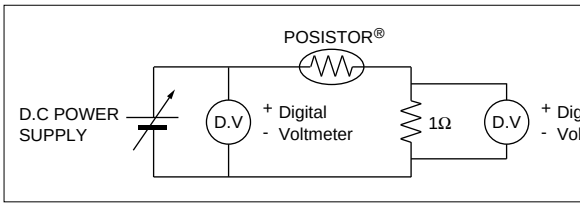
(3) Measurement circuit



This product is designed for application in an ordinary environment (normal room temperature, humidity and atmospheric pressure). Do not use under the following conditions because all of these factors can deteriorate the characteristics or cause product failure and burn-out.

1. Corrosive gas or deoxidizing gas (Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
2. Volatile or flammable gas
3. Dusty conditions
4. Under vacuum, or under high or low pressure
5. Wet or humid conditions
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

■ ⚠Caution (Other)

Be sure to provide an appropriate fail-safe function on your product to prevent secondary damage that may be caused by the abnormal function or the failure of our product.

■ Notice (Storage and Operating Conditions)

To keep solderability of product from declining, the following storage conditions are recommended.

1. Storage condition:
   Temperature -10 to +40°C
   Humidity less than 75%RH (not dewing condition)
2. Storage term:
   Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Handling after unpacking:
   After unpacking, promptly reseal this product or store it in a sealed container with a drying agent.
4. Storage place:
   Do not store this product in corrosive gas (Sulfuric acid, Chlorine, etc.) or in direct sunlight.

■ Notice (Soldering and Mounting)

When the lead of this product is soldered, pay attention as follows to avoid the decline of element characteristics or break-down of the element.

1. Use Rosin type flux or non-activated flux
2. Do not dip the body into flux (flux should be coated to lead wire only for soldering).
3. Be sure that preheating does not melt the soldering of this product.

■ Notice (Handling)

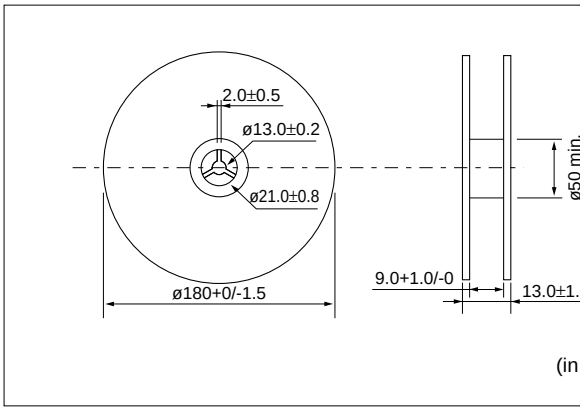
1. Do not apply an excessive force to the lead. Otherwise, it may cause the junction between lead and element to break, or may crack the element. Therefore, holding the element side lead wire is recommended when lead wire is bent or cut.
2. This product does not have waterproof construction. Splashed water may cause failure mode such as decline of characteristics or current leak.
3. When this product is operated, the temperature of some areas may be over 100 to 160°C. Be sure that surrounding parts and inserting material can withstand the temperature. If the surrounding part and material are kept under such conditions, they may deteriorate or produce harmful gas (Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.), and such harmful gas may deteriorate the element.

Part Number	Quantity (pcs.)	
	Paper Tape	Embossed Tape
NCP15	10000	-
NCP18/NCG18	4000	-

