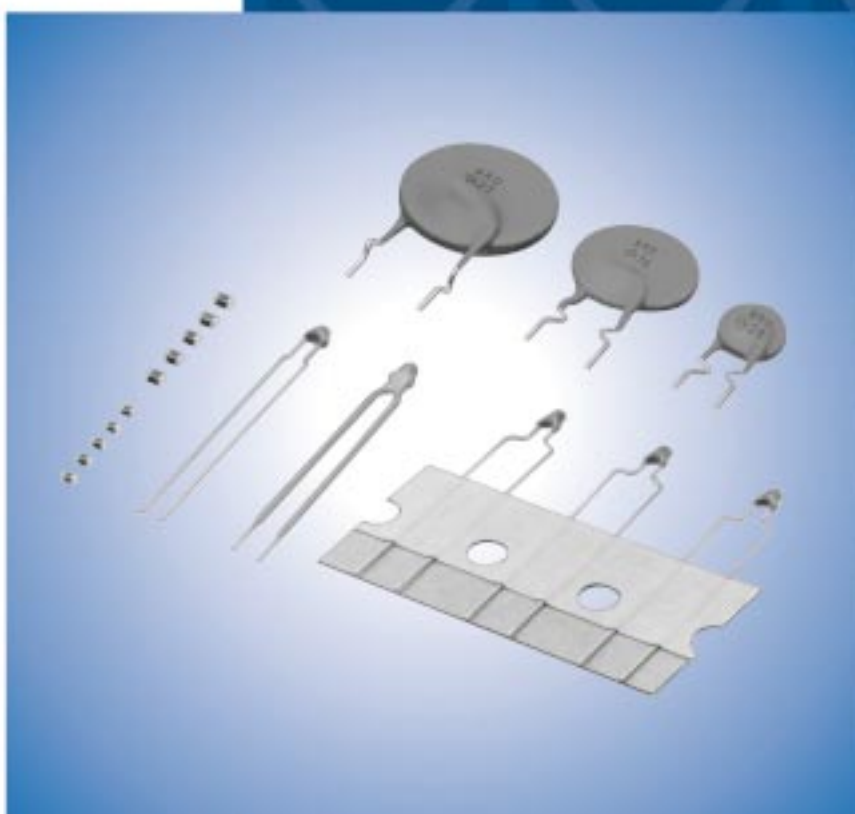


# NTC Thermistors



**muRata**

*Innovator  
in Electronics*

Murata  
Manufacturing Co., Ltd.

Cat.No.R44E-9

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## ● Part Numbering

### NTC Thermistors for Temp. Sensor and Compensation Chip Type

(Part Number) 

|    |   |    |    |     |   |    |    |
|----|---|----|----|-----|---|----|----|
| NC | P | 18 | XH | 103 | J | 03 | RB |
| ①  | ② | ③  | ④  | ⑤   | ⑥ | ⑦  | ⑧  |

#### ① Product ID

| Product ID |                           |
|------------|---------------------------|
| NC         | NTC Thermistors Chip Type |

#### ② Series

| Code | Series                    |
|------|---------------------------|
| P    | Plated Termination Series |

#### ③ Dimensions (L×W)

| Code | Dimensions (L×W) | EIA  |
|------|------------------|------|
| 03   | 0.60×0.30mm      | 0201 |
| 15   | 1.00×0.50mm      | 0402 |
| 18   | 1.60×0.80mm      | 0603 |
| 21   | 2.00×1.25mm      | 0805 |

#### ④ Temperature 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 |

#### ⑤ Resistance

Expressed by three figures. The unit is ohm ( $\Omega$ ). 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    |
|------|---------------|
| 102  | 1k $\Omega$   |
| 103  | 10k $\Omega$  |
| 104  | 100k $\Omega$ |

#### ⑥ Resistance Tolerance

| Code | Resistance Tolerance |
|------|----------------------|
| E    | ±3%                  |
| F    | ±1%                  |
| J    | ±5%                  |
| K    | ±10%                 |

#### ⑦ Individual Specifications

Structures and others are expressed by two figures.

| Code | Individual Specifications |
|------|---------------------------|
| 03   | Standard Type             |

Please contact us for details.

#### ⑧ Packaging

| Code | Packaging                           |
|------|-------------------------------------|
| RA   | Plastic Taping 4mm Pitch            |
| RB   | Paper Taping 4mm Pitch              |
| RC   | Paper Taping 2mm Pitch (10000 pcs.) |
| RL   | Paper Taping 2mm Pitch (15000 pcs.) |

## NTC Thermistors for Temp. Sensor and Compensation Lead Type

(Part Number)

|    |     |    |     |   |    |    |
|----|-----|----|-----|---|----|----|
| NT | SA0 | XH | 103 | F | E1 | B0 |
| ①  | ②   | ③  | ④   | ⑤ | ⑥  | ⑦  |

### ① Product ID

| Product ID |                 |
|------------|-----------------|
| NT         | NTC Thermistors |

### ② Series

| Code | Series                                                                 |
|------|------------------------------------------------------------------------|
| SA0  | for Temperature Sensors No Lead-coating Type                           |
| SD0  | for Temperature Sensors Lead-coating Type<br>(Total Length 30mm max.)  |
| SD1  | for Temperature Sensors Lead-coating Type<br>(Total Length 30 to 50mm) |

### ③ Temperature 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 |

### ④ Resistance

Expressed by three figures. The unit is ohm ( $\Omega$ ). 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   |
|------|--------------|
| 202  | 2k $\Omega$  |
| 203  | 20k $\Omega$ |

### ⑤ Resistance Tolerance

| Code | Resistance Tolerance |
|------|----------------------|
| E    | $\pm 3\%$            |
| F    | $\pm 1\%$            |

### ⑥ Individual Specifications

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

| Code | Individual Specifications          |
|------|------------------------------------|
| E1   | Standard Bulk (NTSA, NTSD0 Series) |
| N6   | Standard Taping (NTSA Series)      |
| PB   | Standard Bulk (NTSD1 Series)       |

### ⑦ Packaging (NTSA/NTSD0 Series)

| Code | Packaging |
|------|-----------|
| A0   | Ammo Pack |
| B0   | Bulk      |

### ⑦ Total Length (NTSD1 Series)

| Code | Total Length |
|------|--------------|
| 30   | 30mm         |
| 40   | 40mm         |
| 50   | 50mm         |

## NTC Thermistors for Inrush Current Suppression

(Part Number)

|    |     |     |   |    |    |
|----|-----|-----|---|----|----|
| NT | PA7 | 160 | L | BM | B0 |
| ①  | ②   | ③   | ④ | ⑤  | ⑥  |

### ①Product ID

| Product ID |                 |
|------------|-----------------|
| NT         | NTC Thermistors |

### ②Series

| Code | Series                                     | Nominal Body Diameter |
|------|--------------------------------------------|-----------------------|
| PA7  | Inrush Current<br>Suppression<br>Lead Type | ø7mm                  |
| PA9  |                                            | ø9mm                  |
| PAA  |                                            | ø10mm                 |
| PAD  |                                            | ø13mm                 |
| PAJ  |                                            | ø18mm                 |
| PAN  |                                            | ø22mm                 |

### ③Resistance

Expressed by three figures. The unit is ohm ( $\Omega$ ). 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  |
|------|-------------|
| 3R0  | 3 $\Omega$  |
| 100  | 10 $\Omega$ |

### ④Resistance Tolerance

| Code | Resistance Tolerance |
|------|----------------------|
| L    | ±15%                 |

### ⑤Individual Specifications

A lead structure and other specifications are expressed by two capital letters.

| Code | Individual Specifications | Body Diameter |
|------|---------------------------|---------------|
| DK   | Standard Type             | ø18mm, ø22mm  |
| DN   | Standard Type             | ø10mm, ø13mm  |
| BM   | Standard Type             | ø7mm, ø9mm    |

### ⑥Packaging

| Code | Packaging |
|------|-----------|
| A0   | Ammo Pack |
| B0   | Bulk      |

## Basic Characteristics

### ■Basic Characteristics

#### 1. Zero-power Resistance of Thermistor : R

$$R = R_0 \exp B (1/T - 1/T_0) \quad \dots\dots\dots(1)$$

R : Resistance in ambient temperature T (K)

(K : absolute temperature)

R<sub>0</sub> : Resistance in ambient temperature T<sub>0</sub> (K)

B : B-constant of Thermistor

#### 2. B-Constant

as (1) formula

$$B = \frac{\ln (R/R_0)}{(1/T - 1/T_0)} \quad \dots\dots\dots(2)$$

#### 3. Thermal Dissipation Constant

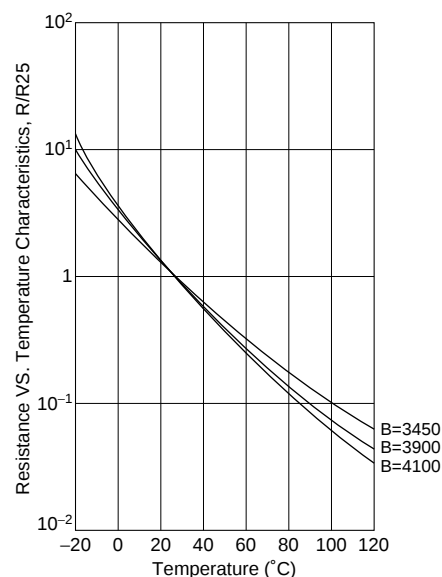
When electric power P (mW) is spent in ambient temperature T<sub>1</sub> and thermistor temperature rises T<sub>2</sub>, there is a formula as follows

$$P = C (T_2 - T_1) \quad \dots\dots\dots(3)$$

C : Thermal dissipation constant (mW/°C)

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

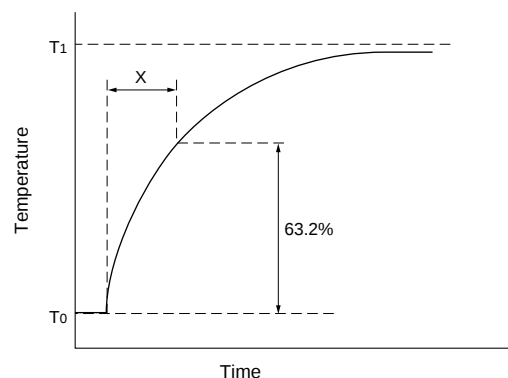
[Resistance vs. Temperature]



#### 4. Thermal Time Constant

Period in which Thermistor's temperature will change 63.2% of its temperature difference from ambient temperature T<sub>0</sub> (°C) to T<sub>1</sub> (°C).

[Thermal Time Constant]



### ■Performance

| Item                          | Condition                                                                                                                                                            |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistance                    | Measured by zero-power in specified ambient temperature.                                                                                                             |
| B-Constant                    | Calculated between two specified ambient temperatures by next formula.<br>T and T <sub>0</sub> is absolute temperature (K).<br>$B = \frac{\ln (R/R_0)}{1/T - 1/T_0}$ |
| Thermal Dissipation Constant  | Shows necessary electric power that Thermistor's temperature rises 1°C by self heating.<br>It is calculated by next formula. (mW/°C)<br>$C = \frac{P}{T - T_0}$      |
| Rated Electric Power          | Shows necessary electric power that Thermistor's temperature rises 100°C by self heating in ambient temperature 25°C.                                                |
| Permissible Operating Current | It is possible to keep Thermistor's temperature rising max. 1°C                                                                                                      |

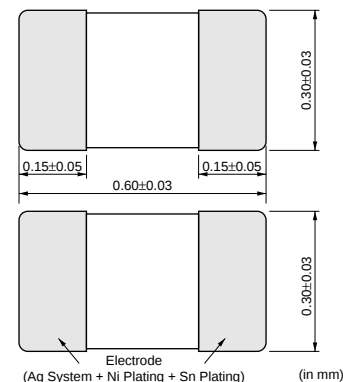
Please inquire about test conditions and ratings.

# NTC Thermistors



## for Temperature Compensation 0201 (0603) Size

0201/0402/0603/0805 sized Chip NTC Thermistor 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.

### ■ Applications

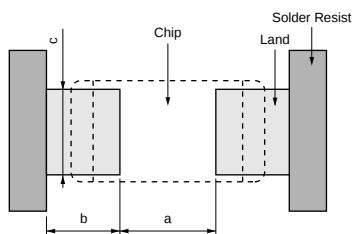
1. Temperature compensation of transistor, IC, crystal oscillator of mobile communications equipment
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation and sensing of car audio equipment (CD, MD, Tuner)
5. Temperature compensation of several kinds of circuits

| Part Number     | Resistance (25°C) | B-Constant (25-50°C) (K) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Operating Temperature Range (°C) |
|-----------------|-------------------|--------------------------|-------------------------------------------|----------------------------------|---------------------------------------------|----------------------------------|
| NCP03YS110□05RL | 11ohm             | 2750 ±3%                 | 9.50                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03YS220□05RL | 22ohm             | 2750 ±3%                 | 6.70                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03YS330□05RL | 33ohm             | 2750 ±3%                 | 5.50                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03YS470□05RL | 47ohm             | 2750 ±3%                 | 4.60                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03YS680□05RL | 68ohm             | 2750 ±3%                 | 3.80                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03YS101□05RL | 100ohm            | 2750 ±3%                 | 3.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03XH682□05RL | 6.8k ohm          | 3380 ±3%                 | 0.38                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03XH103□05RL | 10k ohm           | 3380 ±3%                 | 0.31                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03XH153□05RL | 15k ohm           | 3380 ±3%                 | 0.25                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03XH223□05RL | 22k ohm           | 3380 ±3%                 | 0.21                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WF333□05RL | 33k ohm           | 4250 ±3%                 | 0.17                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WB473□05RL | 47k ohm           | 4050 ±3%                 | 0.14                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WL473□05RL | 47k ohm           | 4485 ±3%                 | 0.14                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WF683□05RL | 68k ohm           | 4250 ±3%                 | 0.12                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WL683□05RL | 68k ohm           | 4485 ±3%                 | 0.12                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WF104□05RL | 100k ohm          | 4250 ±3%                 | 0.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WL104□05RL | 100k ohm          | 4485 ±3%                 | 0.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WL154□05RL | 150k ohm          | 4485 ±3%                 | 0.08                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP03WL224□05RL | 220k ohm          | 4485 ±3%                 | 0.06                                      | 100                              | 1.0                                         | -40 to 125                       |

A blank column is filled with resistance tolerance codes. (J: ±5%, K: ±10%)

## ■ Standard Land Dimensions

1



| Soldering Methods | a    | b    | c   |
|-------------------|------|------|-----|
| Reflow Soldering  | 0.25 | 0.25 | 0.3 |

(in mm)

# NTC Thermistors

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## for Temperature Compensation 0402 (1005) Size

2

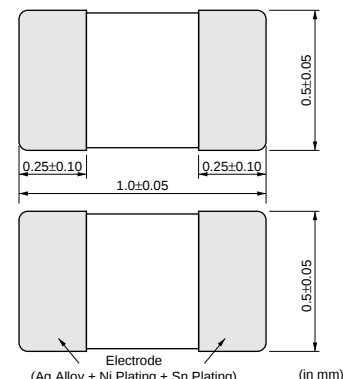
0201/0402/0603/0805 sized Chip NTC Thermistors have Ni barrier termination and provide excellent solderability and offer high stability in environment by unique inner construction.

