



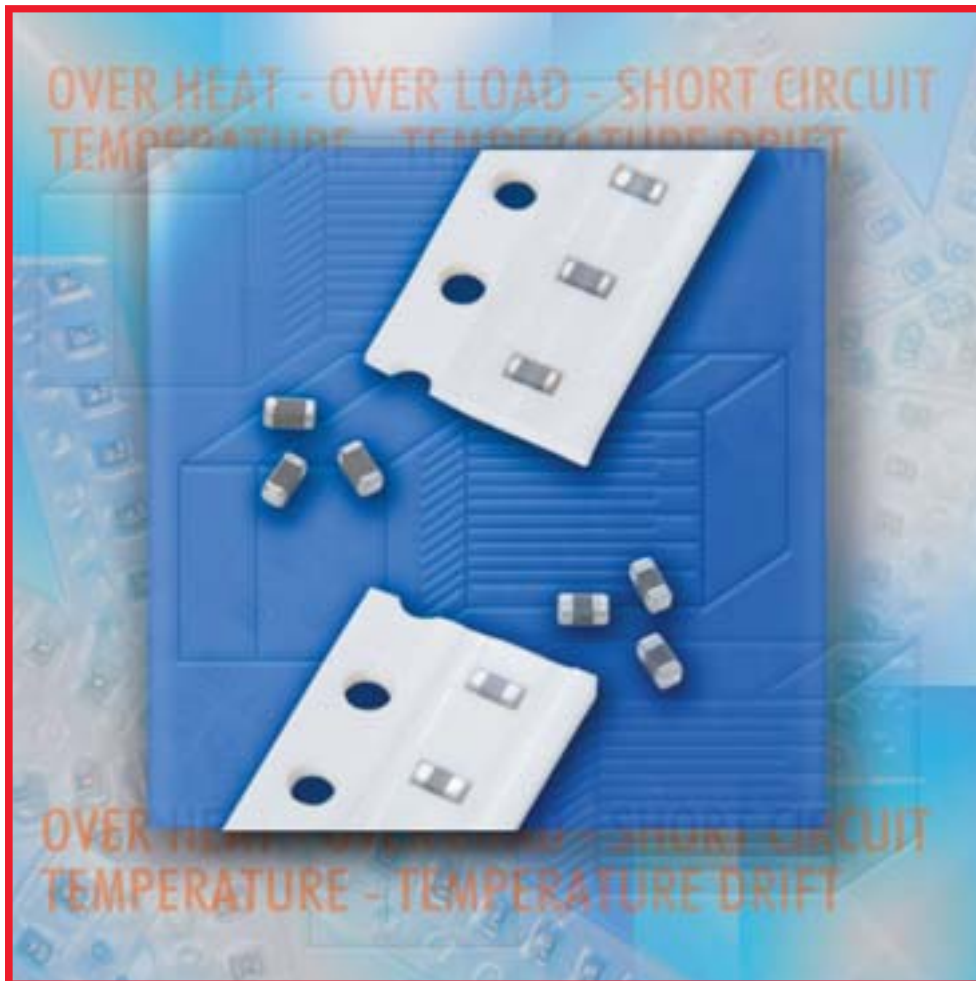
**THE DATASHEET OF  
NCP15WB473E03RC**



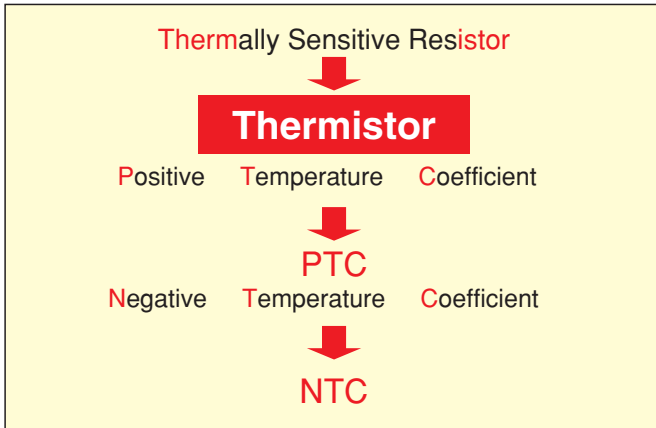
## **PTC - NTC** **for Surface Mounting** **Application**

**muRata**

*Innovator in Electronics*



## What is a Thermistor?



### Characteristics of Thermistors

Resistance - Temperature Characteristics

**PTC Thermistor (POSISTOR®)**  
 $BaTiO_3 + X$   
 Ceramics

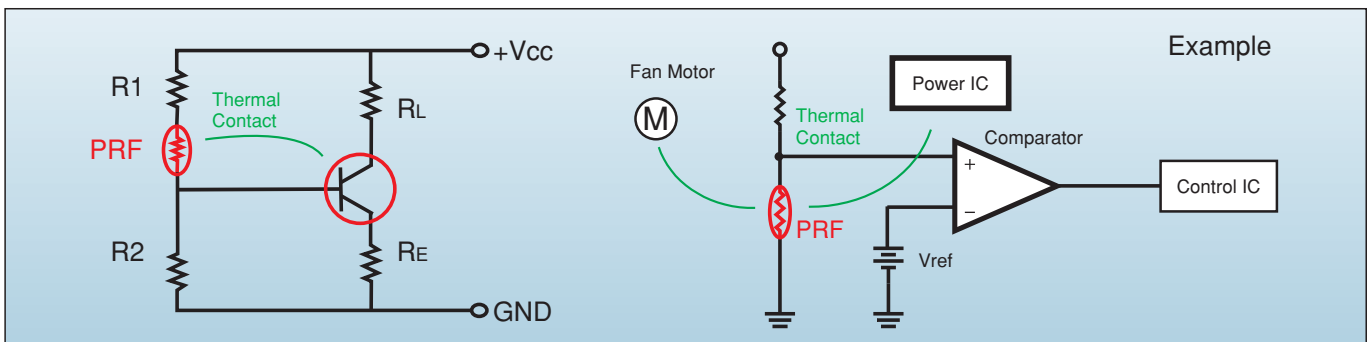
**NTC Thermistor**  
 $Mn-Ni, Mn-Co-Cu, Mn-Ni + X$   
 Ceramics

