⚠Note • Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
• This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the approval sheet for product specifications before ordering.

R44E.pdf
Feb.21,2011

# NTC Thermistors



muRata Innovator in Electronics

Murata
Manufacturing Co., Ltd.

Cat.No.R44E-13

**EU RoHS Compliant**

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

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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**
❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽

❶Product ID

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

❷Series

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

❸Dimensions (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 |

❹Temperature Characteristics

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

❺Resistance

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

Ex.

| Code | Resistance |
|---|---|
| **102** | 1kΩ |
| **103** | 10kΩ |
| **104** | 100kΩ |

❻Resistance Tolerance

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

❼Individual Specifications

Structures and others are expressed by two figures.

Ex.

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

❽Packaging

| 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 Thermistor for Temperature Sensor Thermo String Type

(Part Number)

| NXF | T | 15 | XH | 103 | F | A | 2 | B | 025 |
|---|---|---|---|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ | ❼ | ❽ | ❾ | ❿ |

### ❶Product ID

| Product ID | |
|---|---|
| **NXF** | NTC Thermistors Sensor Thermo String Type |

### ❷Individual Specifications

| Code | Individual Specifications |
|---|---|
| **T** | Commercial Type |

### ❸Chip Dimensions

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

### ❹Temperature Characteristics

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

### ❺Resistance

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

Ex.

| Code | Resistance |
|---|---|
| **103** | 10kΩ |
| **473** | 47kΩ |
| **104** | 100kΩ |

### ❻Resistance Tolerance

| Code | Resistance Tolerance |
|---|---|
| **F** | ±1% |

### ❼Lead Wire Type

| Code | Lead Wire Type |
|---|---|
| **A** | ø0.3 Copper Lead Wire with Polyurethane Coat |

### ❽Shape of the Lead Wire Kink

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

### ❾Packaging

| Code | Packaging |
|---|---|
| **B** | Bulk |

### ❿Dimensions (Full Length)

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

## NTC Thermistors for Temperature Sensor Lead Type

(Part Number) **NT** **SA0** **XH** **103** **F** **E1** **B0**
❶ ❷ ❸ ❹ ❺ ❻ ❼

### ❶Product ID

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

### ❷Series

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

### ❸Temperature Characteristics

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

### ❹Resistance

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

Ex.

| Code | Resistance |
|---|---|
| **202** | 2kΩ |
| **203** | 20kΩ |

### ❺Resistance Tolerance

| Code | Resistance Tolerance |
|---|---|
| **E** | ±3% |
| **F** | ±1% |

### ❻Individual Specifications

A lead structure and other specifications are expressed by two-digit alphanumerics.

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

### ❼Packaging (NTSA/NTSD0 Series)

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

### ❼Total Length (NTSD1 Series)

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

## NTC Thermistors for Inrush Current Suppression Lead Type

(Part Number) **NT** **PA7** **160** **L** **BM** **B0**
❶ ❷ ❸ ❹ ❺ ❻

### ❶Product ID

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

### ❷Series

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

### ❸Resistance

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

Ex.

| Code | Resistance |
|---|---|
| **3R0** | 3Ω |
| **100** | 10Ω |

### ❹Resistance Tolerance

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

### ❺Individual Specifications

A lead structure and other specifications are expressed by two-digit alphanumerics.

| Code | Individual Specifications | Body Diameter |
|---|---|---|
| **B1** | Standard Type (Ammo Pack) | ø7mm, ø9mm |
| **BM** | Standard Type (Bulk) | ø7mm, ø9mm |
| **D6** | Standard Type (Ammo Pack) | ø10mm, ø13mm |
| **DK** | Standard (Bulk) | ø18mm, ø22mm |
| **DN** | Standard (Bulk) | ø10mm, ø13mm |

### ❻Packaging

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

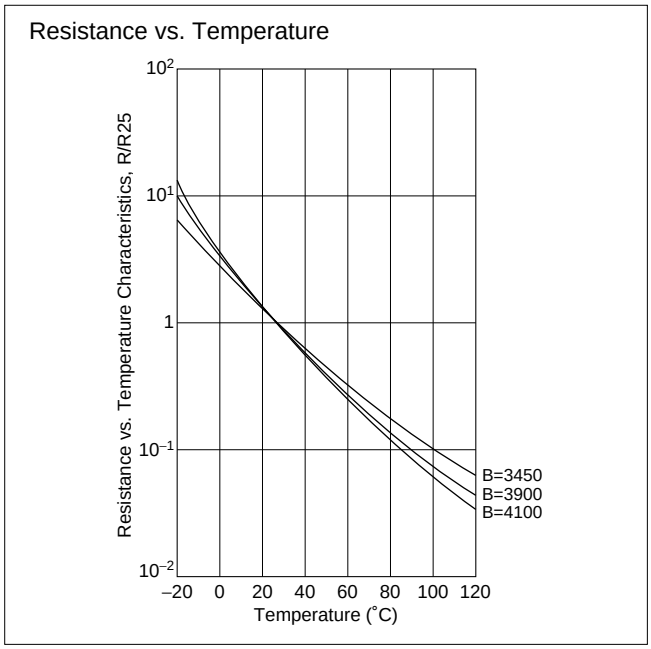
# Basic Characteristics

## ■Basic Characteristics

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

$R=R_0 \exp B(1/T-1/T_0)$ ……(1)

R: Resistance in ambient temperature T (K)
(K: absolute temperature)
$R_0$: Resistance in ambient temperature $T_0$ (K)
B: B-Constant of Thermistor




### 2. B-Constant

as (1) formula

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

### 3. Thermal Dissipation Constant

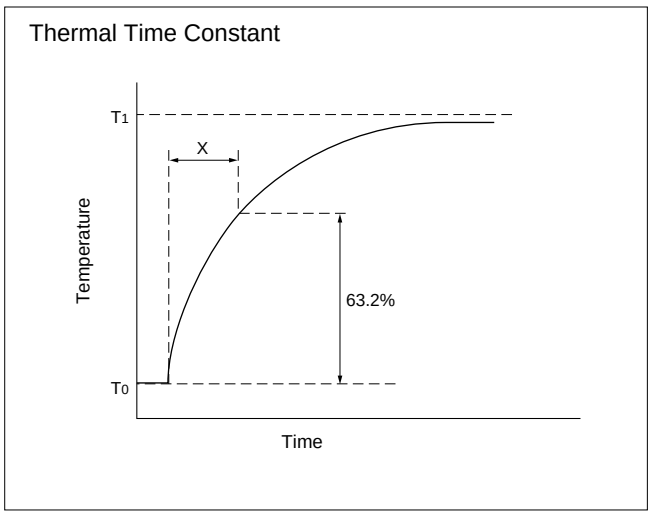
When electric power P (mW) is spent in ambient temperature $T_1$ and thermistor temperature rises $T_2$, there is a formula as follows

$P=C(T_2-T_1)$ ……(3)

C: Thermal dissipation constant (mW/°C)
Thermal dissipation constant is varied with dimensions, measurement conditions, etc.

### 4. Thermal Time Constant

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




## ■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 $T_0$ is absolute temperature (K).<br>$B=\frac{\ell n (R/R_0)}{1/T-1/T_0}$ |
| 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 the required electric power that causes Thermistor's temperature to rise to a specified temperature by self heating, at ambient temperature of 25 °C. |
| Permissive Operating Current | It is possible to keep Thermistor's temperature rising max. 1˚C. |

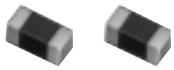
Please inquire about test conditions and ratings.

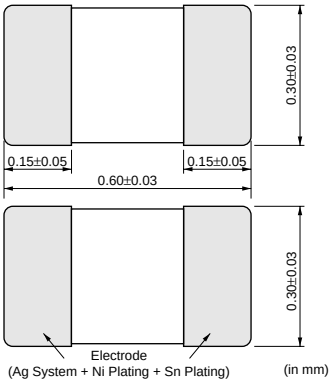
# NTC Thermistors



## Temperature Sensor and Compensation 0201 (0603) Size

0201/0402/0603/0805 sized Chip NTC Thermistors have a unique inner construction and nickel barrier terminations which provide excellent solderability and high stability in the application environment.






### ■ Features

1. Excellent solderability and high stability in environment
2. Excellent long-term aging stability
3. High accuracy in resistance and B-Constant
4. Reflow soldering possible
5. NCP series are recognized by UL/cUL (UL1434, File No. E137188).

### ■ Applications

1. Temperature compensation for transistor, IC and crystal oscillator in mobile communications
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation in general use of electric circuits

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|---|---|---|
| **NCP03YS110J05RL** | 11 ±5% | 2750 ±3% | 2758 | 2758 | 2758 | 9.50 | 100 | 1 |
| **NCP03YS220J05RL** | 22 ±5% | 2750 ±3% | 2758 | 2758 | 2758 | 6.70 | 100 | 1 |
| **NCP03YS330J05RL** | 33 ±5% | 2750 ±3% | 2758 | 2758 | 2758 | 5.50 | 100 | 1 |
| **NCP03YS470J05RL** | 47 ±5% | 2750 ±3% | 2758 | 2758 | 2758 | 4.60 | 100 | 1 |
| **NCP03YS680J05RL** | 68 ±5% | 2750 ±3% | 2758 | 2758 | 2758 | 3.80 | 100 | 1 |
| **NCP03YS101J05RL** | 100 ±5% | 2750 ±3% | 2758 | 2758 | 2758 | 3.10 | 100 | 1 |
| **NCP03XM102□05RL** | 1.0k | 3500 ±1% | 3539 | 3545 | 3560 | 1.00 | 100 | 1 |
| **NCP03XM152□05RL** | 1.5k | 3500 ±1% | 3539 | 3545 | 3560 | 0.81 | 100 | 1 |
| **NCP03XM222□05RL** | 2.2k | 3500 ±1% | 3539 | 3545 | 3560 | 0.67 | 100 | 1 |
| **NCP03XM332□05RL** | 3.3k | 3500 ±1% | 3539 | 3545 | 3560 | 0.55 | 100 | 1 |
| **NCP03XM472□05RL** | 4.7k | 3500 ±1% | 3539 | 3545 | 3560 | 0.46 | 100 | 1 |
| **NCP03XH682□05RL** | 6.8k | 3380 ±1% | 3428 | 3434 | 3455 | 0.38 | 100 | 1 |
| **NCP03XH103F25RL** | 10k ±1% | 3380 ±0.8% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP03XH103F05RL** | 10k ±1% | 3380 ±1% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP03XH103□05RL** | 10k | 3380 ±1% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP03XV103□05RL** | 10k | 3900 ±1% | 3930 | 3934 | 3944 | 0.31 | 100 | 1 |
| **NCP03XH153□05RL** | 15k | 3380 ±1% | 3428 | 3434 | 3455 | 0.25 | 100 | 1 |
| **NCP03XH223□05RL** | 22k | 3380 ±1% | 3428 | 3434 | 3455 | 0.21 | 100 | 1 |
| **NCP03WF333□05RL** | 33k | 4250 ±1% | 4303 | 4311 | 4334 | 0.17 | 100 | 1 |
| **NCP03WB473□05RL** | 47k | 4050 ±3% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP03WL473□05RL** | 47k | 4485 ±1% | 4537 | 4543 | 4557 | 0.14 | 100 | 1 |
| **NCP03WF683□05RL** | 68k | 4250 ±1% | 4303 | 4311 | 4334 | 0.12 | 100 | 1 |
| **NCP03WL683□05RL** | 68k | 4485 ±1% | 4537 | 4543 | 4557 | 0.12 | 100 | 1 |
| **NCP03WF104F05RL** | 100k ±1% | 4250 ±1% | 4303 | 4311 | 4334 | 0.10 | 100 | 1 |
| **NCP03WF104□05RL** | 100k | 4250 ±1% | 4303 | 4311 | 4334 | 0.10 | 100 | 1 |
| **NCP03WL104□05RL** | 100k | 4485 ±1% | 4537 | 4543 | 4557 | 0.10 | 100 | 1 |
| **NCP03WL154□05RL** | 150k | 4485 ±1% | 4537 | 4543 | 4557 | 0.08 | 100 | 1 |
| **NCP03WL224□05RL** | 220k | 4485 ±1% | 4537 | 4543 | 4557 | 0.06 | 100 | 1 |

□ is filled with resistance tolerance codes (E: ±3%, J: ±5%).
Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 125°C by self heating, at ambient temperature of 25 °C.
Operating Temperature Range: -40°C to +125°C

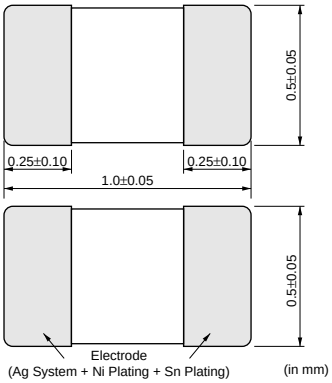
# NTC Thermistors

## Temperature Sensor and Compensation 0402 (1005) Size



0201/0402/0603/0805 sized Chip NTC Thermistors have a unique inner construction and nickel barrier terminations which provide excellent solderability and high stability in the application environment.






### ■ Features

1. Excellent solderability and high stability in environment
2. Excellent long-term aging stability
3. High accuracy in resistance and B-Constant
4. Reflow soldering possible
5. Provide flexibility to use the smaller size version in certain circuits because of same B-Constant in the same resistance.
6. NCP series are recognized by UL/cUL (UL1434, File No. E137188).

### ■ Applications

1. Temperature compensation for transistor, IC and crystal oscillator in mobile communications
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation in general use of electric circuits

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|---|---|---|
| **NCP15XC220□03RC** | 22 | 3100 ±3% | 3126 | 3128 | 3136 | 6.70 | 100 | 1 |
| **NCP15XC330□03RC** | 33 | 3100 ±3% | 3126 | 3128 | 3136 | 5.50 | 100 | 1 |
| **NCP15XC470□03RC** | 47 | 3100 ±3% | 3126 | 3128 | 3136 | 4.60 | 100 | 1 |
| **NCP15XC680□03RC** | 68 | 3100 ±3% | 3126 | 3128 | 3136 | 3.80 | 100 | 1 |
| **NCP15XF101□03RC** | 100 | 3250 ±3% | 3282 | 3284 | 3296 | 3.10 | 100 | 1 |
| **NCP15XF151□03RC** | 150 | 3250 ±3% | 3282 | 3284 | 3296 | 2.50 | 100 | 1 |
| **NCP15XM221□03RC** | 220 | 3500 ±3% | 3539 | 3545 | 3560 | 2.10 | 100 | 1 |
| **NCP15XM331□03RC** | 330 | 3500 ±3% | 3539 | 3545 | 3560 | 1.70 | 100 | 1 |
| **NCP15XQ471□03RC** | 470 | 3650 ±2% | 3688 | 3693 | 3706 | 1.40 | 100 | 1 |
| **NCP15XQ681□03RC** | 680 | 3650 ±3% | 3688 | 3693 | 3706 | 1.20 | 100 | 1 |
| **NCP15XQ102□03RC** | 1.0k | 3650 ±2% | 3688 | 3693 | 3706 | 1.00 | 100 | 1 |
| **NCP15XW152□03RC** | 1.5k | 3950 ±3% | 3982 | 3987 | 3998 | 0.81 | 100 | 1 |
| **NCP15XW222□03RC** | 2.2k | 3950 ±3% | 3982 | 3987 | 3998 | 0.67 | 100 | 1 |
| **NCP15XW332□03RC** | 3.3k | 3950 ±3% | 3982 | 3987 | 3998 | 0.55 | 100 | 1 |
| **NCP15XM472□03RC** | 4.7k | 3500 ±2% | 3539 | 3545 | 3560 | 0.46 | 100 | 1 |
| **NCP15XW472□03RC** | 4.7k | 3950 ±3% | 3982 | 3987 | 3998 | 0.46 | 100 | 1 |
| **NCP15XW682□03RC** | 6.8k | 3950 ±3% | 3982 | 3987 | 3998 | 0.38 | 100 | 1 |
| **NCP15XH103D03RC** | 10k ±0.5% | 3380 ±0.7% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP15XH103F03RC** | 10k ±1% | 3380 ±1% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP15XH103□03RC** | 10k | 3380 ±1% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP15XV103□03RC** | 10k | 3900 ±3% | 3930 | 3934 | 3944 | 0.31 | 100 | 1 |
| **NCP15XW153□03RC** | 15k | 3950 ±3% | 3982 | 3987 | 3998 | 0.25 | 100 | 1 |
| **NCP15XW223□03RC** | 22k | 3950 ±3% | 3982 | 3987 | 3998 | 0.21 | 100 | 1 |
| **NCP15WL223□03RC** | 22k | 4485 ±1% | 4537 | 4543 | 4557 | 0.21 | 100 | 1 |
| **NCP15WB333□03RC** | 33k | 4050 ±3% | 4101 | 4108 | 4131 | 0.17 | 100 | 1 |

Continued on the following page.