### ■ 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. Same B-constant in the same resistance in the three sizes (0805/0603/0402)  
Easy to use smaller size in the circuits
6. Lead is not contained in the product.
7. NCP15/18/21 series are recognized by UL  
(UL1434, File No. E137188 Vol. 2, Sec. 2)

### ■ Applications

1. Temperature compensation of transistor, IC, crystal oscillator of mobile communications equipment
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation and sensing of car audio equipment (CD, MD, Tuner)
5. Temperature compensation of several kinds of circuits



| Part Number     | Resistance (25°C) | B-Constant (25-50°C) (K) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Operating Temperature Range (°C) |
|-----------------|-------------------|--------------------------|-------------------------------------------|----------------------------------|---------------------------------------------|----------------------------------|
| NCP15XC220□03RC | 22ohm             | 3100 ±3%                 | 6.70                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XC330□03RC | 33ohm             | 3100 ±3%                 | 5.50                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XC470□03RC | 47ohm             | 3100 ±3%                 | 4.60                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XC680□03RC | 68ohm             | 3100 ±3%                 | 3.80                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XF101□03RC | 100ohm            | 3250 ±3%                 | 3.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XF151□03RC | 150ohm            | 3250 ±3%                 | 2.50                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XM221□03RC | 220ohm            | 3500 ±3%                 | 2.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XM331□03RC | 330ohm            | 3500 ±3%                 | 1.70                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XQ471□03RC | 470ohm            | 3650 ±2%                 | 1.40                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XQ681□03RC | 680ohm            | 3650 ±3%                 | 1.20                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XQ102□03RC | 1.0k ohm          | 3650 ±2%                 | 1.00                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XW152□03RC | 1.5k ohm          | 3950 ±3%                 | 0.81                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XW222□03RC | 2.2k ohm          | 3950 ±3%                 | 0.67                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XW332□03RC | 3.3k ohm          | 3950 ±3%                 | 0.55                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XM472□03RC | 4.7k ohm          | 3500 ±2%                 | 0.46                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XW682□03RC | 6.8k ohm          | 3950 ±3%                 | 0.38                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XH103□03RC | 10k ohm           | 3380 ±1%                 | 0.31                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XV103□03RC | 10k ohm           | 3900 ±3%                 | 0.31                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XW153□03RC | 15k ohm           | 3950 ±3%                 | 0.25                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15XW223□03RC | 22k ohm           | 3950 ±3%                 | 0.21                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15WL223□03RC | 22k ohm           | 4485 ±1%                 | 0.21                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP15WB333□03RC | 33k ohm           | 4050 ±3%                 | 0.17                                      | 100                              | 1.0                                         | -40 to 125                       |

Continued on the following page.

Continued from the preceding page.

| Part Number     | Resistance<br>(25°C) | B-Constant<br>(25-50°C)<br>(K) | Permissive Operating<br>Current (25°C)<br>(mA) | Rated Electric<br>Power (25°C)<br>(mW) | Typical Dissipation<br>Constant (25°C)<br>(mW/°C) | Operating<br>Temperature Range<br>(°C) |
|-----------------|----------------------|--------------------------------|------------------------------------------------|----------------------------------------|---------------------------------------------------|----------------------------------------|
| NCP15WL333□03RC | 33k ohm              | 4485 ±1%                       | 0.17                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WB473□03RC | 47k ohm              | 4050 ±1%                       | 0.14                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WL473□03RC | 47k ohm              | 4485 ±1%                       | 0.14                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WD683□03RC | 68k ohm              | 4150 ±3%                       | 0.12                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WL683□03RC | 68k ohm              | 4485 ±1%                       | 0.12                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WF104□03RC | 100k ohm             | 4250 ±1%                       | 0.10                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WL104□03RC | 100k ohm             | 4485 ±1%                       | 0.10                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WM154□03RC | 150k ohm             | 4500 ±3%                       | 0.08                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WL154□03RC | 154k ohm             | 4485 ±1%                       | 0.08                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WM224□03RC | 220k ohm             | 4500 ±3%                       | 0.06                                           | 100                                    | 1.0                                               | -40 to 125                             |
| NCP15WM474□03RC | 470k ohm             | 4500 ±3%                       | 0.04                                           | 100                                    | 1.0                                               | -40 to 125                             |

A blank column is filled with resistance tolerance codes. (J: ±5%, K: ±10%)

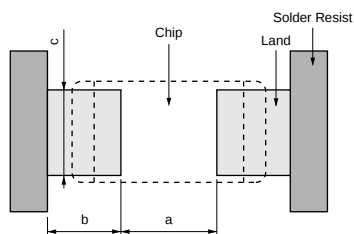
Tolerance ±1% is also available for the following type.

10k ohm: NCP15XH103F03RC

47k ohm: NCP15WB473F03RC

100k ohm: NCP15WF104F03RC

## Standard Land Dimensions



| Soldering Methods | a   | b       | c   |
|-------------------|-----|---------|-----|
| Reflow Soldering  | 0.4 | 0.4-0.5 | 0.5 |

(in mm)

# NTC Thermistors

**muRata**

## for Temperature Compensation 0603 (1608) Size

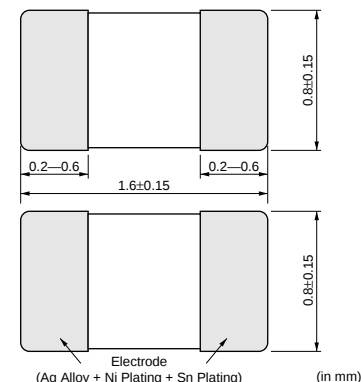
0201/0402/0603/0805 sized Chip NTC Thermistors have Ni barrier termination and provide excellent solderability and offer high stability in environment by unique inner construction.

### ■ 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. Same B-constant in the same resistance in the three sizes (0805/0603/0402)  
Easy to use smaller size in the circuits
6. Lead is not contained in the product
7. NCP15/18/21 series are recognized by UL  
(UL1434, File No. E137188 Vol. 2, Sec. 2)

### ■ Applications

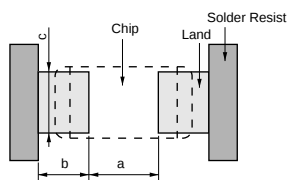
1. Temperature compensation of transistor, IC, crystal oscillator of mobile communications equipment
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation and sensing of car audio equipment (CD, MD, Tuner)
5. Temperature compensation of several kinds of circuits



| Part Number     | Resistance (25°C) | B-Constant (25-50°C) (K) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Operating Temperature Range (°C) |
|-----------------|-------------------|--------------------------|-------------------------------------------|----------------------------------|---------------------------------------------|----------------------------------|
| NCP18XF101□03RB | 100ohm            | 3250 ±3%                 | 3.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XF151□03RB | 150ohm            | 3250 ±3%                 | 2.50                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XM221□03RB | 220ohm            | 3500 ±3%                 | 2.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XM331□03RB | 330ohm            | 3500 ±3%                 | 1.70                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XQ471□03RB | 470ohm            | 3650 ±2%                 | 1.40                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XQ681□03RB | 680ohm            | 3650 ±3%                 | 1.20                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XQ102□03RB | 1.0k ohm          | 3650 ±2%                 | 1.00                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XW152□03RB | 1.5k ohm          | 3950 ±3%                 | 0.81                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XW222□03RB | 2.2k ohm          | 3950 ±3%                 | 0.67                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XW332□03RB | 3.3k ohm          | 3950 ±3%                 | 0.55                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XM472□03RB | 4.7k ohm          | 3500 ±2%                 | 0.46                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XW682□03RB | 6.8k ohm          | 3950 ±3%                 | 0.38                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XH103□03RB | 10k ohm           | 3380 ±1%                 | 0.31                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XW153□03RB | 15k ohm           | 3950 ±3%                 | 0.25                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18XW223□03RB | 22k ohm           | 3950 ±3%                 | 0.21                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WB333□03RB | 33k ohm           | 4050 ±3%                 | 0.17                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WB473□03RB | 47k ohm           | 4050 ±2%                 | 0.14                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WD683□03RB | 68k ohm           | 4150 ±3%                 | 0.12                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WF104□03RB | 100k ohm          | 4250 ±2%                 | 0.10                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WM154□03RB | 150k ohm          | 4500 ±3%                 | 0.08                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WM224□03RB | 220k ohm          | 4500 ±3%                 | 0.06                                      | 100                              | 1.0                                         | -40 to 125                       |
| NCP18WM474□03RB | 470k ohm          | 4500 ±3%                 | 0.04                                      | 100                              | 1.0                                         | -40 to 125                       |

A blank column is filled with resistance tolerance codes. (J: ±5%, K: ±10%)  
Tolerance ±1% NCP18XH103F03RB is also available for 10k ohm type.

## ■ Standard Land Dimensions



| Soldering Methods | a       | b       | c       |
|-------------------|---------|---------|---------|
| Flow Soldering    | 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 |

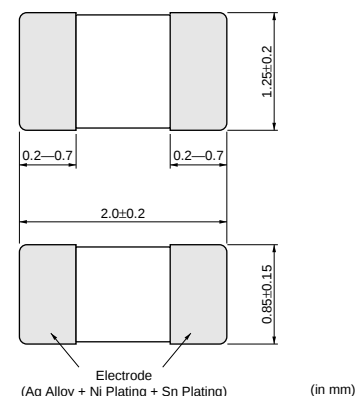
(in mm)

# NTC Thermistors

**muRata**

## for Temperature Compensation 0805 (2012) Size

0201/0402/0603/0805 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. Same B-constant in the same resistance in the three sizes (0805/0603/0402)  
Easy to use smaller size in the circuits
6. Lead is not contained in the product
7. NCP15/18/21 series are recognized by UL  
(UL1434, File No. E137188 Vol. 2, Sec. 2)

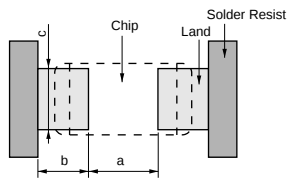
### ■ Applications

1. Temperature compensation of transistor, IC, crystal oscillator of mobile communications equipment
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation and sensing of car audio equipment (CD, MD, Tuner)
5. Temperature compensation of several kinds of circuits

| Part Number     | Resistance (25°C) | B-Constant (25-50°C) (K) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Operating Temperature Range (°C) |
|-----------------|-------------------|--------------------------|-------------------------------------------|----------------------------------|---------------------------------------------|----------------------------------|
| NCP21XM221□03RA | 220ohm            | 3500 ±3%                 | 3.00                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XQ471□03RA | 470ohm            | 3650 ±3%                 | 2.00                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XQ102□03RA | 1.0k ohm          | 3650 ±3%                 | 1.40                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XW222□03RA | 2.2k ohm          | 3950 ±3%                 | 0.90                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XM472□03RA | 4.7k ohm          | 3500 ±3%                 | 0.65                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XV103□03RA | 10k ohm           | 3900 ±3%                 | 0.44                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XW153□03RA | 15k ohm           | 3950 ±3%                 | 0.36                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21XW223□03RA | 22k ohm           | 3950 ±3%                 | 0.30                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21WB333□03RA | 33k ohm           | 4050 ±3%                 | 0.24                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21WB473□03RA | 47k ohm           | 4050 ±3%                 | 0.20                                      | 200                              | 2.0                                         | -40 to 125                       |
| NCP21WF104□03RA | 100k ohm          | 4250 ±3%                 | 0.14                                      | 200                              | 2.0                                         | -40 to 125                       |

A blank column is filled with resistance tolerance codes. (J: ±5%, K: ±10%)

■ Standard Land Dimensions



| Soldering Methods | a       | b       | c       |
|-------------------|---------|---------|---------|
| Flow Soldering    | 1.0-1.1 | 0.9-1.0 | 1.0-1.2 |
| Reflow Soldering  | 1.0-1.1 | 0.6-0.7 | 1.0-1.2 |

(in mm)