## PRF15/18 Series Chip POSISTOR® for Overheat Sensing

PRF15/18 PTC Chip Thermistors detect overheating of Hybrid ICs, Power Transistors, Power Diodes and Power ICs etc.

1. 0402 and 0603 light weight
2. High gain simplifies circuit design

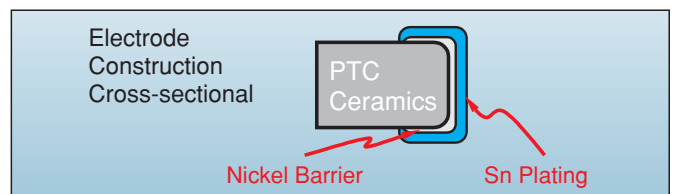
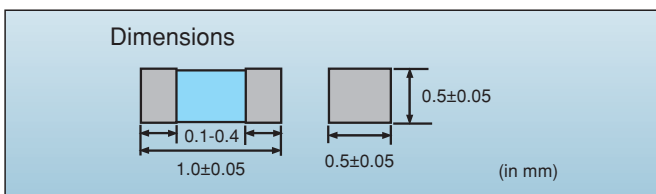
3. Free of contact noise and problems
4. Pb free plated terminations
5. Sturdy construction resists mechanical vibration and shock.
6. PRF18xxx5RB series is available for Reflow/Flow soldering.



## PRF15 Series Characteristics



Part Number	Sensing Temperature (at 100k ohm) (°C)	Sensing Temperature (at 10k ohm) (°C)	Max. Voltage (V)	Resistance (at 25°C) (ohm)	Operating Temp. (°C)
PRF15BA102RB6RC	140 ±3°C	125 ±5°C	32	1k ±50%	-20 to 150
PRF15BB102RB6RC	130 ±3°C	115 ±5°C	32	1k ±50%	-20 to 140
PRF15BC102RB6RC	120 ±3°C	105 ±5°C	32	1k ±50%	-20 to 130
PRF15BD102RB6RC	110 ±3°C	95 ±5°C	32	1k ±50%	-20 to 120
PRF15BE102RB6RC	100 ±3°C	85 ±5°C	32	1k ±50%	-20 to 110
PRF15BF102RB6RC	90 ±3°C	75 ±5°C	32	1k ±50%	-20 to 100
PRF15BG102RB6RC	80 ±3°C	65 ±5°C	32	1k ±50%	-20 to 90



## PRF18 Series Characteristics

Part Number	Sensing Temperature (at 4.7k ohm) (°C)	Sensing Temperature (at 47k ohm) (°C)	Maximum Voltage (V)	Resistance (at 25°C) (ohm)	Operating Temperature Range (°C)
PRF18BG471QB5RB	65 ±5°C	80 ±7°C	32	470 ±50%	-20 to 90
PRF18BF471QB5RB	75 ±5°C	90 ±7°C	32	470 ±50%	-20 to 100
PRF18BE471QB5RB	85 ±5°C	100 ±7°C	32	470 ±50%	-20 to 110
PRF18BD471QB5RB	95 ±5°C	110 ±7°C	32	470 ±50%	-20 to 120
PRF18BC471QB5RB	105 ±5°C	120 ±7°C	32	470 ±50%	-20 to 130
PRF18BB471QB5RB	115 ±5°C	130 ±7°C	32	470 ±50%	-20 to 140
PRF18BA471QB5RB	125 ±5°C	140 ±7°C	32	470 ±50%	-20 to 150
PRF18AR471QB5RB	135 ±5°C	150 ±7°C	32	470 ±50%	-20 to 160
PRF18AS471QB5RB	145 ±5°C	-	32	470 ±50%	-20 to 160

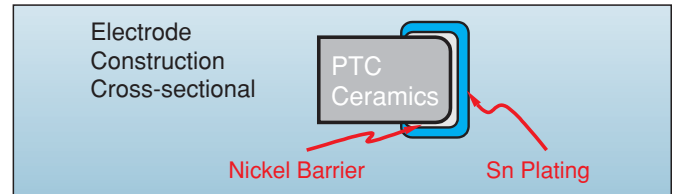
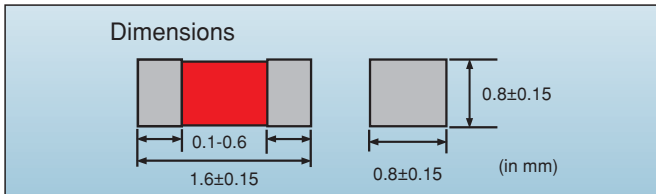
### Chip Tight Tolerance Type

Part Number	Sensing Temperature (at 4.7k ohm) (°C)	Maximum Voltage (V)	Resistance (at 25°C) (ohm)	Operating Temperature Range (°C)
PRF18BG471RB5RB	65 ±3°C	32	470 ±50%	-20 to 80
PRF18BF471RB5RB	75 ±3°C	32	470 ±50%	-20 to 90
PRF18BE471RB5RB	85 ±3°C	32	470 ±50%	-20 to 100
PRF18BD471RB5RB	95 ±3°C	32	470 ±50%	-20 to 110
PRF18BC471RB5RB	105 ±3°C	32	470 ±50%	-20 to 120
PRF18BB471RB5RB	115 ±3°C	32	470 ±50%	-20 to 130

