# NTC thermistors for temperature measurement

## Glass-encapsulated sensors with insulation

**Series/Type:** **B57541G1**

Date: January 2016

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### Applications

- Temperature measurement

### Features

- Glass-encapsulated NTC thermistor, heat-resistant and highly stable
- Coating of glass body and leads for electrical insulation
- For temperature measurement up to 250 °C
- Very short response time
- Small dimensions
- Leads: dumet wires (copper-clad FeNi)

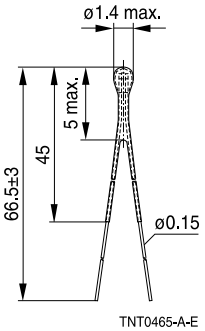
### Options

- Alternative dimensions available on request

### Delivery mode

Bulk

### Dimensional drawing




Dimensions in mm
Approx. weight 40 mg

### General technical data

| | | | | |
|---|---|---|---|---|
| Climatic category | (IEC 60068-1) | | 55/250/56 | |
| Max. power | (at 25 °C) | $P_{25}$ | 18 | mW |
| Resistance tolerance | | $\Delta R_R/R_R$ | ±1, ±2, ±3 | % |
| Rated temperature | | $T_R$ | 25 | °C |
| Dissipation factor | (in air) | $\delta_{th}$ | approx. 0.5 | mW/K |
| Thermal cooling time constant | (in air) | $\tau_c$ | approx. 4 | s |
| Heat capacity | | $C_{th}$ | approx. 2 | mJ/K |
| Insulation resistance[1)] | (V = 100 V DC) | $R_{ins}$ | ≥ 100 | MΩ |
| Test voltage[1)] | (t = 1 s) | $V_{test}$ | 500 | V DC |

1) Medium: NaCl-solution; Temperature: Room temperature

### Electrical specification and ordering codes

| $R_{25}$ Ω | No. of R/T characteristic | $B_{25/85}$ K | $B_{0/100}$ K | $B_{25/100}$ K | Ordering code |
|---|---|---|---|---|---|
| 5 k | 8324 | 3483 | 3455 | 3497 ±1% | B57541G1502+000 |
| 10 k | 8307 | 3478 | 3450 | 3492 ±1% | B57541G1103+000 |
| 10 k | 7003 | 3612 | 3586 | 3625 ±1% | B57541G1103+005 |
| 50 k | 8342 | 3991 | 3967 | 4006 ±1% | B57541G1503+000 |
| 100 k | 8304 | 4072 | 4036 | 4092 ±1% | B57541G1104+000 |

+ = Resistance tolerance
F = ±1%
G = ±2%
H = ±3%

### Reliability data

| Test | Standard | Test conditions | $\Delta R_{25}/R_{25}$ (typical) | Remarks |
|---|---|---|---|---|
| Storage in dry heat | IEC 60068-2-2 | Storage at upper category temperature<br>T: 250 °C<br>t: 1000 h | < 3% | No visible damage |
| Storage in damp heat, steady state | IEC 60068-2-67 | Temperature of air: 85 °C<br>Relative humidity of air: 85%<br>Duration: 1000 h | < 2% | No visible damage |
| Rapid temperature cycling | IEC 60068-2-14 | Lower test temperature: −55 °C<br>Upper test temperature: 200 °C<br>Number of cycles: 1000 | < 2% | No visible damage |

**Reliability data according to AEC-Q200, Rev. D**

| Test | Standard | Test conditions | $\Delta R_{25}/R_{25}$ (typical) | Remarks |
|---|---|---|---|---|
| High temperature exposure (storage) | MIL-STD-202, method 108 | Storage at T = +125 °C<br>t = 1000 h | < 2% | No visible damage |
| Operational life | MIL-STD-202, method 108 | 1000 h / +125 °C<br>Test voltage max. 0.3 V DC on NTC[1)] | < 2% | No visible damage |
| Temperature cycling | JESD 22, method JA-104 | Lower test temperature: −55 °C<br>Upper test temperature: 125 °C<br>1000 cycles<br>Dwell time: max. 30 min at each temperature<br>Transition time in air: max. 1 min | < 2% | No visible damage |
| Terminal strength (leaded) | MIL-STD-202, method 211 | Test leaded device integrity<br>Condition A: 2.27 N[2)] | < 1% | No visible damage |
| Mechanical shock | MIL-STD-202, method 213, condition C | Acceleration: 40 *g*[2)]<br>Pulse duration: 6 ms<br>Number of bumps: 3, each direction | < 1% | No visible damage |
| Vibration | MIL-STD-202, method 204 | Acceleration: 5 *g*<br>t = 20 min<br>12 cycles in each of 3 directions<br>Frequency range: 10 to 2000 Hz | < 1% | No visible damage |

1) Self heating of the NTC thermistor must not exceed 0.2 K, steady state. Test conditions deviating from AEC Q200, Rev. D.
2) Deviating from AEC Q200, Rev. D.

**Note**

- Contact of NTC thermistors with any liquids and solvents shall be prevented. It must be ensured that no water enters the NTC thermistors (e.g. through plug terminals).
- Avoid dewing and condensation unless thermistor is specified for these conditions.

