

NTC Thermistors, Flex Foil Sensors



FEATURES

- Rapid response time down to 2 s
- Suitable for narrow space applications
- High flexibility of the foil
- Insulated and humidity resistant
- A strain relief hole is included in the flex design to avoid traction to the sensor head
- Gold plated terminations
- AEC-Q200 qualified
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

QUICK REFERENCE DATA

| PARAMETER | VALUE | UNIT |
|---|-------------|-----------------|
| Resistance value at 25 °C | 10K, 47K | Ω |
| Tolerance on R_{25} -value | ± 3 | % |
| $B_{25/85}$ -value | 3960 | K |
| Tolerance on $B_{25/85}$ -value | ± 1 | % |
| Operating temperature range at zero power | - 40 to 125 | °C |
| Thermal time constant on heating ⁽¹⁾ | 2 | s |
| Thermal gradient | < 0.02 | K/K |
| Minimum dielectric withstanding voltage | 500 | V _{AC} |
| Minimum insulation resistance | 10 | MΩ |
| Maximum dissipation at 25 °C | 60 | mW |
| Climatic category (LCT/UCT/days) | 40/125/56 | |
| Weight (without connector) | 0.06 | g |

Note

- ⁽¹⁾ Measured from 25 °C air to 125 °C heated plate, pressed on the surface

DESIGNERS OPTIONS

- Other dimensions and various shapes of the flex circuit are available on request
- A 3D solid model is available on request

Note

- FFC/FPC = Flexible Film Circuit/Flexible Printed Circuit

APPLICATIONS

- Consumer appliances and white goods
- Power supply (heat-sinks)
- Battery, displays, LED
- Industrial applications, robotics
- Boilers
- EV and HV batteries

DESCRIPTION

- Miniature NTC temperature sensor on flex foil, insulated used for temperature sensing and control
- Surface temperature sensor with low thermal mass and rapid response time on surface

MOUNTING

- The sensor head can be pressed on the surface with means of insulating material (silicone foam) or spring
- The sensor head can also be glued with a double-face temperature resistant adhesive
- The sensor end can be connected to PCB counter-connector or wire-to-wire connector or soldered to conductors, or crimped with FFC connectors and ZiF connectors
- Remark: The response time and thermal gradient are dependant of the application and of the way of mounting the sensor in place

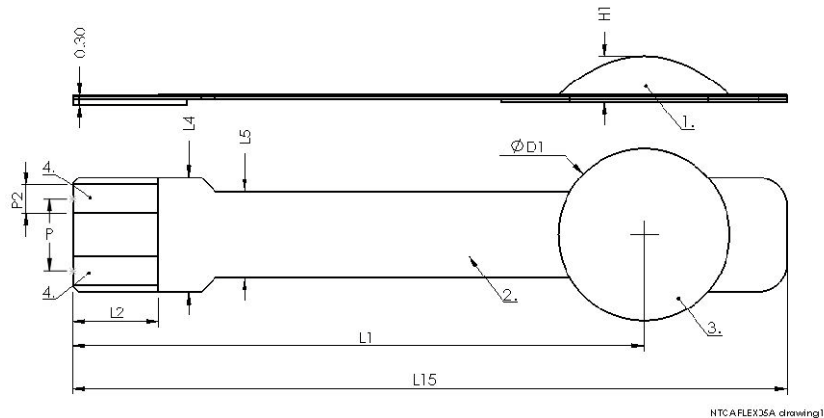
ELECTRICAL DATA AND ORDERING INFORMATION

| VISHAY SAP ORDERING NUMBER | R_{25} -VALUE (Ω) | R_{25} TOL. (± %) | $B_{25/85}$ -VALUE (K) | $B_{25/85}$ TOL. (± %) | DESCRIPTION | R/T TABLE |
|----------------------------|---------------------|---------------------|------------------------|------------------------|---------------------------------|-----------|
| NTCAFLEX05103HH | 10 000 | 3 | 3960 | 1 | NTC Flex05 10K 3 % 3960 K 25 mm | Table 1 |
| NTCAFLEX05473HH | 47 000 | 3 | 3960 | 1 | NTC Flex05 47K 3 % 3960 K 25 mm | Table 2 |

