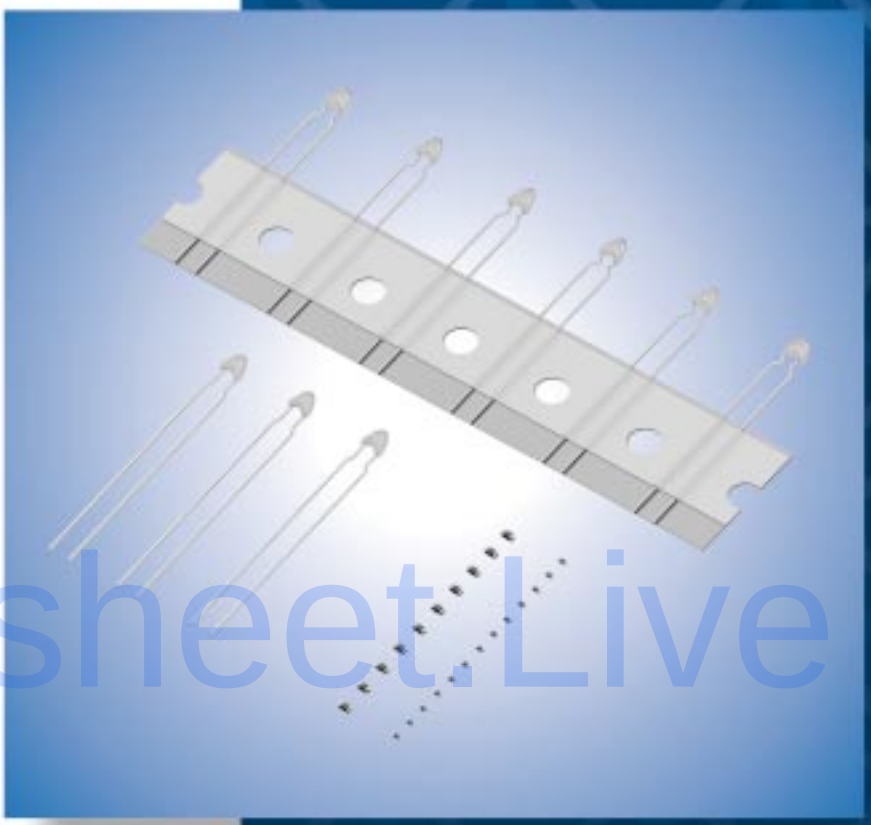
NTC / PTC Thermistors for Automotive



muRata Innovator in Electronics

Murata
Manufacturing Co., Ltd.

Cat.No.R03E-4

for 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).

CONTENTS

● Part Numbering

NTC Thermistors for Temperature Compensation Chip Type

(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
XQ	Nominal B-Constant 3650−3699K
XH	Nominal B-Constant 3350−3399K
XM	Nominal B-Constant 3500−3549K
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 which 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.)

NTC Thermistors for Temperature Sensor Lead Type

(Part Number) NT | SS0 | XH | 103 | F | E1 | B0
❶ ❷ ❸ ❹ ❺ ❻ ❼

❶Product ID

Product ID	
NT	NTC Thermistors

❷Series

Code	Series
SS0	Temperature Sensors for Automotive Equipment

❸Temperature Characteristics

Code	Temperature Characteristics
WB	Nominal B-Constant 4050−4099K
WC	Nominal B-Constant 4100−4149K
WD	Nominal B-Constant 4150−4199K
WF	Nominal B-Constant 4250−4299K
XM	Nominal B-Constant 3500−3549K
XH	Nominal B-Constant 3350−3399K
XR	Nominal B-Constant 3700−3749K
XV	Nominal B-Constant 3900−3949K

❹Resistance

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 which follow the two figures.

Ex.)

Code	Resistance
202	2kΩ
203	20kΩ

❺Resistance Tolerance

Code	Resistance Tolerance
E	±3%
F	±1%

❻Individual Specifications

A lead structure and other specifications are expressed by two digits.

Code	Individual Specifications
E1	Bulk
N6	Standard Taping

❼Packaging

Code	Packaging
A0	Ammo Pack
B0	Bulk

PTC Thermistors (POSISTOR®) for Overheat Sensing Chip Type

(Part Number) PR | F | 18 | BB | 471 | Q | S2 | RB
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
AR	Curie Point 120°C
AS	Curie Point 130°C
BA	Curie Point 110°C
BB	Curie Point 100°C
BC	Curie Point 90°C
BD	Curie Point 80°C
BE	Curie Point 70°C
BF	Curie Point 60°C
BG	Curie Point 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 which 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

❽Packaging

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

PTC Thermistors (POSISTOR®) for Circuit Protection

(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 which 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
420	42Ω
471	470Ω

❻Resistance Tolerance

Code	Resistance Tolerance
M	±20%
Q	Special Tolerance

❼Individual Specifications

Code	Individual Specifications
S1	for Automotive

❽Packaging

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

PTC Thermistors (POSISTOR®) for Circuit Protection Lead Type

(Part Number)

PT	GL	4	S	AS	220	K	4B51	B0
❶	❷	❸	❹	❺	❻	❼	❽	❾

❶Product ID

Product ID	
PT	PTC Thermistors

❷Series

Code	Series
GL	for Circuit 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 alphanumerics. The unit is ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros which 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

Basic Characteristics of NTC Thermistor

■Basic Characteristics

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, there is a formula as follows

$P=C (T_2-T_1)$ ·····(3)

C: Thermal dissipation constant (mW/°C)

Thermal dissipation constant is varied with dimensions, measurement conditions, etc.

4. Thermal Time Constant

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

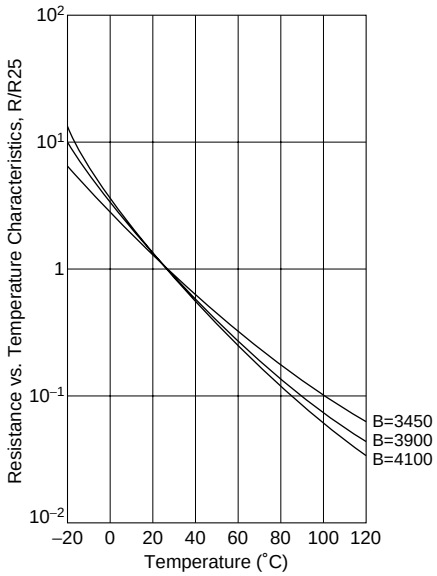
5. Rated Electric Power

Shows necessary electric power that Thermistor's temperature rises 100˚C by self heating in ambient temperature 25˚C.

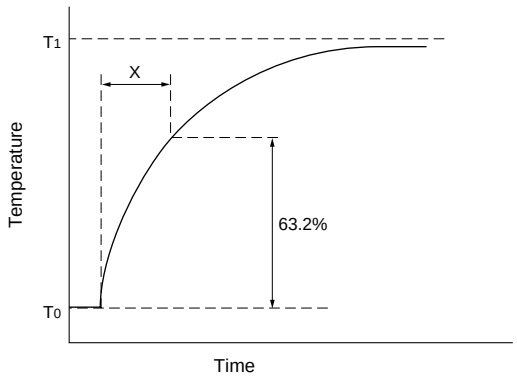
6. Permissive Operating Current

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

Resistance vs. Temperature



Thermal Time Constant



Basic Characteristics of POSISTOR®

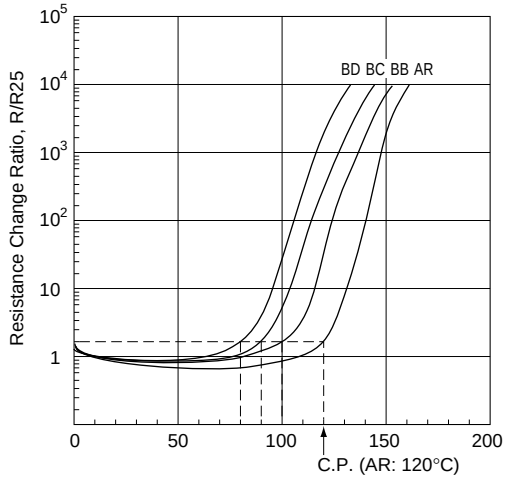
■Basic Characteristics

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 temperature which the resistance value is twice the one at 25 °C.

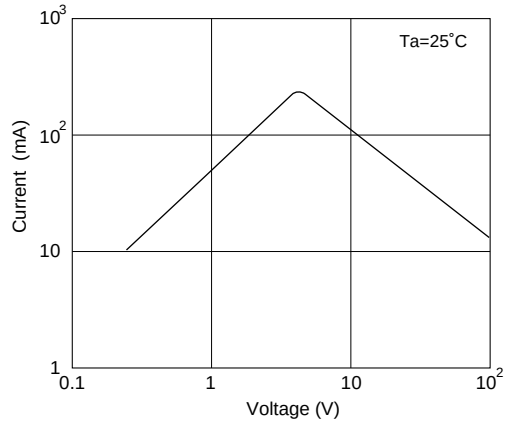
Resistance - Temperature Characteristic



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.

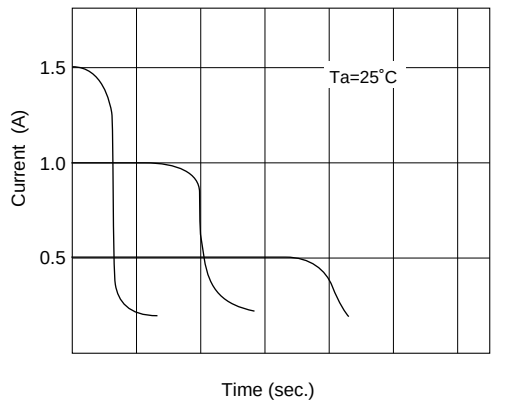
Current - Voltage Characteristics (Static Characteristics)



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.

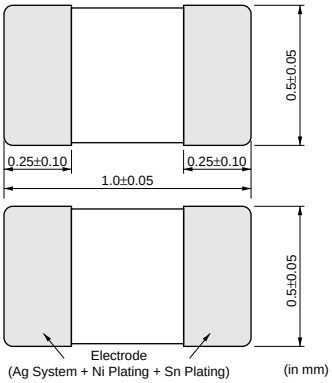
Current - Time Characteristics (Dynamic Characteristics)



NTC / PTC Thermistors for Automotive

NTC Thermistor Chip Type 0402 (1005) Size (Meet AEC-Q200rev.C)

0402/0603 sized Chip NTC Thermistors have Ni barrier termination and provide excellent solderability and offer high stability in environment by 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. NCP15 series are recognized by UL (UL1434, File No.E137188 Vol.2, Sec.2).

■ 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 Dissipation Constant (25°C) (mW/°C)
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
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
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
NCP15WM224□0SRC	220k	4500 ±3%	4571	4582	4614	0.06	100	1
NCP15WM474□0SRC	470k	4500 ±3%	4571	4582	4614	0.04	100	1

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

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

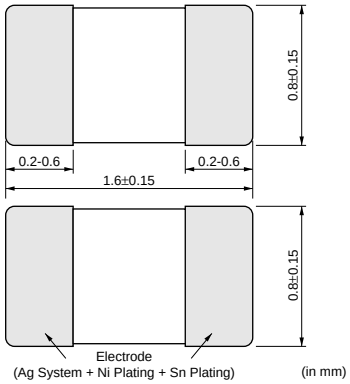
Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)
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 ±3%	3539	3545	3560	0.46	100	1

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

NTC / PTC Thermistors for Automotive

NTC Thermistor Chip Type 0603 (1608) Size (Meet AEC-Q200rev.C)

0402/0603 sized Chip NTC Thermistors have Ni barrier termination and provide excellent solderability and offer high stability in environment by 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. NCP18 series are recognized by UL (UL1434, File No.E137188 Vol.2, Sec.2).

■ 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 Dissipation Constant (25°C) (mW/°C)
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
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
NCP18WF104F3SRB	100k ±1%	4200 ±1%	4303	4311	4334	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
NCP18WM474□0SRB	470k	4500 ±3%	4571	4582	4614	0.04	100	1

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

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

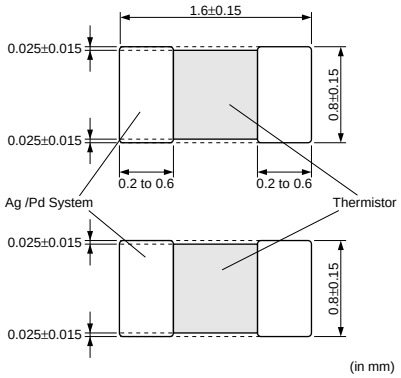
Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)
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%).

NTC / PTC Thermistors for Automotive

NTC Thermistor Chip Type 0603(1608) Size For Conductive Glue

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



■ 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

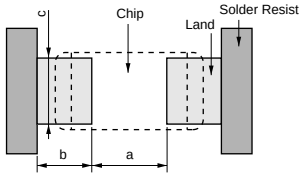
■ Applications

1. Various engine control units
2. ABS control unit
3. High power devices (IGBT)
4. Various circuits required low temperature mounting below solder melting point.
5. Temperature compensation for various circuits required 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 Dissipation Constant (25°C) (mW/°C)
NCG18XH103F0SRB	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1

Operating Temperature Range: -55°C to +150°C

For NTC Thermistors Chip Type Standard Land Pattern Dimensions



(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

For NTC Thermistors Chip Type Temperature Characteristics (Center Value)

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

Part Number	NCP18XF101	NCP18XF151	NCP18XQ471	NCP18XQ681	NCP18XQ102	NCP□□XW152	NCP□□XW222	NCP□□XW332
Resistance	100Ω	150Ω	470Ω	680Ω	1.0kΩ	1.5kΩ	2.2kΩ	3.3kΩ
B-Constant	3250K	3250K	3650K	3650K	3650K	3950K	3950K	3950K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
−40	1824.175	2736.262	11822.473	17104.854	25.154	51.791	75.961	113.941
−35	1390.685	2086.028	8767.745	12685.248	18.655	37.172	54.520	81.779
−30	1070.653	1605.979	6570.224	9505.855	13.979	27.005	39.607	59.411
−25	831.138	1246.708	4971.784	7193.219	10.578	19.843	29.103	43.654
−20	650.960	976.440	3796.933	5493.436	8.079	14.728	21.601	32.401
−15	514.441	771.661	2923.400	4229.599	6.220	11.044	16.198	24.297
−10	409.700	614.550	2269.599	3283.675	4.829	8.362	12.264	18.396
−5	328.877	493.315	1775.225	2568.411	3.777	6.389	9.370	14.055
0	265.759	398.639	1399.050	2024.158	2.977	4.922	7.219	10.829
5	215.785	323.677	1110.220	1606.275	2.362	3.825	5.609	8.414
10	176.395	264.592	887.257	1283.691	1.888	2.994	4.391	6.586
15	145.161	217.742	713.463	1032.245	1.518	2.361	3.463	5.195
20	120.152	180.228	577.375	835.351	1.229	1.876	2.751	4.126
25	100.000	150.000	470.000	680.000	1.000	1.500	2.200	3.300
30	83.669	125.503	384.800	556.733	0.819	1.207	1.771	2.656
35	70.361	105.541	316.757	458.287	0.674	0.978	1.434	2.152
40	59.456	89.184	262.177	379.320	0.558	0.797	1.169	1.753
45	50.470	75.705	218.069	315.504	0.464	0.653	0.958	1.437
50	43.029	64.543	182.297	263.749	0.388	0.538	0.789	1.184
55	36.830	55.246	153.150	221.579	0.326	0.446	0.654	0.981
60	31.649	47.473	129.249	186.998	0.275	0.371	0.545	0.817
65	27.364	41.045	109.551	158.499	0.233	0.311	0.456	0.684
70	23.756	35.634	93.281	134.960	0.199	0.261	0.383	0.575
75	20.651	30.976	79.750	115.383	0.170	0.221	0.324	0.486
80	18.011	27.016	68.446	99.029	0.146	0.187	0.275	0.412
85	15.800	23.700	58.996	85.356	0.126	0.160	0.234	0.351
90	13.908	20.862	51.036	73.839	0.109	0.137	0.200	0.301
95	12.263	18.394	44.332	64.140	0.094	0.117	0.172	0.258
100	10.844	16.265	38.640	55.905	0.082	0.101	0.149	0.223
105	9.622	14.434	33.790	48.888	0.072	0.088	0.129	0.193
110	8.563	12.844	29.664	42.918	0.063	0.076	0.112	0.168
115	7.648	11.472	26.123	37.795	0.056	0.067	0.098	0.146
120	6.850	10.275	23.091	33.409	0.049	0.058	0.085	0.128
125	6.162	9.243	20.472	29.618	0.044	0.051	0.075	0.113
130	5.557	8.336	18.200	26.332	0.039	0.045	0.066	0.099
135	5.025	7.537	16.225	23.475	0.035	0.040	0.059	0.088
140	4.554	6.832	14.502	20.982	0.031	0.035	0.052	0.078
145	4.138	6.206	13.007	18.819	0.028	0.032	0.046	0.069
150	3.768	5.561	11.696	16.922	0.025	0.028	0.041	0.062

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

Continued on the following page.

For NTC Thermistors Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

Part Number	NCP□□XW472	NCP□□XW682	NCP□□XH103D	NCP□□XH103	NCP□□XV103	NCP□□XW153	NCP□□XW223	NCP15WL223
Resistance	4.7kΩ	6.8kΩ	10kΩ±0.5%	10kΩ	10kΩ	15kΩ	22kΩ	22kΩ
B-Constant	3950K	3950K	3380K±0.7%	3380K	3900K	3950K	3950K	4485K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
−40	162.279	234.787	197.390	195.652	328.996	517.912	759.605	1073.436
−35	116.474	168.515	149.390	148.171	237.387	371.724	545.196	753.900
−30	84.615	122.422	114.340	113.347	173.185	270.048	396.070	535.073
−25	62.173	89.953	88.381	87.559	127.773	198.426	291.025	383.590
−20	46.147	66.766	68.915	68.237	95.327	147.278	216.008	277.643
−15	34.604	50.066	54.166	53.650	71.746	110.439	161.977	202.813
−10	26.200	37.906	42.889	42.506	54.564	83.617	122.638	149.462
−5	20.018	28.963	34.196	33.892	41.813	63.888	93.702	111.082
0	15.423	22.313	27.445	27.219	32.330	49.221	72.191	83.233
5	11.984	17.338	22.165	22.021	25.194	38.245	56.093	62.858
10	9.380	13.571	18.010	17.926	19.785	29.936	43.907	47.831
15	7.399	10.705	14.720	14.674	15.651	23.613	34.633	36.664
20	5.877	8.503	12.099	12.081	12.468	18.756	27.509	28.304
25	4.700	6.800	10.000	10.000	10.000	15.000	22.000	22.000
30	3.783	5.474	8.309	8.315	8.072	12.074	17.709	17.214
35	3.064	4.434	6.939	6.948	6.556	9.780	14.344	13.557
40	2.497	3.613	5.824	5.834	5.356	7.969	11.688	10.744
45	2.046	2.961	4.911	4.917	4.401	6.531	9.578	8.566
50	1.686	2.440	4.160	4.161	3.635	5.382	7.894	6.871
55	1.397	2.022	3.539	3.535	3.019	4.459	6.540	5.543
60	1.164	1.683	3.024	3.014	2.521	3.713	5.446	4.497
65	0.974	1.409	2.593	2.586	2.115	3.108	4.559	3.669
70	0.819	1.185	2.233	2.228	1.781	2.613	3.832	3.009
75	0.692	1.001	1.929	1.925	1.509	2.208	3.239	2.481
80	0.587	0.849	1.673	1.669	1.284	1.873	2.748	2.055
85	0.500	0.724	1.455	1.452	1.097	1.597	2.342	1.710
90	0.428	0.620	1.270	1.268	0.941	1.367	2.004	1.430
95	0.368	0.532	1.112	1.110	0.810	1.174	1.722	1.201
100	0.318	0.459	0.976	0.974	0.701	1.013	1.486	1.013
105	0.275	0.398	0.860	0.858	0.608	0.878	1.287	0.858
110	0.239	0.346	0.759	0.758	0.530	0.763	1.119	0.729
115	0.208	0.302	0.673	0.672	0.463	0.665	0.975	0.623
120	0.182	0.264	0.598	0.596	0.406	0.582	0.854	0.533
125	0.160	0.232	0.532	0.531	0.358	0.511	0.750	0.458
130	0.141	0.204	0.476	0.474	0.316	0.451	0.661	0.395
135	0.125	0.181	0.426	0.424	0.280	0.399	0.585	0.342
140	0.111	0.160	0.383	0.381	0.249	0.354	0.519	0.297
145	0.099	0.143	0.344	0.342	0.222	0.315	0.462	0.258
150	0.088	0.127	0.311	0.309	0.198	0.281	0.412	0.225

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

Continued on the following page.