**R/T characteristics**

| R/T No. | **7003** | | **8304** | |
|---|---|---|---|---|
| T (°C) | $B_{25/100}$ = 3625 K | | $B_{25/100}$ = 4092 K | |
| | $R_T/R_{25}$ | $\alpha$ (%/K) | $R_T/R_{25}$ | $\alpha$ (%/K) |
| −55.0 | 63.225 | 6.7 | 100.11 | 7.4 |
| −50.0 | 45.46 | 6.5 | 69.56 | 7.2 |
| −45.0 | 33.07 | 6.3 | 48.945 | 6.9 |
| −40.0 | 24.324 | 6.0 | 34.853 | 6.7 |
| −35.0 | 18.081 | 5.8 | 25.102 | 6.5 |
| −30.0 | 13.575 | 5.6 | 18.275 | 6.2 |
| −25.0 | 10.29 | 5.4 | 13.443 | 6.0 |
| −20.0 | 7.8716 | 5.3 | 9.9853 | 5.9 |
| −15.0 | 6.0739 | 5.1 | 7.4867 | 5.7 |
| −10.0 | 4.7258 | 4.9 | 5.6636 | 5.5 |
| −5.0 | 3.7062 | 4.8 | 4.3212 | 5.3 |
| 0.0 | 2.9287 | 4.6 | 3.324 | 5.2 |
| 5.0 | 2.3311 | 4.5 | 2.5769 | 5.0 |
| 10.0 | 1.8684 | 4.4 | 2.0127 | 4.9 |
| 15.0 | 1.5075 | 4.2 | 1.5834 | 4.7 |
| 20.0 | 1.224 | 4.1 | 1.2542 | 4.6 |
| 25.0 | 1.0000 | 4.0 | 1.0000 | 4.5 |
| 30.0 | 0.82176 | 3.9 | 0.80239 | 4.3 |
| 35.0 | 0.67909 | 3.8 | 0.64776 | 4.2 |
| 40.0 | 0.56422 | 3.7 | 0.52598 | 4.1 |
| 45.0 | 0.47122 | 3.6 | 0.4295 | 4.0 |
| 50.0 | 0.3955 | 3.5 | 0.35262 | 3.9 |
| 55.0 | 0.33355 | 3.4 | 0.291 | 3.8 |
| 60.0 | 0.2826 | 3.3 | 0.24136 | 3.7 |
| 65.0 | 0.24049 | 3.2 | 0.20114 | 3.6 |
| 70.0 | 0.20553 | 3.1 | 0.16841 | 3.5 |
| 75.0 | 0.17637 | 3.0 | 0.14164 | 3.4 |
| 80.0 | 0.15195 | 2.9 | 0.11963 | 3.3 |
| 85.0 | 0.13141 | 2.9 | 0.10147 | 3.3 |
| 90.0 | 0.11406 | 2.8 | 0.086407 | 3.2 |
| 95.0 | 0.099352 | 2.7 | 0.073867 | 3.1 |
| 100.0 | 0.086837 | 2.7 | 0.063383 | 3.0 |
| 105.0 | 0.076149 | 2.6 | 0.054584 | 3.0 |
| 110.0 | 0.066989 | 2.5 | 0.04717 | 2.9 |
| 115.0 | 0.059112 | 2.5 | 0.040901 | 2.8 |
| 120.0 | 0.052316 | 2.4 | 0.035581 | 2.8 |
| 125.0 | 0.046433 | 2.4 | 0.03105 | 2.7 |
| 130.0 | 0.041327 | 2.3 | 0.027179 | 2.6 |
| 135.0 | 0.03688 | 2.3 | 0.023861 | 2.6 |
| 140.0 | 0.032998 | 2.2 | 0.021008 | 2.5 |
| 145.0 | 0.029598 | 2.2 | 0.018548 | 2.5 |
| 150.0 | 0.026612 | 2.1 | 0.016419 | 2.4 |
| 155.0 | 0.023984 | 2.1 | 0.014573 | 2.4 |

| R/T No. | **7003** | | **8304** | |
|---|---|---|---|---|
| T (°C) | $B_{25/100}$ = 3625 K | | $B_{25/100}$ = 4092 K | |
| | $R_T/R_{25}$ | $\alpha$ (%/K) | $R_T/R_{25}$ | $\alpha$ (%/K) |
| 160.0 | 0.021665 | 2.0 | 0.012967 | 2.3 |
| 165.0 | 0.019613 | 2.0 | 0.011566 | 2.3 |
| 170.0 | 0.017793 | 1.9 | 0.010341 | 2.2 |
| 175.0 | 0.016176 | 1.9 | 0.0092664 | 2.2 |
| 180.0 | 0.014735 | 1.8 | 0.0083224 | 2.1 |
| 185.0 | 0.013448 | 1.8 | 0.0074907 | 2.1 |
| 190.0 | 0.012297 | 1.8 | 0.0067564 | 2.0 |
| 195.0 | 0.011265 | 1.7 | 0.0061064 | 2.0 |
| 200.0 | 0.010338 | 1.7 | 0.0055299 | 2.0 |
| 205.0 | 0.009504 | 1.7 | 0.0050175 | 1.9 |
| 210.0 | 0.0087516 | 1.6 | 0.0045611 | 1.9 |
| 215.0 | 0.0080718 | 1.6 | 0.0041537 | 1.9 |
| 220.0 | 0.0074567 | 1.6 | 0.0037895 | 1.8 |
| 225.0 | 0.0068989 | 1.5 | 0.0034631 | 1.8 |
| 230.0 | 0.0063925 | 1.5 | 0.0031701 | 1.8 |
| 235.0 | 0.0059318 | 1.5 | 0.0029067 | 1.7 |
| 240.0 | 0.005512 | 1.5 | 0.0026693 | 1.7 |
| 245.0 | 0.005129 | 1.4 | 0.0024551 | 1.7 |
| 250.0 | 0.004779 | 1.4 | 0.0022615 | 1.6 |
| 255.0 | 0.0044586 | 1.4 | 0.0020862 | 1.6 |
| 260.0 | 0.004165 | 1.4 | 0.0019273 | 1.6 |
| 265.0 | 0.0038955 | 1.3 | 0.0017829 | 1.5 |
| 270.0 | 0.0036478 | 1.3 | 0.0016516 | 1.5 |
| 275.0 | 0.0034199 | 1.3 | 0.0015319 | 1.5 |
| 280.0 | 0.0032098 | 1.3 | 0.0014228 | 1.5 |
| 285.0 | 0.003016 | 1.2 | 0.0013231 | 1.4 |
| 290.0 | 0.002837 | 1.2 | 0.0012319 | 1.4 |
| 295.0 | 0.0026714 | 1.2 | 0.0011483 | 1.4 |
| 300.0 | 0.002518 | 1.2 | 0.0010716 | 1.4 |

