# NTC Thermistors, Mini Epoxy PVC Twin Insulated Leads



## LINKS TO ADDITIONAL RESOURCES

3D Models | Design Tools | Related Documents

| QUICK REFERENCE DATA | | |
|---|---|---|
| **PARAMETER** | **VALUE** | **UNIT** |
| Resistance value at 25 °C | 4.7K to 100K | Ω |
| Tolerance on $R_{25}$-value | ± 1.0 to ± 5.0 | % |
| $B_{25/85}$-value | 3435 to 4190 | K |
| Tolerance on $B_{25/85}$ | ± 0.5 to ± 1.5 | % |
| Operating temperature range at zero dissipation | -40 to 105 | °C |
| Maximum power dissipation at 55 °C | 100 | mW |
| Accuracy of temperature measurement (for 1 % types) | ± 0.5 between 0 and 40<br>± 1.0 between -40 and 80 | °C |
| Dissipation factor δ (in still air) | ≈ 3 | mW/K |
| Response time (in oil) | ≈ 2.5 | s |
| Climatic category (LCT / UCT / days) | 40 / 105 / 28 | |
| Minimum dielectric withstanding voltage between leads and coated body | 500 | $V_{RMS}$ |
| Weight (40 mm length) | 0.2 | g |

## FEATURES

- High adhesive strength between the PVC wire and the encapsulating lacquer
- Accurate down to ± 0.3 °C
- Small body of max. 3 mm for easy installation
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available

e3

RoHS COMPLIANT

## APPLICATIONS

- Temperature measurement, sensing, and control
- On battery packs, heat-sinks, tubing, enclosures, etc.

## DESCRIPTION

These sensors consist of small NTC chip soldered between stranded AWG #30, 105 °C resistant, PVC (UL2651). The conductors are overall tinned. They are lacquered and insulated with a black epoxy coating.

## MARKING

Black lacquered body without additional mark

## PACKAGING

SPQ: 125 items (for standard 40 mm lead wire length)

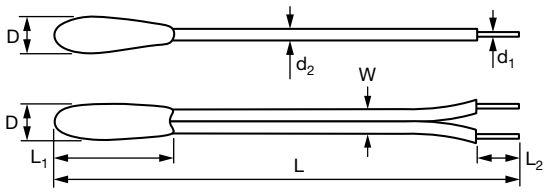
## MOUNTING

**Important mounting and handling instructions: see www.vishay.com/doc?29222**

By soldering the wire end, or crimping connector. The body can be inserted in a tube, free in air, tape attached or glued. Not intended for fluid immersed applications or continuous contact with water. Not for potting in hard material or over-molding applications. Consult Vishay for specific application or mounting.

## DESIGN-IN SUPPORT

- NTC curve computation: www.vishay.com/thermistors/ntc-rt-calculator/
- Other R/T curves available on request
- The lead length can be customized
- Connectors can be added to the wire end
- Consult Vishay for multistranded conductors for connector crimping

| **DIMENSIONS** in millimeters | |
|---|---|
| Electronic components of assessed quality measured in accordance with IEC 60539-1 | |
| **Outline** | **NTCLE413E2** |
|  |  |
| **Ø D max.** | 3.0 |
| **L** | Refer to the “Electrical Data and Ordering Information” table |
| **$L_1$ max.** | 10 |
| **$L_2$** | 3 ± 1 |
| **W** | 2 (for information) |
| **Ø $d_1$** | 0.3 ± 0.03 |
| **Ø $d_2$** | 1 (for information) |



