



NTC thermistors for temperature measurement

SMD NTC thermistors for automotive applications

Series/Type:	Automotive series
Ordering code:	B57232V5103A260
Date:	2025-04-24
Version:	1

Applications

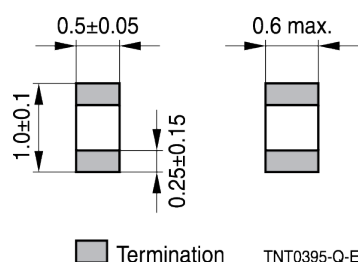
Temperature measurement and compensation in various automotive circuits, such as

- charging and temperature control of battery packs and battery management systems (BMS)
- electronic control units (ECUs), e.g., motor management, HVAC, electronic power steering (EPS), gearbox controls, ABS systems
- temperature sensor for air-conditioning
- LED lighting
- DC/DC converters, inverters, on-board chargers (OBC)

Features

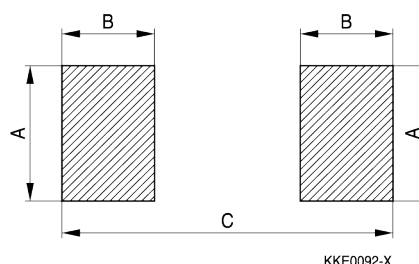
- Qualification based on AEC-Q200
- Accurate temperature measurement from -40 °C to 175 °C
- Excellent long-term aging stability in high temperature and high humidity environment
- Tight R tolerances and B tolerances
- Pb free, RoHS, UL approval (file number E69802)

Dimensional drawing



Dimensions in mm

Recommended geometry of solder pads



Case size [inch/mm]	A [mm]	B [mm]	C [mm]
0402/1005	0.6	0.6	1.7

Electrical specifications

Ordering code	Zero-power resistance (at 25 °C)	B _{25/100}	B _{25/85}	B _{25/50}
B57232V5103A260	10 kΩ ±1.0%	3455 K ±1.0%	(3435 K)	(3380 K)

General technical data

Operating temperature range	T _{op}	-40 ... 175	°C
Maximum power (at 25 °C, on PCB)	P ₂₅ ¹⁾	150	mW
Rated temperature	T _R	25	°C
Dissipation factor (on PCB)	δ _{th} ¹⁾	approx. 2.5	mW/K
Thermal cooling time constant (on PCB)	τ _c ¹⁾	approx. 3	s
Heat capacity	C _{th} ¹⁾	approx. 7.5	mJ/K
Weight of component		approx. 2	mg

¹⁾ Depends on mounting situation

Resistance/temperature characteristic

NTC resistance temperature curve

R/T curve 8509

R at 25 °C 10000 [Ω]

B (25/100) 3455 [K] ±1 [%]

Temp. [°C]	R Nom [Ω]	R Min [Ω]	R Max [Ω]	ΔR [±%]	ΔT [±°C]	α [%/K]
-40	190031.211	181896.622	198165.800	4.3	0.8	5.4
-35	145358.130	139588.086	151128.174	4.0	0.8	5.3
-30	112057.723	107943.849	116171.596	3.7	0.7	5.1
-25	87040.884	84094.634	89987.134	3.4	0.7	5.0
-20	68104.427	65986.442	70222.412	3.1	0.6	4.8
-15	53664.955	52137.884	55192.026	2.8	0.6	4.7
-10	42575.939	41472.682	43679.195	2.6	0.6	4.6
-5	34001.079	33203.260	34798.899	2.3	0.5	4.4
0	27325.981	26749.238	27902.723	2.1	0.5	4.3
5	22096.109	21679.988	22512.229	1.9	0.4	4.2
10	17972.902	17673.853	18271.951	1.7	0.4	4.1
15	14702.509	14489.006	14916.013	1.5	0.4	4.0
20	12093.365	11942.482	12244.247	1.2	0.3	3.9
25	10000.000	9900.000	10100.000	1.0	0.3	3.7
30	8311.279	8208.126	8414.433	1.2	0.3	3.6
35	6941.794	6842.800	7040.788	1.4	0.4	3.6
40	5825.530	5732.026	5919.035	1.6	0.5	3.5
45	4911.183	4823.839	4998.527	1.8	0.5	3.4
50	4158.659	4077.711	4239.608	1.9	0.6	3.3
55	3536.469	3461.871	3611.068	2.1	0.7	3.2
60	3019.749	2951.279	3088.220	2.3	0.7	3.1
65	2588.776	2526.107	2651.444	2.4	0.8	3.0
70	2227.823	2170.576	2285.070	2.6	0.9	3.0
75	1924.300	1872.070	1976.530	2.7	0.9	2.9
80	1668.075	1620.456	1715.695	2.9	1.0	2.8
85	1450.964	1407.561	1494.368	3.0	1.1	2.8
90	1266.326	1226.764	1305.888	3.1	1.2	2.7
95	1108.751	1072.679	1144.822	3.3	1.2	2.6
100	973.812	940.905	1006.718	3.4	1.3	2.6
105	857.876	827.837	887.914	3.5	1.4	2.5
110	757.947	730.504	785.391	3.6	1.5	2.4
115	671.550	646.455	696.645	3.7	1.6	2.4
120	596.627	573.656	619.597	3.9	1.6	2.3
125	531.464	510.415	552.513	4.0	1.7	2.3
130	474.631	455.322	493.939	4.1	1.8	2.2
135	424.926	407.194	442.659	4.2	1.9	2.2
140	381.341	365.037	397.646	4.3	2.0	2.1
145	343.024	328.014	358.033	4.4	2.1	2.1
150	309.252	295.419	323.086	4.5	2.2	2.1
155	279.416	266.651	292.181	4.6	2.3	2.0
160	252.994	241.200	264.788	4.7	2.4	2.0
165	229.542	218.632	240.451	4.8	2.5	1.9
170	208.680	198.576	218.783	4.8	2.6	1.9
175	190.081	180.713	199.449	4.9	2.7	1.8

Reliability data

- The tests of SMD NTC thermistors are based on AEC-Q200.
- The parts are mounted on standardized PCB.

