

NTC Thermistors



for EU RoHS Compliant

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

CONTENTS

| | | |
|--|-------|----|
| Part Numbering | _____ | 2 |
| Basic Characteristics | _____ | 6 |
| 1 for Temperature Sensor and Compensation 0201 (0603) Size | _____ | 7 |
| 2 for Temperature Sensor and Compensation 0402 (1005) Size | _____ | 8 |
| 3 for Temperature Sensor and Compensation 0603 (1608) Size | _____ | 10 |
| 4 for Temperature Sensor and Compensation 0805 (2012) Size | _____ | 12 |
| for Temp. Sensor and Compensation Chip Type Standard Land Pattern Dimensions | _____ | 13 |
| for Temp. Sensor and Compensation Chip Type Temperature Characteristics (Center Value) | _____ | 14 |
| for Temp. Sensor and Compensation Chip Type △Caution/Notice | _____ | 18 |
| for Temp. Sensor and Compensation Chip Type Package | _____ | 22 |
| 5 for Temperature Sensor Thermo String Type | _____ | 25 |
| ● for Temperature Sensor Thermo String Type Specifications and Test Methods | _____ | 26 |
| 6 for Temperature Sensor Lead Type | _____ | 28 |
| 7 for Temperature Sensor Lead Insulation Type | _____ | 29 |
| for Temperature Sensor Temperature Characteristics (Center Value) | _____ | 31 |
| for Temperature Sensor Thermo String Type/Lead Type △Caution/Notice | _____ | 32 |
| for Temperature Sensor Thermo String Type/Lead Type Package | _____ | 34 |
| 8 for Inrush Current Suppression Lead Type | _____ | 35 |
| ● Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical) | _____ | 37 |
| ● for Inrush Current Suppression Lead Type △Caution/Notice | _____ | 41 |
| ● for Inrush Current Suppression Lead Type Package | _____ | 43 |

1

2

3

4

5

6

7

8

● Part Numbering

NTC Thermistors for Temp. Sensor and Compensation Chip Type

(Part Number)

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

① Product ID

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

② Series

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

③ Dimensions (L×W)

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

④ Temperature Characteristics

| Code | Temperature Characteristics |
|-----------|-------------------------------|
| WB | Nominal B-Constant 4050—4099K |
| WD | Nominal B-Constant 4150—4199K |
| WF | Nominal B-Constant 4250—4299K |
| WL | Nominal B-Constant 4450—4499K |
| WM | Nominal B-Constant 4500—4549K |
| XC | Nominal B-Constant 3100—3149K |
| XF | Nominal B-Constant 3250—3299K |
| 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 |

⑤ Resistance

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 |
|------------|---------------|
| 102 | 1k Ω |
| 103 | 10k Ω |
| 104 | 100k Ω |

⑥ Resistance Tolerance

| Code | Resistance Tolerance |
|----------|----------------------|
| D | $\pm 0.5\%$ |
| E | $\pm 3\%$ |
| F | $\pm 1\%$ |
| J | $\pm 5\%$ |

⑦ Individual Specifications

Structures and others are expressed by two figures.

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

Please contact us for details.

⑧ Packaging

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

NTC Thermistor for Temperature Sensor Thermo String Type

(Part Number)

| | | | | | | | | | |
|------------|----------|-----------|-----------|------------|----------|----------|----------|----------|------------|
| NXF | T | 15 | XH | 103 | F | A | 2 | B | 025 |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ |

① Product ID

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

② Individual Specifications

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

③ Chip Dimensions

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

④ Temperature Characteristics

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

⑤ Resistance

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 | 10k Ω |
| 473 | 47k Ω |
| 104 | 100k Ω |

⑥ Resistance Tolerance

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

⑦ Lead Wire Type

| Code | Lead Wire Type |
|----------|--|
| A | $\phi 0.3$ Copper Lead Wire with Polyurethane Coat |

⑧ Shape of the Lead Wire Kink

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

⑨ Packaging

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

⑩ Dimensions (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 |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

① Product ID

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

② Series

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

③ Temperature Characteristics

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

④ Resistance

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 |
|------------|--------------|
| 202 | 2k Ω |
| 203 | 20k Ω |

⑤ Resistance Tolerance

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

⑥ Individual Specifications

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

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

⑦ Packaging (NTSA/NTSD0 Series)

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

⑦ Total 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 |
| ① | ② | ③ | ④ | ⑤ | ⑥ |

① Product ID

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

② Series

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

③ Resistance

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 | 3 Ω |
| 100 | 10 Ω |

④ Resistance Tolerance

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

⑤ Individual Specifications

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

| 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 |

⑥ Packaging

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

Basic Characteristics

Basic Characteristics

1. Zero-power Resistance of Thermistor: R

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

R: Resistance in ambient temperature T (K)
 (K: absolute temperature)

R₀: Resistance in ambient temperature T₀ (K)

B: B-Constant of Thermistor

2. B-Constant

as (1) formula

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

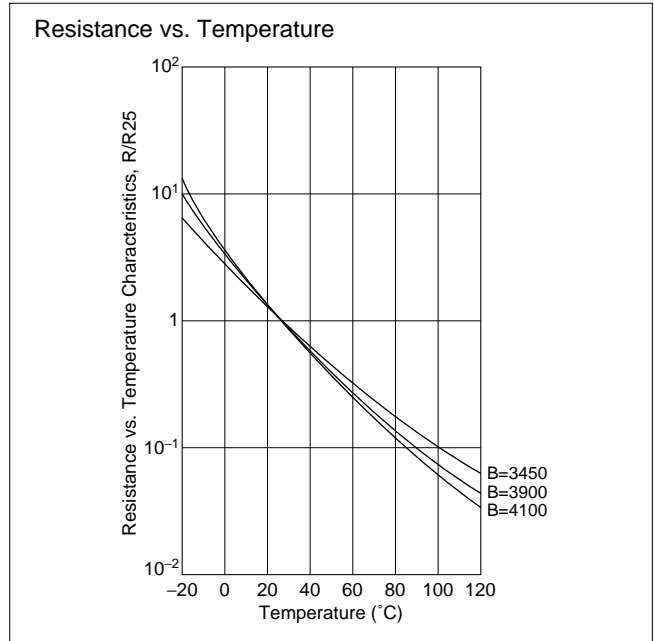
3. Thermal Dissipation Constant

When electric power P (mW) is spent in ambient temperature T₁ and thermistor temperature rises T₂, there is a formula as follows

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

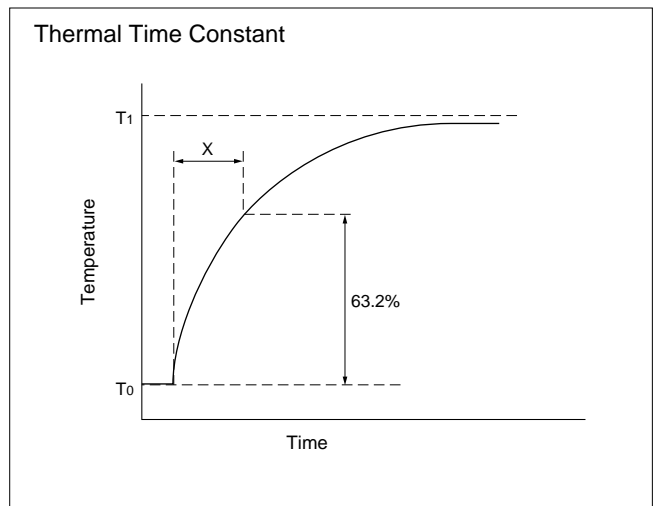
C: Thermal dissipation constant (mW/°C)

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 T₀ (°C) to T₁ (°C).



Performance

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

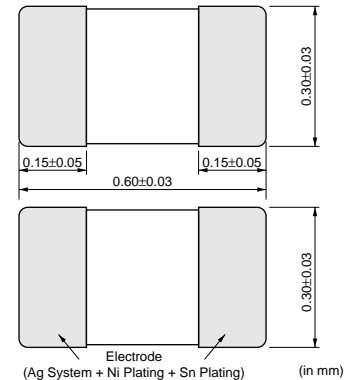
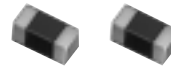
Please inquire about test conditions and ratings.

NTC Thermistors



for Temperature Sensor and Compensation 0201 (0603) Size

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



■ Features

1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-Constant
4. 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) | Permissible 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 |
| 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 |

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

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

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

NTC Thermistors



for Temperature Sensor and Compensation 0402 (1005) Size

2

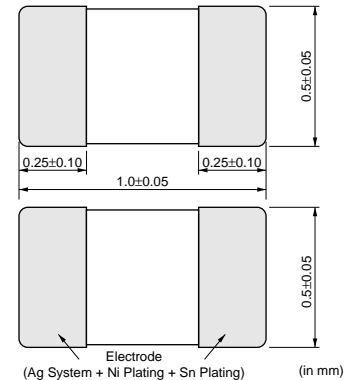
0201/0402/0603/0805 sized Chip NTC Thermistor have Ni barrier termination and provide excellent solderability and offer high stability in environment by unique inner construction.