Continued from the preceding page.

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|---|---|---|
| **NCP15WL333□03RC** | 33k | 4485 ±1% | 4537 | 4543 | 4557 | 0.17 | 100 | 1 |
| **NCP15WB473D03RC** | 47k ±0.5% | 4050 ±0.5% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP15WB473F03RC** | 47k ±1% | 4050 ±1% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP15WB473□03RC** | 47k | 4050 ±1% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP15WL473□03RC** | 47k | 4485 ±1% | 4537 | 4543 | 4557 | 0.14 | 100 | 1 |
| **NCP15WD683□03RC** | 68k | 4150 ±3% | 4201 | 4209 | 4232 | 0.12 | 100 | 1 |
| **NCP15WL683□03RC** | 68k | 4485 ±1% | 4537 | 4543 | 4557 | 0.12 | 100 | 1 |
| **NCP15WF104D03RC** | 100k ±0.5% | 4250 ±0.5% | 4303 | 4311 | 4334 | 0.10 | 100 | 1 |
| **NCP15WF104F03RC** | 100k ±1% | 4250 ±1% | 4303 | 4311 | 4334 | 0.10 | 100 | 1 |
| **NCP15WF104□03RC** | 100k | 4250 ±1% | 4303 | 4311 | 4334 | 0.10 | 100 | 1 |
| **NCP15WL104□03RC** | 100k | 4485 ±1% | 4537 | 4543 | 4557 | 0.10 | 100 | 1 |
| **NCP15WL154□03RC** | 150k | 4485 ±1% | 4537 | 4543 | 4557 | 0.08 | 100 | 1 |
| **NCP15WM154□03RC** | 150k | 4500 ±3% | 4571 | 4582 | 4614 | 0.08 | 100 | 1 |
| **NCP15WM224□03RC** | 220k | 4500 ±3% | 4571 | 4582 | 4614 | 0.06 | 100 | 1 |
| **NCP15WM474□03RC** | 470k | 4500 ±3% | 4571 | 4582 | 4614 | 0.04 | 100 | 1 |

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

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 125°C by self heating, at ambient temperature of 25 °C.

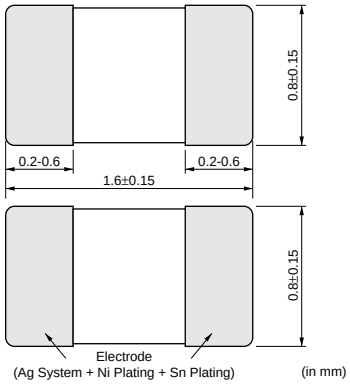
Operating Temperature Range: -40°C to +125°C

# NTC Thermistors

## Temperature Sensor and Compensation 0603 (1608) Size

0201/0402/0603/0805 sized Chip NTC Thermistors have a unique inner construction and nickel barrier terminations which provide excellent solderability and high stability in the application environment.






3

### ■ Features

1. Excellent solderability and high stability in environment
2. Excellent long-term aging stability
3. High accuracy in resistance and B-constant
4. Flow / Reflow soldering possible
5. Provide flexibility to use the smaller size version in certain circuits because of same B-Constant in the same resistance.
6. NCP series are recognized by UL/cUL (UL1434, File No. E137188).

### ■ Applications

1. Temperature compensation for transistor, IC and crystal oscillator in mobile communications
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation in general use of electric circuits

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|---|---|---|
| **NCP18XF101□03RB** | 100 | 3250 ±3% | 3282 | 3284 | 3296 | 3.10 | 100 | 1 |
| **NCP18XF151□03RB** | 150 | 3250 ±3% | 3282 | 3284 | 3296 | 2.50 | 100 | 1 |
| **NCP18XM221□03RB** | 220 | 3500 ±3% | 3539 | 3545 | 3560 | 2.10 | 100 | 1 |
| **NCP18XM331□03RB** | 330 | 3500 ±3% | 3539 | 3545 | 3560 | 1.70 | 100 | 1 |
| **NCP18XQ471□03RB** | 470 | 3650 ±2% | 3688 | 3693 | 3706 | 1.40 | 100 | 1 |
| **NCP18XQ681□03RB** | 680 | 3650 ±3% | 3688 | 3693 | 3706 | 1.20 | 100 | 1 |
| **NCP18XQ102□03RB** | 1.0k | 3650 ±2% | 3688 | 3693 | 3706 | 1.00 | 100 | 1 |
| **NCP18XW152□03RB** | 1.5k | 3950 ±3% | 3982 | 3987 | 3998 | 0.81 | 100 | 1 |
| **NCP18XW222□03RB** | 2.2k | 3950 ±3% | 3982 | 3987 | 3998 | 0.67 | 100 | 1 |
| **NCP18XW332□03RB** | 3.3k | 3950 ±3% | 3982 | 3987 | 3998 | 0.55 | 100 | 1 |
| **NCP18XM472□03RB** | 4.7k | 3500 ±2% | 3539 | 3545 | 3560 | 0.46 | 100 | 1 |
| **NCP18XW472□03RB** | 4.7k | 3950 ±3% | 3982 | 3987 | 3998 | 0.46 | 100 | 1 |
| **NCP18XW682□03RB** | 6.8k | 3950 ±3% | 3982 | 3987 | 3998 | 0.38 | 100 | 1 |
| **NCP18XH103D03RB** | 10k ±0.5% | 3380 ±0.7% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP18XH103F03RB** | 10k ±1% | 3380 ±1% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP18XH103□03RB** | 10k | 3380 ±1% | 3428 | 3434 | 3455 | 0.31 | 100 | 1 |
| **NCP18XV103□03RB** | 10k | 3900 ±3% | 3930 | 3934 | 3944 | 0.31 | 100 | 1 |
| **NCP18XW153□03RB** | 15k | 3950 ±3% | 3982 | 3987 | 3998 | 0.25 | 100 | 1 |
| **NCP18XW223□03RB** | 22k | 3950 ±3% | 3982 | 3987 | 3998 | 0.21 | 100 | 1 |
| **NCP18WB333□03RB** | 33k | 4050 ±3% | 4101 | 4108 | 4131 | 0.17 | 100 | 1 |
| **NCP18WB473D03RB** | 47k ±0.5% | 4030 ±0.5% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP18WB473F10RB** | 47k ±1% | 4050 ±1.5% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP18WB473□03RB** | 47k | 4050 ±2% | 4101 | 4108 | 4131 | 0.14 | 100 | 1 |
| **NCP18WD683□03RB** | 68k | 4150 ±3% | 4201 | 4209 | 4232 | 0.12 | 100 | 1 |
| **NCP18WF104D03RB** | 100k ±0.5% | 4200 ±0.5% | 4255 | 4260 | 4282 | 0.10 | 100 | 1 |

Continued on the following page.

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| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|---|---|---|
| **NCP18WF104F12RB** | 100k ±1% | 4200 ±1% | 4255 | 4260 | 4282 | 0.10 | 100 | 1 |
| **NCP18WF104□03RB** | 100k | 4250 ±2% | 4303 | 4311 | 4334 | 0.10 | 100 | 1 |
| **NCP18WM154□03RB** | 150k | 4500 ±3% | 4571 | 4582 | 4614 | 0.08 | 100 | 1 |
| **NCP18WM224□03RB** | 220k | 4500 ±3% | 4571 | 4582 | 4614 | 0.06 | 100 | 1 |
| **NCP18WM474□03RB** | 470k | 4500 ±3% | 4571 | 4582 | 4614 | 0.04 | 100 | 1 |

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

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 125°C by self heating, at ambient temperature of 25 °C.

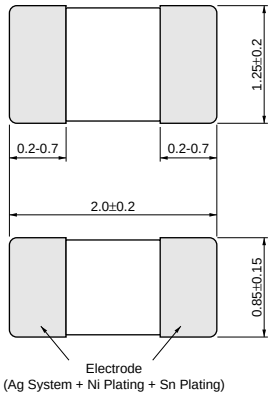
Operating Temperature Range: -40°C to +125°C

# NTC Thermistors

## Temperature Sensor and Compensation 0805 (2012) Size

0201/0402/0603/0805 sized Chip NTC Thermistors have a unique inner construction and nickel barrier terminations which provide excellent solderability and high stability in the application environment.






(in mm)

### ■ Features

1. Excellent solderability and high stability in environment
2. Excellent long-term aging stability
3. High accuracy in resistance and B-constant
4. Flow / Reflow soldering possible
5. Provide flexibility to use the smaller size version in certain circuits because of same B-Constant in the same resistance.
6. NCP series are recognized by UL/cUL (UL1434, File No. E137188).

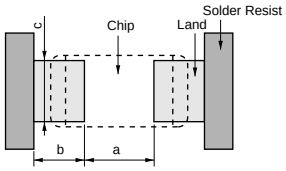
### ■ Applications

1. Temperature compensation for transistor, IC and crystal oscillator in mobile communications
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation in general use of electric circuits

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|---|---|---|
| **NCP21XM221J03RA** | 220 ±5% | 3500 ±3% | 3539 | 3545 | 3560 | 3.00 | 200 | 2 |
| **NCP21XQ471J03RA** | 470 ±5% | 3650 ±3% | 3688 | 3693 | 3706 | 2.00 | 200 | 2 |
| **NCP21XQ102J03RA** | 1.0k ±5% | 3650 ±3% | 3688 | 3693 | 3706 | 1.40 | 200 | 2 |
| **NCP21XW222J03RA** | 2.2k ±5% | 3950 ±3% | 3982 | 3987 | 3998 | 0.90 | 200 | 2 |
| **NCP21XM472J03RA** | 4.7k ±5% | 3500 ±3% | 3539 | 3545 | 3560 | 0.65 | 200 | 2 |
| **NCP21XV103J03RA** | 10k ±5% | 3900 ±3% | 3930 | 3934 | 3944 | 0.44 | 200 | 2 |
| **NCP21XW153J03RA** | 15k ±5% | 3950 ±3% | 3982 | 3987 | 3998 | 0.36 | 200 | 2 |
| **NCP21XW223J03RA** | 22k ±5% | 3950 ±3% | 3982 | 3987 | 3998 | 0.30 | 200 | 2 |
| **NCP21WB333J03RA** | 33k ±5% | 4050 ±3% | 4101 | 4108 | 4131 | 0.24 | 200 | 2 |
| **NCP21WB473J03RA** | 47k ±5% | 4050 ±3% | 4101 | 4108 | 4131 | 0.20 | 200 | 2 |
| **NCP21WF104J03RA** | 100k ±5% | 4250 ±3% | 4303 | 4311 | 4334 | 0.14 | 200 | 2 |

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 125°C by self heating, at ambient temperature of 25 °C.
Operating Temperature Range: -40°C to +125°C

# Temp. Sensor and Compensation Chip Type Standard Land Pattern Dimensions




| Part Number | Soldering Methods | Dimensions (mm) | | | |
|---|---|---|---|---|---|
| | | Chip (LxW) | a | b | c |
| **NCP03** | Reflow Soldering | 0.6x0.3 | 0.25 | 0.25 | 0.3 |
| **NCP15** | Reflow Soldering | 1.0x0.5 | 0.4 | 0.4-0.5 | 0.5 |
| **NCP18** | Flow Soldering | 1.6x0.8 | 0.6-1.0 | 0.8-0.9 | 0.6-0.8 |
| | Reflow Soldering | | 0.6-0.8 | 0.6-0.7 | 0.6-0.8 |
| **NCP21** | Flow Soldering | 2.0x1.25 | 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 |

# Temp. Sensor and Compensation Chip Type 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 |

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

Continued on the following page.

