

NTC Thermistors, Radial Leaded, Standard Precision



FEATURES

- Accuracy over a wide temperature range
- High stability over a long life
- Excellent price/performance ratio
- UL recognized, file E148885
- Material categorization:
For definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

APPLICATIONS

- Temperature measurement, sensing and control, temperature compensation in industrial and consumer electronics

DESCRIPTION

These thermistors have a negative temperature coefficient. The device consists of a chip with two solid copper tin plated leads. It is grey lacquered and color coded, but not insulated.

PACKAGING

The thermistors are packed in bulk or tape on reel; see code numbers and relevant packaging quantities.

DESIGN-IN SUPPORT

For complete Curve Computation, visit:
www.vishay.com/resistors-non-linear/curve-computation-list/

MARKING

The thermistors are marked with colored bands; see dimensions drawing and "Electrical data and ordering information".

MOUNTING

By soldering in any position.
Not intended for potted applications.

| QUICK REFERENCE DATA | | |
|----------------------------------------------------------------------------|-------------------------------------------|------|
| PARAMETER | VALUE | UNIT |
| Resistance value at 25 °C | 3.3 to 470K | Ω |
| Tolerance on R_{25} -value | ± 2; ± 3; ± 5 | % |
| $B_{25/85}$ -value | 2880 to 4570 | K |
| Tolerance on $B_{25/85}$ -value | ± 0.5 to ± 3 | % |
| Operating temperature range: At zero power dissipation; continuously | - 40 to + 125 | °C |
| At zero power dissipation; for short periods | ≤ 150 | |
| Response time (in oil) | ≈ 1.2 | s |
| Thermal time constant τ (for information only) | 15 | s |
| Dissipation factor δ (for information only) | 7 8.5 (for R_{25} -value ≤ 680 Ω) | mW/K |
| Maximum power dissipation at 55 °C | 500 | mW |
| Climatic category (LCT/UCT/days) | 40/125/56 | - |
| Weight | ≈ 0.3 | g |

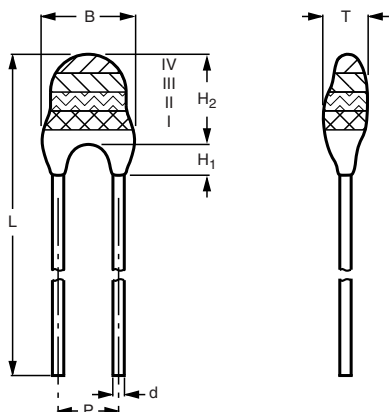
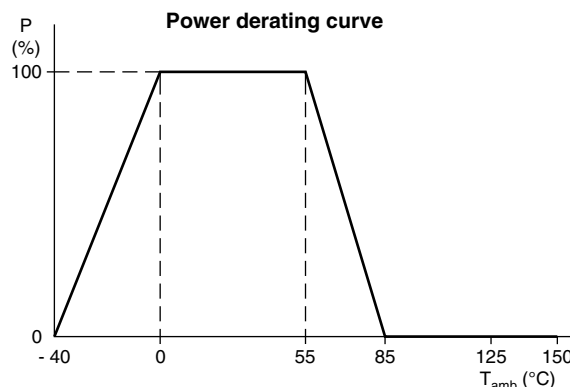
| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | |
|------------------------------------------|---------------------------|-------|----------------------|-------------------------------------------------------------|----------------------------------------------------|---------------------------|--------|-------|
| R_{25} (Ω) | $B_{25/85}$ -VALUE (K) | (± %) | UL APPROVED (Y/N) | SAP MATERIAL NUMBER NTCLE100E3...B0/T1/T2 ⁽²⁾ | OLD 12NC CODE 2381 640 3/4/6.... ⁽¹⁾ | COLOR CODE ⁽³⁾ | | |
| | | | | | | I | II | III |
| 3.3 | 2880 | 3 | N | 338*B0 | *338 | Orange | Orange | Gold |
| 4.7 | 2880 | 3 | N | 478*B0 | *478 | Yellow | Violet | Gold |
| 6.8 | 2880 | 3 | N | 688*B0 | *688 | Blue | Grey | Gold |
| 10 | 2990 | 3 | N | 109*B0 | *109 | Brown | Black | Black |
| 15 | 3041 | 3 | N | 159*B0 | *159 | Brown | Green | Black |
| 22 | 3136 | 3 | N | 229*B0 | *229 | Red | Red | Black |
| 33 | 3390 | 3 | Y | 339*B0 | *339 | Orange | Orange | Black |
| 47 | 3390 | 3 | Y | 479*B0 | *479 | Yellow | Violet | Black |
| 68 | 3390 | 3 | Y | 689*B0 | *689 | Blue | Grey | Black |
| 100 | 3560 | 1.5 | Y | 101*B0 | *101 | Brown | Black | Brown |
| 150 | 3560 | 1.5 | Y | 151*B0 | *151 | Brown | Green | Brown |
| 220 | 3560 | 1.5 | Y | 221*B0 | *221 | Red | Red | Brown |
| 330 | 3560 | 1.5 | Y | 331*B0 | *331 | Orange | Orange | Brown |

ELECTRICAL DATA AND ORDERING INFORMATION

| R_{25} (Ω) | $B_{25/85}$ -VALUE (K) | VALUE (\pm %) | UL APPROVED (Y/N) | SAP MATERIAL NUMBER NTCLE100E3...B0/T1/T2 (2) | OLD 12NC CODE 2381 640 3/4/6.... (1) | COLOR CODE (3) | | |
|--------------------------|---------------------------|---------------------|----------------------|--------------------------------------------------|-----------------------------------------|----------------|--------|--------|
| | | | | | | I | II | III |
| 470 | 3560 | 1.5 | Y | 471*B0 | *471 | Yellow | Violet | Brown |
| 680 | 3560 | 1.5 | Y | 681*B0 | *681 | Blue | Grey | Brown |
| 1000 | 3528 | 0.5 | Y | 102*B0 | *102 | Brown | Black | Red |
| 1500 | 3528 | 0.5 | Y | 152*B0 | *152 | Brown | Green | Red |
| 2000 | 3528 | 0.5 | Y | 202*B0 | *202 | Red | Black | Red |
| 2200 | 3977 | 0.75 | Y | 222*B0 | *222 | Red | Red | Red |
| 2700 | 3977 | 0.75 | Y | 272*B0 | *272 | Red | violet | Red |
| 3300 | 3977 | 0.75 | Y | 332*B0 | *332 | Orange | Orange | Red |
| 4700 | 3977 | 0.75 | Y | 472*B0 | *472 | Yellow | Violet | Red |
| 5000 | 3977 | 0.75 | Y | 502*B0 | *502 | Green | Black | Red |
| 6800 | 3977 | 0.75 | Y | 682*B0 | *682 | Blue | Grey | Red |
| 10 000 | 3977 | 0.75 | Y | 103*B0 | *103 | Brown | Black | Orange |
| 12 000 | 3740 | 2 | Y | 123*B0 | *123 | Brown | Red | Orange |
| 15 000 | 3740 | 2 | Y | 153*B0 | *153 | Brown | Green | Orange |
| 22 000 | 3740 | 2 | Y | 223*B0 | *223 | Red | Red | Orange |
| 33 000 | 4090 | 1.5 | Y | 333*B0 | *333 | Orange | Orange | Orange |
| 47 000 | 4090 | 1.5 | Y | 473*B0 | *473 | Yellow | Violet | Orange |
| 50 000 | 4190 | 1.5 | Y | 503*B0 | *503 | Green | Black | Orange |
| 68 000 | 4190 | 1.5 | Y | 683*B0 | *683 | Blue | Grey | Orange |
| 100 000 | 4190 | 1.5 | Y | 104*B0 | *104 | Brown | Black | Yellow |
| 150 000 | 4370 | 2.5 | Y | 154*B0 | *154 | Brown | Green | Yellow |
| 220 000 | 4370 | 2.5 | Y | 224*B0 | *224 | Red | Red | Yellow |
| 330 000 | 4570 | 1.5 | N | 334*B0 | *334 | Orange | Orange | Yellow |
| 470 000 | 4570 | 1.5 | N | 474*B0 | *474 | Yellow | Violet | Yellow |

Notes

- (1) Replace * in 12NC by 3 for 5 %, 6 for 3 %, 4 for 2 %
(2) Replace * in SAP by J for 5 %, H for 3 %, G for 2 %
(3) For $R_{25} \pm 2$ % band IV is red, ± 3 % band IV is orange, ± 5 % band IV is gold

DIMENSIONS in millimeters

DERATING AND TEMPERATURE TOLERANCES

Note

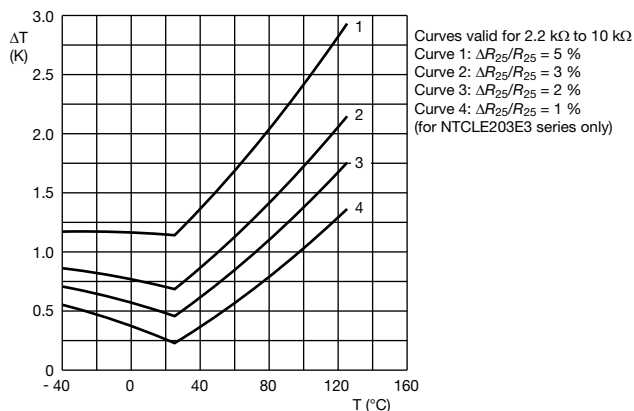
- Zero power is considered as measuring power max. 1 % of max. power.

