



NTC thermistors for temperature measurement

SMD NTC thermistor for semiconductor power modules

Series/Type:
Ordering code: B57621C5502H062
Date: 14.04.2022
Version: 4

Applications

Temperature measurement for semiconductor power modules

- Threshold temperature measurement
- DCB & PCB temperature measurement
- Heat sink temperature monitoring

Features

- Multilayer SMD NTC thermistor with nickel barrier termination (AgNiSn)
- B values specified between 25 °C and 100 °C for highest accuracy at typical working temperature
- Minimized resistance drift after soldering process
- Excellent long-term aging stability in high temperature and high humidity environment
- UL approval (E69802)
- RoHS compliant without exemption
- 100% lead-free

Electrical specifications

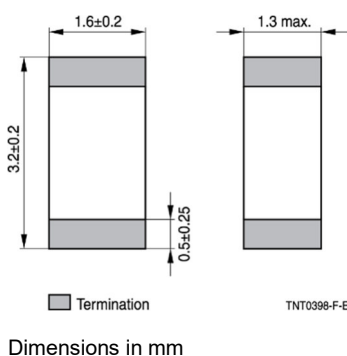
| Ordering code | Zero-power resistance (at 25 °C) | B _{25/100} | B _{25/85} | B _{25/50} |
|-----------------|-------------------------------------|---------------------|--------------------|--------------------|
| B57621C5502H062 | 5 kΩ ±3% | 3455 K ±2% | (3420 K) | (3375 K) |

General technical data

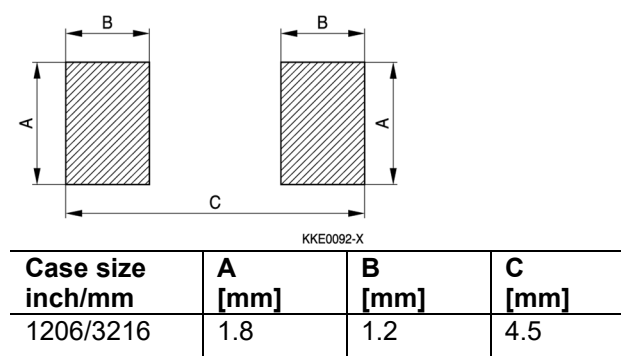
| | | | |
|--------------------------------------|-------------------------------|-------------|------|
| Operating temperature range | T _{op} | -40 ... 175 | °C |
| Maximum power @ 25 °C on PCB | P ₂₅ ¹⁾ | 50 | mW |
| Rated temperature | T _R | 25 | °C |
| Dissipation factor on PCB | δ _{th} ¹⁾ | approx. 5 | mW/K |
| Thermal cooling time constant on PCB | τ _c ¹⁾ | approx. 10 | s |
| Heat capacity | C _{th} ¹⁾ | approx. 50 | mJ/K |
| Weight of component | | approx. 18 | mg |

¹⁾ Depends on mounting situation.

Dimensional drawing for case size 1206



Recommended geometry of solder pads



Reliability data

Tests of SMD NTC thermistors are based on AEC-Q200 Rev-D.

The parts are mounted on standardized PCB.

| Test | Standard | Test conditions | $\Delta R_{25} / R_{25}$ (typical) | Remarks |
|--------------------------------------|---------------------------|--|---------------------------------------|-----------------------------|
| Pre- and post-stress electrical test | | Resistance at: 25 °C and 100 °C | - | |
| High temperature exposure (storage) | MIL-STD-202, method 108 | Test temperature: 150 °C Duration: 1000 h Unpowered | < 5% | |
| Temperature cycling | JESD22, method JA-104 | Lower test temperature: -40 °C Upper test temperature: 150 °C Number of cycles: 1000 Dwell time: 15 min | < 5% | |
| Biased humidity | MIL-STD-202, method 103 | Test temperature: 85 °C Rel. humidity of air: 85% Duration: 1000 h Test voltage: $V_{NTC} = 0.3 \text{ V DC}$ | < 5% | |
| Operational life | MIL-STD-202, method 108 | Test temperature: 150 °C $P_{max} = 0.35 \text{ mW}$ Duration: 1000 h | < 5% | |
| External visual | MIL-STD-883E, method 2009 | Visual inspection | | |
| Physical dimensions | JESD22, method JB-100 | Measured with calipers | | Within the specified values |
| Resistance to solvents | MIL-STD-202, method 215 | Not applicable for SMD NTC thermistors (component has no marking, color coding or coating) | | |
| Mechanical shock | MIL-STD-202, method 213 | Peak value: 1500 g Half sine Condition F | < 5% | |
| Vibration | MIL-STD-202, method 204 | Acceleration: 5 g Sweep time: 20 min Frequency range: 10 ... 2000 Hz 3 x 12 cycles | < 5% | |
| Resistance to soldering heat | MIL-STD-202, method 210 | Dip: 260 °C; 10 s 1 heat cycle | < 5% | |