# Temp. Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

| Part Number | NCP□□XM102 | NCP□□XQ102 | NCP□□XM152 | NCP□□XW152 | NCP□□XM222 | NCP□□XW222 | NCP□□XM332 | NCP□□XW332 |
|---|---|---|---|---|---|---|---|---|
| Resistance | 1kΩ | 1kΩ | 1.5kΩ | 1.5kΩ | 2.2kΩ | 2.2kΩ | 3.3kΩ | 3.3kΩ |
| B-Constant | 3500K | 3650K | 3500K | 3950K | 3500K | 3950K | 3500K | 3950K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| −40 | 21.266 | 25.154 | 31.899 | 51.791 | 46.786 | 75.961 | 70.179 | 113.941 |
| −35 | 16.150 | 18.655 | 24.225 | 37.172 | 35.530 | 54.520 | 53.295 | 81.779 |
| −30 | 12.347 | 13.979 | 18.520 | 27.005 | 27.162 | 39.607 | 40.743 | 59.411 |
| −25 | 9.503 | 10.578 | 14.255 | 19.843 | 20.907 | 29.103 | 31.360 | 43.654 |
| −20 | 7.365 | 8.079 | 11.047 | 14.728 | 16.203 | 21.601 | 24.304 | 32.401 |
| −15 | 5.747 | 6.220 | 8.621 | 11.044 | 12.644 | 16.198 | 18.966 | 24.297 |
| −10 | 4.516 | 4.829 | 6.773 | 8.362 | 9.934 | 12.264 | 14.901 | 18.396 |
| −5 | 3.572 | 3.777 | 5.358 | 6.389 | 7.858 | 9.370 | 11.787 | 14.055 |
| 0 | 2.844 | 2.977 | 4.266 | 4.922 | 6.257 | 7.219 | 9.386 | 10.829 |
| 5 | 2.280 | 2.362 | 3.419 | 3.825 | 5.015 | 5.609 | 7.523 | 8.414 |
| 10 | 1.839 | 1.888 | 2.758 | 2.994 | 4.045 | 4.391 | 6.067 | 6.586 |
| 15 | 1.492 | 1.518 | 2.238 | 2.361 | 3.283 | 3.463 | 4.924 | 5.195 |
| 20 | 1.218 | 1.229 | 1.827 | 1.876 | 2.680 | 2.751 | 4.019 | 4.126 |
| 25 | 1.000 | 1.000 | 1.500 | 1.500 | 2.200 | 2.200 | 3.300 | 3.300 |
| 30 | 0.825 | 0.819 | 1.238 | 1.207 | 1.816 | 1.771 | 2.724 | 2.656 |
| 35 | 0.685 | 0.674 | 1.027 | 0.978 | 1.507 | 1.434 | 2.260 | 2.152 |
| 40 | 0.571 | 0.558 | 0.857 | 0.797 | 1.257 | 1.169 | 1.885 | 1.753 |
| 45 | 0.479 | 0.464 | 0.718 | 0.653 | 1.053 | 0.958 | 1.580 | 1.437 |
| 50 | 0.403 | 0.388 | 0.605 | 0.538 | 0.887 | 0.789 | 1.331 | 1.184 |
| 55 | 0.341 | 0.326 | 0.512 | 0.446 | 0.751 | 0.654 | 1.126 | 0.981 |
| 60 | 0.290 | 0.275 | 0.435 | 0.371 | 0.638 | 0.545 | 0.957 | 0.817 |
| 65 | 0.247 | 0.233 | 0.371 | 0.311 | 0.544 | 0.456 | 0.816 | 0.684 |
| 70 | 0.212 | 0.199 | 0.318 | 0.261 | 0.466 | 0.383 | 0.700 | 0.575 |
| 75 | 0.182 | 0.170 | 0.274 | 0.221 | 0.401 | 0.324 | 0.602 | 0.486 |
| 80 | 0.157 | 0.146 | 0.236 | 0.187 | 0.346 | 0.275 | 0.520 | 0.412 |
| 85 | 0.136 | 0.126 | 0.205 | 0.160 | 0.300 | 0.234 | 0.450 | 0.351 |
| 90 | 0.119 | 0.109 | 0.178 | 0.137 | 0.261 | 0.200 | 0.392 | 0.301 |
| 95 | 0.104 | 0.094 | 0.155 | 0.117 | 0.228 | 0.172 | 0.342 | 0.258 |
| 100 | 0.091 | 0.082 | 0.136 | 0.101 | 0.200 | 0.149 | 0.299 | 0.223 |
| 105 | 0.080 | 0.072 | 0.120 | 0.088 | 0.175 | 0.129 | 0.263 | 0.193 |
| 110 | 0.070 | 0.063 | 0.105 | 0.076 | 0.155 | 0.112 | 0.232 | 0.168 |
| 115 | 0.062 | 0.056 | 0.093 | 0.067 | 0.137 | 0.098 | 0.205 | 0.146 |
| 120 | 0.055 | 0.049 | 0.083 | 0.058 | 0.121 | 0.085 | 0.182 | 0.128 |
| 125 | 0.049 | 0.044 | 0.074 | 0.051 | 0.108 | 0.075 | 0.162 | 0.113 |

| Part Number | NCP□□XM472 | NCP□□XW472 | NCP□□XH682 | NCP□□XW682 | NCP□□XH103 | NCP□□XV103 | NCP□□XH153 | NCP□□XW153 |
|---|---|---|---|---|---|---|---|---|
| Resistance | 4.7kΩ | 4.7kΩ | 6.8kΩ | 6.8kΩ | 10kΩ | 10kΩ | 15kΩ | 15kΩ |
| B-Constant | 3500K | 3950K | 3380K | 3950K | 3380K | 3900K | 3380K | 3950K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| −40 | 105.705 | 162.279 | 133.043 | 234.787 | 195.652 | 328.996 | 293.478 | 517.912 |
| −35 | 79.126 | 116.474 | 100.756 | 168.515 | 148.171 | 237.387 | 222.256 | 371.724 |
| −30 | 59.794 | 84.615 | 77.076 | 122.422 | 113.347 | 173.185 | 170.021 | 270.048 |
| −25 | 45.630 | 62.173 | 59.540 | 89.953 | 87.559 | 127.773 | 131.338 | 198.426 |
| −20 | 35.144 | 46.147 | 46.401 | 66.766 | 68.237 | 95.327 | 102.355 | 147.278 |
| −15 | 27.303 | 34.604 | 36.482 | 50.066 | 53.650 | 71.746 | 80.474 | 110.439 |
| −10 | 21.377 | 26.200 | 28.904 | 37.906 | 42.506 | 54.564 | 63.759 | 83.617 |
| −5 | 16.869 | 20.018 | 23.047 | 28.963 | 33.892 | 41.813 | 50.838 | 63.888 |
| 0 | 13.411 | 15.423 | 18.509 | 22.313 | 27.219 | 32.330 | 40.828 | 49.221 |
| 5 | 10.735 | 11.984 | 14.974 | 17.338 | 22.021 | 25.194 | 33.032 | 38.245 |
| 10 | 8.653 | 9.380 | 12.189 | 13.571 | 17.926 | 19.785 | 26.888 | 29.936 |
| 15 | 7.018 | 7.399 | 9.978 | 10.705 | 14.674 | 15.651 | 22.010 | 23.613 |
| 20 | 5.726 | 5.877 | 8.215 | 8.503 | 12.081 | 12.468 | 18.121 | 18.756 |
| 25 | 4.700 | 4.700 | 6.800 | 6.800 | 10.000 | 10.000 | 15.000 | 15.000 |
| 30 | 3.879 | 3.783 | 5.654 | 5.474 | 8.315 | 8.072 | 12.472 | 12.074 |
| 35 | 3.219 | 3.064 | 4.725 | 4.434 | 6.948 | 6.556 | 10.422 | 9.780 |
| 40 | 2.685 | 2.497 | 3.967 | 3.613 | 5.834 | 5.356 | 8.751 | 7.969 |
| 45 | 2.250 | 2.046 | 3.344 | 2.961 | 4.917 | 4.401 | 7.375 | 6.531 |
| 50 | 1.895 | 1.686 | 2.829 | 2.440 | 4.161 | 3.635 | 6.241 | 5.382 |
| 55 | 1.604 | 1.397 | 2.404 | 2.022 | 3.535 | 3.019 | 5.302 | 4.459 |
| 60 | 1.363 | 1.164 | 2.050 | 1.683 | 3.014 | 2.521 | 4.521 | 3.713 |
| 65 | 1.163 | 0.974 | 1.759 | 1.409 | 2.586 | 2.115 | 3.879 | 3.108 |
| 70 | 0.996 | 0.819 | 1.515 | 1.185 | 2.228 | 1.781 | 3.341 | 2.613 |
| 75 | 0.857 | 0.692 | 1.309 | 1.001 | 1.925 | 1.509 | 2.887 | 2.208 |
| 80 | 0.740 | 0.587 | 1.135 | 0.849 | 1.669 | 1.284 | 2.503 | 1.873 |
| 85 | 0.641 | 0.500 | 0.988 | 0.724 | 1.452 | 1.097 | 2.178 | 1.597 |
| 90 | 0.558 | 0.428 | 0.862 | 0.620 | 1.268 | 0.941 | 1.902 | 1.367 |
| 95 | 0.487 | 0.368 | 0.755 | 0.532 | 1.110 | 0.810 | 1.664 | 1.174 |
| 100 | 0.426 | 0.318 | 0.662 | 0.459 | 0.974 | 0.701 | 1.461 | 1.013 |
| 105 | 0.375 | 0.275 | 0.583 | 0.398 | 0.858 | 0.608 | 1.287 | 0.878 |
| 110 | 0.330 | 0.239 | 0.515 | 0.346 | 0.758 | 0.530 | 1.137 | 0.763 |
| 115 | 0.292 | 0.208 | 0.457 | 0.302 | 0.672 | 0.463 | 1.007 | 0.665 |
| 120 | 0.259 | 0.182 | 0.406 | 0.264 | 0.596 | 0.406 | 0.895 | 0.582 |
| 125 | 0.230 | 0.160 | 0.361 | 0.232 | 0.531 | 0.358 | 0.797 | 0.511 |

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

Continued on the following page.

# Temp. Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

| Part Number | NCP□□XH223 | NCP□□XW223 | NCP□□WL223 | NCP□□WB333 | NCP□□WF333 | NCP□□WL333 | NCP□□WB473 | NCP□□WL473 |
|---|---|---|---|---|---|---|---|---|
| Resistance | 22kΩ | 22kΩ | 22kΩ | 33kΩ | 33kΩ | 33kΩ | 47kΩ | 47kΩ |
| B-Constant | 3380K | 3950K | 4485K | 4050K | 4250K | 4485K | 4050K | 4485K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| −40 | 430.434 | 759.605 | 1073.436 | 1227.263 | 1451.049 | 1610.154 | 1747.920 | 2293.249 |
| −35 | 325.976 | 545.196 | 753.900 | 874.449 | 1019.238 | 1130.850 | 1245.428 | 1610.605 |
| −30 | 249.364 | 396.070 | 535.073 | 630.851 | 725.084 | 802.609 | 898.485 | 1143.110 |
| −25 | 192.629 | 291.025 | 383.590 | 460.457 | 522.021 | 575.385 | 655.802 | 819.487 |
| −20 | 150.121 | 216.008 | 277.643 | 339.797 | 379.842 | 416.464 | 483.954 | 593.146 |
| −15 | 118.029 | 161.977 | 202.813 | 253.363 | 279.371 | 304.219 | 360.850 | 433.281 |
| −10 | 93.514 | 122.638 | 149.462 | 190.766 | 207.566 | 224.193 | 271.697 | 319.305 |
| −5 | 74.563 | 93.702 | 111.082 | 144.964 | 155.639 | 166.623 | 206.463 | 237.312 |
| 0 | 59.881 | 72.191 | 83.233 | 111.087 | 117.814 | 124.850 | 158.214 | 177.816 |
| 5 | 48.446 | 56.093 | 62.858 | 85.842 | 89.925 | 94.287 | 122.259 | 134.287 |
| 10 | 39.436 | 43.907 | 47.831 | 66.861 | 69.204 | 71.747 | 95.227 | 102.184 |
| 15 | 32.282 | 34.633 | 36.664 | 52.470 | 53.675 | 54.996 | 74.730 | 78.327 |
| 20 | 26.577 | 27.509 | 28.304 | 41.471 | 41.937 | 42.455 | 59.065 | 60.467 |
| 25 | 22.000 | 22.000 | 22.000 | 33.000 | 33.000 | 33.000 | 47.000 | 47.000 |
| 30 | 18.292 | 17.709 | 17.214 | 26.430 | 26.143 | 25.822 | 37.643 | 36.776 |
| 35 | 15.285 | 14.344 | 13.557 | 21.298 | 20.845 | 20.335 | 30.334 | 28.962 |
| 40 | 12.834 | 11.688 | 10.744 | 17.266 | 16.723 | 16.115 | 24.591 | 22.952 |
| 45 | 10.817 | 9.578 | 8.566 | 14.076 | 13.498 | 12.849 | 20.048 | 18.301 |
| 50 | 9.154 | 7.894 | 6.871 | 11.538 | 10.954 | 10.306 | 16.433 | 14.679 |
| 55 | 7.777 | 6.540 | 5.544 | 9.506 | 8.940 | 8.317 | 13.539 | 11.845 |
| 60 | 6.631 | 5.446 | 4.498 | 7.870 | 7.334 | 6.748 | 11.209 | 9.610 |
| 65 | 5.690 | 4.559 | 3.669 | 6.549 | 6.046 | 5.504 | 9.328 | 7.839 |
| 70 | 4.901 | 3.832 | 3.009 | 5.475 | 5.011 | 4.513 | 7.798 | 6.427 |
| 75 | 4.234 | 3.239 | 2.479 | 4.595 | 4.170 | 3.718 | 6.544 | 5.296 |
| 80 | 3.671 | 2.748 | 2.052 | 3.874 | 3.487 | 3.078 | 5.518 | 4.384 |
| 85 | 3.195 | 2.342 | 1.707 | 3.282 | 2.928 | 2.560 | 4.674 | 3.646 |
| 90 | 2.790 | 2.004 | 1.426 | 2.789 | 2.469 | 2.139 | 3.972 | 3.046 |
| 95 | 2.441 | 1.722 | 1.196 | 2.379 | 2.091 | 1.794 | 3.388 | 2.555 |
| 100 | 2.142 | 1.486 | 1.008 | 2.038 | 1.777 | 1.511 | 2.902 | 2.152 |
| 105 | 1.888 | 1.287 | 0.852 | 1.751 | 1.516 | 1.278 | 2.494 | 1.820 |
| 110 | 1.668 | 1.119 | 0.724 | 1.509 | 1.298 | 1.085 | 2.150 | 1.546 |
| 115 | 1.477 | 0.975 | 0.617 | 1.306 | 1.116 | 0.925 | 1.860 | 1.318 |
| 120 | 1.312 | 0.854 | 0.528 | 1.134 | 0.962 | 0.792 | 1.615 | 1.128 |
| 125 | 1.169 | 0.750 | 0.454 | 0.987 | 0.832 | 0.681 | 1.406 | 0.970 |