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## ELECTRICAL DATA AND ORDERING INFORMATION

| $R_{25}$ (Ω) | $R_{25}$-TOL. (± %) | $B_{25/85}$ (K) | $B_{25/85}$-TOL. (± %) | L (mm) | R/T TABLE | SAP MATERIAL AND ORDERING NUMBER | |
|---|---|---|---|---|---|---|---|
| | | | | | | RoHS COMPLIANT WITH EXEMPTION (1) | RoHS COMPLIANT |
| 4700 | 3 | 3984 | 0.5 | 40 ± 5 | Table 1 | NTCLE413E2472H400 | NTCLE413E2472H400A |
| 5000 | 3 | 3984 | 0.5 | 40 ± 5 | Table 2 | **NTCLE413E2502H400** | **NTCLE413E2502H400A** |
| 10 000 | 1 | 3435 | 1 | 40 ± 5 | Table 3 | **NTCLE413E2103F400L** | **NTCLE413E2103F404A** |
| 10 000 | 1 | 3435 | 1 | 52 ± 5 | Table 3 | **NTCLE413E2103F520L** | **NTCLE413E2103F524A** |
| 10 000 | 1 | 3435 | 1 | 1000 ± 20 | Table 3 | **NTCLE413E2103F102L** | **NTCLE413E2103F106A** |
| 10 000 | 5 | 3435 | 1 | 52 ± 5 | Table 4 | **NTCLE413E2103J520L** | **NTCLE413E2103J524A** |
| 10 000 | 3 | 3984 | 0.5 | 40 ± 5 | Table 5 | **NTCLE413E2103H400** | **NTCLE413E2103H400A** |
| 10 000 | 3 | 3984 | 0.5 | 400 ± 10 | Table 5 | NTCLE413E2103H401 | NTCLE413E2103H401A |
| 47 000 | 3 | 4090 | 1.5 | 40 ± 5 | Table 6 | NTCLE413E2473H400 | NTCLE413E2473H400A |
| 100 000 | 3 | 4190 | 1.5 | 40 ± 5 | Table 7 | NTCLE413E2104H400 | NTCLE413E2104H400A |

**Notes**

Preferred versions for new designs

- Preferred types are marked in **bold**

(1) RoHS exemption 7(c)-I: electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezo-electronic devices, or in a glass or ceramic matrix compound

**Table 1**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 4.7K 3 % B3984 K | 4.7 | 3 | 3984 | 0.5 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 157 109 | 33.427 | 4.92 | -6.63 | 0.74 | 149 382 | 164 836 |
| -35.0 | 113 422 | 24.132 | 4.73 | -6.41 | 0.74 | 108 052 | 118 791 |
| -30.0 | 82 782 | 17.613 | 4.56 | -6.19 | 0.74 | 79 010 | 86 555 |
| -25.0 | 61 053 | 12.990 | 4.39 | -5.99 | 0.73 | 58 375 | 63 731 |
| -20.0 | 45 478 | 9.6761 | 4.22 | -5.79 | 0.73 | 43 557 | 47 399 |
| -15.0 | 34 199 | 7.2765 | 4.07 | -5.61 | 0.73 | 32 809 | 35 590 |
| -10.0 | 25 953 | 5.5218 | 3.92 | -5.43 | 0.72 | 24 936 | 26 969 |
| -5.0 | 19 866 | 4.2268 | 3.77 | -5.26 | 0.72 | 19 117 | 20 615 |
| 0.0 | 15 333 | 3.2624 | 3.63 | -5.10 | 0.71 | 14 777 | 15 890 |
| 5.0 | 11 929 | 2.5381 | 3.49 | -4.94 | 0.71 | 11 512 | 12 346 |
| 10.0 | 9351.5 | 1.9897 | 3.36 | -4.80 | 0.70 | 9036.9 | 9666.2 |
| 15.0 | 7384.3 | 1.5711 | 3.24 | -4.65 | 0.70 | 7145.1 | 7623.5 |
| 20.0 | 5871.6 | 1.2493 | 3.12 | -4.52 | 0.69 | 5688.5 | 6054.6 |
| 25.0 | 4700.0 | 1.00000 | 3.00 | -4.39 | 0.68 | 4559.0 | 4841.0 |
| 30.0 | 3786.3 | 0.80560 | 3.11 | -4.26 | 0.73 | 3668.4 | 3904.2 |
| 35.0 | 3069.0 | 0.65297 | 3.22 | -4.14 | 0.78 | 2970.1 | 3167.9 |
| 40.0 | 2502.2 | 0.53239 | 3.33 | -4.03 | 0.83 | 2418.9 | 2585.5 |
| 45.0 | 2051.7 | 0.43653 | 3.43 | -3.92 | 0.88 | 1981.3 | 2122.1 |
| 50.0 | 1691.4 | 0.35987 | 3.53 | -3.81 | 0.93 | 1631.7 | 1751.1 |
| 55.0 | 1401.7 | 0.29823 | 3.63 | -3.71 | 0.98 | 1350.8 | 1452.5 |
| 60.0 | 1167.4 | 0.24838 | 3.72 | -3.61 | 1.03 | 1123.9 | 1210.9 |
| 65.0 | 976.97 | 0.20787 | 3.81 | -3.51 | 1.09 | 939.70 | 1014.2 |
| 70.0 | 821.40 | 0.17477 | 3.90 | -3.42 | 1.14 | 789.34 | 853.45 |
| 75.0 | 693.68 | 0.14759 | 3.99 | -3.34 | 1.20 | 666.02 | 721.35 |
| 80.0 | 588.35 | 0.12518 | 4.07 | -3.25 | 1.25 | 564.39 | 612.30 |
| 85.0 | 501.07 | 0.10661 | 4.15 | -3.17 | 1.31 | 480.26 | 521.88 |
| 90.0 | 428.45 | 0.091159 | 4.23 | -3.09 | 1.37 | 410.31 | 446.58 |
| 95.0 | 367.75 | 0.078246 | 4.31 | -3.02 | 1.43 | 351.91 | 383.60 |
| 100.0 | 316.83 | 0.067411 | 4.38 | -2.94 | 1.49 | 302.94 | 330.72 |
| 105.0 | 273.94 | 0.058284 | 4.46 | -2.87 | 1.55 | 261.73 | 286.14 |