### R/T characteristics

| R/T No. | **8307** | | **8324** | | **8342** | |
|---|---|---|---|---|---|---|
| T (°C) | $B_{25/100}$ = 3492 K | | $B_{25/100}$ = 3497 K | | $B_{25/100}$ = 4006 K | |
| | $R_T/R_{25}$ | $\alpha$ (%/K) | $R_T/R_{25}$ | $\alpha$ (%/K) | $R_T/R_{25}$ | $\alpha$ (%/K) |
| −55.0 | 52.624 | 6.4 | 53.720 | 6.5 | 100.56 | 7.5 |
| −50.0 | 38.452 | 6.2 | 39.080 | 6.2 | 69.453 | 7.3 |
| −45.0 | 28.401 | 6.0 | 28.768 | 6.0 | 48.647 | 7.0 |
| −40.0 | 21.194 | 5.8 | 21.412 | 5.8 | 34.525 | 6.7 |
| −35.0 | 15.972 | 5.6 | 16.104 | 5.6 | 24.808 | 6.5 |
| −30.0 | 12.149 | 5.4 | 12.231 | 5.4 | 18.036 | 6.3 |
| −25.0 | 9.3246 | 5.2 | 9.3758 | 5.2 | 13.258 | 6.1 |
| −20.0 | 7.2181 | 5.0 | 7.2507 | 5.1 | 9.8478 | 5.8 |
| −15.0 | 5.6332 | 4.9 | 5.6542 | 4.9 | 7.3874 | 5.7 |
| −10.0 | 4.4308 | 4.7 | 4.4444 | 4.7 | 5.5937 | 5.5 |
| −5.0 | 3.5112 | 4.6 | 3.5200 | 4.6 | 4.2733 | 5.3 |
| 0.0 | 2.8024 | 4.4 | 2.8080 | 4.5 | 3.2922 | 5.1 |
| 5.0 | 2.252 | 4.3 | 2.2555 | 4.3 | 2.5567 | 5.0 |
| 10.0 | 1.8216 | 4.2 | 1.8236 | 4.2 | 2.0007 | 4.8 |
| 15.0 | 1.4827 | 4.1 | 1.4838 | 4.1 | 1.577 | 4.7 |
| 20.0 | 1.2142 | 3.9 | 1.2146 | 3.9 | 1.2516 | 4.5 |
| 25.0 | 1.0000 | 3.8 | 1.0000 | 3.8 | 1.0000 | 4.4 |
| 30.0 | 0.82818 | 3.7 | 0.82789 | 3.7 | 0.80501 | 4.3 |
| 35.0 | 0.68954 | 3.6 | 0.68906 | 3.6 | 0.65207 | 4.2 |
| 40.0 | 0.57703 | 3.5 | 0.57644 | 3.5 | 0.53135 | 4.0 |
| 45.0 | 0.48525 | 3.4 | 0.48461 | 3.4 | 0.43546 | 3.9 |
| 50.0 | 0.41 | 3.3 | 0.40933 | 3.3 | 0.35884 | 3.8 |
| 55.0 | 0.34798 | 3.2 | 0.34732 | 3.2 | 0.29726 | 3.7 |
| 60.0 | 0.29663 | 3.2 | 0.29599 | 3.2 | 0.24751 | 3.6 |
| 65.0 | 0.25392 | 3.1 | 0.25331 | 3.1 | 0.20709 | 3.5 |
| 70.0 | 0.21824 | 3.0 | 0.21767 | 3.0 | 0.17408 | 3.4 |
| 75.0 | 0.1883 | 2.9 | 0.18777 | 2.9 | 0.147 | 3.3 |
| 80.0 | 0.16307 | 2.8 | 0.16259 | 2.8 | 0.12468 | 3.3 |
| 85.0 | 0.14174 | 2.8 | 0.14130 | 2.8 | 0.10618 | 3.2 |
| 90.0 | 0.12362 | 2.7 | 0.12323 | 2.7 | 0.0908 | 3.1 |
| 95.0 | 0.10818 | 2.6 | 0.10783 | 2.6 | 0.077949 | 3.0 |
| 100.0 | 0.094973 | 2.6 | 0.094663 | 2.6 | 0.067168 | 2.9 |
| 105.0 | 0.08364 | 2.5 | 0.083368 | 2.5 | 0.058088 | 2.9 |
| 110.0 | 0.073881 | 2.5 | 0.073645 | 2.5 | 0.050412 | 2.8 |
| 115.0 | 0.06545 | 2.4 | 0.065247 | 2.4 | 0.043898 | 2.7 |
| 120.0 | 0.058144 | 2.3 | 0.057972 | 2.3 | 0.038351 | 2.7 |
| 125.0 | 0.051794 | 2.3 | 0.051649 | 2.3 | 0.033611 | 2.6 |
| 130.0 | 0.046259 | 2.2 | 0.046139 | 2.2 | 0.029546 | 2.5 |
| 135.0 | 0.04142 | 2.2 | 0.041323 | 2.2 | 0.02605 | 2.5 |
| 140.0 | 0.037179 | 2.1 | 0.037102 | 2.1 | 0.023033 | 2.4 |
| 145.0 | 0.033451 | 2.1 | 0.033393 | 2.1 | 0.020421 | 2.4 |
| 150.0 | 0.030166 | 2.0 | 0.030125 | 2.0 | 0.018154 | 2.3 |
| 155.0 | 0.027264 | 2.0 | 0.027238 | 2.0 | 0.016181 | 2.3 |