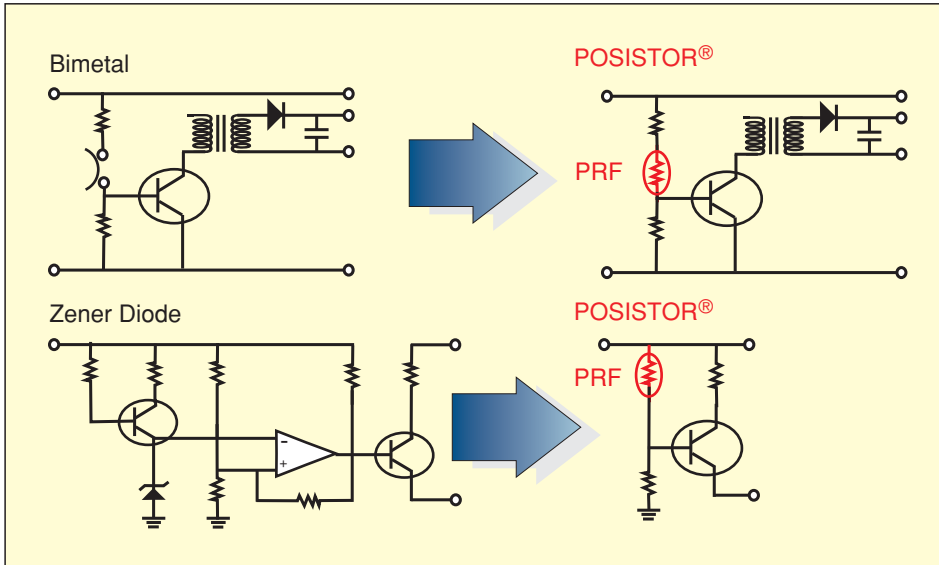
This product is applied to flow/reflow soldering. This product is recognized by UL.

Part Number	Sensing Temperature (at 4.7k ohm) (°C)	Maximum Voltage (V)	Resistance (at +25°C) (ohm)	Operating Temperature Range (°C)
PRF18BA103QB1RB	130 ±5°C	32	10k ±50%	-20 to 140

Low Current Consumption!



## Circuit Examples



The POSISTOR® has the following advantages over Bimetal devices.

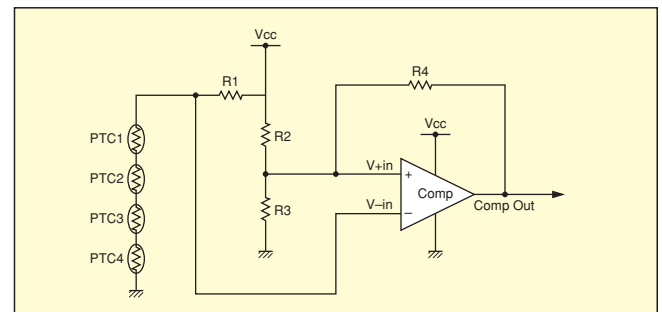
1. Noise free
2. No contact problems
3. Low price

The POSISTOR® has the following additional advantages over Zener Diodes.

1. Reduced numbers of parts used in circuits
2. Reduced process costs of mounting parts on PCBs
3. Reduces occupied space, helping high density PCB mounting

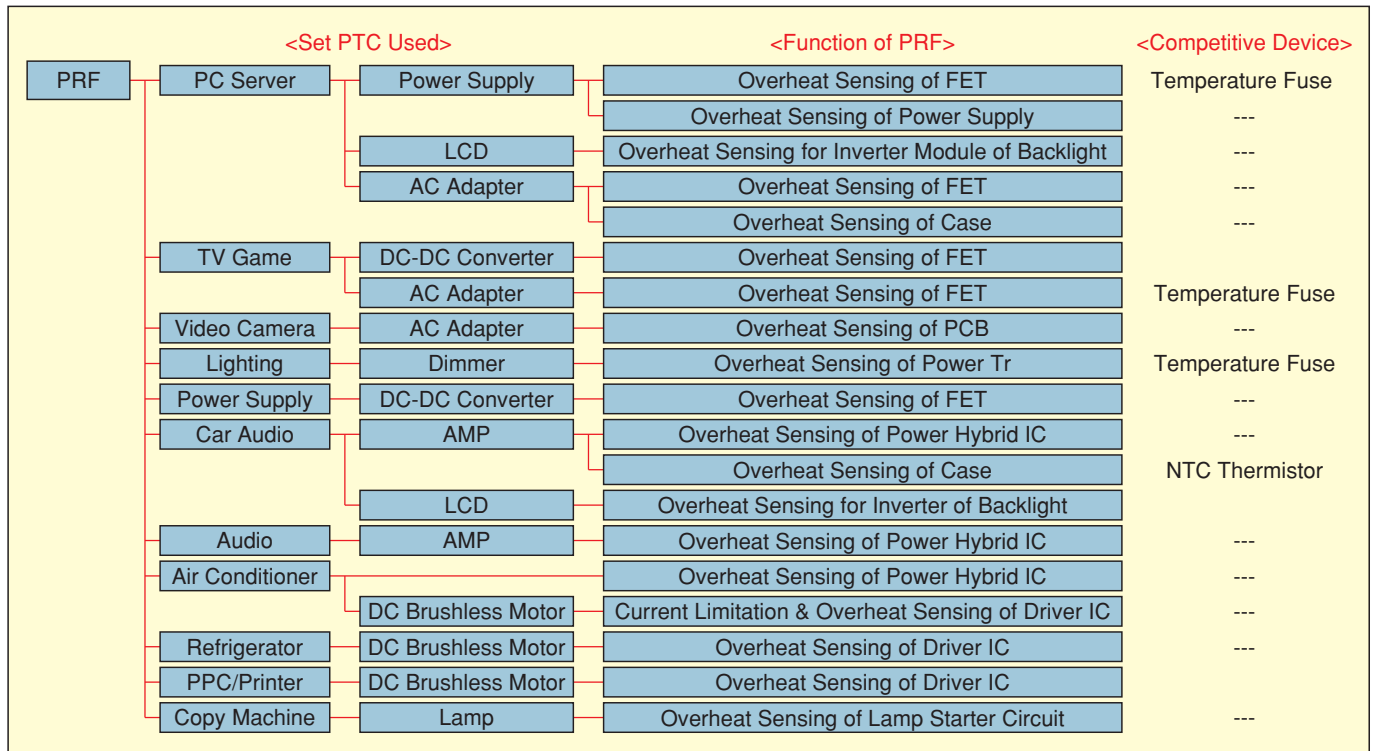
	Zener Diode		POSISTOR®	
Mounting Area	10x10 = 100mm <sup>2</sup>		6x6 = 36mm <sup>2</sup>	
Parts	Parts	UPS	Parts	UPS
	Diode	1	POSISTOR®	1
	Transistor	2	Transistor	1
	Resistor	7	Resistor	2
	Op. Amp.	1	Op. Amp.	0
	<b>Total</b>	<b>11</b>	<b>Total</b>	<b>4</b>