| Test | Standard | Test conditions | $\Delta R_{25} / R_{25}$ (typical) | Remarks |
|-------------------------------------|------------------------------|--|---------------------------------------|-----------------------------------|
| ESD | AEC-Q200-002, method -002 | Discharge capacitance: 150 pF Discharge resistance: 2 k Ω Charging voltage: 6 kV Contact discharge 2 pulses in each polarity | < 5% | |
| Solderability | J-STD-002 | a) Dip: 235 °C; 5 s: aging 4 h @ 155 °C b) Dip: 215 °C; 5 s: steam aging 8 h @ 92 °C c) Dip: 260 °C; 7 s: steam aging 8 h @ 92 °C | | 95% of termination wetted |
| Electrical characterization | | R(25 °C), R(100 °C), B(25/100) | | Within the specified values |
| Flammability | UL-94, V-0 or V-1 | Not applicable for SMD NTC thermistors (component is not coated or encapsulated with plastic materials) | | |
| Board flex | AEC-Q200-005, method -005 | Max. bending: 2 mm Duration @ max. bending: 60 s | < 5% | |
| Terminal strength | AEC-Q200-006, method -006 | Max. F: 17.7 N | < 5% | |
| Resistance drift after soldering | | Reflow soldering profile Wave soldering profile | < 1% | |

R/T characteristics

NTC resistance temperature curve

R/T-curve N/A

R at 25 °C 5000 [Ω]

B (25/100) 3455 [K] ±2.0 [%]

 R_N at 25 °C 5000 [Ω] ±3.0 [%]

| Temp. [°C] | R Nom [Ω] | R Min [Ω] | R Max [Ω] | ΔT [±°C] | α [%/K] |
|------------|---------------|---------------|---------------|------------|------------|
| 85 | 731.92 | 683.20 | 783.42 | 2.6 | 2.7 |
| 86 | 712.27 | 664.50 | 762.78 | 2.6 | 2.7 |
| 87 | 693.23 | 646.40 | 742.79 | 2.6 | 2.7 |
| 88 | 674.79 | 628.87 | 723.42 | 2.7 | 2.7 |
| 89 | 656.94 | 611.91 | 704.64 | 2.7 | 2.7 |
| 90 | 639.64 | 595.49 | 686.44 | 2.7 | 2.7 |
| 91 | 622.87 | 579.58 | 668.79 | 2.8 | 2.7 |
| 92 | 606.63 | 564.17 | 651.69 | 2.8 | 2.6 |
| 93 | 590.88 | 549.25 | 635.10 | 2.8 | 2.6 |
| 94 | 575.62 | 534.79 | 619.01 | 2.9 | 2.6 |
| 95 | 560.82 | 520.78 | 603.40 | 2.9 | 2.6 |
| 96 | 546.48 | 507.20 | 588.26 | 3.0 | 2.6 |
| 97 | 532.57 | 494.04 | 573.57 | 3.0 | 2.6 |
| 98 | 519.07 | 481.29 | 559.32 | 3.0 | 2.6 |
| 99 | 505.99 | 468.92 | 545.49 | 3.1 | 2.6 |
| 100 | 493.29 | 456.93 | 532.06 | 3.1 | 2.5 |
| 101 | 480.97 | 445.30 | 519.03 | 3.1 | 2.5 |
| 102 | 469.02 | 434.02 | 506.38 | 3.2 | 2.5 |
| 103 | 457.41 | 423.08 | 494.09 | 3.2 | 2.5 |
| 104 | 446.15 | 412.46 | 482.16 | 3.2 | 2.5 |
| 105 | 435.22 | 402.17 | 470.57 | 3.3 | 2.5 |
| 106 | 424.61 | 392.17 | 459.31 | 3.3 | 2.5 |
| 107 | 414.30 | 382.47 | 448.38 | 3.3 | 2.5 |
| 108 | 404.29 | 373.06 | 437.75 | 3.4 | 2.4 |
| 109 | 394.57 | 363.92 | 427.43 | 3.4 | 2.4 |
| 110 | 385.13 | 355.04 | 417.40 | 3.5 | 2.4 |
| 111 | 375.96 | 346.43 | 407.64 | 3.5 | 2.4 |
| 112 | 367.05 | 338.06 | 398.17 | 3.5 | 2.4 |
| 113 | 358.39 | 329.93 | 388.95 | 3.6 | 2.4 |
| 114 | 349.97 | 322.03 | 379.99 | 3.6 | 2.4 |
| 115 | 341.79 | 314.36 | 371.28 | 3.6 | 2.4 |