■ Features

1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-Constant
4. Reflow soldering possible
5. Same B-constant in the same resistance in the three sizes (0805 size / 0603 size / 0402 size)
Easy to use smaller size in the circuits
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) | Permissible 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 |
| 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 |
| NCP15WL333□03RC | 33k | 4485 ±1% | 4537 | 4543 | 4557 | 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) |
|------------------------|-------------------------------|--------------------------------|--|--|---|--|--|---|
| 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 |

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

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

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

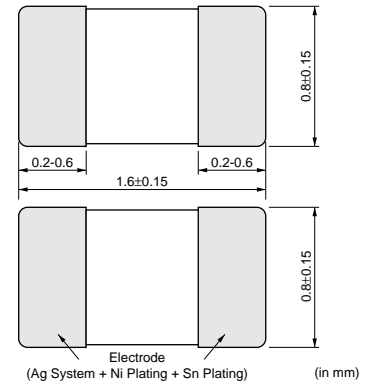
2

NTC Thermistors



for Temperature Sensor and Compensation 0603 (1608) Size

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



3

■ Features


1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-constant
4. Flow / Reflow soldering possible
5. Same B-Constant in the same resistance in the three sizes (0805 size / 0603 size / 0402 size)
Easy to use smaller size in the circuits
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) | Permissible 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 |
| 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 |
| NCP18WF104F12RB | 100k ±1% | 4200 ±1% | 4255 | 4260 | 4282 | 0.10 | 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) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) |
|------------------------|-------------------------|--------------------------|--|--|---|---|----------------------------------|---|
| NCP18WF104□03RB | 100k | 4250 ±2% | 4255 | 4260 | 4282 | 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 |

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

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

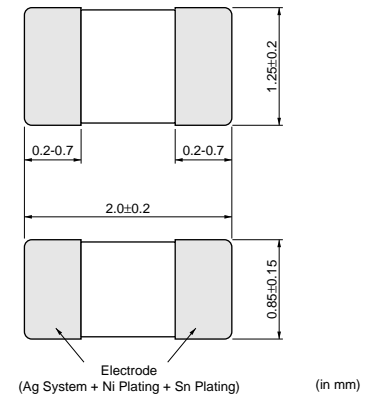
Operating Temperature Range: -40°C to +125°C

NTC Thermistors



for Temperature Sensor and Compensation 0805 (2012) Size

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



■ Features

1. Excellent solderability and high stability in environment
2. Excellent long time aging stability
3. High accuracy in resistance and B-constant
4. Flow / Reflow soldering possible
5. Same B-Constant in the same resistance in the three sizes (0805 size / 0603 size / 0402 size)
Easy to use smaller size in the circuits
6. NCP series are recognized by UL/cUL.
(UL1434, File No.E137188)

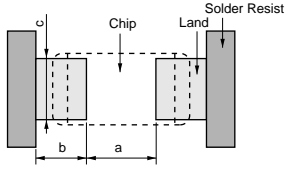
■ Applications

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) | Permissible 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 is necessary electric power that Thermistor's temperature rises 100°C by self heating at 25°C in still air.
 Operating Temperature Range: -40°C to +125°C

for 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 |

for 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 | 2200K | 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. 

for 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□□XH682 | NCP□□XW682 | NCP□□XH103 | NCP□□XV103 | NCP□□XH153 | NCP□□XW153 | NCP□□XH223 |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance | 4.7kΩ | 6.8kΩ | 6.8kΩ | 10kΩ | 10kΩ | 15kΩ | 15kΩ | 22kΩ |
| B-Constant | 3500K | 3380K | 3950K | 3380K | 3900K | 3380K | 3950K | 3380K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40 | 105.705 | 133.043 | 234.787 | 195.652 | 328.996 | 293.478 | 517.912 | 430.434 |
| -35 | 79.126 | 100.756 | 168.515 | 148.171 | 237.387 | 222.256 | 371.724 | 325.976 |
| -30 | 59.794 | 77.076 | 122.422 | 113.347 | 173.185 | 170.021 | 270.048 | 249.364 |
| -25 | 45.630 | 59.540 | 89.953 | 87.559 | 127.773 | 131.338 | 198.426 | 192.629 |
| -20 | 35.144 | 46.401 | 66.766 | 68.237 | 95.327 | 102.355 | 147.278 | 150.121 |
| -15 | 27.303 | 36.482 | 50.066 | 53.650 | 71.746 | 80.474 | 110.439 | 118.029 |
| -10 | 21.377 | 28.904 | 37.906 | 42.506 | 54.564 | 63.759 | 83.617 | 93.514 |
| -5 | 16.869 | 23.047 | 28.963 | 33.892 | 41.813 | 50.838 | 63.888 | 74.563 |
| 0 | 13.411 | 18.509 | 22.313 | 27.219 | 32.330 | 40.828 | 49.221 | 59.881 |
| 5 | 10.735 | 14.974 | 17.338 | 22.021 | 25.194 | 33.032 | 38.245 | 48.446 |
| 10 | 8.653 | 12.189 | 13.571 | 17.926 | 19.785 | 26.888 | 29.936 | 39.436 |
| 15 | 7.018 | 9.978 | 10.705 | 14.674 | 15.651 | 22.010 | 23.613 | 32.282 |
| 20 | 5.726 | 8.215 | 8.503 | 12.081 | 12.468 | 18.121 | 18.756 | 26.577 |
| 25 | 4.700 | 6.800 | 6.800 | 10.000 | 10.000 | 15.000 | 15.000 | 22.000 |
| 30 | 3.879 | 5.654 | 5.474 | 8.315 | 8.072 | 12.472 | 12.074 | 18.292 |
| 35 | 3.219 | 4.725 | 4.434 | 6.948 | 6.556 | 10.422 | 9.780 | 15.285 |
| 40 | 2.685 | 3.967 | 3.613 | 5.834 | 5.356 | 8.751 | 7.969 | 12.834 |
| 45 | 2.250 | 3.344 | 2.961 | 4.917 | 4.401 | 7.375 | 6.531 | 10.817 |
| 50 | 1.895 | 2.829 | 2.440 | 4.161 | 3.635 | 6.241 | 5.382 | 9.154 |
| 55 | 1.604 | 2.404 | 2.022 | 3.535 | 3.019 | 5.302 | 4.459 | 7.777 |
| 60 | 1.363 | 2.050 | 1.683 | 3.014 | 2.521 | 4.521 | 3.713 | 6.631 |
| 65 | 1.163 | 1.759 | 1.409 | 2.586 | 2.115 | 3.879 | 3.108 | 5.690 |
| 70 | 0.996 | 1.515 | 1.185 | 2.228 | 1.781 | 3.341 | 2.613 | 4.901 |
| 75 | 0.857 | 1.309 | 1.001 | 1.925 | 1.509 | 2.887 | 2.208 | 4.234 |
| 80 | 0.740 | 1.135 | 0.849 | 1.669 | 1.284 | 2.503 | 1.873 | 3.671 |
| 85 | 0.641 | 0.988 | 0.724 | 1.452 | 1.097 | 2.178 | 1.597 | 3.195 |
| 90 | 0.558 | 0.862 | 0.620 | 1.268 | 0.941 | 1.902 | 1.367 | 2.790 |
| 95 | 0.487 | 0.755 | 0.532 | 1.110 | 0.810 | 1.664 | 1.174 | 2.441 |
| 100 | 0.426 | 0.662 | 0.459 | 0.974 | 0.701 | 1.461 | 1.013 | 2.142 |
| 105 | 0.375 | 0.583 | 0.398 | 0.858 | 0.608 | 1.287 | 0.878 | 1.888 |
| 110 | 0.330 | 0.515 | 0.346 | 0.758 | 0.530 | 1.137 | 0.763 | 1.668 |
| 115 | 0.292 | 0.457 | 0.302 | 0.672 | 0.463 | 1.007 | 0.665 | 1.477 |
| 120 | 0.259 | 0.406 | 0.264 | 0.596 | 0.406 | 0.895 | 0.582 | 1.312 |
| 125 | 0.230 | 0.361 | 0.232 | 0.531 | 0.358 | 0.797 | 0.511 | 1.169 |

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

Continued on the following page.

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

Continued from the preceding page.

| Part Number | NCP□□XW223 | NCP□□WL223 | NCP□□WB333 | NCP□□WF333 | NCP□□WL333 | NCP□□WB473 | NCP□□WL473 | NCP□□WD683 |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance | 22kΩ | 22kΩ | 33kΩ | 33kΩ | 33kΩ | 47kΩ | 47kΩ | 68kΩ |
| B-Constant | 3950K | 4485K | 4050K | 4250K | 4485K | 4050K | 4485K | 4150K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40 | 759.605 | 1073.436 | 1227.263 | 1451.049 | 1610.154 | 1747.920 | 2293.249 | 2735.359 |
| -35 | 545.196 | 753.900 | 874.449 | 1019.238 | 1130.850 | 1245.428 | 1610.605 | 1937.391 |
| -30 | 396.070 | 535.073 | 630.851 | 725.084 | 802.609 | 898.485 | 1143.110 | 1389.345 |
| -25 | 291.025 | 383.590 | 460.457 | 522.021 | 575.385 | 655.802 | 819.487 | 1008.014 |
| -20 | 216.008 | 277.643 | 339.797 | 379.842 | 416.464 | 483.954 | 593.146 | 738.978 |
| -15 | 161.977 | 202.813 | 253.363 | 279.371 | 304.219 | 360.850 | 433.281 | 547.456 |
| -10 | 122.638 | 149.462 | 190.766 | 207.566 | 224.193 | 271.697 | 319.305 | 409.600 |
| -5 | 93.702 | 111.082 | 144.964 | 155.639 | 166.623 | 206.463 | 237.312 | 309.217 |
| 0 | 72.191 | 83.233 | 111.087 | 117.814 | 124.850 | 158.214 | 177.816 | 235.606 |
| 5 | 56.093 | 62.858 | 85.842 | 89.925 | 94.287 | 122.259 | 134.287 | 180.980 |
| 10 | 43.907 | 47.831 | 66.861 | 69.204 | 71.747 | 95.227 | 102.184 | 140.139 |
| 15 | 34.633 | 36.664 | 52.470 | 53.675 | 54.996 | 74.730 | 78.327 | 109.344 |
| 20 | 27.509 | 28.304 | 41.471 | 41.937 | 42.455 | 59.065 | 60.467 | 85.929 |
| 25 | 22.000 | 22.000 | 33.000 | 33.000 | 33.000 | 47.000 | 47.000 | 68.000 |
| 30 | 17.709 | 17.214 | 26.430 | 26.143 | 25.822 | 37.643 | 36.776 | 54.167 |
| 35 | 14.344 | 13.557 | 21.298 | 20.845 | 20.335 | 30.334 | 28.962 | 43.421 |
| 40 | 11.688 | 10.744 | 17.266 | 16.723 | 16.115 | 24.591 | 22.952 | 35.016 |
| 45 | 9.578 | 8.566 | 14.076 | 13.498 | 12.849 | 20.048 | 18.301 | 28.406 |
| 50 | 7.894 | 6.871 | 11.538 | 10.954 | 10.306 | 16.433 | 14.679 | 23.166 |
| 55 | 6.540 | 5.543 | 9.506 | 8.940 | 8.314 | 13.539 | 11.842 | 18.997 |
| 60 | 5.446 | 4.497 | 7.870 | 7.334 | 6.746 | 11.209 | 9.607 | 15.657 |
| 65 | 4.559 | 3.669 | 6.549 | 6.046 | 5.503 | 9.328 | 7.837 | 12.967 |
| 70 | 3.832 | 3.009 | 5.475 | 5.011 | 4.513 | 7.798 | 6.428 | 10.794 |
| 75 | 3.239 | 2.481 | 4.595 | 4.170 | 3.721 | 6.544 | 5.300 | 9.021 |
| 80 | 2.748 | 2.056 | 3.874 | 3.487 | 3.084 | 5.518 | 4.393 | 7.575 |
| 85 | 2.342 | 1.713 | 3.282 | 2.928 | 2.569 | 4.674 | 3.659 | 6.387 |
| 90 | 2.004 | 1.434 | 2.789 | 2.469 | 2.151 | 3.972 | 3.063 | 5.407 |
| 95 | 1.722 | 1.206 | 2.379 | 2.091 | 1.809 | 3.388 | 2.577 | 4.598 |
| 100 | 1.486 | 1.019 | 2.038 | 1.777 | 1.529 | 2.902 | 2.178 | 3.922 |
| 105 | 1.287 | 0.866 | 1.751 | 1.516 | 1.299 | 2.494 | 1.849 | 3.359 |
| 110 | 1.119 | 0.739 | 1.509 | 1.298 | 1.108 | 2.150 | 1.578 | 2.887 |
| 115 | 0.975 | 0.633 | 1.306 | 1.116 | 0.949 | 1.860 | 1.352 | 2.489 |
| 120 | 0.854 | 0.545 | 1.134 | 0.962 | 0.817 | 1.615 | 1.164 | 2.155 |
| 125 | 0.750 | 0.471 | 0.987 | 0.832 | 0.707 | 1.406 | 1.006 | 1.870 |