| R/T No. | **8307** | | **8324** | | **8342** | |
|---|---|---|---|---|---|---|
| T (°C) | $B_{25/100}$ = 3492 K | | $B_{25/100}$ = 3497 K | | $B_{25/100}$ = 4006 K | |
| | $R_T/R_{25}$ | α (%/K) | $R_T/R_{25}$ | α (%/K) | $R_T/R_{25}$ | α (%/K) |
| 160.0 | 0.024694 | 2.0 | 0.024669 | 1.9 | 0.014458 | 2.2 |
| 165.0 | 0.022414 | 1.9 | 0.022398 | 1.9 | 0.01295 | 2.2 |
| 170.0 | 0.020385 | 1.9 | 0.020383 | 1.9 | 0.011626 | 2.1 |
| 175.0 | 0.018577 | 1.8 | 0.018589 | 1.8 | 0.010462 | 2.1 |
| 180.0 | 0.016961 | 1.8 | 0.016987 | 1.8 | 0.0094347 | 2.0 |
| 185.0 | 0.015514 | 1.8 | 0.015552 | 1.7 | 0.0085267 | 2.0 |
| 190.0 | 0.014216 | 1.7 | 0.014263 | 1.7 | 0.0077222 | 2.0 |
| 195.0 | 0.013049 | 1.7 | 0.013104 | 1.7 | 0.0070076 | 1.9 |
| 200.0 | 0.011999 | 1.7 | 0.012060 | 1.6 | 0.0063716 | 1.9 |
| 205.0 | 0.011051 | 1.6 | 0.011117 | 1.6 | 0.0058044 | 1.8 |
| 210.0 | 0.010194 | 1.6 | 0.010264 | 1.6 | 0.0052974 | 1.8 |
| 215.0 | 0.0094181 | 1.6 | 0.0094930 | 1.5 | 0.0048434 | 1.8 |
| 220.0 | 0.0087144 | 1.5 | 0.0087939 | 1.5 | 0.004436 | 1.7 |
| 225.0 | 0.0080751 | 1.5 | 0.0081599 | 1.5 | 0.0040697 | 1.7 |
| 230.0 | 0.0074933 | 1.5 | 0.0075842 | 1.4 | 0.0037398 | 1.7 |
| 235.0 | 0.0069631 | 1.5 | 0.0070611 | 1.4 | 0.0034422 | 1.6 |
| 240.0 | 0.0064791 | 1.4 | 0.0065853 | 1.4 | 0.0031732 | 1.6 |
| 245.0 | 0.0060366 | 1.4 | 0.0061522 | 1.3 | 0.0029296 | 1.6 |
| 250.0 | 0.0056316 | 1.4 | 0.0057577 | 1.3 | 0.0027087 | 1.6 |
| 255.0 | 0.0052602 | 1.4 | – | – | – | – |
| 260.0 | 0.0049193 | 1.3 | – | – | – | – |
| 265.0 | 0.0046059 | 1.3 | – | – | – | – |
| 270.0 | 0.0043173 | 1.3 | – | – | – | – |
| 275.0 | 0.0040514 | 1.3 | – | – | – | – |
| 280.0 | 0.003806 | 1.2 | – | – | – | – |
| 285.0 | 0.0035793 | 1.2 | – | – | – | – |
| 290.0 | 0.0033696 | 1.2 | – | – | – | – |
| 295.0 | 0.0031753 | 1.2 | – | – | – | – |
| 300.0 | 0.0029952 | 1.2 | – | – | – | – |

## Mounting instructions

### 1 Soldering

### 1.1 Leaded NTC thermistors

Leaded thermistors comply with the solderability requirements specified by CECC.

