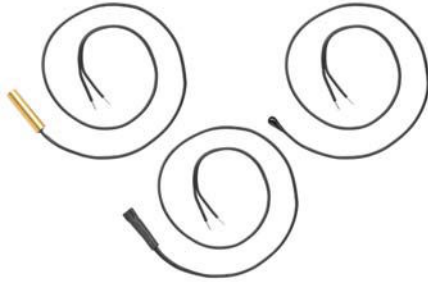


## NTC Thermistors, Special Long Lead Sensors



### FEATURES

- Accurate over wide temperature range
- High stability
- Excellent price/performance ratio
- High adhesive strength between PVC wire and the encapsulating laquer
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

Temperature measurement, sensing and control in remote locations and for various environmental conditions.

### DESCRIPTION

These sensors exist of a small NTC chip reflow soldered between two AWG24 UL-2468 wires. They are lacquered and insulated with black epoxy (NTCLE400 type), sleeved (NTCLS100 type) or potted into a brass pipe (NTCLP100 type).

### MARKING

UL mark on wire, no mark on body.

### PACKAGING

The thermistors are packed in cardboard boxes; each box containing 500 pieces.

### DESIGN-IN SUPPORT

Other wire length and wire type (UL-2651 PVC 105 °C) are available on request. The products can be provided with a connector on request.

For complete curve computation, visit:

[www.vishay.com/thermistors/curve-computation-list/](http://www.vishay.com/thermistors/curve-computation-list/)

### MOUNTING

By soldering or clamping the wire ends, in any position. Body can be inserted or taped attached. Not intended for fluid immersed applications.

| QUICK REFERENCE DATA                        |                         |          |
|---|-------------------------|----------|
| PARAMETER                                   | VALUE                   | UNIT     |
| Resistance value at 25 °C ( $R_{25}$ )      | 2.2K to 100K            | $\Omega$ |
| Tolerance on $R_{25}$ -value <sup>(2)</sup> | $\pm 3$                 | %        |
| $B_{25/85}$ -value                          | 3977 to 4190            | K        |
| Tolerance on $B_{25/85}$ -value             | $\pm 0.75$ to $\pm 1.5$ | %        |
| Operating temperature range:                |                         |          |
| At zero dissipation (continuously)          | - 40 to + 85            | °C       |
| At maximum dissipation                      | 0 to + 55               |          |
| Maximum power dissipation at 55 °C          | 250                     | mW       |
| Dissipation factor:                         |                         |          |
| NTCLE400...                                 | 6.0                     | mW/K     |
| NTCLS100...                                 | 8.0                     |          |
| NTCLP100...                                 | 6.0                     |          |
| Response time <sup>(1)</sup> :              |                         |          |
| NTCLE400...                                 | $\approx 7$             | s        |
| NTCLS100...                                 | $\approx 15$            |          |
| NTCLP100...                                 | $\approx 10$            |          |
| Climatic category (LCT/UCT/days)            | 40/085/56               |          |
| Weight                                      |                         |          |
| NTCLE400...                                 | $\approx 4$             | g        |
| NTCLS100...                                 | $\approx 6$             |          |
| NTCLP100...                                 | $\approx 6$             |          |

#### Notes

<sup>(1)</sup> Response time in silicone oil MS 200/50. This is the time needed for the sensor to reach 63.2 % of the total temperature difference when subjected to a temperature change from 25 °C in air to 85 °C in oil.