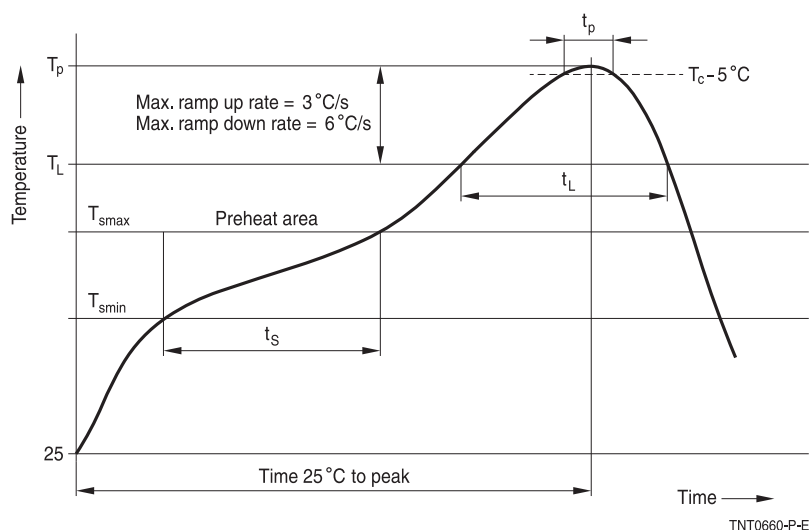
| Temp. [°C] | R Nom [Ω] | R Min [Ω] | R Max [Ω] | ΔT [±°C] | α [%/K] |
|------------|-----------|-----------|-----------|----------|---------|
| 116 | 333.84 | 306.91 | 362.80 | 3.7 | 2.4 |
| 117 | 326.11 | 299.67 | 354.56 | 3.7 | 2.3 |
| 118 | 318.59 | 292.63 | 346.54 | 3.8 | 2.3 |
| 119 | 311.28 | 285.79 | 338.74 | 3.8 | 2.3 |
| 120 | 304.17 | 279.14 | 331.16 | 3.8 | 2.3 |
| 121 | 297.26 | 272.67 | 323.77 | 3.9 | 2.3 |
| 122 | 290.53 | 266.39 | 316.58 | 3.9 | 2.3 |
| 123 | 283.99 | 260.27 | 309.59 | 4.0 | 2.3 |
| 124 | 277.62 | 254.33 | 302.78 | 4.0 | 2.3 |
| 125 | 271.43 | 248.54 | 296.15 | 4.0 | 2.3 |
| 126 | 265.40 | 242.92 | 289.70 | 4.1 | 2.2 |
| 127 | 259.53 | 237.45 | 283.41 | 4.1 | 2.2 |
| 128 | 253.82 | 232.12 | 277.29 | 4.2 | 2.2 |
| 129 | 248.26 | 226.94 | 271.33 | 4.2 | 2.2 |
| 130 | 242.84 | 221.90 | 265.53 | 4.2 | 2.2 |
| 131 | 237.57 | 216.99 | 259.87 | 4.3 | 2.2 |
| 132 | 232.44 | 212.21 | 254.36 | 4.3 | 2.2 |
| 133 | 227.44 | 207.56 | 248.99 | 4.4 | 2.2 |
| 134 | 222.57 | 203.03 | 243.76 | 4.4 | 2.2 |
| 135 | 217.82 | 198.62 | 238.66 | 4.4 | 2.2 |
| 136 | 213.20 | 194.32 | 233.69 | 4.5 | 2.1 |
| 137 | 208.69 | 190.14 | 228.85 | 4.5 | 2.1 |
| 138 | 204.30 | 186.07 | 224.13 | 4.6 | 2.1 |
| 139 | 200.03 | 182.10 | 219.52 | 4.6 | 2.1 |
| 140 | 195.86 | 178.23 | 215.03 | 4.6 | 2.1 |
| 141 | 191.79 | 174.46 | 210.66 | 4.7 | 2.1 |
| 142 | 187.83 | 170.79 | 206.39 | 4.7 | 2.1 |
| 143 | 183.97 | 167.21 | 202.22 | 4.8 | 2.1 |
| 144 | 180.20 | 163.72 | 198.16 | 4.8 | 2.1 |
| 145 | 176.53 | 160.32 | 194.20 | 4.9 | 2.1 |
| 146 | 172.95 | 157.01 | 190.33 | 4.9 | 2.0 |
| 147 | 169.45 | 153.78 | 186.56 | 4.9 | 2.0 |
| 148 | 166.05 | 150.63 | 182.88 | 5.0 | 2.0 |
| 149 | 162.72 | 147.56 | 179.29 | 5.0 | 2.0 |
| 150 | 159.48 | 144.56 | 175.78 | 5.1 | 2.0 |
| 151 | 156.31 | 141.64 | 172.36 | 5.1 | 2.0 |
| 152 | 153.23 | 138.79 | 169.02 | 5.2 | 2.0 |
| 153 | 150.21 | 136.00 | 165.76 | 5.2 | 2.0 |
| 154 | 147.27 | 133.29 | 162.57 | 5.3 | 2.0 |