When soldering, care must be taken that the NTC thermistors are not damaged by excessive heat. The following maximum temperatures, maximum time spans and minimum distances have to be observed:

| | *Dip soldering* | *Iron soldering* |
|---|---|---|
| Bath temperature | max. 260 °C | max. 360 °C |
| Soldering time | max. 4 s | max. 2 s |
| Distance from thermistor | min. 6 mm | min. 6 mm |

Under more severe soldering conditions the resistance may change.

### 1.2 Leadless NTC thermistors

In case of NTC thermistors without leads, soldering is restricted to devices which are provided with a solderable metallization. The temperature shock caused by the application of hot solder may produce fine cracks in the ceramic, resulting in changes in resistance.

To prevent leaching of the metallization, solder with silver additives or with a low tin content should be used. In addition, soldering methods should be employed which permit short soldering times.

### 1.3 SMD NTC thermistors

SMD NTC thermistors can be provided with a nickel barrier termination or on special request with silver-palladium termination. The usage of mild, non-activated fluxes for soldering is recommended as well as a proper cleaning of the PCB.

- Nickel barrier termination

The nickel barrier layer of the silver/nickel/tin termination (see figure 1) prevents leaching of the silver base metalization layer. This allows great flexibility in the selection of soldering parameters.

The tin prevents the nickel layer from oxidizing and thus ensures better wetting by the solder. The nickel barrier termination is suitable for all commonly-used soldering methods.

**Note:** SMD NTCs with AgPd termination are not approved for lead-free soldering.

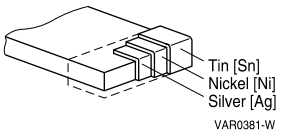



Figure 1

SMD NTC thermistors, structure of nickel barrier termination

### 1.3.1 Solderability (test to IEC 60068-2-58)

Preconditioning: Immersion into flux F-SW 32.
Evaluation criterion: Wetting of soldering areas ≥95%.

| Solder | Bath temperature (°C) | Dwell time (s) |
|---|---|---|
| SnPb 60/40 | 215 ±3 | 3 ±0.3 |
| SnAg (3.0 ... 4.0), Cu (0.5 ... 0.9) | 245 ±3 | 3 ±0.3 |

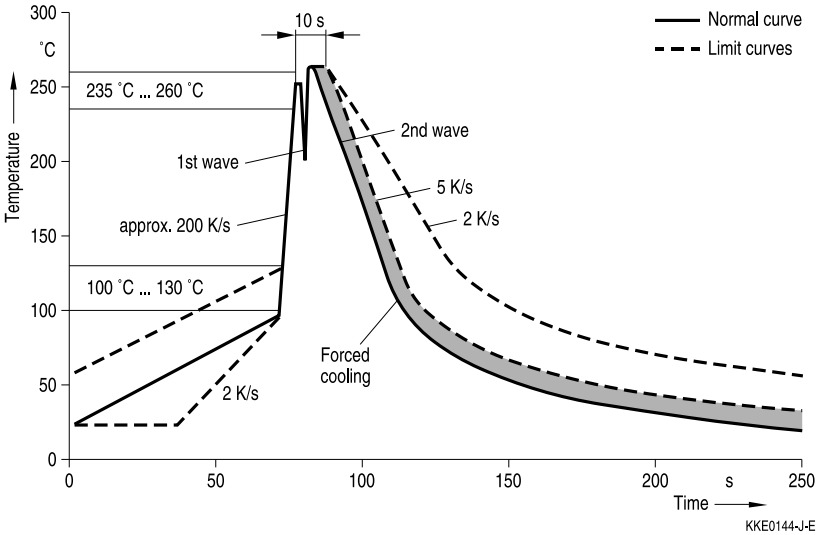
### 1.3.2 Resistance to soldering heat (test to IEC 60068-2-58)

Preconditioning: Immersion into flux F-SW 32.
Evaluation criterion: Leaching of side edges ≤1/3.

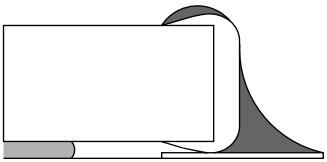
| Solder | Bath temperature (°C) | Dwell time (s) |
|---|---|---|
| SnPb 60/40 | 260 ±5 | 10 ±1 |
| SnAg (3.0 ... 4.0), Cu (0.5 ... 0.9) | 260 ±5 | 10 ±1 |

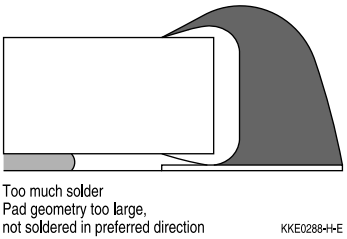
### Wave soldering

Temperature characteristic at component terminal with dual wave soldering



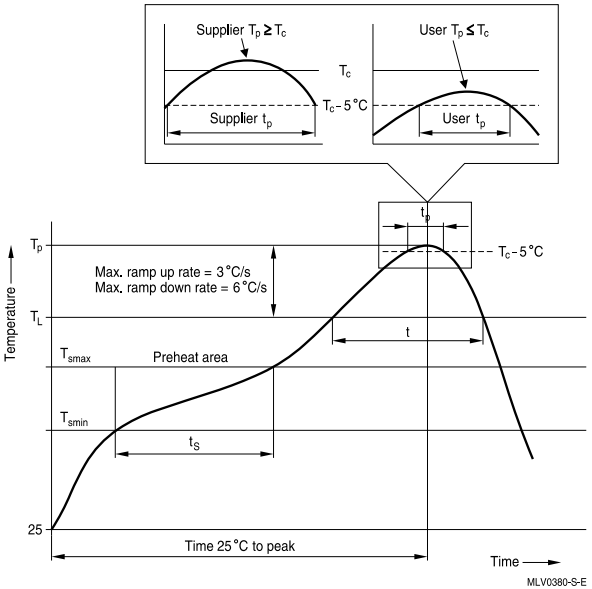

Solder joint profiles for silver/nickel/tin terminations



### Reflow soldering

Recommended temperature characteristic for reflow soldering following JEDEC J-STD-020D