PHYSICAL DIMENSIONS FOR RELEVANT TYPE (all dimensions in millimeters)

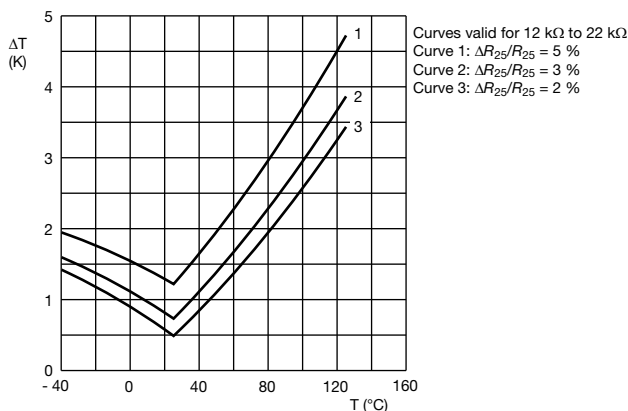
| R_{25} -VALUE | $B_{MAX.}$ | d | H_1 | | H_2 MAX. | L | P | $T_{MAX.}$ |
|--------------------------------|---------------|----------------|-------|------|------------|--------------|------|------------|
| | | | MIN. | MAX. | | | | |
| 3.3 Ω to 220 Ω | 5.0 | 0.6 \pm 0.06 | 1.0 | 4.0 | 6.0 | 24 \pm 1.5 | 2.54 | 4.0 |
| 330 Ω to 470 k Ω | 3.3 \pm 0.5 | 0.6 \pm 0.06 | 1.0 | 3.0 | 6.0 | 24 \pm 1.5 | 2.54 | 3.0 |



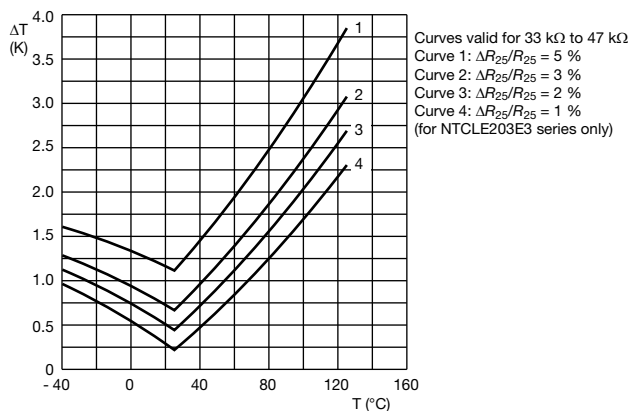
TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



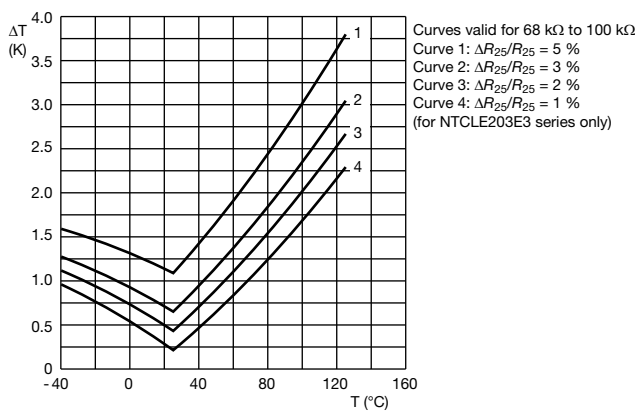
TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



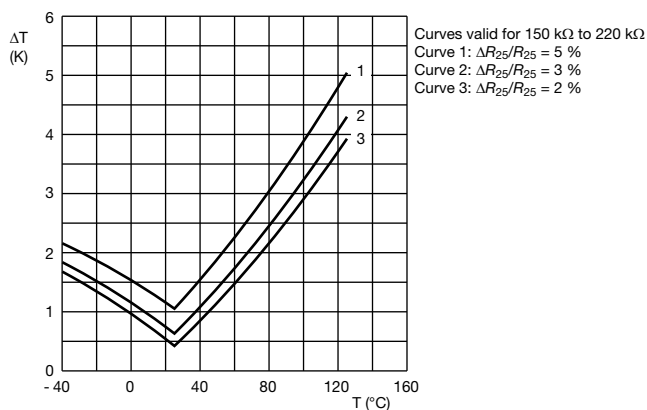
TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



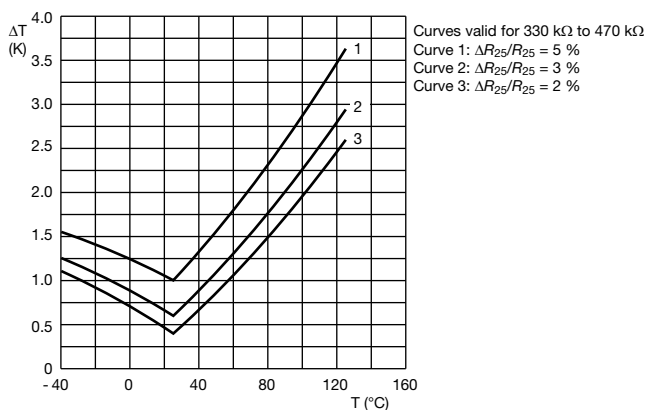
TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



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TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



R_T VALUE AND TOLERANCE

These thermistors have a narrow tolerance on the B-value, the result of which provides a very small tolerance on the nominal resistance value over a wide temperature range. For this reason the usual graphs of $R = f(T)$ are replaced by Resistance Values at Intermediate Temperatures Tables, together with a formula to calculate the characteristics with a high precision.

FORMULAE TO DETERMINE NOMINAL RESISTANCE VALUES

The resistance values at intermediate temperatures, or the operating temperature values, can be calculated using the following interpolation laws (extended "Steinhart and Hart"):

$$R_{(T)} = R_{\text{ref}} \times e^{(A/B/T + C/T^2 + D/T^3)} \quad (1)$$

$$T_{(R)} = \left(A_1 + B_1 \ln \frac{R}{R_{\text{ref}}} + C_1 \ln^2 \frac{R}{R_{\text{ref}}} + D_1 \ln^3 \frac{R}{R_{\text{ref}}} \right)^{-1} \quad (2)$$

where:

A, B, C, D, A₁, B₁, C₁ and D₁ are constant values depending on the material concerned; see table below.

R_{ref.} is the resistance value at a reference temperature (in this event 25 °C, R_{ref.} = R₂₅).

T is the temperature in K.

Formulae numbered and are interchangeable with an error of max. 0.005 °C in the range 25 °C to 125 °C and max. 0.015 °C in the range - 40 °C to + 25 °C.

DETERMINATION OF THE RESISTANCE/TEMPERATURE DEVIATION FROM NOMINAL VALUE

The total resistance deviation is obtained by combining the "R₂₅-tolerance" and the "resistance deviation due to B-tolerance".

When:

X = R₂₅-tolerance

Y = resistance deviation due to B-tolerance

Z = complete resistance deviation,

then: $Z = \left[\left(1 + \frac{X}{100} \right) \times \left(1 + \frac{Y}{100} \right) - 1 \right] \times 100 \%$ or $Z \approx X + Y$

When:

TCR = temperature coefficient

ΔT = temperature deviation,

then: $\Delta T = \frac{Z}{TCR}$

The temperature tolerances are plotted in the graphs on the previous page.

Example: at 0 °C, assume X = 5 %, Y = 0.89 % and TCR = 5.08 %/K (see table), then:

$$Z = \left\{ \left[1 + \frac{5}{100} \right] \times \left[1 + \frac{0.89}{100} \right] - 1 \right\} \times 100 \%$$

$$= \{ 1.05 \times 1.0089 - 1 \} \times 100 \% = 5.9345 \% (\approx 5.93 \%)$$

$$\Delta T = \frac{Z}{TCR} = \frac{5.93}{5.08} = 1.167 \text{ °C } (\approx 1.17 \text{ °C})$$

A NTC with a R₂₅-value of 10 kΩ has a value of 32.56 kΩ between - 1.17 °C and + 1.17 °C.

PARAMETER FOR DETERMINING NOMINAL RESISTANCE VALUES

| NUMBER | B _{25/85} (K) | NAME | TOL. B (%) | A | B (K) | C (K ²) | D (K ³) | A ₁ | B ₁ (K ⁻¹) | C ₁ (K ⁻²) | D ₁ (K ⁻³) |
|--------|---------------------------|---------------------------------------|---------------|-----------|----------|------------------------|------------------------|----------------|--------------------------------------|--------------------------------------|--------------------------------------|
| 1 | 2880 | Mat O. with B _n = 2880K | 3 | - 9.094 | 2251.74 | 229098 | - 2.744820E+07 | 3.354016E-03 | 3.495020E-04 | 2.095959E-06 | 4.260615E-07 |
| 2 | 2990 | Mat P. with B _n = 3990K | 3 | - 10.2296 | 2887.62 | 132336 | - 2.502510E+07 | 3.354016E-03 | 3.415560E-04 | 4.955455E-06 | 4.364236E-07 |
| 3 | 3041 | Mat Q. with B _n = 3041K | 3 | - 11.1334 | 3658.73 | - 102895 | 5.166520E+05 | 3.354016E-03 | 3.349290E-04 | 3.683843E-06 | 7.050455E-07 |
| 4 | 3136 | Mat R. with B _n = 3136K | 3 | - 12.4493 | 4702.74 | - 402687 | 3.196830E+07 | 3.354016E-03 | 3.243880E-04 | 2.658012E-06 | - 2.701560E-07 |
| 5 | 3390 | Mat S. with B _n = 3390K | 3 | - 12.6814 | 4391.97 | - 232807 | 1.509643E+07 | 3.354016E-03 | 2.993410E-04 | 2.135133E-06 | - 5.672000E-09 |
| 6 | 3528 ⁽¹⁾ | Mat I. with B _n = 3528K | 0.5 | - 12.0596 | 3687.667 | - 7617.13 | - 5.914730E+06 | 3.354016E-03 | 2.909670E-04 | 1.632136E-06 | 7.192200E-08 |
| | 3528 ⁽²⁾ | | | - 21.0704 | 11903.95 | - 2504699 | 2.470338E+08 | 3.354016E-03 | 2.933908E-04 | 3.494314E-06 | - 7.712690E-07 |
| 7 | 3560 | Mat H. with B _n = 3560K | 1.5 | - 13.0723 | 4190.574 | - 47158.4 | - 1.199256E+07 | 3.354016E-03 | 2.884193E-04 | 4.118032E-06 | 1.786790E-07 |
| 8 | 3740 | Mat B. with B _n = 3740K | 2 | - 13.8973 | 4557.725 | - 98275 | - 7.522357E+06 | 3.354016E-03 | 2.744032E-04 | 3.666944E-06 | 1.375492E-07 |
| 9 | 3977 | Mat A. with B _n = 3977K | 0.75 | - 14.6337 | 4791.842 | - 115334 | - 3.730535E+06 | 3.354016E-03 | 2.569850E-04 | 2.620131E-06 | 6.383091E-08 |
| 10 | 4090 | Mat C. with B _n = 4090K | 1.5 | - 15.5322 | 5229.973 | - 160451 | - 5.414091E+06 | 3.354016E-03 | 2.519107E-04 | 3.510939E-06 | 1.105179E-07 |
| 11 | 4190 | Mat D. with B _n = 4190K | 1.5 | - 16.0349 | 5459.339 | - 191141 | - 3.328322E+06 | 3.354016E-03 | 2.460382E-04 | 3.405377E-06 | 1.034240E-07 |
| 12 | 4370 | Mat E. with B _n = 4370K | 2.5 | - 16.8717 | 5759.15 | - 194267 | - 6.869149E+06 | 3.354016E-03 | 2.367720E-04 | 3.585140E-06 | 1.255349E-07 |
| 13 | 4570 | Mat F. with B _n = 4570K | 1.5 | - 17.6439 | 6022.726 | - 203157 | - 7.183526E+06 | 3.354016E-03 | 2.264097E-04 | 3.278184E-06 | 1.097628E-07 |