## for Temperature Compensation Temperature Characteristics (Center Value)

| Part Number | NCP□□YS110     | NCP□□YS220     | NCP□□XC220     | NCP□□YS330     | NCP□□XC330     | NCP□□YS470     | NCP□□XC470     | NCP□□YS680     |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Resistance  | 11Ω            | 22Ω            | 22Ω            | 33Ω            | 33Ω            | 47Ω            | 47Ω            | 68Ω            |
| B-Constant  | 2750K          | 2750K          | 3100K          | 2750K          | 3100K          | 2750K          | 3100K          | 2750K          |
| Temp. (°C)  | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) |
| -40         | 127.366        | 254.732        | 355.823        | 382.098        | 533.734        | 544.201        | 760.166        | 787.354        |
| -35         | 101.662        | 203.325        | 273.975        | 304.987        | 410.962        | 434.376        | 585.310        | 628.459        |
| -30         | 81.726         | 163.452        | 213.003        | 245.178        | 319.504        | 349.193        | 455.051        | 505.215        |
| -25         | 66.148         | 132.296        | 166.943        | 198.444        | 250.415        | 282.633        | 356.652        | 408.915        |
| -20         | 53.946         | 107.893        | 131.997        | 161.839        | 197.996        | 230.498        | 281.994        | 333.487        |
| -15         | 44.273         | 88.546         | 105.318        | 132.819        | 157.978        | 189.167        | 224.998        | 273.688        |
| -10         | 36.494         | 72.987         | 84.670         | 109.481        | 127.005        | 155.927        | 180.886        | 225.597        |
| -5          | 30.262         | 60.523         | 68.628         | 90.785         | 102.942        | 129.299        | 146.614        | 187.071        |
| 0           | 25.226         | 50.451         | 55.981         | 75.677         | 83.972         | 107.782        | 119.596        | 155.940        |
| 5           | 21.150         | 42.300         | 45.859         | 63.449         | 68.789         | 90.367         | 97.972         | 130.744        |
| 10          | 17.828         | 35.657         | 37.819         | 53.485         | 56.728         | 76.176         | 80.794         | 110.212        |
| 15          | 15.103         | 30.205         | 31.396         | 45.308         | 47.094         | 64.529         | 67.073         | 93.361         |
| 20          | 12.859         | 25.719         | 26.211         | 38.578         | 39.317         | 54.944         | 55.997         | 79.494         |
| 25          | 11.000         | 22.000         | 22.000         | 33.000         | 33.000         | 47.000         | 47.000         | 68.000         |
| 30          | 9.452          | 18.904         | 18.560         | 28.356         | 27.840         | 40.386         | 39.651         | 58.430         |
| 35          | 8.162          | 16.323         | 15.735         | 24.485         | 23.603         | 34.872         | 33.616         | 50.454         |
| 40          | 7.077          | 14.155         | 13.403         | 21.232         | 20.104         | 30.239         | 28.633         | 43.750         |
| 45          | 6.161          | 12.323         | 11.462         | 18.484         | 17.193         | 26.326         | 24.487         | 38.089         |
| 50          | 5.389          | 10.778         | 9.842          | 16.167         | 14.763         | 23.025         | 21.026         | 33.313         |
| 55          | 4.731          | 9.461          | 8.488          | 14.192         | 12.732         | 20.213         | 18.133         | 29.244         |
| 60          | 4.168          | 8.336          | 7.348          | 12.504         | 11.022         | 17.809         | 15.698         | 25.766         |
| 65          | 3.687          | 7.374          | 6.399          | 11.061         | 9.598          | 15.753         | 13.670         | 22.792         |
| 70          | 3.273          | 6.545          | 5.595          | 9.817          | 8.392          | 13.982         | 11.952         | 20.230         |
| 75          | 2.915          | 5.830          | 4.896          | 8.744          | 7.345          | 12.454         | 10.461         | 18.019         |
| 80          | 2.605          | 5.210          | 4.299          | 7.814          | 6.448          | 11.130         | 9.184          | 16.102         |
| 85          | 2.335          | 4.671          | 3.795          | 7.006          | 5.692          | 9.979          | 8.107          | 14.437         |
| 90          | 2.100          | 4.201          | 3.360          | 6.301          | 5.040          | 8.974          | 7.179          | 12.984         |
| 95          | 1.894          | 3.789          | 2.983          | 5.683          | 4.474          | 8.094          | 6.373          | 11.710         |
| 100         | 1.713          | 3.427          | 2.656          | 5.140          | 3.983          | 7.320          | 5.673          | 10.591         |
| 105         | 1.554          | 3.107          | 2.367          | 4.661          | 3.551          | 6.638          | 5.057          | 9.604          |
| 110         | 1.412          | 2.825          | 2.116          | 4.237          | 3.173          | 6.035          | 4.520          | 8.731          |
| 115         | 1.287          | 2.574          | 1.901          | 3.862          | 2.851          | 5.500          | 4.060          | 7.957          |
| 120         | 1.176          | 2.352          | 1.712          | 3.528          | 2.568          | 5.024          | 3.657          | 7.269          |
| 125         | 1.077          | 2.153          | 1.543          | 3.230          | 2.314          | 4.600          | 3.296          | 6.655          |

| Part Number | NCP□□XC680     | NCP□□YS101     | NCP□□XF101     | NCP□□XF151     | NCP□□XM221     | NCP□□XM331     | NCP□□XQ471     | NCP□□XQ681     |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Resistance  | 68Ω            | 100Ω           | 100Ω           | 150Ω           | 220Ω           | 330Ω           | 470Ω           | 680Ω           |
| B-Constant  | 3100K          | 2750K          | 3250K          | 3250K          | 3500K          | 3500K          | 3650K          | 3650K          |
| Temp. (°C)  | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) | Resistance (Ω) |
| -40         | 1099.815       | 1157.874       | 1824.175       | 2736.262       | 4947.904       | 7421.856       | 11822.473      | 17104.854      |
| -35         | 846.832        | 924.204        | 1390.685       | 2086.028       | 3703.755       | 5555.632       | 8767.745       | 12685.248      |
| -30         | 658.372        | 742.963        | 1070.653       | 1605.979       | 2798.873       | 4198.309       | 6570.224       | 9505.855       |
| -25         | 516.007        | 601.346        | 831.138        | 1246.708       | 2135.887       | 3203.831       | 4971.784       | 7193.219       |
| -20         | 407.991        | 490.422        | 650.960        | 976.440        | 1645.037       | 2467.555       | 3796.933       | 5493.436       |
| -15         | 325.529        | 402.482        | 514.441        | 771.661        | 1278.034       | 1917.051       | 2923.400       | 4229.599       |
| -10         | 261.707        | 331.760        | 409.700        | 614.550        | 1000.620       | 1500.930       | 2269.599       | 3283.675       |
| -5          | 212.123        | 275.105        | 328.877        | 493.315        | 789.612        | 1184.418       | 1775.225       | 2568.411       |
| 0           | 173.033        | 229.324        | 265.759        | 398.639        | 627.752        | 941.628        | 1399.050       | 2024.158       |
| 5           | 141.747        | 192.270        | 215.785        | 323.677        | 502.474        | 753.711        | 1110.220       | 1606.275       |
| 10          | 116.894        | 162.076        | 176.395        | 264.592        | 405.010        | 607.514        | 887.257        | 1283.691       |
| 15          | 97.042         | 137.296        | 145.161        | 217.742        | 328.480        | 492.720        | 713.463        | 1032.245       |
| 20          | 81.016         | 116.902        | 120.152        | 180.228        | 268.044        | 402.066        | 577.375        | 835.351        |
| 25          | 68.000         | 100.000        | 100.000        | 150.000        | 220.000        | 330.000        | 470.000        | 680.000        |
| 30          | 57.368         | 85.927         | 83.669         | 125.503        | 181.576        | 272.365        | 384.800        | 556.733        |
| 35          | 48.636         | 74.197         | 70.361         | 105.541        | 150.668        | 226.002        | 316.757        | 458.287        |
| 40          | 41.426         | 64.339         | 59.456         | 89.184         | 125.681        | 188.521        | 262.177        | 379.320        |
| 45          | 35.428         | 56.013         | 50.470         | 75.705         | 105.336        | 158.004        | 218.069        | 315.504        |
| 50          | 30.421         | 48.989         | 43.029         | 64.543         | 88.717         | 133.076        | 182.297        | 263.749        |
| 55          | 26.235         | 43.006         | 36.830         | 55.246         | 75.059         | 112.588        | 153.150        | 221.579        |
| 60          | 22.712         | 37.891         | 31.649         | 47.473         | 63.777         | 95.666         | 129.249        | 186.998        |
| 65          | 19.778         | 33.517         | 27.364         | 41.045         | 54.415         | 81.622         | 109.551        | 158.499        |
| 70          | 17.293         | 29.750         | 23.756         | 35.634         | 46.631         | 69.946         | 93.281         | 134.960        |
| 75          | 15.134         | 26.498         | 20.651         | 30.976         | 40.115         | 60.172         | 79.750         | 115.383        |
| 80          | 13.288         | 23.680         | 18.011         | 27.016         | 34.637         | 51.955         | 68.446         | 99.029         |
| 85          | 11.729         | 21.231         | 15.800         | 23.700         | 30.013         | 45.019         | 58.996         | 85.356         |
| 90          | 10.386         | 19.094         | 13.908         | 20.862         | 26.110         | 39.165         | 51.036         | 73.839         |
| 95          | 9.220          | 17.221         | 12.263         | 18.394         | 22.790         | 34.186         | 44.332         | 64.140         |
| 100         | 8.208          | 15.575         | 10.844         | 16.265         | 19.957         | 29.935         | 38.640         | 55.905         |
| 105         | 7.317          | 14.124         | 9.622          | 14.434         | 17.541         | 26.312         | 33.790         | 48.888         |
| 110         | 6.539          | 12.840         | 8.563          | 12.844         | 15.453         | 23.180         | 29.664         | 42.918         |
| 115         | 5.874          | 11.702         | 7.648          | 11.472         | 13.663         | 20.494         | 26.123         | 37.795         |
| 120         | 5.291          | 10.690         | 6.850          | 10.275         | 12.114         | 18.171         | 23.091         | 33.409         |
| 125         | 4.768          | 9.787          | 6.162          | 9.243          | 10.778         | 16.168         | 20.472         | 29.618         |

Continued on the following page. ➤

## for Temperature Compensation Temperature Characteristics (Center Value)

Continued from the preceding page.

| Part Number | NCP□□XQ102      | NCP□□XW152      | NCP□□XW222      | NCP□□XW332      | NCP□□XM472      | NCP□□XH682      | NCP□□XW682      | NCP□□XH103      |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance  | 1kΩ             | 1.5kΩ           | 2.2kΩ           | 3.3kΩ           | 4.7kΩ           | 6.8kΩ           | 6.8kΩ           | 10kΩ            |
| B-Constant  | 3650K           | 3950K           | 3950K           | 3950K           | 3500K           | 3380K           | 3950K           | 3380K           |
| Temp. (°C)  | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40         | 25.154          | 51.791          | 75.961          | 113.941         | 105.705         | 133.122         | 234.787         | 195.652         |
| -35         | 18.655          | 37.172          | 54.520          | 81.779          | 79.126          | 100.810         | 168.515         | 148.171         |
| -30         | 13.979          | 27.005          | 39.607          | 59.411          | 59.794          | 77.113          | 122.422         | 113.347         |
| -25         | 10.578          | 19.843          | 29.103          | 43.654          | 45.630          | 59.566          | 89.953          | 87.559          |
| -20         | 8.079           | 14.728          | 21.601          | 32.401          | 35.144          | 46.419          | 66.766          | 68.237          |
| -15         | 6.220           | 11.044          | 16.198          | 24.297          | 27.303          | 36.494          | 50.066          | 53.650          |
| -10         | 4.829           | 8.362           | 12.264          | 18.396          | 21.377          | 28.913          | 37.906          | 42.506          |
| -5          | 3.777           | 6.389           | 9.370           | 14.055          | 16.869          | 23.052          | 28.963          | 33.892          |
| 0           | 2.977           | 4.922           | 7.219           | 10.829          | 13.411          | 18.512          | 22.313          | 27.219          |
| 5           | 2.362           | 3.825           | 5.609           | 8.414           | 10.735          | 14.977          | 17.338          | 22.021          |
| 10          | 1.888           | 2.994           | 4.391           | 6.586           | 8.653           | 12.191          | 13.571          | 17.926          |
| 15          | 1.518           | 2.361           | 3.463           | 5.195           | 7.018           | 9.979           | 10.705          | 14.674          |
| 20          | 1.229           | 1.876           | 2.751           | 4.126           | 5.726           | 8.215           | 8.503           | 12.081          |
| 25          | 1.000           | 1.500           | 2.200           | 3.300           | 4.700           | 6.800           | 6.800           | 10.000          |
| 30          | 0.819           | 1.207           | 1.771           | 2.656           | 3.879           | 5.654           | 5.474           | 8.315           |
| 35          | 0.674           | 0.978           | 1.434           | 2.152           | 3.219           | 4.724           | 4.434           | 6.948           |
| 40          | 0.558           | 0.797           | 1.169           | 1.753           | 2.685           | 3.967           | 3.613           | 5.834           |
| 45          | 0.464           | 0.653           | 0.958           | 1.437           | 2.250           | 3.343           | 2.961           | 4.917           |
| 50          | 0.388           | 0.538           | 0.789           | 1.184           | 1.895           | 2.829           | 2.440           | 4.161           |
| 55          | 0.326           | 0.446           | 0.654           | 0.981           | 1.604           | 2.403           | 2.022           | 3.535           |
| 60          | 0.275           | 0.371           | 0.545           | 0.817           | 1.363           | 2.049           | 1.683           | 3.014           |
| 65          | 0.233           | 0.311           | 0.456           | 0.684           | 1.163           | 1.758           | 1.409           | 2.586           |
| 70          | 0.199           | 0.261           | 0.383           | 0.575           | 0.996           | 1.514           | 1.185           | 2.228           |
| 75          | 0.170           | 0.221           | 0.324           | 0.486           | 0.857           | 1.308           | 1.001           | 1.925           |
| 80          | 0.146           | 0.187           | 0.275           | 0.412           | 0.740           | 1.134           | 0.849           | 1.669           |
| 85          | 0.126           | 0.160           | 0.234           | 0.351           | 0.641           | 0.987           | 0.724           | 1.452           |
| 90          | 0.109           | 0.137           | 0.200           | 0.301           | 0.558           | 0.862           | 0.620           | 1.268           |
| 95          | 0.094           | 0.117           | 0.172           | 0.258           | 0.487           | 0.754           | 0.532           | 1.110           |
| 100         | 0.082           | 0.101           | 0.149           | 0.223           | 0.426           | 0.662           | 0.459           | 0.974           |
| 105         | 0.072           | 0.088           | 0.129           | 0.193           | 0.375           | 0.583           | 0.398           | 0.858           |
| 110         | 0.063           | 0.076           | 0.112           | 0.168           | 0.330           | 0.515           | 0.346           | 0.758           |
| 115         | 0.056           | 0.067           | 0.098           | 0.146           | 0.292           | 0.456           | 0.302           | 0.672           |
| 120         | 0.049           | 0.058           | 0.085           | 0.128           | 0.259           | 0.405           | 0.264           | 0.596           |
| 125         | 0.044           | 0.051           | 0.075           | 0.113           | 0.230           | 0.361           | 0.232           | 0.531           |