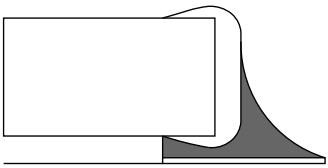



| Profile feature | | Sn-Pb eutectic assembly | Pb-free assembly |
|---|---|---|---|
| Preheat and soak | | | |
| - Temperature min | $T_{smin}$ | 100 °C | 150 °C |
| - Temperature max | $T_{smax}$ | 150 °C | 200 °C |
| - Time | $t_{smin}$ to $t_{smax}$ | 60 ... 120 s | 60 ... 180 s |
| Average ramp-up rate | $T_{smax}$ to $T_p$ | 3 °C/ s max. | 3 °C/ s max. |
| Liquidous temperature | $T_L$ | 183 °C | 217 °C |
| Time at liquidous | $t_L$ | 60 ... 150 s | 60 ... 150 s |
| Peak package body temperature | $T_p$ [1)] | 220 °C ... 235 °C [2)] | 245 °C ... 260 °C [2)] |
| Time ($t_P$) [3)] within 5 °C of specified classification temperature ($T_c$) | | 20 s [3)] | 30 s [3)] |
| Average ramp-down rate | $T_p$ to $T_{smax}$ | 6 °C/ s max. | 6 °C/ s max. |
| Time 25 °C to peak temperature | | max. 6 minutes | max. 8 minutes |

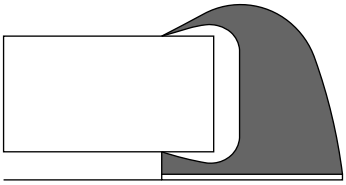
1) Tolerance for peak profile temperature ($T_P$) is defined as a supplier minimum and a user maximum.
2) Depending on package thickness. For details please refer to JEDEC J-STD-020D.
3) Tolerance for time at peak profile temperature ($t_P$) is defined as a supplier minimum and a user maximum.

**Note:** All temperatures refer to topside of the package, measured on the package body surface. Number of reflow cycles: 3

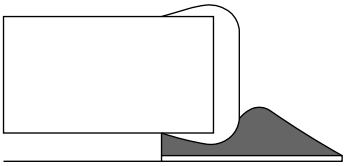
Solder joint profiles for silver/nickel/tin terminations



Good solder joint TNT0565-G-E

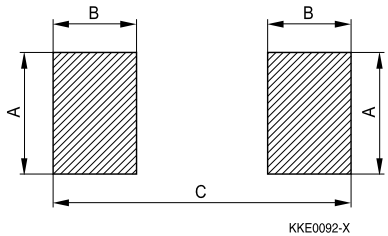


Too much solder
Pad geometry too large KKE0071-A-E



Poor wetting KKE0072-I-E

### 1.3.3 Recommended geometry of solder pads




KKE0092-X

Recommended maximum dimensions (mm)

| Case size inch/mm | A | B | C |
|---|---|---|---|
| 0402/1005 | 0.6 | 0.6 | 1.7 |
| 0603/1608 | 1.0 | 1.0 | 3.0 |
| 0805/2012 | 1.3 | 1.2 | 3.4 |
| 1206/3216 | 1.8 | 1.2 | 4.5 |

### 1.3.4 Notes

Iron soldering should be avoided, hot air methods are recommended for repair purposes.

## 2 Conductive adhesion

An alternative to soldering is the gluing of thermistors with conductive adhesives. The benefit of this method is that it involves no thermal stress. The adhesives used must be chemically inert.

## 3 Clamp contacting

Pressure contacting by means of clamps is particularly suitable for applications involving frequent switching and high turn-on powers.

## 4 Robustness of terminations (leaded types)

The leads meet the requirements of IEC 60068-2-21. They may not be bent closer than 4 mm from the solder joint on the thermistor body or from the point at which they leave the feed-throughs. During bending, any mechanical stress at the outlet of the leads must be removed. The bending radius should be at least 0.75 mm.

Tensile strength: Test Ua1:

| Leads | | | |
|---|---|---|---|
| | | ∅ ≤0.25 mm = | 1.0 N |
| | 0.25 < | ∅ ≤0.35 mm = | 2.5 N |
| | 0.35 < | ∅ ≤0.50 mm = | 5.0 N |
| | 0.50 < | ∅ ≤0.80 mm = | 10.0 N |
| | 0.80 < | ∅ ≤1.25 mm = | 20.0 N |

Bending strength: Test Ub:

Two 90°-bends in opposite directions at a weight of 0.25 kg.

Torsional strength: Test Uc: severity 2

The lead is bent by 90° at a distance of 6 to 6.5 mm from the thermistor body.