<sup>(2)</sup> Tighter tolerances on  $R_{25}$  are available upon request.

| ELECTRICAL DATA AND ORDERING INFORMATION |                    |  |                |                |                              |              |                 |
|--|--------------------|--|----------------|----------------|------------------------------|--------------|-----------------|
| $R_{25}$<br>(k $\Omega$ )                | $B_{25/85}$ -VALUE | SAP MATERIAL AND ORDERING NUMBER <sup>(3)(4)</sup> |                |                | OLD 12NC CODE 2381 641 ..... |              |                 |
|  |                    | EPOXY TYPE   | SLEEVED TYPE   | PIPE TYPE      | EPOXY-COATED TYPE            | SLEEVED TYPE | BRASS-PIPE TYPE |
| 2.2                                      | 3977K $\pm 0.75$ % | NTCLE400E3222H                                     | NTCLS100E3222H | NTCLP100E3222H | 26222                        | 36222        | 46222           |
| 4.7                                      | 3977K $\pm 0.75$ % | NTCLE400E3472H                                     | NTCLS100E3472H | NTCLP100E3472H | 26472                        | 36472        | 46472           |
| 5  | 3977K $\pm 0.75$ % | NTCLE400E3502H                                     | NTCLS100E3502H | NTCLP100E3502H | 26502                        | 36502        | 46502           |
| 10                                       | 3977K $\pm 0.75$ % | NTCLE400E3103H                                     | NTCLS100E3103H | NTCLP100E3103H | 26103                        | 36103        | 46103           |
| 47                                       | 4090K $\pm 1.5$ %  | NTCLE400E3473H                                     | NTCLS100E3473H | NTCLP100E3473H | 26473                        | 36473        | 46473           |
| 100                                      | 4190K $\pm 1.5$ %  | NTCLE400E3104H                                     | NTCLS100E3104H | NTCLP100E3104H | 26104                        | 36104        | 46104           |

#### Notes

<sup>(3)</sup> Other values and tolerances based on the NTCC100E4 series are available on request. ([www.vishay.com/doc?29058](http://www.vishay.com/doc?29058))

<sup>(4)</sup> The specified catalog numbers refer to products with L = 400 mm, without connector and adopt UL-2468.AWG24 wire.

# NTCLE400, NTCLS100, NTCLP100

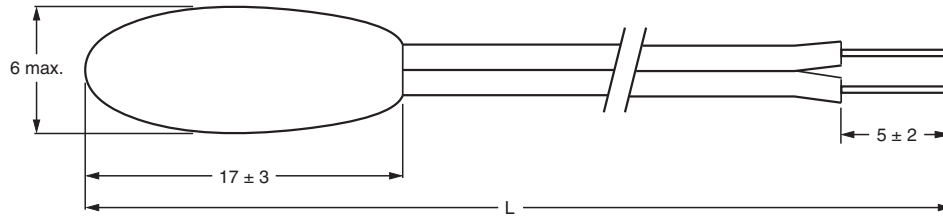


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## DIMENSIONS in millimeters

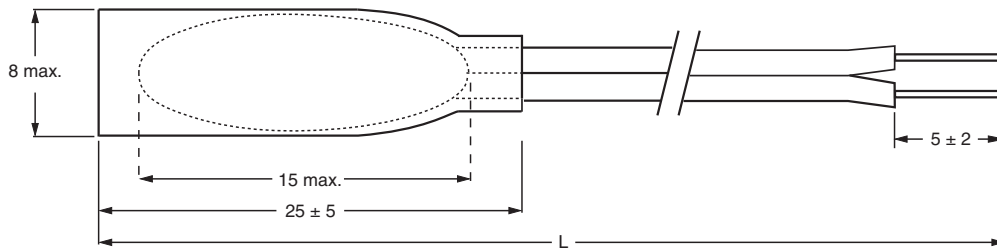
Epoxy-coated type NTCLE400E....



$$L = 400 \text{ mm} + 15/- 0$$

Other wire lengths or connector attached available on request.

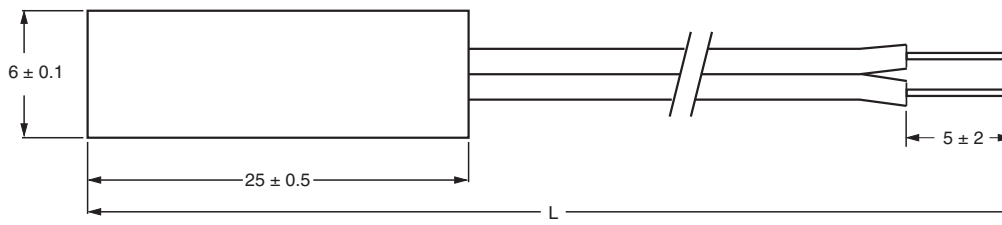
Sleeved type NTCLS100E....



$$L = 400 \text{ mm} + 15/- 0$$

Other wire lengths or connector attached available on request.

