

# NTC Thermistors, Epoxy PVC Long Leads Sensors



## LINKS TO ADDITIONAL RESOURCES



| 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                        | -40 to +85              | °C       |
| Maximum power dissipation at 55 °C                                     | 250                     | mW       |
| Min. dielectric withstanding voltage between terminals and sensor body | 1500                    | $V_{AC}$ |
| Dissipation factor   | 6.0                     | mW/K     |
| Response time <sup>(1)</sup>   | $\approx 7$             | s        |
| Weight   | $\approx 4$             | g        |

### 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

## FEATURES

- Accurate over wide temperature range
- High stability
- Excellent price / performance ratio
- High adhesive strength between PVC wire and the encapsulating lacquer
- 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 in remote locations and for various environmental conditions.

## DESCRIPTION

These sensors exist of a small NTC chip reflow soldered between two AWG #24 UL-2468 style wires. They are lacquered and insulated with black epoxy.

## 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 style PVC 105 °C), other wire gauge, are available on request.

The products can be provided with a connector on request. A UL-2651 105 °C multistranded version is available as **NTCLE430**.

For complete curve computation, please visit:

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

## MOUNTING

**Important mounting and handling instructions: see** [www.vishay.com/doc?29222](http://www.vishay.com/doc?29222)

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

| ELECTRICAL DATA AND ORDERING INFORMATION |                              |                    |                                 |  |                 |
|--|------------------------------|--------------------|---------------------------------|--|-----------------|
| $R_{25}$<br>( $\Omega$ )                 | $R_{25}$ -TOL.<br>( $\pm$ %) | $B_{25/85}$<br>(K) | $B_{25/85}$ -TOL.<br>( $\pm$ %) | SAP MATERIAL AND ORDERING NUMBER             |                 |
|  |                              |                    |                                 | RoHS COMPLIANT WITH EXEMPTION <sup>(1)</sup> | RoHS COMPLIANT  |
| 2200                                     | 3                            | 3977               | 0.75                            | NTCLE400E3222H                               | NTCLE400E3222HA |
| 4700                                     | 3                            | 3977               | 0.75                            | NTCLE400E3472H                               | NTCLE400E3472HA |
| 5000                                     | 3                            | 3977               | 0.75                            | NTCLE400E3502H                               | NTCLE400E3502HA |
| 10 000                                   | 3                            | 3977               | 0.75                            | NTCLE400E3103H                               | NTCLE400E3103HA |
| 47 000                                   | 3                            | 4090               | 1.5                             | NTCLE400E3473H                               | NTCLE400E3473HA |
| 100 000                                  | 3                            | 4190               | 1.5                             | NTCLE400E3104H                               | NTCLE400E3104HA |

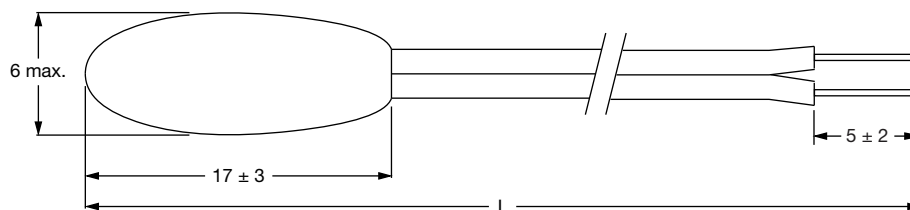
### Notes

  Preferred versions for new designs

- <sup>(1)</sup> 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

**DIMENSIONS** in millimeters

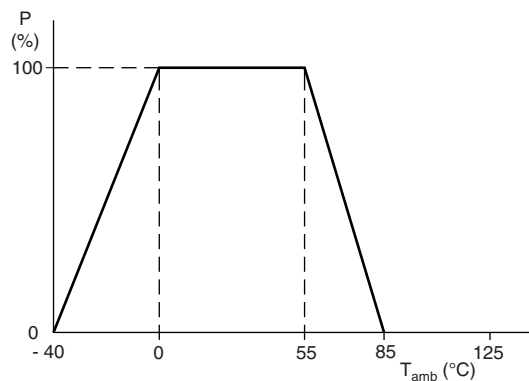
Epoxy-coated type NTCLE400E...


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

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



| 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>NTCLE400E3222H(A) | PART NR.<br>NTCLE400E3472H(A) | PART NR.<br>NTCLE400E3502H(A) | PART NR.<br>NTCLE400E3103H(A) | $R$ -TOL.<br>(± %) | $\alpha$<br>(%/K) | $T$ -TOL.<br>(± °C) |
|  | $R_T$<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                |

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH  $R_{25}$  AT 47 k $\Omega$** 

| $T_{OPER}$<br>(°C) | PART NR.<br>NTCLE400E3473H(A) | $R-TOL.$<br>( $\pm$ %) | $\alpha$<br>(%/K) | $T-TOL.$<br>( $\pm$ °C) |
|--------------------|-------------------------------|------------------------|-------------------|-------------------------|
|                    | $R_T$<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                    |

**RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH  $R_{25}$  AT 100 k $\Omega$** 

| $T_{\text{OPER}}$<br>(°C) | PART NR.<br>NTCLE400E3104H(A) | $R$ -TOL.<br>( $\pm$ %) | $\alpha$<br>(%/K) | $T$ -TOL.<br>( $\pm$ °C) |
|---------------------------|-------------------------------|-------------------------|-------------------|--------------------------|
|                           | $R_T$<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 | Rapid change of temperature | -40 °C to +85 °C; 50 cycles       | $\Delta R/R < 5$ % |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.