| Part Number | NCP□□WF683 | NCP□□WL683 | NCP□□WF104 | NCP18WF104F | NCP□□WL104 | NCP□□WL154 | NCP□□WM154 | NCP□□WL224 |
|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Resistance | 68kΩ | 68kΩ | 100kΩ | 100kΩ±1% | 100kΩ | 150kΩ | 150kΩ | 220kΩ |
| B-Constant | 4250K | 4485K | 4250K | 4200K | 4485K | 4485K | 4500K | 4485K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) | Resistance (kΩ) |
| -40 | 2990.041 | 3317.893 | 4397.119 | 4205.686 | 4879.254 | 7318.881 | 7899.466 | 10734.358 |
| -35 | 2100.247 | 2330.237 | 3088.599 | 2966.436 | 3426.818 | 5140.228 | 5466.118 | 7539.001 |
| -30 | 1494.113 | 1653.862 | 2197.225 | 2118.789 | 2432.149 | 3648.224 | 3834.499 | 5350.729 |
| -25 | 1075.679 | 1185.641 | 1581.881 | 1531.319 | 1743.590 | 2615.385 | 2720.523 | 3835.898 |
| -20 | 782.705 | 858.168 | 1151.037 | 1118.422 | 1262.012 | 1893.018 | 1951.216 | 2776.427 |
| -15 | 575.674 | 626.875 | 846.579 | 825.570 | 921.875 | 1382.813 | 1415.565 | 2028.126 |
| -10 | 427.712 | 461.974 | 628.988 | 615.526 | 679.373 | 1019.059 | 1036.984 | 1494.620 |
| -5 | 320.710 | 343.345 | 471.632 | 463.104 | 504.919 | 757.379 | 767.079 | 1110.822 |
| 0 | 242.768 | 257.266 | 357.012 | 351.706 | 378.333 | 567.499 | 572.667 | 832.332 |
| 5 | 185.300 | 194.287 | 272.500 | 269.305 | 285.717 | 428.575 | 431.264 | 628.577 |
| 10 | 142.603 | 147.841 | 209.710 | 207.891 | 217.414 | 326.121 | 327.405 | 478.310 |
| 15 | 110.602 | 113.325 | 162.651 | 161.722 | 166.654 | 249.981 | 250.538 | 366.639 |
| 20 | 86.415 | 87.484 | 127.080 | 126.723 | 128.653 | 192.979 | 193.166 | 283.036 |
| 25 | 68.000 | 68.000 | 100.000 | 100.000 | 100.000 | 150.000 | 150.000 | 220.000 |
| 30 | 53.871 | 53.208 | 79.222 | 79.439 | 78.247 | 117.370 | 117.281 | 172.143 |
| 35 | 42.954 | 41.903 | 63.167 | 63.509 | 61.622 | 92.433 | 92.293 | 135.569 |
| 40 | 34.460 | 33.208 | 50.677 | 51.084 | 48.835 | 73.252 | 73.090 | 107.436 |
| 45 | 27.814 | 26.477 | 40.904 | 41.336 | 38.937 | 58.406 | 58.240 | 85.662 |
| 50 | 22.572 | 21.237 | 33.195 | 33.628 | 31.231 | 46.846 | 46.665 | 68.708 |
| 55 | 18.422 | 17.133 | 27.091 | 27.510 | 25.195 | 37.793 | 37.605 | 55.429 |
| 60 | 15.113 | 13.900 | 22.224 | 22.621 | 20.441 | 30.661 | 30.453 | 44.970 |
| 65 | 12.459 | 11.339 | 18.323 | 18.692 | 16.675 | 25.013 | 24.804 | 36.686 |
| 70 | 10.325 | 9.300 | 15.184 | 15.525 | 13.677 | 20.516 | 20.293 | 30.090 |
| 75 | 8.592 | 7.668 | 12.635 | 12.947 | 11.277 | 16.916 | 16.679 | 24.810 |
| 80 | 7.185 | 6.356 | 10.566 | 10.849 | 9.346 | 14.019 | 13.776 | 20.562 |
| 85 | 6.033 | 5.294 | 8.873 | 9.129 | 7.785 | 11.678 | 11.428 | 17.128 |
| 90 | 5.087 | 4.432 | 7.481 | 7.713 | 6.517 | 9.776 | 9.520 | 14.338 |
| 95 | 4.309 | 3.728 | 6.337 | 6.546 | 5.482 | 8.223 | 7.966 | 12.061 |
| 100 | 3.661 | 3.151 | 5.384 | 5.572 | 4.634 | 6.951 | 6.688 | 10.194 |
| 105 | 3.124 | 2.676 | 4.594 | 4.764 | 3.935 | 5.902 | 5.639 | 8.657 |
| 110 | 2.675 | 2.283 | 3.934 | 4.087 | 3.357 | 5.035 | 4.772 | 7.385 |
| 115 | 2.299 | 1.956 | 3.380 | 3.518 | 2.877 | 4.315 | 4.052 | 6.329 |
| 120 | 1.983 | 1.684 | 2.916 | 3.040 | 2.476 | 3.714 | 3.454 | 5.448 |
| 125 | 1.715 | 1.456 | 2.522 | 2.634 | 2.141 | 3.211 | 2.955 | 4.710 |

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

Continued on the following page.

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

Continued from the preceding page.

| Part Number | NCP□□WM224 | NCP□□WM474 |
|-------------|-----------------|-----------------|
| Resistance | 220kΩ | 470kΩ |
| B-Constant | 4500K | 4500K |
| Temp. (°C) | Resistance (kΩ) | Resistance (kΩ) |
| -40 | 11585.884 | 24751.661 |
| -35 | 8016.973 | 17127.169 |
| -30 | 5623.931 | 12014.762 |
| -25 | 3990.100 | 8524.305 |
| -20 | 2861.784 | 6113.811 |
| -15 | 2076.162 | 4435.437 |
| -10 | 1520.909 | 3249.216 |
| -5 | 1125.049 | 2403.515 |
| 0 | 839.912 | 1794.358 |
| 5 | 632.521 | 1351.294 |
| 10 | 480.194 | 1025.870 |
| 15 | 367.455 | 785.018 |
| 20 | 283.310 | 605.252 |
| 25 | 220.000 | 470.000 |
| 30 | 172.012 | 367.480 |
| 35 | 135.364 | 289.186 |
| 40 | 107.198 | 229.014 |
| 45 | 85.419 | 182.485 |
| 50 | 68.441 | 146.215 |
| 55 | 55.153 | 117.828 |
| 60 | 44.665 | 95.420 |
| 65 | 36.379 | 77.718 |
| 70 | 29.763 | 63.584 |
| 75 | 24.462 | 52.260 |
| 80 | 20.205 | 43.166 |
| 85 | 16.761 | 35.808 |
| 90 | 13.962 | 29.828 |
| 95 | 11.684 | 24.961 |
| 100 | 9.809 | 20.955 |
| 105 | 8.270 | 17.668 |
| 110 | 6.998 | 14.951 |
| 115 | 5.942 | 12.695 |
| 120 | 5.067 | 10.824 |
| 125 | 4.334 | 9.259 |

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

for 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.

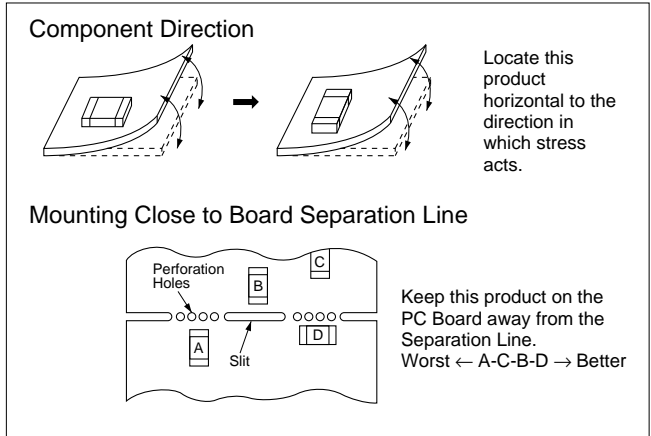
Such forces may cause cracking or chipping.