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**Table 2**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 5K 3 % B3984 K | 5 | 3 | 3984 | 0.5 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 167 137 | 33.427 | 4.92 | -6.63 | 0.74 | 158 917 | 175 358 |
| -35.0 | 120 661 | 24.132 | 4.73 | -6.41 | 0.74 | 114 949 | 126 373 |
| -30.0 | 88 066 | 17.613 | 4.56 | -6.19 | 0.74 | 84 053 | 92 079 |
| -25.0 | 64 950 | 12.990 | 4.39 | -5.99 | 0.73 | 62 101 | 67 799 |
| -20.0 | 48 381 | 9.6761 | 4.22 | -5.79 | 0.73 | 46 337 | 50 424 |
| -15.0 | 36 382 | 7.2765 | 4.07 | -5.61 | 0.73 | 34 903 | 37 862 |
| -10.0 | 27 609 | 5.5218 | 3.92 | -5.43 | 0.72 | 26 528 | 28 690 |
| -5.0 | 21 134 | 4.2268 | 3.77 | -5.26 | 0.72 | 20 337 | 21 931 |
| 0.0 | 16 312 | 3.2624 | 3.63 | -5.10 | 0.71 | 15 720 | 16 904 |
| 5.0 | 12 691 | 2.5381 | 3.49 | -4.94 | 0.71 | 12 247 | 13 134 |
| 10.0 | 9948.4 | 1.9897 | 3.36 | -4.80 | 0.70 | 9613.7 | 10 283 |
| 15.0 | 7855.6 | 1.5711 | 3.24 | -4.65 | 0.70 | 7601.2 | 8110.1 |
| 20.0 | 6246.4 | 1.2493 | 3.12 | -4.52 | 0.69 | 6051.6 | 6441.1 |
| 25.0 | 5000.0 | 1.00000 | 3.00 | -4.39 | 0.68 | 4850.0 | 5150.0 |
| 30.0 | 4028.0 | 0.80560 | 3.11 | -4.26 | 0.73 | 3902.6 | 4153.4 |
| 35.0 | 3264.9 | 0.65297 | 3.22 | -4.14 | 0.78 | 3159.6 | 3370.1 |
| 40.0 | 2661.9 | 0.53239 | 3.33 | -4.03 | 0.83 | 2573.3 | 2750.6 |
| 45.0 | 2182.6 | 0.43653 | 3.43 | -3.92 | 0.88 | 2107.7 | 2257.6 |
| 50.0 | 1799.4 | 0.35987 | 3.53 | -3.81 | 0.93 | 1735.8 | 1862.9 |
| 55.0 | 1491.1 | 0.29823 | 3.63 | -3.71 | 0.98 | 1437.0 | 1545.3 |
| 60.0 | 1241.9 | 0.24838 | 3.72 | -3.61 | 1.03 | 1195.7 | 1288.1 |
| 65.0 | 1039.3 | 0.20787 | 3.81 | -3.51 | 1.09 | 999.69 | 1079.0 |
| 70.0 | 873.83 | 0.17477 | 3.90 | -3.42 | 1.14 | 839.73 | 907.93 |
| 75.0 | 737.96 | 0.14759 | 3.99 | -3.34 | 1.20 | 708.53 | 767.39 |
| 80.0 | 625.90 | 0.12518 | 4.07 | -3.25 | 1.25 | 600.42 | 651.39 |
| 85.0 | 533.05 | 0.10661 | 4.15 | -3.17 | 1.31 | 510.92 | 555.19 |
| 90.0 | 455.79 | 0.091159 | 4.23 | -3.09 | 1.37 | 436.50 | 475.08 |
| 95.0 | 391.23 | 0.078246 | 4.31 | -3.02 | 1.43 | 374.37 | 408.08 |
| 100.0 | 337.06 | 0.067411 | 4.38 | -2.94 | 1.49 | 322.28 | 351.83 |
| 105.0 | 291.42 | 0.058284 | 4.46 | -2.87 | 1.55 | 278.44 | 304.41 |