For NTC Thermistors Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

Part Number	NCP□□WB333	NCP15WL333	NCP□□WB473	NCP15WL473	NCP□□WD683	NCP15WL683	NCP18WF104F	NCP□□WF104
Resistance	33kΩ	33kΩ	47kΩ	47kΩ	68kΩ	68kΩ	100kΩ	100kΩ
B-Constant	4050K	4485K	4050K	4485K	4150K	4485K	4200K	4250K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
−40	1227.263	1610.154	1747.920	2293.249	2735.359	3317.893	4205.686	4397.119
−35	874.449	1130.850	1245.428	1610.605	1937.391	2330.237	2966.436	3088.599
−30	630.851	802.609	898.485	1143.110	1389.345	1653.862	2118.789	2197.225
−25	460.457	575.385	655.802	819.487	1008.014	1185.641	1531.319	1581.881
−20	339.797	416.464	483.954	593.146	738.978	858.168	1118.422	1151.037
−15	253.363	304.219	360.850	433.281	547.456	626.875	825.570	846.579
−10	190.766	224.193	271.697	319.305	409.600	461.974	615.526	628.988
−5	144.964	166.623	206.463	237.312	309.217	343.345	463.104	471.632
0	111.087	124.850	158.214	177.816	235.606	257.266	351.706	357.012
5	85.842	94.287	122.259	134.287	180.980	194.287	269.305	272.500
10	66.861	71.747	95.227	102.184	140.139	147.841	207.891	209.710
15	52.470	54.996	74.730	78.327	109.344	113.325	161.722	162.651
20	41.471	42.455	59.065	60.467	85.929	87.484	126.723	127.080
25	33.000	33.000	47.000	47.000	68.000	68.000	100.000	100.000
30	26.430	25.822	37.643	36.776	54.167	53.208	79.439	79.222
35	21.298	20.335	30.334	28.962	43.421	41.903	63.509	63.167
40	17.266	16.115	24.591	22.952	35.016	33.208	51.084	50.677
45	14.076	12.849	20.048	18.301	28.406	26.477	41.336	40.904
50	11.538	10.306	16.433	14.679	23.166	21.237	33.628	33.195
55	9.506	8.314	13.539	11.842	18.997	17.133	27.510	27.091
60	7.870	6.746	11.209	9.607	15.657	13.900	22.621	22.224
65	6.549	5.503	9.328	7.837	12.967	11.339	18.692	18.323
70	5.475	4.513	7.798	6.428	10.794	9.300	15.525	15.184
75	4.595	3.721	6.544	5.300	9.021	7.668	12.947	12.635
80	3.874	3.082	5.518	4.393	7.575	6.356	10.849	10.566
85	3.282	2.566	4.674	3.659	6.387	5.294	9.129	8.873
90	2.789	2.145	3.972	3.063	5.407	4.432	7.713	7.481
95	2.379	1.802	3.388	2.577	4.598	3.728	6.546	6.337
100	2.038	1.520	2.902	2.178	3.922	3.151	5.572	5.384
105	1.751	1.287	2.494	1.849	3.359	2.676	4.764	4.594
110	1.509	1.094	2.150	1.578	2.887	2.283	4.087	3.934
115	1.306	0.934	1.860	1.352	2.489	1.956	3.518	3.380
120	1.134	0.800	1.615	1.164	2.155	1.684	3.040	2.916
125	0.987	0.687	1.406	1.006	1.870	1.456	2.634	2.522
130	0.862	0.593	1.227	0.874	1.629	1.264	2.290	2.190
135	0.755	0.513	1.075	0.762	1.423	1.102	1.998	1.907
140	0.663	0.445	0.945	0.667	1.247	0.965	1.748	1.665
145	0.584	0.387	0.831	0.587	1.096	0.849	1.533	1.459
150	0.516	0.338	0.735	0.518	0.966	0.750	1.349	1.282

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

Continued on the following page.

For NTC Thermistors Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

Part Number	NCP15WL104	NCP15WL154	NCP□□WM154	NCP□□WM224	NCP□□WM474
Resistance	100kΩ	150kΩ	150kΩ	220kΩ	470kΩ
B-Constant	4485K	4485K	4500K	4500K	4500K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
−40	4879.254	7318.881	7899.466	11585.884	24751.661
−35	3426.818	5140.228	5466.118	8016.973	17127.169
−30	2432.149	3648.224	3834.499	5623.931	12014.762
−25	1743.590	2615.385	2720.523	3990.100	8524.305
−20	1262.012	1893.018	1951.216	2861.784	6113.811
−15	921.875	1382.813	1415.565	2076.162	4435.437
−10	679.373	1019.059	1036.984	1520.909	3249.216
−5	504.919	757.379	767.079	1125.049	2403.515
0	378.333	567.499	572.667	839.912	1794.358
5	285.717	428.575	431.264	632.521	1351.294
10	217.414	326.121	327.405	480.194	1025.870
15	166.654	249.981	250.538	367.455	785.018
20	128.653	192.979	193.166	283.310	605.252
25	100.000	150.000	150.000	220.000	470.000
30	78.247	117.370	117.281	172.012	367.480
35	61.622	92.433	92.293	135.364	289.186
40	48.835	73.252	73.090	107.198	229.014
45	38.937	58.406	58.240	85.419	182.485
50	31.231	46.846	46.665	68.441	146.215
55	25.195	37.793	37.605	55.153	117.828
60	20.441	30.661	30.453	44.665	95.420
65	16.675	25.013	24.804	36.379	77.718
70	13.677	20.516	20.293	29.763	63.584
75	11.277	16.912	16.679	24.462	52.260
80	9.346	14.011	13.776	20.205	43.166
85	7.785	11.662	11.428	16.761	35.808
90	6.517	9.751	9.520	13.962	29.828
95	5.482	8.190	7.966	11.684	24.961
100	4.634	6.907	6.688	9.809	20.955
105	3.935	5.850	5.639	8.270	17.668
110	3.357	4.973	4.772	6.998	14.951
115	2.877	4.244	4.052	5.942	12.695
120	2.476	3.635	3.454	5.067	10.824
125	2.141	3.124	2.955	4.334	9.259
130	1.859	2.694	2.536	3.719	7.945
135	1.621	2.331	2.182	3.200	6.837
140	1.420	2.023	1.884	2.763	5.904
145	1.248	1.760	1.632	2.394	5.113
150	1.102	1.536	1.418	2.079	4.442

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

For NTC Thermistors Chip Type Temperature Characteristics (Center Value)

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

Part Number	NCP15XC220	NCP15XC330	NCP15XC470	NCP15XC680	NCP15XF101	NCP15XF151	NCP□□XM221	NCP□□XM331
Resistance	22Ω	33Ω	47Ω	68Ω	100Ω	150Ω	220Ω	330Ω
B-Constant	3100K	3100K	3100K	3100K	3250K	3250K	3500K	3500K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)
−40	355.823	533.734	760.166	1099.815	1824.175	2736.262	4947.904	7421.856
−35	273.975	410.962	585.310	846.832	1390.685	2086.028	3703.755	5555.632
−30	213.003	319.504	455.051	658.372	1070.653	1605.979	2798.873	4198.309
−25	166.943	250.415	356.652	516.007	831.138	1246.708	2135.887	3203.831
−20	131.997	197.996	281.994	407.991	650.960	976.440	1645.037	2467.555
−15	105.318	157.978	224.998	325.529	514.441	771.661	1278.034	1917.051
−10	84.670	127.005	180.886	261.707	409.700	614.550	1000.620	1500.930
−5	68.628	102.942	146.614	212.123	328.877	493.315	789.612	1184.418
0	55.981	83.972	119.596	173.033	265.759	398.639	627.752	941.628
5	45.859	68.789	97.972	141.747	215.785	323.677	502.474	753.711
10	37.819	56.728	80.794	116.894	176.395	264.592	405.010	607.514
15	31.396	47.094	67.073	97.042	145.161	217.742	328.480	492.720
20	26.211	39.317	55.997	81.016	120.152	180.228	268.044	402.066
25	22.000	33.000	47.000	68.000	100.000	150.000	220.000	330.000
30	18.560	27.840	39.651	57.368	83.669	125.503	181.576	272.365
35	15.735	23.603	33.616	48.636	70.361	105.541	150.668	226.002
40	13.403	20.104	28.633	41.426	59.456	89.184	125.681	188.521
45	11.462	17.193	24.487	35.428	50.470	75.705	105.336	158.004
50	9.842	14.763	21.026	30.421	43.029	64.543	88.717	133.076
55	8.488	12.732	18.133	26.235	36.830	55.246	75.059	112.588
60	7.348	11.022	15.698	22.712	31.649	47.473	63.777	95.666
65	6.399	9.598	13.670	19.778	27.364	41.045	54.415	81.622
70	5.595	8.392	11.952	17.293	23.756	35.634	46.631	69.946
75	4.896	7.345	10.461	15.134	20.651	30.976	40.115	60.172
80	4.299	6.448	9.184	13.288	18.011	27.016	34.637	51.955
85	3.795	5.692	8.107	11.729	15.800	23.700	30.013	45.019
90	3.360	5.040	7.179	10.386	13.908	20.862	26.110	39.165
95	2.983	4.474	6.373	9.220	12.263	18.394	22.790	34.186
100	2.656	3.983	5.673	8.208	10.844	16.265	19.957	29.935
105	2.367	3.551	5.057	7.317	9.622	14.434	17.541	26.312
110	2.116	3.173	4.520	6.539	8.563	12.844	15.453	23.180
115	1.901	2.851	4.060	5.874	7.648	11.472	13.663	20.494
120	1.712	2.568	3.657	5.291	6.850	10.275	12.114	18.171
125	1.543	2.314	3.296	4.768	6.162	9.243	10.778	16.168

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

Continued on the following page.

For NTC Thermistors Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

Part Number	NCP15XQ471	NCP15XQ681	NCP15XQ102	NCP□□XM472
Resistance	470Ω	680Ω	1.0kΩ	4.7kΩ
B-Constant	3650K	3650K	3650K	3500K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (kΩ)	Resistance (kΩ)
−40	11822.473	17104.854	25.154	105.705
−35	8767.745	12685.248	18.655	79.126
−30	6570.224	9505.855	13.979	59.794
−25	4971.784	7193.219	10.578	45.630
−20	3796.933	5493.436	8.079	35.144
−15	2923.400	4229.599	6.220	27.303
−10	2269.599	3283.675	4.829	21.377
−5	1775.225	2568.411	3.777	16.869
0	1399.050	2024.158	2.977	13.411
5	1110.220	1606.275	2.362	10.735
10	887.257	1283.691	1.888	8.653
15	713.463	1032.245	1.518	7.018
20	577.375	835.351	1.229	5.726
25	470.000	680.000	1.000	4.700
30	384.800	556.733	0.819	3.879
35	316.757	458.287	0.674	3.219
40	262.177	379.320	0.558	2.685
45	218.069	315.504	0.464	2.250
50	182.297	263.749	0.388	1.895
55	153.150	221.579	0.326	1.604
60	129.249	186.998	0.275	1.363
65	109.551	158.499	0.233	1.163
70	93.281	134.960	0.199	0.996
75	79.750	115.383	0.170	0.857
80	68.446	99.029	0.146	0.740
85	58.996	85.356	0.126	0.641
90	51.036	73.839	0.109	0.558
95	44.332	64.140	0.094	0.487
100	38.640	55.905	0.082	0.426
105	33.790	48.888	0.072	0.375
110	29.664	42.918	0.063	0.330
115	26.123	37.795	0.056	0.292
120	23.091	33.409	0.049	0.259
125	20.472	29.618	0.044	0.230

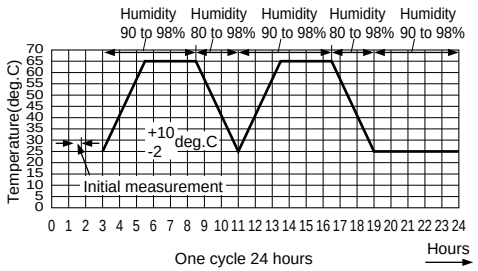
Detailed Resistance-Temperature Tables are downloadable from the following URL.
http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en

■ For Conductive Glue

Part Number	NCG18XH103
Resistance	10kΩ
B-Constant	3380K
Temp. (°C)	Resistance (kΩ)
−55	481.258
−50	352.304
−45	261.060
−40	195.661
−35	148.177
−30	113.351
−25	87.562
−20	68.239
−15	53.651
−10	42.507
−5	33.893
0	27.219
5	22.021
10	17.926
15	14.674
20	12.081
25	10.000
30	8.315
35	6.948
40	5.834
45	4.917
50	4.161
55	3.535
60	3.014
65	2.586
70	2.228
75	1.925
80	1.669
85	1.452
90	1.268
95	1.110
100	0.974
105	0.858
110	0.758
115	0.672
120	0.596
125	0.531
130	0.474
135	0.424
140	0.381
145	0.342
150	0.309

For NTC Thermistors Chip Type Specifications and Test Methods

■ NCP15/18 Series (Operating Temperature Range: -40°C to +150°C)

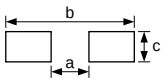
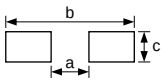
No.	AEC-Q200 Test Item	Specifications	AEC-Q200 Test Methods
1	Pre-and Post-Stress Electrical Test	-	
2	High Temperature Exposure (Storage)	(*1) •Resistance(R_{25}) change should be less than ±5%. •B-constant($B_{25/50}$) change should be less than ±2%. •No visible damage.	150±3 °C in air for 1000 hours. 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 the 1000 cycles according to the four heat treatments listed in the following table. Step 1: -55+0/-3, 15±3 min. Step 2: Room Temp., 1 min. Step 3: 125+3/-0, 15±3 min. Step 4: Room Temp., 1 min. 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 hours heat (25 to 65 °C) and humidity (80 to 98%) 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.	150±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 part (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 intersecting 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 back to 10 Hz of max. amplitude 1.5mm for 20 minutes. This motion should be applied for 12 times in each of 3 mutually perpendicular 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*, NCP15WL233**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 page.

For NTC Thermistors Chip Type Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>Specifications</th><th>AEC-Q200 Test Methods</th></tr>
<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 the 300 cycles according to the two heat treatments listed in the following table. (Maximum transfer time is 20 seconds.)
<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-Q200-004</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****0SRC</td><td>0.4</td><td>1.2</td><td>0.5</td></tr><tr><td>NCP18****0SRB</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 an *18N force to the side of device for 60 seconds.
Use follow land size.
*5N (NCP15****0SRC)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>NCP15****0SRC</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>NCP18****0SRB</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.

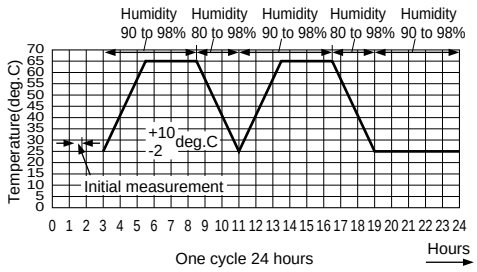
P/N: NCP15XH103**SR*, NCP15WL233**SR*, NCP15WL333**SR*, NCP15WL473**SR*, NCP15WL683**SR*, NCP15WL104**SR*, NCP15WL154**SR*, NCP15WB473**SR*, NCP15WF104**SR*, NCP18XH103**SR*,

(*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%

For NTC Thermistors Chip Type Specifications and Test Methods

■ NCP15/18 Series (Operating Temperature Range: -40°C to +125°C)

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.	125±3 °C in air for 1000 hours. 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 the 1000 cycles according to the four heat treatments listed in the following table. Step 1: -55+0/-3 (Temp. (deg.C)), 15±3 (Time (min.)) Step 2: Room Temp., 1 Step 3: 125+3/-0, 15±3 Step 4: Room Temp., 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 hours heat (25 to 65 °C) and humidity (80 to 98%) 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.	125±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 part (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 intersecting 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 back to 10 Hz of max. amplitude 1.5mm for 20 minutes. This motion should be applied for 12 times in each of 3 mutually perpendicular 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*, NCP15WL233**SR*, NCP15WL333**SR*, NCP15WL473**SR*, NCP15WL683**SR*, NCP15WL104**SR*, NCP15WL154**SR*, NCP15WB473**SR*, NCP15WF104**SR*, NCP18XH103**SR*,

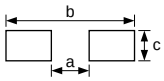
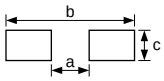
(*1) Resistance(R_{25}) change should be less than 1%
B-constant($B_{25/50}$) change should be less than 1%

(*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 page.

For NTC Thermistors Chip Type Specifications and Test Methods

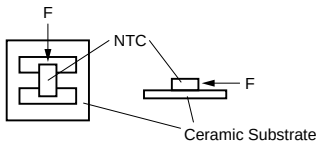
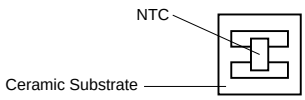
Continued from the preceding page.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>Specifications</th><th>AEC-Q200 Test Methods</th></tr>
<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 the 300 cycles according to the two heat treatments listed in the following table. (Maximum transfer time is 20 seconds.)
<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-Q200-004</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****0SRC</td><td>0.4</td><td>1.2</td><td>0.5</td></tr><tr><td>NCP18****0SRB</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 an *18N force to the side of device for 60 seconds.
Use follow land size.
*5N (NCP15****0SRC)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>NCP15****0SRC</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>NCP18****0SRB</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*, NCP15WL233**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%

For NTC Thermistors Chip Type Specifications and Test Methods

■ NCG18 Series (For Conductive Glue)

No.	Item	Rating value	Method of Examination
1	Dry Heat	· Resistance (R_{25}) change should be less than ±3% · B-constant ($B_{25\text{-}50}$) change should be less than ±1% · No visible damage.	150±3°C in air, for 1000 +48/-0 hours without loading.
2	Cold	· Resistance (R_{25}) change should be less than ±1% · B-constant ($B_{25\text{-}50}$) change should be less than ±1% · No visible damage.	-40±3°C in air, for 1000 +48/-0 hours without loading.
3	Damp Heat	· Resistance (R_{25}) change should be less than ±3% · B-constant ($B_{25\text{-}50}$) change should be less than ±1% · No visible damage.	60±2°C, 90 to 95%RH in air, for 1000 +48/-0 hours without loading.
4	High Temperature Load		150±3°C in air, with Permissive Operating Current (D.C. 0.31mA) for 1000 +48/-0 hours.
5	High Temperature Humidity Load		85±2°C, 85%RH in air, with Permissive Operating Current (D.C. 0.31mA) for 1000 +48/-0 hours.
6	Thermal Shock		1000 cycles of following sequence without loading. Step | Temp. (°C) | Time (minute) 1 | -55+0/-3 | 15 2 | +150+3/-0 | 15
7	Robustness of Electrode	· No peeling of the electrodes.	Mounting NTC Thermistor with conductive glue on Ceramic substrate, and apply 4.90N of force as shown below.: 
8	Vibration Resistant	· Resistance (R_{25}) change should be less than ±5% · B-constant ($B_{25\text{-}50}$) change should be less than ±2% · No visible damage.	Solder NTC Thermistor on the Glass Epoxy PCB as shown 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.). 

· 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 case of R_{25} or $B_{25\text{-}50}$ change are over than specified value caused by method of mounting with conductive glue, these specification should be judged by the evaluation with chip only (not mounting).

For NTC Thermistors Chip Type ⚠Caution/Notice

■ ⚠Caution (Storage and Operating Condition)

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 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 Condition)

To keep mounting nature of product from declining, the following storage condition is recommended.

1. Storage condition:
   Temperature -10 to +40 degrees 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.

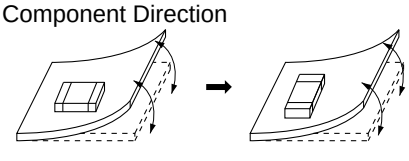
For NTC Thermistors Chip Type ⚠Caution/Notice

■ Notice (Soldering and Mounting) NCP15/18 Series

1. Mounting Position

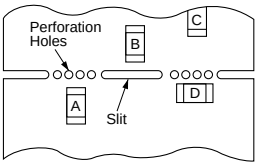
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

Component Direction



Locate this product horizontal to the direction in which stress acts.