| Part Number | NCP□□WD683 | NCP□□WF683 | NCP□□WL683 | NCP□□WF104 | NCP18WF104F | NCP□□WL104 | NCP□□WL154 | NCP□□WM154 |
|---|---|---|---|---|---|---|---|---|
| Resistance | 68kΩ | 68kΩ | 68kΩ | 100kΩ | 100kΩ±1% | 100kΩ | 150kΩ | 150kΩ |
| B-Constant | 4150K | 4250K | 4485K | 4250K | 4200K | 4485K | 4485K | 4500K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| −40 | 2735.359 | 2990.041 | 3317.893 | 4397.119 | 4205.686 | 4879.254 | 7318.881 | 7899.466 |
| −35 | 1937.391 | 2100.247 | 2330.237 | 3088.599 | 2966.436 | 3426.818 | 5140.228 | 5466.118 |
| −30 | 1389.345 | 1494.113 | 1653.862 | 2197.225 | 2118.789 | 2432.149 | 3648.224 | 3834.499 |
| −25 | 1008.014 | 1075.679 | 1185.641 | 1581.881 | 1531.319 | 1743.590 | 2615.385 | 2720.523 |
| −20 | 738.978 | 782.705 | 858.168 | 1151.037 | 1118.422 | 1262.012 | 1893.018 | 1951.216 |
| −15 | 547.456 | 575.674 | 626.875 | 846.579 | 825.570 | 921.875 | 1382.813 | 1415.565 |
| −10 | 409.600 | 427.712 | 461.974 | 628.988 | 615.526 | 679.373 | 1019.059 | 1036.984 |
| −5 | 309.217 | 320.710 | 343.345 | 471.632 | 463.104 | 504.919 | 757.379 | 767.079 |
| 0 | 235.606 | 242.768 | 257.266 | 357.012 | 351.706 | 378.333 | 567.499 | 572.667 |
| 5 | 180.980 | 185.300 | 194.287 | 272.500 | 269.305 | 285.717 | 428.575 | 431.264 |
| 10 | 140.139 | 142.603 | 147.841 | 209.710 | 207.891 | 217.414 | 326.121 | 327.405 |
| 15 | 109.344 | 110.602 | 113.325 | 162.651 | 161.722 | 166.654 | 249.981 | 250.538 |
| 20 | 85.929 | 86.415 | 87.484 | 127.080 | 126.723 | 128.653 | 192.979 | 193.166 |
| 25 | 68.000 | 68.000 | 68.000 | 100.000 | 100.000 | 100.000 | 150.000 | 150.000 |
| 30 | 54.167 | 53.871 | 53.208 | 79.222 | 79.439 | 78.247 | 117.370 | 117.281 |
| 35 | 43.421 | 42.954 | 41.903 | 63.167 | 63.509 | 61.622 | 92.433 | 92.293 |
| 40 | 35.016 | 34.460 | 33.208 | 50.677 | 51.084 | 48.835 | 73.252 | 73.090 |
| 45 | 28.406 | 27.814 | 26.477 | 40.904 | 41.336 | 38.937 | 58.406 | 58.240 |
| 50 | 23.166 | 22.572 | 21.237 | 33.195 | 33.628 | 31.231 | 46.846 | 46.665 |
| 55 | 18.997 | 18.422 | 17.137 | 27.091 | 27.510 | 25.202 | 37.803 | 37.605 |
| 60 | 15.657 | 15.113 | 13.904 | 22.224 | 22.621 | 20.448 | 30.671 | 30.453 |
| 65 | 12.967 | 12.459 | 11.342 | 18.323 | 18.692 | 16.679 | 25.018 | 24.804 |
| 70 | 10.794 | 10.325 | 9.299 | 15.184 | 15.525 | 13.675 | 20.513 | 20.293 |
| 75 | 9.021 | 8.592 | 7.662 | 12.635 | 12.947 | 11.268 | 16.902 | 16.679 |
| 80 | 7.575 | 7.185 | 6.343 | 10.566 | 10.849 | 9.329 | 13.993 | 13.776 |
| 85 | 6.387 | 6.033 | 5.276 | 8.873 | 9.129 | 7.758 | 11.638 | 11.428 |
| 90 | 5.407 | 5.087 | 4.407 | 7.481 | 7.713 | 6.481 | 9.721 | 9.520 |
| 95 | 4.598 | 4.309 | 3.697 | 6.337 | 6.546 | 5.437 | 8.155 | 7.966 |
| 100 | 3.922 | 3.661 | 3.114 | 5.384 | 5.572 | 4.580 | 6.869 | 6.688 |
| 105 | 3.359 | 3.124 | 2.634 | 4.594 | 4.764 | 3.873 | 5.810 | 5.639 |
| 110 | 2.887 | 2.675 | 2.236 | 3.934 | 4.087 | 3.289 | 4.933 | 4.772 |
| 115 | 2.489 | 2.299 | 1.907 | 3.380 | 3.518 | 2.804 | 4.206 | 4.052 |
| 120 | 2.155 | 1.983 | 1.632 | 2.916 | 3.040 | 2.400 | 3.601 | 3.454 |
| 125 | 1.870 | 1.715 | 1.403 | 2.522 | 2.634 | 2.064 | 3.096 | 2.955 |

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

Continued on the following page.

# Temp. Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

| Part Number | NCP□□WL224 | NCP□□WM224 | NCP□□WM474 |
|---|---|---|---|
| Resistance | 220kΩ | 220kΩ | 470kΩ |
| B-Constant | 4485K | 4500K | 4500K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| −40 | 10734.358 | 11585.884 | 24751.661 |
| −35 | 7539.001 | 8016.973 | 17127.169 |
| −30 | 5350.729 | 5623.931 | 12014.762 |
| −25 | 3835.898 | 3990.100 | 8524.305 |
| −20 | 2776.427 | 2861.784 | 6113.811 |
| −15 | 2028.126 | 2076.162 | 4435.437 |
| −10 | 1494.620 | 1520.909 | 3249.216 |
| −5 | 1110.822 | 1125.049 | 2403.515 |
| 0 | 832.332 | 839.912 | 1794.358 |
| 5 | 628.577 | 632.521 | 1351.294 |
| 10 | 478.310 | 480.194 | 1025.870 |
| 15 | 366.639 | 367.455 | 785.018 |
| 20 | 283.036 | 283.310 | 605.252 |
| 25 | 220.000 | 220.000 | 470.000 |
| 30 | 172.143 | 172.012 | 367.480 |
| 35 | 135.569 | 135.364 | 289.186 |
| 40 | 107.436 | 107.198 | 229.014 |
| 45 | 85.662 | 85.419 | 182.485 |
| 50 | 68.708 | 68.441 | 146.215 |
| 55 | 55.444 | 55.153 | 117.828 |
| 60 | 44.984 | 44.665 | 95.420 |
| 65 | 36.694 | 36.379 | 77.718 |
| 70 | 30.085 | 29.763 | 63.584 |
| 75 | 24.789 | 24.462 | 52.260 |
| 80 | 20.523 | 20.205 | 43.166 |
| 85 | 17.068 | 16.761 | 35.808 |
| 90 | 14.258 | 13.962 | 29.828 |
| 95 | 11.961 | 11.684 | 24.961 |
| 100 | 10.075 | 9.809 | 20.955 |
| 105 | 8.521 | 8.270 | 17.668 |
| 110 | 7.236 | 6.998 | 14.951 |
| 115 | 6.169 | 5.942 | 12.695 |
| 120 | 5.281 | 5.067 | 10.824 |
| 125 | 4.540 | 4.334 | 9.259 |

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

# Temp. Sensor and Compensation 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 vacuum, or under high or low pressure
5. Wet or humid locations
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

## ■ ⚠Caution (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 degrees C
   Humidity less than 75%RH (not dewing condition)
2. Storage term:
   Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Storage place:
   Do not store this product in corrosive gas (Sulfuric acid gas, Chlorine gas, etc.) or in direct sunlight.

## ■ Notice (Rating)

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

## ■ Notice (Handling)

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

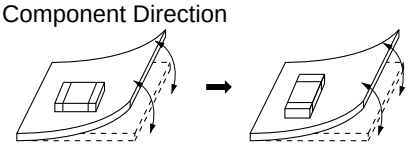
# Temp. Sensor and Compensation Chip Type ⚠Caution/Notice

## ■ Notice (Soldering and Mounting)

### 1. Mounting Position

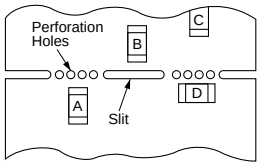
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

Component Direction



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

Mounting Close to Board Separation Line



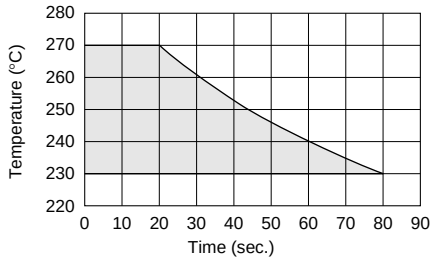

Keep this product on the PC Board away from the Separation Line.
Worst ← A-C-B-D → Better

### 2. Allowable Soldering Temperature and Time

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

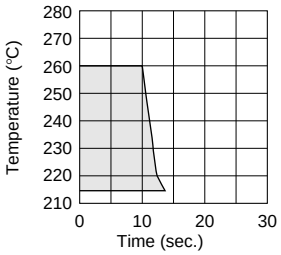
**NCP03/15** Series

Allowable Reflow Soldering Temp. and Time

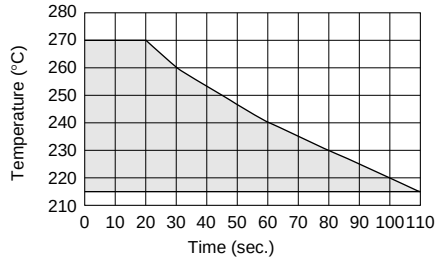



**NCP18/21** Series

Allowable Flow Soldering Temp. and Time




Allowable Reflow Soldering Temp. and Time




Continued on the following page.

# Temp. Sensor and Compensation Chip Type ⚠Caution/Notice

Continued from the preceding page.

## 3. Recommended Temperature Profile for Soldering

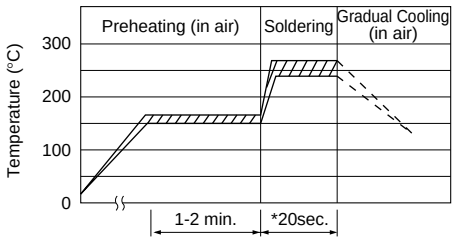
(a) Insufficient preheating may cause a crack on ceramic body. The difference between preheating temperature and maximum temperature in the profile shall be 100 °C.

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

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

**NCP03/15** Series

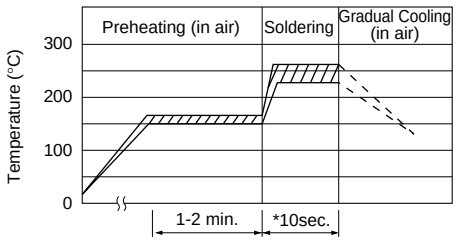
Reflow Soldering Conditions




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

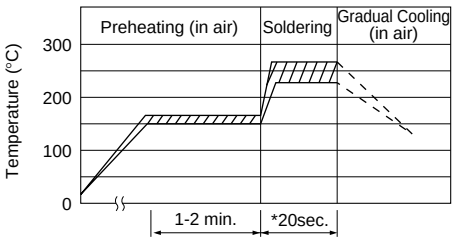
**NCP18/21** Series

Flow Soldering Conditions




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

Reflow Soldering Conditions




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

## 4. Solder and Flux

(1) Solder and Paste

(a) Reflow Soldering: 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 type flux in soldering process.

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

Please do not use the following flux.

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

## 5. Cleaning Conditions

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

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

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

## 6. Drying

After cleaning, promptly dry this product.

Continued on the following page.

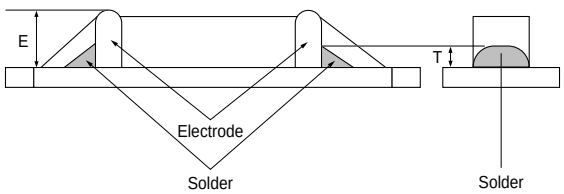
# Temp. Sensor and Compensation Chip Type ⚠Caution/Notice

Continued from the preceding page.

## 7. Printing Conditions of Solder Paste

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

Reference: Optimum Solder Amount




| Part Number | The Solder Paste Thickness | T |
|---|---|---|
| **NCP03** | 100μm | 1/3E≦T≦E |
| **NCP15** | 150μm | 1/3E≦T≦E |
| **NCP18/NCP21** | 200μm | 0.2mm≦T≦E |

## 8. Adhesive Application and Curing

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

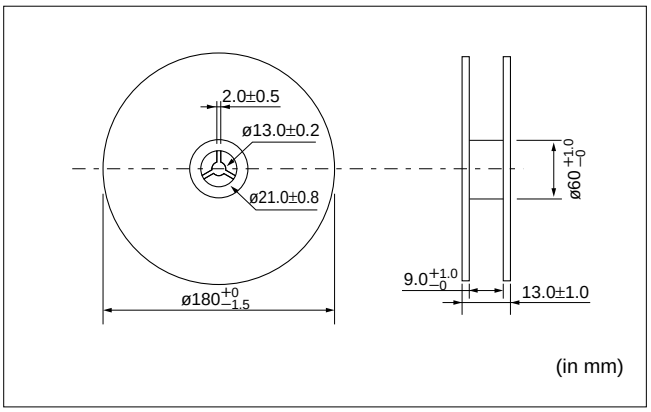
# Temp. Sensor and Compensation Chip Type Package

## ■ Minimum Quantity Guide

| Part Number | Quantity (pcs.) | |
|---|---|---|
| | Paper Tape | Embossed Tape |
| **NCP03** | 15,000 | - |
| **NCP15** | 10,000 | |
| **NCP18** | 4,000 | |
| **NCP21** | - | 4,000 |

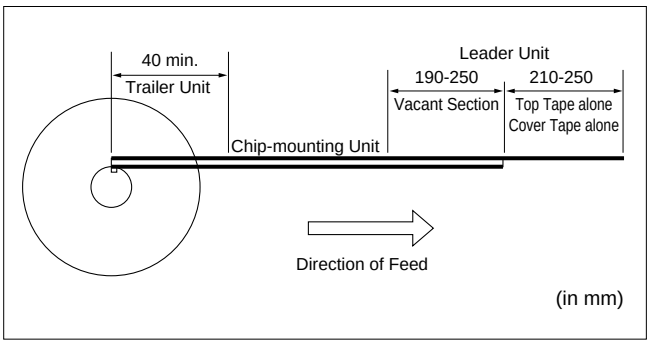
## ■ Tape Carrier Packaging

1. Dimensions of Reel




2. Taping Method

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



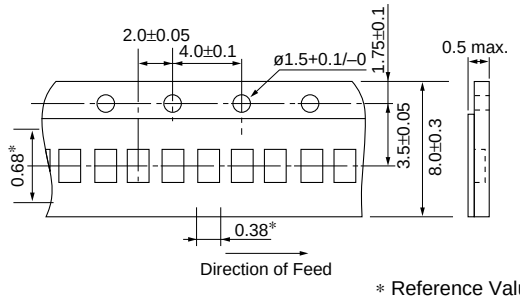

Continued on the following page.

# Temp. Sensor and Compensation Chip Type Package

Continued from the preceding page.

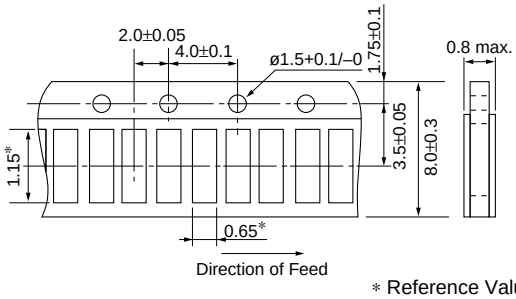
3. Paper Tape (NCP03/15/18 Series)

NCP03 Series



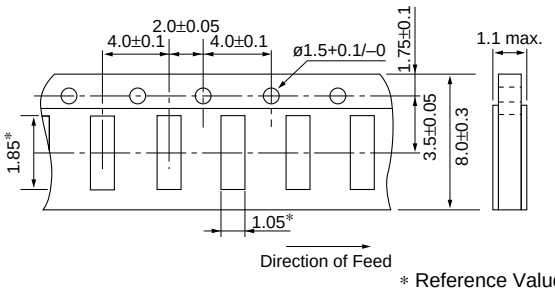

* Reference Value

NCP15 Series




* Reference Value

NCP18 Series




* Reference Value

(in mm)

(1) Other Conditions

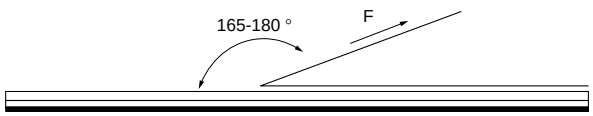
(a) Packaging

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




* 1 Peeling angle: 165 to 180 degrees against the fixed surface of tape.
* 2 Peeling speed: 300mm/min.
* 3 Peeling force: 0.1 - 0.6N

(3) Pull Strength

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

Pull strength of bottom tape should be specified 5N minimum.