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**Table 3**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 10K 1 % B3435 K | 10 | 1 | 3435 | 1.0 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 190 953 | 19.095 | 4.24 | -5.46 | 0.78 | 182 848 | 199 057 |
| -35.0 | 145 953 | 14.595 | 3.93 | -5.30 | 0.74 | 140 213 | 151 693 |
| -30.0 | 112 440 | 11.244 | 3.63 | -5.14 | 0.71 | 108 354 | 116 526 |
| -25.0 | 87 285 | 8.7285 | 3.35 | -4.99 | 0.67 | 84 364 | 90 206 |
| -20.0 | 68 260 | 6.8260 | 3.07 | -4.85 | 0.63 | 66 164 | 70 355 |
| -15.0 | 53 762 | 5.3762 | 2.80 | -4.71 | 0.60 | 52 254 | 55 270 |
| -10.0 | 42 636 | 4.2636 | 2.55 | -4.57 | 0.56 | 41 549 | 43 723 |
| -5.0 | 34 038 | 3.4038 | 2.30 | -4.44 | 0.52 | 33 254 | 34 822 |
| 0.0 | 27 348 | 2.7348 | 2.07 | -4.31 | 0.48 | 26 783 | 27 913 |
| 5.0 | 22 108 | 2.2108 | 1.84 | -4.19 | 0.44 | 21 702 | 22 515 |
| 10.0 | 17 979 | 1.7979 | 1.62 | -4.08 | 0.40 | 17 689 | 18 270 |
| 15.0 | 14 706 | 1.4706 | 1.40 | -3.96 | 0.35 | 14 499 | 14 912 |
| 20.0 | 12 094 | 1.2094 | 1.20 | -3.86 | 0.31 | 11 949 | 12 239 |
| 25.0 | 10 000 | 1.0000 | 1.00 | -3.75 | 0.27 | 9900.0 | 10 100 |
| 30.0 | 8310.8 | 0.83108 | 1.19 | -3.65 | 0.33 | 8211.7 | 8409.8 |
| 35.0 | 6941.1 | 0.69411 | 1.38 | -3.55 | 0.39 | 6845.5 | 7036.7 |
| 40.0 | 5824.9 | 0.58249 | 1.56 | -3.46 | 0.45 | 5734.1 | 5915.6 |
| 45.0 | 4910.6 | 0.49106 | 1.73 | -3.37 | 0.51 | 4825.6 | 4995.7 |
| 50.0 | 4158.3 | 0.41583 | 1.90 | -3.28 | 0.58 | 4079.2 | 4237.3 |
| 55.0 | 3536.2 | 0.35362 | 2.06 | -3.20 | 0.65 | 3463.2 | 3609.2 |
| 60.0 | 3019.7 | 0.30197 | 2.22 | -3.12 | 0.71 | 2952.5 | 3086.8 |
| 65.0 | 2588.8 | 0.25888 | 2.38 | -3.04 | 0.78 | 2527.3 | 2650.4 |
| 70.0 | 2228.0 | 0.22280 | 2.53 | -2.96 | 0.85 | 2171.7 | 2284.3 |
| 75.0 | 1924.6 | 0.19246 | 2.67 | -2.89 | 0.92 | 1873.1 | 1976.0 |
| 80.0 | 1668.4 | 0.16684 | 2.81 | -2.82 | 1.00 | 1621.5 | 1715.3 |
| 85.0 | 1451.3 | 0.14513 | 2.95 | -2.75 | 1.07 | 1408.5 | 1494.2 |
| 90.0 | 1266.7 | 0.12667 | 3.08 | -2.69 | 1.15 | 1227.7 | 1305.8 |
| 95.0 | 1109.2 | 0.11092 | 3.21 | -2.62 | 1.22 | 1073.6 | 1144.8 |
| 100.0 | 974.26 | 0.097426 | 3.34 | -2.56 | 1.30 | 941.74 | 1006.8 |
| 105.0 | 858.33 | 0.085833 | 3.46 | -2.50 | 1.38 | 828.62 | 888.04 |