Mounting Close to Board Separation Line



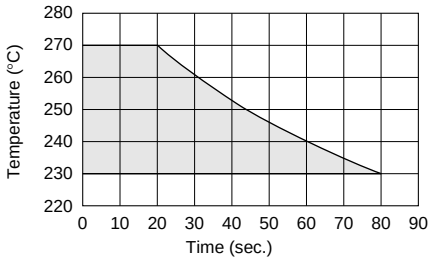
Keep this product on the PC Board away from the Separation Line.
Worst ← A-B-C-D → Better

2. Allowable Soldering Temperature and Time

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

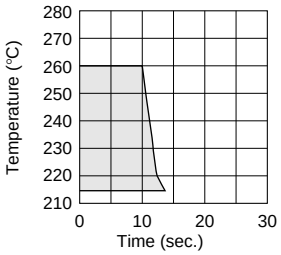
NCP15 Series

Allowable Reflow Soldering Temp. and Time

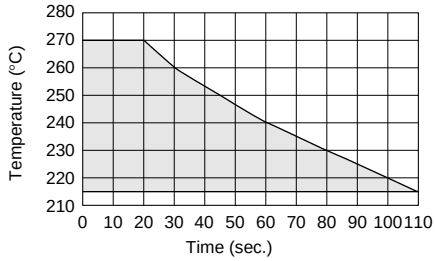


NCP18 Series

Allowable Flow Soldering Temp. and Time



Allowable Reflow Soldering Temp. and Time



Continued on the following page.

For NTC Thermistors Chip Type ⚠Caution/Notice

Continued from the preceding page.

3. Recommendable Temperature Profile for Soldering

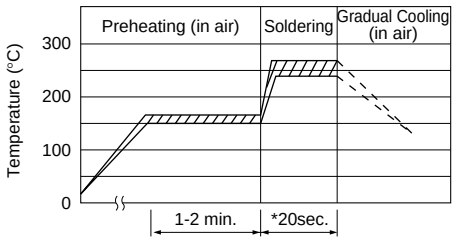
(a) Insufficient preheating may cause a crack on ceramic body. The difference between preheating temperature and maximum temperature in the profile shall be 100 °C.

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

* In case of repeated soldering, the accumulated soldering time should be within the range shown above figure 2.

NCP15 Series

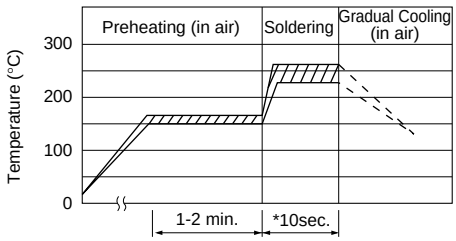
Reflow Soldering Conditions



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

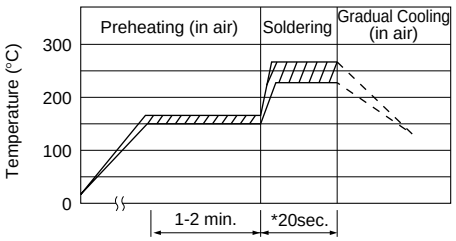
NCP18 Series

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 solder paste below for any internal tests of this product.

•Sn:Pb=63wt%:37wt%

•Sn:Ag:Cu=96.5wt%:3.0wt%:0.5wt%

(2) Flux

Use Rosin-based flux.

Do not use strong acidic flux (with halide content exceeding 0.1wt%)

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 a substrate from an occurance 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 minutes at room temp. or less than 2 minutes at 40°C max.
Ultrasonic Cleaning	Less than 5 minutes 20W/ℓ Frequency of 28 to 40kHz.	Less than 1 minute 20W/ℓ Frequency of several 10 to 100kHz.

6. Drying

After cleaning, promptly dry this product.

Continued on the following page.

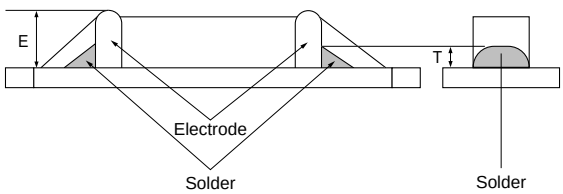
For NTC Thermistors Chip Type ⚠Caution/Notice

Continued from the preceding page.

7. Printing Conditions of Solder Paste

- 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

8. Adhesive Application and Curing

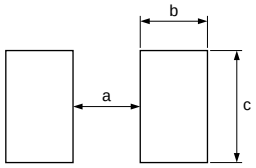
- Thin or insufficient adhesive may result in loose component contact with land during flow soldering.
- Low viscosity adhesive causes chips to slip after mounting.

■ 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 the points below.

1. Recommendable Land Size

Too small the land size parameter 'a' may cause the 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

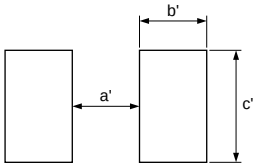
(in mm)

2. Recommendable Conductive Glue

· PC3000 (Manufactured by Heraeus)

3. Screening Conditions of Conductive glue

(1) Recommendable Screening Size



	a'	b'	c'
Land pad size	0.65	0.55	0.95

(in mm)

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

(3) Too much conductive glue gives the electric short mode of this product by conductive glue expanding on the surface of this product on mounting.

4. There is a fear of unexpected failures in your mounting process, caused by the mounting conditions. Please evaluate if this product is correctly mounted under your mounting conditions.

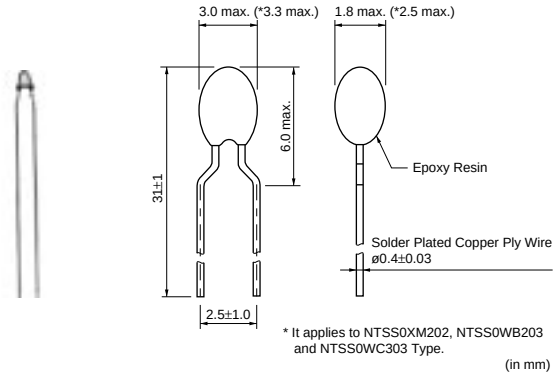
■ Notice (Handling)

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

NTC / PTC Thermistors for Automotive

NTC Thermistor Lead Type for Temperature Sensor

This product is sensor type NTC Thermistor to be useful in the normal temperature range developed by the unique ceramic technology and the automatic assembly.



■ Features

1.High-accuracy of B-Constant tolerance +/-0.5%
+/-1% of resistance and +/-0.5% of B-Constant is realized due to technical advantages of the material and manufacturing process.
2.Quick response
This product provides faster response time due to its smaller size.
3.Taping type is available.
4.Strong lead strength
Original lead-wiring technique assures reliable connection. It can be formed and bent flexibly according to the mounting condition.

■ Applications

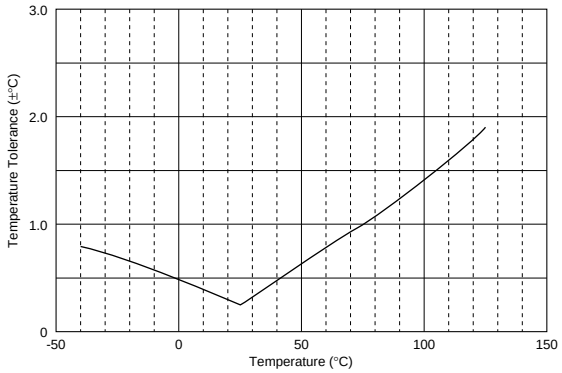
1. Car audio, Car navigation
2. Various engine contorol unit
3. Circuit for ETC equipment
4. Various motor driving circuit
5. Temperature compensation for various circuit

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 Dissipation Constant (25°C) (mW/°C)
NTSS0XM202□E1B0	2.0k	3500 ±0.5%	3523	3526	3543	1.05	21	2.1
NTSS0XR502□E1B0	5.0k	3700 ±1%	3727	3738	3760	0.68	15	1.5
NTSS0XH103□E1B0	10k	3380 ±0.5%	3428	3434	3455	0.38	15	1.5
NTSS0XV103□E1B0	10k	3900 ±0.5%	3930	3934	3944	0.46	15	1.5
NTSS0WB203□E1B0	20k	4050 ±1%	4078	4080	4096	0.31	21	2.1
NTSS0WC303□E1B0	30k	4100 ±1%	4128	4130	4147	0.26	21	2.1
NTSS0WD503□E1B0	50k	4150 ±1%	4205	4213	4234	0.20	15	1.5
NTSS0WF104□E1B0	100k	4250 ±1%	4303	4311	4334	0.14	15	1.5

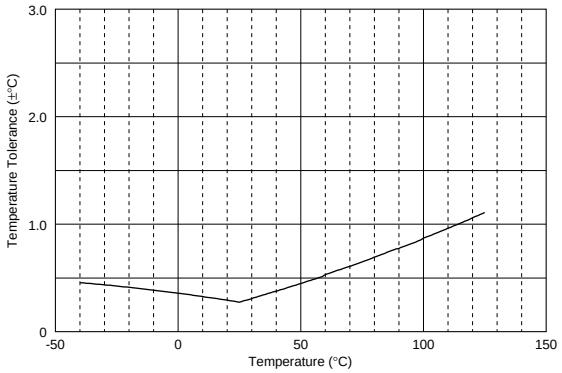
A blank column is filled with resistance tolerance codes (F: ±1%, E: ±3%).
Opwrating Temperature Range: -40°C to +125°C
Taping type of part numbers with "N6A0" is available (Lead spacing = 5mm)

■ Temperature Tolerance - Temperature Characteristics

Resistance tolerance:1% B - Constant tolerance:1%



Resistance tolerance:1% B - Constant tolerance:0.5%

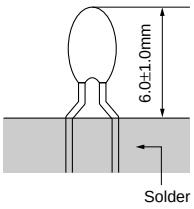
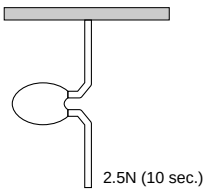
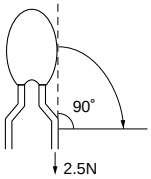


For NTC Thermistors Lead Type Temperature Characteristics (Center Value)

Part Number	NTS□□XM202	NTS□□XR502	NTS□□XH103	NTS□□XV103	NTS□□WB203	NTS□□WC303	NTS□□WD503	NTS□□WF104
Resistance	2.0kΩ	5.0kΩ	10kΩ	10kΩ	20kΩ	30kΩ	50kΩ	100kΩ
B-Constant	3500K	3700K	3380K	3900K	4050K	4100K	4150K	4250K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
−40	44.657	123.484	195.652	347.808	733.007	1149.500	1948.575	4256.752
−35	33.505	92.295	148.171	248.591	524.831	819.651	1387.289	3005.888
−30	25.388	69.614	113.347	179.973	380.184	591.391	999.456	2148.514
−25	19.402	52.860	87.559	131.832	277.845	430.529	728.895	1555.020
−20	14.961	40.480	68.237	97.679	205.260	316.870	537.039	1137.312
−15	11.644	31.275	53.650	73.119	153.642	236.337	399.167	839.314
−10	9.133	24.339	42.506	55.301	116.016	177.842	299.469	625.338
−5	7.198	19.154	33.892	42.257	88.125	134.630	226.186	469.127
0	5.716	15.148	27.219	32.582	67.522	102.816	172.393	355.224
5	4.571	11.964	22.021	25.324	52.168	79.183	132.857	272.045
10	3.682	9.520	17.926	19.847	40.617	61.460	103.089	209.803
15	2.987	7.624	14.674	15.679	31.847	48.045	80.430	162.713
20	2.437	6.160	12.081	12.478	25.151	37.834	63.201	127.117
25	2.000	5.000	10.000	10.000	20.000	30.000	50.000	100.000
30	1.651	4.082	8.315	8.068	16.014	23.955	39.825	79.215
35	1.371	3.354	6.948	6.552	12.902	19.249	31.918	63.150
40	1.143	2.773	5.834	5.353	10.457	15.560	25.733	50.649
45	0.958	2.299	4.917	4.399	8.527	12.657	20.877	40.885
50	0.807	1.914	4.161	3.635	6.993	10.354	17.034	33.195
55	0.683	1.607	3.535	3.020	5.771	8.525	13.929	27.014
60	0.582	1.356	3.014	2.521	4.789	7.058	11.439	22.079
65	0.497	1.149	2.586	2.115	3.992	5.869	9.485	18.226
70	0.426	0.978	2.228	1.783	3.343	4.905	7.906	15.124
75	0.367	0.834	1.925	1.510	2.809	4.113	6.614	2.598
80	0.318	0.714	1.669	1.284	2.376	3.472	5.558	10.542
85	0.276	0.612	1.452	1.096	2.020	2.945	4.686	8.852
90	0.240	0.527	1.268	0.939	1.724	2.509	3.967	7.463
95	0.210	0.456	1.110	0.808	1.476	2.143	3.373	6.321
100	0.183	0.396	0.974	0.698	1.264	1.832	2.878	5.374
105	0.161	0.345	0.858	0.605	1.085	1.571	2.465	4.585
110	0.142	0.302	0.758	0.527	0.935	1.350	2.118	3.925
115	0.125	0.264	0.671	0.460	0.812	1.171	1.828	3.376
120	0.111	0.232	0.596	0.403	0.708	1.019	1.583	2.913
125	0.099	0.205	0.531	0.354	0.617	0.886	1.374	2.520

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

For NTC Thermistors Lead Type Specifications and Test Methods

No.	Item	Rating Value	Method of Examination
1	High Temp. Test 1	•Resistance (R25) fluctuation rate less than ±2% •B-Constant (B25/50) fluctuation rate less than ±1%	150±2°C in air, for 500 +48/-0 hours without loading
2	High Temp. Test 2	•Resistance (R25) fluctuation rate less than ±1% •B-Constant (B25/50) fluctuation rate less than ±1%	125±3°C in air, for 1000 +48/-0 hours without loading
3	Low Temp. Test		-40±3°C in air, for 1000 +48/-0 hours without loading
4	Humidity Test		60±2°C, 90-95%RH in air, for 1000 +48/-0 hours without loading
5	High Temp. Pressure Test	•Resistance (R25) fluctuation rate less than ±2% •B-Constant (B25/50) fluctuation rate less than ±1%	121±2°C, 2atm. in saturated vapor, leave for 2 +1/-0 hours without loading
6	Heat Shock Test		-55±3°C, 30 minutes in air 125±2°C, 30 minutes in air (1 cycle) Continuous 1000 +4/-0 cycles without loading
7	High Temp. Continuous Load Test		100±2°C in air, with Permissive Operating Current for 1000 +48/-0 hours
8	Humidy Continuous Load Test		85±2°C, 85%RH in air, with Permissive Operating Current for 1000 +48/-0 hours
9	Insulation Break-down Voltage	•Normal appearance •Normal electrical characteristics on 500Vdc, 1 minute	2mm length of coating resin from the top of thermistor is to be dipped into beads of lead (Pb), and D.C 500V is applied to circuit between beads of lead (Pb) and lead wire.
10	Solvent Proof	•Normal appearance •Resistance (R25) fluctuation rate less than ±1% •B-Constant (B25/50) fluctuation rate less than ±1%	Using Chlorine Washing Solvents, Boiling, 10 minutes Supersonic, 10 minutes
11	Resistance to Soldering Heat	•Resistance (R25) change less than ±1% •B-Constant (B25/50) change less than ±1%	Both lead wires are immersed into 350±10°C solder for 3.5±0.5 seconds or 260±5°C solder for 10±1 seconds according to Fig. 1. (solder <JIS Z 3282 H60A>) Fig. 1 
12	Solderability	More than 90% of lead wire surface should be covered by solder.	Both lead wires are immersed into flux (25wt% colophony <JIS K 5902> isopropyl alcohol <JIS K 8839>) for 5-10 seconds. Then both lead wires are immersed into 235±5°C solder <JIS Z 3282 H60A> for 2±0.5 seconds. according to Fig. 1.
13	Lead Wire Pull Strength	•No visible damage •Resistance (R25) change less than ±1% •B-Constant (B25/50) change less than ±1%	One end of a lead wire should be fixed and 2.5N force for 10 seconds should be applied to the other lead wire as shown in Fig. 2. Fig. 2 
14	Lead Wire Bending Strength	No visible damage on lead wire	One lead wire is held and 2.5N force is applied. Then the body of NTC thermistor is bent 90° degrees and again bent back to the initial position. This sequence should be completed twice. See Fig. 3. Fig. 3 
15	Drop Test	•No visible damage •Resistance (R25) change less than ±1% •B-Constant (B25/50) change less than ±1%	NTC Thermistor should be dropped without any force onto concrete floor from 1 meter height one time.
16	Vibration		NTC Thermistor is to be fixed to the vibration test equipment. Frequency: 10-2000-10Hz (20 minutes) Max amplitude: 3.0mm Vibrated for a period of 4 hours in 3 perpendicular directions each other (for total of 12 hours.)

∗ •R25 is zero-power resistance of Thermistor in 25°C.
•After each test, NTC Thermistor should be kept for 1 hour at room temperature (normal humidity and normal atmospheric pressure). Then the resistances (R25 and R50) should be measured and the appearance should be visually examined.

For NTC Thermistors Lead Type ⚠Caution/Notice

■ ⚠Caution (Storage and Operating Condition)

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 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.

4

■ Notice (Storage and Operating Condition)

To keep solderability of product from declining, the following storage condition is recommended.

1. Storage condition:
   Temperature -10 to +40 degrees 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, reseal product promptly or store it in a sealed container with a drying agent.
4. 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)

1. Be sure that the preheat-up does not melt the soldering of this product. Excessive heat may cause failure to open, short or insulation break down.
2. Do not touch the body with soldering iron.
   The soldering point should be min. 5mm away from the root of lead wire.

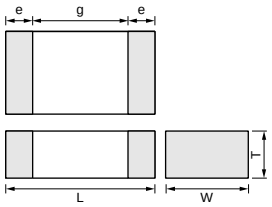
■ Notice (Handling)

1. The ceramic element of this product is fragile, and care must be taken not to load an excessive press-force or not to give a shock at handling. Such forces may cause cracking or chipping.
2. Do not apply an excessive force to the lead. Otherwise, it may cause junction between lead and element to break or crack. Holding element by side lead wire is recommended when lead wire is bent or cut.

NTC / PTC Thermistors for Automotive

PTC Thermistor (POSISTOR®) for Overheat Sensing Chip Type 0603 (1608) Size

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



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

■ Features

1. SMD type is helpful for miniaturizing the circuit because of small size and light weight.
2. Excellent thermal response because of no coating.
3. Elements of solid-state construction provides excellent mechanical vibration and impact resistance.
4. Contactless operation provides prolonged service life and noiseless operation.
5. Lead is not contained in the terminations.

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 degree) (ohm)
PRF18BG471QS2RB	65 ±5°C	80 ±7°C	32	470 ±50%
PRF18BF471QS2RB	75 ±5°C	90 ±7°C	32	470 ±50%
PRF18BE471QS2RB	85 ±5°C	100 ±7°C	32	470 ±50%
PRF18BD471QS2RB	95 ±5°C	110 ±7°C	32	470 ±50%
PRF18BC471QS2RB	105 ±5°C	120 ±7°C	32	470 ±50%
PRF18BB471QS2RB	115 ±5°C	130 ±7°C	32	470 ±50%
PRF18BA471QS2RB	125 ±5°C	140 ±7°C	32	470 ±50%
PRF18AR471QS2RB	135 ±5°C	150 ±7°C	32	470 ±50%
PRF18AS471QS2RB	145 ±5°C	-	32	470 ±50%

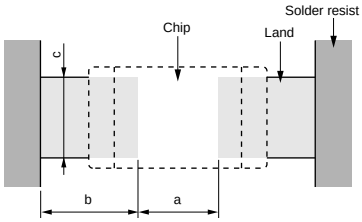
This product is applied to Flow/reflow soldering.
Operationg Temperature Range: -40°C to +150°C
Please contact us for UL recognized products.

Chip Tight Tolerance Type 0603 (1608) Size

Part Number	Sensing Temperature (at 4.7k ohm) (°C)	Maximum Voltage (V)	Resistance (at 25 degree) (ohm)
PRF18BE471RS2RB	85 ±3°C	32	470 ±50%
PRF18BD471RS2RB	95 ±3°C	32	470 ±50%
PRF18BC471RS2RB	105 ±3°C	32	470 ±50%
PRF18BB471RS2RB	115 ±3°C	32	470 ±50%

This product is applied to Flow/reflow soldering.
Operationg Temperature Range: -40°C to +150°C
This product is recognized by UL.