Notes

⁽¹⁾ Temperature < 25 °C

⁽²⁾ Temperature ≥ 25 °C



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (3.3, 4.7, 6.8) Ω | | | | | |
|------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------|---------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3338*** | PART NUMBER NTCLE100E3478*** | PART NUMBER NTCLE100E3688*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| | R_T (Ω) | R_T (Ω) | R_T (Ω) | | |
| - 40 | 45.00 | 64.09 | 92.73 | - 4.97 | 8.08 |
| - 35 | 35.25 | 50.20 | 72.63 | - 4.80 | 7.30 |
| - 30 | 27.84 | 39.64 | 57.36 | - 4.64 | 6.55 |
| - 25 | 22.16 | 31.56 | 45.66 | - 4.48 | 5.84 |
| - 20 | 17.78 | 25.32 | 36.63 | - 4.33 | 5.15 |
| - 15 | 14.37 | 20.46 | 29.60 | - 4.19 | 4.49 |
| - 10 | 11.69 | 16.65 | 24.09 | - 4.05 | 3.85 |
| - 5 | 9.582 | 13.65 | 19.74 | - 3.92 | 3.24 |
| 0 | 7.904 | 11.26 | 16.29 | - 3.79 | 2.65 |
| 5 | 6.560 | 9.344 | 13.52 | - 3.66 | 2.08 |
| 10 | 5.479 | 7.803 | 11.29 | - 3.55 | 1.54 |
| 15 | 4.602 | 6.554 | 9.482 | - 3.43 | 1.01 |
| 20 | 3.886 | 5.535 | 8.008 | - 3.32 | 0.49 |
| 25 | 3.300 | 4.700 | 6.800 | - 3.22 | 0.00 |
| 30 | 2.816 | 4.011 | 5.803 | - 3.12 | 0.48 |
| 35 | 2.415 | 3.440 | 4.977 | - 3.02 | 0.94 |
| 40 | 2.081 | 2.964 | 4.289 | - 2.93 | 1.39 |
| 45 | 1.801 | 2.566 | 3.712 | - 2.84 | 1.82 |
| 50 | 1.566 | 2.230 | 3.227 | - 2.76 | 2.24 |
| 55 | 1.367 | 1.947 | 2.817 | - 2.68 | 2.65 |
| 60 | 1.198 | 1.706 | 2.469 | - 2.60 | 3.04 |
| 65 | 1.054 | 1.501 | 2.172 | - 2.52 | 3.43 |
| 70 | 0.9308 | 1.326 | 1.918 | - 2.45 | 3.80 |
| 75 | 0.8248 | 1.175 | 1.700 | - 2.38 | 4.16 |
| 80 | 0.7334 | 1.044 | 1.511 | - 2.32 | 4.51 |
| 85 | 0.6542 | 0.9318 | 1.348 | - 2.25 | 4.85 |
| 90 | 0.5854 | 0.8338 | 1.206 | - 2.19 | 5.19 |
| 95 | 0.5255 | 0.7484 | 1.083 | - 2.13 | 5.51 |
| 100 | 0.4730 | 0.6737 | 0.9748 | - 2.07 | 5.82 |
| 105 | 0.4270 | 0.6082 | 0.8799 | - 2.02 | 6.13 |
| 110 | 0.3865 | 0.5505 | 0.7965 | - 1.97 | 6.43 |
| 115 | 0.3508 | 0.4996 | 0.7228 | - 1.92 | 6.72 |
| 120 | 0.3192 | 0.4545 | 0.6576 | - 1.87 | 7.00 |
| 125 | 0.2911 | 0.4145 | 0.5998 | - 1.82 | 7.28 |
| 130 | 0.2661 | 0.3789 | 0.5483 | - 1.77 | 7.55 |
| 135 | 0.2438 | 0.3472 | 0.5023 | - 1.73 | 7.81 |
| 140 | 0.2238 | 0.3188 | 0.4612 | - 1.69 | 8.07 |
| 145 | 0.2059 | 0.2933 | 0.4244 | - 1.65 | 8.32 |
| 150 | 0.1899 | 0.2704 | 0.3912 | - 1.61 | 8.56 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (10, 15, 22) Ω | | | | | | | | | |
|---------------------------------------------------------------------------------------|---------------------------------|--------------|---------------------------------------|---------------------------------|--------------|---------------------------------------|---------------------------------|--------------|---------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3109*** | | | PART NUMBER NTCLE100E3159*** | | | PART NUMBER NTCLE100E3229*** | | |
| | R_T (Ω) | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) | R_T (Ω) | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) | R_T (Ω) | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| -40 | 136.7 | -4.86 | 8.39 | 224.8 | -5.16 | 8.65 | 374.9 | -5.54 | 8.80 |
| -35 | 107.6 | -4.72 | 7.58 | 174.5 | -4.98 | 7.79 | 285.8 | -5.31 | 7.95 |
| -30 | 85.32 | -4.58 | 6.81 | 136.6 | -4.80 | 6.98 | 220.4 | -5.10 | 7.14 |
| -25 | 68.10 | -4.44 | 6.06 | 107.9 | -4.64 | 6.21 | 171.7 | -4.90 | 6.36 |
| -20 | 54.72 | -4.31 | 5.35 | 85.94 | -4.48 | 5.47 | 135.0 | -4.71 | 5.61 |
| -15 | 44.25 | -4.18 | 4.66 | 68.96 | -4.33 | 4.76 | 107.2 | -4.53 | 4.89 |
| -10 | 36.02 | -4.06 | 4.00 | 55.74 | -4.19 | 4.08 | 85.79 | -4.37 | 4.20 |
| -5 | 29.49 | -3.94 | 3.37 | 45.37 | -4.05 | 3.43 | 69.21 | -4.22 | 3.53 |
| 0 | 24.30 | -3.82 | 2.75 | 37.17 | -3.92 | 2.81 | 56.26 | -4.07 | 2.89 |
| 5 | 20.13 | -3.71 | 2.16 | 30.65 | -3.80 | 2.20 | 46.05 | -3.94 | 2.27 |
| 10 | 16.77 | -3.60 | 1.59 | 25.42 | -3.68 | 1.62 | 37.94 | -3.81 | 1.67 |
| 15 | 14.04 | -3.50 | 1.04 | 21.21 | -3.57 | 1.06 | 31.45 | -3.69 | 1.10 |
| 20 | 11.82 | -3.39 | 0.51 | 17.79 | -3.46 | 0.52 | 26.23 | -3.57 | 0.54 |
| 25 | 10.00 | -3.30 | 0.00 | 15.00 | -3.36 | 0.00 | 22.00 | -3.47 | 0.00 |
| 30 | 8.500 | -3.20 | 0.50 | 12.76 | -3.26 | 0.49 | 18.55 | -3.36 | 0.52 |
| 35 | 7.259 | -3.11 | 0.98 | 10.86 | -3.17 | 0.98 | 15.72 | -3.26 | 1.02 |
| 40 | 6.226 | -3.03 | 1.44 | 9.291 | -3.08 | 1.46 | 13.38 | -3.17 | 1.51 |
| 45 | 5.363 | -2.94 | 1.89 | 7.982 | -2.99 | 1.92 | 11.45 | -3.08 | 1.98 |
| 50 | 4.639 | -2.86 | 2.33 | 6.887 | -2.91 | 2.36 | 9.833 | -3.00 | 2.44 |
| 55 | 4.029 | -2.78 | 2.75 | 5.966 | -2.83 | 2.79 | 8.482 | -2.92 | 2.88 |
| 60 | 3.512 | -2.71 | 3.16 | 5.189 | -2.75 | 3.21 | 7.346 | -2.84 | 3.32 |
| 65 | 3.073 | -2.64 | 3.56 | 4.529 | -2.68 | 3.62 | 6.386 | -2.76 | 3.73 |
| 70 | 2.698 | -2.57 | 3.95 | 3.968 | -2.61 | 4.02 | 5.572 | -2.69 | 4.14 |
| 75 | 2.377 | -2.50 | 4.32 | 3.488 | -2.54 | 4.41 | 4.879 | -2.62 | 4.53 |
| 80 | 2.101 | -2.43 | 4.69 | 3.077 | -2.48 | 4.78 | 4.286 | -2.56 | 4.91 |
| 85 | 1.864 | -2.37 | 5.04 | 2.722 | -2.41 | 5.15 | 3.777 | -2.50 | 5.29 |
| 90 | 1.658 | -2.31 | 5.38 | 2.416 | -2.35 | 5.51 | 3.339 | -2.44 | 5.65 |
| 95 | 1.479 | -2.25 | 5.72 | 2.151 | -2.30 | 5.85 | 2.960 | -2.38 | 6.00 |
| 100 | 1.323 | -2.20 | 6.05 | 1.920 | -2.24 | 6.19 | 2.632 | -2.32 | 6.34 |
| 105 | 1.187 | -2.14 | 6.36 | 1.719 | -2.19 | 6.53 | 2.347 | -2.27 | 6.68 |
| 110 | 1.068 | -2.09 | 6.67 | 1.543 | -2.13 | 6.85 | 2.098 | -2.22 | 7.00 |
| 115 | 0.9635 | -2.04 | 6.98 | 1.389 | -2.08 | 7.17 | 1.880 | -2.17 | 7.32 |
| 120 | 0.8712 | -1.99 | 7.27 | 1.253 | -2.03 | 7.48 | 1.689 | -2.12 | 7.62 |
| 125 | 0.7897 | -1.94 | 7.56 | 1.133 | -1.99 | 7.78 | 1.521 | -2.07 | 7.93 |
| 130 | 0.7174 | -1.90 | 7.84 | 1.027 | -1.94 | 8.08 | 1.373 | -2.03 | 8.22 |
| 135 | 0.6533 | -1.85 | 8.11 | 0.9326 | -1.90 | 8.37 | 1.242 | -1.98 | 8.50 |
| 140 | 0.5961 | -1.81 | 8.37 | 0.8490 | -1.86 | 8.65 | 1.126 | -1.94 | 8.78 |
| 145 | 0.5451 | -1.77 | 8.63 | 0.7744 | -1.82 | 8.93 | 1.023 | -1.90 | 9.06 |
| 150 | 0.4995 | -1.73 | 8.89 | 0.7079 | -1.78 | 9.20 | 0.9309 | -1.86 | 9.32 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (33, 47, 68) Ω | | | | | |
|---------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------|---------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3339*** | PART NUMBER NTCLE100E3479*** | PART NUMBER NTCLE100E3689*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| | R_T (Ω) | R_T (Ω) | R_T (Ω) | | |
| - 40 | 707.0 | 1007 | 1457 | - 5.94 | 9.30 |
| - 35 | 528.5 | 752.7 | 1089 | - 5.70 | 8.44 |
| - 30 | 399.5 | 569.0 | 823.3 | - 5.49 | 7.60 |
| - 25 | 305.3 | 434.8 | 629.1 | - 5.28 | 6.79 |
| - 20 | 235.6 | 335.6 | 485.5 | - 5.09 | 6.01 |
| - 15 | 183.5 | 261.4 | 378.2 | - 4.90 | 5.25 |
| - 10 | 144.3 | 205.5 | 297.3 | - 4.73 | 4.51 |
| - 5 | 114.3 | 162.8 | 235.6 | - 4.57 | 3.80 |
| 0 | 91.34 | 130.1 | 188.2 | - 4.42 | 3.11 |
| 5 | 73.51 | 104.7 | 151.5 | - 4.27 | 2.45 |
| 10 | 59.59 | 84.87 | 122.8 | - 4.13 | 1.80 |
| 15 | 48.63 | 69.26 | 100.2 | - 4.00 | 1.18 |
| 20 | 39.94 | 56.88 | 82.29 | - 3.88 | 0.58 |
| 25 | 33.00 | 47.00 | 68.00 | - 3.76 | 0.00 |
| 30 | 27.43 | 39.06 | 56.51 | - 3.64 | 0.56 |
| 35 | 22.92 | 32.64 | 47.23 | - 3.54 | 1.11 |
| 40 | 19.26 | 27.42 | 39.68 | - 3.43 | 1.63 |
| 45 | 16.26 | 23.16 | 33.50 | - 3.34 | 2.14 |
| 50 | 13.79 | 19.65 | 28.42 | - 3.24 | 2.63 |
| 55 | 11.76 | 16.74 | 24.23 | - 3.15 | 3.11 |
| 60 | 10.06 | 14.33 | 20.74 | - 3.07 | 3.57 |
| 65 | 8.652 | 12.32 | 17.83 | - 2.98 | 4.02 |
| 70 | 7.468 | 10.64 | 15.39 | - 2.90 | 4.45 |
| 75 | 6.471 | 9.216 | 13.33 | - 2.83 | 4.87 |
| 80 | 5.628 | 8.015 | 11.60 | - 2.76 | 5.27 |
| 85 | 4.912 | 6.996 | 10.12 | - 2.69 | 5.66 |
| 90 | 4.302 | 6.127 | 8.865 | - 2.62 | 6.04 |
| 95 | 3.780 | 5.384 | 7.790 | - 2.55 | 6.41 |
| 100 | 3.332 | 4.746 | 6.867 | - 2.49 | 6.77 |
| 105 | 2.946 | 4.196 | 6.071 | - 2.43 | 7.11 |
| 110 | 2.613 | 3.721 | 5.384 | - 2.37 | 7.45 |
| 115 | 2.324 | 3.310 | 4.788 | - 2.32 | 7.77 |
| 120 | 2.072 | 2.951 | 4.270 | - 2.26 | 8.09 |
| 125 | 1.853 | 2.639 | 3.818 | - 2.21 | 8.39 |
| 130 | 1.661 | 2.365 | 3.422 | - 2.16 | 8.69 |
| 135 | 1.492 | 2.125 | 3.075 | - 2.11 | 8.97 |
| 140 | 1.344 | 1.914 | 2.770 | - 2.07 | 9.25 |
| 145 | 1.213 | 1.728 | 2.500 | - 2.02 | 9.52 |
| 150 | 1.098 | 1.564 | 2.262 | - 1.98 | 9.79 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (100, 150, 220, 330, 470, 680) Ω | | | | | | | | |
|---------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------|-------------------------------------------------------|
| T _{OPER} (°C) | PART NUMBER NTCLE100E3101*** | PART NUMBER NTCLE100E3151*** | PART NUMBER NTCLE100E3221*** | PART NUMBER NTCLE100E3331*** | PART NUMBER NTCLE100E3471*** | PART NUMBER NTCLE100E3681*** | TCR (%/K) | $\Delta R/R$ DUE TO B _{tol.} (%) |
| | R_T (Ω) | R_T (Ω) | R_T (Ω) | R_T (Ω) | R_T (Ω) | R_T (Ω) | | |
| -40 | 2193 | 3289 | 4824 | 7236 | 10 305 | 14 910 | -5.75 | 4.99 |
| -35 | 1652 | 2478 | 3635 | 5452 | 7766 | 11 235 | -5.57 | 4.51 |
| -30 | 1256 | 1884 | 2763 | 4144 | 5902 | 8540 | -5.40 | 4.05 |
| -25 | 962.5 | 1444 | 2117 | 3176 | 4524 | 6545 | -5.24 | 3.61 |
| -20 | 743.6 | 1115 | 1636 | 2454 | 3495 | 5057 | -5.08 | 3.19 |
| -15 | 579.0 | 868.5 | 1274 | 1911 | 2721 | 3937 | -4.93 | 2.78 |
| -10 | 454.2 | 681.2 | 999.1 | 1499 | 2135 | 3088 | -4.78 | 2.38 |
| -5 | 358.8 | 538.2 | 789.4 | 1184 | 1686 | 2440 | -4.64 | 2.01 |
| 0 | 285.4 | 428.2 | 628.0 | 942.0 | 1342 | 1941 | -4.51 | 1.64 |
| 5 | 228.6 | 342.9 | 502.9 | 754.4 | 1074 | 1554 | -4.38 | 1.29 |
| 10 | 184.2 | 276.4 | 405.3 | 608.0 | 866.0 | 1253 | -4.25 | 0.95 |
| 15 | 149.4 | 224.1 | 328.7 | 493.1 | 702.2 | 1016 | -4.13 | 0.62 |
| 20 | 121.9 | 182.8 | 268.2 | 402.2 | 572.9 | 828.8 | -4.01 | 0.31 |