More than two pieces of POSISTOR® can cover multi hot spots working with a comparator. Fig. shows basic circuit idea to connect multiple POSISTOR® in series. When One POSISTOR® detects overheat at least, a comparator can work by the sharp temperature-resistance characteristic. It easily allows changing a number of POSISTOR® or sensing temperature in the same basic circuit design.



Connection of multiple POSISTOR®

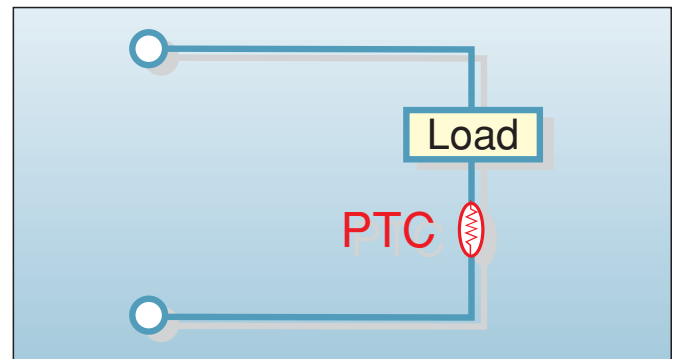
## Markets & Applications of Overheat Sensing



## PRG18/21 Series Chip POSISTOR® for Overcurrent Protection

Chip Thermistors prevent failure of apparatus due to excess current.

1. 0603 and 0805 light weight
2. High gain simplifies circuit design
3. Free of contact noise and problems
4. Pb free plated terminations
5. Sturdy construction resists mechanical vibration and shock.



## PRG Series Characteristics

Chip Type 0603 Size

Part Number	Max. Voltage (V)	Hold Current (at +60°C) (mA)	Hold Current (at +25°C) (mA)	Trip Current (at +25°C) (mA)	Trip Current (at -10°C) (mA)	Max. Current (mA)	Resistance (at +25°C) (ohm)
PRG18BB471MB1RB	24	7	10	21	25	60	470 ±20%
PRG18BB221MB1RB	24	10	14	29	35	130	220 ±20%
PRG18BB101MB1RB	24	15	21	45	55	300	100 ±20%
PRG18BB470MB1RB	24	20	29	61	75	630	47 ±20%
PRG18BB330MB1RB	24	25	36	71	85	900	33 ±20%
PRG18BC6R8MM1RB	20	80	120	260	320	3500	6.8 ±20%
PRG18BC4R7MM1RB	20	100	155	330	400	5000	4.7 ±20%
PRG18BC3R3MM1RB	12	120	180	400	480	4500	3.3 ±20%
PRG18BC2R2MM1RB	9	150	220	500	600	5000	2.2 ±20%
PRG18BC1R0MM1RB	6	220	330	740	850	7500	1.0 ±20%

## Chip Type 0805 Size

Part Number	Max. Voltage (V)	Hold Current (at +60°C) (mA)	Hold Current (at +25°C) (mA)	Trip Current (at +25°C) (mA)	Trip Current (at -10°C) (mA)	Max. Current (mA)	Resistance (at +25°C) (ohm)
PRG21BB220MB1RK	20	30	44	91	110	1100	22 ±20%
PRG21BB150MB1RK	20	40	59	116	140	1600	15 ±20%
PRG21BC6R8MM1RA	20	80	120	260	320	3500	6.8 ±20%
PRG21BC4R7MM1RA	20	100	155	330	400	5000	4.7 ±20%
PRG21BC3R3MM1RA	16	120	180	400	480	6000	3.3 ±20%
PRG21BC2R2MM1RA	12	150	220	500	600	6500	2.2 ±20%
PRG21BC1R0MM1RA	9	220	330	740	850	10000	1.0 ±20%
PRG21BC0R6MM1RA	6	285	420	920	1100	10000	0.6 ±20%
PRG21BC0R2MM1RA	6	500	750	1620	2000	10000	0.2 ±20%

Maximum Current shows typical capacities of the transformer which can be used. Please contact us for UL recognized products.