| Part Number | NCP□□XV103      | NCP□□XH153      | NCP□□XW153      | NCP□□XH223      | NCP□□XW223      | NCP□□WL223      | NCP□□WB333      | NCP□□WF333      |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance  | 10kΩ            | 15kΩ            | 15kΩ            | 22kΩ            | 22kΩ            | 22kΩ            | 33kΩ            | 33kΩ            |
| B-Constant  | 3900K           | 3380K           | 3950K           | 3380K           | 3950K           | 4485K           | 4050K           | 4250K           |
| Temp. (°C)  | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40         | 328.996         | 293.651         | 517.912         | 430.688         | 759.605         | 1073.436        | 1227.263        | 1451.049        |
| -35         | 237.387         | 222.375         | 371.724         | 326.150         | 545.196         | 753.900         | 874.449         | 1019.238        |
| -30         | 173.185         | 170.103         | 270.048         | 249.484         | 396.070         | 535.073         | 630.851         | 725.084         |
| -25         | 127.773         | 131.395         | 198.426         | 192.712         | 291.025         | 383.590         | 460.457         | 522.021         |
| -20         | 95.327          | 102.394         | 147.278         | 150.178         | 216.008         | 277.643         | 339.797         | 379.842         |
| -15         | 71.746          | 80.501          | 110.439         | 118.068         | 161.977         | 202.813         | 253.363         | 279.371         |
| -10         | 54.564          | 63.778          | 83.617          | 93.540          | 122.638         | 149.462         | 190.766         | 207.566         |
| -5          | 41.813          | 50.851          | 63.888          | 74.581          | 93.702          | 111.082         | 144.964         | 155.639         |
| 0           | 32.330          | 40.836          | 49.221          | 59.893          | 72.191          | 83.233          | 111.087         | 117.814         |
| 5           | 25.194          | 33.037          | 38.245          | 48.454          | 56.093          | 62.858          | 85.842          | 89.925          |
| 10          | 19.785          | 26.891          | 29.936          | 39.441          | 43.907          | 47.831          | 66.861          | 69.204          |
| 15          | 15.651          | 22.012          | 23.613          | 32.284          | 34.633          | 36.664          | 52.470          | 53.675          |
| 20          | 12.468          | 18.122          | 18.756          | 26.578          | 27.509          | 28.304          | 41.471          | 41.937          |
| 25          | 10.000          | 15.000          | 15.000          | 22.000          | 22.000          | 22.000          | 33.000          | 33.000          |
| 30          | 8.072           | 12.471          | 12.074          | 18.291          | 17.709          | 17.214          | 26.430          | 26.143          |
| 35          | 6.556           | 10.421          | 9.780           | 15.284          | 14.344          | 13.557          | 21.298          | 20.845          |
| 40          | 5.356           | 8.750           | 7.969           | 12.833          | 11.688          | 10.744          | 17.266          | 16.723          |
| 45          | 4.401           | 7.374           | 6.531           | 10.816          | 9.578           | 8.566           | 14.076          | 13.498          |
| 50          | 3.635           | 6.240           | 5.382           | 9.152           | 7.894           | 6.871           | 11.538          | 10.954          |
| 55          | 3.019           | 5.301           | 4.459           | 7.775           | 6.540           | 5.543           | 9.506           | 8.940           |
| 60          | 2.521           | 4.520           | 3.713           | 6.630           | 5.446           | 4.497           | 7.870           | 7.334           |
| 65          | 2.115           | 3.878           | 3.108           | 5.688           | 4.559           | 3.669           | 6.549           | 6.046           |
| 70          | 1.781           | 3.340           | 2.613           | 4.899           | 3.832           | 3.009           | 5.475           | 5.011           |
| 75          | 1.509           | 2.886           | 2.208           | 4.233           | 3.239           | 2.481           | 4.595           | 4.170           |
| 80          | 1.284           | 2.502           | 1.873           | 3.669           | 2.748           | 2.056           | 3.874           | 3.487           |
| 85          | 1.097           | 2.177           | 1.597           | 3.194           | 2.342           | 1.713           | 3.282           | 2.928           |
| 90          | 0.941           | 1.901           | 1.367           | 2.788           | 2.004           | 1.434           | 2.789           | 2.469           |
| 95          | 0.810           | 1.664           | 1.174           | 2.440           | 1.722           | 1.206           | 2.379           | 2.091           |
| 100         | 0.701           | 1.460           | 1.013           | 2.141           | 1.486           | 1.019           | 2.038           | 1.777           |
| 105         | 0.608           | 1.286           | 0.878           | 1.887           | 1.287           | 0.866           | 1.751           | 1.516           |
| 110         | 0.530           | 1.136           | 0.763           | 1.667           | 1.119           | 0.739           | 1.509           | 1.298           |
| 115         | 0.463           | 1.007           | 0.665           | 1.477           | 0.975           | 0.633           | 1.306           | 1.116           |
| 120         | 0.406           | 0.894           | 0.582           | 1.311           | 0.854           | 0.545           | 1.134           | 0.962           |
| 125         | 0.358           | 0.796           | 0.511           | 1.168           | 0.750           | 0.471           | 0.987           | 0.832           |

Continued on the following page. ➤

## for Temperature Compensation Temperature Characteristics (Center Value)

Continued from the preceding page.

| Part Number | NCP□□WL333      | NCP□□WB473      | NCP□□WL473      | NCP□□WD683      | NCP□□WF683      | NCP□□WL683      | NCP□□WF104      | NCP□□WL104      |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance  | 33kΩ            | 47kΩ            | 47kΩ            | 68kΩ            | 68kΩ            | 68kΩ            | 100kΩ           | 100kΩ           |
| B-Constant  | 4485K           | 4050K           | 4485K           | 4150K           | 4250K           | 4485K           | 4250K*          | 4485K           |
| Temp. (°C)  | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40         | 1610.154        | 1747.920        | 2293.249        | 2735.359        | 2990.041        | 3317.893        | 4397.119        | 4879.254        |
| -35         | 1130.850        | 1245.428        | 1610.605        | 1937.391        | 2100.247        | 2330.237        | 3088.599        | 3426.818        |
| -30         | 802.609         | 898.485         | 1143.110        | 1389.345        | 1494.113        | 1653.862        | 2197.225        | 2432.149        |
| -25         | 575.385         | 655.802         | 819.487         | 1008.014        | 1075.679        | 1185.641        | 1581.881        | 1743.590        |
| -20         | 416.464         | 483.954         | 593.146         | 738.978         | 782.705         | 858.168         | 1151.037        | 1262.012        |
| -15         | 304.219         | 360.850         | 433.281         | 547.456         | 575.674         | 626.875         | 846.579         | 921.875         |
| -10         | 224.193         | 271.697         | 319.305         | 409.600         | 427.712         | 461.974         | 628.988         | 679.373         |
| -5          | 166.623         | 206.463         | 237.312         | 309.217         | 320.710         | 343.345         | 471.632         | 504.919         |
| 0           | 124.850         | 158.214         | 177.816         | 235.606         | 242.768         | 257.266         | 357.012         | 378.333         |
| 5           | 94.287          | 122.259         | 134.287         | 180.980         | 185.300         | 194.287         | 272.500         | 285.717         |
| 10          | 71.747          | 95.227          | 102.184         | 140.139         | 142.603         | 147.841         | 209.710         | 217.414         |
| 15          | 54.996          | 74.730          | 78.327          | 109.344         | 110.602         | 113.325         | 162.651         | 166.654         |
| 20          | 42.455          | 59.065          | 60.467          | 85.929          | 86.415          | 87.484          | 127.080         | 128.653         |
| 25          | 33.000          | 47.000          | 47.000          | 68.000          | 68.000          | 68.000          | 100.000         | 100.000         |
| 30          | 25.822          | 37.643          | 36.776          | 54.167          | 53.871          | 53.208          | 79.222          | 78.247          |
| 35          | 20.335          | 30.334          | 28.962          | 43.421          | 42.954          | 41.903          | 63.167          | 61.622          |
| 40          | 16.115          | 24.591          | 22.952          | 35.016          | 34.460          | 33.208          | 50.677          | 48.835          |
| 45          | 12.849          | 20.048          | 18.301          | 28.406          | 27.814          | 26.477          | 40.904          | 38.937          |
| 50          | 10.306          | 16.433          | 14.679          | 23.166          | 22.572          | 21.237          | 33.195          | 31.231          |
| 55          | 8.314           | 13.539          | 11.842          | 18.997          | 18.422          | 17.133          | 27.091          | 25.195          |
| 60          | 6.746           | 11.209          | 9.607           | 15.657          | 15.113          | 13.900          | 22.224          | 20.441          |
| 65          | 5.503           | 9.328           | 7.837           | 12.967          | 12.459          | 11.339          | 18.323          | 16.675          |
| 70          | 4.513           | 7.798           | 6.428           | 10.794          | 10.325          | 9.300           | 15.184          | 13.677          |
| 75          | 3.721           | 6.544           | 5.300           | 9.021           | 8.592           | 7.668           | 12.635          | 11.277          |
| 80          | 3.084           | 5.518           | 4.393           | 7.575           | 7.185           | 6.356           | 10.566          | 9.346           |
| 85          | 2.569           | 4.674           | 3.659           | 6.387           | 6.033           | 5.294           | 8.873           | 7.785           |
| 90          | 2.151           | 3.972           | 3.063           | 5.407           | 5.087           | 4.432           | 7.481           | 6.517           |
| 95          | 1.809           | 3.388           | 2.577           | 4.598           | 4.309           | 3.728           | 6.337           | 5.482           |
| 100         | 1.529           | 2.902           | 2.178           | 3.922           | 3.661           | 3.151           | 5.384           | 4.634           |
| 105         | 1.299           | 2.494           | 1.849           | 3.359           | 3.124           | 2.676           | 4.594           | 3.935           |
| 110         | 1.108           | 2.150           | 1.578           | 2.887           | 2.675           | 2.283           | 3.934           | 3.357           |
| 115         | 0.949           | 1.860           | 1.352           | 2.489           | 2.299           | 1.956           | 3.380           | 2.877           |
| 120         | 0.817           | 1.615           | 1.164           | 2.155           | 1.983           | 1.684           | 2.916           | 2.476           |
| 125         | 0.707           | 1.406           | 1.006           | 1.870           | 1.715           | 1.456           | 2.522           | 2.141           |

| Part Number | NCP□□WL154      | NCP□□WM154      | NCP□□WL224      | NCP□□WM224      | NCP□□WM474      |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance  | 150kΩ           | 150kΩ           | 220kΩ           | 220kΩ           | 470kΩ           |
| B-Constant  | 4485K           | 4500K           | 4485K           | 4500K           | 4500K           |
| Temp. (°C)  | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40         | 7318.881        | 7899.466        | 10734.358       | 11585.884       | 24751.661       |
| -35         | 5140.228        | 5466.118        | 7539.001        | 8016.973        | 17127.169       |
| -30         | 3648.224        | 3834.499        | 5350.729        | 5623.931        | 12014.762       |
| -25         | 2615.385        | 2720.523        | 3835.898        | 3990.100        | 8524.305        |
| -20         | 1893.018        | 1951.216        | 2776.427        | 2861.784        | 6113.811        |
| -15         | 1382.813        | 1415.565        | 2028.126        | 2076.162        | 4435.437        |
| -10         | 1019.059        | 1036.984        | 1494.620        | 1520.909        | 3249.216        |
| -5          | 757.379         | 767.079         | 1110.822        | 1125.049        | 2403.515        |
| 0           | 567.499         | 572.667         | 832.332         | 839.912         | 1794.358        |
| 5           | 428.575         | 431.264         | 628.577         | 632.521         | 1351.294        |
| 10          | 326.121         | 327.405         | 478.310         | 480.194         | 1025.870        |
| 15          | 249.981         | 250.538         | 366.639         | 367.455         | 785.018         |
| 20          | 192.979         | 193.166         | 283.036         | 283.310         | 605.252         |
| 25          | 150.000         | 150.000         | 220.000         | 220.000         | 470.000         |
| 30          | 117.370         | 117.281         | 172.143         | 172.012         | 367.480         |
| 35          | 92.433          | 92.293          | 135.569         | 135.364         | 289.186         |
| 40          | 73.252          | 73.090          | 107.436         | 107.198         | 229.014         |
| 45          | 58.406          | 58.240          | 85.662          | 85.419          | 182.485         |
| 50          | 46.846          | 46.665          | 68.708          | 68.441          | 146.215         |
| 55          | 37.793          | 37.605          | 55.429          | 55.153          | 117.828         |
| 60          | 30.661          | 30.453          | 44.970          | 44.665          | 95.420          |
| 65          | 25.013          | 24.804          | 36.686          | 36.379          | 77.718          |
| 70          | 20.516          | 20.293          | 30.090          | 29.763          | 63.584          |
| 75          | 16.916          | 16.679          | 24.810          | 24.462          | 52.260          |
| 80          | 14.019          | 13.776          | 20.562          | 20.205          | 43.166          |
| 85          | 11.678          | 11.428          | 17.128          | 16.761          | 35.808          |
| 90          | 9.776           | 9.520           | 14.338          | 13.962          | 29.828          |
| 95          | 8.223           | 7.966           | 12.061          | 11.684          | 24.961          |
| 100         | 6.951           | 6.688           | 10.194          | 9.809           | 20.955          |
| 105         | 5.902           | 5.639           | 8.657           | 8.270           | 17.668          |
| 110         | 5.035           | 4.772           | 7.385           | 6.998           | 14.951          |
| 115         | 4.315           | 4.052           | 6.329           | 5.942           | 12.695          |
| 120         | 3.714           | 3.454           | 5.448           | 5.067           | 10.824          |
| 125         | 3.211           | 2.955           | 4.710           | 4.334           | 9.259           |

\* B-Constant of NCP18WF104F type is 4200K. Please contact us for the detail data.

## Chip Type ⚠Caution/Notice

### ■ ⚠Caution (Storage and Operating Conditions)

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 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 (Others)

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

### ■ Notice (Storage and Operating Conditions)

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

1. Storage condition:  
Temperature -10 to +40 degree 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 (Handling)

The ceramic of this product is fragile, and care must be taken not to load a excessive press-force or not to give a shock at handling.