The bending radius of the leads should be approx. 0.75 mm. Two torsions of 180° each (severity 2).

When subjecting leads to mechanical stress, the following should be observed:

*Tensile stress on leads*

During mounting and operation tensile forces on the leads are to be avoided.

*Bending of leads*

Bending of the leads directly on the thermistor body is not permissible.

A lead may be bent at a minimum distance of twice the wire's diameter +2 mm from the solder joint on the thermistor body. During bending the wire must be mechanically relieved at its outlet. The bending radius should be at least 0.75 mm.

## 5 Sealing and potting

When thermistors are sealed, potted or overmolded, there must be no mechanical stress caused by thermal expansion during the production process (curing / overmolding process) and during later operation. The upper category temperature of the thermistor must not be exceeded. Ensure that the materials used (sealing / potting compound and plastic material) are chemically neutral.

## 6 Cleaning

Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g. ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.

## 7 Storage

In order to maintain their solderability, thermistors must be stored in a non-corrosive atmosphere. Humidity, temperature and container materials are critical factors.

Do not store SMDs where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed or SMDs may stick together, causing problems during mounting. After opening the factory seals, such as polyvinyl-sealed packages, use the SMDs as soon as possible.

The components should be left in the original packing. Touching the metallization of unsoldered thermistors may change their soldering properties.

| | |
|---|---|
| Storage temperature: | −25 °C up to 45 °C |
| Relative humidity (without condensation): | ≤75% annual mean |
| | <95%, maximum 30 days per annum |

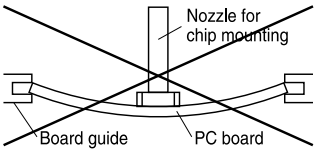
Solder the thermistors listed in this data book after shipment from EPCOS within the time specified:

| | |
|---|---|
| SMDs with nickel barrier termination: | 12 months |
| SMDs with AgPd termination: | 6 months |
| Leaded components: | 24 months |

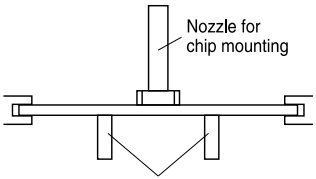
## 8 Placement and orientation of SMD NTC thermistors on PCB

### a) Component placement

**Incorrect**



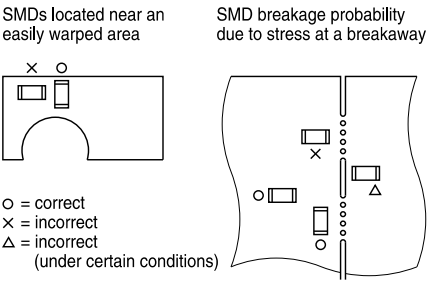

**Correct**




KKE0267-U-E

It is recommended that the PC board should be held by means of some adequate supporting pins such as shown left to prevent the SMDs from being damaged or cracked.

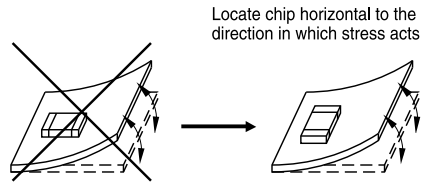
### b) Cracks




KKE0268-3-E

When placing a component near an area which is apt to bend or a grid groove on the PC board, it is advisable to have both electrodes subjected to uniform stress, or to position the component's electrodes at right angles to the grid groove or bending line (see c) Component orientation).

### c) Component orientation




KKE0269-B-E

Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

### Cautions and warnings

See "Important notes".

### Storage

- Store thermistors only in original packaging. Do not open the package prior to processing.
- Storage conditions in original packaging: storage temperature −25 °C ... +45 °C, relative humidity ≤75% annual mean, <95% maximum 30 days per annum, dew precipitation is inadmissible.
- Do not store thermistors where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed or components may stick together, causing problems during mounting.
- Avoid contamination of thermistor surface during storage, handling and processing.
- Avoid storage of thermistors in harmful environments like corrosive gases ($SO_x$, Cl etc).
- Use the components as soon as possible after opening the factory seals, i.e. the polyvinyl-sealed packages.
- Solder thermistors within the time specified after shipment from EPCOS.
  For leaded components this is 24 months, for SMD components with nickel barrier termination 12 months, for SMD components with AgPd termination 6 months.

### Handling

- NTC thermistors must not be dropped. Chip-offs or any other damage must not be caused during handling of NTCs.
- Do not touch components with bare hands. Gloves are recommended.
- Avoid contamination of thermistor surface during handling.
- Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g. ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.

### Bending / twisting leads

- A lead (wire) may be bent at a minimum distance of twice the wire's diameter plus 4 mm from the component head or housing. When bending ensure the wire is mechanically relieved at the component head or housing. The bending radius should be at least 0.75 mm.

### Soldering

- Use resin-type flux or non-activated flux.
- Insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended.
- Complete removal of flux is recommended.