| 25 | 100.0 | 150.0 | 220.0 | 330.0 | 470.0 | 680.0 | -3.90 | 0.00 |
| 30 | 82.49 | 123.7 | 181.5 | 272.2 | 387.7 | 561.0 | -3.80 | 0.30 |
| 35 | 68.41 | 102.6 | 150.5 | 225.8 | 321.5 | 465.2 | -3.69 | 0.58 |
| 40 | 57.02 | 85.54 | 125.5 | 188.2 | 268.0 | 387.8 | -3.59 | 0.86 |
| 45 | 47.77 | 71.65 | 105.1 | 157.6 | 224.5 | 324.8 | -3.50 | 1.13 |
| 50 | 40.20 | 60.30 | 88.44 | 132.7 | 188.9 | 273.3 | -3.40 | 1.39 |
| 55 | 33.98 | 50.98 | 74.76 | 112.1 | 159.7 | 231.1 | -3.31 | 1.64 |
| 60 | 28.86 | 43.28 | 63.48 | 95.23 | 135.6 | 196.2 | -3.23 | 1.88 |
| 65 | 24.61 | 36.91 | 54.13 | 81.20 | 115.6 | 167.3 | -3.15 | 2.12 |
| 70 | 21.07 | 31.60 | 46.35 | 69.52 | 99.01 | 143.3 | -3.07 | 2.35 |
| 75 | 18.11 | 27.16 | 39.84 | 59.76 | 85.11 | 123.1 | -2.99 | 2.57 |
| 80 | 15.62 | 23.43 | 34.37 | 51.56 | 73.43 | 106.2 | -2.91 | 2.79 |
| 85 | 13.53 | 20.29 | 29.76 | 44.65 | 63.59 | 92.00 | -2.84 | 3.00 |
| 90 | 11.76 | 17.63 | 25.86 | 38.80 | 55.26 | 79.95 | -2.77 | 3.21 |
| 95 | 10.25 | 15.38 | 22.55 | 33.83 | 48.18 | 69.71 | -2.71 | 3.41 |
| 100 | 8.968 | 13.45 | 19.73 | 29.59 | 42.15 | 60.98 | -2.64 | 3.60 |
| 105 | 7.871 | 11.81 | 17.32 | 25.97 | 36.99 | 53.52 | -2.58 | 3.79 |
| 110 | 6.928 | 10.39 | 15.24 | 22.86 | 32.56 | 47.11 | -2.52 | 3.97 |
| 115 | 6.117 | 9.176 | 13.46 | 20.19 | 28.75 | 41.60 | -2.46 | 4.15 |
| 120 | 5.416 | 8.125 | 11.92 | 17.87 | 25.46 | 36.83 | -2.41 | 4.33 |
| 125 | 4.809 | 7.214 | 10.58 | 15.87 | 22.60 | 32.70 | -2.35 | 4.50 |
| 130 | 4.282 | 6.422 | 9.419 | 14.13 | 20.12 | 29.11 | -2.30 | 4.66 |
| 135 | 3.822 | 5.732 | 8.408 | 12.61 | 17.96 | 25.99 | -2.25 | 4.83 |
| 140 | 3.420 | 5.130 | 7.523 | 11.29 | 16.07 | 23.25 | -2.20 | 4.99 |
| 145 | 3.068 | 4.601 | 6.749 | 10.12 | 14.42 | 20.86 | -2.15 | 5.14 |
| 150 | 2.758 | 4.137 | 6.068 | 9.102 | 12.96 | 18.76 | -2.10 | 5.29 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (1, 1.5, 2) k Ω | | | | | |
|----------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------|---------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3102*** | PART NUMBER NTCLE100E3152*** | PART NUMBER NTCLE100E3202*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| | R_T (Ω) | R_T (Ω) | R_T (Ω) | | |
| -40 | 23 342 | 35 013 | 46 684 | - 6.06 | 1.65 |
| -35 | 17 336 | 26 004 | 34 672 | - 5.84 | 1.49 |
| -30 | 13 018 | 19 526 | 26 035 | - 5.62 | 1.34 |
| -25 | 9877 | 14 816 | 19 754 | - 5.42 | 1.19 |
| -20 | 7569 | 11 353 | 15 138 | - 5.23 | 1.05 |
| -15 | 5855 | 8782 | 11 709 | - 5.05 | 0.92 |
| -10 | 4569 | 6854 | 9138 | - 4.87 | 0.79 |
| -5 | 3596 | 5395 | 7193 | - 4.71 | 0.66 |
| 0 | 2854 | 4280 | 5707 | - 4.55 | 0.54 |
| 5 | 2282 | 3422 | 4563 | - 4.40 | 0.43 |
| 10 | 1838 | 2757 | 3675 | - 4.26 | 0.31 |
| 15 | 1491 | 2236 | 2981 | - 4.12 | 0.21 |
| 20 | 1217 | 1826 | 2434 | - 3.99 | 0.10 |
| 25 | 1000 | 1500 | 2000 | - 3.87 | 0.00 |
| 30 | 826.6 | 1240 | 1653 | - 3.75 | 0.10 |
| 35 | 687.3 | 1031 | 1375 | - 3.63 | 0.19 |
| 40 | 574.6 | 861.9 | 1149 | - 3.53 | 0.28 |
| 45 | 482.7 | 724.0 | 965.4 | - 3.42 | 0.37 |
| 50 | 407.4 | 611.0 | 814.7 | - 3.32 | 0.46 |
| 55 | 345.2 | 517.8 | 690.5 | - 3.23 | 0.54 |
| 60 | 293.7 | 440.6 | 587.4 | - 3.14 | 0.62 |
| 65 | 250.8 | 376.2 | 501.6 | - 3.05 | 0.70 |
| 70 | 214.9 | 322.4 | 429.8 | - 2.97 | 0.78 |
| 75 | 184.7 | 277.1 | 369.5 | - 2.89 | 0.86 |
| 80 | 159.3 | 238.9 | 318.6 | - 2.81 | 0.93 |
| 85 | 137.7 | 206.6 | 275.5 | - 2.73 | 1.01 |
| 90 | 119.4 | 179.1 | 238.8 | - 2.66 | 1.08 |
| 95 | 103.8 | 155.7 | 207.6 | - 2.59 | 1.15 |
| 100 | 90.45 | 135.7 | 180.9 | - 2.53 | 1.22 |
| 105 | 79.00 | 118.5 | 158.0 | - 2.46 | 1.29 |
| 110 | 69.15 | 103.7 | 138.3 | - 2.40 | 1.35 |
| 115 | 60.66 | 90.99 | 121.3 | - 2.34 | 1.42 |
| 120 | 53.32 | 79.98 | 106.6 | - 2.29 | 1.48 |
| 125 | 46.96 | 70.44 | 93.92 | - 2.23 | 1.55 |
| 130 | 41.43 | 62.15 | 82.87 | - 2.18 | 1.61 |
| 135 | 36.63 | 54.94 | 73.25 | - 2.13 | 1.67 |
| 140 | 32.43 | 48.65 | 64.87 | - 2.08 | 1.73 |
| 145 | 28.77 | 43.16 | 57.54 | - 2.03 | 1.79 |
| 150 | 25.56 | 38.34 | 51.12 | - 1.98 | 1.85 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (2.2, 2.7, 3.3, 4.7, 5.0, 6.8, 10) k Ω | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|------------------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3222*** R_T (Ω) | PART NUMBER NTCLE100E3272*** R_T (Ω) | PART NUMBER NTCLE100E3332*** R_T (Ω) | PART NUMBER NTCLE100E3472*** R_T (Ω) | PART NUMBER NTCLE100E3502*** R_T (Ω) | PART NUMBER NTCLE100E3682*** R_T (Ω) | PART NUMBER NTCLE100E3103*** R_T (Ω) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| -40 | 73 061 | 89 665 | 109 591 | 156 084 | 166 047 | 225 824 | 332 094 | -6.62 2.79 |
| -35 | 52 778 | 64 773 | 79 167 | 112 753 | 119 950 | 163 132 | 239 900 | -6.39 2.52 |
| -30 | 38 544 | 47 304 | 57 816 | 82 344 | 87 600 | 119 136 | 175 200 | -6.18 2.26 |
| -25 | 28 443 | 34 907 | 42 665 | 60 765 | 64 643 | 87 915 | 129 287 | -5.98 2.02 |
| -20 | 21 199 | 26 017 | 31 798 | 45 288 | 48 179 | 65 524 | 96 358 | -5.78 1.78 |
| -15 | 15 950 | 19 575 | 23 925 | 34 075 | 36 250 | 49 300 | 72 500 | -5.60 1.55 |
| -10 | 12 110 | 14 862 | 18 165 | 25 872 | 27 523 | 37 431 | 55 046 | -5.42 1.33 |
| -5 | 9275 | 11 382 | 13 912 | 19 814 | 21 078 | 28 667 | 42 157 | -5.25 1.12 |
| 0 | 7162 | 8790 | 10 743 | 15 300 | 16 277 | 22 137 | 32 554 | -5.09 0.92 |
| 5 | 5574 | 6841 | 8362 | 11 909 | 12 669 | 17 230 | 25 339 | -4.93 0.72 |
| 10 | 4372 | 5365 | 6558 | 9340 | 9936 | 13 513 | 19 872 | -4.79 0.53 |
| 15 | 3454 | 4239 | 5180 | 7378 | 7849 | 10 675 | 15 698 | -4.64 0.35 |
| 20 | 2747 | 3372 | 4121 | 5869 | 6244 | 8492 | 12 488 | -4.51 0.17 |
| 25 | 2200 | 2700 | 3300 | 4700 | 5000 | 6800 | 10 000 | -4.38 0.00 |
| 30 | 1773 | 2176 | 2659 | 3788 | 4030 | 5480 | 8059 | -4.25 0.17 |
| 35 | 1438 | 1764 | 2156 | 3071 | 3267 | 4444 | 6535 | -4.13 0.32 |
| 40 | 1173 | 1439 | 1759 | 2505 | 2665 | 3624 | 5330 | -4.02 0.48 |
| 45 | 961.8 | 1180 | 1443 | 2055 | 2186 | 2973 | 4372 | -3.91 0.63 |
| 50 | 793.2 | 973.4 | 1190 | 1694 | 1803 | 2452 | 3605 | -3.80 0.77 |
| 55 | 657.5 | 806.9 | 986.3 | 1405 | 1494 | 2032 | 2989 | -3.70 0.91 |
| 60 | 547.8 | 672.3 | 821.7 | 1170 | 1245 | 1693 | 2490 | -3.60 1.05 |
| 65 | 458.6 | 562.8 | 687.9 | 979.7 | 1042 | 1417 | 2084 | -3.51 1.18 |
| 70 | 385.7 | 473.3 | 578.5 | 823.9 | 876.5 | 1192 | 1753 | -3.42 1.31 |
| 75 | 325.8 | 399.8 | 488.7 | 696.0 | 740.5 | 1007 | 1481 | -3.33 1.44 |
| 80 | 276.4 | 339.2 | 414.6 | 590.5 | 628.2 | 854.3 | 1256 | -3.25 1.56 |
| 85 | 235.5 | 289.0 | 353.2 | 503.0 | 535.2 | 727.8 | 1070 | -3.17 1.68 |
| 90 | 201.4 | 247.2 | 302.1 | 430.2 | 457.7 | 622.5 | 915.4 | -3.09 1.79 |
| 95 | 172.9 | 212.2 | 259.4 | 369.4 | 393.0 | 534.5 | 786.0 | -3.01 1.90 |
| 100 | 149.0 | 182.9 | 223.5 | 318.3 | 338.6 | 460.6 | 677.3 | -2.94 2.01 |
| 105 | 128.9 | 158.2 | 193.3 | 275.3 | 292.9 | 398.3 | 585.7 | -2.87 2.12 |
| 110 | 111.8 | 137.2 | 167.7 | 238.9 | 254.2 | 345.7 | 508.3 | -2.80 2.22 |
| 115 | 97.37 | 119.5 | 146.1 | 208.0 | 221.3 | 301.0 | 442.6 | -2.74 2.32 |
| 120 | 85.05 | 104.4 | 127.6 | 181.7 | 193.3 | 262.9 | 386.6 | -2.67 2.42 |
| 125 | 74.52 | 91.46 | 111.8 | 159.2 | 169.4 | 230.3 | 338.7 | -2.61 2.51 |
| 130 | 65.49 | 80.38 | 98.24 | 139.9 | 148.8 | 202.4 | 297.7 | -2.55 2.61 |
| 135 | 57.72 | 70.84 | 86.59 | 123.3 | 131.2 | 178.4 | 262.4 | -2.50 2.70 |
| 140 | 51.02 | 62.62 | 76.53 | 109.0 | 116.0 | 157.7 | 231.9 | -2.44 2.78 |
| 145 | 45.22 | 55.49 | 67.83 | 96.60 | 102.8 | 139.8 | 205.5 | -2.39 2.87 |
| 150 | 40.18 | 49.31 | 60.27 | 85.84 | 91.32 | 124.2 | 182.6 | -2.34 2.96 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (12, 15, 22) k Ω | | | | | |
|-----------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------|---------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3123*** | PART NUMBER NTCLE100E3153*** | PART NUMBER NTCLE100E3223*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| | R_T (k Ω) | R_T (k Ω) | R_T (k Ω) | | |
| -40 | 309.4 | 386.7 | 567.2 | -6.07 | 7.00 |
| -35 | 229.5 | 286.9 | 420.8 | -5.88 | 6.32 |
| -30 | 171.8 | 214.8 | 315.0 | -5.70 | 5.68 |
| -25 | 129.8 | 162.3 | 238.0 | -5.52 | 5.06 |
| -20 | 98.93 | 123.7 | 181.4 | -5.35 | 4.46 |
| -15 | 76.02 | 95.02 | 139.4 | -5.19 | 3.89 |
| -10 | 58.88 | 73.60 | 107.9 | -5.03 | 3.34 |
| -5 | 45.95 | 57.44 | 84.25 | -4.88 | 2.81 |
| 0 | 36.13 | 45.16 | 66.24 | -4.74 | 2.30 |
| 5 | 28.61 | 35.76 | 52.45 | -4.60 | 1.80 |
| 10 | 22.80 | 28.51 | 41.81 | -4.47 | 1.33 |
| 15 | 18.30 | 22.87 | 33.55 | -4.34 | 0.87 |
| 20 | 14.77 | 18.47 | 27.08 | -4.22 | 0.43 |
| 25 | 12.00 | 15.00 | 22.00 | -4.10 | 0.00 |
| 30 | 9.804 | 12.25 | 17.97 | -3.99 | 0.41 |
| 35 | 8.054 | 10.07 | 14.77 | -3.88 | 0.81 |
| 40 | 6.652 | 8.315 | 12.20 | -3.77 | 1.20 |
| 45 | 5.522 | 6.903 | 10.12 | -3.67 | 1.58 |
| 50 | 4.607 | 5.759 | 8.447 | -3.58 | 1.94 |
| 55 | 3.862 | 4.828 | 7.081 | -3.48 | 2.29 |
| 60 | 3.252 | 4.066 | 5.963 | -3.39 | 2.64 |
| 65 | 2.751 | 3.439 | 5.044 | -3.30 | 2.97 |
| 70 | 2.337 | 2.921 | 4.284 | -3.22 | 3.29 |
| 75 | 1.993 | 2.492 | 3.654 | -3.14 | 3.60 |
| 80 | 1.707 | 2.134 | 3.129 | -3.06 | 3.91 |
| 85 | 1.467 | 1.834 | 2.690 | -2.99 | 4.20 |
| 90 | 1.266 | 1.582 | 2.321 | -2.92 | 4.49 |
| 95 | 1.096 | 1.370 | 2.010 | -2.85 | 4.77 |
| 100 | 0.9524 | 1.190 | 1.746 | -2.78 | 5.04 |
| 105 | 0.8302 | 1.038 | 1.522 | -2.71 | 5.31 |
| 110 | 0.7260 | 0.9075 | 1.331 | -2.65 | 5.56 |
| 115 | 0.6369 | 0.7961 | 1.168 | -2.59 | 5.82 |
| 120 | 0.5604 | 0.7005 | 1.027 | -2.53 | 6.06 |
| 125 | 0.4945 | 0.6181 | 0.9065 | -2.47 | 6.30 |
| 130 | 0.4375 | 0.5469 | 0.8022 | -2.42 | 6.53 |
| 135 | 0.3882 | 0.4853 | 0.7117 | -2.37 | 6.76 |
| 140 | 0.3454 | 0.4317 | 0.6332 | -2.31 | 6.98 |
| 145 | 0.3080 | 0.3850 | 0.5647 | -2.26 | 7.20 |
| 150 | 0.2754 | 0.3442 | 0.5049 | -2.22 | 7.41 |