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

■ Notice (Soldering and Mounting)

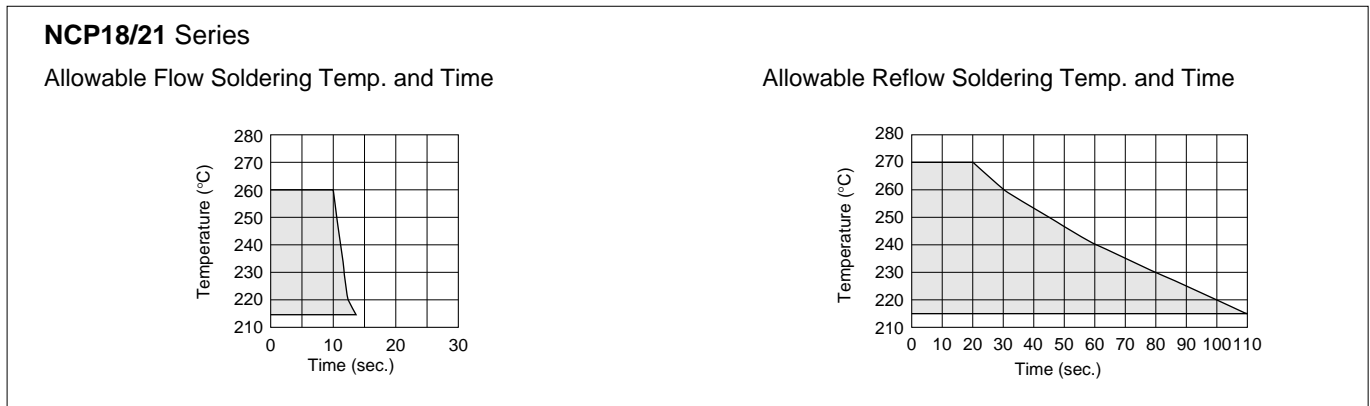
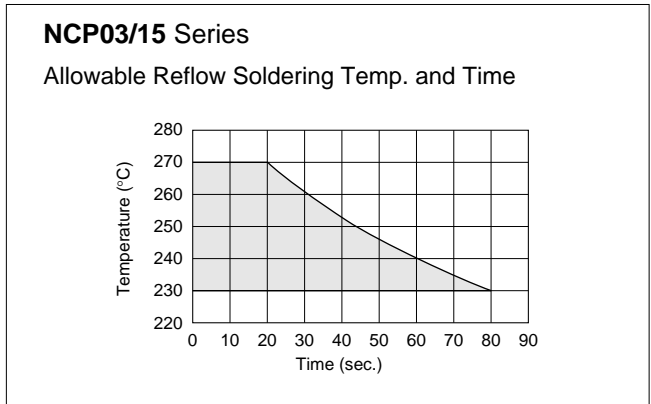
1. Mounting Position

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



2. Allowable Soldering Temperature and Time

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



Continued on the following page. ↗

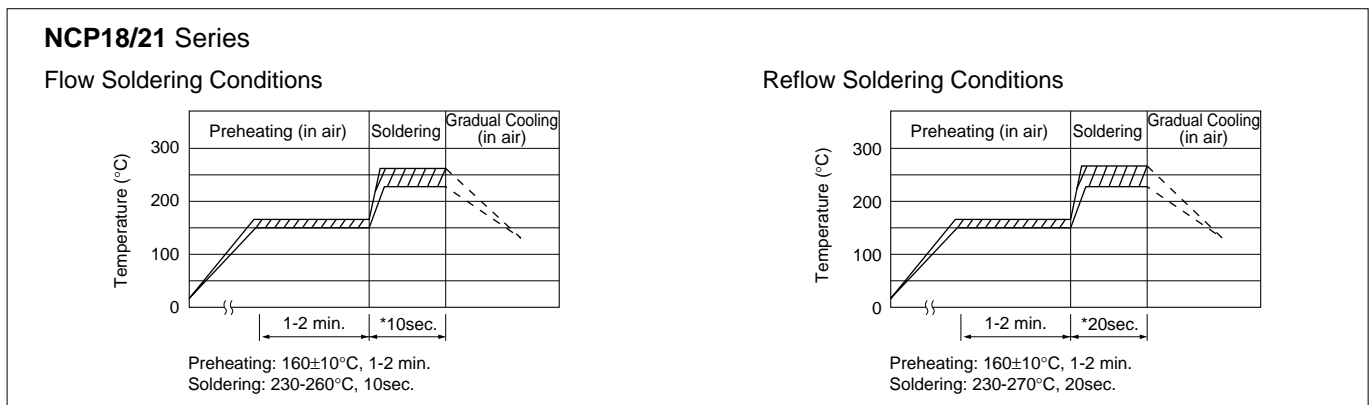
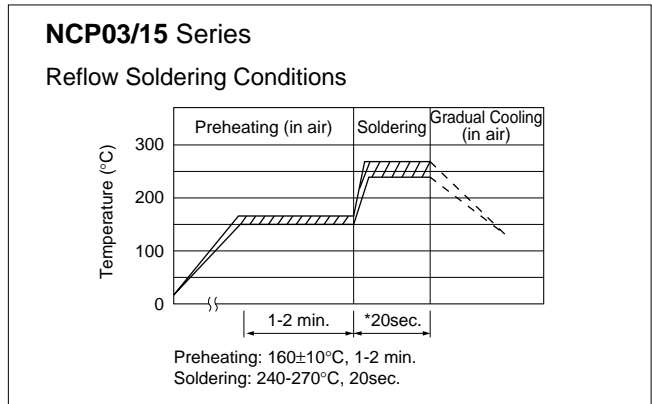
for Temp. Sensor and Compensation Chip Type ⚠ Caution/Notice

☐ Continued from the preceding page.

3. Recommendable Temperature Profile for Soldering

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

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



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

Please do not use below 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.

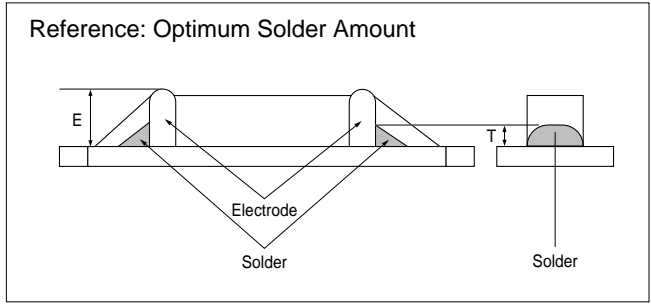
Continued on the following page. ↗

for 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.



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

8. Adhesive Application and Curing

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

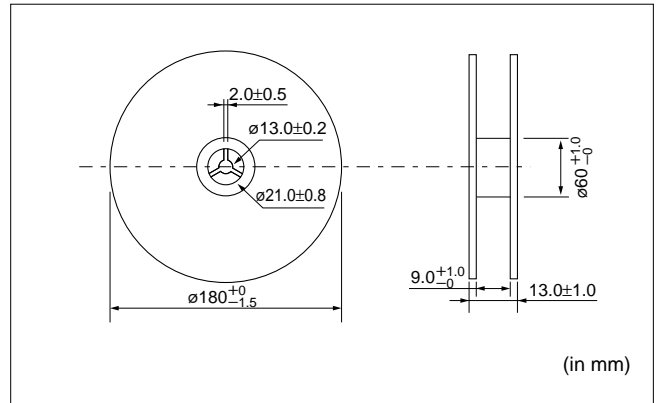
for Temp. Sensor and Compensation Chip Type Package

■ Minimum Quantity Guide

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

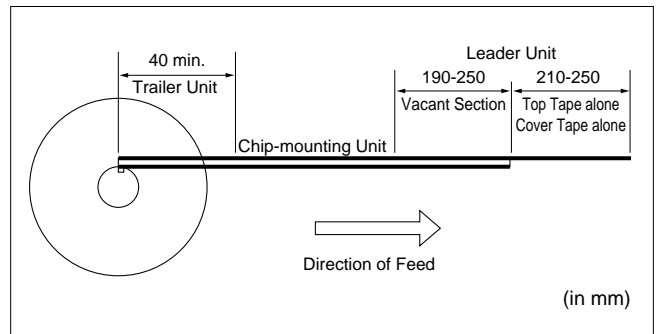
■ Tape Carrier Packaging

1. Dimensions of Reel



2. Taping Method

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

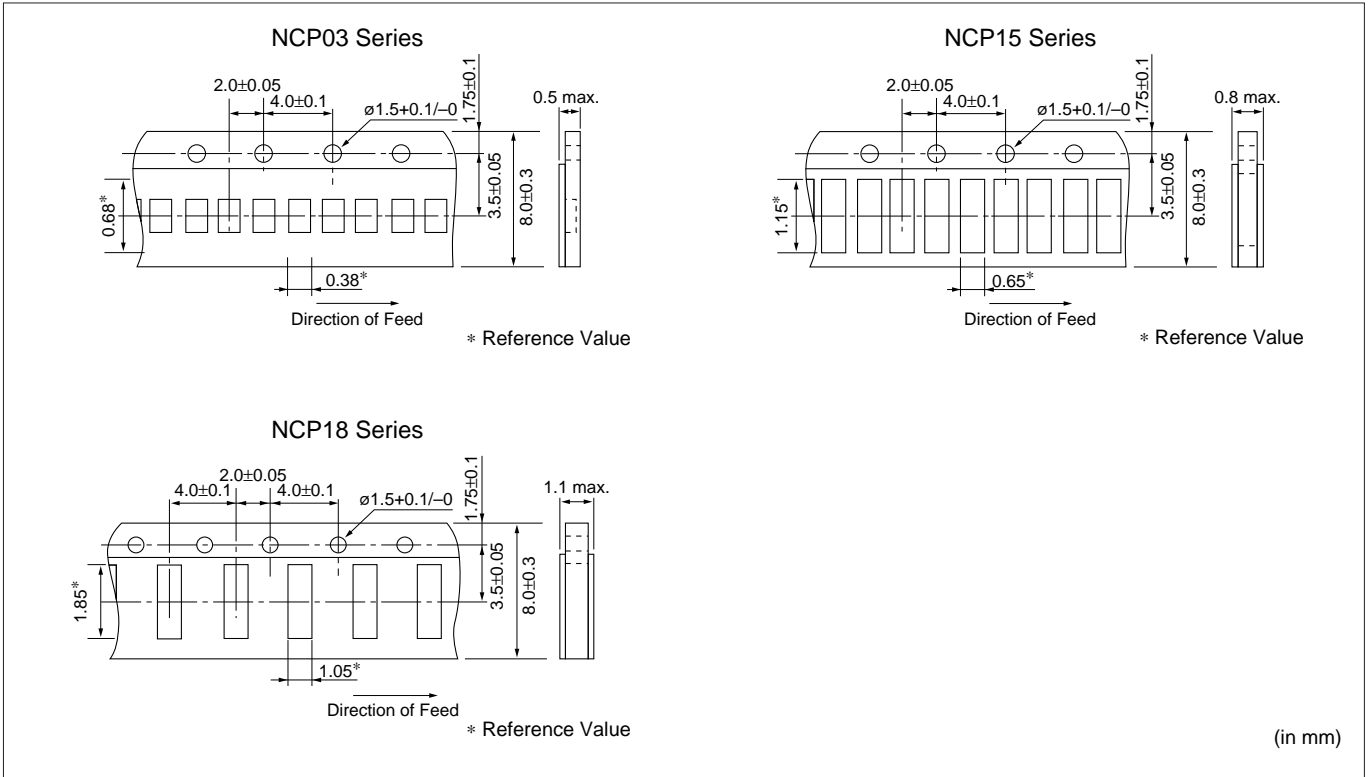


Continued on the following page.

for Temp. Sensor and Compensation Chip Type Package

☐ Continued from the preceding page.