Continued on the following page.

# Temp. Sensor and Compensation Chip Type Package

Continued from the preceding page.

4. Embossed Tape (NCP21 Series)

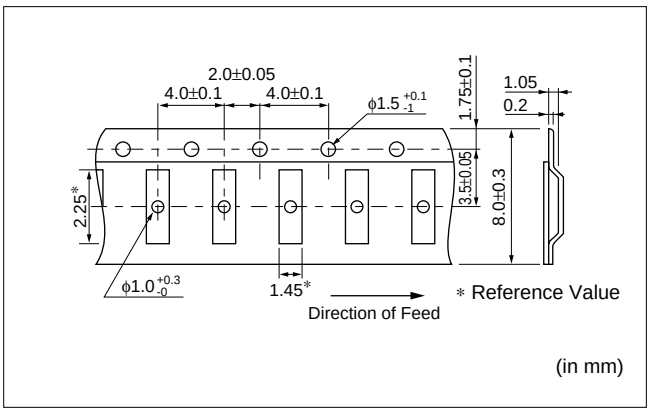
(1) Other Conditions

(a) Packaging

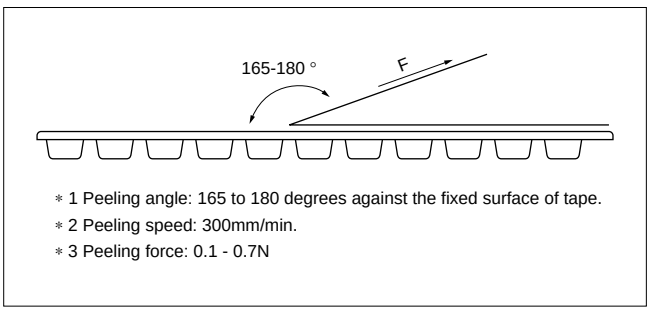
Products are packaged in each cavity of the Embossed tape and sealed by Cover tape.

(b) Tape

Cover tape has no joints.




(2) Peeling Force of Cover Tape




(3) Tape Strength

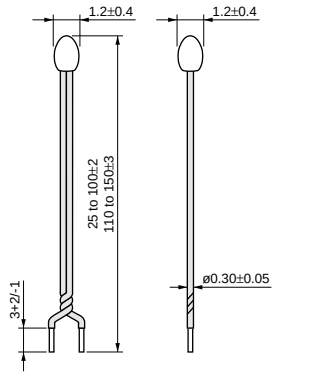
Pull strength of Embossed tape and Cover tape should be specified 10N minimum.

# NTC Thermistors

## Temperature Sensor Thermo String Type

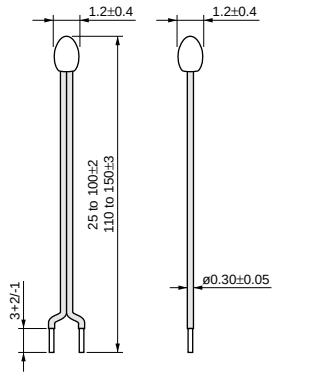
This product is a small flexible lead type NTC Thermistor with a small head and a thin lead wire.






The full length 25mm, 30 to 150mm Interval 10mm. (in mm)

NXFT15_1B Type(twist)




The full length 25mm, 30 to 150mm Interval 10mm. (in mm)

NXFT15_2B Type(without twist)

### ■ Features

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

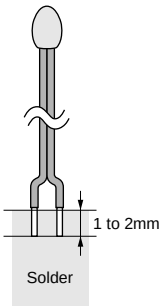
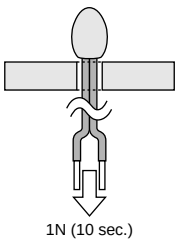
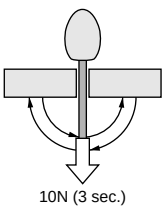
### ■ Applications

1. Temperature compensation for transistor, IC and crystal oscillator in mobile communications
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation in general use of electric circuits

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Operating Current for Sensor (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C) (s) |
|---|---|---|---|---|---|---|---|---|---|
| **NXFT15XH103FA□B□□□** | 10k ±1% | 3380 ±1% | 3423 | 3431 | 3452 | 0.12 | 7.5 | 1.5 | 4 |
| **NXFT15WB473FA□B□□□** | 47k ±1% | 4050 ±1% | 4091 | 4097 | 4114 | 0.06 | 7.5 | 1.5 | 4 |
| **NXFT15WF104FA□B□□□** | 100k ±1% | 4250 ±1% | 4303 | 4311 | 4334 | 0.04 | 7.5 | 1.5 | 4 |

□ is the filled with lead shape (1: twist, 2: without twist).
□□□ is the filled with Total-length codes. (25mm, 30 to 150mm interval 10mm, ex. 050=50mm)
Operating Current for Sensor rises Thermistor's temperature by 0.1°C
Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 30°C by self heating, at ambient temperature of 25 °C.
Operating Temperature Range: -40°C to +125°C

# Temperature Sensor Thermo String Type Specifications and Test Methods

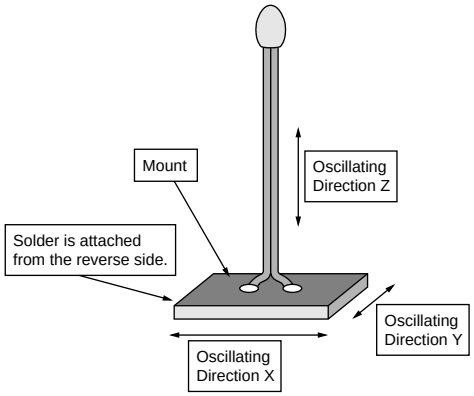
| No. | Item | Specifications | Test Methods |
|---|---|---|---|
| 1 | High Temperature Storage Test | · Resistance (R25°C) fluctuation rate: less than ±1%.<br>· B-Constant (B25/50°C) fluctuation rate: less than ±1%. | 125±2°C in air, for 1000 +48/-0 hours without loading. |
| 2 | Low Temperature Storage Test | | -40 +0/-3°C in air, for 1000 +48/-0 hours without loading. |
| 3 | Humidity Storage Test | · Resistance (R25°C) fluctuation rate: less than ±2%.<br>· B-Constant (B25/50°C) fluctuation rate: less than ±1%. | 60±2°C, 90 to 95%RH in air, for 1000 +48/-0 hours without loading. |
| 4 | Temperature Cycle | | -40 +0/-3°C, 30 minutes in air<br>+25±2°C, 10 to 15 minutes in air<br>+125±2°C, 30 minutes in air<br>+ 25 +2/-0°C, 10 to 15 minutes in air (1 cycle)<br>Continuous 100 cycles, without loading. |
| 5 | High Temperature Load | | 85±2°C in air, with 'Operating Current for Sensor' for 1000 +48/-0 hrs. |
| 6 | Insulation Break - down Voltage | · No damage electrical characteristics at DC100 V, 1 min. | 2mm length of coating resin from the top of Thermistor is to be dipped into beads of lead (Pb), and DC100V 1 minute is applied to circuit between beads of lead (Pb) and lead wire. |
| 7 | Resistance to Soldering Heat | · Resistance (R25°C) fluctuation rate: less than ±1%.<br>· B-Constant (B25/50°C) fluctuation rate: less than ±1%. | Both lead wires are dipped into 350±10°C solder for 3.5±0.5 seconds, or 260±5°C solder for 10±1 seconds according to Fig-1 (solder <JIS Z 3282 H60A>).<br><br>Fig-1 |
| 8 | Solderability | More than 90% of lead wire surface shall be covered by solder. | Both lead wires are dipped into flux (25wt% colophony <JIS K 5902> isopropyl alcohol <JIS K 8839>) for 5 to 10 seconds. Then both lead wires are dipped into 235±5°C solder <JIS Z 3282 H60A> for 2±0.5 seconds according to Fig-1. |
| 9 | Lead Wire Pull Strength | · Resistance (R25°C) fluctuation rate: less than ±1%.<br>· B-Constant (B25/50°C) fluctuation rate: less than ±1%. | The lead wire shall be inserted in a ø1.0mm hole until resin part contacts with a substrate as shown in fig.-2, and 1N force for 10 seconds shall be applied to the lead wire.<br><br>Fig-2 |
| 10 | Lead Wire Bending Strength | · Lead wire does not break. | Hold the lead wires as in Fig-3. Bend by 90 degrees and again bend back to the initial position. Then bend to the other side by 90 degrees and again bend back to the initial position. After bending process, 10N force for 3 seconds shall be applied to the lead wire.<br><br>Fig-3 |

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

Continued on the following page.

# Temperature Sensor Thermo String Type Specifications and Test Methods

Continued from the preceding page.

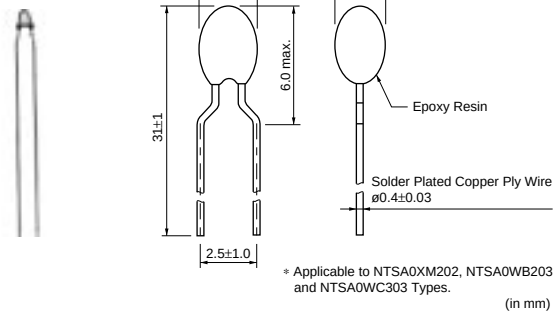
| No. | Item | Specifications | Test Methods |
|---|---|---|---|
| 11 | Free Fall | · Resistance (R25°C) fluctuation rate: less than ±1%.<br>· B-Constant (B25/50°C) fluctuation rate: less than ±1%.<br>· No visible damage at resin part. | NTC Thermistor shall be dropped without any force onto concrete floor from 1 meter height one time. |
| 12 | Vibration | | NTC Thermistor shall be fixed to the vibration test equipment. Vibration of total 1.5 mm amplitude, Frequency sequence of 10Hz - 55Hz - 10Hz in 1 minute, shall be applied for right angled 3 directions for each 2 hours duration.<br> |

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

# NTC Thermistors

## Temperature Sensor Lead Type

This product is a sensor type NTC Thermistor developed by our unique ceramic technology and automatic assemble, to be used in normal temperature ranges.




### ■ Features

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

### ■ Applications

1. Rechargeable batteries
2. Battery charging circuits
3. Printer heads
4. DC fan motors
5. Home appliance equipment

6

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C) (s) |
|---|---|---|---|---|---|---|---|---|---|
| **NTSA0XM202□E1B0** | 2.0k | 3500 ±0.5% | 3523 | 3526 | 3543 | 1.05 | 21 | 2.1 | 7 |
| **NTSA0XR502□E1B0** | 5.0k | 3700 ±1% | 3727 | 3738 | 3760 | 0.68 | 15 | 1.5 | 7 |
| **NTSA0XH103□E1B0** | 10k | 3380 ±0.5% | 3428 | 3434 | 3455 | 0.38 | 15 | 1.5 | 7 |
| **NTSA0XV103□E1B0** | 10k | 3900 ±0.5% | 3930 | 3934 | 3944 | 0.46 | 15 | 1.5 | 7 |
| **NTSA0WB203□E1B0** | 20k | 4050 ±1% | 4078 | 4080 | 4096 | 0.31 | 21 | 2.1 | 7 |
| **NTSA0WC303□E1B0** | 30k | 4100 ±1% | 4128 | 4130 | 4147 | 0.26 | 21 | 2.1 | 7 |
| **NTSA0WD503□E1B0** | 50k | 4150 ±1% | 4205 | 4213 | 4234 | 0.20 | 15 | 1.5 | 7 |
| **NTSA0WF104□E1B0** | 100k | 4250 ±1% | 4303 | 4311 | 4334 | 0.14 | 15 | 1.5 | 7 |

□ is filled with resistance tolerance codes (F: ±1%, E: ±3%).
Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 35°C by self heating, at ambient temperature of 25 °C.
Operating Temperature Range: -40°C to +125°C
Taping type of part numbers with "N6A0" is available (Lead Spacing=5mm, Lead Diameter=ø0.5mm).

# NTC Thermistors

## Temperature Sensor Lead Insulation Type

This product is a sensor type NTC Thermistor developed by our unique ceramic technology and automatic assemble, to be used in normal temperature ranges.

### ■ Features

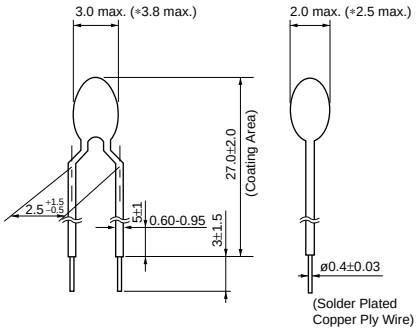
1. Electric insulation on lead wire
2. Excellent bending resistance due to suitable hardness of surface coating
3. Easy handling due to most suitable hardness of surface of coating
4. High accuracy of B-Constant tolerance +/-0.5% +/-1% of resistance and +/-0.5% of B-Constant is realized due to technical advantages of the material and manufacturing processes.

### ■ Applications

1. Rechargeable batteries
2. Battery charging circuits
3. Printer heads
4. DC fan motors
5. Home appliance equipment



NTSD0 Series

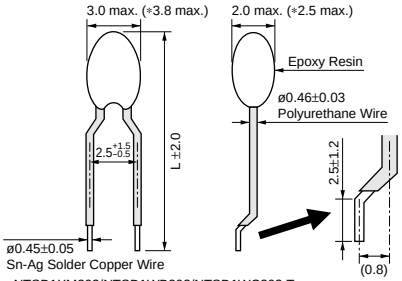



∗ Applicable to NTSD0XM202, NTSD0WB203 and NTSD0WC303 Types.

(in mm)



NTSD1 Series




∗ NTSD1XM202/NTSD1WB203/NTSD1WC303 Types

(in mm)

| Type | L (mm) |
|---|---|
| NTSD1_FPB30 | 30 |
| NTSD1_FPB40 | 40 |
| NTSD1_FPB50 | 50 |

## NTSD0 Series

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C) (s) |
|---|---|---|---|---|---|---|---|---|---|
| **NTSD0XM202□E1B0** | 2.0k | 3500 ±0.5% | 3523 | 3526 | 3543 | 1.05 | 21 | 2.1 | 7 |
| **NTSD0XR502□E1B0** | 5.0k | 3700 ±1% | 3727 | 3738 | 3760 | 0.68 | 15 | 1.5 | 7 |
| **NTSD0XH103□E1B0** | 10k | 3380 ±0.5% | 3428 | 3434 | 3455 | 0.38 | 15 | 1.5 | 7 |
| **NTSD0XV103□E1B0** | 10k | 3900 ±0.5% | 3930 | 3934 | 3944 | 0.46 | 15 | 1.5 | 7 |
| **NTSD0WB203□E1B0** | 20k | 4050 ±1% | 4078 | 4080 | 4096 | 0.31 | 21 | 2.1 | 7 |
| **NTSD0WC303□E1B0** | 30k | 4100 ±1% | 4128 | 4130 | 4147 | 0.26 | 21 | 2.1 | 7 |
| **NTSD0WD503□E1B0** | 50k | 4150 ±1% | 4205 | 4213 | 4234 | 0.20 | 15 | 1.5 | 7 |
| **NTSD0WF104□E1B0** | 100k | 4250 ±1% | 4303 | 4311 | 4334 | 0.14 | 15 | 1.5 | 7 |

□ is filled with resistance tolerance codes (F: ±1%, E: ±3%).