For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (33, 47, 50, 68, 100) k Ω | | | | | | | | | |
|--------------------------------------------------------------------------------------------------|---------------------------|------------------------|--------------|------------------------------------------|------------------------|------------------------|------------------------|--------------|------------------------------------------|
| T_{OPER} (°C) | PART NUMBER NTCLE100E3 | | | | | | | | |
| | 333*** | 473*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) | 503*** | 683*** | 104*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| | R_T (k Ω) | R_T (k Ω) | | | R_T (k Ω) | R_T (k Ω) | R_T (k Ω) | | |
| - 40 | 1116 | 1589 | - 6.54 | 5.74 | 1833 | 2493 | 3666 | - 6.69 | 5.88 |
| - 35 | 808.6 | 1152 | - 6.34 | 5.19 | 1319 | 1794 | 2638 | - 6.49 | 5.31 |
| - 30 | 591.7 | 842.8 | - 6.15 | 4.66 | 958.3 | 1303 | 1917 | - 6.29 | 4.77 |
| - 25 | 437.1 | 622.6 | - 5.96 | 4.15 | 703.1 | 956.2 | 1406 | - 6.10 | 4.25 |
| - 20 | 325.9 | 464.1 | - 5.79 | 3.66 | 520.6 | 708.0 | 1041 | - 5.92 | 3.75 |
| - 15 | 245.0 | 349.0 | - 5.62 | 3.19 | 388.9 | 528.9 | 777.8 | - 5.75 | 3.27 |
| - 10 | 185.8 | 264.6 | - 5.45 | 2.74 | 293.0 | 398.5 | 586.1 | - 5.58 | 2.80 |
| - 5 | 142.0 | 202.3 | - 5.30 | 2.30 | 222.6 | 302.8 | 445.3 | - 5.42 | 2.36 |
| 0 | 109.4 | 155.8 | - 5.14 | 1.88 | 170.5 | 231.8 | 340.9 | - 5.26 | 1.93 |
| 5 | 84.91 | 120.9 | - 5.00 | 1.48 | 131.5 | 178.9 | 263.1 | - 5.11 | 1.52 |
| 10 | 66.37 | 94.53 | - 4.86 | 1.09 | 102.2 | 139.0 | 204.4 | - 4.97 | 1.12 |
| 15 | 52.24 | 74.40 | - 4.72 | 0.71 | 80.01 | 108.8 | 160.0 | - 4.83 | 0.73 |
| 20 | 41.39 | 58.95 | - 4.59 | 0.35 | 63.04 | 85.74 | 126.1 | - 4.70 | 0.36 |
| 25 | 33.00 | 47.00 | - 4.47 | 0.00 | 50.00 | 68.00 | 100.0 | - 4.57 | 0.00 |
| 30 | 26.47 | 37.71 | - 4.35 | 0.34 | 39.90 | 54.27 | 79.81 | - 4.45 | 0.35 |
| 35 | 21.37 | 30.43 | - 4.23 | 0.67 | 32.04 | 43.57 | 64.08 | - 4.33 | 0.68 |
| 40 | 17.34 | 24.70 | - 4.12 | 0.99 | 25.87 | 35.19 | 51.75 | - 4.22 | 1.01 |
| 45 | 14.15 | 20.15 | - 4.01 | 1.29 | 21.01 | 28.57 | 42.02 | - 4.11 | 1.33 |
| 50 | 11.61 | 16.53 | - 3.91 | 1.59 | 17.15 | 23.33 | 34.31 | - 4.00 | 1.63 |
| 55 | 9.572 | 13.63 | - 3.81 | 1.88 | 14.08 | 19.15 | 28.16 | - 3.90 | 1.93 |
| 60 | 7.931 | 11.30 | - 3.71 | 2.16 | 11.61 | 15.79 | 23.22 | - 3.80 | 2.21 |
| 65 | 6.603 | 9.404 | - 3.62 | 2.43 | 9.623 | 13.09 | 19.25 | - 3.71 | 2.49 |
| 70 | 5.522 | 7.865 | - 3.53 | 2.70 | 8.012 | 10.90 | 16.02 | - 3.62 | 2.76 |
| 75 | 4.639 | 6.607 | - 3.44 | 2.95 | 6.701 | 9.114 | 13.40 | - 3.53 | 3.03 |
| 80 | 3.913 | 5.573 | - 3.36 | 3.20 | 5.629 | 7.655 | 11.26 | - 3.45 | 3.28 |
| 85 | 3.315 | 4.721 | - 3.28 | 3.45 | 4.748 | 6.457 | 9.496 | - 3.36 | 3.53 |
| 90 | 2.819 | 4.015 | - 3.20 | 3.68 | 4.021 | 5.469 | 8.042 | - 3.28 | 3.77 |
| 95 | 2.406 | 3.427 | - 3.13 | 3.91 | 3.419 | 4.649 | 6.837 | - 3.21 | 4.01 |
| 100 | 2.062 | 2.936 | - 3.05 | 4.13 | 2.918 | 3.968 | 5.835 | - 3.13 | 4.24 |
| 105 | 1.773 | 2.525 | - 2.98 | 4.35 | 2.499 | 3.399 | 4.998 | - 3.06 | 4.46 |
| 110 | 1.530 | 2.179 | - 2.92 | 4.56 | 2.148 | 2.921 | 4.296 | - 2.99 | 4.68 |
| 115 | 1.324 | 1.886 | - 2.85 | 4.77 | 1.853 | 2.519 | 3.705 | - 2.93 | 4.89 |
| 120 | 1.150 | 1.638 | - 2.79 | 4.97 | 1.603 | 2.180 | 3.206 | - 2.86 | 5.09 |
| 125 | 1.002 | 1.427 | - 2.73 | 5.17 | 1.392 | 1.892 | 2.783 | - 2.80 | 5.29 |
| 130 | 0.8757 | 1.247 | - 2.67 | 5.36 | 1.212 | 1.648 | 2.423 | - 2.74 | 5.49 |
| 135 | 0.7675 | 1.093 | - 2.61 | 5.54 | 1.058 | 1.439 | 2.116 | - 2.68 | 5.68 |
| 140 | 0.6746 | 0.9608 | - 2.55 | 5.73 | 0.9269 | 1.261 | 1.854 | - 2.62 | 5.87 |
| 145 | 0.5946 | 0.8468 | - 2.50 | 5.90 | 0.8141 | 1.107 | 1.628 | - 2.57 | 6.05 |
| 150 | 0.5254 | 0.7483 | - 2.45 | 6.08 | 0.7170 | 0.9752 | 1.434 | - 2.51 | 6.23 |



