

# NTC Thermistors, Mini Epoxy PVC Twin Insulated Leads



## LINKS TO ADDITIONAL RESOURCES



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

## FEATURES

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


**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). Terminations are solder dipped. 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](http://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

- For complete curve computation, please visit: [www.vishay.com/thermistors/ntc-curve-list/](http://www.vishay.com/thermistors/ntc-curve-list/)
- Other R/T curves available on request
- The lead length can be customized
- Connectors can be added to the wire end

| DIMENSIONS in millimeters   |  |
|---|--|
| Electronic components of assessed quality measured in accordance with IEC 60539-1 |  |
| Outline   | NTCLE413E2                                     |
|   |  |
| $\varnothing D$ max.  | 3.0  |
| L   | 40 $\pm$ 5 (or refer to table SAP description) |
| $L_1$ max.  | 10   |
| $L_2$   | 3 $\pm$ 1                                      |
| W   | 2 (for information)                            |
| $\varnothing d_1$   | 0.3 $\pm$ 0.03                                 |
| $\varnothing d_2$   | 1 (for information)                            |



ELECTRICAL DATA AND ORDERING INFORMATION

Table with 8 columns: R25 (Ω), R25-TOL. (± %), B25/85 (K), B25/85-TOL. (± %), L (mm), R/T TABLE, SAP MATERIAL AND ORDERING NUMBER (RoHS COMPLIANT WITH EXEMPTION (1) and RoHS COMPLIANT). Rows include various resistance and tolerance values and corresponding SAP part numbers.

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

Table 1: PART IDENTIFICATION table with columns for R25 (kΩ, ± %) and B25/85 (K, ± %). Example row: NTCLE413 4.7K 3 % B3984 K.

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

Table with 8 columns: TEMPERATURE (°C), RT (Ω), RT/R25, R-TOL. (± %), α (%/K), T-TOL. (± °C), RMIN. (Ω), RMAX. (Ω). Rows show resistance and tolerance values across a temperature range from -40.0°C to 105.0°C.



Table 2

| PART IDENTIFICATION     | $R_{25}$   |         | $B_{25/85}$ |         |
|-------------------------|------------|---------|-------------|---------|
|                         | k $\Omega$ | $\pm$ % | K           | $\pm$ % |
| NTCLE413 5K 3 % B3984 K | 5          | 3       | 3984        | 0.5     |

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES |                    |              |                   |                |                    |                         |                         |
|--|--------------------|--------------|-------------------|----------------|--------------------|-------------------------|-------------------------|
| TEMPERATURE (°C)                               | $R_T$ ( $\Omega$ ) | $R_T/R_{25}$ | R-TOL. ( $\pm$ %) | $\alpha$ (%/K) | T-TOL. ( $\pm$ °C) | $R_{MIN.}$ ( $\Omega$ ) | $R_{MAX.}$ ( $\Omega$ ) |
| -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                  |



Table 3

| PART IDENTIFICATION      | $R_{25}$   |         | $B_{25/85}$ |         |
|--------------------------|------------|---------|-------------|---------|
|                          | k $\Omega$ | $\pm$ % | K           | $\pm$ % |
| NTCLE413 10K 1 % B3435 K | 10         | 1       | 3435        | 1.0     |

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES |                    |              |                   |                |                    |                         |                         |
|--|--------------------|--------------|-------------------|----------------|--------------------|-------------------------|-------------------------|
| TEMPERATURE (°C)                               | $R_T$ ( $\Omega$ ) | $R_T/R_{25}$ | R-TOL. ( $\pm$ %) | $\alpha$ (%/K) | T-TOL. ( $\pm$ °C) | $R_{MIN.}$ ( $\Omega$ ) | $R_{MAX.}$ ( $\Omega$ ) |
| -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                  |



Table 4

| PART IDENTIFICATION      | $R_{25}$   |         | $B_{25/85}$ |         |
|--------------------------|------------|---------|-------------|---------|
|                          | k $\Omega$ | $\pm$ % | K           | $\pm$ % |
| NTCLE413 10K 5 % B3435 K | 10         | 5       | 3435        | 1.0     |

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES |                    |              |                   |                |                    |                         |                         |
|--|--------------------|--------------|-------------------|----------------|--------------------|-------------------------|-------------------------|
| TEMPERATURE (°C)                               | $R_T$ ( $\Omega$ ) | $R_T/R_{25}$ | R-TOL. ( $\pm$ %) | $\alpha$ (%/K) | T-TOL. ( $\pm$ °C) | $R_{MIN.}$ ( $\Omega$ ) | $R_{MAX.}$ ( $\Omega$ ) |
| -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                  |



Table 5

| PART IDENTIFICATION      | $R_{25}$   |         | $B_{25/85}$ |         |
|--------------------------|------------|---------|-------------|---------|
|                          | k $\Omega$ | $\pm$ % | K           | $\pm$ % |
| NTCLE413 10K 3 % B3984 K | 10         | 3       | 3984        | 0.5     |

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES |                    |              |                   |                |                    |                         |                         |
|--|--------------------|--------------|-------------------|----------------|--------------------|-------------------------|-------------------------|
| TEMPERATURE (°C)                               | $R_T$ ( $\Omega$ ) | $R_T/R_{25}$ | R-TOL. ( $\pm$ %) | $\alpha$ (%/K) | T-TOL. ( $\pm$ °C) | $R_{MIN.}$ ( $\Omega$ ) | $R_{MAX.}$ ( $\Omega$ ) |
| -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                  |



Table 6

| PART IDENTIFICATION      | $R_{25}$   |         | $B_{25/85}$ |         |
|--------------------------|------------|---------|-------------|---------|
|                          | k $\Omega$ | $\pm$ % | K           | $\pm$ % |
| NTCLE413 47K 3 % B4090 K | 47         | 3       | 4090        | 1.5     |

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES |                    |              |                   |                |                    |                         |                         |
|--|--------------------|--------------|-------------------|----------------|--------------------|-------------------------|-------------------------|
| TEMPERATURE (°C)                               | $R_T$ ( $\Omega$ ) | $R_T/R_{25}$ | R-TOL. ( $\pm$ %) | $\alpha$ (%/K) | T-TOL. ( $\pm$ °C) | $R_{MIN.}$ ( $\Omega$ ) | $R_{MAX.}$ ( $\Omega$ ) |
| -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                   |



Table 7

| PART IDENTIFICATION       | $R_{25}$   |         | $B_{25/85}$ |         |
|---------------------------|------------|---------|-------------|---------|
|                           | k $\Omega$ | $\pm$ % | K           | $\pm$ % |
| NTCLE413 100K 3 % B4190 K | 100        | 3       | 4190        | 1.5     |

| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES |                    |              |                   |                |                    |                         |                         |
|--|--------------------|--------------|-------------------|----------------|--------------------|-------------------------|-------------------------|
| TEMPERATURE (°C)                               | $R_T$ ( $\Omega$ ) | $R_T/R_{25}$ | R-TOL. ( $\pm$ %) | $\alpha$ (%/K) | T-TOL. ( $\pm$ °C) | $R_{MIN.}$ ( $\Omega$ ) | $R_{MAX.}$ ( $\Omega$ ) |
| -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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