Such forces may cause cracking or chipping.

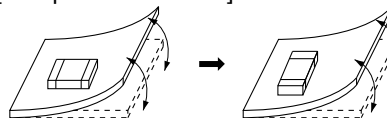
## Chip Type ⚠Caution/Notice

### ■ Notice (Soldering and Mounting)

#### 1. Mounting Position

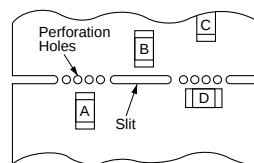
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

##### [Component Direction]



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

##### [Mounting Close to Board Separation Line]

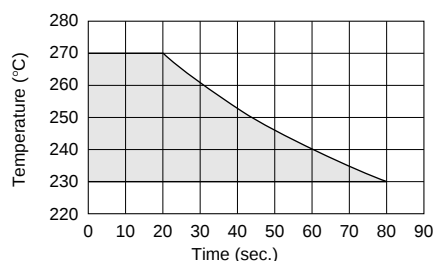


Keep this product on the PC Board away from the Separation Line.  
Worst ← A-C-B-D → Better

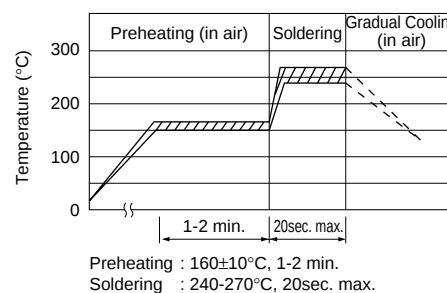
#### 2. Reflow Soldering Conditions

##### (NCP03/NCP15 Series)

Allowable Reflow Soldering Temperature and Time

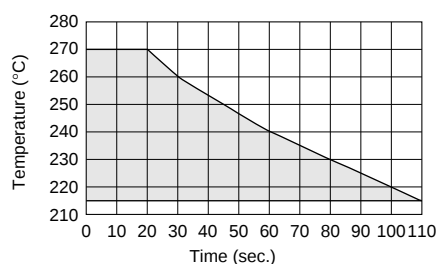


Standard Soldering Conditions

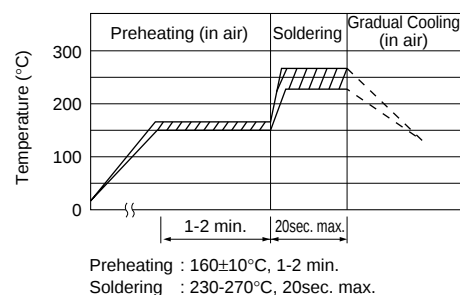


##### (NCP18/NCP21 Series)

Allowable Reflow Soldering Temperature and Time



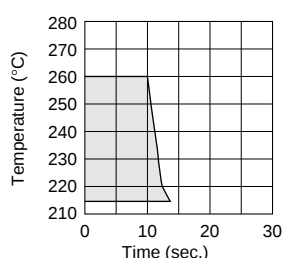
Standard Soldering Conditions



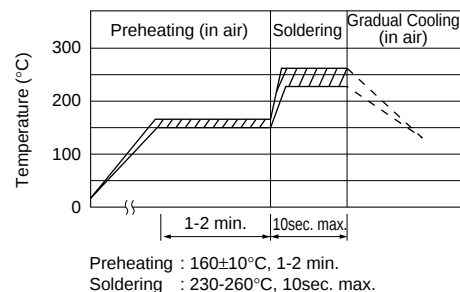
#### 3. Flow Soldering Conditions

##### (NCP18/NCP21 Series)

Allowable Reflow Soldering Temperature and Time



Standard Soldering Conditions



Continued on the following page. ➤

## Chip Type ⚠Caution/Notice

☐ Continued from the preceding page.

### 4. Solder and Flux

#### (1) Solder and Paste

##### (a) Reflow Soldering : NCP03/15/18/21 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 : NCP18/21 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 0.2wt%)

### 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.

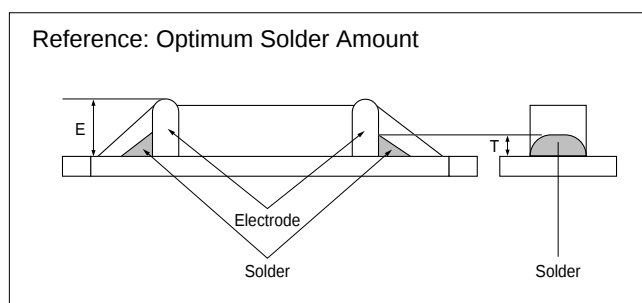
|                     | NCP03/15                                                      | NCP18/21                                                       |
|---------------------|---------------------------------------------------------------|----------------------------------------------------------------|
| Solvent             | Isopropyl Alcohol                                             | Isopropyl Alcohol                                              |
| Dipping Cleaning    | Less than 5min. at room temp. or less than 2min. at 40°C max. | Less than 5min. at room temp. or less than 2min. at 40°C max.  |
| Ultrasonic Cleaning | Less than 5min. 20W/ℓ<br>Frequency of 28 to 40kHz.            | Less than 1min. 20W/ℓ<br>Frequency of several 10kHz to 100kHz. |

### 6. Drying

After cleaning, promptly dry this product.

### 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.



| Part Number | The solder paste thickness | T                            |
|-------------|----------------------------|------------------------------|
| NCP03       | 100μm                      | $1/3E \leq T \leq E$         |
| NCP15       | 100μm                      | $1/3E \leq T \leq E$         |
| NCP18/NCP21 | 150μm                      | $0.2\text{mm} \leq T \leq E$ |

### 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.

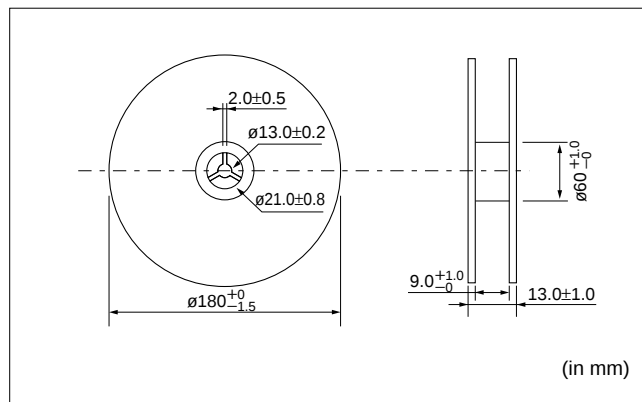
## Chip Type Package

### ■ Minimum Quantity Guide

| Part Number | Quantity (pcs.) |              |
|-------------|-----------------|--------------|
|             | Paper Tape      | Plastic Tape |
| NCP03       | 15000           | -            |
| NCP15       | 10000           |              |
| NCP18       | 4000            |              |
| NCP21       | -               | 4000         |

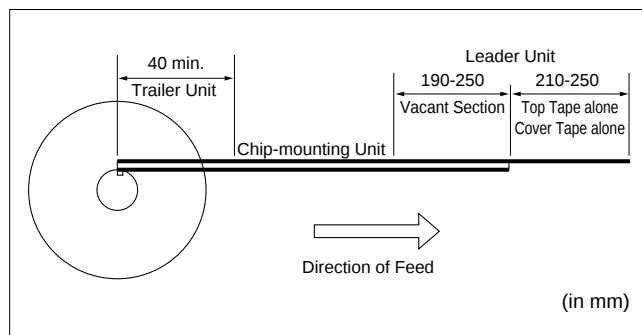
### ■ Tape Carrier Packaging

#### 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 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.

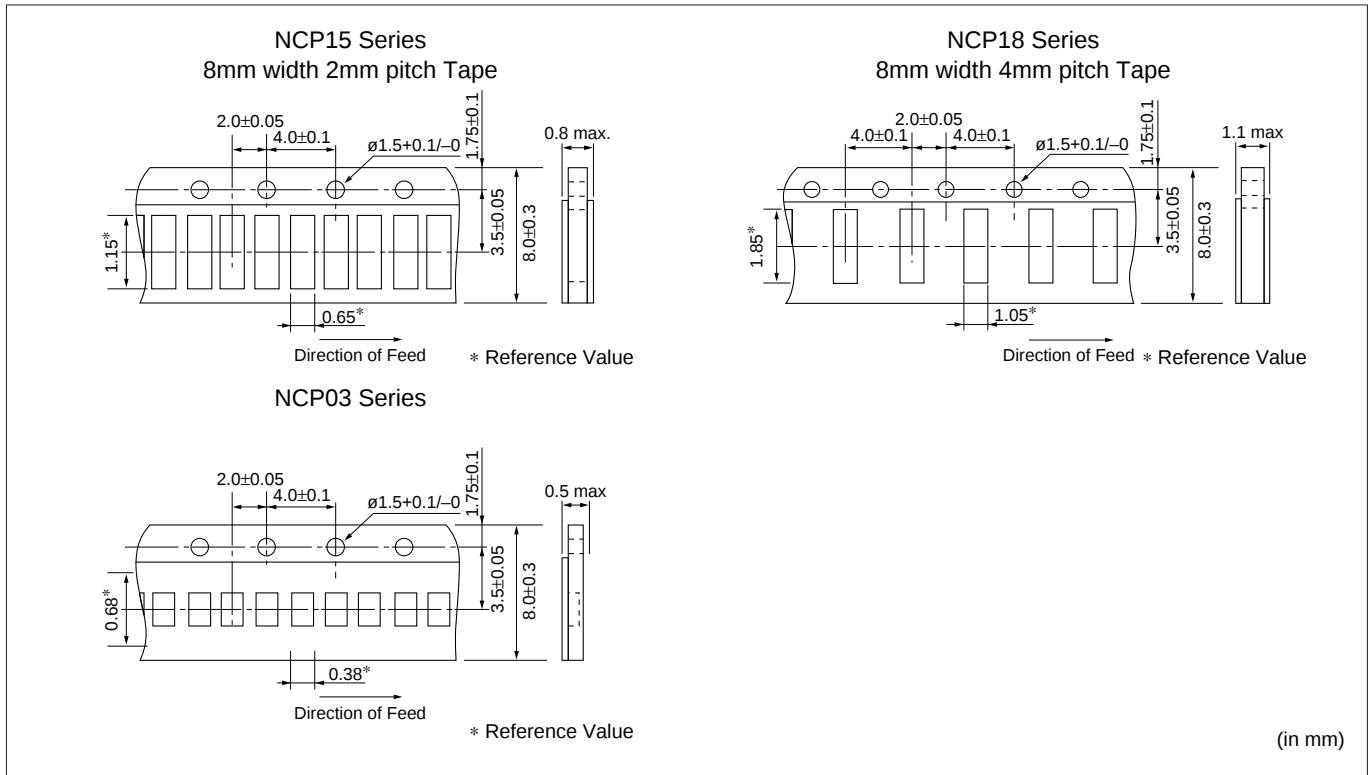


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## Chip Type Package

Continued from the preceding page.

### 3. Paper Tape (NCP03/15/18 Series)



#### (1) Other Conditions

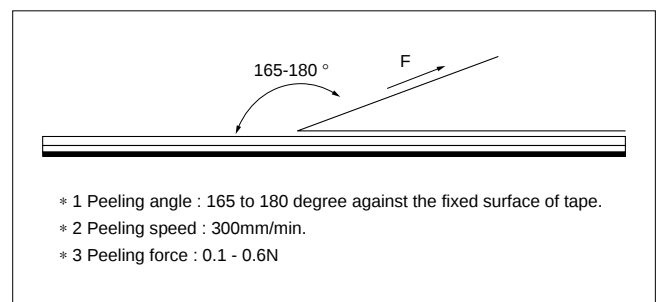
##### (a) Packaging

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

##### (b) 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



#### (3) Pull Strength

Pull strength of top tape is specified at 10N minimum.

Pull strength of bottom tape are specified 5N minimum.

Continued on the following page. ➤

## Chip Type Package

☐ Continued from the preceding page.

### 4. Plastic Tape (NCP21 Series)

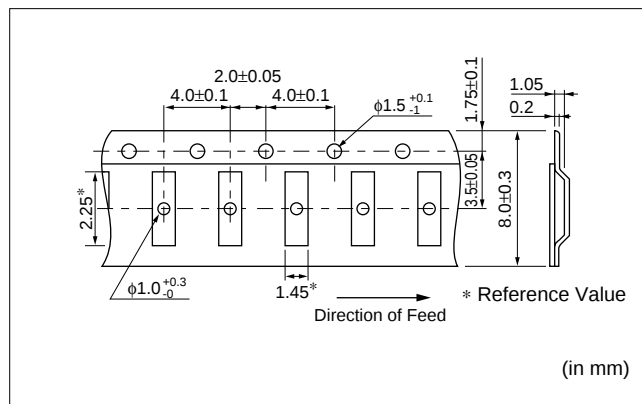
#### (1) Other Conditions

##### (a) Packaging

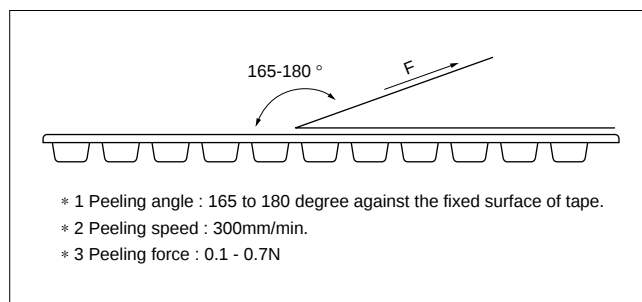
Products are packaged in the each embossed cavity of plastic tape and sealed by cover tape.

##### (b) Tape

Cover tape has no joints.



#### (2) Peeling force of cover tape



#### (3) Tape Strength

Pull strength of plastic tape and cover tape shall be specified 10N minimum.