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**Table 4**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 10K 5 % B3435 K | 10 | 5 | 3435 | 1.0 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 190 953 | 19.095 | 8.37 | -5.46 | 1.53 | 174 965 | 206 940 |
| -35.0 | 145 953 | 14.595 | 8.05 | -5.30 | 1.52 | 134 205 | 157 700 |
| -30.0 | 112 440 | 11.244 | 7.74 | -5.14 | 1.51 | 103 739 | 121 141 |
| -25.0 | 87 285 | 8.7285 | 7.44 | -4.99 | 1.49 | 80 792 | 93 779 |
| -20.0 | 68 260 | 6.8260 | 7.15 | -4.85 | 1.48 | 63 377 | 73 142 |
| -15.0 | 53 762 | 5.3762 | 6.88 | -4.71 | 1.46 | 50 066 | 57 459 |
| -10.0 | 42 636 | 4.2636 | 6.61 | -4.57 | 1.45 | 39 818 | 45 455 |
| -5.0 | 34 038 | 3.4038 | 6.35 | -4.44 | 1.43 | 31 875 | 36 201 |
| 0.0 | 27 348 | 2.7348 | 6.11 | -4.31 | 1.42 | 25 677 | 29 018 |
| 5.0 | 22 108 | 2.2108 | 5.87 | -4.19 | 1.40 | 20 810 | 23 406 |
| 10.0 | 17 979 | 1.7979 | 5.64 | -4.08 | 1.38 | 16 965 | 18 994 |
| 15.0 | 14 706 | 1.4706 | 5.42 | -3.96 | 1.37 | 13 908 | 15 503 |
| 20.0 | 12 094 | 1.2094 | 5.21 | -3.86 | 1.35 | 11 465 | 12 724 |
| 25.0 | 10 000 | 1.0000 | 5.00 | -3.75 | 1.33 | 9500.0 | 10 500 |
| 30.0 | 8310.8 | 0.83108 | 5.20 | -3.65 | 1.42 | 7878.6 | 8742.9 |
| 35.0 | 6941.1 | 0.69411 | 5.39 | -3.55 | 1.52 | 6566.8 | 7315.4 |
| 40.0 | 5824.9 | 0.58249 | 5.58 | -3.46 | 1.61 | 5499.8 | 6149.9 |
| 45.0 | 4910.6 | 0.49106 | 5.76 | -3.37 | 1.71 | 4627.7 | 5193.5 |
| 50.0 | 4158.3 | 0.41583 | 5.94 | -3.28 | 1.81 | 3911.4 | 4405.1 |
| 55.0 | 3536.2 | 0.35362 | 6.11 | -3.20 | 1.91 | 3320.3 | 3752.2 |
| 60.0 | 3019.7 | 0.30197 | 6.27 | -3.12 | 2.01 | 2830.3 | 3209.0 |
| 65.0 | 2588.8 | 0.25888 | 6.43 | -3.04 | 2.12 | 2422.3 | 2755.3 |
| 70.0 | 2228.0 | 0.22280 | 6.59 | -2.96 | 2.22 | 2081.2 | 2374.7 |
| 75.0 | 1924.6 | 0.19246 | 6.74 | -2.89 | 2.33 | 1794.9 | 2054.2 |
| 80.0 | 1668.4 | 0.16684 | 6.88 | -2.82 | 2.44 | 1553.5 | 1783.3 |
| 85.0 | 1451.3 | 0.14513 | 7.03 | -2.75 | 2.55 | 1349.4 | 1553.3 |
| 90.0 | 1266.7 | 0.12667 | 7.17 | -2.69 | 2.67 | 1176.0 | 1357.5 |
| 95.0 | 1109.2 | 0.11092 | 7.30 | -2.62 | 2.78 | 1028.2 | 1190.2 |
| 100.0 | 974.26 | 0.097426 | 7.43 | -2.56 | 2.90 | 901.86 | 1046.7 |
| 105.0 | 858.33 | 0.085833 | 7.56 | -2.50 | 3.02 | 793.45 | 923.21 |