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 35°C by self heating, at ambient temperature of 25 °C.

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

## NTSD1 Series

| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C) (s) |
|---|---|---|---|---|---|---|---|---|---|
| **NTSD1XM202FPB□□** | 2.0k ±1% | 3500 ±0.5% | 3523 | 3526 | 3543 | 1.05 | 21 | 2.1 | 7 |
| **NTSD1XR502FPB□□** | 5.0k ±1% | 3700 ±1% | 3727 | 3738 | 3760 | 0.68 | 15 | 1.5 | 7 |
| **NTSD1XH103FPB□□** | 10k ±1% | 3380 ±0.5% | 3428 | 3434 | 3455 | 0.38 | 15 | 1.5 | 7 |
| **NTSD1XV103FPB□□** | 10k ±1% | 3900 ±0.5% | 3930 | 3934 | 3944 | 0.46 | 15 | 1.5 | 7 |
| **NTSD1WB203FPB□□** | 20k ±1% | 4050 ±1% | 4078 | 4080 | 4096 | 0.31 | 21 | 2.1 | 7 |
| **NTSD1WC303FPB□□** | 30k ±1% | 4100 ±1% | 4128 | 4130 | 4147 | 0.26 | 21 | 2.1 | 7 |

Continued on the following page.

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| Part Number | Resistance (25°C) (ohm) | B-Constant (25-50°C) (K) | B-Constant (25-80°C) (Reference Value) (K) | B-Constant (25-85°C) (Reference Value) (K) | B-Constant (25-100°C) (Reference Value) (K) | Permissive Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (25°C) (s) |
|---|---|---|---|---|---|---|---|---|---|
| **NTSD1WD503FPB□□** | 50k ±1% | 4150 ±1% | 4205 | 4213 | 4234 | 0.20 | 15 | 1.5 | 7 |
| **NTSD1WF104FPB□□** | 100k ±1% | 4250 ±1% | 4303 | 4311 | 4334 | 0.14 | 15 | 1.5 | 7 |

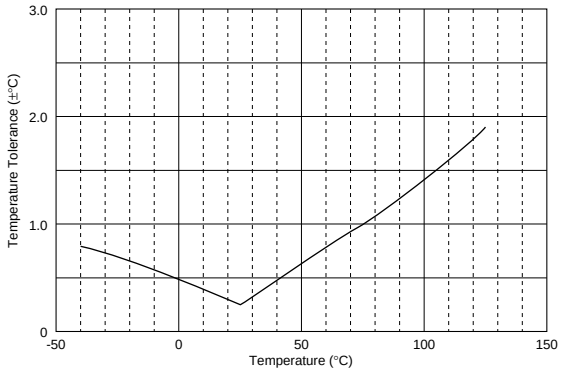
□□ is filled with Total-length codes (30, 40, 50).

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 35°C by self heating, at ambient temperature of 25 °C.

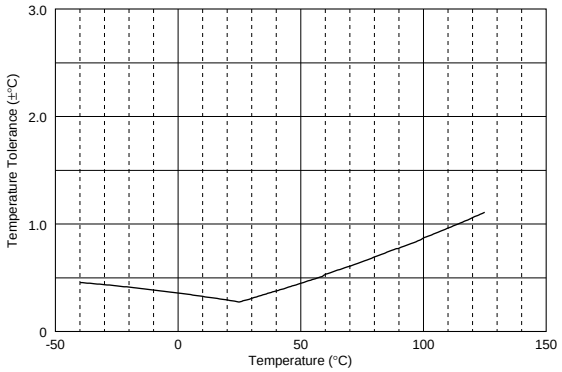
Operating Temperature Range: -40°C to +125°C

## ■ Temperature Tolerance - Temperature Characteristics

Resistance Tolerance: +/-1% B-Constant Tolerance: +/-1%




Resistance Tolerance: +/-1% B-Constant Tolerance: +/-0.5%




7

# Temperature Sensor Temperature Characteristics (Center Value)

| Part Number | NXF□XH103 | NXF□WB473 | NXF□WF104 |
|---|---|---|---|
| Resistance | 10kΩ | 47kΩ | 100kΩ |
| B-Constant | 3380K | 4050K | 4250K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| −40 | 197.388 | 1690.590 | 4221.280 |
| −35 | 149.395 | 1215.320 | 2995.040 |
| −30 | 114.345 | 882.908 | 2147.000 |
| −25 | 88.381 | 647.911 | 1554.600 |
| −20 | 68.915 | 480.069 | 1136.690 |
| −15 | 54.166 | 359.009 | 839.019 |
| −10 | 42.889 | 270.868 | 624.987 |
| −5 | 34.196 | 206.113 | 469.678 |
| 0 | 27.445 | 158.126 | 355.975 |
| 5 | 22.165 | 122.267 | 272.011 |
| 10 | 18.010 | 95.256 | 209.489 |
| 15 | 14.720 | 74.754 | 162.559 |
| 20 | 12.099 | 59.075 | 127.057 |
| 25 | 10.000 | 47.000 | 100.000 |
| 30 | 8.309 | 37.636 | 79.222 |
| 35 | 6.939 | 30.326 | 63.167 |
| 40 | 5.824 | 24.583 | 50.677 |
| 45 | 4.911 | 20.043 | 40.904 |
| 50 | 4.160 | 16.433 | 33.195 |
| 55 | 3.539 | 13.545 | 27.091 |
| 60 | 3.024 | 11.223 | 22.224 |
| 65 | 2.593 | 9.345 | 18.323 |
| 70 | 2.233 | 7.818 | 15.184 |
| 75 | 1.929 | 6.571 | 12.635 |
| 80 | 1.673 | 5.548 | 10.566 |
| 85 | 1.455 | 4.704 | 8.873 |
| 90 | 1.270 | 4.004 | 7.481 |
| 95 | 1.112 | 3.422 | 6.337 |
| 100 | 0.976 | 2.936 | 5.384 |
| 105 | 0.860 | 2.528 | 4.594 |
| 110 | 0.759 | 2.184 | 3.934 |
| 115 | 0.673 | 1.893 | 3.380 |
| 120 | 0.598 | 1.646 | 2.916 |
| 125 | 0.532 | 1.436 | 2.522 |

| 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 | 12.598 |
| 80 | 0.318 | 0.714 | 1.669 | 1.284 | 2.376 | 3.472 | 5.558 | 10.542 |
| 85 | 0.276 | 0.612 | 1.452 | 1.096 | 2.020 | 2.945 | 4.686 | 8.852 |
| 90 | 0.240 | 0.527 | 1.268 | 0.939 | 1.724 | 2.509 | 3.967 | 7.463 |
| 95 | 0.210 | 0.456 | 1.110 | 0.808 | 1.476 | 2.143 | 3.373 | 6.321 |
| 100 | 0.183 | 0.396 | 0.974 | 0.698 | 1.264 | 1.832 | 2.878 | 5.374 |
| 105 | 0.161 | 0.345 | 0.858 | 0.605 | 1.085 | 1.571 | 2.465 | 4.585 |
| 110 | 0.142 | 0.302 | 0.758 | 0.527 | 0.935 | 1.350 | 2.118 | 3.925 |
| 115 | 0.125 | 0.264 | 0.671 | 0.460 | 0.812 | 1.171 | 1.828 | 3.376 |
| 120 | 0.111 | 0.232 | 0.596 | 0.403 | 0.708 | 1.019 | 1.583 | 2.913 |
| 125 | 0.099 | 0.205 | 0.531 | 0.354 | 0.617 | 0.886 | 1.374 | 2.520 |

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

# Temperature Sensor Thermo String Type/Lead 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 vacuum, or under high or low pressure
5. Wet or humid locations
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

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

## ■ Notice (Rating)

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

## ■ Notice (Soldering and Mounting) NTS Series

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.

# Temperature Sensor Thermo String Type/Lead Type ⚠Caution/Notice

## ■ Notice (Soldering and Mounting) NXF Series

Please notice as shown below when you mount this product.

1. When you solder this product, do not melt the solder in resin head. If you melt the solder in resin head, there is the possibility of breaks in the wire, shorts and breaks of the lead insulation. In case you cut the lead wire of this product less than 20mm from resin head, the heat of melted solder at lead wire edge is propagated easily to the resin head along the lead wire.
2. Do not touch the resin head directly with solder iron. It may cause the melting of solder in resin head.
3. Do not separate the parallel lead wires 10mm or less from the resin head, when you separate parallel lead wires.
4. If you mold by resin this product, please evaluate the quality before you use it.
5. Do not bend the lead wire radius 1mm or less when you bend the lead wire.

## ■ Notice (Handling)

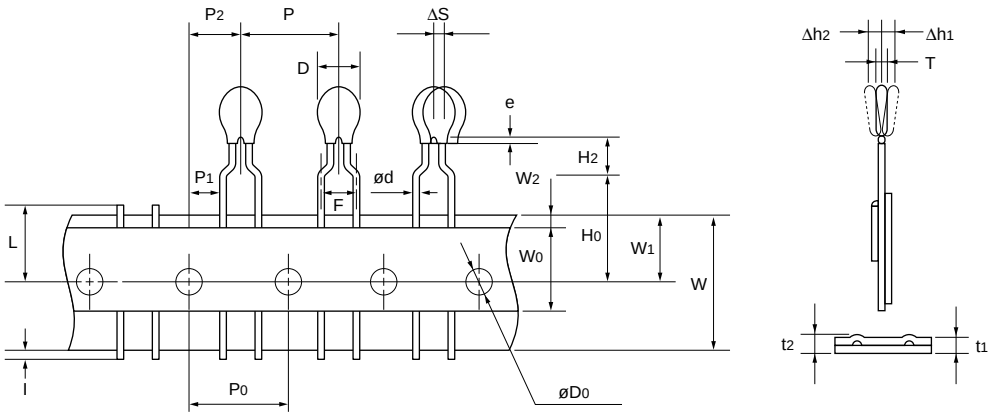
1. The ceramic element of this product is fragile, and care must be taken not to load an excessive press-force or not to cause a shock while handling. Such forces may cause cracking or chipping.
2. Do not apply excessive force to the lead. Otherwise, it may cause the junction between lead and element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

# Temperature Sensor Thermo String Type/Lead Type Package

## ■ Minimum Order Quantity

| Bulk | | Ammo Pack Taping | |
|---|---|---|---|
| Part Number | Minimum Quantity (pcs.) | Part Number | Minimum Quantity (pcs.) |
| **NXFT** | 1,000 | - | - |
| **NTSA_E1B0** | 500 | **NTSA_N6A0** | 3,000 |
| **NTSD0** | 500 | - | - |
| **NTSD1_30** | 500 | - | - |
| **NTSD1_40** | 200 | - | - |
| **NTSD1_50** | 200 | - | - |

## ■ Taping Dimensions (NTSA_N6A0 Series)




| Item | Code | Dimensions (mm) |
|---|---|---|
| Pitch of Component | P | 12.7 |
| Pitch of Sprocket Hole | $P_0$ | 12.7±0.3 |
| Lead Spacing | F | 5.0+0.8/–0.2 |
| Length from Hole Center to Component Center | $P_2$ | 6.35±1.3 |
| Length from Hole Center to Lead | $P_1$ | 3.85±0.8 |
| Body Diameter | D | 3.5 max. |
| Deviation along Tape, Left or Right | ΔS | 0±2.0 |
| Carrier Tape Width | W | 18.0±0.5 |
| Position of Sprocket Hole | $W_1$ | 9.0±0.5 |
| Lead Distance between Reference and Bottom Planes | $H_0$ | 16.0±1.0 |
| Height of Component | $H_2$ | 4.0 max. |
| Protrusion Length | I | +0.5 to –1.0 |
| Diameter of Sprocket Hole | $D_0$ | 4.0±0.1 |
| Lead Diameter | d | 0.50±0.03 |
| Total Tape Thickness | $t_1$ | 0.6±0.3 |
| Total Thickness, Tape and Lead Wire | $t_2$ | 1.6 max. |
| Deviation across Tape | $\Delta h_1$, $\Delta h_2$ | 1.0 max. |
| Portion to Cut in Case of Defect | L | 11.0+0/–2.0 |
| Hold down Tape Width | $W_0$ | 11.0 min. |
| Hold down Tape Position | $W_2$ | 1.5±1.5 |
| Coating Extension on Lead | e | Up to the crimp point |
| Body Thickness | T | 2.6 max. |

(in mm)

# NTC Thermistors

## Inrush Current Suppression Lead Type

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

### ■ Features

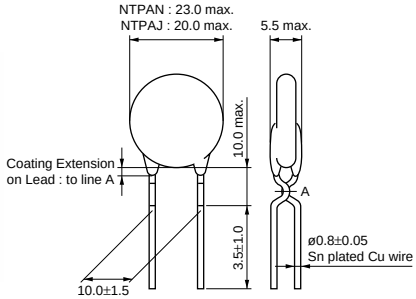
1. Lead is not contained in the ceramic element, the terminations, the solder for inner connection or the coating resin.
2. Most suitable for power supplies of less than 100W
3. Excellent recovery characteristics due to resin coating with excellent heat characteristics
4. Highly reliable

### ■ Applications

1. Switching power supplies
2. CRT monitors
3. Televisions
4. VCR Power supplies
5. Other power circuits



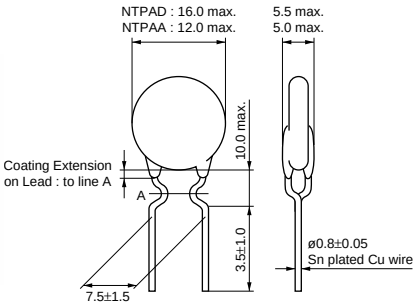
NTPAN/NTPAJ Series




(in mm)



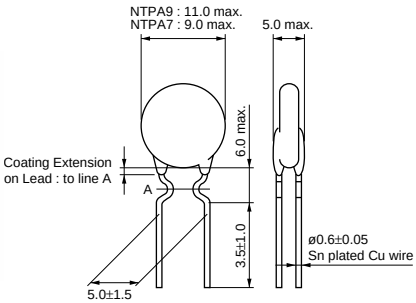
NTPAD/NTPAA Series




(in mm)