### Dimensions

	PRG18BB	PRG21BB	PRG21BC
L	1.6±0.15	2.0±0.2	2.0±0.2
W	0.8±0.15	1.25±0.2	1.25±0.2
T			0.9±0.2
e	0.1-0.6	0.2 min.	0.2 min.
b	-	0.5 min.	0.5 min.

(in mm)

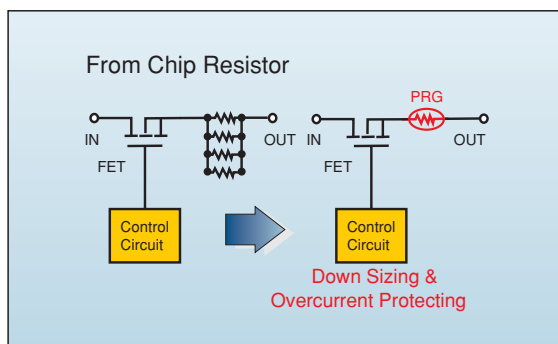
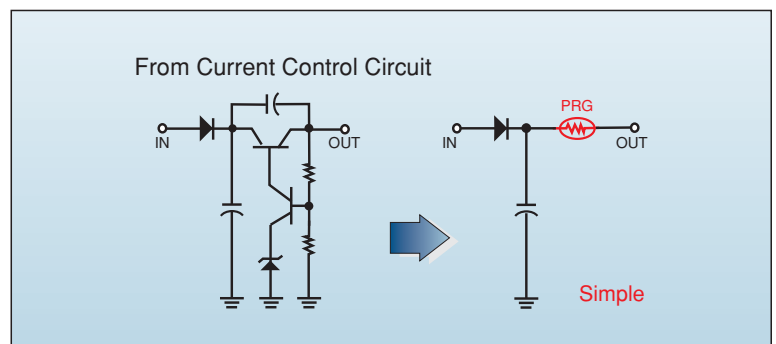
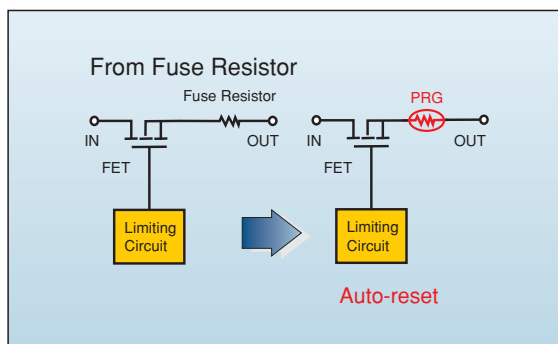
### Multilayer Chip POSISTOR® for Overcurrent Protection

PRG18/21BC Type

### Electrode Construction Cross-sectional

Data here are reference only. Specifications available upon request. Product to be evaluated, confirmed by the user before actual use. Description here may be revised without notice.

## POSISTOR® Ideas



Item	POSISTOR®	Fuse Resistor	Control Circuit	Chip Resistor
Safety	○	○	○	✗
Repeat	○	✗	○	✗
Space	○	○	✗	✗
Cost	△	△	✗	○

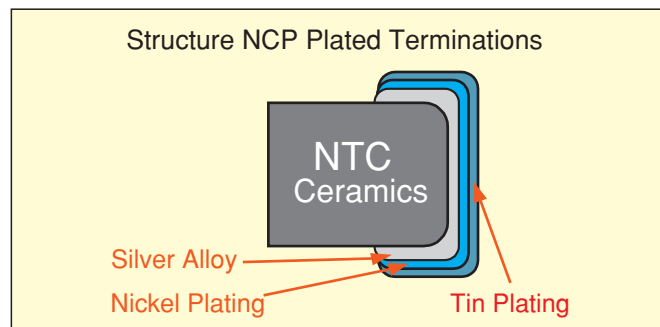
Key: Cross = Bad - Circle = Good - Triangle = Little difference

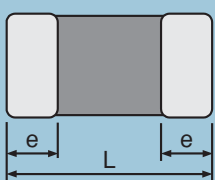
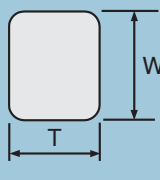
## Markets & Applications for Overcurrent Protection

<Product / Use>		<POSISTOR® Function>		<Competitive Devices>
PRG	Note PC PDA	Rechargeable Battery	Current Limitation & Overcurrent Protection for Trickle Charging Circuit	Chip Resistor
			Current Limitation & Overcurrent Protection for Control IC	Fuse Resistor Chip Resistor
		Mother Board et Al.	Short-circuit Protection for Signal Line	---
		LCD	Short-circuit Protection for LCD Drive Module	
	TV Game	DC-DC Converter	Overcurrent Protection	Circuit Using Tr
	Power Supply	DC-DC Converter	Overcurrent Protection for Output Circuit	Circuit Using Tr
	Car Audio	Signal Line	Overcurrent Protection	Leaded PTC
	Undefined	Optical Sensor	Short-circuit Protection for Optical Sensor Driver	---

## Chip NTC Thermistor NCP Series

1. A common relationship between Resistance and B constant in all sizes (0201/ 0402/ 0603/ 0805) offers convenience when downsizing.
2. No lead contained (Pb free).
3. Tight resistance tolerance of  $\pm 1\%$  (Code F) available on 10k ohm (0201, 0402, 0603), 47k ohm (0402, 0603) and 100k ohm (0201, 0402, 0603) products.
4. High soldering heat resistant
5. High humidity resistant due to unique inner electrodes.



