

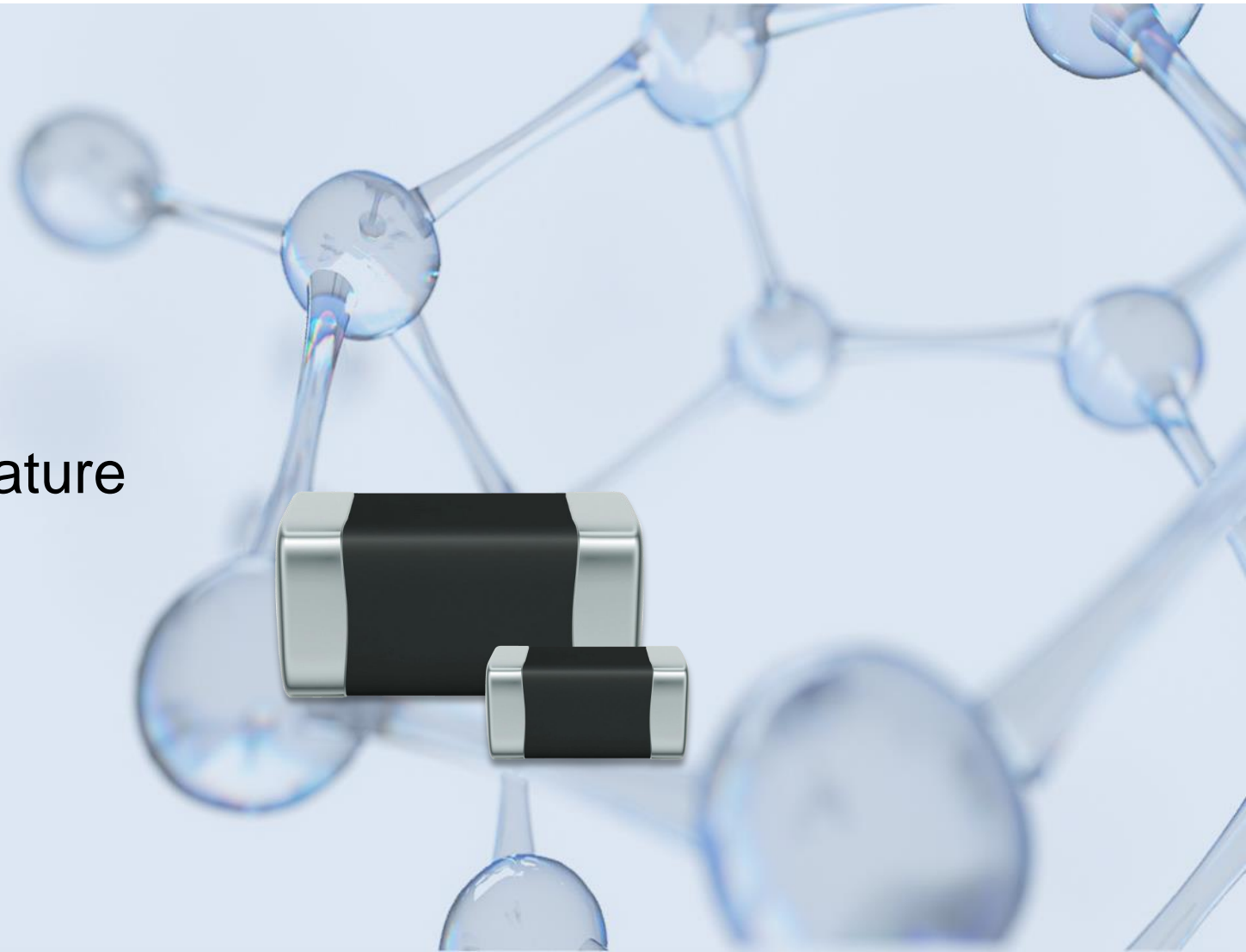
Attracting Tomorrow



Multilayer SMD NTC thermistors

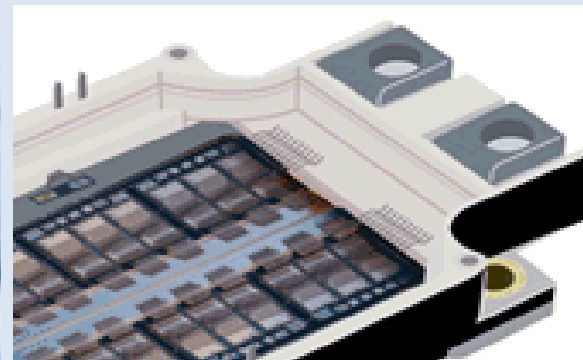
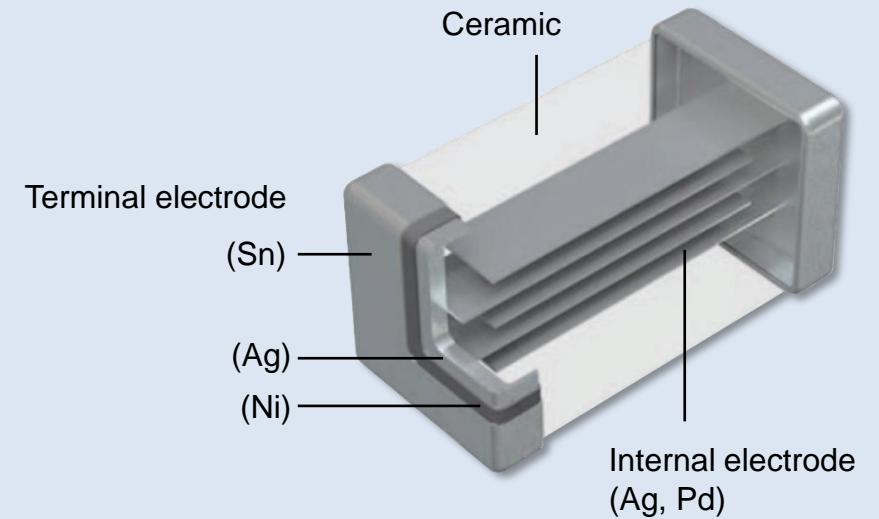
The preferred solution for temperature measurement and compensation

TDK Electronics AG
Piezo & Protection Devices Business Group
Multilayer Business Unit



SMD NTC thermistors

- NTC (Negative Temperature Coefficient) thermistors are thermally sensitive resistors that show a decrease in resistance as temperature increases.
- Thanks to their excellent long-term stability, sensitivity, and accuracy, NTC thermistors are the preferred solution for temperature measurement and compensation in automotive, commercial, and industrial applications.