Brass-pipe type NTCLP100E....

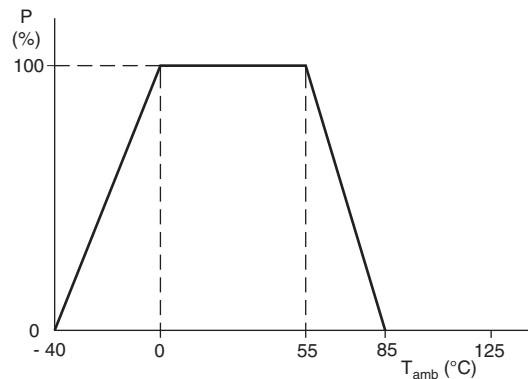


$$L = 400 \text{ mm} + 15/- 0$$

Other wire lengths or connector attached available on request.

## DERATING

Power derating curve.



### Note

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



# NTCLE400, NTCLS100, NTCLP100

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## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH $R_{25}$ AT 2.2 k $\Omega$ , 4.7 k $\Omega$ , 5.0 k $\Omega$ , AND 10 k $\Omega$

| $T_{OPER}$<br>(°C) | PART NR.<br>NTCL**00E3222H | PART NR.<br>NTCL**00E3472H | PART NR.<br>NTCL**00E3502H | PART NR.<br>NTCL**00E3103H | $\Delta R/R$<br>(%) | TCR<br>(%/K) | $\Delta T_{max}$<br>( $\pm$ K) |
|--------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------|--------------|--------------------------------|
|                    | $R_T$<br>( $\Omega$ )      | $R_T$<br>( $\Omega$ )      | $R_T$<br>( $\Omega$ )      | $R_T$<br>( $\Omega$ )      |                     |              |                                |
| -40                | 73 061                     | 156 084                    | 166 047                    | 332 094                    | 5.87                | - 6.62       | 0.89                           |
| -35                | 52 778                     | 112 753                    | 119 950                    | 239 900                    | 5.60                | - 6.39       | 0.88                           |
| -30                | 38 544                     | 82 344                     | 87 600                     | 175 200                    | 5.33                | - 6.18       | 0.86                           |
| -25                | 28 443                     | 60 765                     | 64 643                     | 129 287                    | 5.08                | - 5.98       | 0.85                           |
| -20                | 21 199                     | 45 288                     | 48 179                     | 96 358                     | 4.83                | - 5.78       | 0.84                           |
| -15                | 15 950                     | 34 075                     | 36 250                     | 72 500                     | 4.60                | - 5.60       | 0.82                           |
| -10                | 12 110                     | 25 872                     | 27 523                     | 55 046                     | 4.37                | - 5.42       | 0.81                           |
| -5                 | 9275                       | 19 814                     | 21 078                     | 42 157                     | 4.15                | - 5.25       | 0.79                           |
| 0                  | 7162                       | 15 300                     | 16 277                     | 32 554                     | 3.94                | - 5.09       | 0.77                           |
| 5                  | 5574                       | 11 909                     | 12 669                     | 25 339                     | 3.74                | - 4.93       | 0.76                           |
| 10                 | 4372                       | 9340                       | 9936                       | 19 872                     | 3.55                | - 4.79       | 0.74                           |
| 15                 | 3454                       | 7378                       | 7849                       | 15 698                     | 3.36                | - 4.64       | 0.72                           |
| 20                 | 2747                       | 5869                       | 6244                       | 12 488                     | 3.18                | - 4.51       | 0.70                           |
| 25                 | 2200                       | 4700                       | 5000                       | 10 000                     | 3.00                | - 4.38       | 0.69                           |
| 30                 | 1773                       | 3788                       | 4030                       | 8059                       | 3.17                | - 4.25       | 0.75                           |
| 35                 | 1438                       | 3071                       | 3267                       | 6535                       | 3.33                | - 4.13       | 0.81                           |
| 40                 | 1173                       | 2505                       | 2665                       | 5330                       | 3.49                | - 4.02       | 0.87                           |
| 45                 | 961.8                      | 2055                       | 2186                       | 4372                       | 3.65                | - 3.91       | 0.93                           |
| 50                 | 793.2                      | 1694                       | 1803                       | 3605                       | 3.80                | - 3.80       | 1.00                           |
| 55                 | 657.5                      | 1405                       | 1494                       | 2989                       | 3.94                | - 3.70       | 1.07                           |
| 60                 | 547.8                      | 1170                       | 1245                       | 2490                       | 4.08                | - 3.60       | 1.13                           |
| 65                 | 458.6                      | 979.7                      | 1042                       | 2084                       | 4.22                | - 3.51       | 1.20                           |
| 70                 | 385.7                      | 823.9                      | 876.5                      | 1753                       | 4.35                | - 3.42       | 1.27                           |
| 75                 | 325.8                      | 696.0                      | 740.5                      | 1481                       | 4.48                | - 3.33       | 1.35                           |
| 80                 | 276.4                      | 590.5                      | 628.2                      | 1256                       | 4.60                | - 3.25       | 1.42                           |
| 85                 | 235.5                      | 503.0                      | 585.2                      | 1070                       | 4.73                | - 3.17       | 1.49                           |