Part Number	Quantity (pcs.)
	Bulk Type
NXF	1000

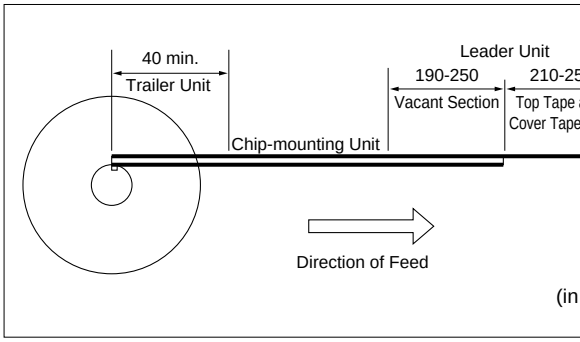
■ Chip Type/Tape Carrier Packaging

1. Dimensions of Reel



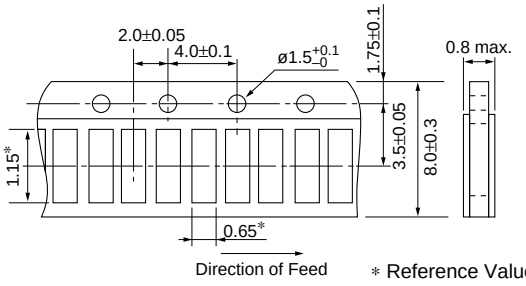
2. Taping Method

(1) A tape in a reel contains Leader unit and Trailer unit where products are not packed. (Please refer to the figure at right.)
(2) The top and base tapes or plastic and cover tape are not stuck at the first five pitches minimum.
(3) A label should be attached on the reel. (MURATA's part number, inspection number and quantity should be marked on the label.)
(4) Taping reels are packaged.



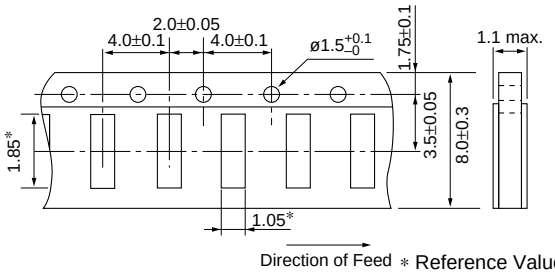
Continued on the following pa

NCP15 Series
8mm Width 2mm Pitch Tape



＊ Reference Value

NCP18/NCG18 Series
8mm Width 4mm Pitch Tape



＊ Reference Value

(in

(1) Other Conditions

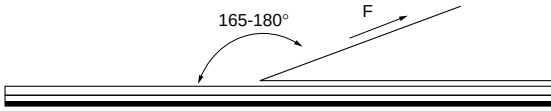
① Packaging

Products are packaged in the cavity of the base tape and sealed by top tape and bottom tape.

② Tape

Top tape and bottom tape have no joints and products are packaged and sealed in the cavity of the base tape, continuously.

(2) Peeling Force of Top Tape



Peeling Angle: 165 to 180° against the fixed surface of tape.
Peeling Speed: 300mm/min.
Peeling Force: 0.1 - 0.6N

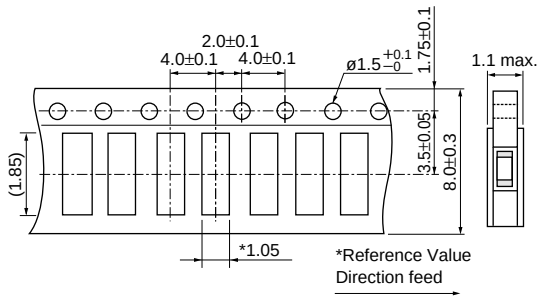
(3) Pull Strength

Pull strength of top tape is specified at 10N minimum.
Pull strength of bottom tape shall be specified 5N minimum.

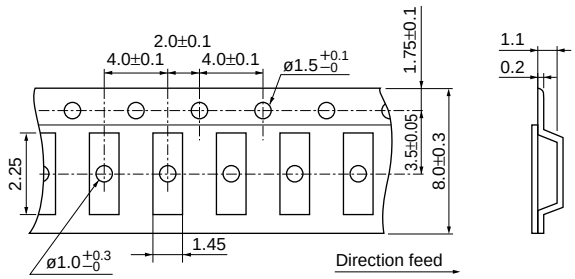
Part Number	Quantity (pcs.)	
	Paper Tape	Embossed Tape
PR*18_RB	4000	-
PR*21_RA	-	4000
PR*21_RK	-	3000