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



(1) Other Conditions

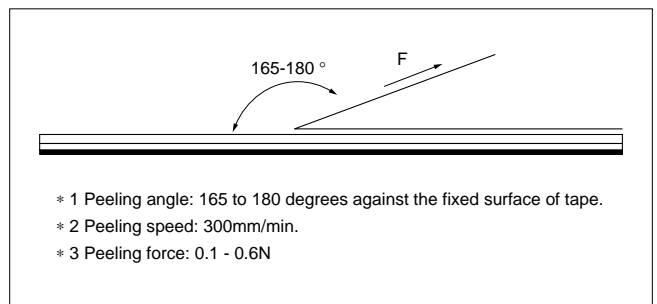
(a) Packaging

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

(b) Tape

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

(2) Peeling Force of Top Tape



(3) Pull Strength

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

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

Continued on the following page. ☐

for Temp. Sensor and Compensation Chip Type Package

☐ Continued from the preceding page.

4. Embossed Tape (NCP21 Series)

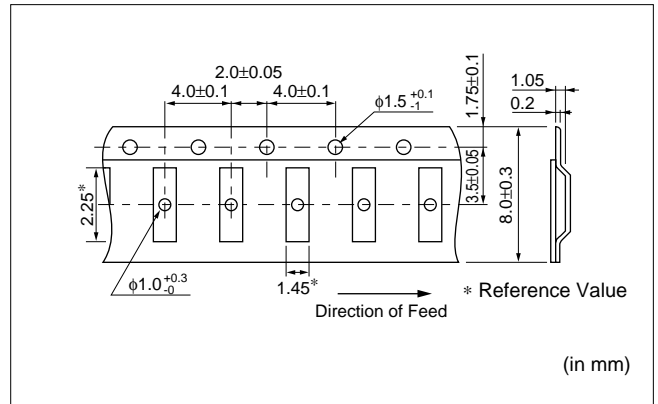
(1) Other Conditions

(a) Packaging

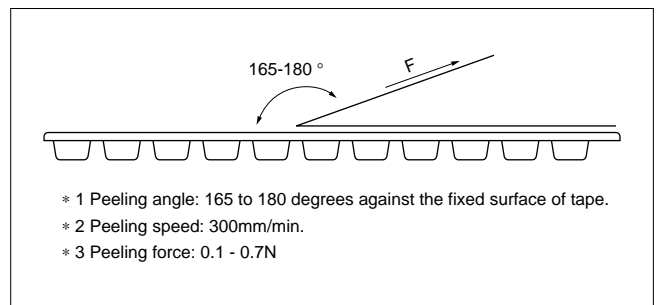
Products are packaged in each cavity of the Embossed tape and sealed by Cover tape.

(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



for Temperature Sensor Thermo String Type

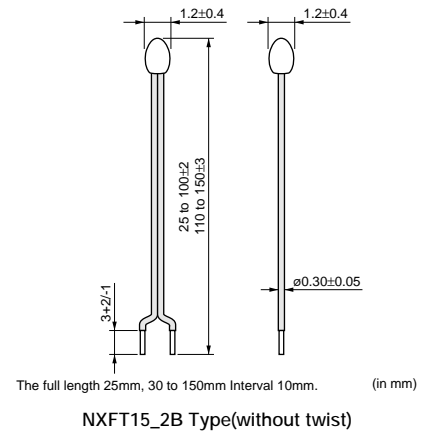
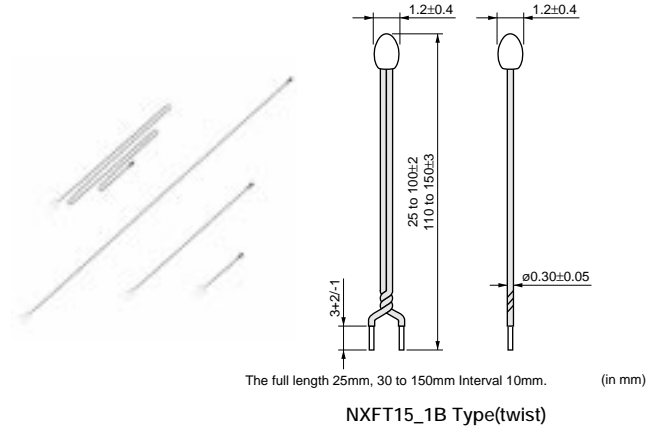
This product is a small flexible lead type NTC Thermistor with the small head and the thin lead wire.

■ Features

1. High accuracy and high sensibility temperature sensing is available by the small size and high accuracy NTC Thermistor.
2. Narrow space temperature sensing is available by the small sensing head and the thin lead wire.
3. Flexibility and wide variety length (25 mm to 150mm) enables designing flexible temperature sensing architectures.
4. This product is compatible with our 0402 (EIA) size chip Thermistor.
5. Excellent long time aging stability
6. This is 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



5

| 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 (s) |
|----------------------------|-------------------------|--------------------------|--|--|---|--|----------------------------------|---|---------------------------|
| NXFT15XH103FA □B□□□ | 10k | 3380 ±1% | 3423 | 3431 | 3452 | 0.12 | 7.5 | 1.5 | 4 |
| NXFT15WB473FA □B□□□ | 47k | 4050 ±1% | 4091 | 4097 | 4114 | 0.06 | 7.5 | 1.5 | 4 |
| NXFT15WF104FA □B□□□ | 100k | 4250 ±1% | 4303 | 4311 | 4334 | 0.04 | 7.5 | 1.5 | 4 |

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

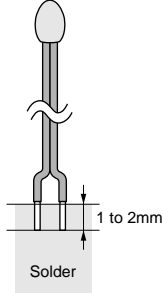
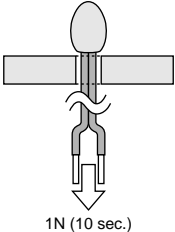
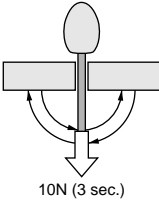
□□□ is the filled with Total-length codes. (25mm, 30 to 150mm interval 10mm, ex. 050=50mm)

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

Rated Electric Power is necessary electric power that Thermistor's temperature rises 5°C by self heating at 25°C in still air.

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

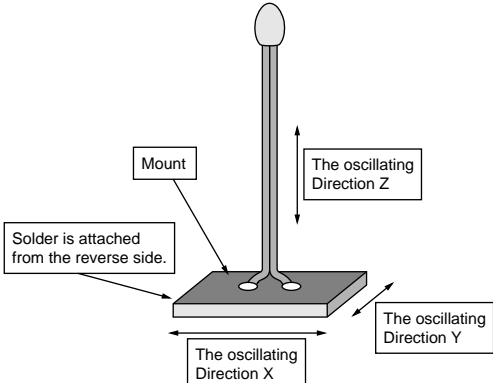
for Temperature Sensor Thermo String Type Specifications and Test Methods

| No. | Item | Specifications | Test Methods |
|-----|---------------------------------|---|--|
| 1 | High Temperature Storage Test | <ul style="list-style-type: none"> Resistance (R25°C) fluctuation rate: less than ±1%. B-Constant (B25/50°C) fluctuation rate: less than ±1%. | 125±2°C in air, for 1000 +48/-0 hours without loading. |
| 2 | Low Temperature Storage Test | | -40 +0/-3°C in air, for 1000 +48/-0 hours without loading. |
| 3 | Humidity Storage Test | <ul style="list-style-type: none"> Resistance (R25°C) fluctuation rate: less than ±2%. 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 +25±2°C, 10 to 15 minutes in air +125±2°C, 30 minutes in air + 25 +2/-0°C, 10 to 15 minutes in air (1 cycle) 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 | <ul style="list-style-type: none"> No damage electrical characteristics on 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 | <ul style="list-style-type: none"> Resistance (R25°C) fluctuation rate: less than ±1%. B-Constant (B25/50°C) fluctuation rate: less than ±1%. | <p>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>)</p>  <p>Fig-1</p> |
| 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 | <ul style="list-style-type: none"> Resistance (R25°C) fluctuation rate: less than ±1%. B-Constant (B25/50°C) fluctuation rate: less than ±1%. | <p>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.</p>  <p>1N (10 sec.)</p> <p>Fig-2</p> |
| 10 | Lead Wire Bending Strength | <ul style="list-style-type: none"> Lead wire does not break. | <p>Hold the lead wires like 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.</p>  <p>10N (3 sec.)</p> <p>Fig-3</p> |

* · 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).

for Temperature Sensor Thermo String Type Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Methods |
|-----|-----------|---|--|
| 11 | Free Fall | | NTC Thermistor shall be dropped without any force onto concrete floor from 1 meter height one time. |
| 12 | Vibration | <ul style="list-style-type: none"> · Resistance (R25°C) fluctuation rate: less than ±1%. · B-Constant (B25/50°C) fluctuation rate: less than ±1%. · No visible damage at resin part. | <p>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.</p>  <p>The diagram illustrates the vibration test setup. It shows a rectangular base with a thermistor mounted on top. The thermistor has a long, thin stem and a small circular head. The base is labeled 'Mount'. A label points to the bottom of the thermistor stem, stating 'Solder is attached from the reverse side.' Three arrows indicate the oscillating directions: 'The oscillating Direction X' (horizontal), 'The oscillating Direction Y' (diagonal), and 'The oscillating Direction Z' (vertical).</p> |

- * · 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



for Temperature Sensor Lead Type

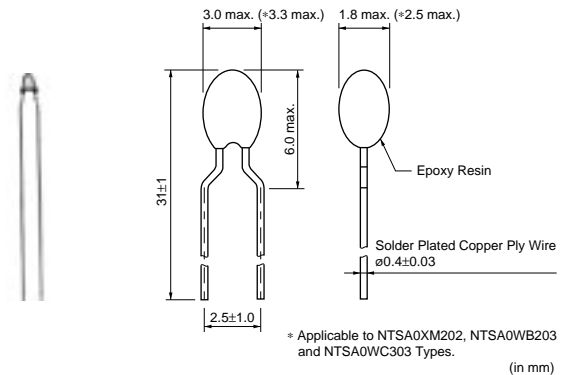
This product is a sensor type NTC Thermistor to be useful in the normal temperature range developed by the unique ceramic technology and the automatic assembly.

■ Features

1. High-accuracy of B-Constant tolerance $\pm 0.5\%$ $\pm 1\%$ of resistance and $\pm 0.5\%$ 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. Head of printers
4. DC fan motors
5. Home appliance equipments



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

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

Rated Electric Power is necessary electric power that Thermistor's temperature rises 10°C by self heating at 25°C in still air.

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

Taping type of part numbers with "N6A0" is available (Lead spacing=5mm).