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**Table 5**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 10K 3 % B3984 K | 10 | 3 | 3984 | 0.5 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 334 274 | 33.427 | 4.92 | -6.63 | 0.74 | 317 833 | 350 716 |
| -35.0 | 241 323 | 24.132 | 4.73 | -6.41 | 0.74 | 229 899 | 252 747 |
| -30.0 | 176 133 | 17.613 | 4.56 | -6.19 | 0.74 | 168 106 | 184 159 |
| -25.0 | 129 900 | 12.990 | 4.39 | -5.99 | 0.73 | 124 201 | 135 599 |
| -20.0 | 96 761 | 9.6761 | 4.22 | -5.79 | 0.73 | 92 674 | 100 848 |
| -15.0 | 72 765 | 7.2765 | 4.07 | -5.61 | 0.73 | 69 806 | 75 724 |
| -10.0 | 55 218 | 5.5218 | 3.92 | -5.43 | 0.72 | 53 056 | 57 380 |
| -5.0 | 42 268 | 4.2268 | 3.77 | -5.26 | 0.72 | 40 674 | 43 861 |
| 0.0 | 32 624 | 3.2624 | 3.63 | -5.10 | 0.71 | 31 440 | 33 809 |
| 5.0 | 25 381 | 2.5381 | 3.49 | -4.94 | 0.71 | 24 494 | 26 268 |
| 10.0 | 19 897 | 1.9897 | 3.36 | -4.80 | 0.70 | 19 227 | 20 566 |
| 15.0 | 15 711 | 1.5711 | 3.24 | -4.65 | 0.70 | 15 202 | 16 220 |
| 20.0 | 12 493 | 1.2493 | 3.12 | -4.52 | 0.69 | 12 103 | 12 882 |
| 25.0 | 10 000 | 1.00000 | 3.00 | -4.39 | 0.68 | 9700.0 | 10 300 |
| 30.0 | 8056.0 | 0.80560 | 3.11 | -4.26 | 0.73 | 7805.1 | 8306.8 |
| 35.0 | 6529.7 | 0.65297 | 3.22 | -4.14 | 0.78 | 6319.3 | 6740.2 |
| 40.0 | 5323.9 | 0.53239 | 3.33 | -4.03 | 0.83 | 5146.6 | 5501.1 |
| 45.0 | 4365.3 | 0.43653 | 3.43 | -3.92 | 0.88 | 4215.4 | 4515.1 |
| 50.0 | 3598.7 | 0.35987 | 3.53 | -3.81 | 0.93 | 3471.6 | 3725.8 |
| 55.0 | 2982.3 | 0.29823 | 3.63 | -3.71 | 0.98 | 2874.0 | 3090.5 |
| 60.0 | 2483.8 | 0.24838 | 3.72 | -3.61 | 1.03 | 2391.3 | 2576.3 |
| 65.0 | 2078.7 | 0.20787 | 3.81 | -3.51 | 1.09 | 1999.4 | 2157.9 |
| 70.0 | 1747.7 | 0.17477 | 3.90 | -3.42 | 1.14 | 1679.5 | 1815.9 |
| 75.0 | 1475.9 | 0.14759 | 3.99 | -3.34 | 1.20 | 1417.1 | 1534.8 |
| 80.0 | 1251.8 | 0.12518 | 4.07 | -3.25 | 1.25 | 1200.8 | 1302.8 |
| 85.0 | 1066.1 | 0.10661 | 4.15 | -3.17 | 1.31 | 1021.8 | 1110.4 |
| 90.0 | 911.59 | 0.091159 | 4.23 | -3.09 | 1.37 | 873.01 | 950.16 |
| 95.0 | 782.46 | 0.078246 | 4.31 | -3.02 | 1.43 | 748.75 | 816.17 |
| 100.0 | 674.11 | 0.067411 | 4.38 | -2.94 | 1.49 | 644.56 | 703.66 |
| 105.0 | 582.84 | 0.058284 | 4.46 | -2.87 | 1.55 | 556.87 | 608.82 |