# NTC Thermistors

**muRata**

## for Temperature Sensor Lead Type

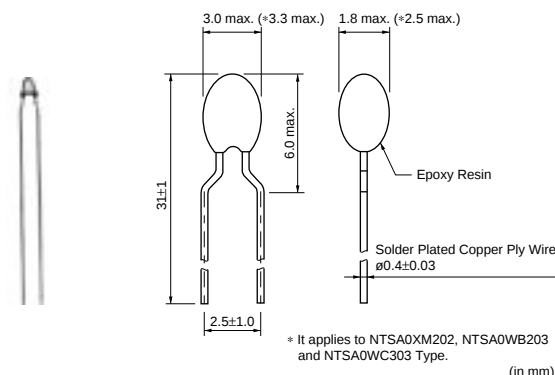
This product is a sensor type NTC Thermistor to be useful in the normal temperature range developed by the unique ceramic technology and the automatic assembly.

### ■ Features

1. High-accuracy of  $\pm 1\%$   
 $\pm 1\%$  of resistance and B-Constant tolerance is realized due to uniform thickness by the precise sheet forming method.
2. Quick response  
 This product provides faster response time due to its smaller size.
3. Taping type is available (Standard type).
4. Strong lead strength  
 Original lead-wiring technique assures reliable connection. It can be formed and bent flexibly according to the mounting conditions.

### ■ Applications

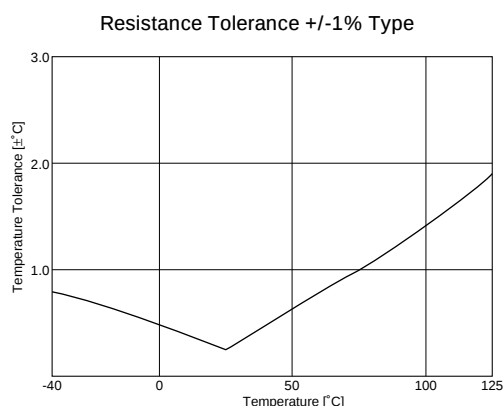
1. Rechargeable batteries
2. Battery charging circuits
3. Head of printers
4. DC fan motors
5. Home appliance equipments



| Part Number      | Resistance (25°C)<br>(k ohm) | B-Constant (25-50°C)<br>(K) | Permissible Operating Current (25°C)<br>(mA) | Rated Electric Power (25°C)<br>(mW) | Typical Dissipation Constant (25°C)<br>(mW/°C) | Thermal Time Constant (25°C)(s) | Operating Temperature Range (°C) |
|------------------|------------------------------|-----------------------------|----------------------------------------------|-------------------------------------|------------------------------------------------|---------------------------------|----------------------------------|
| NNTSA0XM202□E1B0 | 2.0                          | 3500 $\pm 1\%$              | 1.05                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |
| NNTSA0XR502□E1B0 | 5.0                          | 3700 $\pm 1\%$              | 0.68                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |
| NNTSA0XH103□E1B0 | 10                           | 3380 $\pm 1\%$              | 0.38                                         | 15                                  | 1.5                                            | 7                               | -40 to 125                       |
| NNTSA0XV103□E1B0 | 10                           | 3900 $\pm 1\%$              | 0.46                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |
| NNTSA0WB203□E1B0 | 20                           | 4050 $\pm 1\%$              | 0.31                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |
| NNTSA0WC303□E1B0 | 30                           | 4100 $\pm 1\%$              | 0.26                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |
| NNTSA0WD503□E1B0 | 50                           | 4150 $\pm 1\%$              | 0.20                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |
| NNTSA0WF104□E1B0 | 100                          | 4250 $\pm 1\%$              | 0.14                                         | 21                                  | 2.1                                            | 7                               | -40 to 125                       |

A blank column is filled with resistance tolerance codes. (F:  $\pm 1\%$ , E:  $\pm 3\%$ )  
Taping type of part numbers with "N6A0" is available. (Lead spacing=5mm)

### ■ Temperature Tolerance-Temperature Characteristics



**muRata**

# NTC Thermistors

**muRata**

## for Temperature Sensor Lead Insulation Type

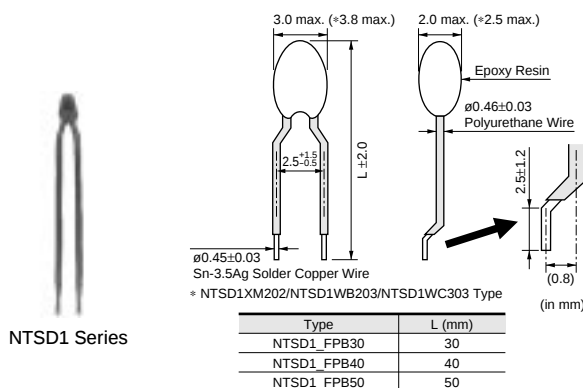
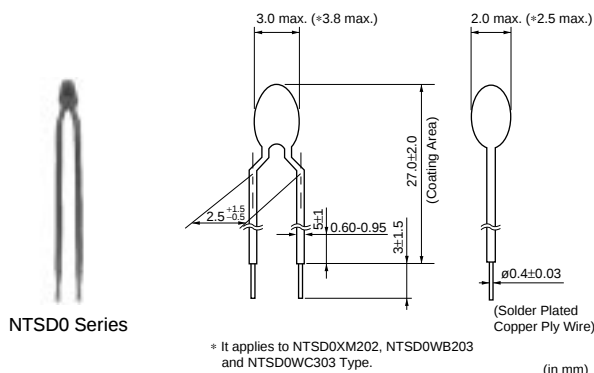
This product is a sensor type NTC Thermistor to be useful in the normal temperature range developed by the unique ceramic technology and the automatic assembly.

### ■ Features

1. Electric insulation on lead wire
2. Excellent bending resistance due to suitable hardness of surface coating
3. Easy handling due to most suitable hardness of surface of coating
4. High-accuracy of  $\pm 1\%$   
 $\pm 1\%$  of resistance and B-Constant tolerance are realized due to uniform thickness by the precise sheet forming method.

### ■ Applications

1. Rechargeable batteries
2. Battery charging circuits
3. Head of printers
4. DC fan motors
5. Home appliance equipments



6

### NTSD0 Series

| Part Number     | Resistance (25°C) (k ohm) | B-Constant (25-50°C) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C)(s) | Operating Temperature Range (°C) |
|-----------------|---------------------------|--------------------------|------------------------------------------|----------------------------------|---------------------------------------------|---------------------------------|----------------------------------|
| NTSD0XM202□E1B0 | 2.0                       | 3500 $\pm 1\%$           | 1.05                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD0XR502□E1B0 | 5.0                       | 3700 $\pm 1\%$           | 0.68                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD0XH103□E1B0 | 10                        | 3380 $\pm 1\%$           | 0.38                                     | 15                               | 1.5                                         | 7                               | -40 to 125                       |
| NTSD0XV103□E1B0 | 10                        | 3900 $\pm 1\%$           | 0.46                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD0WB203□E1B0 | 20                        | 4050 $\pm 1\%$           | 0.31                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD0WC303□E1B0 | 30                        | 4100 $\pm 1\%$           | 0.26                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD0WD503□E1B0 | 50                        | 4150 $\pm 1\%$           | 0.20                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD0WF104□E1B0 | 100                       | 4250 $\pm 1\%$           | 0.14                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |

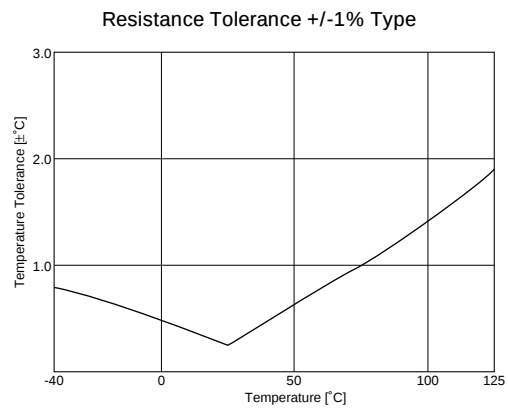
A blank column is filled with resistance tolerance codes. (F:  $\pm 1\%$ , E:  $\pm 3\%$ )

### NTSD1 Series

| Part Number     | Resistance (25°C) (k ohm) | B-Constant (25-50°C) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C)(s) | Operating Temperature Range (°C) |
|-----------------|---------------------------|--------------------------|------------------------------------------|----------------------------------|---------------------------------------------|---------------------------------|----------------------------------|
| NTSD1XM202FPB□□ | 2.0 $\pm 1\%$             | 3500 $\pm 1\%$           | 1.05                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD1XR502FPB□□ | 5.0 $\pm 1\%$             | 3700 $\pm 1\%$           | 0.68                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD1XH103FPB□□ | 10 $\pm 1\%$              | 3380 $\pm 1\%$           | 0.38                                     | 15                               | 1.5                                         | 7                               | -40 to 125                       |
| NTSD1XV103FPB□□ | 10 $\pm 1\%$              | 3900 $\pm 1\%$           | 0.46                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD1WB203FPB□□ | 20 $\pm 1\%$              | 4050 $\pm 1\%$           | 0.31                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD1WC303FPB□□ | 30 $\pm 1\%$              | 4100 $\pm 1\%$           | 0.26                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD1WD503FPB□□ | 50 $\pm 1\%$              | 4150 $\pm 1\%$           | 0.20                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |
| NTSD1WF104FPB□□ | 100 $\pm 1\%$             | 4250 $\pm 1\%$           | 0.14                                     | 21                               | 2.1                                         | 7                               | -40 to 125                       |

A blank column is filled with Total-length codes. (30, 40, 50)

## ■ Temperature Tolerance-Temperature Characteristics



## for Temperature Sensor 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           | 2.371           | 3.463           | 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           | 1.729           | 2.516           | 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           |

## for Temperature Sensor Lead Type/Lead Insulation Type ⚠Caution/Notice

### ■ ⚠Caution (Storage and Operating Conditions)

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 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 (Others)

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

### ■ Notice (Storage and Operating Conditions)

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

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

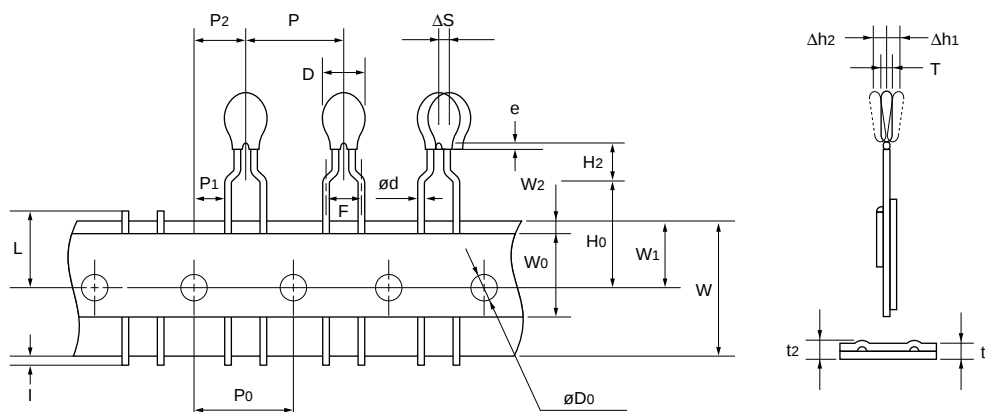
1. The ceramic element of this product is fragile, and care must be taken not to load an excessive press-force or not to give a shock at handling. Such forces may cause cracking or chipping.
2. Do not apply an excessive force to the lead. Otherwise, it may cause junction between lead and element to break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

## for Temperature Sensor Lead Type/Lead Insulation Type NTSA/NTSD Series Package

### ■ Minimum Quantity

| Part Number | Minimum Quantity (pcs.) |      |
|-------------|-------------------------|------|
|             | Ammo Pack               | Bulk |
| NTSA        | 3000                    | 100  |
| NTSD        | -                       | 100  |

### ■ Taping Dimensions (NTSA Series)



| Item                                              | Code                              | Dimensions (mm)       |
|---------------------------------------------------|-----------------------------------|-----------------------|
| Pitch of Component                                | P                                 | 12.7                  |
| Pitch of Sprocket Hole                            | P <sub>0</sub>                    | 12.7±0.3              |
| Lead Spacing                                      | F                                 | 5.0+0.8/-0.2          |
| Lead Length from Hole Center to Component Center  | P <sub>2</sub>                    | 6.35±1.3              |
| Lead Length from Hole Center to Lead              | P <sub>1</sub>                    | 3.85±0.8              |
| Body Diameter                                     | D                                 | 3.5 max.              |
| Deviation along Tape, Left or Right               | ΔS                                | 0±2.0                 |
| Carrier Tape Width                                | W                                 | 18.0±0.5              |
| Position of Sprocket Hole                         | W <sub>1</sub>                    | 9.0±0.5               |
| Lead Distance between Reference and Bottom Planes | H <sub>0</sub>                    | 16.0±1.0              |
| Height of Component                               | H <sub>2</sub>                    | 4.0 max.              |
| Overflow of Lead                                  | I                                 | +0.5 to -1.0          |
| Diameter of Sprocket Hole                         | D <sub>0</sub>                    | 4.0±0.1               |
| Lead Diameter                                     | d                                 | 0.50±0.03             |
| Total Tape Thickness                              | t <sub>1</sub>                    | 0.6±0.3               |
| Total Thickness, Tape and Lead Wire               | t <sub>2</sub>                    | 1.6 max.              |
| Deviation across Tape                             | Δh <sub>1</sub> , Δh <sub>2</sub> | 1.0 max.              |
| Portion to Cut in Case of Defect                  | L                                 | 11.0+0/-2.0           |
| Hole Down Tape Width                              | W <sub>0</sub>                    | 11.0 min.             |
| Hole Down Tape Position                           | W <sub>2</sub>                    | 1.5±1.5               |
| Coating Extension on Lead                         | e                                 | Up to the crimp point |
| Thickness                                         | T                                 | 2.6 max.              |

(in mm)

***muRata***

This product effectively suppresses surge currents which are generated when switching power regulators are turned on.