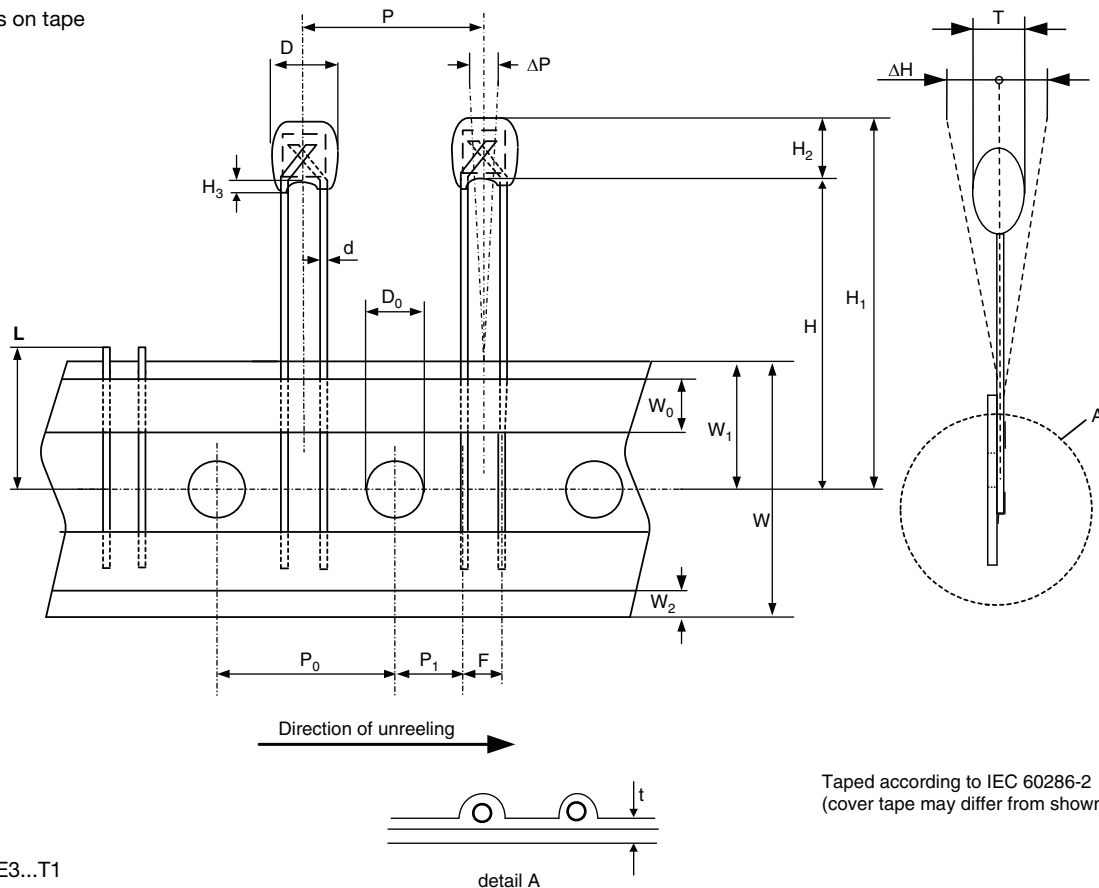
For complete Curve Computation, visit: www.vishay.com/resistors-non-linear/curve-computation-list/