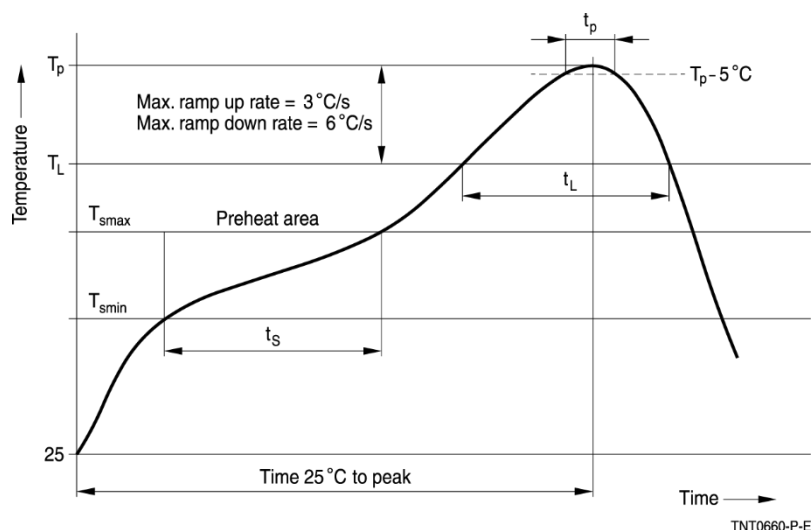
Test	Standard	Test conditions	$\Delta R_{25} / R_{25}$ (typical)	Remarks
Pre-stress and post-stress electrical test		Resistance at: 25 °C and 100 °C	-	
High temperature exposure (storage)	MIL-STD-202, method 108	Test temperature: 175 °C Duration: 1000 h Unpowered	< 5%	
Temperature cycling	JESD22, method JA-104	Lower test temperature: -40 °C Upper test temperature: 175 °C Number of cycles: 1000 Transfer time: < 10 s Dwell time: 15 min Air – Air	< 5%	Temperature cycling is performed acc. to MIL-STD-202, method 107. No warranty will be assumed for the reliability of the solder joint.
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: 175 °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%	

Test	Standard	Test conditions	$\Delta R_{25} / R_{25}$ (typical)	Remarks
Resistance to soldering heat	MIL-STD-202, method 210	Dip: 260 °C; 10 s 1 heat cycle	< 1%	
ESD	AEC-Q200-002, method -002	Discharge capacitance: 150 pF Discharge resistance: 2 kΩ 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	< 2%	
Terminal strength	AEC-Q200-006, method -006	Max. F: 5 N	< 2%	
Resistance drift after soldering		Reflow soldering profile	< 1%	

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 _s	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 (t _p) 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.

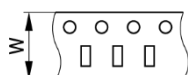
Recommended solder

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

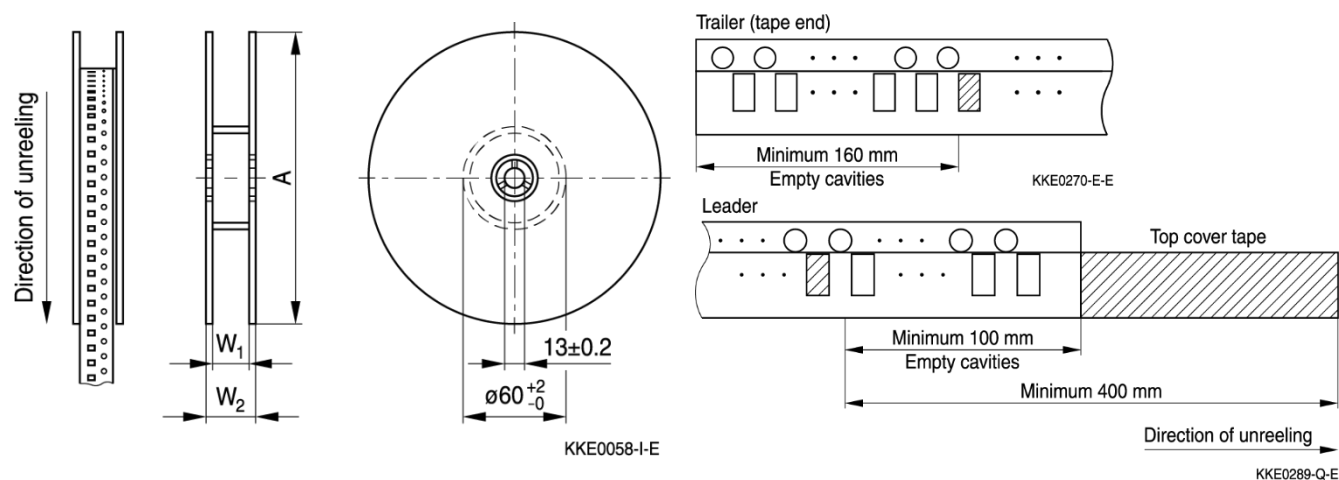
- Tape and reel packing according to IEC 60286-3
- Tape material: Cardboard

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 $-25\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$, 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).

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

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Important notes

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