1. Lead is not contained in the ceramic element, the terminations, the solder for inner connection and the coating resin.
2. Most suitable for power supplies of less than 100W
3. Excellent recovery characteristics due to resin coating with excellent heat characteristics
4. Highly reliable

1. Switching power supplies
2. CRT monitors
3. Color televisions
4. VCR-Power supplies
5. Other power circuits

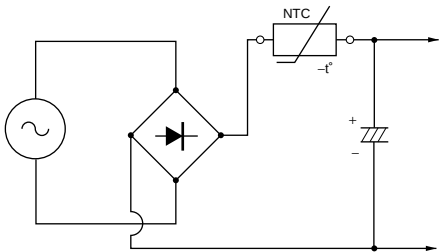
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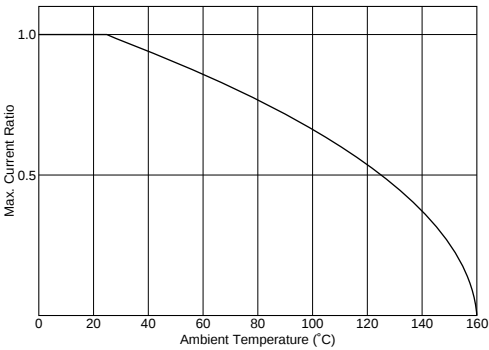
| Part Number   | Resistance<br>(25°C)<br>(ohm) | Permissible Max.<br>Current (25°C)<br>(A) | Permissible Max.<br>Current (55°C)<br>(A) | Thermal Time<br>Constant (25°C)(s) | Thermal Dissipation<br>Constant<br>(mW/°C) | Permissible<br>Electrolytic Capacitor<br>(μF) |
|---------------|-------------------------------|-------------------------------------------|-------------------------------------------|------------------------------------|--------------------------------------------|-----------------------------------------------|
| NTPAA3R9LDNB0 | 3.9 ±15%                      | 2.7                                       | 2.3                                       | 70                                 | 13.5                                       | 1400 at 100V                                  |
| NTPAA5R1LDNB0 | 5.1 ±15%                      | 2.5                                       | 2.2                                       | 70                                 | 13.5                                       | 1400 at 100V                                  |
| NTPAA8R2LDNB0 | 8.2 ±15%                      | 2.0                                       | 1.7                                       | 70                                 | 13.5                                       | 1400 at 100V                                  |
| NTPAA100LDNB0 | 10.0 ±15%                     | 1.7                                       | 1.5                                       | 70                                 | 13.5                                       | 1400 at 100V                                  |
| NTPA9160LBMB0 | 16.0 ±15%                     | 1.4                                       | 1.2                                       | 65                                 | 11.6                                       | 800 at 100V                                   |
| NTPA74R0LBMB0 | 4.0 ±15%                      | 2.3                                       | 2.0                                       | 40                                 | 9.4                                        | 700 at 100V                                   |
| NTPA78R0LBMB0 | 8.0 ±15%                      | 1.7                                       | 1.5                                       | 40                                 | 9.5                                        | 570 at 100V                                   |
| NTPA7160LBMB0 | 16.0 ±15%                     | 1.2                                       | 1.0                                       | 40                                 | 9.9                                        | 400 at 100V                                   |
| NTPA7220LBMB0 | 22.0 ±15%                     | 1.0                                       | 0.88                                      | 40                                 | 9.1                                        | 400 at 100V                                   |

NTPAD/NTPAA/NTPA7 series are also available on tape.

Application Circuit

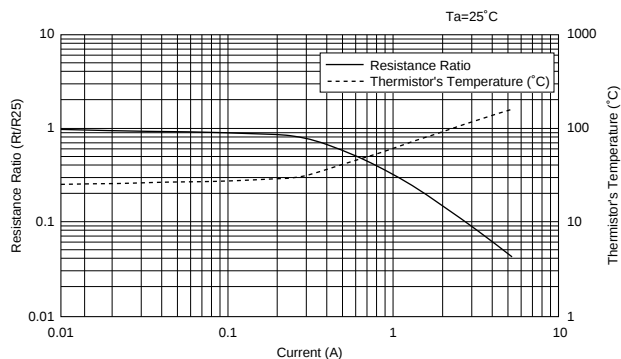


Determination of Allowable Current

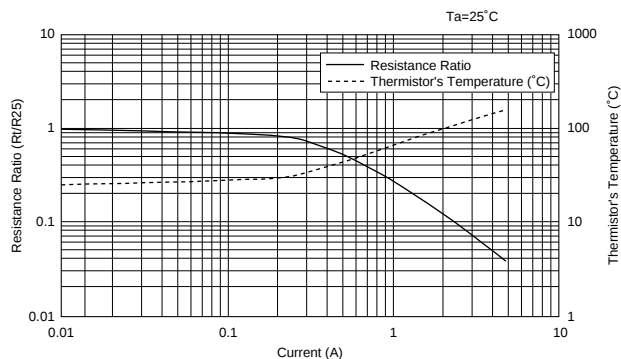


## Current-R Ratio ( $R_t/R_{25}$ ) / Current-Temperature Characteristics (Typical)

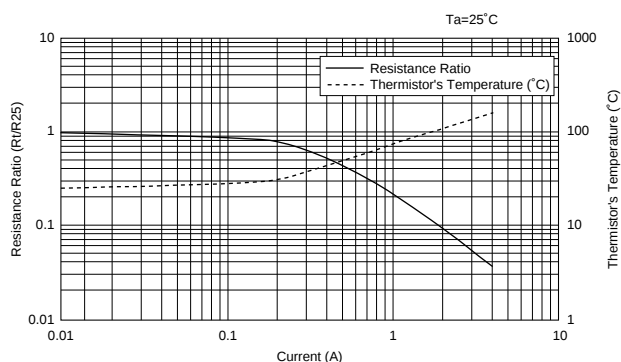
### ■ NTPAN3R0L Type



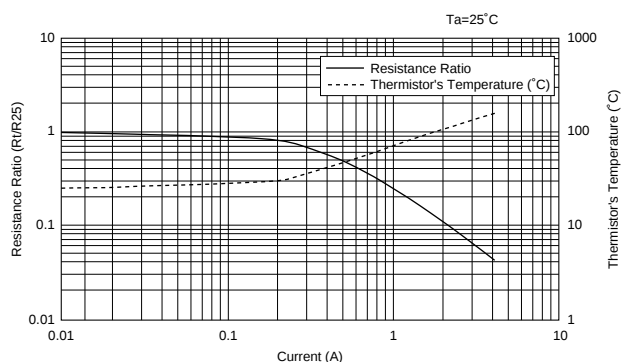
### ■ NTPAN4R0L Type



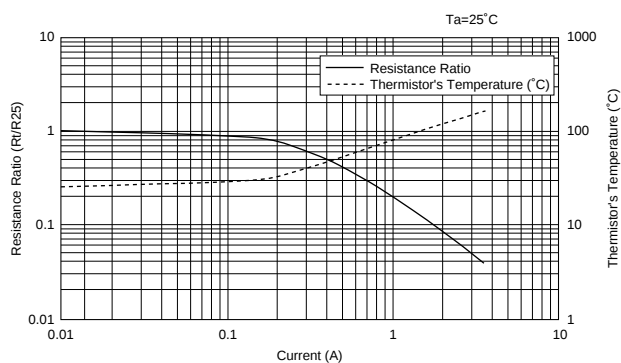
### ■ NTPAN6R0L Type



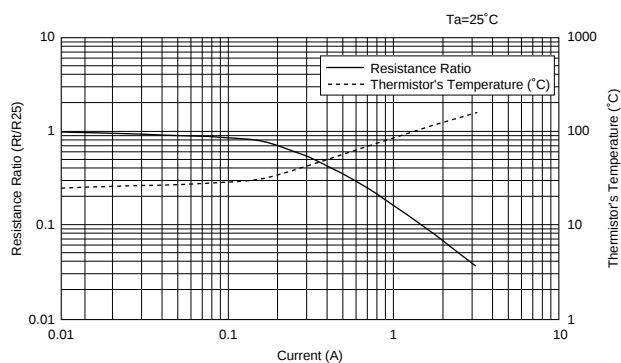
### ■ NTPAJ4R0L Type



### ■ NTPAJ6R0L Type



### ■ NTPAJ8R0L Type

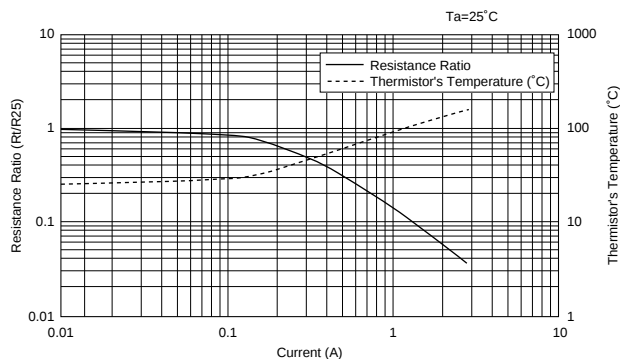


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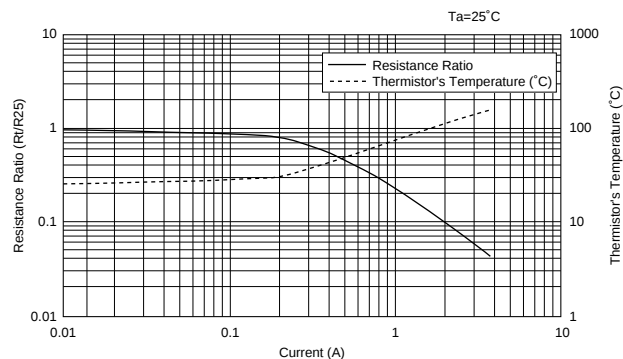
## Current-R Ratio (RT/R25) / Current-Temperature Characteristics (Typical)

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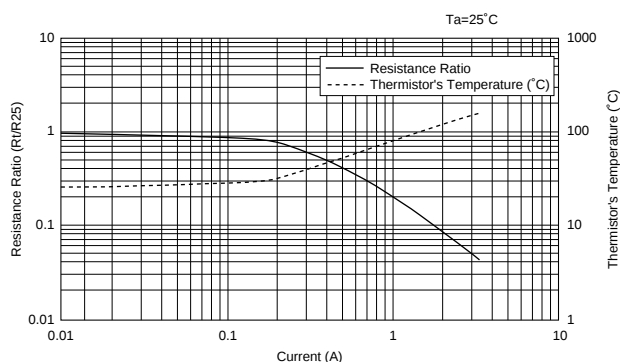
### ■ NTPAJ100L Type



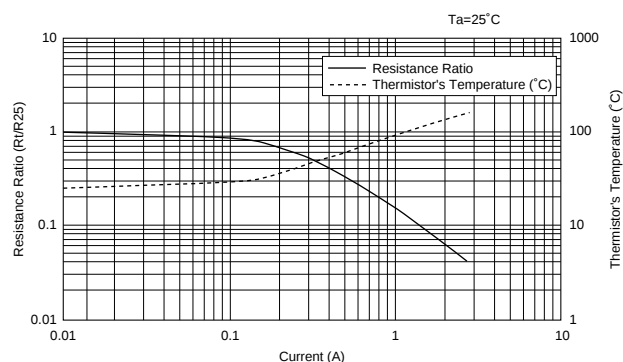
### ■ NTPAD3R9L Type



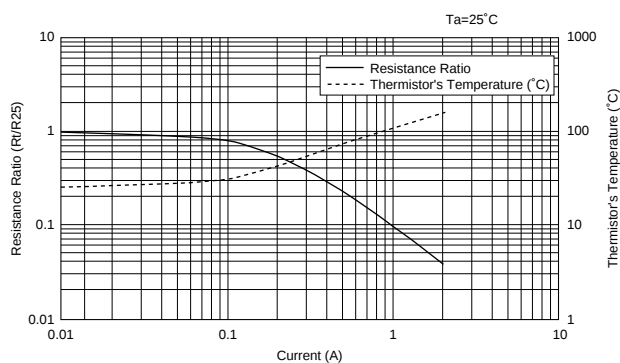
### ■ NTPAD5R1L Type



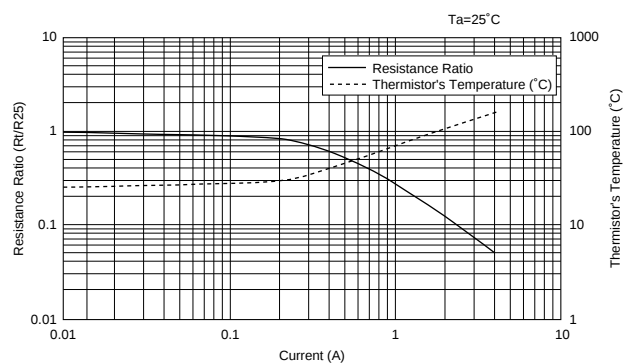
### ■ NTPAD8R0L Type



### ■ NTPAD160L Type



### ■ NTPAA2R2L Type

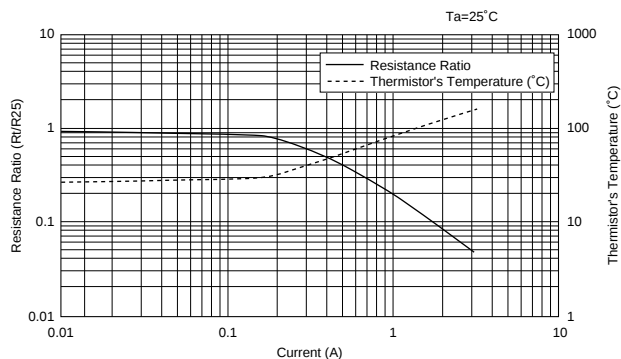


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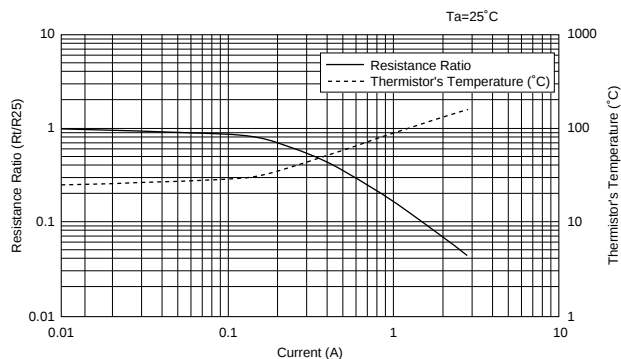
## Current-R Ratio ( $R_T/R_{25}$ ) / Current-Temperature Characteristics (Typical)