# NTCLE400, NTCLS100, NTCLP100



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| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH $R_{25}$ AT 47 k $\Omega$ |                            |                  |              |                            |
|---|----------------------------|------------------|--------------|----------------------------|
| $T_{OPER}$<br>(°C)  | PART NR.<br>NTCL**00E3473H | $\Delta R/R$ (%) | TCR<br>(%/K) | $\Delta T_{max.}$<br>(± K) |
|   | $R_T$<br>( $\Omega$ )      |                  |              |                            |
| -40   | 1 589 068                  | 8.91             | - 6.54       | 1.36                       |
| -35   | 1 151 627                  | 8.34             | - 6.34       | 1.32                       |
| -30   | 842 790                    | 7.79             | - 6.15       | 1.27                       |
| -25   | 622 597                    | 7.27             | - 5.96       | 1.22                       |
| -20   | 464 110                    | 6.77             | - 5.79       | 1.17                       |
| -15   | 348 989                    | 6.28             | - 5.62       | 1.12                       |
| -10   | 264 628                    | 5.82             | - 5.45       | 1.07                       |
| -5  | 202 280                    | 5.37             | - 5.30       | 1.01                       |
| 0   | 155 823                    | 4.94             | - 5.14       | 0.96                       |
| 5   | 120 932                    | 4.52             | - 5.00       | 0.91                       |
| 10  | 94 528                     | 4.12             | - 4.86       | 0.85                       |
| 15  | 74 399                     | 3.74             | - 4.72       | 0.79                       |
| 20  | 58 945                     | 3.36             | - 4.59       | 0.73                       |
| 25  | 47 000                     | 3.00             | - 4.47       | 0.67                       |
| 30  | 37 706                     | 3.35             | - 4.35       | 0.77                       |
| 35  | 30 429                     | 3.69             | - 4.23       | 0.87                       |
| 40  | 24 696                     | 4.02             | - 4.12       | 0.97                       |
| 45  | 20 154                     | 4.33             | - 4.01       | 1.08                       |
| 50  | 16 534                     | 4.64             | - 3.91       | 1.19                       |
| 55  | 13 633                     | 4.94             | - 3.81       | 1.30                       |
| 60  | 11 296                     | 5.23             | - 3.71       | 1.41                       |
| 65  | 9404                       | 5.51             | - 3.62       | 1.52                       |
| 70  | 7865                       | 5.78             | - 3.53       | 1.64                       |
| 75  | 6607                       | 6.04             | - 3.44       | 1.75                       |
| 80  | 5573                       | 6.30             | - 3.36       | 1.87                       |
| 85  | 4721                       | 6.55             | - 3.28       | 2.00                       |