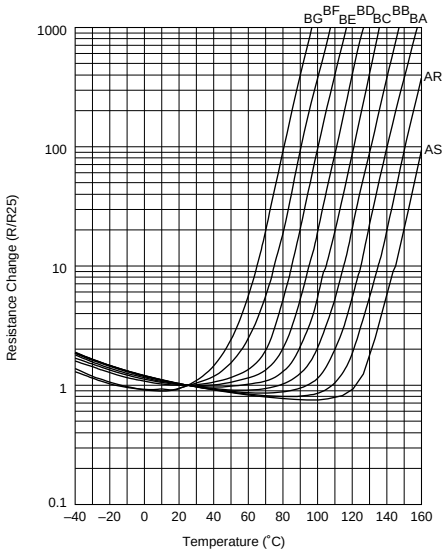
■ Standard Land Pattern Dimensions



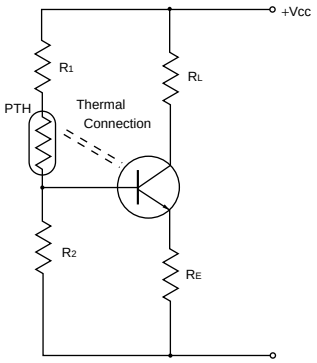
(in mm)

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

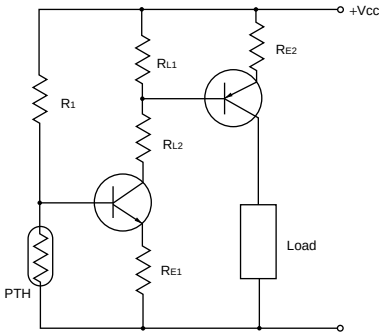
■ Resistance - Temperature Characteristics (Typical)



■ Overheat Protection Circuit

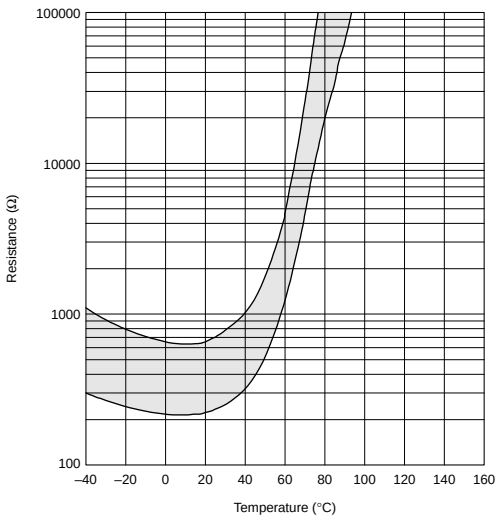


■ Overheat Sensing Circuit

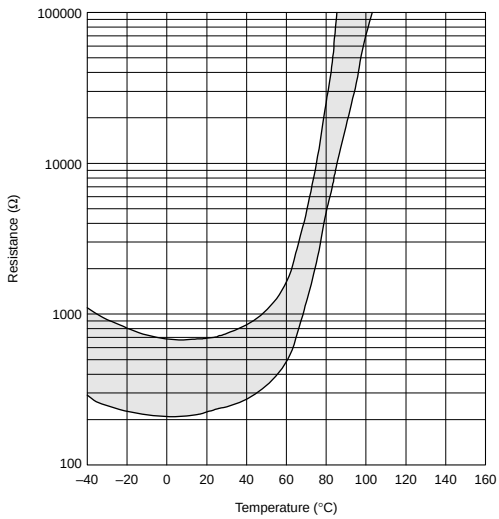


■ Resistance - Temperature Characteristics Range (Ref. Only)

PRF18BG471QS2RB



PRF18BF471QS2RB

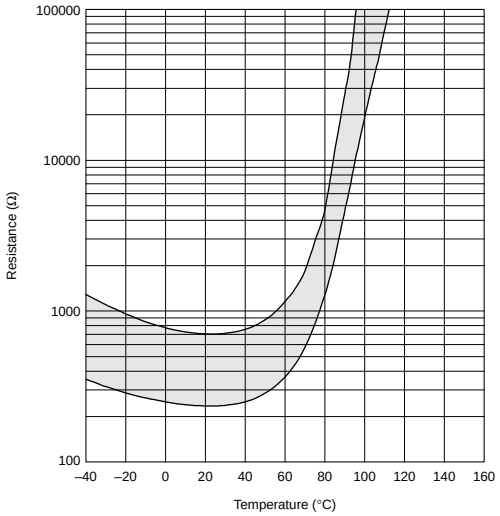


Continued on the following page.

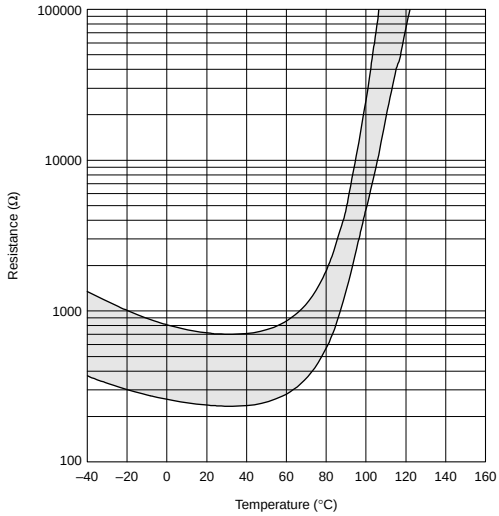
Continued from the preceding page.

■ Resistance - Temperature Characteristics Range (Ref. Only)

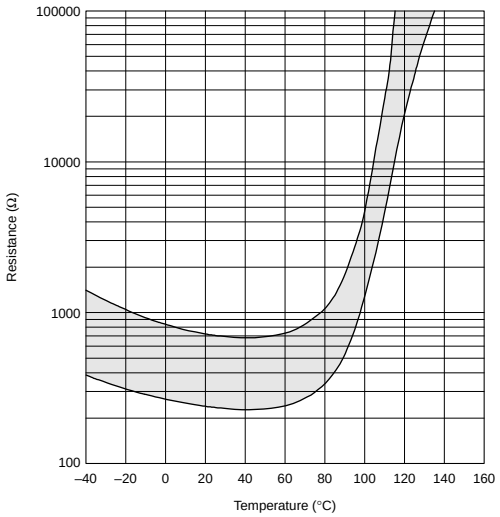
PRF18BE471QS2RB



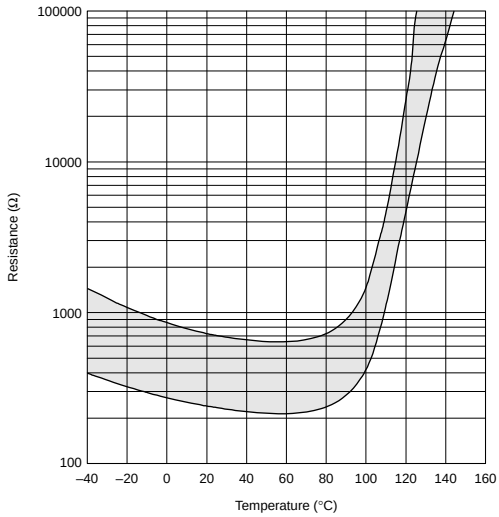
PRF18BD471QS2RB



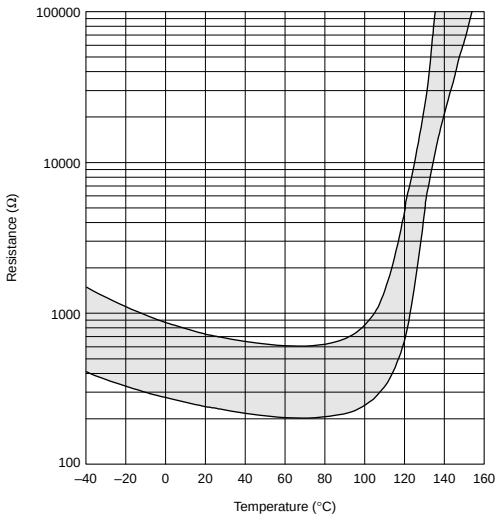
PRF18BC471QS2RB



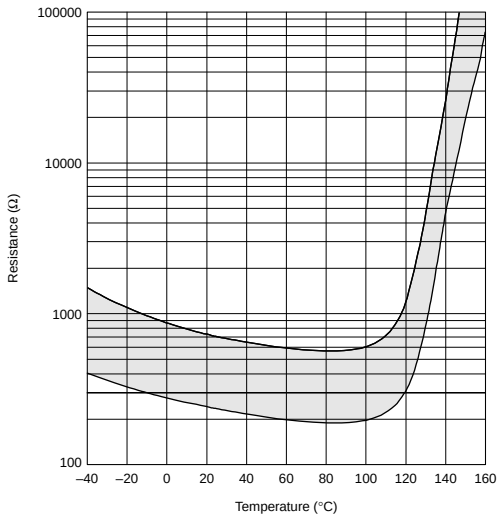
PRF18BB471QS2RB



PRF18BA471QS2RB



PRF18AR471QS2RB



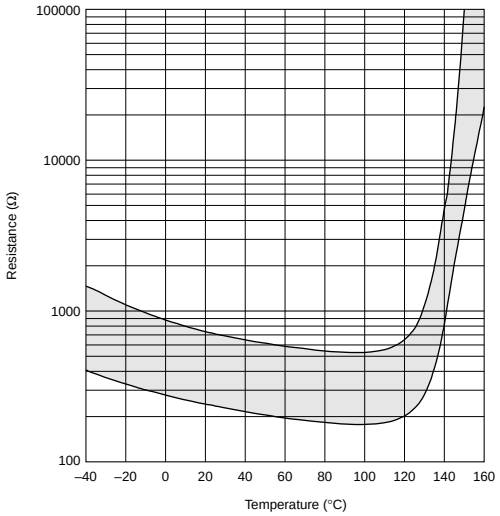
5

Continued on the following page.

Continued from the preceding page.

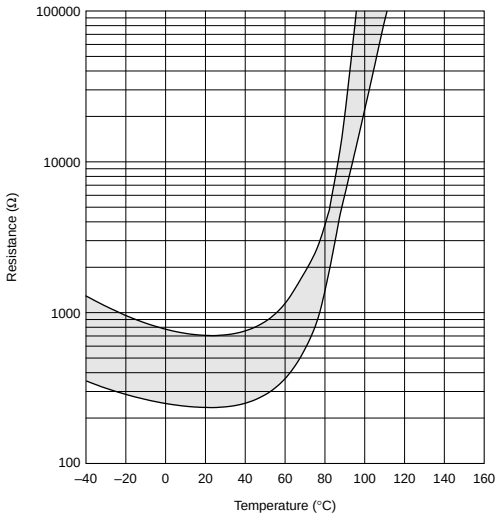
■ Resistance - Temperature Characteristics Range (Ref. Only)

PRF18AS471QS2RB

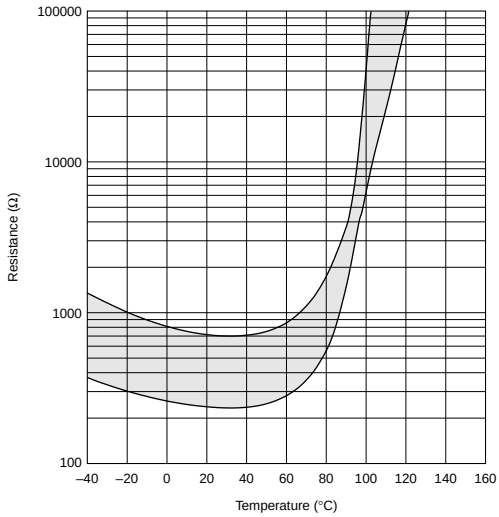


■ Resistance - Temperature Characteristics Range (Ref. Only) Tight Tolerance Type

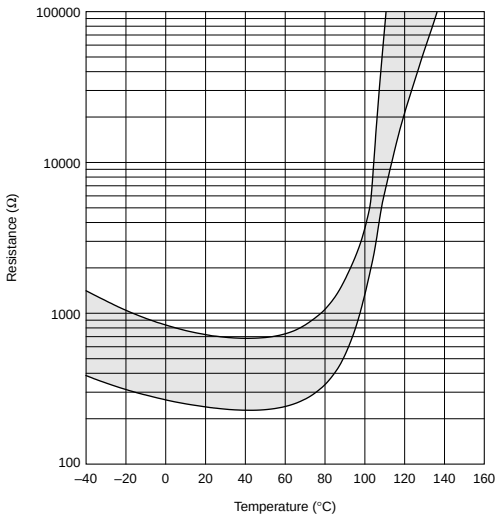
PRF18BE471RS2RB



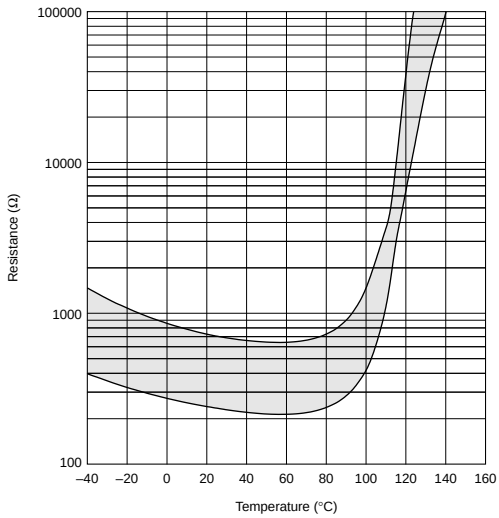
PRF18BD471RS2RB



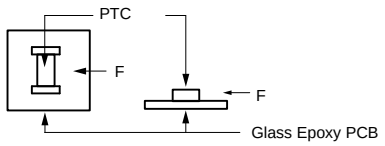
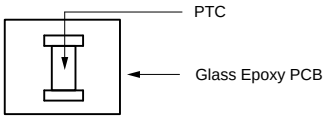
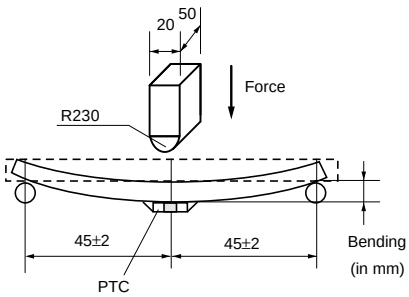
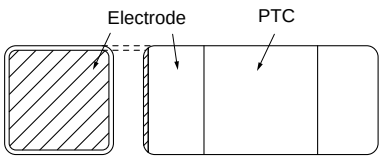
PRF18BC471RS2RB



PRF18BB471RS2RB



Chip Type of POSISTOR® for Overheat Protection Specifications and Test Methods

No.	Item	Rating Value	Method of Examination
1	Resistance Value (at 25˚C)	The resistance value should be within the specified tolerance.	After applying maximum operating voltage for 3 minutes and leaving for 2 hours at 25°C, measured by applying voltage of less than 1.5Vdc (by a direct current of less than 10mA).
2	Adhesive Strength	There is no detachment sign of electrode.	EIAJ ET-7403 term 9 Prepare soldered PTC to PCB ∗1 and add the force of 5.0N in the direction shown below. (PTC=POSISTOR®) 
3	Vibration Resistance	Normal appearance Resistance change: not to exceed ±20%∗2	Soldered PTC to PCB∗1 Vibration: 10-2000-10Hz (20 minutes) Max. Amplitude: 3.0mm Vibrate for 4 hours in each of 3 mutually perpendicular planes for a total of 12 hours. This test condition is according to "MIL-STD-204D" 
4	Resistance to Bending of Substance	Normal appearance Resistance change: not to exceed ±20%∗2	Soldered PTC on Test Board∗1, and apply force on back side of Test Board shown below: Bending Speed: 1.0mm/s Bending Strength: 2.0mm Hold time: 5±1 seconds Board Dimension: 100 × 40 × 1.6t mm Board Material: Glass Epoxy 
5	Solderability	Min. 95% electrode is covered with new solder. Resistance change: not to exceed ±20%∗2	JIS C 5102 term 8.4 Solder temp.: 230±5°C Solder: Sn63%/Pb37% (or 60%/40%) Soaking time: 3±0.5 seconds Soaking position: Until a whole electrode is soaked
6	Soldering Heat Resistance	Resistance change: not exceed ±20%∗2 Normal appearance on the section showed by slanting line parts of the electrodes on the figure. 	Solder temp.: 260±5°C Solder: Sn63%/Pb37% (or 60%/40%) Flux: Containing less than 0.2wt% of chlorine. Soaking time: 10±0.5 seconds Soaking position: Until a whole electrode is soaked. Preheating: 150±5°C 3 minutes
7	Dry Heat Resistance	Normal appearance Resistance change: not to exceed ±20%∗2 <Tight Tolerance Type> Sensing Temperature change: not exceed ±1°C	Soldered PTC to PCB∗1 +150±3°C leave for 1000±12 hours
8	Cold Resistance		Soldered PTC to PCB∗1 -40±3°C leave for 1000±12 hours
9	Damp Heat Resistance		Soldered PTC to PCB∗1 +85±3°C 80-85%RH leave for 1000±12 hours
10	Thermal Shock∗3		Soldered PTC to PCB∗1 Cycles: 1000 cycles

Step	Temp. (°C)	Time (minutes)
1	-55+0, -3	30
2	+125+3, -0	30

Continued on the following page.

5

Chip Type of POSISTOR® for Overheat Protection Specifications and Test Methods

Continued from the preceding page.

No.	Item	Rating Value	Method of Examination
11	High Temperature Humidity Load	Normal appearance Resistance change: not to exceed ±20%∗2 <Tight Tolerance Type> Sensing Temperature change: not exceed ±1°C	Soldered PTC to PCB∗1 85±3°C, 80-85%RH (in air), load max. operating voltage for 1000±12 hours
12	High Temperature Load		Soldered PTC to PCB∗1 +85±3°C (in air), load max. operating voltage for 1000±12 hours.

∗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 mentioned in Notice.

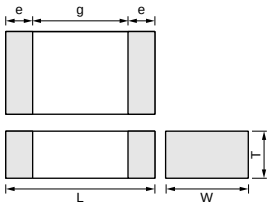
∗2 Measure resistance after the test by applying voltage of less than 1.5Vdc by a direct current of less than 10mA after product is left at 25±2°C for 2 hours.

∗3 We cannot guarantee the resistance change in Thermal Shock (No.10) in case of defective mounting.

NTC / PTC Thermistors for Automotive

PTC Thermistor (POSISTOR®) for Overcurrent Protection Chip Type 0805 (2012) Size

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



Part Number	Dimensions (mm)				
	L	W	T	e	g
PRG21_RA	2.0±0.2	1.25±0.2	0.9±0.2	0.2 min.	0.5 min.
PRG21_RK	2.0±0.2	1.25±0.2	1.25±0.2	0.2 min.	0.5 min.