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**Table 6**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 47K 3 % B4090 K | 47 | 3 | 4090 | 1.5 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 1 589 068 | 33.810 | 8.91 | -6.54 | 1.36 | 1 447 482 | 1 730 653 |
| -35.0 | 1 151 627 | 24.503 | 8.34 | -6.34 | 1.32 | 1 055 560 | 1 247 693 |
| -30.0 | 842 790 | 17.932 | 7.80 | -6.15 | 1.27 | 777 081 | 908 499 |
| -25.0 | 622 597 | 13.247 | 7.27 | -5.96 | 1.22 | 577 315 | 667 878 |
| -20.0 | 464 110 | 9.8747 | 6.77 | -5.79 | 1.17 | 432 690 | 495 530 |
| -15.0 | 348 989 | 7.4253 | 6.29 | -5.62 | 1.12 | 327 051 | 370 927 |
| -10.0 | 264 628 | 5.6304 | 5.82 | -5.45 | 1.07 | 249 224 | 280 032 |
| -5.0 | 202 280 | 4.3038 | 5.37 | -5.30 | 1.01 | 191 412 | 213 148 |
| 0.0 | 155 823 | 3.3154 | 4.94 | -5.14 | 0.96 | 148 124 | 163 522 |
| 5.0 | 120 932 | 2.5730 | 4.52 | -5.00 | 0.91 | 115 460 | 126 404 |
| 10.0 | 94 528 | 2.0112 | 4.12 | -4.86 | 0.85 | 90 630 | 98 425 |
| 15.0 | 74 399 | 1.5830 | 3.74 | -4.72 | 0.79 | 71 619 | 77 178 |
| 20.0 | 58 945 | 1.2542 | 3.36 | -4.59 | 0.73 | 56 964 | 60 927 |
| 25.0 | 47 000 | 1.0000 | 3.00 | -4.47 | 0.67 | 45 590 | 48 410 |
| 30.0 | 37 706 | 0.80226 | 3.35 | -4.35 | 0.77 | 36 443 | 38 969 |
| 35.0 | 30 429 | 0.64743 | 3.69 | -4.23 | 0.87 | 29 307 | 31 551 |
| 40.0 | 24 696 | 0.52545 | 4.02 | -4.12 | 0.97 | 23 705 | 25 688 |
| 45.0 | 20 154 | 0.42880 | 4.33 | -4.01 | 1.08 | 19 281 | 21 027 |
| 50.0 | 16 534 | 0.35178 | 4.64 | -3.91 | 1.19 | 15 767 | 17 301 |
| 55.0 | 13 633 | 0.29006 | 4.94 | -3.81 | 1.30 | 12 960 | 14 306 |
| 60.0 | 11 296 | 0.24035 | 5.23 | -3.71 | 1.41 | 10 706 | 11 887 |
| 65.0 | 9404.5 | 0.20010 | 5.51 | -3.62 | 1.52 | 8886.6 | 9922.3 |
| 70.0 | 7865.2 | 0.16735 | 5.78 | -3.53 | 1.64 | 7410.7 | 8319.7 |
| 75.0 | 6606.9 | 0.14057 | 6.04 | -3.44 | 1.75 | 6207.6 | 7006.2 |
| 80.0 | 5573.5 | 0.11858 | 6.30 | -3.36 | 1.87 | 5222.3 | 5924.6 |
| 85.0 | 4721.0 | 0.10045 | 6.55 | -3.28 | 2.00 | 4411.8 | 5030.2 |
| 90.0 | 4014.7 | 0.085420 | 6.79 | -3.20 | 2.12 | 3742.0 | 4287.4 |
| 95.0 | 3427.2 | 0.072919 | 7.03 | -3.13 | 2.25 | 3186.3 | 3668.1 |
| 100.0 | 2936.5 | 0.062478 | 7.26 | -3.05 | 2.38 | 2723.3 | 3149.6 |
| 105.0 | 2525.0 | 0.053723 | 7.48 | -2.98 | 2.51 | 2336.1 | 105.0 |