# NTCLE400, NTCLS100, NTCLP100

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| RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH $R_{25}$ AT 100 k $\Omega$ |                            |                  |              |                            |
|--|----------------------------|------------------|--------------|----------------------------|
| $T_{OPER}$<br>(°C)   | PART NR.<br>NTCL**00E3104H | $\Delta R/R$ (%) | TCR<br>(%/K) | $\Delta T_{max.}$<br>(± K) |
|  | $R_T$<br>( $\Omega$ )      |                  |              |                            |
| -40  | 3 666 299                  | 9.05             | - 6.69       | 1.35                       |
| -35  | 2 637 588                  | 8.47             | - 6.49       | 1.31                       |
| -30  | 1 916 576                  | 7.91             | - 6.29       | 1.26                       |
| -25  | 1 406 111                  | 7.37             | - 6.10       | 1.21                       |
| -20  | 1 041 184                  | 6.86             | - 5.92       | 1.16                       |
| -15  | 777 846                    | 6.36             | - 5.75       | 1.11                       |
| -10  | 586 097                    | 5.89             | - 5.58       | 1.06                       |
| -5   | 445 257                    | 5.43             | - 5.42       | 1.00                       |
| 0  | 340 942                    | 4.99             | - 5.26       | 0.95                       |
| 5  | 263 054                    | 4.56             | - 5.11       | 0.89                       |
| 10   | 204 446                    | 4.15             | - 4.97       | 0.84                       |
| 15   | 160 014                    | 3.75             | - 4.83       | 0.78                       |
| 20   | 126 087                    | 3.37             | - 4.70       | 0.72                       |
| 25   | 100 000                    | 3.00             | - 4.57       | 0.66                       |
| 30   | 79 808                     | 3.36             | - 4.45       | 0.75                       |
| 35   | 64 077                     | 3.70             | - 4.33       | 0.86                       |
| 40   | 51 745                     | 4.04             | - 4.22       | 0.96                       |
| 45   | 42 021                     | 4.36             | - 4.11       | 1.06                       |
| 50   | 34 308                     | 4.68             | - 4.00       | 1.17                       |
| 55   | 28 156                     | 4.98             | - 3.90       | 1.28                       |
| 60   | 23 222                     | 5.28             | - 3.80       | 1.39                       |
| 65   | 19 246                     | 5.57             | - 3.71       | 1.50                       |
| 70   | 16 025                     | 5.85             | - 3.62       | 1.62                       |
| 75   | 13 402                     | 6.12             | - 3.53       | 1.73                       |
| 80   | 11 258                     | 6.38             | - 3.45       | 1.85                       |
| 85   | 9496                       | 6.64             | - 3.36       | 1.97                       |

## TESTS AND REQUIREMENTS

| STABILITY TESTS |                               |                                   |                     |
|-----------------|-------------------------------|-----------------------------------|---------------------|
| IEC             | TEST                          | PROCEDURE                         | DRIFT REQUIREMENT   |
| 60068-2-2       | Endurance dry heat            | 85 °C; 1000 h                     | $\Delta R/R < 5 \%$ |
| 60068-2-1       | Endurance cold                | - 40 °C; 1000 h                   | $\Delta R/R < 5 \%$ |
| 60539           | Endurance max. dissipation    | 250 mW; 55 °C; 1000 h             | $\Delta R/R < 5 \%$ |
| 60068-2-3       | Damp heat, steady state       | 56 days at 40 °C; 90 % to 95 % RH | $\Delta R/R < 7 \%$ |
| 60068-20-14     | - 40 °C to + 85 °C; 50 cycles | Rapid change of temperature       | $\Delta R/R < 5 \%$ |



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