■ Tape Dimensions

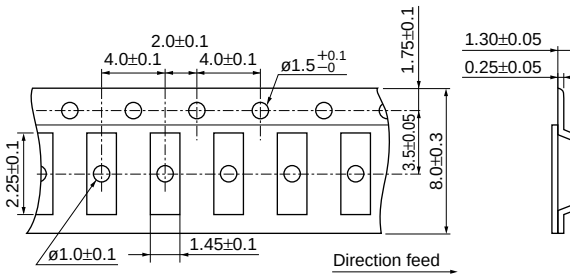
PR*18_RB Series: Paper Tape



PR*21_RA Series: Embossed Tape



PR*21_RK Series: Embossed Tape



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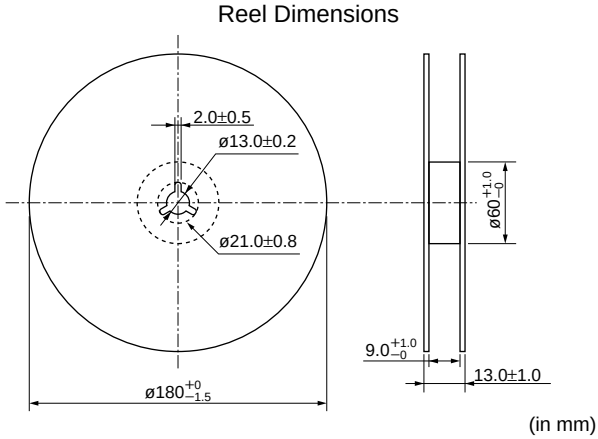
■ Reel Dimensions



Series	Bulk Type		Ammo Pack Taping Type	
	Part Number	Min. Qty. (pcs.)	Part Number	Min. Qty. (pcs.)
16V Series	**PTGL5SAR1R0M1B51B0**	500	**PTGL5SAR1R0M1B51A0**	2000
	PTGL6SAR0R8M1B51B0		**PTGL6SAR0R8M1B51A0**	
	PTGL7SARR47M1B51B0		**PTGL7SARR47M1B51A0**	
	PTGL9SARR33M1B51B0		**PTGL9SARR33M1B51A0**	
	PTGLASARR27M1B51B0	300	**PTGLASARR27M1B51A0**	
	PTGLCSAR0R2M1B51B0		**PTGLCSAR0R2M1B51A0**	
	PTGLESARR15M1B51B0		-	-
Narrow Current Band 30V Series	**PTGL4SAS100K2B51B0**	500	**PTGL4SAS100K2B51A0**	1500
	PTGL4SAS100K2N51B0		**PTGL4SAS100K2N51A0**	
	PTGL5SAS3R9K2B51B0		**PTGL5SAS3R9K2B51A0**	
	PTGL7SAS1R8K2B51B0		**PTGL7SAS1R8K2B51A0**	
	PTGL7SAS2R7K2B51B0		**PTGL7SAS2R7K2B51A0**	
	PTGL9SAS1R2K2B51B0		**PTGL9SAS1R2K2B51A0**	
	PTGLCSAS0R8K2B51B0	300	**PTGLCSAS0R8K2B51A0**	
Narrow Current Band 51V Series	**PTGL4SAS100K3B51B0**	500	**PTGL4SAS100K3B51A0**	1500
	PTGL5SAS6R8K3B51B0		**PTGL5SAS6R8K3B51A0**	
	PTGL7SAS3R3K3B51B0		**PTGL7SAS3R3K3B51A0**	
	PTGL9SAS2R2K3B51B0		**PTGL9SAS2R2K3B51A0**	
	PTGLCSAS1R2K3B51B0	300	**PTGLCSAS1R2K3B51A0**	
Narrow Current Band 60V Series	**PTGL4SAS220K4B51B0**	500	**PTGL4SAS220K4B51A0**	1500
	PTGL4SAS220K4N51B0		**PTGL4SAS220K4N51A0**	
	PTGL5SAS100K4B51B0		**PTGL5SAS100K4B51A0**	
	PTGL7SAS5R6K4B51B0		**PTGL7SAS5R6K4B51A0**	
	PTGL7SAS5R6K4N51B0		**PTGL7SAS5R6K4N51A0**	
	PTGL9SAS3R3K4B51B0		**PTGL9SAS3R3K4B51A0**	
	PTGLCSAS2R2K4B51B0	300	**PTGLCSAS2R2K4B51A0**	
Narrow Current Band 140V Series	**PTGL4SAS560K6B51B0**	500	**PTGL4SAS560K6B51A0**	1500
	PTGL5SAS270K6B51B0		**PTGL5SAS270K6B51A0**	
	PTGL7SAS150K6B51B0		**PTGL7SAS150K6B51A0**	
	PTGL9SAS120K6B51B0		**PTGL9SAS120K6B51A0**	
	PTGL9SAS7R6K6B51B0		**PTGL9SAS7R6K6B51A0**	
	PTGLCSAS4R7K6B51B0	300	**PTGLCSAS4R7K6B51A0**	