Dimensions	NCP03 (0201 size)	NCP15 (0402 size)	NCP18 (0603 size)	NCP21 (0805 size)	
					
					
	L	0.60 $\pm$ 0.03	1.00 $\pm$ 0.05	1.60 $\pm$ 0.15	2.00 $\pm$ 0.20
	W	0.3 $\pm$ 0.03	0.50 $\pm$ 0.05	0.80 $\pm$ 0.15	1.25 $\pm$ 0.20
	T				0.85 $\pm$ 0.15
	e	0.10-0.20	0.15-0.35	0.20-0.60	0.20-0.70

(in mm)

## Line-up of Plated Termination

Resistance at 25°C	0201 size NCP03				0402 size NCP15			
	B-Constant	Part Number	B-Constant	Part Number	B-Constant	Part Number	B-Constant	Part Number
11 ohm	2750 K	NCP03YS110*	-	-	-	-	-	-
22 ohm	2750 K	NCP03YS220*	-	-	3100 K	NCP15XC220*	-	-
33 ohm	2750 K	NCP03YS330*	-	-	3100 K	NCP15XC330*	-	-
47 ohm	2750 K	NCP03YS470*	-	-	3100 K	NCP15XC470*	-	-
68 ohm	2750 K	NCP03YS680*	-	-	3100 K	NCP15XC680*	-	-
100 ohm	2750 K	NCP03YS101*	-	-	3250 K	NCP15XF101*	-	-
150 ohm	( 3100 K	NCP03XC151*	-	-	3250 K	NCP15XF151*	-	-
220 ohm	( 3100 K	NCP03XC221*	-	-	3500 K	NCP15XM221*	-	-
330 ohm	( 3100 K	NCP03XC331*	-	-	3500 K	NCP15XM331*	-	-
470 ohm	( 3100 K	NCP03XC471*	-	-	3650 K	NCP15XQ471*	-	-
680 ohm	( 3100 K	NCP03XC681*	-	-	3650 K	NCP15XQ681*	-	-
1.0k ohm	3500 K	NCP03XM102*	-	-	3650 K	NCP15XQ102*	-	-
1.5k ohm	3500 K	NCP03XM152*	-	-	3950 K	NCP15XW152*	-	-
2.2k ohm	3500 K	NCP03XM222*	-	-	3950 K	NCP15XW222*	-	-
3.3k ohm	3500 K	NCP03XM332*	-	-	3950 K	NCP15XW332*	-	-
4.7k ohm	3500 K	NCP03XM472*	-	-	3500 K	NCP15XM472*	-	-
6.8k ohm	3380 K	NCP03XH682*	-	-	3950 K	NCP15XW682*	-	-
10k ohm	3380 K	NCP03XH103*	3900 K	NCP03XV103*	3380 K	NCP15XH103*	3900 K	NCP15XV103*
15k ohm	3380 K	NCP03XH153*	-	-	3950 K	NCP15XW153*	-	-
22k ohm	3380 K	NCP03XH223*	-	-	3950 K	NCP15XW223*	4485 K	NCP15WL223*
33k ohm	4250 K	NCP03WF333*	-	-	4050 K	NCP15WB333*	4485 K	NCP15WL333*
47k ohm	4050 K	NCP03WB473*	4485 K	NCP03WL473*	4050 K	NCP15WB473*	4485 K	NCP15WL473*
68k ohm	4250 K	NCP03WF683*	4485 K	NCP03WL683*	4150 K	NCP15WD683*	4485 K	NCP15WL683*
100k ohm	4250 K	NCP03WF104*	4485 K	NCP03WL104*	4250 K	NCP15WF104*	4485 K	NCP15WL104*
150k ohm	-	-	4485 K	NCP03WL154*	4500 K	NCP15WM154*	4485 K	NCP15WL154*
220k ohm	-	-	4485 K	NCP03WL224*	4500 K	NCP15WM224*	-	-
330k ohm	-	-	-	-	-	-	-	-
470k ohm	-	-	-	-	4500 K	NCP15WM474*	-	-
680k ohm	-	-	-	-	-	-	-	-
1.0M ohm	-	-	-	-	-	-	-	-
Operating Temp.	-40 to +125°C				-40 to +125°C			
Dissipation Constant	Approx. 1.0 mW/°C				Approx. 1.0 mW/°C			
P/N in End	05RL				03RC			
Packaging	15 kpcs./reel				10 kpcs./reel			
Certified UL1434	-				Done		-	

  Recommended types

Coming soon!

\* Resistance tolerance codes: F=±1%, E=±3%, J=±5%

10k ohm, 47k ohm, 100k ohm type have Tight Tolerance Type (±1%: NCP18XH103F03RB, NCP15XH103F03RC, NCP03XH103F05RL, NCP18WB473F10RB, NCP15WB473F03RC, NCP18WF104F12RB, NCP15WF104F03RC, NCP03WF104F05RL)