- TDK portfolio includes a wide range of case sizes, R-values, B-values, and tolerances covering operating temperature ranges up to +175 °C and down to -55 °C.



SMD NTC thermistors

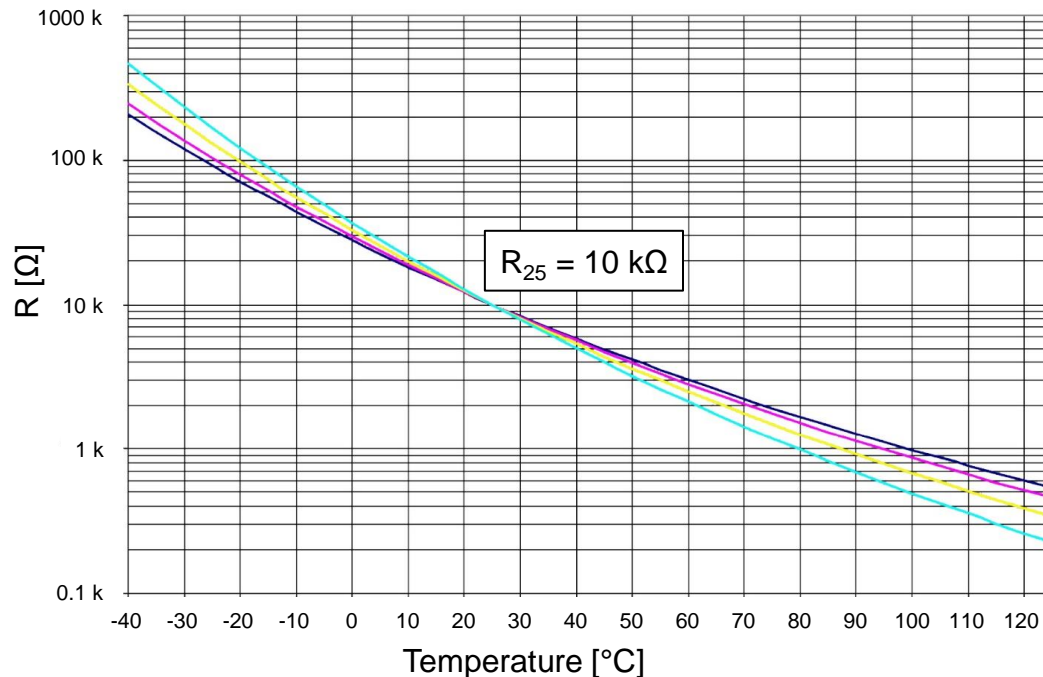
Resistance as a function of temperature

The following equations describe with sufficient accuracy the resistance dependence on temperature:

$$R_T = R_N \cdot e^{B \left(\frac{1}{T} - \frac{1}{T_N} \right)}$$

$$B = \frac{T \cdot T_N}{T_N - T} \cdot \ln \frac{R_T}{R_N} = \frac{T \cdot T_N}{T - T_N} \cdot \ln \frac{R_N}{R_T}$$