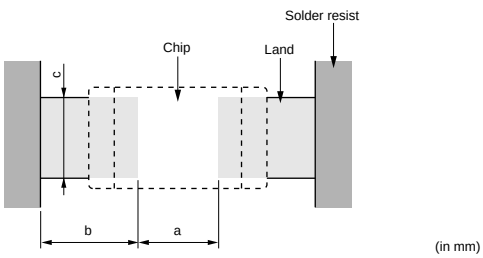
■ Features

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. SMD type is helpful for miniaturizing circuits because of its small size and light weight
7. Lead 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 (mA)	Resistance (at +25°C) (ohm)
PRG21AR220MS1RK	16	25	45	75	195	250	900	22 ±20%
PRG21AR420MS1RA	20	15	25	54	102	130	590	42 ±20%

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

■ Standard Land Pattern Dimensions

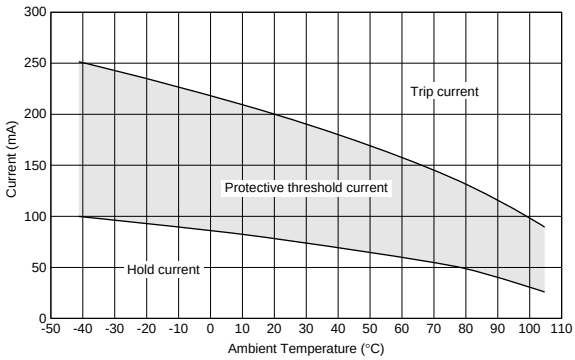


(in mm)

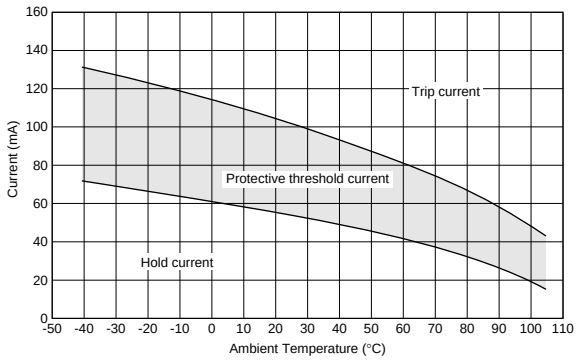
Part Number	Soldering Methods	Dimensions (mm)			
		Chip (L×W)	a	b	c
PRG21	Reflow Soldering	2.0×1.25	1.0-1.2	0.5-0.7	1.0-1.2

■ Protective Threshold Current Range

PRG21AR220MS1RK

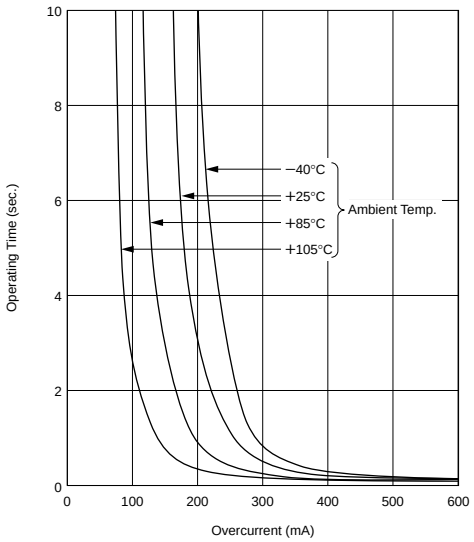


PRG21AR420MS1RA

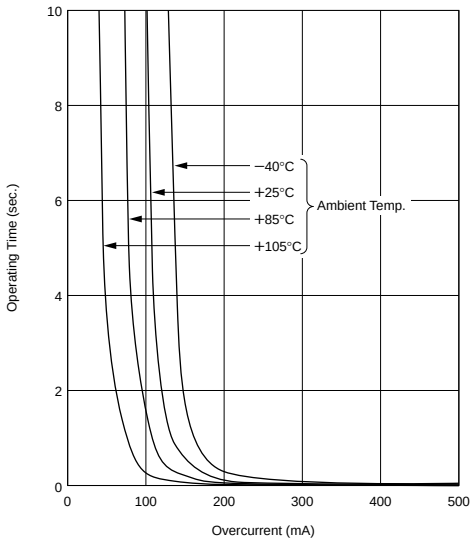


■ Operating Time (Typical Curve)

PRG21AR220MS1RK

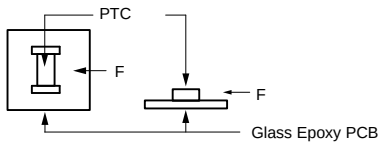
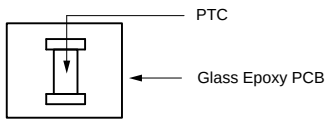
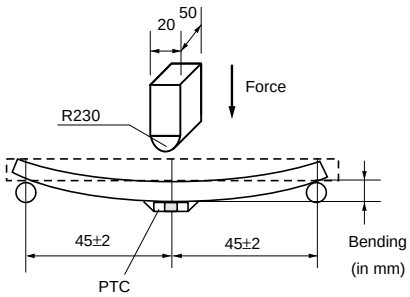


PRG21AR420MS1RA



6

Chip Type of POSISTOR® for Overheat Protection Specifications and Test Methods

No.	Item	Rating Value	Method of Examination
1	Operating Temp. 1	-40 to +105°C	The temperature range with maximum voltage applied to the POSISTOR®.
2	Operating Temp. 2	-40 to +125°C	The temperature range which with zero voltage applied to POSISTOR® after it was soldered to PCB.
3	Resistance Value (at 25˚C)	The resistance value shall be within the specified tolerance.	After applying maximum operating voltage for 3 minutes and leaving for 2 hours at 25°C, measured by applying voltage of less than 1.5Vdc (by a direct current of less than 10mA).
4	Withstanding Voltage	Without damage	We apply 120% of the maximum voltage to PTC by rising gradually for 180±5 seconds at 25°C. (A protective resistor is to be connected in series, and the inrush current through PTC must be limited below maximum rated value.)
5	Adhesive Strength	There is no detachment sign of electrode.	EIAJ ET-7403 term 9 Prepare soldered PTC to PCB ∗1 and add a force of 5.0N in the direction shown below. (PTC=POSISTOR®) 
6	Vibration Resistance	Normal appearance Resistance change: not to exceed ±20%∗2	Soldered PTC to PCB ∗1 Vibration: 10-2000-10Hz (20 min.) Max. Amplitude: 3.0mm Vibrate for 4 hours in each of 3 mutually perpendicular planes for a total of 12 hours. This test condition is according to "MIL-STD-204D" 
7	Resistance to Bending of Substance	Normal appearance Resistance change: not to exceed ±20%∗2	Soldered PTC on Test Board ∗1, and apply force on back side of Test Board shown below: Bending Speed: 1.0mm/s Bending Strength: 2.0mm Hold Time: 5±1 seconds Board Dimension: 100×40×1.6t mm Board Material: Glass Epoxy 
8	Solderability	Min. 95% electrode is covered with new solder. Resistance change: not to exceed ±20%∗2	JIS C 5102 term 8.4 Solder Temp.: 230±5°C Solder: Sn63%/Pb37% (or 60%/40%) Soaking Time: 3±0.5 seconds Soaking Position: Until a whole electrode is soaked
9	Soldering Heat Resistance	Normal appearance Resistance change: not to exceed ±20%∗2	Solder: Sn 63%/Pb 37% (or 60%/40%) solder paste Flux: Containing less than 0.2wt% of chlorine. Preheating: 150±5°C 3 minutes Peak Temp.: 260±5°C 10±5 seconds (reflow) PCB: JIS C 6484 Glass Epoxy PCB
10	Dry Heat Resistance	Normal appearance Resistance change: not to exceed ±20%∗2	Soldered PTC to PCB∗1 +125±3°C leave for 1000±12 hours.
11	Cold Resistance		Soldered PTC to PCB∗1 -40±3°C leave for 1000±12 hours.
12	Damp Heat Resistance		Soldered PTC to PCB∗1 +85±3°C 80-85%RH leave for 1000±12 hours.

Continued on the following page.

Chip Type of POSISTOR® for Overheat Protection Specifications and Test Methods

Continued from the preceding page.

No.	Item	Rating Value	Method of Examination
13	Thermal Shock*3	Normal appearance Resistance change: not to exceed ±20%*2	Soldered PTC to PCB*1 Cycles: 1000 cycles Step 1: -55+0, -3: 30 minutes Step 2: +125+3, -0: 30 minutes
14	High Temperature Humidity Load		Soldered PTC to PCB*1 85±3°C, 80-85%RH (in air), load max. operating voltage for 1000±12 hours.
15	High Temperature Load		Soldered PTC to PCB*1 125±3°C (in air), PTC is applied max. operating voltage for 1.5 hours on and 0.5 hours off. This cycle is repeated for 1000±10 hours.

*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 mentioned 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 hours.

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

For POSISTOR® Chip Type ⚠Caution/Notice

■ ⚠Caution (Storage and Operating Condition)

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 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 Condition)

To keep solderability of product from declining, following storage condition is recommended.

1. Storage condition:
   Temperature -10 to +40 degrees 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.

For POSISTOR® Chip Type ⚠Caution/Notice

■ Notice (Soldering and Mounting) 0603 (1608) Size

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-based flux. Do not use strong acidic flux (with halide content exceeding 0.2wt%).

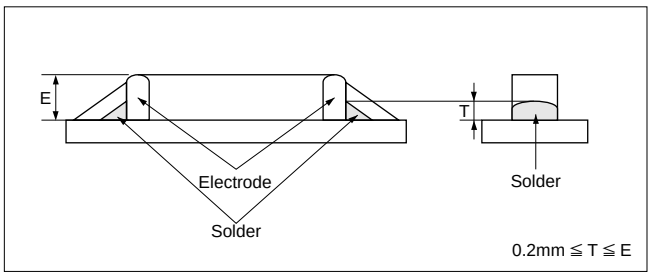
2. Cleaning Conditions and Drying
   To remove the flux after soldering, observe the following points in order to avoid deterioration of the characteristics or any change to the external electrodes quality.
   (1) Cleaning Conditions

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 gives too strong 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 page.

For POSISTOR® Chip Type ⚠Caution/Notice

Continued from the preceding page.

(2) Adhesive Application and Curing

(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 board, after mounting.

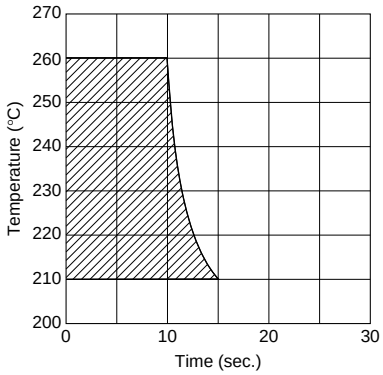
(3) Allowable Soldering Temperature and Time

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

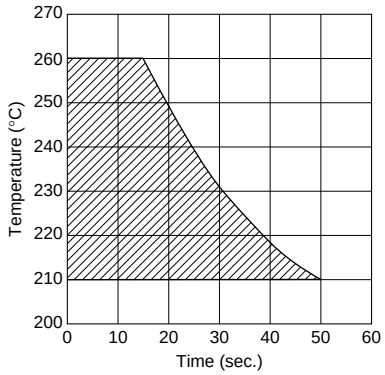
(b) The excessive soldering conditions may cause dissolution of metallization or deterioration of solder-wetting on the external electrode.

(c) In case of repeated soldering, the accumulated soldering time should be within the range shown below figure. (For example, Reflow peak temperature: 260°C, twice -> The accumulated soldering time at 260°C is within 15 sec.)

Allowable Flow Soldering Temp. and Time



Allowable Reflow Soldering Temp. and Time

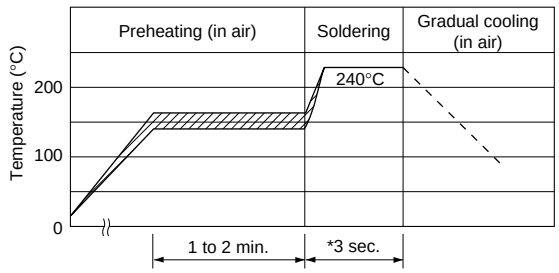


(4) Recommendable Temperature Profile for Soldering

(a) Insufficient preheating may cause a crack on ceramic body. 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.

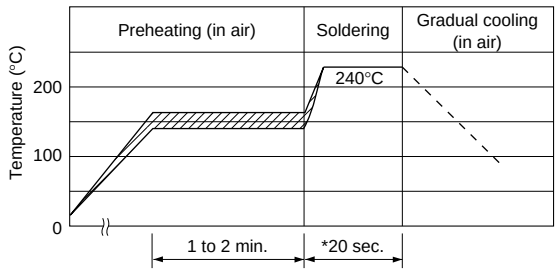
Flow Soldering Conditions



Preheating: 150±10°C, 1-2 minutes.
Soldering: 240°C, 3 sec.

* In case of repeated soldering, the accumulated soldering time should be within the range shown above figure (3).

Reflow Soldering Conditions



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

* In case of repeated soldering, the accumulated soldering time should be within the range shown above figure (3).

(5) 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.

For POSISTOR® Chip Type ⚠Caution/Notice

■ Notice (Soldering and Mounting) 0805 (2012) Size

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-based flux. Do not use strong acidic flux (with halide content exceeding 0.2wt%).

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.

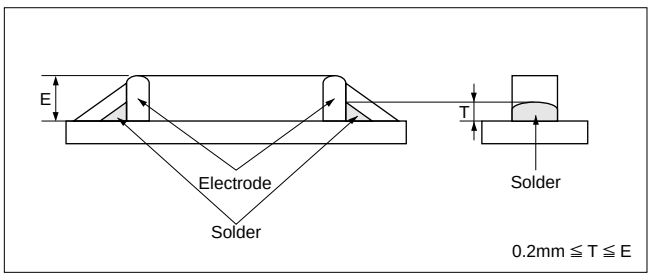
This product is for reflow soldering only. Flow soldering should not be allowed.

(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 gives too strong 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 page.

For POSISTOR® Chip Type ⚠Caution/Notice

Continued from the preceding page.

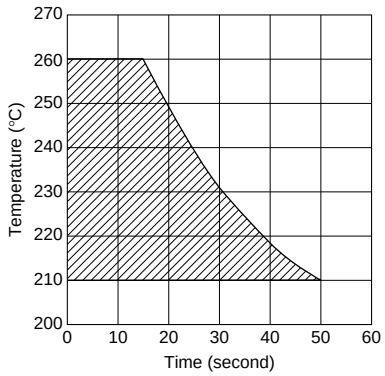
(2) Allowable Soldering Temperature and Time

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

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

(c) In case of repeated soldering, the accumulated soldering time should be within the range shown below figure. (For example, Reflow peak temperature: 260°C, twice → The accumulated soldering time at 260°C is within 15 sec.)

Allowable Reflow Soldering Temp. and Time

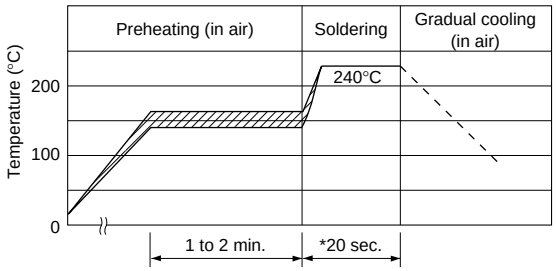


(3) Standard Temperature Profile for Soldering

(a) Insufficient preheating may cause a crack on ceramic body. 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 case of repeated soldering, the accumulated soldering time should be within the range shown above figure (3).

(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 specified mounting conditions.

For POSISTOR® Chip Type ⚠Caution/Notice

■ Notice (Handling)

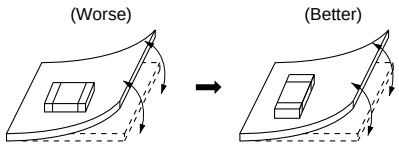
1. Do not give this product a strong press-force nor a mechanical shock, because such mechanical forces may cause cracking or chipping of this ceramic product.

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. Shrinkage is much less if selecting a resin material.

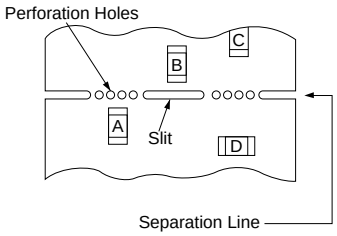
4. Location on Printed Circuit Board (PC Board)
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

Component Direction



Locate chip horizontal to the direction in which stress acts

Chip Mounting Close to Board Separation Point



Put this product on the PC Board near the Slit, not near the Perforation Holes. Keep this product on the PC Board away from the Separation Line.

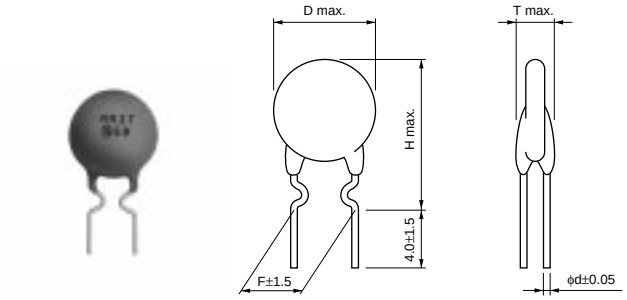
Worst A-C-B-D Better

NTC / PTC Thermistors for Automotive

PTC Thermistor (POSISTOR®) for Overcurrent Protection Lead Type

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 like 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.



(in mm)

■ Features

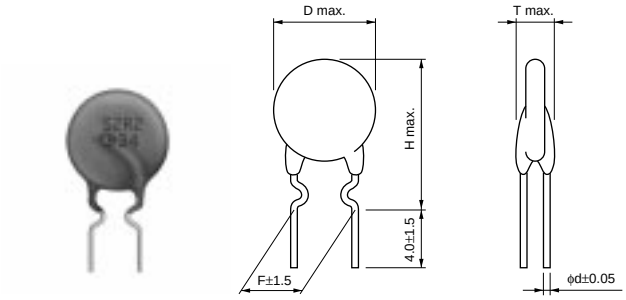
1. Best suited to meet the requirements for power supply and motor protection. Error-free operation is assured by rush current.
2. Circuit is protected until current is turned off.
3. Restores the original low resistance value automatically once the overload is removed.
4. Non-contact design leads to 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)	Lead Diameter (phi d)(mm)
PTGL5SAR1R0M1B51B0	16	252	470	880	1095	2.0	1.0 ±20%	6.0	3.5	9.5	5.0	0.6
PTGL6SAR0R8M1B51B0	16	274	505	955	1193	3.0	0.8 ±20%	6.5	3.5	10.0	5.0	0.6
PTGL7SARR47M1B51B0	16	376	705	1310	1634	5.0	0.47 ±20%	7.5	3.5	12.0	5.0	0.6
PTGL9SARR33M1B51B0	16	466	875	1625	2026	7.0	0.33 ±20%	9.0	3.5	14.0	5.0	0.6
PTGLASARR27M1B51B0	16	545	1025	1900	2369	8.0	0.27 ±20%	10.1	3.5	15.0	5.0	0.6
PTGLCSAR0R2M1B51B0	16	692	1300	2410	3006	9.0	0.2 ±20%	11.3	3.5	16.0	5.0	0.6
PTGLESARR15M1B51B0	16	820	1545	2855	3561	10	0.15 ±20%	13.5	3.5	18.5	5.0	0.6

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

30-140V Series

New leaded type "POSISTOR" for overcurrent protection as automotive grade can be used with wide temperature range. This product is suitable for short-protect and current limiting resistor on power supply equipment.



(in mm)

■ Features

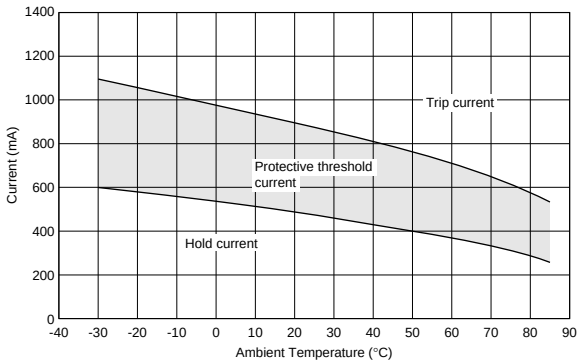
1. This product has useful Protective threshold current range with wide temperature range.
2. Small fluctuation in the circuit due to resistance tolerance +/-10%.
3. Quick operating time due to small size compared with conventional products.
4. Best suited to meet the requirements for power supply and motor protector. Error-free operations are 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)	Lead Diameter (phi d)(mm)
PTGL4SAS100K2N51B0	30	65	92	154	205	261	1.5	10 ±10%	4.5	3.5	9.5	5.0	0.5
PTGL4SAS100K2B51B0	30	89	127	212	282	359	2.0	10 ±10%	4.5	3.5	9.5	5.0	0.6
PTGL5SAS3R9K2B51B0	30	143	204	340	452	576	3.5	3.9 ±10%	5.5	3.5	10.5	5.0	0.6
PTGL7SAS2R7K2B51B0	30	179	255	425	565	720	4.5	2.7 ±10%	7.3	3.5	12.3	5.0	0.6
PTGL7SAS1R8K2B51B0	30	223	319	532	708	902	5.0	1.8 ±10%	7.3	3.5	12.3	5.0	0.6
PTGL9SAS1R2K2B51B0	30	296	422	704	936	1193	6.0	1.2 ±10%	9.3	3.5	14.3	5.0	0.6
PTGLCSAS0R8K2B51B0	30	364	520	867	1153	1470	7.0	0.8 ±10%	11.5	3.5	16.5	5.0	0.6
PTGL4SAS100K3B51B0	51	89	128	213	283	361	1.0	10 ±10%	4.5	3.5	9.5	5.0	0.6
PTGL5SAS6R8K3B51B0	51	105	149	249	331	422	1.5	6.8 ±10%	5.5	3.5	10.5	5.0	0.6
PTGL7SAS3R3K3B51B0	51	163	233	389	517	659	3.0	3.3 ±10%	7.3	3.5	12.3	5.0	0.6
PTGL9SAS2R2K3B51B0	51	219	313	522	694	885	4.0	2.2 ±10%	9.3	3.5	14.3	5.0	0.6
PTGLCSAS1R2K3B51B0	51	315	449	749	996	1270	5.0	1.2 ±10%	11.5	3.5	16.5	5.0	0.6
PTGL4SAS220K4N51B0	60	47	67	112	149	190	1.0	22 ±10%	4.5	3.5	9.5	5.0	0.5
PTGL4SAS220K4B51B0	60	61	87	145	193	246	1.0	22 ±10%	4.5	3.5	9.5	5.0	0.6
PTGL5SAS100K4B51B0	60	90	129	215	286	364	1.5	10 ±10%	5.5	3.5	10.5	5.0	0.6
PTGL7SAS5R6K4N51B0	60	99	142	236	314	400	2.2	5.6 ±10%	7.3	3.5	12.3	5.0	0.5
PTGL7SAS5R6K4B51B0	60	122	174	290	386	492	3.0	5.6 ±10%	7.3	3.5	12.3	5.0	0.6
PTGL9SAS3R3K4B51B0	60	177	253	421	560	714	4.0	3.3 ±10%	9.3	3.5	14.3	5.0	0.6
PTGLCSAS2R2K4B51B0	60	234	334	556	739	942	5.0	2.2 ±10%	11.5	3.5	16.5	5.0	0.6
PTGL4SAS560K6B51B0	140	39	56	94	125	159	0.5	56 ±10%	4.5	4.5	9.5	5.0	0.6
PTGL5SAS270K6B51B0	140	56	80	134	178	227	1.0	27 ±10%	5.5	4.5	10.5	5.0	0.6
PTGL7SAS150K6B51B0	140	79	112	187	249	317	1.5	15 ±10%	7.3	4.5	12.3	5.0	0.6
PTGL9SAS120K6B51B0	140	102	146	244	324	413	2.0	12 ±10%	9.3	4.5	14.3	5.0	0.6
PTGL9SAS7R6K6B51B0	140	121	172	287	382	486	2.2	7.6 ±10%	9.3	4.5	14.3	5.0	0.6
PTGLCSAS4R7K6B51B0	140	165	236	393	523	666	3.5	4.7 ±10%	11.5	4.5	16.5	5.0	0.6

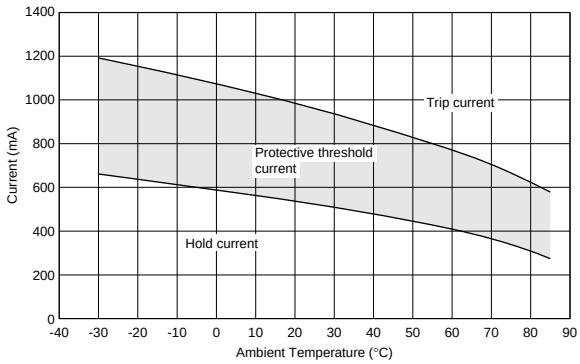
Maximum Current shows typical capacities of the transformer which can be used.
Operating Temperature Range: -40°C to +125°C
These series are recognized by UL.
Taping type of part numbers with "A0" is available.