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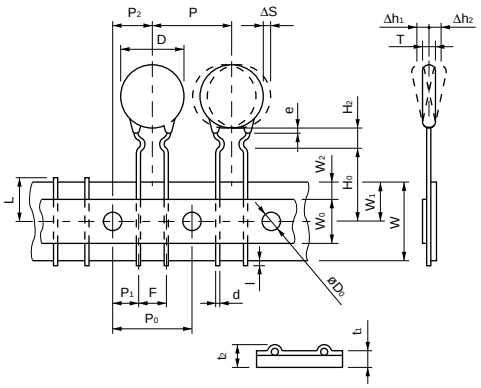

Item	Code	Dimensions (mm)	Note
Pitch of Component	P	12.7	Tolerance is determined by ΔS.
Pitch of Sprocket Hole	P_0	12.7±0.3	
Lead Spacing	F	$5.0^{+0.8}_{-0.3}$	
Length from Hole Center to Lead	P_1	3.85±0.8	
Length from Hole Center to Component Center	P_2	6.35±1.3	Deviation in the feeding direction
Body Diameter	D	Please see in Ratings	
Body Thickness	T	Please see in Ratings	
Deviation along Tape, Left or Right Defect	ΔS	±1.5	Including the inclination caused by lead bending
Carrier Tape Width	W	18.0±0.5	
Position of Sprocket Hole	W_1	$9.0^{+0.5}_{-0.75}$	Deviation of tape width
Lead Distance between Reference and Bottom Planes	H_0	16.0±1.0	
	H_2	6.0 max.	
Protrusion Length	I	+0.5 to −1.0	
Diameter of Sprocket Hole	D_0	4.0±0.2	
Lead Diameter	d	Please see in Ratings	
Total Tape Thickness	t_1	0.6±0.3	
Total Thickness of Tape and Lead Wire	t_2	2.0 max.	
Deviation across Tape	Δh_1, Δh_2	1.5 max.	
Portion to cut in Case of Defect	L	$11.0^{+0}_{-2.0}$	
Hold Down Tape Width	W_0	11.0 min.	
Hold Down Tape Position	W_2	4.0 max.	
Coating Extension on Lead	e	Up to the center of crimp	

⚠Note:

1. Export Control
   <For customers outside Japan>
   No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or o
   contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or
   specially designed or intended for military end-use or utilization by military end-users.
   <For customers in Japan>
   For products which are controlled items subject to the “Foreign Exchange and Foreign Trade Law” of Japan, the export license specified by the law is required for expo
2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high r
   for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other th
   specified in this catalog.
   ① Aircraft equipment ② Aerospace equipment
   ③ Undersea equipment ④ Power plant equipment
   ⑤ Medical equipment ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment ⑩ Application of similar complexity and/or reliability requirements to the applications listed above
3. Product specifications in this catalog are as of March 2011. They are subject to change or our products in it may be discontinued without advance notice. Please ch
   our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.
4. Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the
   sheet for product specifications before ordering.
6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of ou
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7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

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http://www.murata

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