| Temp. [°C] | R Nom [Ω] | R Min [Ω] | R Max [Ω] | ΔT [±°C] | α [%/K] |
|------------|-----------|-----------|-----------|----------|---------|
| 155 | 144.40 | 130.64 | 159.46 | 5.3 | 2.0 |
| 156 | 141.60 | 128.06 | 156.42 | 5.3 | 2.0 |
| 157 | 138.86 | 125.54 | 153.46 | 5.4 | 2.0 |
| 158 | 136.19 | 123.08 | 150.56 | 5.4 | 1.9 |
| 159 | 133.58 | 120.68 | 147.73 | 5.5 | 1.9 |
| 160 | 131.03 | 118.33 | 144.97 | 5.5 | 1.9 |
| 161 | 128.54 | 116.04 | 142.26 | 5.6 | 1.9 |
| 162 | 126.11 | 113.81 | 139.62 | 5.6 | 1.9 |
| 163 | 123.74 | 111.62 | 137.05 | 5.7 | 1.9 |
| 164 | 121.42 | 109.49 | 134.53 | 5.7 | 1.9 |
| 165 | 119.15 | 107.41 | 132.06 | 5.8 | 1.9 |
| 166 | 116.94 | 105.38 | 129.65 | 5.8 | 1.9 |
| 167 | 114.78 | 103.39 | 127.30 | 5.8 | 1.9 |
| 168 | 112.66 | 101.45 | 125.00 | 5.9 | 1.9 |
| 169 | 110.60 | 99.56 | 122.75 | 5.9 | 1.9 |
| 170 | 108.58 | 97.70 | 120.55 | 6.0 | 1.8 |
| 171 | 106.60 | 95.89 | 118.40 | 6.0 | 1.8 |
| 172 | 104.67 | 94.13 | 116.30 | 6.1 | 1.8 |
| 173 | 102.79 | 92.40 | 114.24 | 6.1 | 1.8 |
| 174 | 100.94 | 90.71 | 112.23 | 6.2 | 1.8 |
| 175 | 99.14 | 89.06 | 110.26 | 6.2 | 1.8 |

Recommended soldering profiles

Reflow soldering

Temperature ranges for reflow soldering acc. To IEC 60068-2-58 recommendations.



| 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 ... 120 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 | 40 ... 150 s | 40 ... 150 s |
| Peak package body temperature | $T_p^{1)}$ | 215 °C ... 260 °C | 235 °C ... 260 °C |
| Time above ($T_p - 5$ °C) | t_p | 10 ... 40 s | 10 ... 40 s |
| Average ramp-down rate | T_p to T_{smax} | 6 °C/ s max. | 6 °C/ s max. |
| Time 25 °C to peak temperature | | max. 8 minutes | max. 8 minutes |

1) Depending on package thickness.

Note: All temperatures refer to topside of the package, measured on the package body surface.

Number of reflow cycles: 3

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

Recommended solder

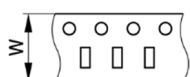
Flux less Pb-free Sn (95.1 ... 96.0), Ag (3.0 ... 4.0), Cu (0.5 ... 0.9) solder is recommended.