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH R_{25} AT (150, 220, 330, 470) k Ω

| T_{OPER} (°C) | PART NUMBER NTCLE100E3 | | | | | | | |
|--------------------|---------------------------|------------------------|--------------|------------------------------------------|------------------------|------------------------|--------------|------------------------------------------|
| | 154*** | 224*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) | 334*** | 474*** | TCR (%/K) | $\Delta R/R$ DUE TO $B_{tol.}$ (%) |
| | R_T (k Ω) | R_T (k Ω) | | | R_T (k Ω) | R_T (k Ω) | | |
| - 40 | 6153 | 9024 | - 6.83 | 10.22 | 16 044 | 22 850 | - 7.14 | 6.41 |
| - 35 | 4394 | 6444 | - 6.64 | 9.24 | 11 282 | 16 068 | - 6.94 | 5.80 |
| - 30 | 3168 | 4646 | - 6.45 | 8.29 | 8013 | 11 413 | - 6.74 | 5.20 |
| - 25 | 2305 | 3381 | - 6.27 | 7.39 | 5747 | 8185 | - 6.55 | 4.64 |
| - 20 | 1693 | 2483 | - 6.09 | 6.52 | 4161 | 5926 | - 6.37 | 4.09 |
| - 15 | 1254 | 1839 | - 5.92 | 5.68 | 3040 | 4329 | - 6.19 | 3.57 |
| - 10 | 936.4 | 1373 | - 5.75 | 4.88 | 2240 | 3190 | - 6.02 | 3.06 |
| - 5 | 705.0 | 1034 | - 5.60 | 4.10 | 1665 | 2371 | - 5.85 | 2.57 |
| 0 | 535.0 | 784.7 | - 5.44 | 3.36 | 1248 | 1777 | - 5.69 | 2.11 |
| 5 | 409.1 | 600.0 | - 5.29 | 2.64 | 942.3 | 1342 | - 5.54 | 1.65 |
| 10 | 315.1 | 462.1 | - 5.15 | 1.94 | 717.1 | 1021 | - 5.39 | 1.22 |
| 15 | 244.4 | 358.4 | - 5.01 | 1.27 | 549.8 | 783.0 | - 5.24 | 0.80 |
| 20 | 190.8 | 279.9 | - 4.88 | 0.63 | 424.5 | 604.6 | - 5.10 | 0.39 |
| 25 | 150.0 | 220.0 | - 4.75 | 0.00 | 330.0 | 470.0 | - 4.97 | 0.00 |
| 30 | 118.6 | 174.0 | - 4.63 | 0.60 | 258.2 | 367.8 | - 4.84 | 0.38 |
| 35 | 94.42 | 138.5 | - 4.51 | 1.19 | 203.4 | 289.6 | - 4.72 | 0.75 |
| 40 | 75.58 | 110.9 | - 4.39 | 1.76 | 161.1 | 229.5 | - 4.59 | 1.10 |
| 45 | 60.85 | 89.24 | - 4.28 | 2.30 | 128.4 | 182.9 | - 4.48 | 1.45 |
| 50 | 49.25 | 72.24 | - 4.17 | 2.83 | 103.0 | 146.7 | - 4.37 | 1.78 |
| 55 | 40.08 | 58.78 | - 4.07 | 3.35 | 83.00 | 118.2 | - 4.26 | 2.10 |
| 60 | 32.78 | 48.08 | - 3.97 | 3.85 | 67.26 | 95.80 | - 4.15 | 2.41 |
| 65 | 26.94 | 39.51 | - 3.87 | 4.33 | 54.79 | 78.04 | - 4.05 | 2.72 |
| 70 | 22.25 | 32.63 | - 3.78 | 4.80 | 44.85 | 63.88 | - 3.95 | 3.01 |
| 75 | 18.46 | 27.07 | - 3.69 | 5.26 | 36.90 | 52.55 | - 3.86 | 3.30 |
| 80 | 15.38 | 22.56 | - 3.60 | 5.70 | 30.49 | 43.43 | - 3.77 | 3.58 |
| 85 | 12.87 | 18.88 | - 3.52 | 6.14 | 25.31 | 36.05 | - 3.68 | 3.85 |
| 90 | 10.82 | 15.87 | - 3.44 | 6.56 | 21.10 | 30.06 | - 3.59 | 4.11 |
| 95 | 9.129 | 13.39 | - 3.36 | 6.96 | 17.67 | 25.16 | - 3.51 | 4.37 |
| 100 | 7.732 | 11.34 | - 3.28 | 7.36 | 14.85 | 21.15 | - 3.43 | 4.62 |
| 105 | 6.574 | 9.642 | - 3.21 | 7.75 | 12.53 | 17.85 | - 3.35 | 4.86 |
| 110 | 5.610 | 8.228 | - 3.14 | 8.13 | 10.62 | 15.12 | - 3.28 | 5.10 |
| 115 | 4.804 | 7.046 | - 3.07 | 8.49 | 9.029 | 12.86 | - 3.21 | 5.33 |
| 120 | 4.128 | 6.054 | - 3.00 | 8.85 | 7.704 | 10.97 | - 3.14 | 5.55 |
| 125 | 3.559 | 5.219 | - 2.94 | 9.20 | 6.597 | 9.396 | - 3.07 | 5.77 |
| 130 | 3.078 | 4.514 | - 2.87 | 9.54 | 5.668 | 8.072 | - 3.00 | 5.99 |
| 135 | 2.670 | 3.916 | - 2.81 | 9.87 | 4.885 | 6.958 | - 2.94 | 6.20 |
| 140 | 2.323 | 3.408 | - 2.75 | 10.20 | 4.224 | 6.016 | - 2.88 | 6.40 |
| 145 | 2.028 | 2.974 | - 2.69 | 10.52 | 3.663 | 5.217 | - 2.82 | 6.60 |
| 150 | 1.774 | 2.603 | - 2.64 | 10.83 | 3.186 | 4.538 | - 2.76 | 6.79 |