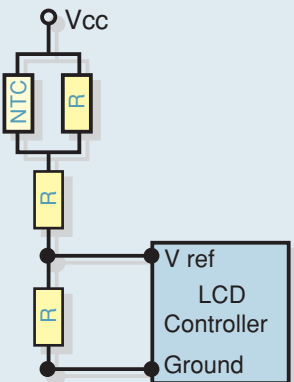
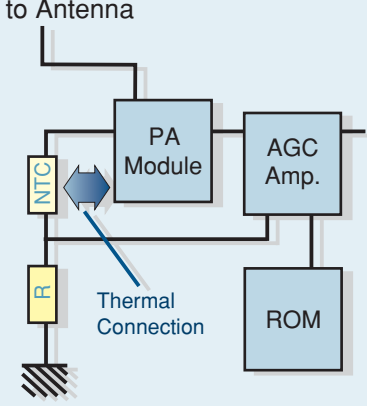
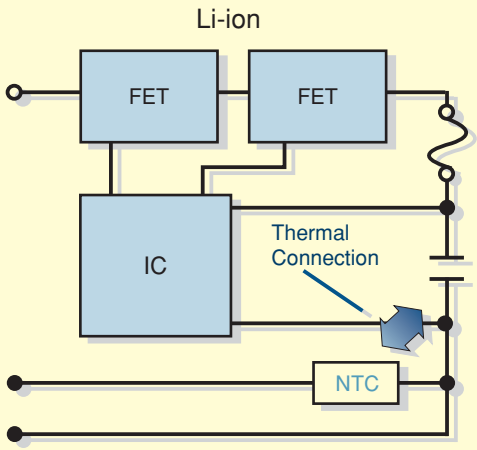
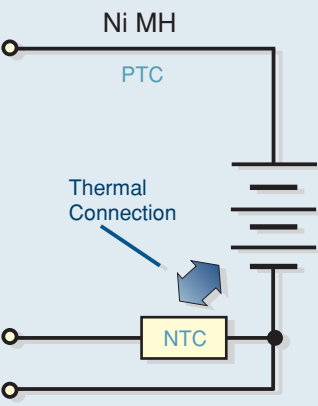
Resistance at 25°C	0603 size NCP18				0805 size NCP21	
	B-Constant	Part Number	B-Constant	Part Number	B-Constant	Part Number
11 ohm	-	-	-	-	-	-
22 ohm	-	-	-	-	-	-
33 ohm	-	-	-	-	-	-
47 ohm	-	-	-	-	-	-
68 ohm	-	-	-	-	-	-
100 ohm	3250 K	<b>NCP18XF101*</b>	-	-	-	-
150 ohm	3250 K	<b>NCP18XF151*</b>	-	-	-	-
220 ohm	3500 K	<b>NCP18XM221*</b>	-	-	3500 K	<b>NCP21XM221*</b>
330 ohm	3500 K	<b>NCP18XM331*</b>	-	-	-	-
470 ohm	3650 K	<b>NCP18XQ471*</b>	-	-	3650 K	<b>NCP21XQ471*</b>
680 ohm	3650 K	<b>NCP18XQ681*</b>	-	-	-	-
1.0k ohm	3650 K	<b>NCP18XQ102*</b>	-	-	3650 K	<b>NCP21XQ102*</b>
1.5k ohm	3950 K	<b>NCP18XW152*</b>	-	-	-	-
2.2k ohm	3950 K	<b>NCP18XW222*</b>	-	-	3950 K	<b>NCP21XW222*</b>
3.3k ohm	3950 K	<b>NCP18XW332*</b>	-	-	-	-
4.7k ohm	3500 K	<b>NCP18XM472*</b>	-	-	3500 K	<b>NCP21XM472*</b>
6.8k ohm	3950 K	<b>NCP18XW682*</b>	-	-	-	-
10k ohm	3380 K	<b>NCP18XH103*</b>	3900 K	<b>NCP18XV103*</b>	3900 K	<b>NCP21XV103*</b>
15k ohm	3950 K	<b>NCP18XW153*</b>	-	-	3950 K	<b>NCP21XW153*</b>
22k ohm	3950 K	<b>NCP18XW223*</b>	-	-	3950 K	<b>NCP21XW223*</b>
33k ohm	4050 K	<b>NCP18WB333*</b>	-	-	4050 K	<b>NCP21WB333*</b>
47k ohm	4050 K	<b>NCP18WB473*</b>	-	-	4050 K	<b>NCP21WB473*</b>
68k ohm	4150 K	<b>NCP18WD683*</b>	-	-	-	-
100k ohm	4250 K	<b>NCP18WF104*</b>	-	-	4250 K	<b>NCP21WF104*</b>
150k ohm	4500 K	<b>NCP18WM154*</b>	-	-	-	-
220k ohm	4500 K	<b>NCP18WM224*</b>	-	-	-	-
330k ohm	-	-	-	-	-	-
470k ohm	4500 K	<b>NCP18WM474*</b>	-	-	-	-
680k ohm	-	-	-	-	-	-
1.0M ohm	-	-	-	-	-	-
Operating Temp.	-40 to +125°C				-40 to +125°C	
Dissipation Constant	Approx. 1.0 mW/°C				Approx. 2.0 mW/°C	
P/N in End	03RB				03RA	
Packaging	4 kpcs./reel				4 kpcs./reel	
Certified UL1434	Done				Done	