### Mounting

- Ensure that no thermo-mechanical stress occurs due to production processes (curing or overmolding processes) when thermistors are sealed, potted or overmolded or during their subsequent operation. The maximum temperature of the thermistor must not be exceeded. Ensure that the materials used (sealing/potting compound and plastic material) are chemically neutral.
- Electrodes/contacts must not be scratched or damaged before/during/after the mounting process.
- Contacts and housing used for assembly with the thermistor must be clean before mounting.
- Ensure that adjacent materials are designed for operation at temperatures comparable to the surface temperature of the thermistor. Be sure that surrounding parts and materials can withstand the temperature.
- Avoid contamination of the thermistor surface during processing.
- The connections of sensors (e.g. cable end, wire end, plug terminal) may only be exposed to an environment with normal atmospheric conditions.
- Tensile forces on cables or leads must be avoided during mounting and operation.
- Bending or twisting of cables or leads directly on the thermistor body is not permissible.
- Avoid using chemical substances as mounting aids. It must be ensured that no water or other liquids enter the NTC thermistors (e.g. through plug terminals). In particular, water based substances (e.g. soap suds) must not be used as mounting aids for sensors.

### Operation

- Use thermistors only within the specified operating temperature range.
- Use thermistors only within the specified power range.
- Environmental conditions must not harm the thermistors. Only use the thermistors under normal atmospheric conditions or within the specified conditions.
- Contact of NTC thermistors with any liquids and solvents shall be prevented. It must be ensured that no water enters the NTC thermistors (e.g. through plug terminals). For measurement purposes (checking the specified resistance vs. temperature), the component must not be immersed in water but in suitable liquids (e.g. perfluoropolyethers such as Galden).
- Avoid dewing and condensation unless thermistor is specified for these conditions.
- Bending or twisting of cables and/or wires is not permissible during operation of the sensor in the application.
- Be sure to provide an appropriate fail-safe function to prevent secondary product damage caused by malfunction.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.

### Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data sheets, data books, other publications, on the EPCOS website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.epcos.com/orderingcodes

## Symbols and terms

| Symbol | English | German |
|---|---|---|
| A | Area | Fläche |
| AWG | American Wire Gauge | Amerikanische Norm für Drahtquerschnitte |
| B | B value | B-Wert |
| $B_{25/100}$ | B value determined by resistance measurement at 25 °C and 100 °C | B-Wert, ermittelt durch Widerstands-messungen bei 25 °C und 100 °C |
| $C_{th}$ | Heat capacitance | Wärmekapazität |
| I | Current | Strom |
| N | Number (integer) | Anzahl (ganzzahliger Wert) |
| $P_{25}$ | Maximum power at 25 °C | Maximale Leistung bei 25 °C |
| $P_{diss}$ | Power dissipation | Verlustleistung |
| $P_{el}$ | Electrical power | Elektrische Leistung |
| $P_{max}$ | Maximum power within stated temperature range | Maximale Leistung im angegebenenTemperaturbereich |
| $\Delta R_B/R_B$ | Resistance tolerance caused by spread of B value | Widerstandstoleranz, die durch die Streuung des B-Wertes verursacht wird |
| $R_{ins}$ | Insulation resistance | Isolationswiderstand |
| $R_P$ | Parallel resistance | Parallelwiderstand |
| $R_R$ | Rated resistance | Nennwiderstand |
| $\Delta R_R/R_R$ | Resistance tolerance | Widerstandstoleranz |
| $R_S$ | Series resistance | Serienwiderstand |
| $R_T$ | Resistance at temperature T (e.g. $R_{25}$ = resistance at 25 °C) | Widerstand bei Temperatur T (z.B. $R_{25}$ = Widerstand bei 25 °C) |
| T | Temperature | Temperatur |
| $\Delta T$ | Temperature tolerance | Temperaturtoleranz |
| t | Time | Zeit |
| $T_A$ | Ambient temperature | Umgebungstemperatur |
| $T_{max}$ | Upper category temperature | Obere Grenztemperatur (Kategorietemperatur) |
| $T_{min}$ | Lower category temperature | Untere Grenztemperatur (Kategorietemperatur) |
| $T_{op}$ | Operating temperature | Betriebstemperatur |
| $T_R$ | Rated temperature | Nenntemperatur |
| $T_{surf}$ | Surface temperature | Oberflächentemperatur |
| V | Voltage | Spannung |
| $V_{ins}$ | Insulation test voltage | Isolationsprüfspannung |
| $V_{op}$ | Operating voltage | Betriebsspannung |
| $V_{test}$ | Test voltage | Prüfspannung |

| Symbol | English | German |
|---|---|---|
| $\alpha$ | Temperature coefficient | Temperaturkoeffizient |
| $\Delta$ | Tolerance, change | Toleranz, Änderung |
| $\delta_{th}$ | Dissipation factor | Wärmeleitwert |
| $\tau_c$ | Thermal cooling time constant | Thermische Abkühlzeitkonstante |
| $\tau_a$ | Thermal time constant | Thermische Zeitkonstante |

**Abbreviations / Notes**

| Symbol | English | German |
|---|---|---|
| SMD | Surface-mounted devices | Oberflächenmontierbares Bauelement |
| * | To be replaced by a number in ordering codes, type designations etc. | Platzhalter für Zahl im Bestellnummern-code oder für die Typenbezeichnung. |
| + | To be replaced by a letter. | Platzhalter für einen Buchstaben. |
| | All dimensions are given in mm. | Alle Maße sind in mm angegeben. |
| | The commas used in numerical values denote decimal points. | Verwendete Kommas in Zahlenwerten bezeichnen Dezimalpunkte. |

## Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
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## Important notes

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