PACKAGING
TAPE SPECIFICATIONS

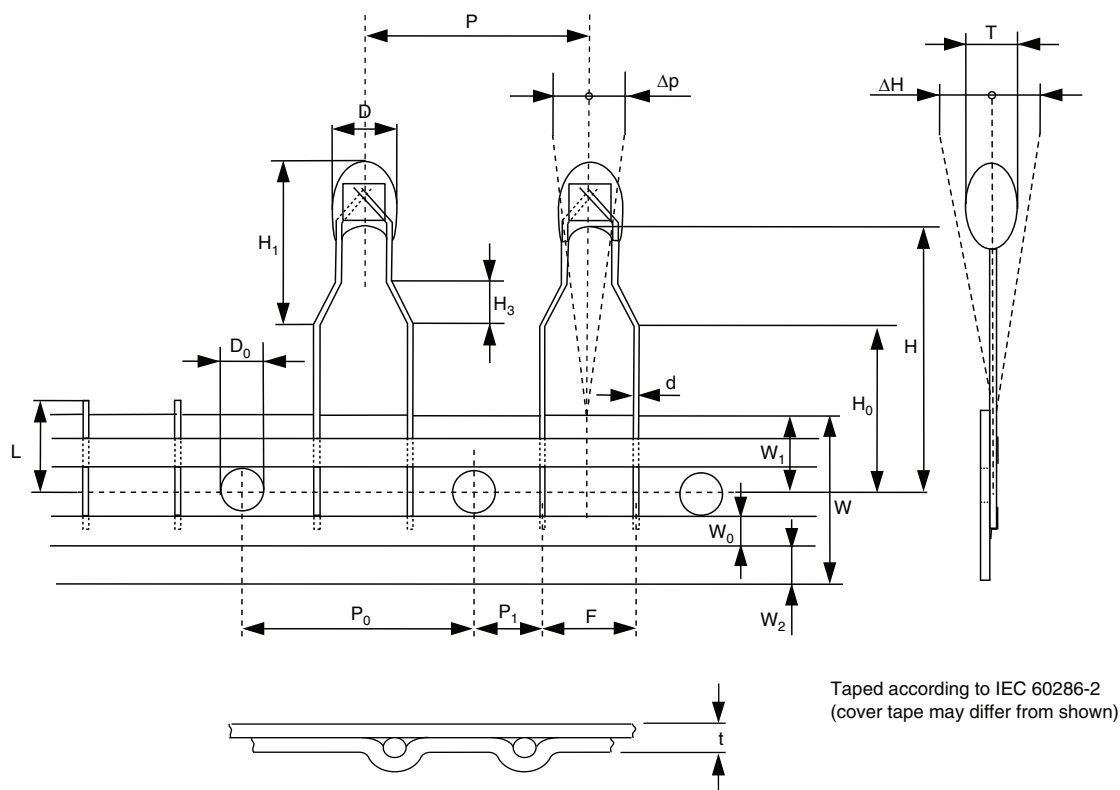
Thermistors on tape


Taped according to IEC 60286-2
(cover tape may differ from shown)

1E pitch
NTCLE100E3...T1

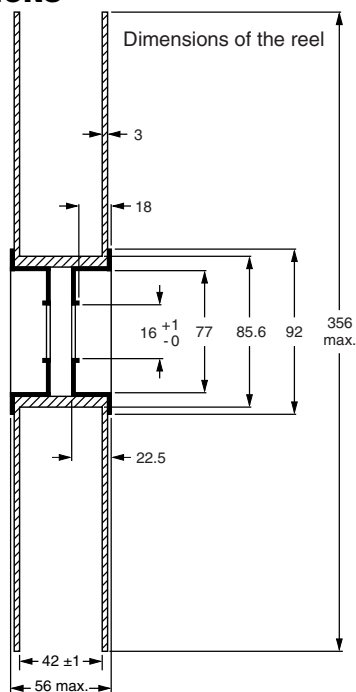
| DIMENSIONS in millimeters | | | | |
|------------------------------------------|------------|--------------------|--------------------|---------------------------------------------------------------------------------------|
| DETAILS | SYMBOL | DIMENSIONS NOMINAL | TOLERANCE | REMARKS |
| Body diameter | D | 3.3 | ± 0.5 | 5 max. for 3.3 Ω to 220 Ω |
| Lead diameter | d | 0.6 | ± 0.06 | |
| Feed hole diameter | D_0 | 4.0 | ± 0.2 | |
| Lead to lead distance | F | 2.54 | ± 0.3 | Guaranteed between component and tape |
| Distance component to tape centre | H | 22.0 | ± 1.0 | 1 to 4 max. for 3.3 Ω to 220 Ω |
| Component height | H_1 | 32.2 | max. | |
| Component alignment | Δh | 0 | ± 2.0 | |
| Distance top/bottom of components | H_2 | 6 | max. | |
| Length of lacquer under the comp. bottom | H_3 | 2 | ± 1 | |
| Length of snapped lead | L | 11.0 | max. | |
| Pitch between thermistors | P | 12.7 | ± 1.0 | Cumulative pitch error ± 1 mm/20 pitches guaranteed between component and tape |
| Feed hole pitch | P_0 | 12.7 | ± 0.3 | |
| Feed hole center to lead center | P_1 | 5.08 | ± 0.7 | |
| Component alignment | Δp | 0 | ± 1.3 | |
| Total thickness | T | 3.0 | max. | 4 max. for 3.3 Ω to 220 Ω with cardboard tape 0.5 ± 0.1 |
| Total tape thickness | t | 0.9 | max. | |
| Tape width | W | 18.0 | ± 1.0 - 0.5 | None of the hold down tapes may cover the holes |
| Hold down tape width | W_0 | 5.0 | ± 0.3 | |
| Hole position | W_1 | 9.0 | ± 0.5 | |
| Hold down tape position | W_2 | 1.5 | ± 1.0 | |

Thermistors on tape


2E pitch

NTCLE100E3...T2

| DIMENSIONS in millimeters | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------|
| DETAILS | SYMBOL | DIMENSIONS NOMINAL | TOLERANCE | REMARKS |
| Body diameter Lead diameter Feed hole diameter | D d D ₀ | 3.3 0.6 4.0 | ± 0.5 ± 0.06 ± 0.2 | 5 max. for 3.3 Ω to 220 Ω |
| Lead to lead distance | F | 5.0 | + 0.6 - 0.1 | Guaranteed between component and tape |
| Distance component to tape centre Component height Component alignment Distance top/bottom of components Length of lacquer under the comp. bottom | H H ₀ H ₁ Δh H ₃ | 20.0 16.0 10.0 0.0 0.0 | ± 2.0 ± 0.5 max. ± 2.0 | 12 max. for 100 Ω to 220 Ω Not defined |
| Length of snapped lead | L | 11.0 | max. | |
| Pitch between thermistors Feed hole pitch Feed hole center to lead center Component alignment | P P ₀ P ₁ Δp | 12.7 12.7 3.81 0.0 | ± 1.0 ± 0.3 ± 0.7 ± 1.3 | Cumulative pitch error ± 1 mm/20 pitches guaranteed between component and tape |
| Total thickness Total tape thickness | T t | 3.0 0.9 | max. max. | 4 max. for 3.3 Ω to 220 Ω with cardboard tape 0.5 ± 0.1 |
| Tape width Hold down tape width Hole position Hold down tape position | W W ₀ W ₁ W ₂ | 18.0 5.0 9.0 1.5 | ± 1.0 - 0.5 ± 0.3 ± 0.5 ± 1.0 | None of the hold down tapes may cover the holes |

REEL SPECIFICATIONS

CODE NUMBERS AND RELEVANT

| PARAMETER | Quantity | |
|------------------------------------------|------------------|-----------------------------------|
| BULK | NTCLE100E3....B0 | 500 |
| TAPE AND REEL 1E PITCH ⁽¹⁾ | NTCLE100E3....T1 | 1500 per reel, 2 reels per box |
| TAPE AND REEL 2E PITCH ⁽¹⁾ | NTCLE100E3....T2 | 1500 per reel, 2 reels per box |

CHARACTERISTICS OF TAPED PRODUCTS

Minimum pull-out force of the component: 5 N

Minimum peel-off force of adhesive tape: 6 N

Minimum tearing force tape: 15 N

Minimum pull-off force of tape-reel: 5 N

STORAGE CONDITIONS

Storage temperature range: - 25 °C to + 40 °C

Maximum relative humidity: 80 %, non-condensing

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with "IEC publication 60068-2; Environmental testing", except where indicated.

STABILITY TESTS

| CECC 32 100 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS |
|-----------------------|----------------------------|-----------------------------|-----------------------------------|------------------------------------|
| D3; 4.20.1 | | Endurance | 25 °C; 1000 h | $\Delta R/R < 1 \%$ |
| | 1 | Endurance | - 40 °C; 1000 h | $\Delta R/R < 1 \%$ |
| | 539 | Endurance | 500 mW; 55 °C; 1000 h | $\Delta R/R < 3 \%$ ⁽¹⁾ |
| | 2 | Dry heat, (steady state) | 125 °C; 1000 h | $\Delta R/R < 3 \%$ |
| D1; 4.19 | 3 | Damp heat (steady state) | 56 days at 40 °C; 90 % to 95 % RH | $\Delta R/R < 3 \%$ |
| C2; 4.14 | 14 | Rapid change of temperature | - 40 °C to + 125 °C; 50 cycles | $\Delta R/R < 2 \%$ |

Other applicable tests

| | | | | |
|--|-----------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| | 21 | Robustness of leads: Tensile strength Bending | Loading force 10 N Loading force 5 N | $\Delta R/R \leq 1 \%$ |
| | 58 | Soldering: Solderability Resistance to heat | 240 °C max.; duration 4 s max. 265 °C max.; duration 5 s max. | $\Delta R/R \leq 1 \%$ ⁽²⁾ |
| | 27 | Impact | Free fall; 1 m | $\Delta R/R \leq 1 \%$ |
| | 29 | Shock | 490 m/s; half sinewave | $\Delta R/R \leq 1 \%$ |
| | 45 | Resistance to solvent (isopropanol) | Ambient temp for 5 minutes; 5 N with hydrophylic cotton wool | No traces of lacquer on cotton wool |
| | 6 | Vibration | 1.5 mm peak to peak: 10 Hz to 58 Hz 10 gp: 50 Hz to 500 Hz 1 octave/min. 2 h in each direction in three orthogonal directions | No visible damage $\Delta R/R < 1 \%$ |
| | 60695-2-2 | Inflammability | 1980, needle flame test | Non-flammable |

Notes

⁽¹⁾ For $R_{25} \geq 100 \text{ k}\Omega$ the drift requirement is $\Delta R/R < 5 \%$

⁽²⁾ For R_{25} from 2.2 k Ω to 10 k Ω , requirement is $\pm 2 \%$ max.



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