Taping and packing

Tape and reel packing according to IEC 60286-3

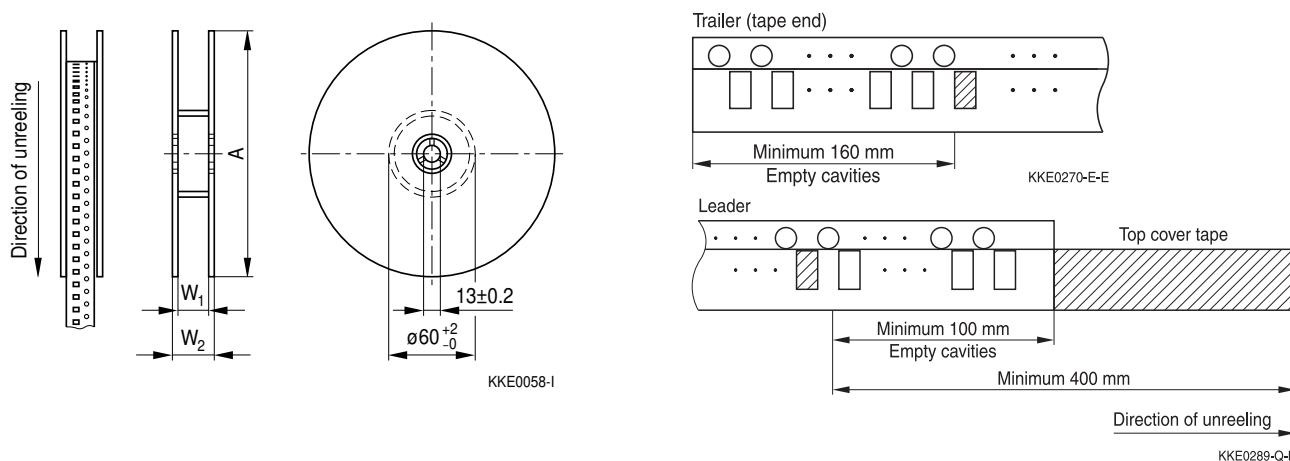
Tape material: Blister

Tape dimensions and tolerances



| Definition | Symbol | Dimension [mm] | Tolerance [mm] |
|------------|--------|----------------|----------------|
| Tape width | W | 8.00 | ±0.30 |

Reel dimensions and tolerances



| Definition | Symbol | Dimension [mm] | Tolerance [mm] |
|----------------------|--------|----------------|----------------|
| Reel diameter | A | 180 | +0/-3 |
| Reel width (inside) | W1 | 8.4 | +1.5/-0 |
| Reel width (outside) | W2 | 14.4 | max. |

Packing unit: 4000 pcs./ reel

Cautions and warnings

Storage

- Store thermistors only in original packaging. Do not open the package before storage.
- Storage conditions in original packaging: storage temperature $-25\text{ °C} \dots +45\text{ °C}$, relative humidity $\leq 75\%$ annual mean, 95% on max. 30 days in a year, dew precipitation and wetness are inadmissible.
- 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.
- Avoid contamination of thermistors surface during storage, handling and processing. Touching the metallization of unsoldered thermistors may change their soldering properties.
- Avoid storage of thermistor in harmful environments like corrosive gases (SO_x , Cl etc.)
- After opening the factory seals, such as polyvinyl-sealed packages, use the SMDs as soon as possible.
- Solder thermistors after shipment from TDK Electronics within the time specified:
SMD NTC thermistors with nickel-barrier termination: 12 months

Handling

- NTC thermistors must not be dropped. Chip-offs must not be caused during handling of NTCs.
- Components must not be touched 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.

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

- When NTC thermistors are encapsulated with sealing material or over molded with plastic material, there must be no mechanical stress caused by thermal expansion during the production process (curing / over molding process) and during later operation. The upper category temperature of the thermistor must not be exceeded. Ensure that the materials used (sealing compound and plastic material) are chemically neutral.
- Electrode must not be scratched before/during/after the mounting process.
- Contacts and housing used for assembly with thermistor have to 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 thermistor surface during processing.

Operation

- Use thermistors only within the specified operating temperature range.
- Environmental conditions must not harm the thermistors. Use thermistors only in normal atmospheric conditions.
- Contact of NTC thermistors with any liquids and solvents should 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. Galden).
- Avoid dewing and condensation.
- Be sure to provide an appropriate fail-safe function to prevent secondary product damage caused by malfunction (e.g. use VDR for limitation of overvoltage condition).

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