NTC Thermistors



for Temperature Sensor Lead Insulation Type

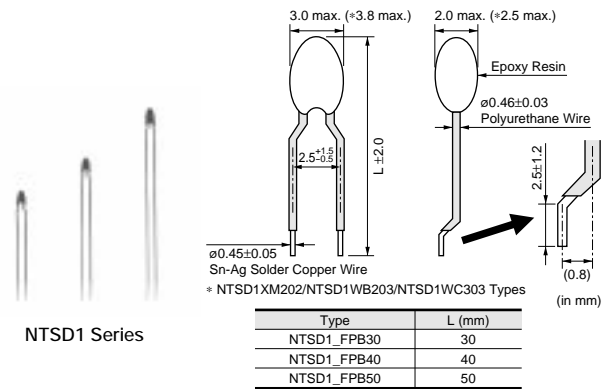
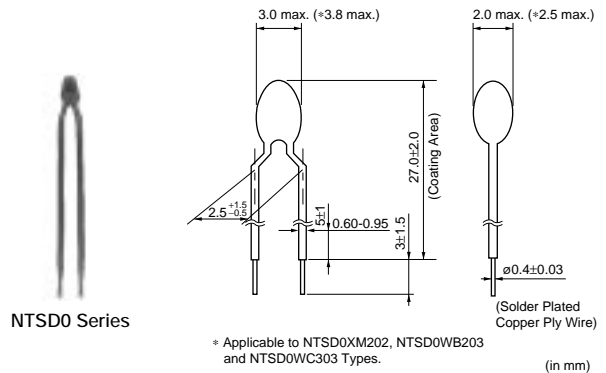
This product is a sensor type NTC Thermistor to be useful in the normal temperature range developed by the unique ceramic technology and the automatic assembly.

■ Features

1. Electric insulation on lead wire
2. Excellent bending resistance due to suitable hardness of surface coating
3. Easy handling due to most suitable hardness of surface of coating
4. High-accuracy of 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.

■ Applications

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



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) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (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 |

A blank column is filled with resistance tolerance codes (F: ±1%, E: ±3%).
 Rated Electric Power is necessary electric power that Thermistor's temperature rises 10°C by self heating at 25°C in still air.
 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) | Permissible Operating Current (25°C) (mA) | Rated Electric Power (25°C) (mW) | Typical Dissipation Constant (25°C) (mW/°C) | Thermal Time Constant (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.

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) | Thermal Time Constant (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 |

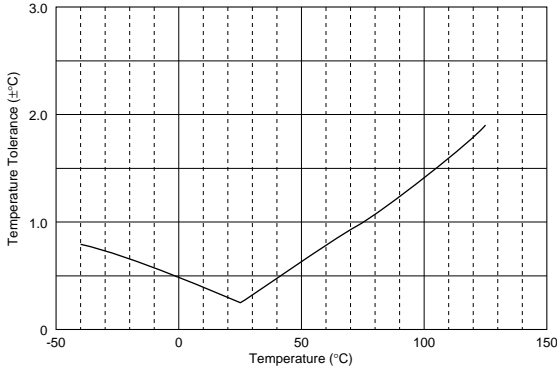
A blank column is filled with Total-length codes. (30, 40, 50)

Rated Electric Power is necessary electric power that Thermistor's temperature rises 10°C by self heating at 25°C in still air.

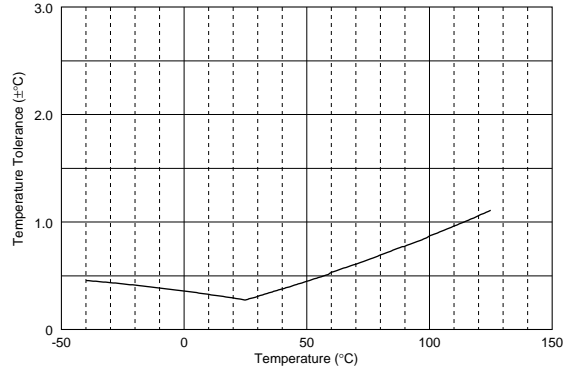
Operating Temperature Range: -40°C to +125°C

■ Temperature Tolerance - Temperature Characteristics

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



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



for 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>

for 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.

for 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. Do not melt the solder in resin head, when you solder this product. If you melt the solder in resin head, it has possibility that the break of wire, short and break of 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 by solder iron. It may cause the melt 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 of this product before you use it.
5. Do not bend the lead wire radius 1mm or less when you bend the lead wire.

■ Notice (Handling)

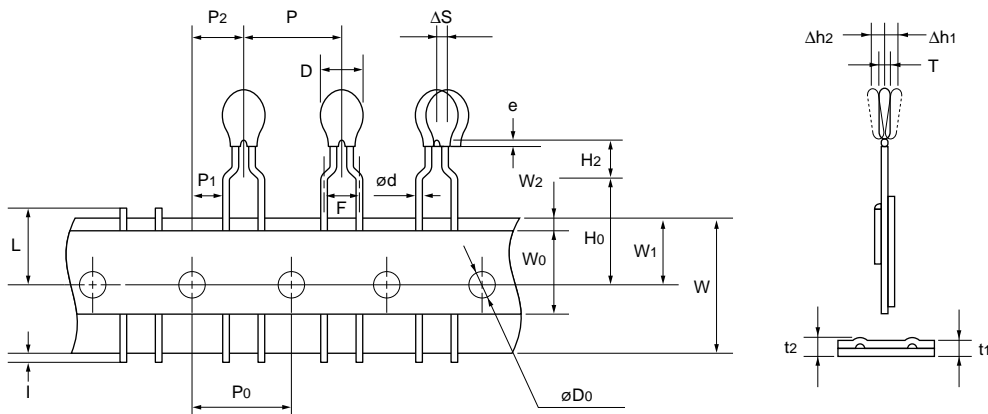
1. The ceramic element of this product is fragile, and care must be taken not to load an excessive press-force or not to give a shock at handling. Such forces may cause cracking or chipping.
2. Do not apply an excessive force to the lead. Otherwise, it may cause junction between lead and element to break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

for Temperature Sensor Thermo String Type/Lead Type Package

■ Minimum Quantity

| Part Number | Minimum Quantity (pcs.) | |
|-------------|-------------------------|------------------|
| | Bulk | Ammo Pack Taping |
| NXF | 1000 | - |
| NTSA | 500 | 3000 |
| 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 | l | +0.5 to -1.0 |
| Diameter of Sprocket Hole | D ₀ | 4.0±0.1 |
| Lead Diameter | d | 0.50±0.03 |
| Total Tape Thickness | t ₁ | 0.6±0.3 |
| Total Thickness, Tape and Lead Wire | t ₂ | 1.6 max. |
| Deviation across Tape | Δh ₁ , Δh ₂ | 1.0 max. |
| Portion to Cut in Case of Defect | L | 11.0+0/-2.0 |
| Hole Down Tape Width | W ₀ | 11.0 min. |
| Hole Down Tape Position | W ₂ | 1.5±1.5 |
| Coating Extension on Lead | e | Up to the crimp point |
| Body Thickness | T | 2.6 max. |

(in mm)

NTC Thermistors



for Inrush Current Suppression Lead Type

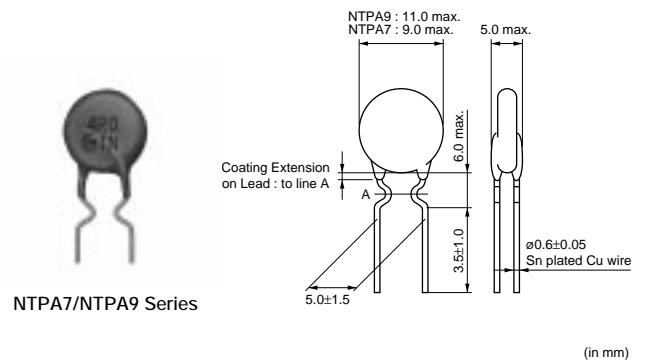
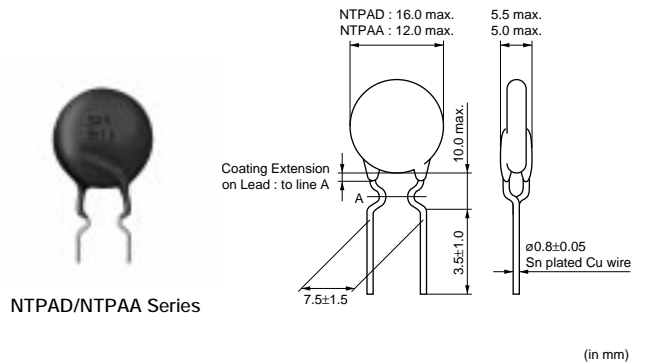
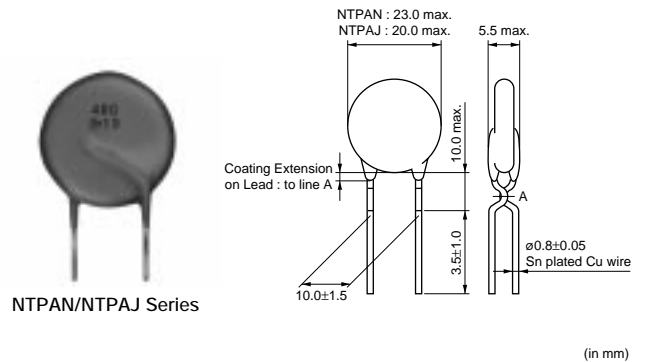
This product effectively suppresses surge currents which are generated when switching power regulators are turned on.

■ Features

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

■ Applications

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



| 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 |

Continued on the following page.

Continued from the preceding page.