SAP CODIFICATION

Part Number: NTCAFLEX01473HH

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------|----------|-------------|--|----------------------|--|--|--|-----------------------|--|--|--|--------|--|---|--|---|--|---|--|---|--|---|--|---|--|---|--|---|--|--|--|
| N | | T | | C | | A | | F | | L | | E | | X | | 0 | | 5 | | 4 | | 7 | | 3 | | H | | H | | | |
| MODEL | ASSEMBLY | FLEX SENSOR | | MECHANICAL EXECUTION | | RESISTANCE VALUE | | TOLERANCE ON R_{25} | | B-VALUE RANGE | | OPTION | | | | | | | | | | | | | | | | | | | |
| NTC | A | FLEX | | 05 | | 103 = $10 \times 10^3 \Omega$ 473 = $47 \times 10^3 \Omega$ | | H = $\pm 3\%$ | | L (low) = $3000 \leq B_{25/85} < 3500$ M (medium) = $3500 \leq B_{25/85} < 3750$ H (high) = $3750 \leq B_{25/85} < 4000$ X (very high) = $4000 \leq B_{25/85} < 4250$ | | Blank | | | | | | | | | | | | | | | | | | | |

MECHANICAL DATA


NTCAFLEX35A drawing13

DIMENSIONS in millimeters

| L1 | L15 | L2 | Ø D1 | L4 | L5 | H1 | P |
|--------|--------|---------|---------|-------|-------|------------|------|
| 20 ± 1 | 25 ± 1 | 3 ± 0.5 | 6 ± 0.5 | 4 ± 1 | 3 ± 1 | 1.40 ± 0.2 | 2.50 |

1. NTC on flex foil circuit
2. Flex foil circuit
3. High quality modified epoxy glob top
4. Conductive tracks

RELIABILITY TEST (following IEC 60068 test methods)

| TEST | PROCEDURE | REQUIREMENT |
|-----------------------------|-------------------------------------|-----------------------|
| Dry heat, steady state | 125 °C; 1000 h | $\Delta R/R \leq 3\%$ |
| Damp heat, steady state | 56 days at 40 °C 90 % to 95 % RH | $\Delta R/R \leq 3\%$ |
| Rapid change of temperature | - 40 °C to + 125 °C; 100 cycles | $\Delta R/R \leq 3\%$ |



R/T TABLE 1

| R ₂₅ -VALUE (kΩ) | R ₂₅ TOL. (%) | B _{25/85} -VALUE (K) | B _{25/85} TOL. (%) | SAP MATERIAL NO. |
|-----------------------------|--------------------------|-------------------------------|-----------------------------|------------------|
| 10 | ± 3 | 3960 | ± 1 | NTCAFLEX05103HH |