NTPA7/NTPA9 Series




(in mm)

| Part Number | Resistance (25°C) (ohm) | Permissible Max. Current (25°C) (A) | Permissible Max. Current (55°C) (A) | Thermal Time Constant (25°C) (s) | Thermal Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|
| **NTPAN3R0LDKB0** | 3.0 ±15% | 5.4 | 4.7 | 135 | 26.8 |
| **NTPAN4R0LDKB0** | 4.0 ±15% | 4.7 | 4.1 | 130 | 26.8 |
| **NTPAN6R0LDKB0** | 6.0 ±15% | 3.9 | 3.4 | 130 | 26.8 |
| **NTPAJ4R0LDKB0** | 4.0 ±15% | 4.0 | 3.5 | 125 | 21.8 |
| **NTPAJ6R0LDKB0** | 6.0 ±15% | 3.4 | 2.9 | 125 | 21.8 |
| **NTPAJ8R0LDKB0** | 8.0 ±15% | 3.0 | 2.6 | 130 | 21.8 |
| **NTPAJ100LDKB0** | 10.0 ±15% | 2.6 | 2.2 | 130 | 21.8 |
| **NTPAD3R9LDNB0** | 3.9 ±15% | 3.3 | 2.9 | 65 | 18.2 |
| **NTPAD5R1LDNB0** | 5.1 ±15% | 3.0 | 2.6 | 85 | 18.8 |
| **NTPAD8R0LDNB0** | 8.0 ±15% | 2.7 | 2.3 | 65 | 18.7 |
| **NTPAD160LDNB0** | 16.0 ±15% | 2.0 | 1.7 | 100 | 19.1 |
| **NTPAA2R2LDNB0** | 2.2 ±15% | 3.7 | 3.2 | 70 | 13.5 |

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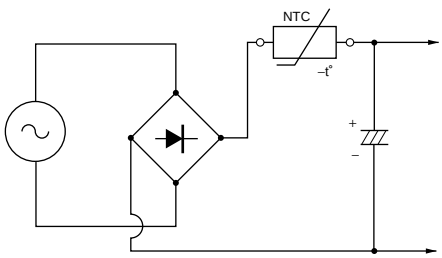
| Part Number | Resistance (25°C) (ohm) | Permissible Max. Current (25°C) (A) | Permissible Max. Current (55°C) (A) | Thermal Time Constant (25°C) (s) | Thermal Dissipation Constant (25°C) (mW/°C) |
|---|---|---|---|---|---|
| **NTPAA3R9LDNB0** | 3.9 ±15% | 2.7 | 2.3 | 70 | 13.5 |
| **NTPAA5R1LDNB0** | 5.1 ±15% | 2.5 | 2.2 | 70 | 13.5 |
| **NTPAA8R2LDNB0** | 8.2 ±15% | 2.0 | 1.7 | 70 | 13.5 |
| **NTPAA100LDNB0** | 10.0 ±15% | 1.7 | 1.5 | 70 | 13.5 |
| **NTPA9160LBMB0** | 16.0 ±15% | 1.4 | 1.2 | 65 | 11.6 |
| **NTPA74R0LBMB0** | 4.0 ±15% | 2.3 | 2.0 | 40 | 9.4 |
| **NTPA75R0LBMB0** | 5.0 ±15% | 1.9 | 1.6 | 40 | 9.4 |
| **NTPA78R0LBMB0** | 8.0 ±15% | 1.7 | 1.5 | 40 | 9.5 |
| **NTPA7100LBMB0** | 10.0 ±15% | 1.4 | 1.2 | 40 | 9.5 |
| **NTPA7160LBMB0** | 16.0 ±15% | 1.2 | 1.0 | 40 | 9.9 |
| **NTPA7220LBMB0** | 22.0 ±15% | 1.0 | 0.88 | 40 | 9.1 |

NTPAD/NTPAA/NTPA9/NTPA7 series are also availabe on tape. The final alphabet of the part number should be "DNB0=>D6A0", "BNB0 =>B1A0".
Operating Temperature Range: -20°C to +160°C

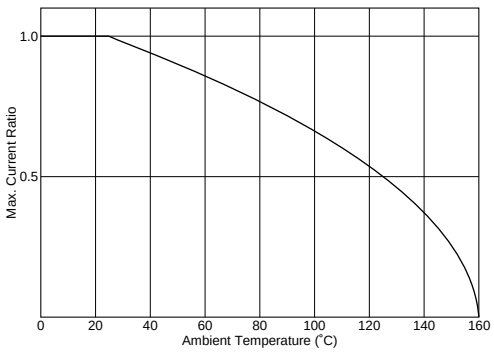
## ■ Permissible Electrolytic Capacitor

| Voltage (AC) / Part Number | 100Vrms | 120Vrms | 132Vrms | 220Vrms | 240Vrms | 264Vrms |
|---|---|---|---|---|---|---|
| **NTPAN** | 8600µF | 5972µF | 4936µF | 1777µF | 1493µF | 1234µF |
| **NTPAJ** | 5000µF | 3472µF | 2870µF | 1033µF | 868µF | 717µF |
| **NTPAD** | 2700µF | 1875µF | 1550µF | 558µF | 469µF | 387µF |
| **NTPAA** | 1400µF | 972µF | 803µF | 289µF | 243µF | 201µF |
| **NTPA9** | 800µF | 556µF | 459µF | 165µF | 139µF | 115µF |
| **NTPA74R0** | 700µF | 486µF | 402µF | 145µF | 122µF | 100µF |
| **NTPA75R0** | | | | | | |
| **NTPA78R0** | 570µF | 396µF | 327µF | 118µF | 99µF | 82µF |
| **NTPA7100** | | | | | | |
| **NTPA7160** | 400µF | 278µF | 230µF | 83µF | 69µF | 57µF |
| **NTPA7220** | | | | | | |

## ■ Application Circuit

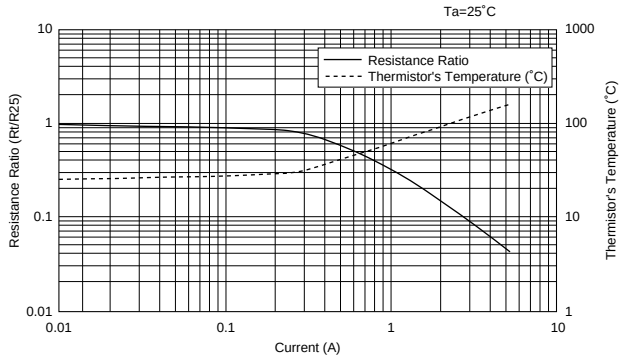



## ■ Determination of Allowable Current

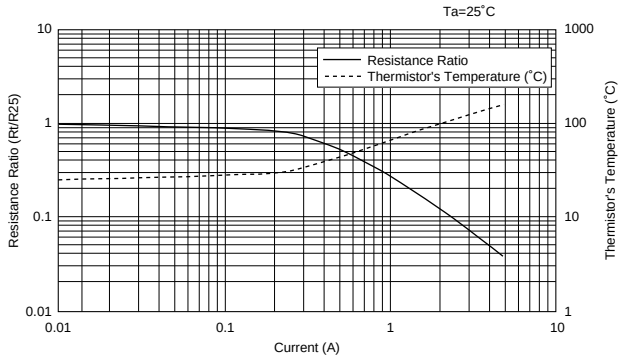


# Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

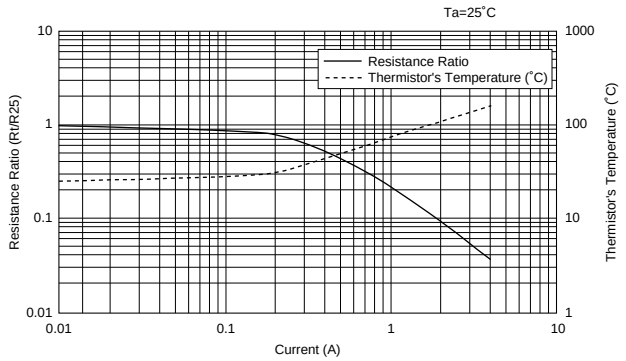
## ■ NTPAN3R0L Type



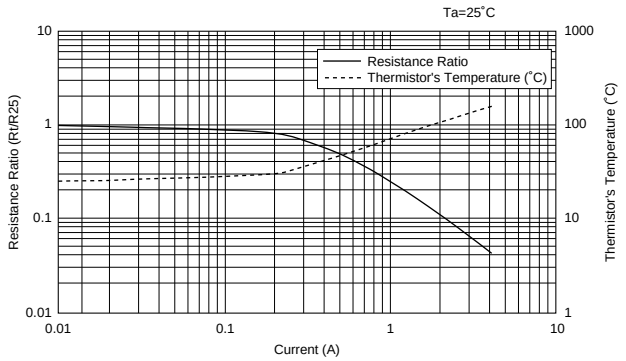

## ■ NTPAN4R0L Type



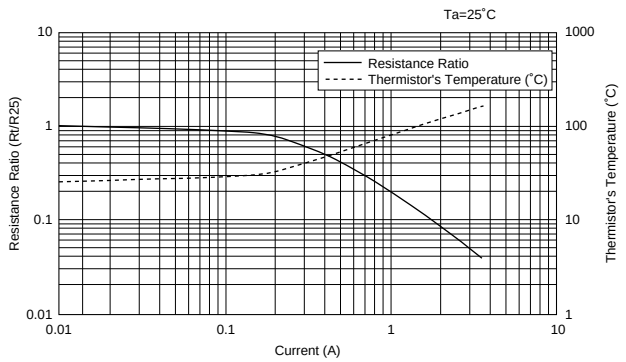

## ■ NTPAN6R0L Type



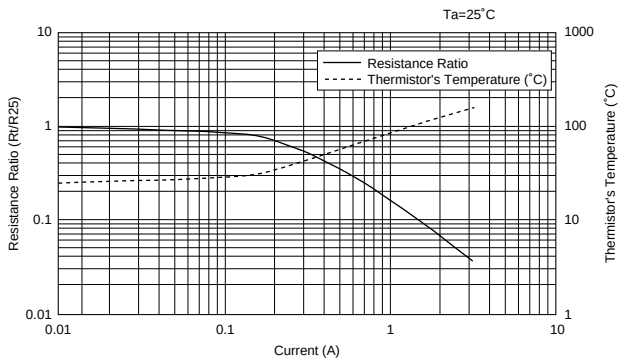

## ■ NTPAJ4R0L Type




## ■ NTPAJ6R0L Type




## ■ NTPAJ8R0L Type



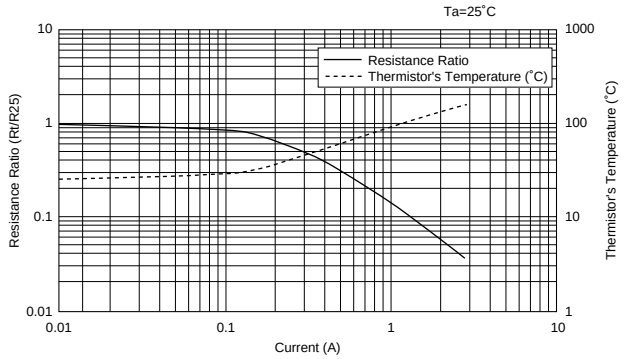

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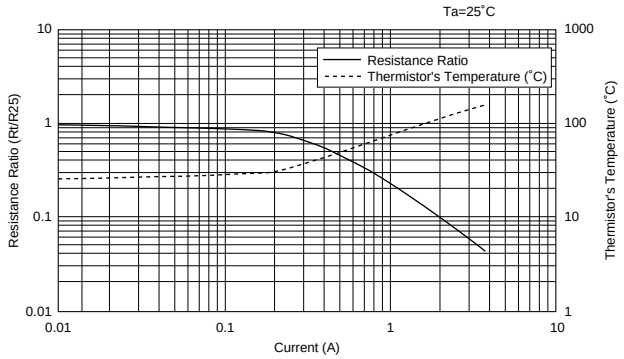
# Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

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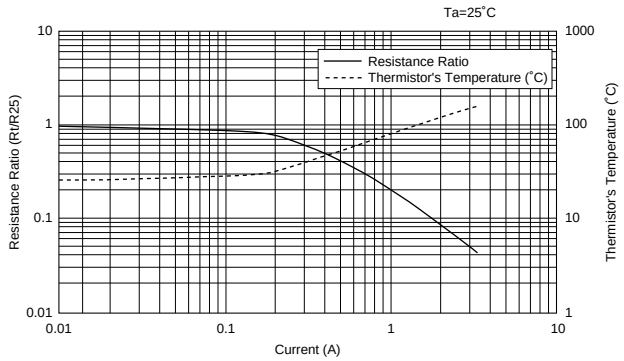
## ■ NTPAJ100L Type



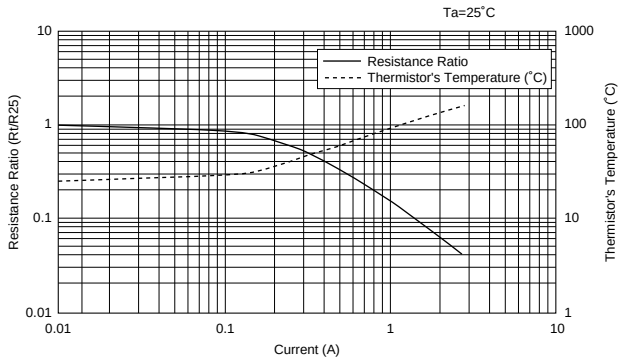

## ■ NTPAD3R9L Type



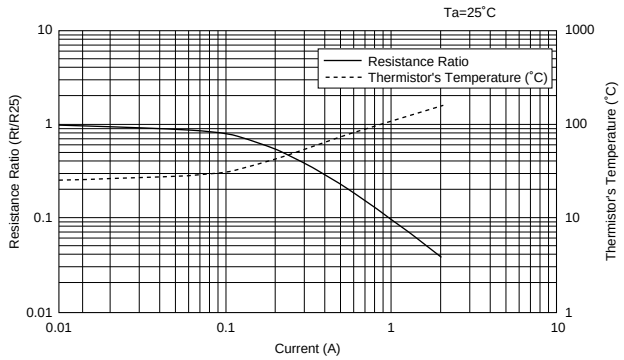

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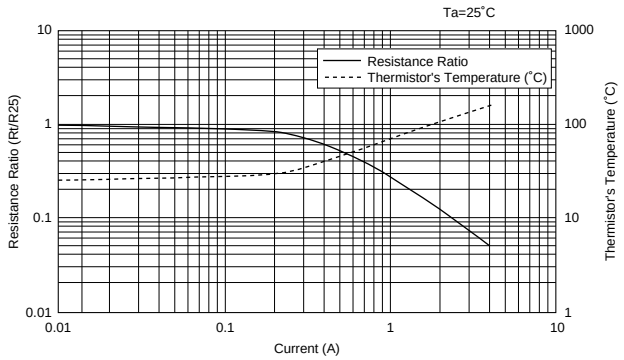