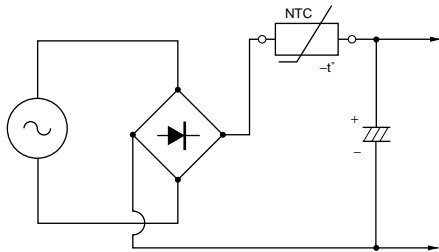
| Part Number | Resistance (25°C) (ohm) | Permissible Max. Current (25°C) (A) | Permissible Max. Current (55°C) (A) | Thermal Time Constant (25°C) (s) | Thermal Dissipation Constant (25°C) (mW/°C) |
|---------------|-------------------------|-------------------------------------|-------------------------------------|----------------------------------|---|
| 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 |
| NTPA78R0LBMB0 | 8.0 ±15% | 1.7 | 1.5 | 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 available on tape. The final alphabet of the part number should be "DNB0=>D6A0", "BNB0 =>B1A0".
 Operating Temperature Range: -20°C to +160°C

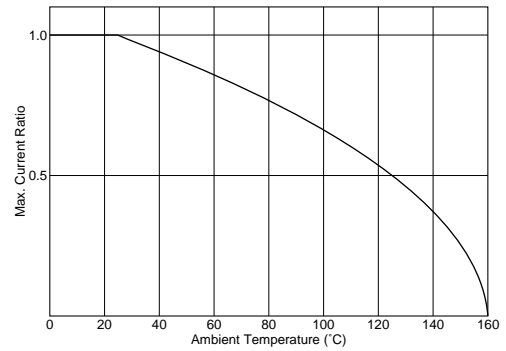
■ Permissible Electrolytic Capacitor

| Part Number | Voltage (AC) | | | | | |
|-------------|--------------|---------|---------|---------|---------|---------|
| | 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 |
| NTPA78R0 | 570μF | 396μF | 327μF | 118μF | 99μF | 82μF |
| NTPA7160 | 400μF | 278μF | 230μF | 83μF | 69μF | 57μF |
| NTPA7220 | | | | | | |

■ Application Circuit

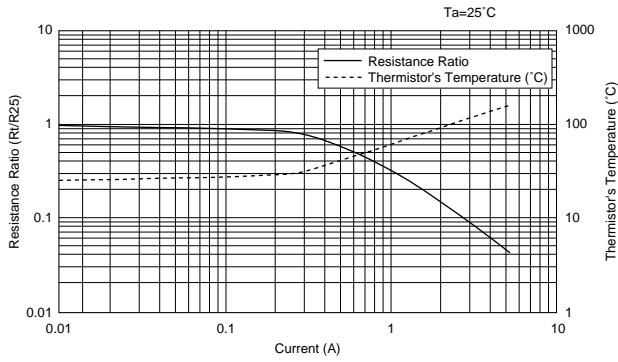


■ Determination of Allowable Current

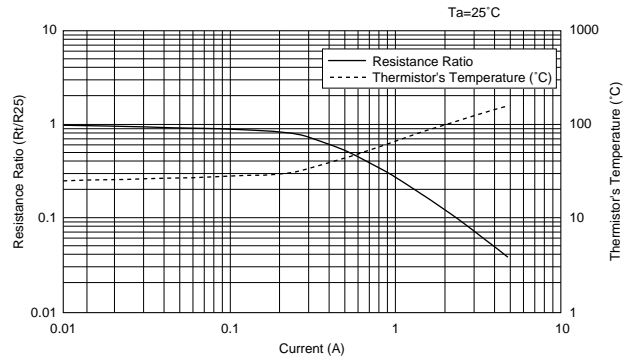


Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

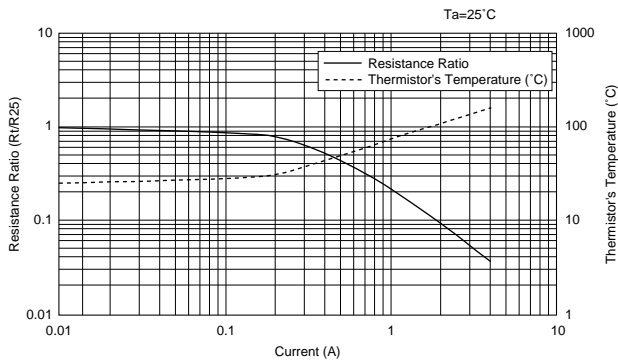
■ NTPAN3R0L Type



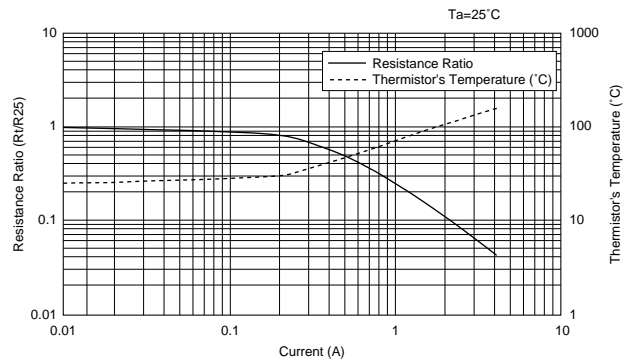
■ NTPAN4R0L Type



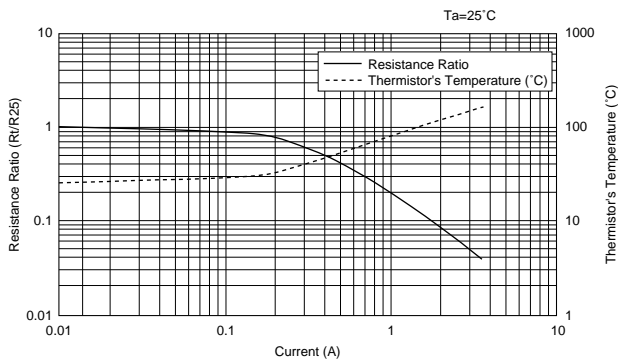
■ NTPAN6R0L Type



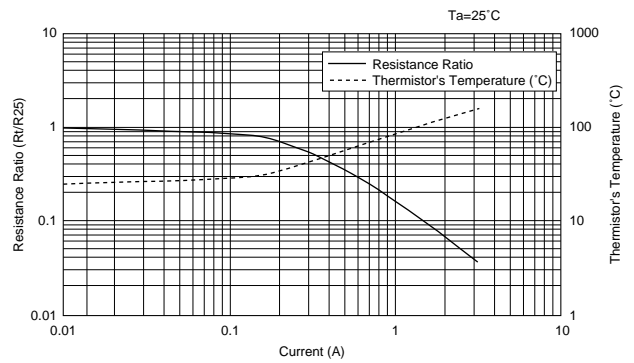
■ NTPAJ4R0L Type



■ NTPAJ6R0L Type



■ NTPAJ8R0L Type

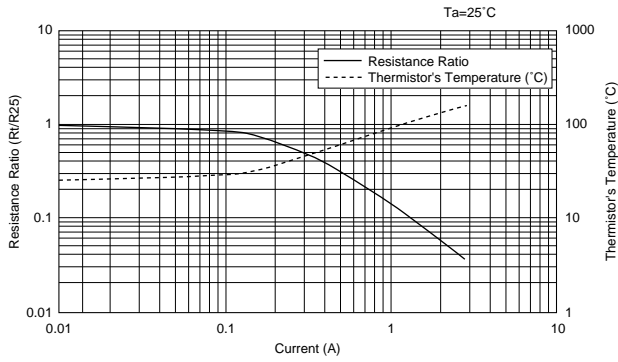


Continued on the following page.

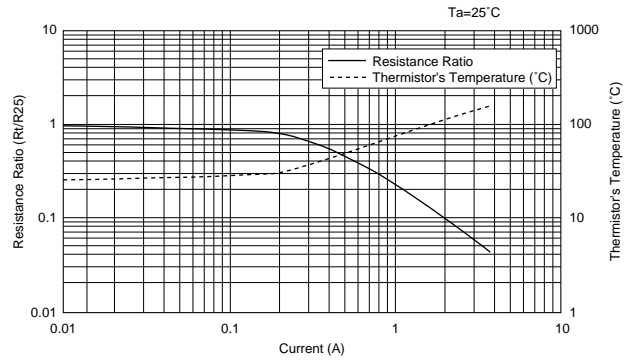
Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

Continued from the preceding page.

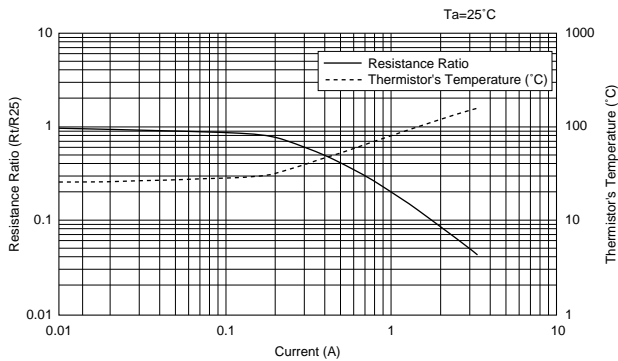
■ NTPAJ100L Type



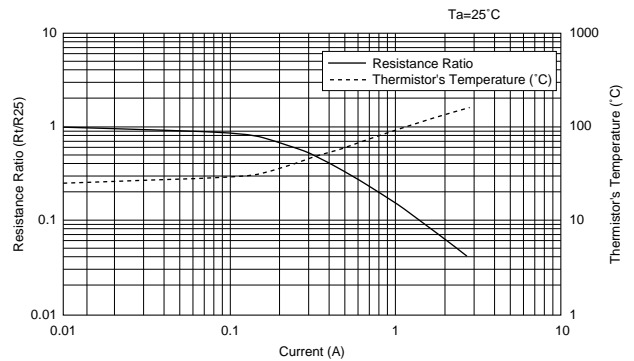
■ NTPAD3R9L Type



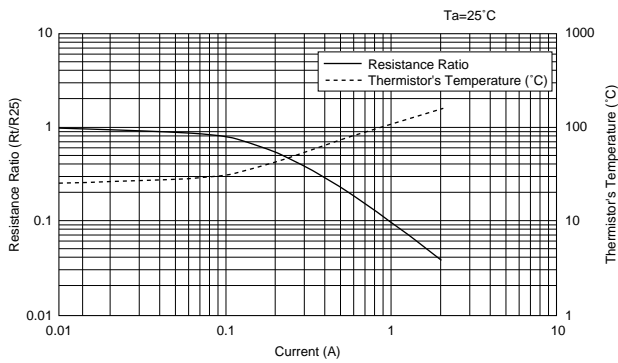
■ NTPAD5R1L Type



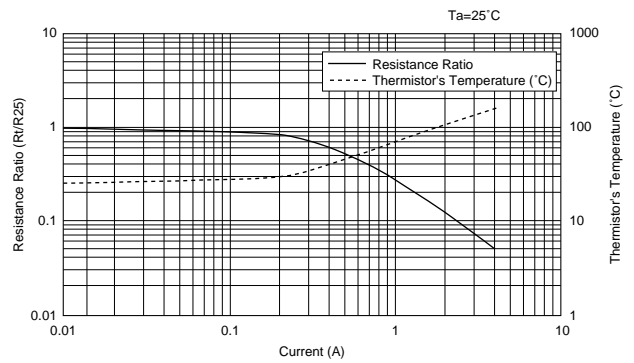
■ NTPAD8R0L Type



■ NTPAD160L Type



■ NTPAA2R2L Type

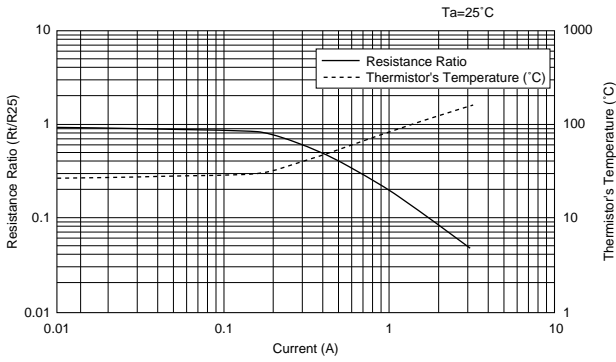


Continued on the following page. ↗

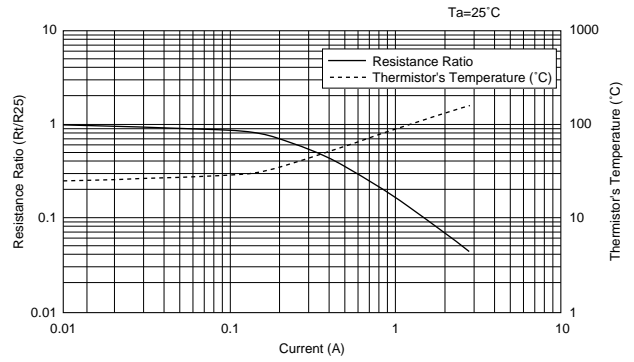
Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

Continued from the preceding page.