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMP. (°C) | R _{(T)/R₂₅} | RESISTANCE (Ω) | ΔR/R (%) | α (%/K) | ΔT (K) | R _{min.} (Ω) | R _{max.} (Ω) |
|------------|---------------------------------|----------------|----------|---------|--------|-----------------------|-----------------------|
| - 40 | 34.7116 | 347 116 | 10.8031 | - 6.66 | 1.62 | 309 617 | 384 616 |
| - 35 | 25.0089 | 250 089 | 10.0392 | - 6.45 | 1.56 | 224 982 | 275 196 |
| - 30 | 18.2023 | 182 023 | 9.3093 | - 6.25 | 1.49 | 165 078 | 198 968 |
| - 25 | 13.3804 | 133 804 | 8.6110 | - 6.06 | 1.42 | 122 282 | 145 326 |
| - 20 | 9.9313 | 99 313 | 7.9424 | - 5.87 | 1.35 | 91 425 | 107 201 |
| - 15 | 7.4408 | 74 408 | 7.3017 | - 5.68 | 1.28 | 68 974 | 79 841 |
| - 10 | 5.6257 | 56 257 | 6.6871 | - 5.50 | 1.22 | 52 495 | 60 019 |
| - 5 | 4.2910 | 42 910 | 6.0971 | - 5.33 | 1.14 | 40 294 | 45 526 |
| 0 | 3.3009 | 33 009 | 5.5303 | - 5.16 | 1.07 | 31 184 | 34 835 |
| 5 | 2.5602 | 25 602 | 4.9853 | - 5.00 | 1.00 | 24 326 | 26 879 |
| 10 | 2.0015 | 20 015 | 4.4608 | - 4.85 | 0.92 | 19 122 | 20 908 |
| 15 | 1.5767 | 15 767 | 3.9558 | - 4.70 | 0.84 | 15 143 | 16 391 |
| 20 | 1.2512 | 12 512 | 3.4692 | - 4.55 | 0.76 | 12 078 | 12 946 |
| 25 | 1.0000 | 10 000 | 3.0000 | - 4.41 | 0.68 | 9700.0 | 10 300 |
| 30 | 0.8047 | 8046.8 | 3.2266 | - 4.28 | 0.75 | 7787.1 | 8306.4 |
| 35 | 0.6518 | 6517.6 | 3.4459 | - 4.15 | 0.83 | 6293.1 | 6742.2 |
| 40 | 0.5313 | 5312.5 | 3.6581 | - 4.03 | 0.91 | 5118.2 | 5506.9 |
| 45 | 0.4357 | 4356.6 | 3.8637 | - 3.91 | 0.99 | 4188.3 | 4524.9 |
| 50 | 0.3594 | 3593.6 | 4.0629 | - 3.79 | 1.07 | 3447.6 | 3739.6 |
| 55 | 0.2981 | 2981.0 | 4.2560 | - 3.68 | 1.16 | 2854.1 | 3107.8 |
| 60 | 0.2486 | 2486.2 | 4.4434 | - 3.58 | 1.24 | 2375.7 | 2596.6 |
| 65 | 0.2084 | 2084.3 | 4.6252 | - 3.48 | 1.33 | 1987.9 | 2180.7 |
| 70 | 0.1756 | 1756.2 | 4.8017 | - 3.38 | 1.42 | 1671.9 | 1840.5 |
| 75 | 0.1487 | 1486.9 | 4.9732 | - 3.28 | 1.52 | 1412.9 | 1560.8 |
| 80 | 0.1265 | 1264.7 | 5.1397 | - 3.19 | 1.61 | 1199.7 | 1329.7 |
| 85 | 0.1081 | 1080.6 | 5.3017 | - 3.10 | 1.71 | 1023.3 | 1137.9 |
| 90 | 0.0927 | 927.23 | 5.6204 | - 3.02 | 1.86 | 875.11 | 979.34 |
| 95 | 0.0799 | 798.94 | 5.9309 | - 2.94 | 2.02 | 751.56 | 846.33 |
| 100 | 0.0691 | 691.16 | 6.2335 | - 2.86 | 2.18 | 648.08 | 734.25 |
| 105 | 0.0600 | 600.23 | 6.5286 | - 2.78 | 2.35 | 561.04 | 639.42 |
| 110 | 0.0523 | 523.20 | 6.8163 | - 2.71 | 2.51 | 487.53 | 558.86 |
| 115 | 0.0458 | 457.68 | 7.0970 | - 2.64 | 2.69 | 425.20 | 490.17 |
| 120 | 0.0402 | 401.76 | 7.3709 | - 2.57 | 2.86 | 372.15 | 431.37 |
| 125 | 0.0354 | 353.85 | 7.6383 | - 2.51 | 3.05 | 326.82 | 380.87 |



R/T TABLE 2

| R ₂₅ -VALUE (kΩ) | R ₂₅ TOL. (%) | B _{25/85} -VALUE (K) | B _{25/85} TOL. (%) | SAP MATERIAL NO. |
|-----------------------------|--------------------------|-------------------------------|-----------------------------|------------------|
| 47 | ± 3 | 3960 | ± 1 | NTCAFLEX05473HH |