■ Protective Threshold Current Range (16V Series)

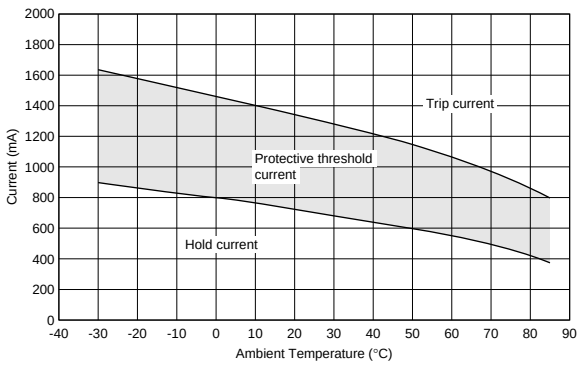
PTGL5SAR1R0M1B51B0



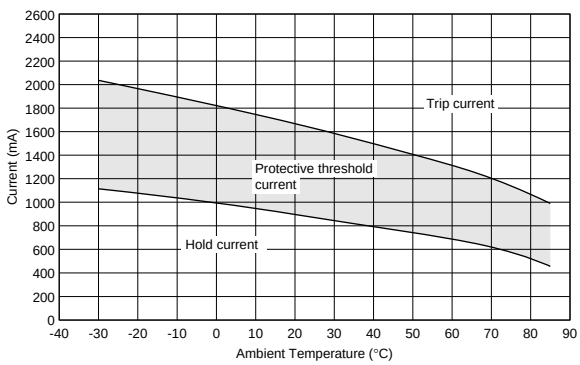
PTGL6SAR0R8M1B51B0



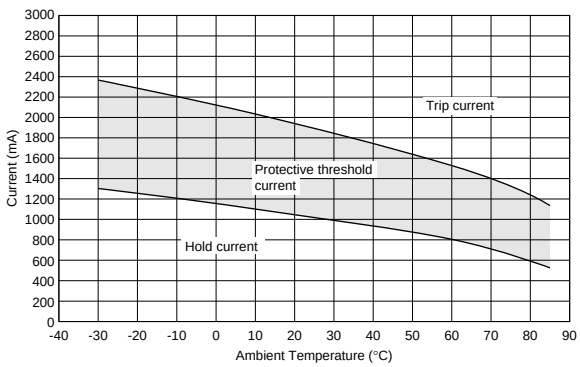
PTGL7SARR47M1B51B0



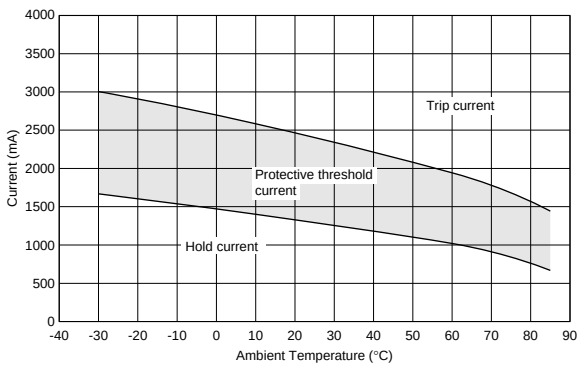
PTGL9SARR33M1B51B0



PTGLASARR27M1B51B0

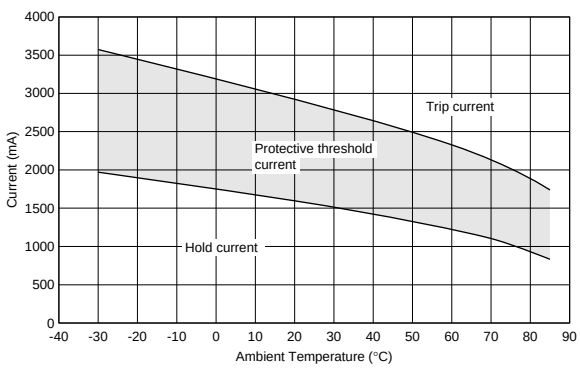


PTGLCSAR0R2M1B51B0

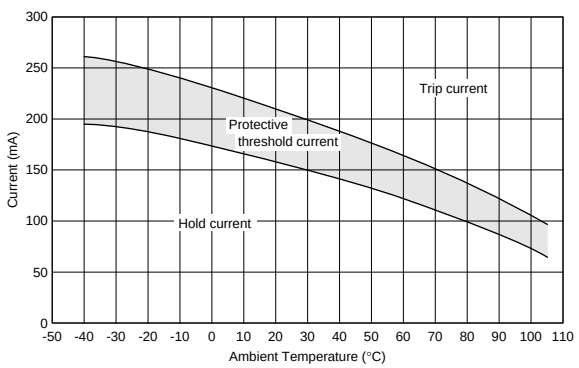


■ Protective Threshold Current Range (30V Series)

PTGLESARR15M1B51B0



PTGL4SAS100K2N51B0

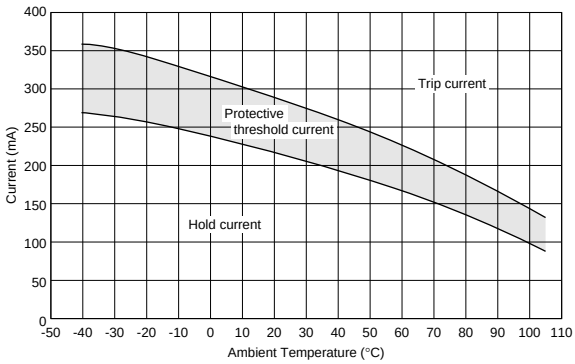


Continued on the following page.

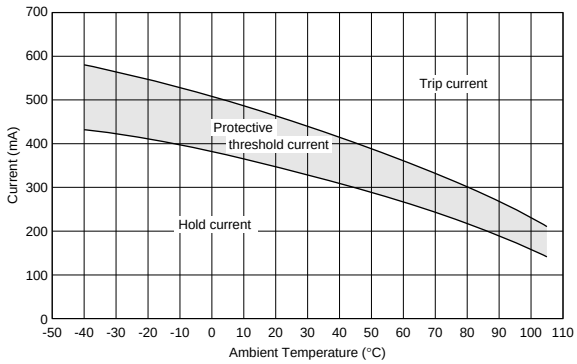
Continued from the preceding page.

■ Protective Threshold Current Range (30V Series)

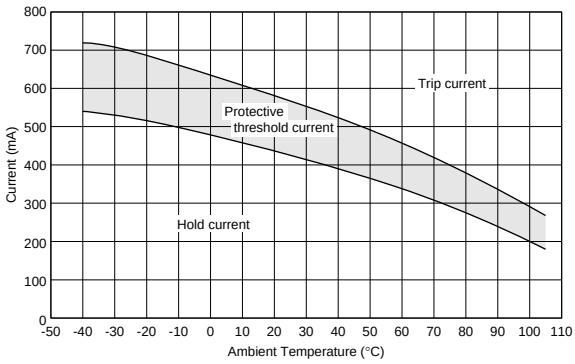
PTGL4SAS100K2B51B0



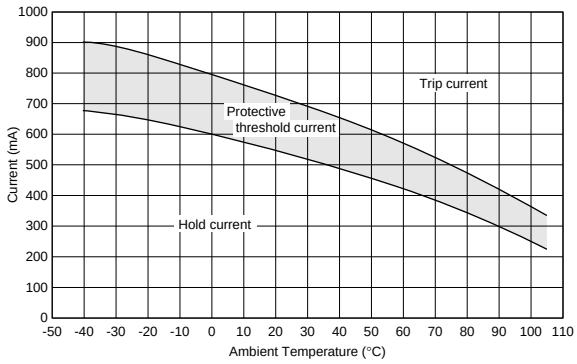
PTGL5SAS3R9K2B51B0



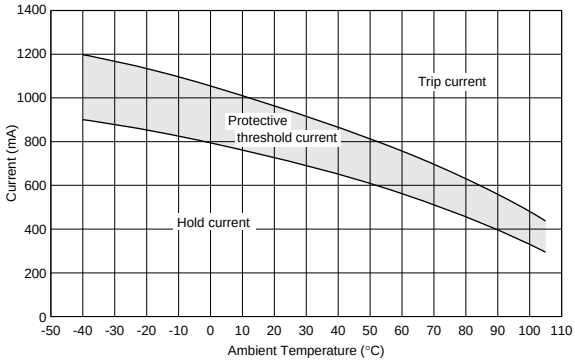
PTGL7SAS2R7K2B51B0



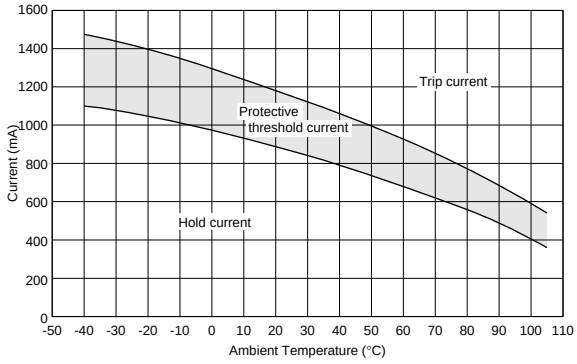
PTGL7SAS1R8K2B51B0



PTGL9SAS1R2K2B51B0

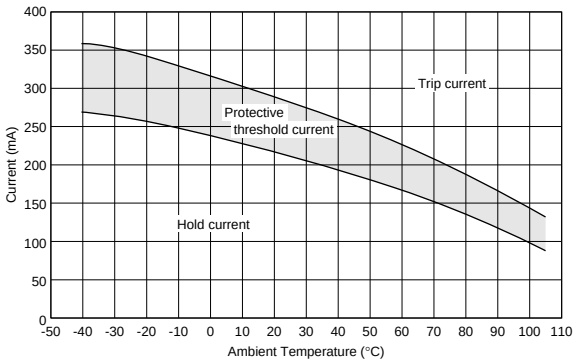


PTGLCSAS0R8K2B51B0

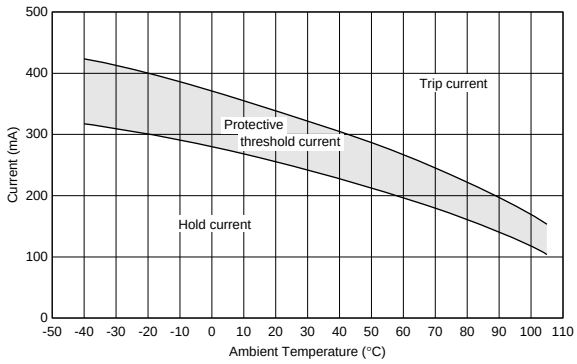


■ Protective Threshold Current Range (51V Series)

PTGL4SAS100K3B51B0



PTGL5SAS6R8K3B51B0

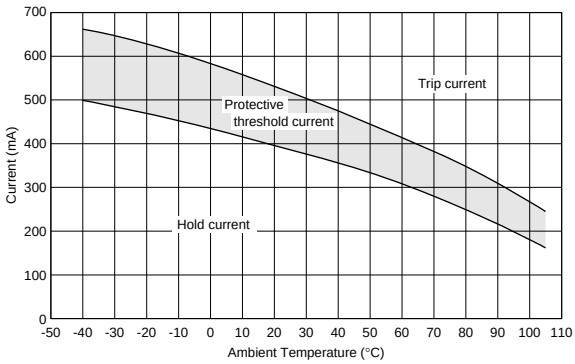


Continued on the following page.

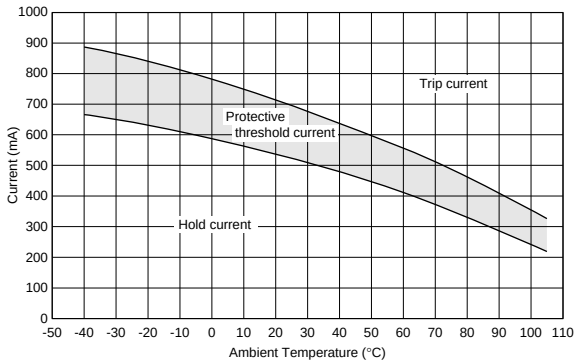
Continued from the preceding page.

■ Protective Threshold Current Range (51V Series)

PTGL7SAS3R3K3B51B0

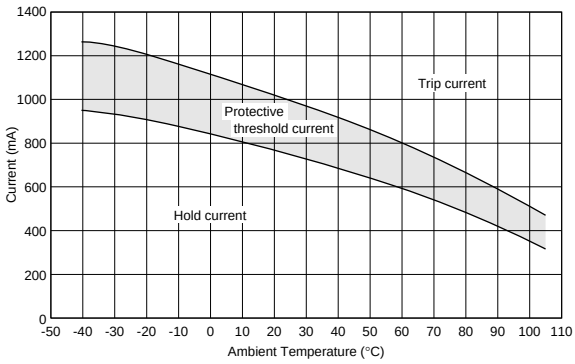


PTGL9SAS2R2K3B51B0

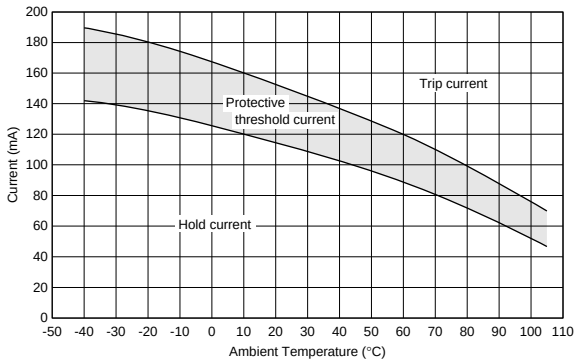


■ Protective Threshold Current Range (60V Series)

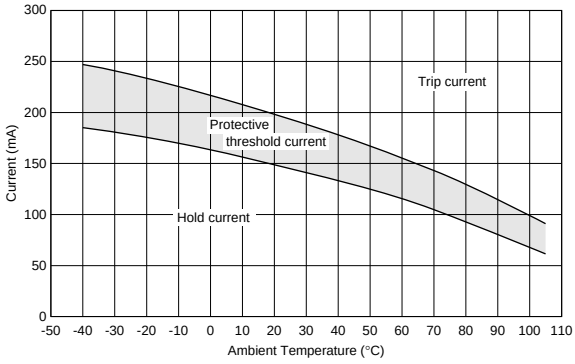
PTGLCSAS1R2K3B51B0



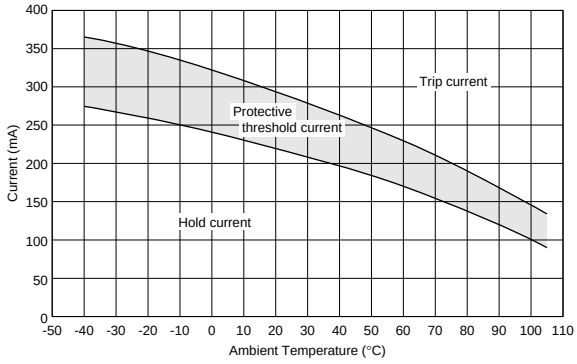
PTGL4SAS220K4N51B0



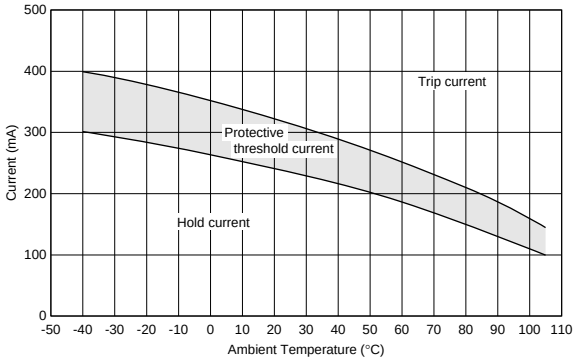
PTGL4SAS220K4B51B0



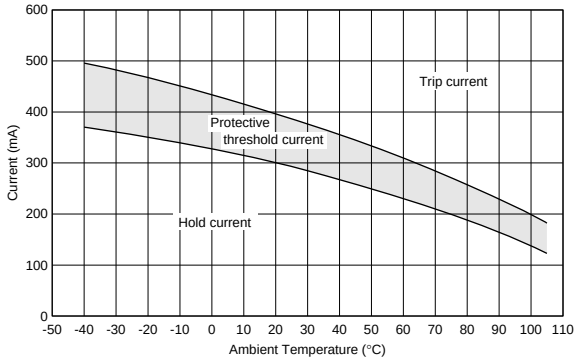
PTGL5SAS100K4B51B0



PTGL7SAS5R6K4N51B0



PTGL7SAS5R6K4B51B0



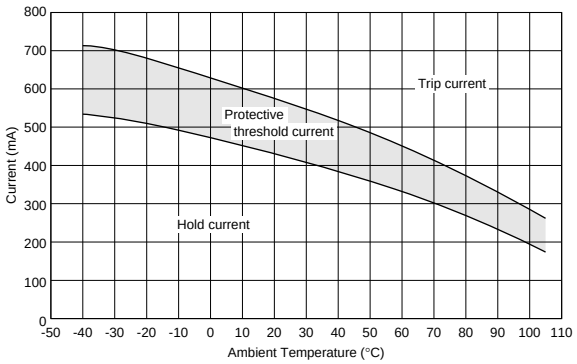
7

Continued on the following page.

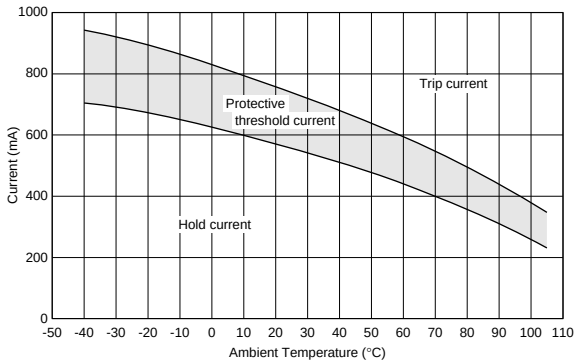
Continued from the preceding page.