## ■ NTPAD8R0L Type




## ■ NTPAD160L Type




## ■ NTPAA2R2L Type



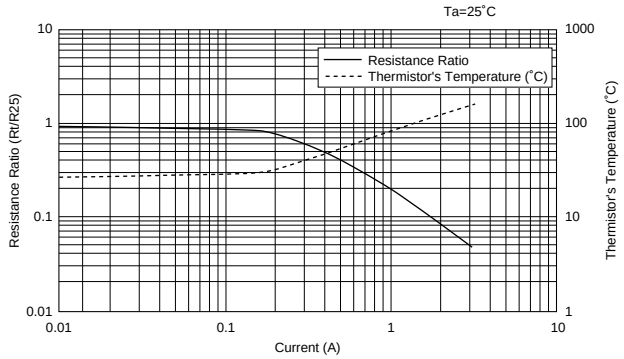

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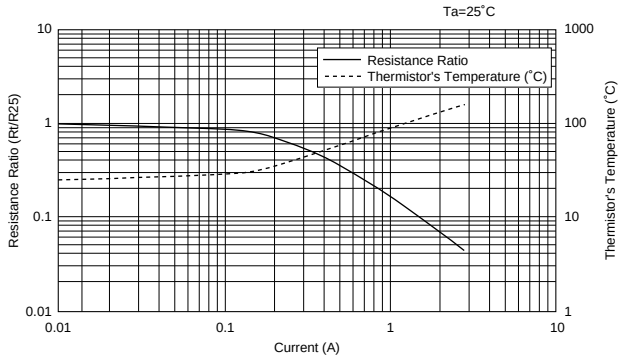
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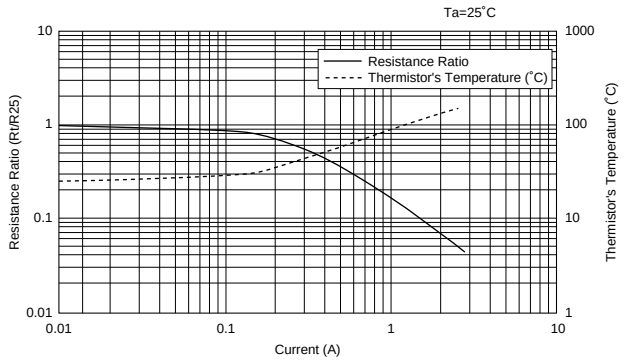
## ■ NTPAA3R9L Type



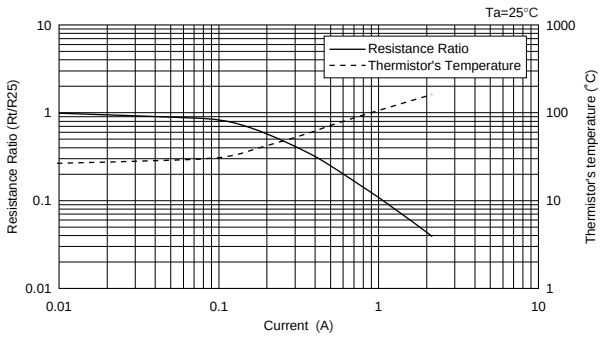

## ■ NTPAA5R1L Type



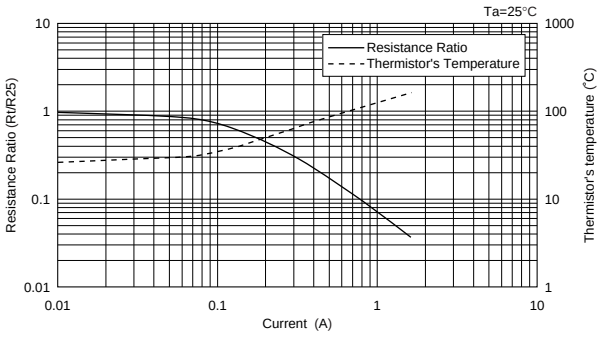

## ■ NTPAA8R2L Type



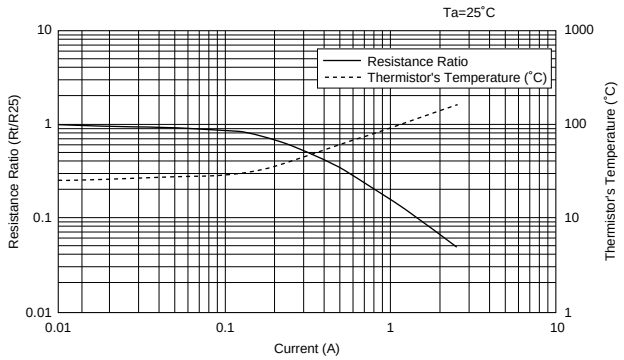

## ■ NTPAA100L Type




## ■ NTPA9160L Type




## ■ NTPA74R0L Type



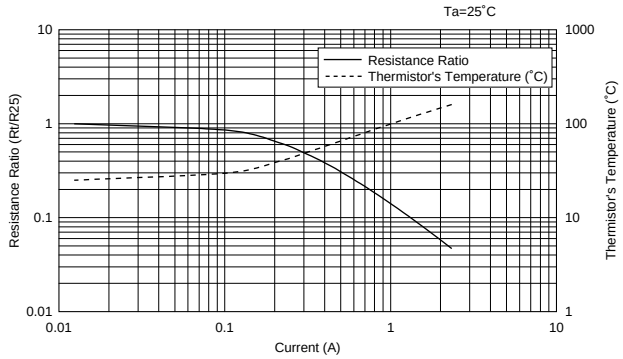

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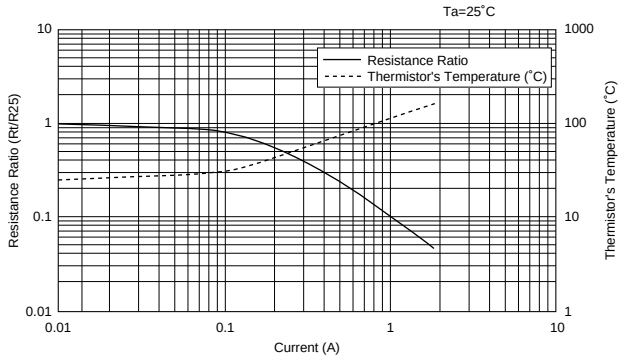
# Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

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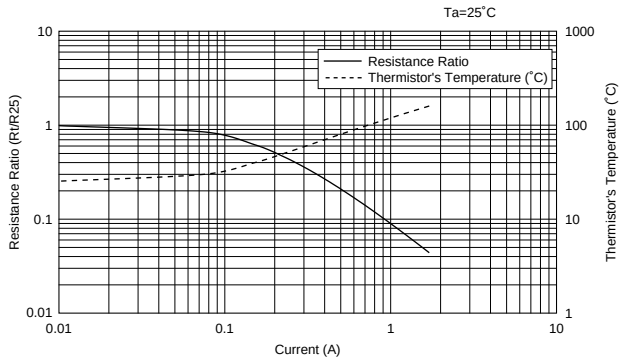
## ■ NTPA75R0L Type



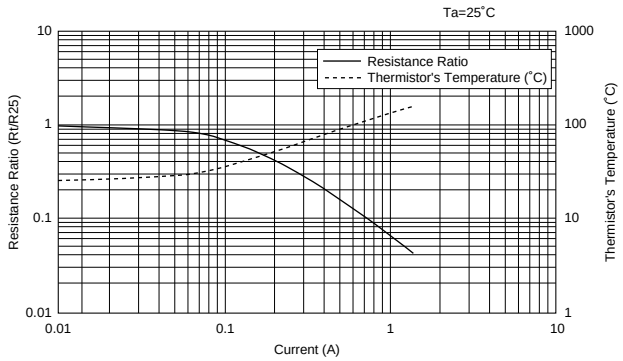

## ■ NTPA78R0L Type



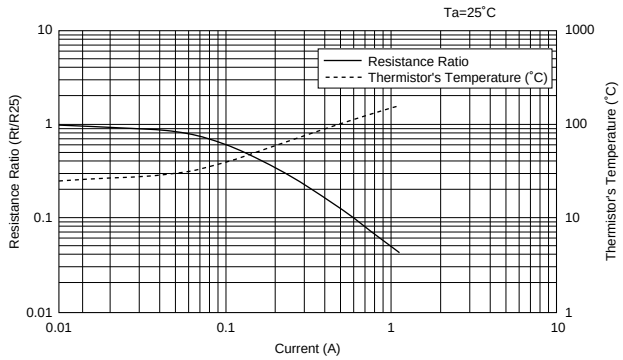

## ■ NTPA7100L Type




## ■ NTPA7160L Type




## ■ NTPA7220L Type



# 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 of these factors can deteriorate the product characteristics causing 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 degrees C
   Humidity less than 75%RH (not dewing condition)
2. Storage term:
   Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Handling after unpacking:
   After unpacking, reseal product promptly or store it in a sealed container with a drying agent.
4. Storage place:
   Do not store this product in corrosive gas (Sulfuric acid gas, Chlorine gas, etc.) or in direct sunlight.

## ■ Notice (Rating)

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

## ■ Notice (Soldering and Mounting)

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

# Inrush Current Suppression Lead Type ⚠Caution/Notice

## ■ Notice (Handling)

1. When this product is operated, temperature of some areas 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 a long time, they may be deteriorated or may produce harmful gas; 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. Therefore, do not immerse it in 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 give a shock at handling.
   Such forces may cause cracking or chipping to the element.
4. Do not apply excessive force to the lead wire. Otherwise, it may cause the junction between lead and element to break or crack.
   So, fix lead wire of element side when lead wire is bent or cut.

## ■ Notice (Others)

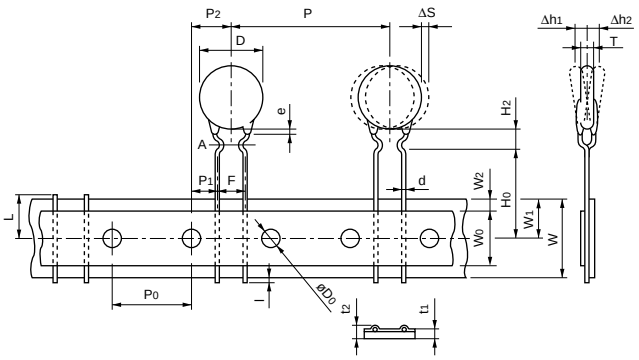
1. This product may allow passing higher current than its initial value when it receives inrush current again shortly after the previous one after it cools down and sufficiently recovers its original resistance. Be sure the highest current under actual condition remains within the operating repetition and the operating temperature.
2. The resin coating of this product does not guarantee insulating. Keep an adequate insulating distance to surrounding parts.

# Inrush Current Suppression Lead Type Package

## ■ Minimum Order Quantity

| Bulk | | Ammo Pack Taping | |
|---|---|---|---|
| Part Number | Minimum Quantity (pcs.) | Part Number | Minimum Quantity (pcs.) |
| **NTPAN_DKB0** | 50 | - | - |
| **NTPAJ_DKB0** | 100 | - | - |
| **NTPAD_DNB0** | 150 | **NTPAD_D6A0** | 400 |
| **NTPAA_DNB0** | 300 | **NTPAA_D6A0** | 750 |
| **NTPA9_BMB0** | 300 | **NTPA9_B1A0** | 1,000 |
| **NTPA7_BMB0** | 500 | **NTPA7_B1A0** | 1,000 |

## ■ Taping Dimensions (NTPAD/NTPAA_D6A0 Series)




| Item | Code | Dimensions (mm) |
|---|---|---|
| Pitch of Component | P | 30.0 |
| Pitch of Sprocket Hole | $P_0$ | 15.0±0.3 |
| Lead Spacing | F | 7.5±0.5 |
| Length from Hole Center to Component Center | $P_2$ | 7.5±1.5 |
| Length from Hole Center to Lead | $P_1$ | 3.75±1.0 |
| Body Diameter | D | (refer to the table below) |
| Body 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 | $W_1$ | 9.0±0.5 |
| Lead Distance between Reference and Bottom Plane | $H_0$ | 16.0±0.5 |
| Height of Component | $H_2$ | 10.0 max. |
| Protrusion Length | I | +0.5 to −6.0 |
| Diameter of Sprocket Hole | $D_0$ | 4.0±0.1 |
| Lead Diameter | d | 0.8±0.05 |
| Total Tape Thickness | $t_1$ | 0.6±0.3 |
| Total Thickness, Tape and Lead Wire | $t_2$ | 2.0 max. |
| Deviation Across Tape | $\Delta h_1$, $\Delta h_2$ | 2.0 max. |
| Portion to Cut in Case of Defect | L | $11.0^{+0}_{-2.0}$ |
| Hold down Tape Width | $W_0$ | 11.5 min. |
| Hold down Tape Position | $W_2$ | 4.0 max. |
| Coating Extension on Lead | e | to line A |

| Type | D (mm) | T (mm) |
|---|---|---|
| **NTPAD** | 16.0 max. | 5.5 max. |
| **NTPAA** | 12.0 max. | 5.0 max. |

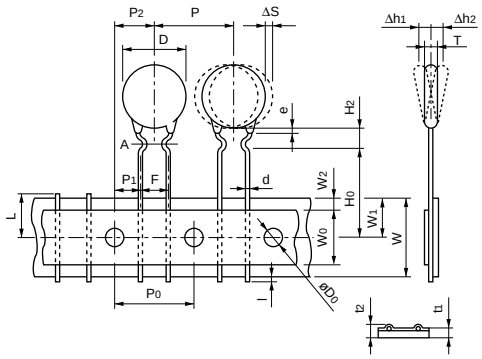
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# Inrush Current Suppression Lead Type Package

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## ■ Taping Dimensions (NTPA9/NTPA7_B1A0 Series)




| Item | Code | Dimensions (mm) |
|---|---|---|
| Pitch of Component | P | 12.7 |
| Pitch of Sprocket Hole | $P_0$ | 12.7±0.3 |
| Lead Spacing | F | $5.0^{+0.8}_{-0.3}$ |
| Length from Hole Center to Component Center | $P_2$ | 6.35±1.3 |
| Length from Hole Center to Lead | $P_1$ | 3.85±0.8 |
| Body Diameter | D | (refer to the table below) |
| Body 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 | $W_1$ | $9.0^{+0.5}_{-0.75}$ |
| Lead Distance between Reference and Bottom Planes | $H_0$ | 16.0±1.0 |
| Height of Component | $H_2$ | 6.0 max. |
| Protrusion Length | I | +0.5 to −4.0 |
| Diameter of Sprocket Hole | $D_0$ | 4.0±0.3 |
| Lead Diameter | d | 0.6±0.05 |
| Total Tape Thickness | $t_1$ | 0.6±0.3 |
| Total Thickness, Tape and Lead Wire | $t_2$ | 2.0 max. |
| Deviation Across Tape | $\Delta h_1$, $\Delta h_2$ | 1.5 max. |
| Portion to Cut in Case of Defect | L | $11.0^{+0}_{-2.0}$ |
| Hold down Tape Width | $W_0$ | 11.0 min. |
| Hold down Tape Position | $W_2$ | 4.0 max. |
| Coating Extension on Lead | e | to line A |

| Type | D (mm) |
|---|---|
| **NTPA9** | 11.0 max. |
| **NTPA7** | 9.0 max. |

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## ⚠Note:

1. Export Control
   <For customers outside Japan>
   No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.
   <For customers in Japan>
   For products which are controlled items subject to the “Foreign Exchange and Foreign Trade Law” of Japan, the export license specified by the law is required for export.
2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.
   ① Aircraft equipment ② Aerospace equipment
   ③ Undersea equipment ④ Power plant equipment
   ⑤ Medical equipment ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment ⑩ Application of similar complexity and/or reliability requirements to the applications listed above
3. Product specifications in this catalog are as of November 2010. 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 review our product specifications or consult the approval sheet for product specifications before ordering.
6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.
7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

**Murata Manufacturing Co., Ltd.**

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