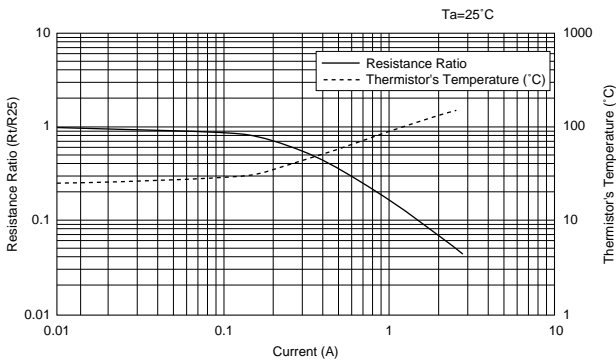
■ NTPAA3R9L Type



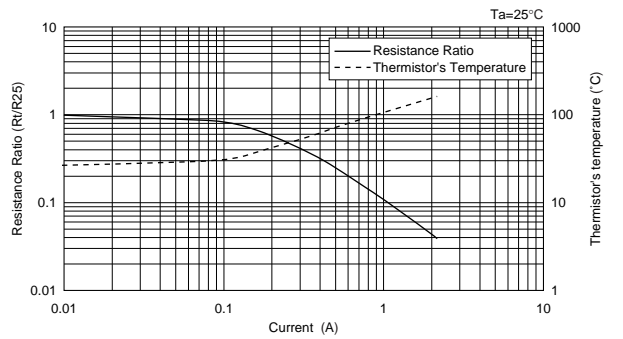
■ NTPAA5R1L Type



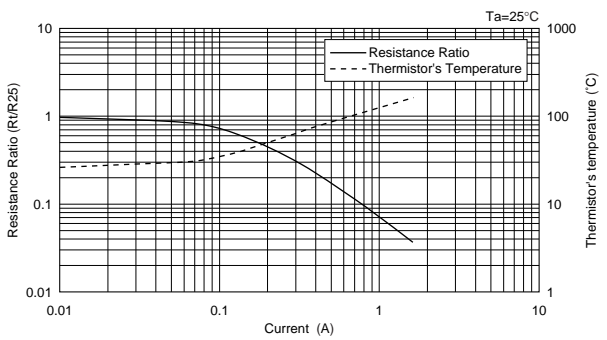
■ NTPAA8R2L Type



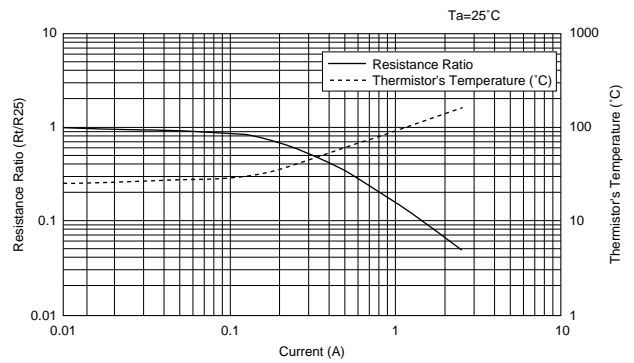
■ NTPAA100L Type



■ NTPA9160L Type



■ NTPA74R0L Type

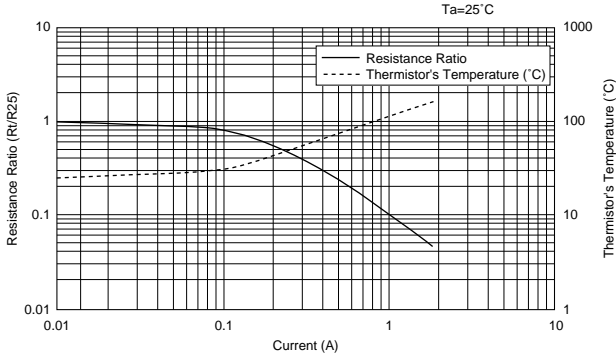


Continued on the following page. ↗

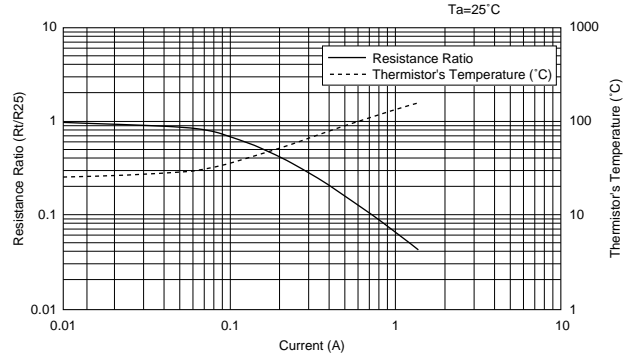
Current - R Ratio (RT/R25)/Current - Temperature Characteristics (Typical)

Continued from the preceding page.

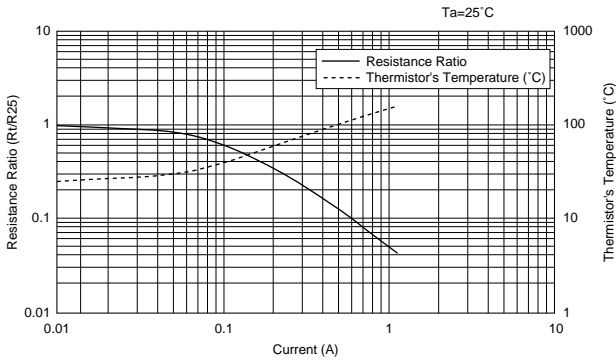
■ NTPA78R0L Type



■ NTPA7160L Type



■ NTPA7220L Type



for Inrush Current Suppression Lead Type ⚠Caution/Notice

■ ⚠Caution (Storage and Operating Conditions)

1. This product is designed for the Switching Power Supply with smoothing capacitors.
Other applications of this product may result in fire.
2. Use this product within the specified maximum current. Otherwise it may catch fire in the worst case.
3. Use this product with smoothing capacitor within the specified maximum capacitance value. Otherwise it may catch fire in the worst case.
4. This product is designed for application in an ordinary environment
(normal room temperature, humidity and atmospheric pressure).
Do not use under the following conditions because all these factors can deteriorate the product characteristics cause failure and burn-out.

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

■ ⚠Caution (Others)

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

■ Notice (Storage and Operating Conditions)

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

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

for Inrush Current Suppression Lead Type ⚠Caution/Notice

■ Notice (Handling)

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

■ Notice (Others)

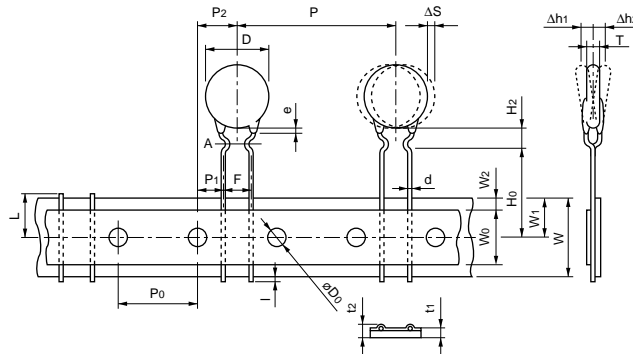
1. This product may allow passing higher current than its initial value when it receives inrush current again just after the last one until it cools down and recovers its original resistance enough. Be sure the highest current under actual condition on the operating repetition and the operating temperature.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

for Inrush Current Suppression Lead Type Package

■ Minimum Quantity

| Part Numbers | Minimum Quantity (pcs.) | |
|--------------|-------------------------|------------------|
| | Bulk | Ammo Pack Taping |
| NTPA7 | 500 | 1000 |
| NTPA9 | 300 | 1000 |
| NTPAA | 300 | 750 |
| NTPAD | 150 | 400 |
| NTPAJ | 100 | - |
| NTPAN | 50 | - |

■ 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 | l | +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 | Δh ₁ , Δh 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 |

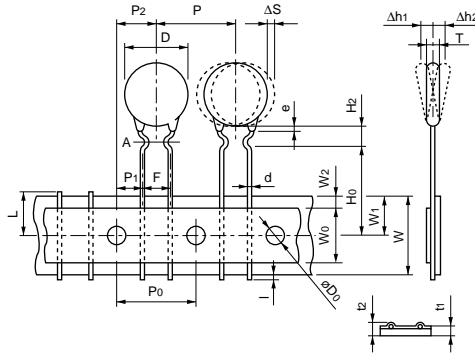
| Type | D (mm) | T (mm) |
|--------------|-----------|----------|
| NTPAD | 16.0 max. | 5.5 max. |
| NTPAA | 12.0 max. | 5.0 max. |

Continued on the following page.

for Inrush Current Suppression Lead Type Package

Continued from the preceding page.

■ 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 | l | +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 | Δh ₁ , Δh ₂ | 1.5 max. |
| Portion to Cut in Case of Defect | L | 11.0 ⁺⁰ _{-2.0} |
| Hold Down Tape Width | W ₀ | 11.0 min. |
| Hold Down Tape Position | W ₂ | 4.0 max. |
| Coating Extension on Lead | e | to line A |

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

△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 January 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 approve our product specifications or transact the approval sheet for product specifications before ordering.

6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

Head Office

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

International Division

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