■ Protective Threshold Current Range (60V Series)

PTGL9SAS3R3K4B51B0

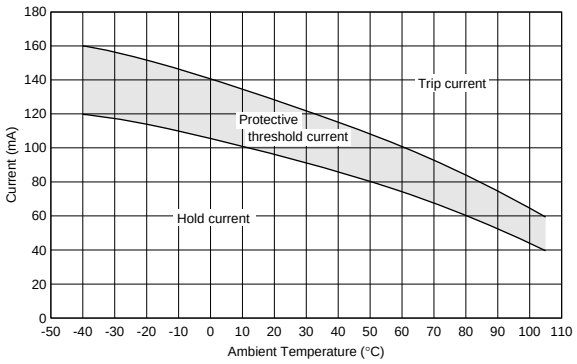


PTGLCSAS2R2K4B51B0

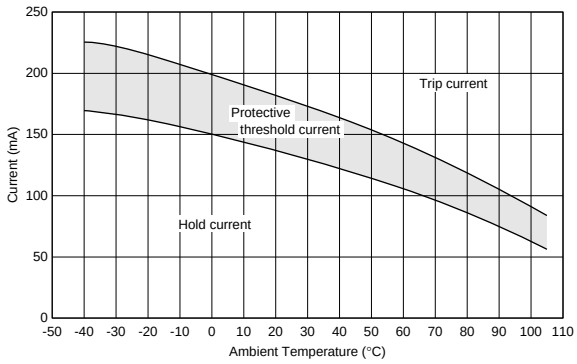


■ Protective Threshold Current Range (140V Series)

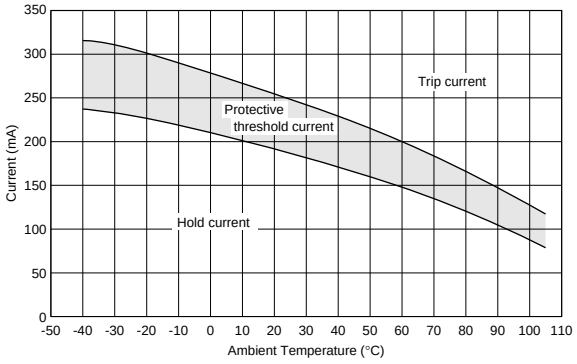
PTGL4SAS560K6B51B0



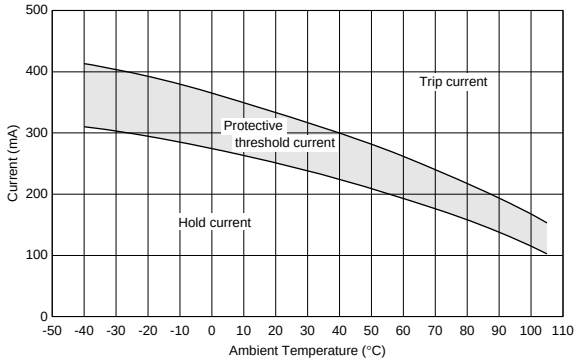
PTGL5SAS270K6B51B0



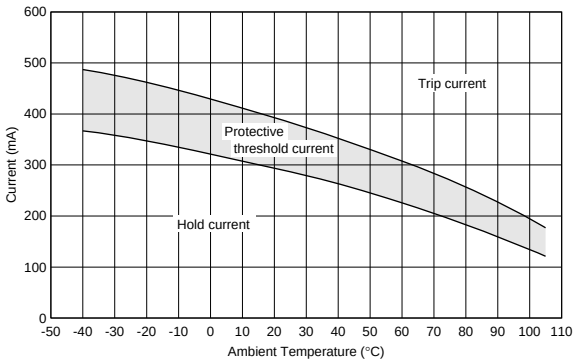
PTGL7SAS150K6B51B0



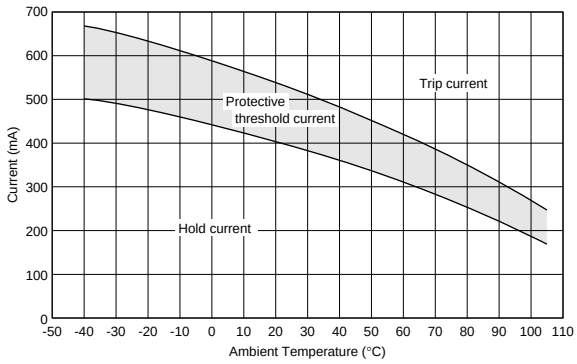
PTGL9SAS120K6B51B0



PTGL9SAS7R6K6B51B0



PTGLCSAS4R7K6B51B0



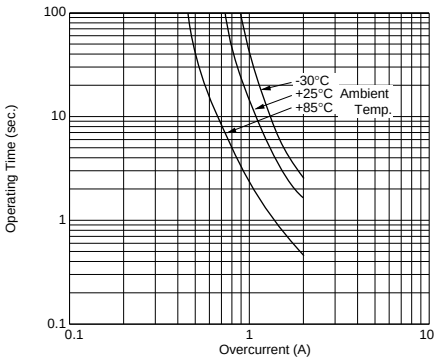
7

Continued on the following page.

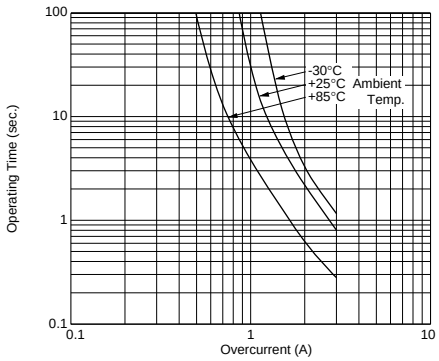
Continued from the preceding page.

■ Operating Time (Typical Curve) (16V Series)

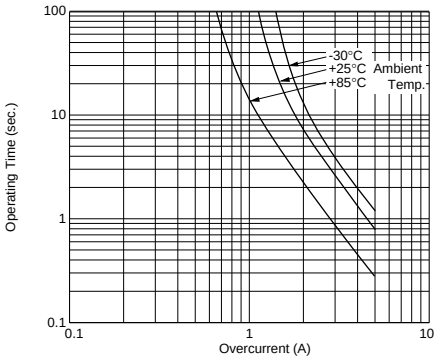
PTGL5SAR1R0M1B51B0



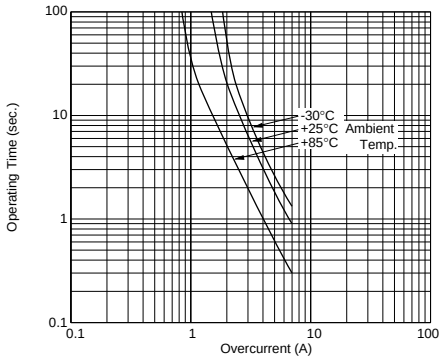
PTGL6SAR0R8M1B51B0



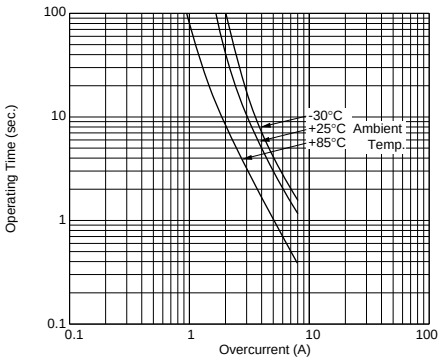
PTGL7SARR47M1B51B0



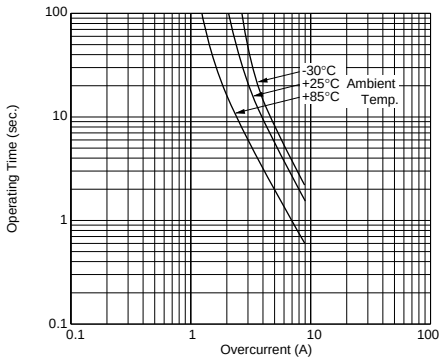
PTGL9SARR33M1B51B0



PTGLASARR27M1B51B0

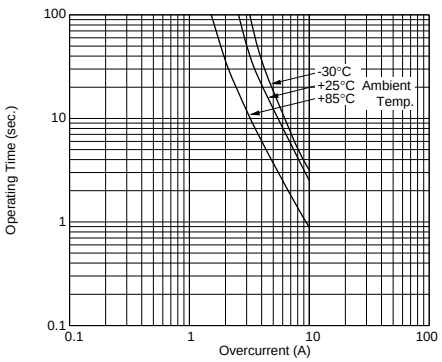


PTGLCSAR0R2M1B51B0

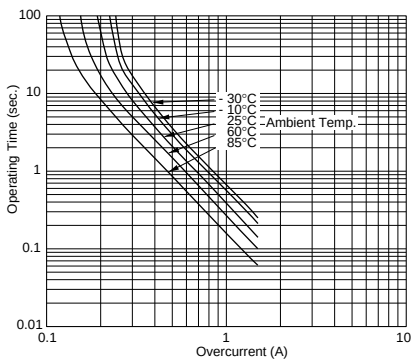


■ Operating Time (Typical Curve) (30V Series)

PTGLESARR15M1B51B0



PTGL4SAS100K2N51B0

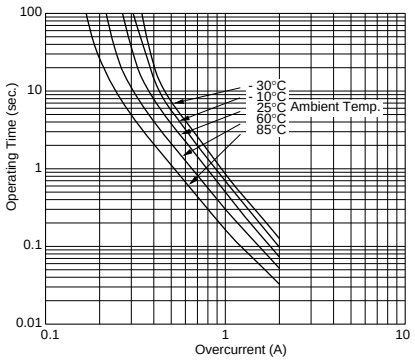


Continued on the following page.

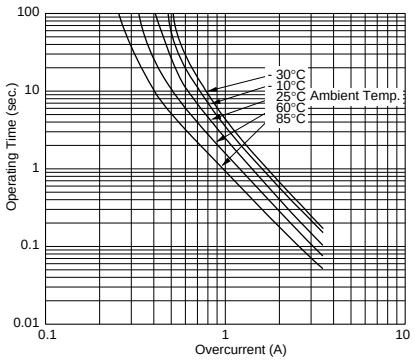
Continued from the preceding page.

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

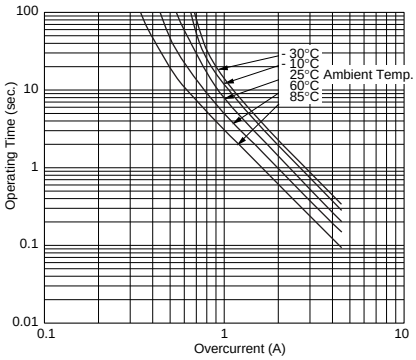
PTGL4SAS100K2B51B0



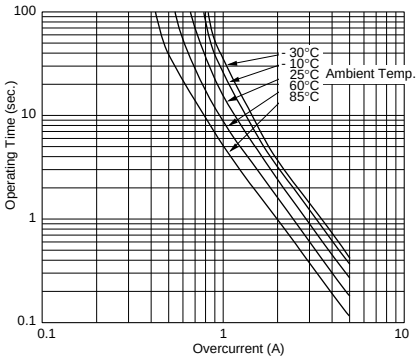
PTGL5SAS3R9K2B51B0



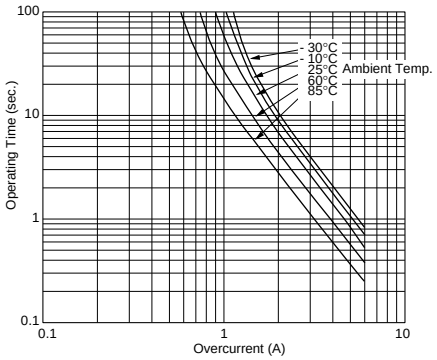
PTGL7SAS2R7K2B51B0



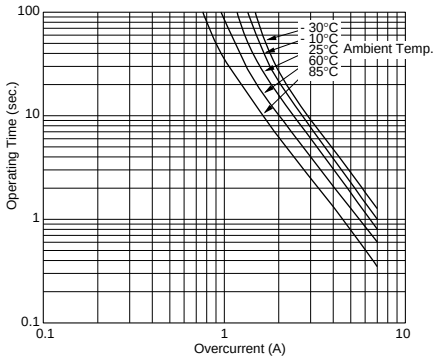
PTGL7SAS1R8K2B51B0



PTGL9SAS1R2K2B51B0

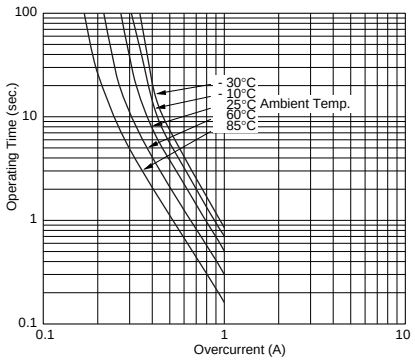


PTGLCSAS0R8K2B51B0

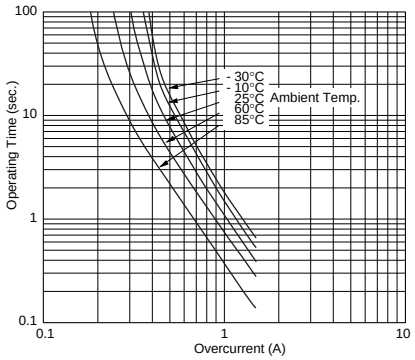


■ Operating Time (Typical Curve) (51V Series)

PTGL4SAS100K3B51B0



PTGL5SAS6R8K3B51B0



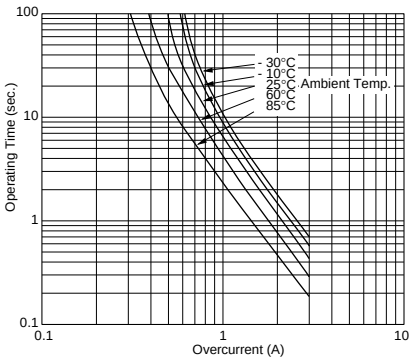
Continued on the following page.

7

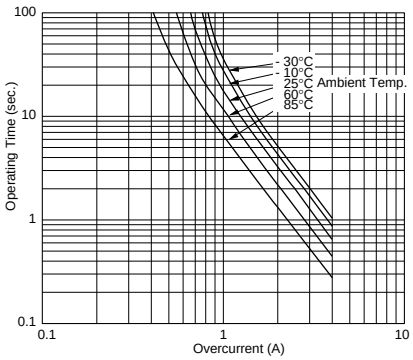
Continued from the preceding page.

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

PTGL7SAS3R3K3B51B0

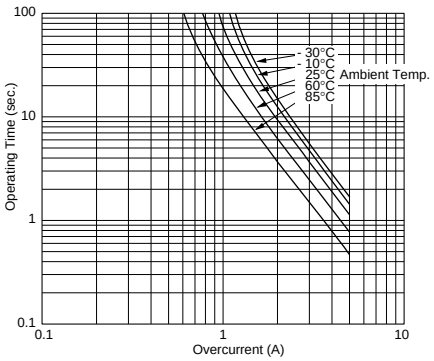


PTGL9SAS2R2K3B51B0

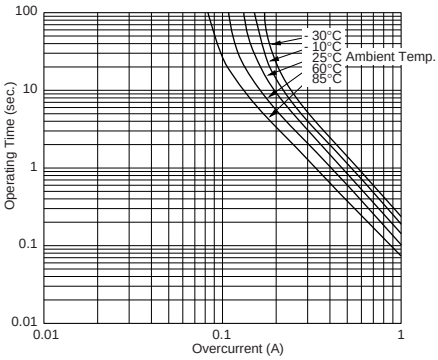


■ Operating Time (Typical Curve) (60V Series)

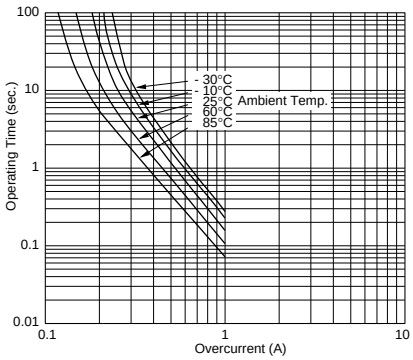
PTGLCSAS1R2K3B51B0



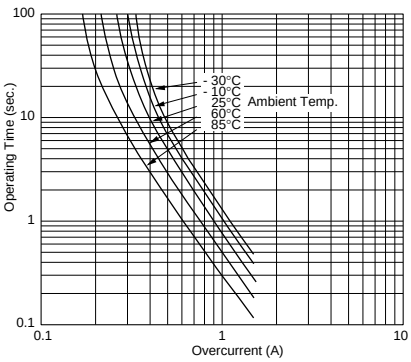
PTGL4SAS220K4N51B0



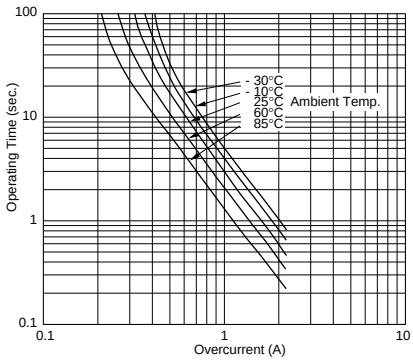
PTGL4SAS220K4B51B0



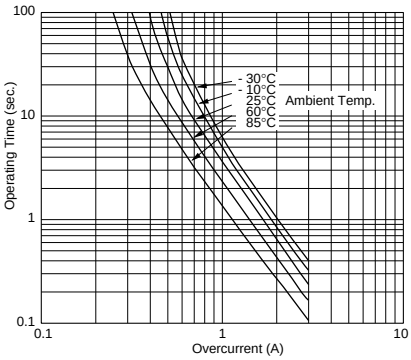
PTGL5SAS100K4B51B0



PTGL7SAS5R6K4N51B0



PTGL7SAS5R6K4B51B0



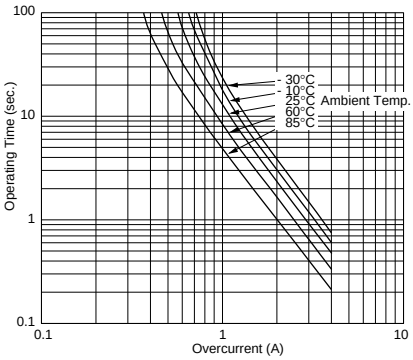
7

Continued on the following page.

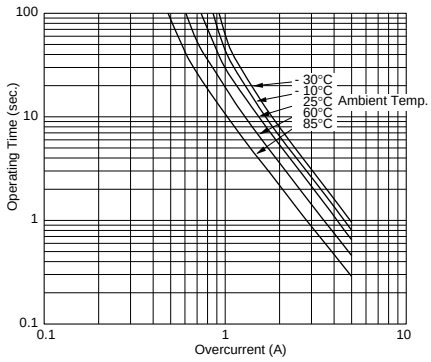
Continued from the preceding page.