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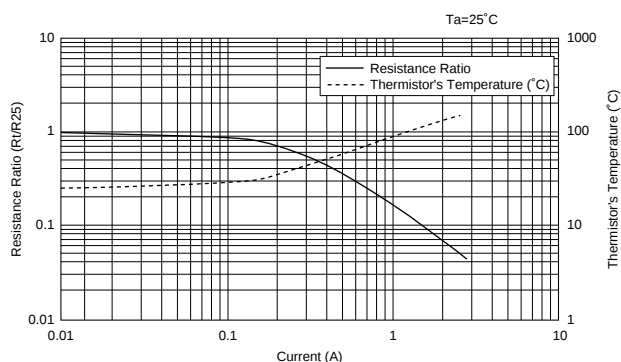
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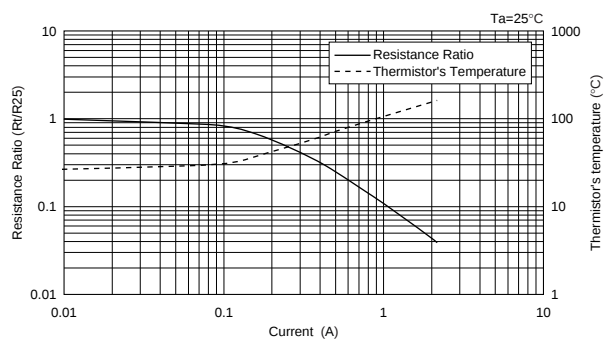
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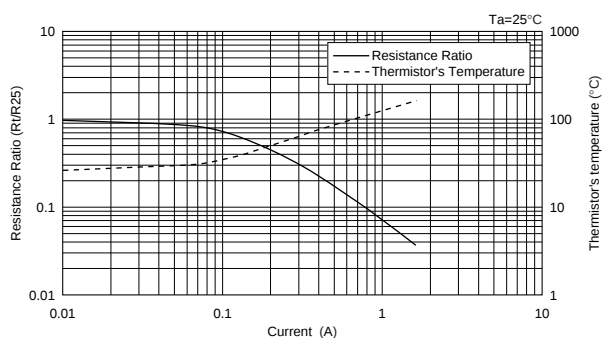
### ■ NTPAA8R2L Type



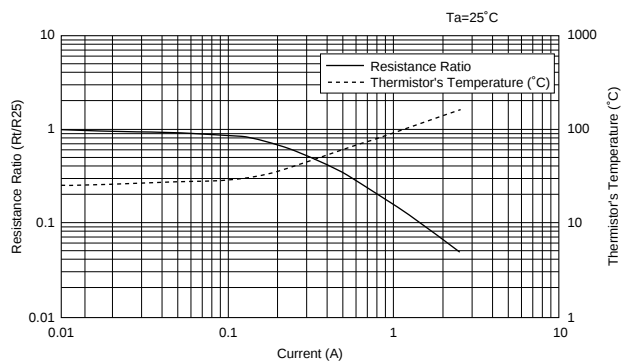
### ■ NTPAA100L Type



### ■ NTPA9160L Type



### ■ NTPA74R0L Type

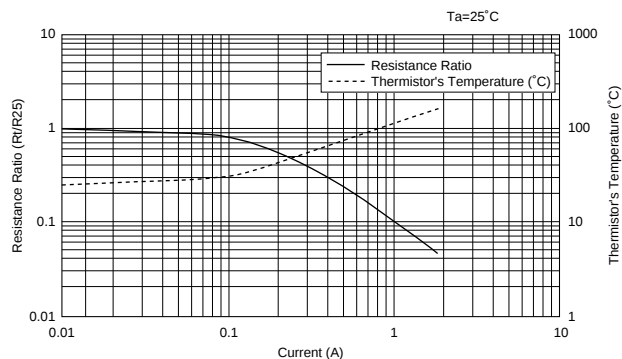


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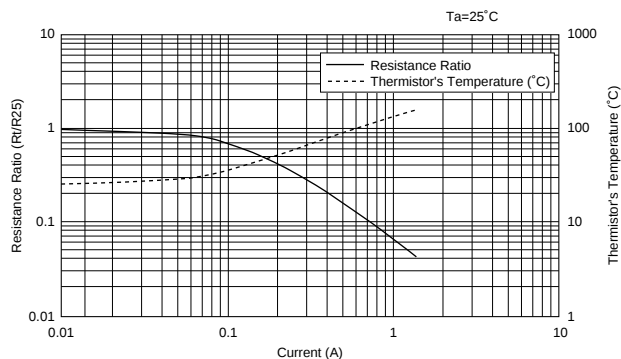
## Current-R Ratio (RT/R25) / Current-Temperature Characteristics (Typical)

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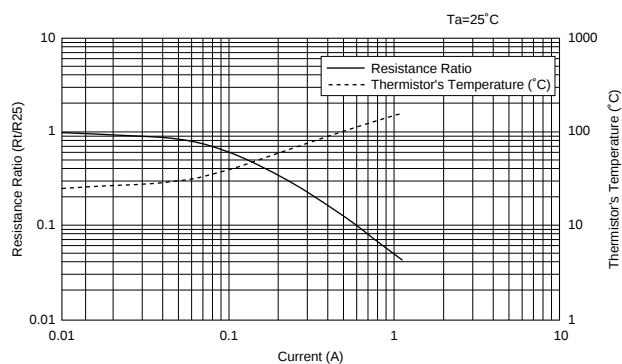
### ■ NTPA78R0L Type



### ■ NTPA7160L Type



### ■ NTPA7220L Type



## for Inrush Current Suppression Lead Type ⚠Caution/Notice

### ■ ⚠Caution (Storage and Operating Conditions)

1. This product is designed for the Switching Power Supply with smoothing capacitors.  
Other applications of this product may result in fire.
2. Use this product within the specified maximum current. Otherwise it may catch fire in the worst case.
3. Use this product with smoothing capacitor within the specified maximum capacitance value. Otherwise it may catch fire in the worst case.
4. 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 cause 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 high or low pressure
- (5) Wet or humid conditions
- (6) Near with salt water, oils, chemical liquids or organic solvents
- (7) Strong vibrations
- (8) Other places where similar hazardous conditions exist.

### ■ ⚠Caution (Others)

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

### ■ Notice (Storage and Operating Conditions)

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

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

## for Inrush Current Suppression Lead Type ⚠Caution/Notice

### ■ Notice (Handling)

1. When this product is operated, temperature of some area may be about 160 (degree C).  
Use proper surrounding parts and material which withstand such temperature. If they are inadequate and kept at high temperature for long time, they may be deteriorated or may produce harmful gas. And, such harmful gas may deteriorate the element of this product.
2. This product does not have waterproof construction. Splashed water may cause failure mode such as deterioration of characteristics or current leak. So, do not apply cleaning to immerse it into water or any solvent.
3. 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 to the element.
4. Do not apply an excessive force to the lead wire. Otherwise, it may cause break off junction between lead wire and element, or may crack element. So, fix lead wire of element side when lead wire is bent or cut.

### ■ Notice (Others)

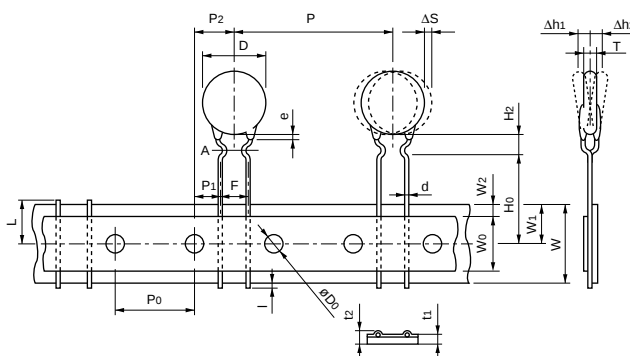
1. This products need sufficient cool off time to recover high resistance. Repeated ON-OFF may cause over specified current rating.  
Make sure inrush current do not exceed the specified ratings even at the worst condition.  
(maximum ambient temperature and the shortest off time.)
2. The resin coating of this product does not guarantee insulating. Keep an adequate insulating distance to surrounding parts.

## for Inrush Current Suppression Lead Type Package

### ■ Minimum Quantity

| Part Numbers | Minimum Quantity (pcs.) |      |
|--------------|-------------------------|------|
|              | Ammo Pack               | Bulk |
| <b>NTPA7</b> | 1000                    | 100  |
| <b>NTPA9</b> | 1000                    | 100  |
| <b>NTPAA</b> | 750                     | 100  |
| <b>NTPAD</b> | 400                     | 100  |
| <b>NTPAJ</b> | -                       | 100  |
| <b>NTPAN</b> | -                       | 100  |

### ■ Taping Dimensions (NTPAD/NTPAA Series)



| Item                                              | Code                              | Dimensions (mm)                    |
|---------------------------------------------------|-----------------------------------|------------------------------------|
| Pitch of Component                                | P                                 | 30.0                               |
| Pitch of Sprocket Hole                            | P <sub>0</sub>                    | 15.0±0.3                           |
| Lead Spacing                                      | F                                 | 7.5±0.5                            |
| Length from Hole Center to Component              | P <sub>2</sub>                    | 7.5±1.5                            |
| Length from Hole Center to Lead                   | P <sub>1</sub>                    | 3.75±1.0                           |
| Body Diameter                                     | D                                 | (refer to the table below)         |
| Thickness                                         | T                                 | (refer to the table below)         |
| Deviation along Tape, Left or Right               | ΔS                                | ±2.0                               |
| Carrier Tape Width                                | W                                 | 18.0±0.5                           |
| Position of Sprocket Hole                         | W <sub>1</sub>                    | 9.0±0.5                            |
| Lead Distance between Reference and Bottom Planes | H <sub>0</sub>                    | 16.0±0.5                           |
| Height of Component                               | H <sub>2</sub>                    | 10.0 max.                          |
| Overflow of Lead                                  | l                                 | +0.5 to -6.0                       |
| Diameter of Sprocket Hole                         | D <sub>0</sub>                    | 4.0±0.1                            |
| Lead Diameter (Sn-Plated Cu Wire)                 | d                                 | 0.8±0.05                           |
| Total Tape Thickness                              | t <sub>1</sub>                    | 0.6±0.3                            |
| Total Thickness, Tape and Lead Wire               | t <sub>2</sub>                    | 2.0 max.                           |
| Deviation across Tape                             | Δh <sub>1</sub> , Δh <sub>2</sub> | 2.0 max.                           |
| Portion to cut in Case of Defect                  | L                                 | 11.0 <sup>+0</sup> <sub>-2.0</sub> |
| Hole Down Tape Width                              | W <sub>0</sub>                    | 11.5 min.                          |
| Hole Down Tape Position                           | W <sub>2</sub>                    | 4.0 max.                           |
| Coating Extension on Lead                         | e                                 | to line A                          |

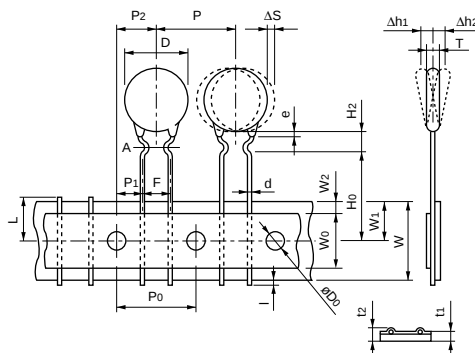
| Type         | D         | T        |
|--------------|-----------|----------|
| <b>NTPAD</b> | 16.0 max. | 5.5 max. |
| <b>NTPAA</b> | 12.0 max. | 5.0 max. |

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## for Inrush Current Suppression Lead Type Package

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### Taping Dimensions (NTPA7/NTPA9 Series)



| Item                                              | Code                              | Dimensions (mm)                      |
|---------------------------------------------------|-----------------------------------|--------------------------------------|
| Pitch of Component                                | P                                 | 12.7                                 |
| Pitch of Sprocket Hole                            | P <sub>0</sub>                    | 12.7±0.3                             |
| Lead Spacing                                      | F                                 | 5.0 <sup>+0.8</sup> <sub>-0.3</sub>  |
| Length from Hole Center to Component              | P <sub>2</sub>                    | 6.35±1.3                             |
| Length from Hole Center to Lead                   | P <sub>1</sub>                    | 3.85±0.8                             |
| Body Diameter                                     | D                                 | (refer to the table below)           |
| Thickness                                         | T                                 | 5.0 max.                             |
| Deviation along Tape, Left or Right               | ΔS                                | ±1.5                                 |
| Carrier Tape Width                                | W                                 | 18.0±0.5                             |
| Position of Sprocket Hole                         | W <sub>1</sub>                    | 9.0 <sup>+0.5</sup> <sub>-0.75</sub> |
| Lead Distance between Reference and Bottom Planes | H <sub>0</sub>                    | 16.0±1.0                             |
| Height of Component                               | H <sub>2</sub>                    | 6.0 max.                             |
| Overflow of Lead                                  | I                                 | +0.5 to -4.0                         |
| Diameter of Sprocket Hole                         | D <sub>0</sub>                    | 4.0±0.3                              |
| Lead Diameter (Sn-Plated Cu Wire)                 | d                                 | 0.6±0.05                             |
| Total Tape Thickness                              | t <sub>1</sub>                    | 0.6±0.3                              |
| Total Thickness, Tape and Lead Wire               | t <sub>2</sub>                    | 2.0 max.                             |
| Deviation across Tape                             | Δh <sub>1</sub> , Δh <sub>2</sub> | 1.5 max.                             |
| Portion to cut in Case of Defect                  | L                                 | 11.0 <sup>+0</sup> <sub>-2.0</sub>   |
| Hole Down Tape Width                              | W <sub>0</sub>                    | 11.0 min.                            |
| Hole Down Tape Position                           | W <sub>2</sub>                    | 4.0 max.                             |
| Coating Extension on Lead                         | e                                 | to line A                            |

| Type         | D        |
|--------------|----------|
| <b>NTPA9</b> | 11.0 max |
| <b>NTPA7</b> | 9.0 max. |

⚠Note:

1. Export Control

〈For customers outside Japan〉

Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.

〈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 to 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 in the above |

3. Product specifications in this catalog are as of January 2005. 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.