$$\alpha = \frac{1}{R_N} \cdot \frac{dR}{dT}$$



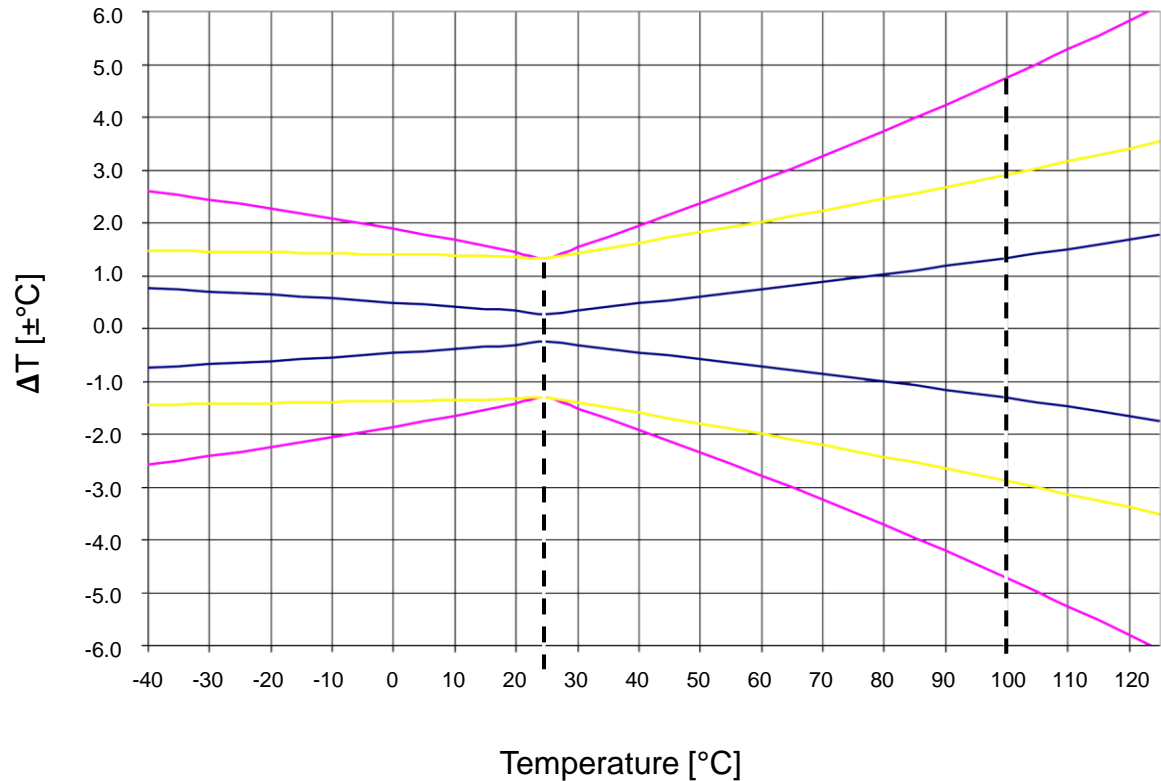
- R_T** Resistance value in Ω at ambient temperature
- T** Ambient temperature in K
- R_N** Nominal resistance in Ω of the thermistor at nominal temperature T_N (25 °C)
- T_N** Nominal temperature in Kelvin (25 °C = 298.15 K)
- B** Material specific constant that characterizes the change in the resistance as a function of the temperature (i.e., the slope of the R/T curve.) The value of the B constant changes by the defined temperature and it is calculated between two specified ambient temperatures.
- α** The temperature coefficient is defined as the relative change in resistance referred to the change in temperature (~2 to ~6 %/K.)




Real resistance versus temperature curves can be found in our [R/T curve calculation tool](#).

SMD NTC thermistors

Temperature accuracy

The R tolerance at 25 °C and the B value tolerance define the tolerance of the thermistor over the temperature range



	R_{25} Ω	R_{tol} %	$B_{25/100}$ K	B_{tol} %	ΔT @ 25 °C	ΔT @ 100 °C
	10 k	1%	3455	1%	±0.3 °C	±1.3 °C
	10 k	5%	3455	1%	±1.3 °C	±2.9 °C
	10 k	5%	3455	3%	±1.3 °C	±4.7 °C

$$\Delta T = \frac{1}{\alpha} \cdot \frac{\Delta R}{R}$$

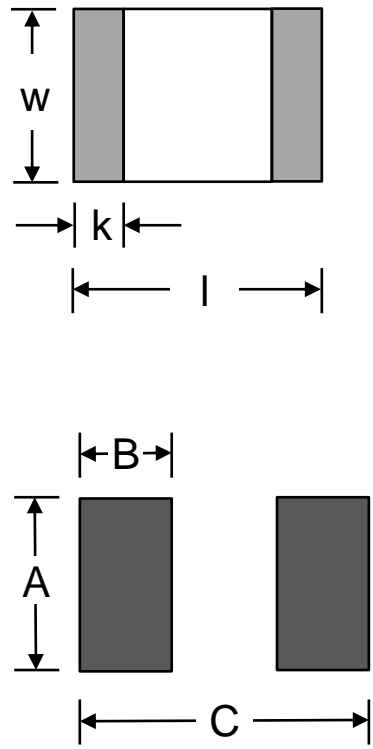
For more Resistance vs. Temperature information, please use our [R/T curve calculation tool](#).