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**Table 7**

| PART IDENTIFICATION | $R_{25}$ | | $B_{25/85}$ | |
|---|---|---|---|---|
| | kΩ | ± % | K | ± % |
| NTCLE413 100K 3 % B4190 K | 100 | 3 | 4190 | 1.5 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMPERATURE (°C) | $R_T$ (Ω) | $R_T/R_{25}$ | $R$-TOL. (± %) | α (%/K) | T-TOL. (± °C) | $R_{MIN.}$ (Ω) | $R_{MAX.}$ (Ω) |
|---|---|---|---|---|---|---|---|
| -40.0 | 3 666 299 | 36.663 | 9.05 | -6.69 | 1.35 | 3 334 354 | 3 998 244 |
| -35.0 | 2 637 588 | 26.376 | 8.47 | -6.49 | 1.31 | 2 414 139 | 2 861 036 |
| -30.0 | 1 916 576 | 19.166 | 7.91 | -6.29 | 1.26 | 1 764 917 | 2 068 236 |
| -25.0 | 1 406 111 | 14.061 | 7.38 | -6.10 | 1.21 | 1 302 387 | 1 509 836 |
| -20.0 | 1 041 184 | 10.412 | 6.86 | -5.92 | 1.16 | 969 745 | 1 112 622 |
| -15.0 | 777 846 | 7.7785 | 6.37 | -5.75 | 1.11 | 728 330 | 827 362 |
| -10.0 | 586 097 | 5.8610 | 5.89 | -5.58 | 1.06 | 551 581 | 620 613 |
| -5.0 | 445 257 | 4.4526 | 5.43 | -5.42 | 1.00 | 421 079 | 469 435 |
| 0.0 | 340 942 | 3.4094 | 4.99 | -5.26 | 0.95 | 323 936 | 357 948 |
| 5.0 | 263 054 | 2.6305 | 4.56 | -5.11 | 0.89 | 251 054 | 275 054 |
| 10.0 | 204 446 | 2.0445 | 4.15 | -4.97 | 0.84 | 195 960 | 212 931 |
| 15.0 | 160 014 | 1.6001 | 3.75 | -4.83 | 0.78 | 154 008 | 166 020 |
| 20.0 | 126 087 | 1.2609 | 3.37 | -4.70 | 0.72 | 121 837 | 130 336 |
| 25.0 | 100 000 | 1.00000 | 3.00 | -4.57 | 0.66 | 97 000 | 103 000 |
| 30.0 | 79 808 | 0.79808 | 3.36 | -4.45 | 0.75 | 77 128 | 82 488 |
| 35.0 | 64 077 | 0.64077 | 3.70 | -4.33 | 0.86 | 61 703 | 66 451 |
| 40.0 | 51 745 | 0.51745 | 4.04 | -4.22 | 0.96 | 49 655 | 53 836 |
| 45.0 | 42 021 | 0.42021 | 4.36 | -4.11 | 1.06 | 40 187 | 43 855 |
| 50.0 | 34 308 | 0.34308 | 4.68 | -4.00 | 1.17 | 32 702 | 35 913 |
| 55.0 | 28 156 | 0.28156 | 4.98 | -3.90 | 1.28 | 26 752 | 29 559 |
| 60.0 | 23 222 | 0.23222 | 5.28 | -3.80 | 1.39 | 21 996 | 24 449 |
| 65.0 | 19 246 | 0.19246 | 5.57 | -3.71 | 1.50 | 18 174 | 20 318 |
| 70.0 | 16 025 | 0.16025 | 5.85 | -3.62 | 1.62 | 15 088 | 16 961 |
| 75.0 | 13 402 | 0.13402 | 6.12 | -3.53 | 1.73 | 12 582 | 14 222 |
| 80.0 | 11 258 | 0.11258 | 6.38 | -3.45 | 1.85 | 10 539 | 11 976 |
| 85.0 | 9495.8 | 0.094958 | 6.64 | -3.36 | 1.97 | 8865.6 | 10 126 |
| 90.0 | 8042.0 | 0.080420 | 6.89 | -3.28 | 2.10 | 7488.3 | 8595.7 |
| 95.0 | 6837.3 | 0.068373 | 7.13 | -3.21 | 2.22 | 6350.0 | 7324.7 |
| 100.0 | 5835.1 | 0.058351 | 7.36 | -3.13 | 2.35 | 5405.4 | 6264.7 |
| 105.0 | 4997.8 | 0.049978 | 7.59 | -3.06 | 2.48 | 4618.4 | 5377.3 |


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