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

PTGL9SAS3R3K4B51B0

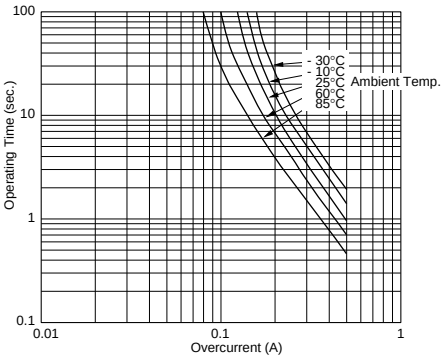


PTGLCSAS2R2K4B51B0

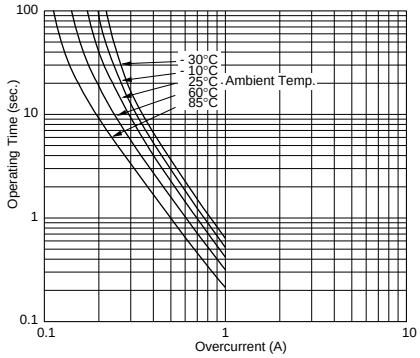


■ Operating Time (Typical Curve) (140V Series)

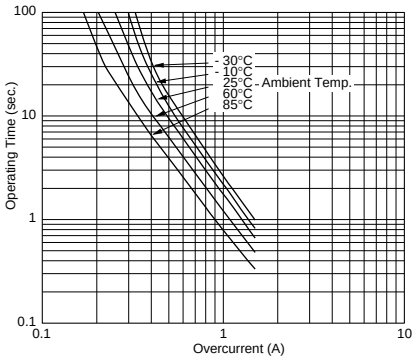
PTGL4SAS560K6B51B0



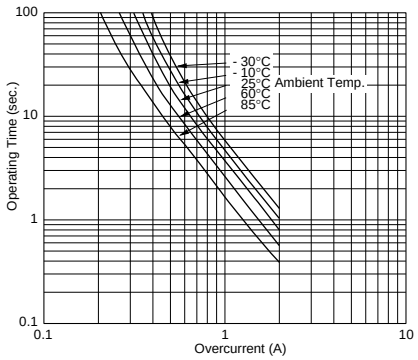
PTGL5SAS270K6B51B0



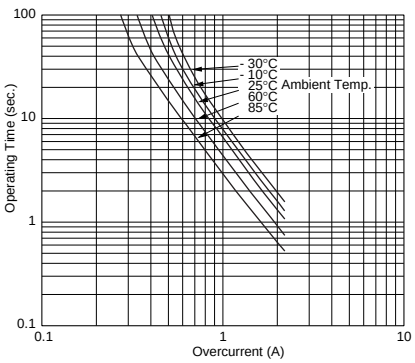
PTGL7SAS150K6B51B0



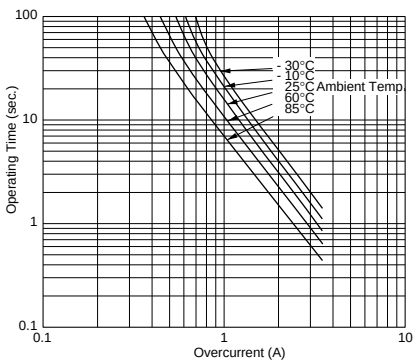
PTGL9SAS120K6B51B0



PTGL9SAS7R6K6B51B0



PTGLCSAS4R7K6B51B0



POSISTOR® Lead Type for Overheat Protection Specifications and Test Methods

■16V Series

No.	Item	Rating Value	Method of Examination
1	Operating Temperature	-30 to +85°C	The temperature range with maximum voltage applied to the 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. (But it must be measured after maximum voltage is applied 180 seconds and then is left for 2 hours at 25°C.)
3	Withstanding Voltage	No problem	We apply AC voltage 110% that of the maximum voltage to POSISTOR® by raising voltage gradually for 180±5 seconds at 25°C. (A protective resistor is to be connected in series, and the inrush current through POSISTOR® must be limited below maximum rated value.)
4	Protective Threshold Current	Satisfies ratings (Trip Current, Non-operating Current)	Maximum current measured in this examination. Voltage is applied to POSISTOR® in 3 minutes step by step on 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 POSISTOR® until the force of 4.9N in the axial direction with fixing POSISTOR®'s body itself and this load is being kept for 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 wire with 2.45N in the axial direction of the lead wire. The lead wire is slowly bent toward 90° and returned; then it is slowly bent in the 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 gap in the axial direction.	The lead wire of POSISTOR® is soaked in a Isopropyl Alcohol (JIS K 8839) solution (about 25wt%) of colophony (JIS K 5902) for 5-10 seconds. And, each lead wire is soaked in molten solder (JIS Z 3282 H60A) at 235±5°C from the bottom to a 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 (JIS Z 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±4 hours, the resistance is measured.
9	Heat Resistant	ΔR/R25≦±20% No damage about marking	At 85±3°C chamber, POSISTOR® is applied max. voltage for 1.5 hr on and 0.5 hr off. This cycle is repeated for 500±10 hours, and after the device is left at room temperature (25°C) 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 below 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°C and 90% to 95% humidity, for 500±4 hours. And, after the device is left at room temperature (25°C) for 1 hour, the resistance measurement is performed.

POSISTOR® Lead Type for Overheat Protection Specifications and Test Methods

■30-140V Series

No.	Item	Rating Value	Method of Examination
1	Operating Temperature 1	-30 to +125°C	The temperature range with maximum voltage applied to the POSISTOR®.
2	Operating Temperature 2	-40 to +125°C	The temperature range with following voltage applied to the POSISTOR®. <applied voltage> 30V and 51V series: max. 16V, 60V series: max. 30V, 140V 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. (But it must be measured after it is applied maximum voltage for 180 seconds and then is left for 2 hours at 25°C.)
4	Withstanding Voltage	No problem	We apply AC voltage 120% that of the maximum voltage to POSISTOR® by raising voltage gradually for 180±5 seconds at 25°C. (A protective resistor is to be connected in series, and the inrush current through POSISTOR® must be limited below max. rated value.)
5	Protective Threshold Current	Satisfies ratings (Trip Current, Non-operating Current)	Maximum current measured in this examination. Voltage is applied to POSISTOR® in 3 minutes step by step on still air based on "Protective Threshold Current Test Conditions" shown in next 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 POSISTOR® until the force of 4.9N in the axial direction with fixing POSISTOR®'s body itself and this load is being kept for 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 wire with 2.45N in the axial direction of the lead wire. The lead wire is slowly bent toward 90° and returned; then it is slowly bent in the 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 gap in the axial direction.	The lead wire of POSISTOR® is soaked in a Isopropyl Alcohol (JIS K 8839) solution (about 25wt%) of colophony (JIS K 5902) for 5-10 sec. And, each lead wire is soaked in molten solder (JIS Z 3282 H60A) at 235±5°C from the bottom to a point of 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 (JIS Z 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±4 hours, the resistance is measured.
10	Vibration Resistant	ΔR/R25≦±20%	Acceleration: 98m/s² (10G) Width: 1.5mm Vibration: 10-500-10Hz Vibrate for 11minutes × 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±3°C for 1000±12 hours. After the device is left at room temperature (25°C) for one hour, the resistance measurement is performed.
12	Cold Resistant	ΔR/R25≦±20%	POSISTOR® is set in an environmental chamber at -40±3°C for 1000±12 hours. After the device is left at room temperature (25°C) for one hour, the resistance measurement is performed.
13	Resistance to Damp Heat	ΔR/R25≦±20%	POSISTOR® is set in an environmental chamber at 85±3°C and 80-85% humidity for 1000±12 hours. After the device is left at room temperature (25°C) for one hour, the resistance measurement is performed.

Continued on the following page.

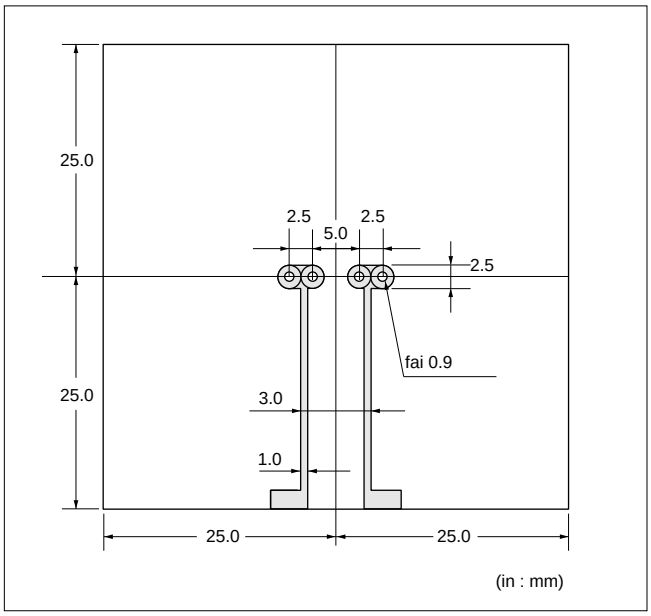
POSISTOR® Lead Type for Overheat Protection Specifications and Test Methods

Continued from the preceding page.

■ Protective Threshold current test conditions

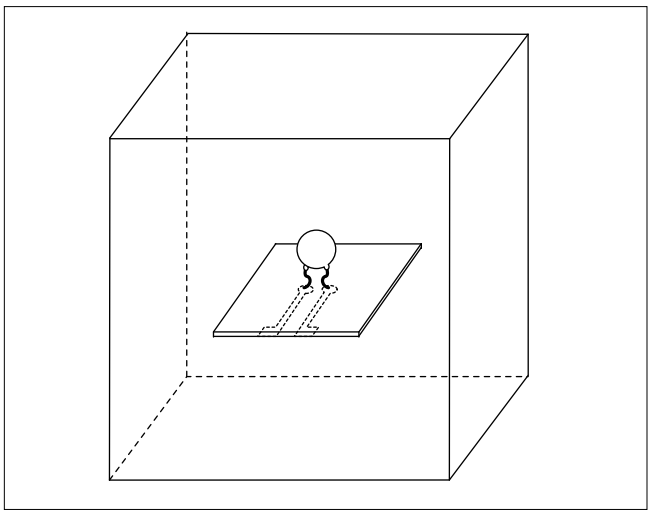
(1) Substrate

Materials: Phenol
Size: 50x50xt1.6mm
Land Pattern: Cu land without through hole

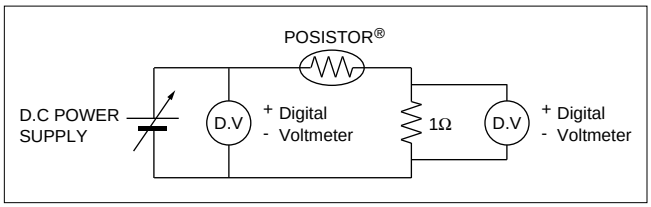


(2) Measurement condition

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



(3) Measurement circuit



7

POSISTOR® Lead Type for Overheat Protection ⚠Caution/Notice

■ ⚠Caution (Storage and Operating Condition)

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 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 Condition)

To keep solderability of product from declining, following storage condition is recommended.

1. Storage condition:
   Temperature -10 to +40 degrees 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)

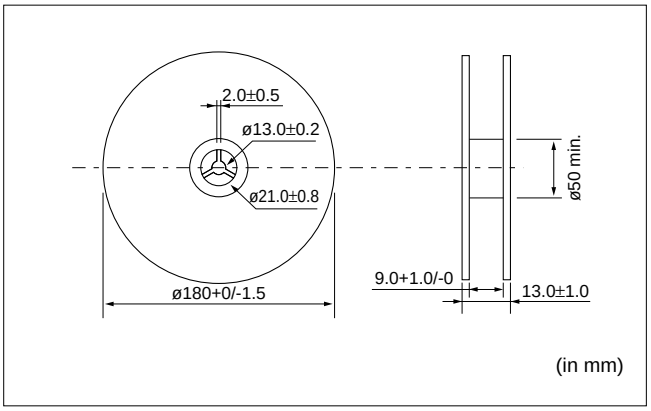
1. Do not apply an excessive force to the lead. Otherwise, it may cause the junction between lead and element to break, or may crack the element. Therefore, holding the element side lead wire is recommended when lead wire is bent or cut.
2. This product does not have waterproof construction. Splashed water may cause failure mode such as decline of characteristics or current leak.
3. When this product is operated, temperature of some areas may be over 100 to 160 degrees 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.

■ Minimum Quantity Guide

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

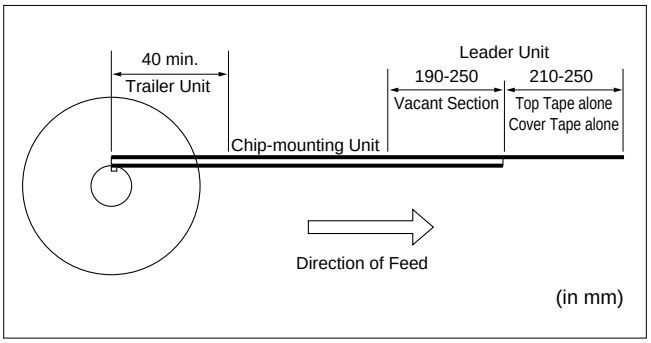
■ Tape Carrier Packaging

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 packed in a package.



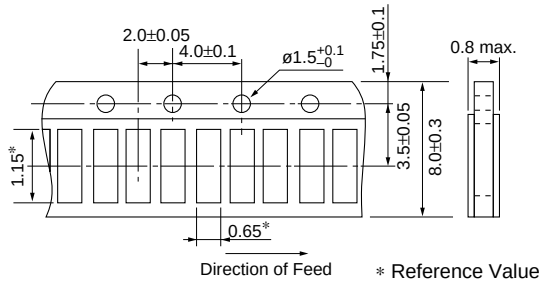
Continued on the following page.

For NTC Thermistors Chip Type Package

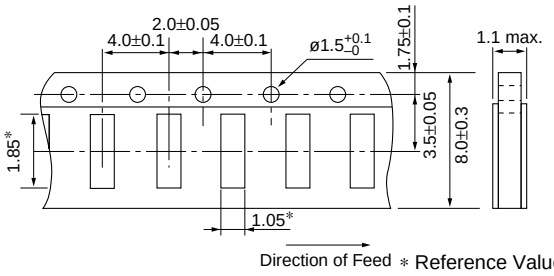
Continued from the preceding page.

3. Paper Tape

NCP15 Series
8mm Width 2mm Pitch Tape



NCP18/NCG18 Series
8mm Width 4mm Pitch Tape



(in mm)

(1) Other Conditions

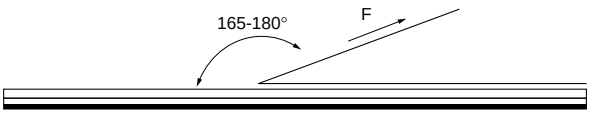
① Packaging

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 degree against the fixed surface of tape.
Peeling Speed: 300mm/min.
Peeling Force: 0.1 - 0.6N

(3) Pull Strength

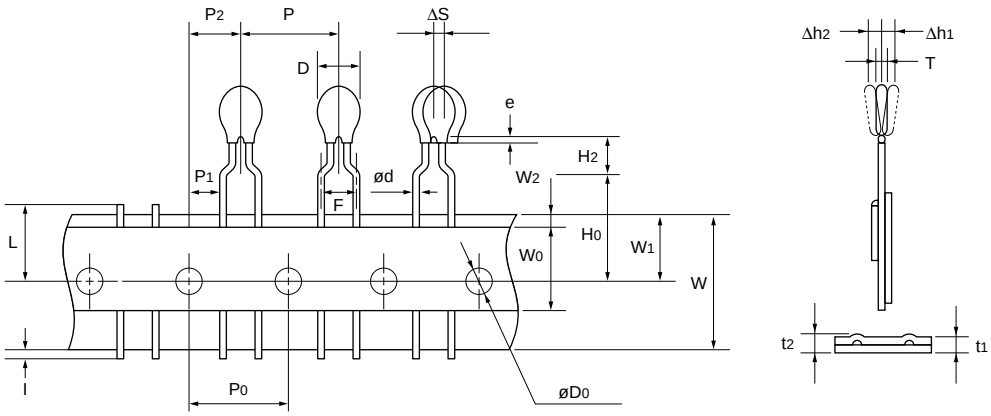
Pull strength of top tape is specified at 10N minimum.
Pull strength of bottom tape shall be specified 5N minimum.

For NTC Thermistors Lead Type Package

■ Minimum Quantity Guide

Part Number	Minimum Quantity (pcs.)	
	Taping (Ammo Pack)	Bulk
NTSS	3000	500

■ Taping Dimension (NTSS_N6A0 Series)



Item	Code	Dimension (mm)
Pitch of Component	P	12.7
Pitch of Sprocket Hole	P_0	12.7±0.3
Lead Spacing	F	5.0+0.8/–0.2
Length from Hole Center to Component Center	P_2	6.35±1.3
Length from Hole Center to Lead	P_1	3.85±0.8
Body Diameter	D	3.5 max.
Deviation along Tape, Left or Right Defect	ΔS	0±2.0
Carrier Tape Width	W	18.0±0.5
Position of Sprocket Hole	W_1	9.0±0.5
Lead Distance between Reference and Bottom Planes	H_0	16.0±1.0
Height of Component	H_2	4.0 max.
Protrusion Length	I	+0.5 to –1.0
Diameter of Sprocket Hole	D_0	4.0±0.1
Lead Diameter	d	0.50±0.03
Total Tape Thickness	t_1	0.6±0.3
Total Thickness, Tape and Lead Wire	t_2	1.6 max.
Deviation across Tape	Δh_1, Δh_2	1.0 max.
Portion to Cut in Case of Defect	L	11.0+0/–2.0
Hole Down Tape Width	W_0	11.0 min.
Hole Down Tape Position	W_2	1.5±1.5
Coating Extension on Lead	e	Up to the crimp point
Body Thickness	T	2.6 max.

(in mm)

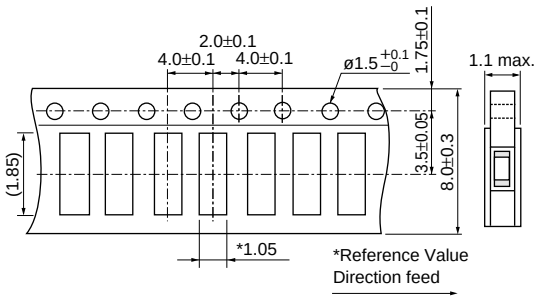
For POSISTOR® Chip Type Package

■ Minimum Quantity Guide

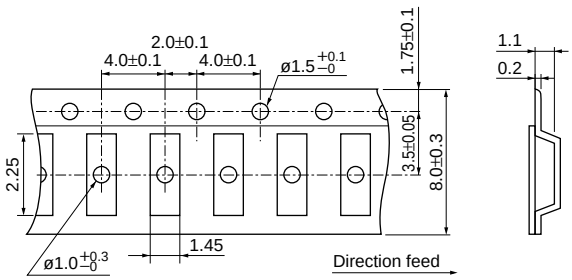
Part Number	Quantity (pcs.)	
	Paper Tape	Embossed Tape
PR*18_RB	4000	-
PR*21_RA	-	4000
PR*21_RK	-	3000

■ Tape Dimensions

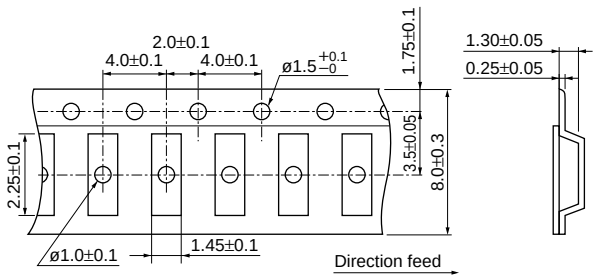
PR*18_RB Series: Paper Tape



PR*21_RA Series: Embossed Tape

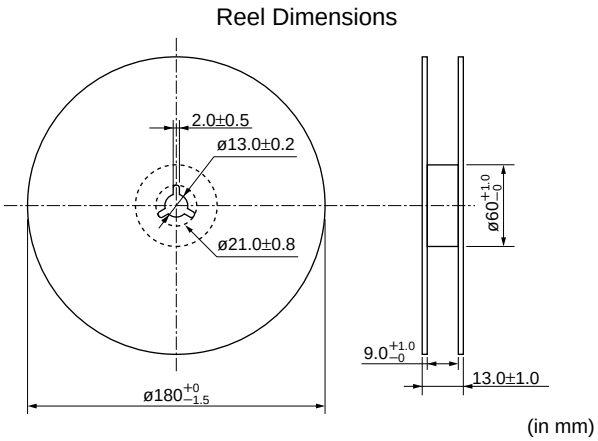


PR*21_RK Series: Embossed Tape



(in mm)

■ Reel Dimensions

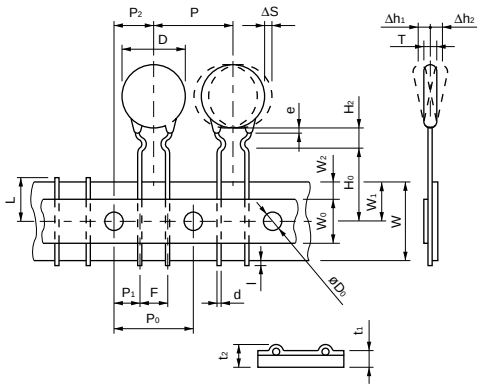


For POSISTOR® Lead Type Package

■ Minimum Quantity Guide

Part Number		Minimum Quantity (pcs.)	
		Taping (Ammo Pack)	Bulk
16V Series	**PTGL5 to 9**	2000	500
	PTGLA,C,E	2000	300
30 to 140V Series	**PTGL4 to 9**	1500	500
	PTGLC	1500	300

■ Taping Dimension (PTGL_A0 Series)



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 otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems 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 export.
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 reliability 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 than those 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 November 2008. They are subject to change or our products in it may be discontinued without advance notice. Please check with 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 approve our product specifications or transact the approval 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 our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.
7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

Murata Manufacturing Co., Ltd.

http://www.murata.com/

Head Office
1-10-1, Higashi Kotari, Nagaokakyo-shi, Kyoto 617-8555, Japan
Phone: 81-75-951-9111

International Division
3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan
Phone: 81-3-5469-6123 Fax: 81-3-5469-6155 E-mail: intl@murata.co.jp