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| TEMP. (°C) | R _(T) /R ₂₅ | RESISTANCE (Ω) | ΔR/R (%) | α (%/K) | ΔT (K) | R _{min.} (Ω) | R _{max.} (Ω) |
|------------|-----------------------------------|----------------|----------|---------|--------|-----------------------|-----------------------|
| -40 | 34.972 | 1 643 693 | 10.803 | - 6.85 | 1.58 | 1 466 123 | 1 821 262 |
| -35 | 24.997 | 1 174 859 | 10.039 | - 6.59 | 1.52 | 1 056 912 | 1 292 806 |
| -30 | 18.095 | 850 461 | 9.3093 | - 6.34 | 1.47 | 771 290 | 929 633 |
| -25 | 13.256 | 623 018 | 8.6110 | - 6.11 | 1.41 | 569 370 | 676 666 |
| -20 | 9.8204 | 461 557 | 7.9424 | - 5.89 | 1.35 | 424 898 | 498 216 |
| -15 | 7.3528 | 345 583 | 7.3017 | - 5.69 | 1.28 | 320 350 | 370 816 |
| -10 | 5.5607 | 261 354 | 6.6871 | - 5.49 | 1.22 | 243 877 | 278 831 |
| -5 | 4.2455 | 199 536 | 6.0971 | - 5.31 | 1.15 | 187 370 | 211 702 |
| 0 | 3.2705 | 153 714 | 5.5303 | - 5.13 | 1.08 | 145 213 | 162 215 |
| 5 | 2.5410 | 119 427 | 4.9853 | - 4.97 | 1.00 | 113 473 | 125 381 |
| 10 | 1.9902 | 93 541 | 4.4608 | - 4.81 | 0.93 | 89 369 | 97 714 |
| 15 | 1.5709 | 73 832 | 3.9558 | - 4.66 | 0.85 | 70 911 | 76 752 |
| 20 | 1.2490 | 58 703 | 3.4692 | - 4.52 | 0.77 | 56 666 | 60 739 |
| 25 | 1.0000 | 47 000 | 3.0000 | - 4.38 | 0.69 | 45 590 | 48 410 |
| 30 | 0.8060 | 37 881 | 3.2266 | - 4.25 | 0.76 | 36 659 | 39 103 |
| 35 | 0.6537 | 30 726 | 3.4459 | - 4.13 | 0.84 | 29 667 | 31 784 |
| 40 | 0.5335 | 25 073 | 3.6581 | - 4.01 | 0.91 | 24 156 | 25 990 |
| 45 | 0.4378 | 20 579 | 3.8637 | - 3.89 | 0.99 | 19 784 | 21 374 |
| 50 | 0.3614 | 16 984 | 4.0629 | - 3.79 | 1.07 | 16 294 | 17 674 |
| 55 | 0.2998 | 14 092 | 4.2560 | - 3.68 | 1.16 | 13 492 | 14 692 |
| 60 | 0.2500 | 11 751 | 4.4434 | - 3.58 | 1.24 | 11 229 | 12 274 |
| 65 | 0.2095 | 9847.6 | 4.6252 | - 3.49 | 1.33 | 9392.1 | 10 303 |
| 70 | 0.1764 | 8290.7 | 4.8017 | - 3.40 | 1.41 | 7892.6 | 8688.8 |
| 75 | 0.1492 | 7011.4 | 4.9732 | - 3.31 | 1.50 | 6662.7 | 7360.1 |
| 80 | 0.1267 | 5955.0 | 5.1397 | - 3.22 | 1.59 | 5648.9 | 6261.1 |
| 85 | 0.1081 | 5078.7 | 5.3017 | - 3.14 | 1.69 | 4809.5 | 5348.0 |
| 90 | 0.0925 | 4348.7 | 5.6204 | - 3.07 | 1.83 | 4104.3 | 4593.1 |
| 95 | 0.0795 | 3737.8 | 5.9309 | - 2.99 | 1.98 | 3516.1 | 3959.5 |
| 100 | 0.0686 | 3224.6 | 6.2335 | - 2.92 | 2.14 | 3023.6 | 3425.7 |
| 105 | 0.0594 | 2791.8 | 6.5286 | - 2.85 | 2.29 | 2609.5 | 2974.1 |
| 110 | 0.0516 | 2425.3 | 6.8163 | - 2.78 | 2.45 | 2260.0 | 2590.7 |
| 115 | 0.0450 | 2113.9 | 7.0970 | - 2.72 | 2.61 | 1963.9 | 2264.0 |
| 120 | 0.0393 | 1848.4 | 7.3709 | - 2.65 | 2.78 | 1712.1 | 1984.6 |
| 125 | 0.0345 | 1621.2 | 7.6383 | - 2.59 | 2.95 | 1497.3 | 1745.0 |



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