  Recommended types

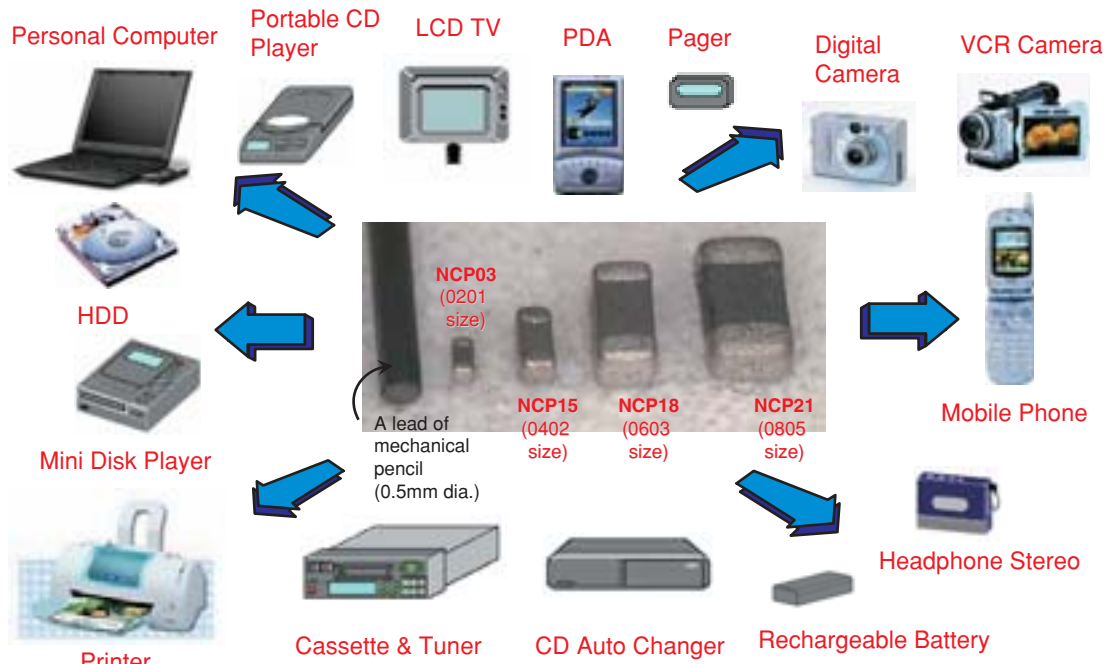
\* Resistance tolerance codes: F=±1%, E=±3%, J=±5%

10k ohm, 47k ohm, 100k ohm type have Tight Tolerance Type (±1%: NCP18XH103F03RB, NCP15XH103F03RC, NCP03XH103F05RL, NCP18WB473F10RB, NCP15WB473F03RC, NCP18WF104F12RB, NCP15WF104F03RC, NCP03WF104F05RL)

## Popular Applications of Chip NTC

LCD		Power Amplifier	
	<p>LCD Contrast control.</p> <p>Drive voltage is compensated utilizing NTC's temperature signal.</p> <p>High resistance values generally required, typically 33k ohms to 470k ohms</p>		<p>Temperature compensation of power amplifier (PA) module.</p>
Battery Pack (Li-ion / Ni MH)			
		<p>Ambient temperature detection of charging time.</p> <p>Detection of battery cell heating in abnormal circumstances.</p> <p>47k ohm±5%              10k ohm±5%              10k ohm±1% ...etc.</p>	

## More Popular Applications of Chip NTC



Personal Computer    Portable CD Player    LCD TV    PDA    Pager    Digital Camera    VCR Camera

HDD    Mini Disk Player    **NCP03 (0201 size)**    **NCP15 (0402 size)**    **NCP18 (0603 size)**    **NCP21 (0805 size)**    Mobile Phone

Printer    Cassette & Tuner    CD Auto Changer    Rechargeable Battery    Headphone Stereo

A lead of mechanical pencil (0.5mm dia.)

## Temperature Sensor Thermo String Type



Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	Operating Temp. (°C)	Dissipation Constant (25°C) (mW)	Operating Temp. (°C)
NXFT15XH103FA□B□□□□	10k	3380	-40 to 125	1.5	-20 to 150
NXFT15WB473FA□B□□□□	47k	4050	-40 to 125	1.5	-20 to 140
NXFT15WF104FA□B□□□□	100k	4250	-40 to 125	1.5	-20 to 130

□ is the filled with lead shape (1: twist, 2: without twist).

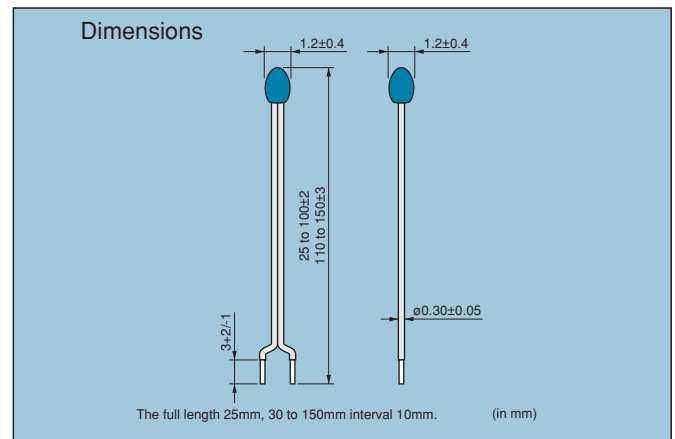
□□□ is the filled with Total-length codes. (25mm, 30 to 150mm interval 10mm, ex. 050=50mm)

Operating Current for Sensor rises Thermistor's temperature by 0.1°C

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 30°C by self heating, at ambient temperature of 25°C.

### Features

1. High accuracy and highly sensitive temperature sensing is made possible by the small size and high accuracy NTC Thermistor.
2. Narrow space temperature sensing is made possible by the small sensing head and the thin lead wire.
3. Flexibility and a wide variety of lengths (25mm to 150mm) enables the design of flexible temperature sensing architectures.
4. This product is compatible with our 0402 (EIA) size chip Thermistor.
5. Excellent long-term aging stability.
6. This is halogen free product.  
 \* Cl=max. 900ppm, Br=max. 900ppm and Cl+Br=max. 1500ppm
7. NXFT series are recognized by UL/cUL (UL1434, File No. E137188).



**△Note:**

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- |                             |  |
|-----------------------------|--|
| 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 |

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 **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

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