SMD NTC thermistors

Ordering codes

B57	3	32	V5	103	F	3	60
NTC thermistor							
Case sizes: 2 \triangleq EIA chip size 0402 (1005) 3 \triangleq EIA chip size 0603 (1608) 4 \triangleq EIA chip size 0805 (2012) 620 \triangleq EIA chip size 0805 (2012) 621 \triangleq EIA chip size 1206 (3016)							
B value code							
Series: V2, C5 \triangleq standard series V5 \triangleq automotive series							
Resistance at rated temperature (25°C): 103 = $10 \cdot 10^3 \Omega = 10 \text{ k}\Omega$							
Resistance tolerance: F = $\pm 1\%$, G = $\pm 2\%$, H = $\pm 3\%$, J = $\pm 5\%$, K = $\pm 10\%$, A = customer specific							
Internal coding							
Packaging codes: 60 \triangleq cardboard tape, 180 mm reel 62 \triangleq blister tape, 180 -mm reel 70 \triangleq cardboard tape, 330 mm reel 72 \triangleq blister tape, 330 mm reel							

Dimensional drawings



Case size EIA / mm	l	w	h	k
0402 / 1005	1.0 ± 0.1	0.5 ± 0.05	0.6 max.	0.25 ± 0.15
0603 / 1608	1.6 ± 0.15	0.8 ± 0.15	0.9 max.	0.35 ± 0.15
0805 / 2012	2.0 ± 0.2	1.25 ± 0.15	1.3 max.	0.5 ± 0.25
1206 / 3216	3.2 ± 0.2	1.6 ± 0.2	1.3 max.	0.5 ± 0.25

Case size EIA / 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

SMD NTC thermistors

Standard series for non-automotive applications

EIA case size	R ₂₅ kΩ	ΔR _R %	B _{25/50} K	B _{25/85} K	B _{25/100} K	ΔB _{25/100} %	Ordering code
0402	10	±0.5 (D), ±1 (F), ±3 (H), ±5 (J)	3380	3435	3455	±1	B57230V2103+260
0402	10	±5 (J)	3940	3980	4000	±3	B57221V2103J060
0402	47	±5 (J)	3940	3980	4000	±3	B57221V2473J060
0402	47	±1 (F), ±3 (H), ±5 (J)	4050	4108	4131	±1	B57250V2473+560
0402	100	±1 (F), ±3 (H), ±5 (J)	4250	4311	4334	±1	B57250V2104+360
0603	10	±1 (F), ±3 (H), ±5 (J)	3380	3435	3455	±1	B57330V2103+260
0603	10	±0,5 (D)	3380	3435	3455	±0.7	B57334V2103D260
0603	10	±3 (H), ±5 (J)	3590	3635	3650	±3	B57301V2103+060
0603	10	±3 (H), ±5 (J)	3940	3980	4000	±3	B57321V2103+060
0603	22	±3 (H), ±5 (J)	4386	4455	4480	±3	B57371V2223+060
0603	47	±3 (H), ±5 (J)	4386	4455	4480	±3	B57371V2473+060
0603	47	±1 (F), ±3 (H), ±5 (J)	4050	4108	4131	±1.5	B57357V2473+560
0603	47	±3 (H), ±5 (J)	4050	4108	4131	±2	B57358V2473+560
0603	100	±3 (H), ±5 (J)	4386	4455	4480	±3	B57371V2104+060
0603	100	±1 (F), ±3 (H), ±5 (J)	4386	4455	4480	±1	B57374V2104+060
0603	100	±1 (F), ±3 (H), ±5 (J)	4200	4260	4282	±1	B57350V2104+460
0603	100	±3 (H), ±5 (J)	4250	4311	4334	±2	B57358V2104+360
0805	1	±3 (H), ±5 (J)	3940	3980	4000	±3	B57421V2102+062
0805	10	±3 (H), ±5 (J)	3590	3635	3650	±3	B57401V2103+062
0806	10	±3 (H), ±5 (J)	3660	3720	3730	±3	B57620C5103+062
0805	10	±3 (H), ±5 (J)	3940	3980	4000	±3	B57421V2103+062
0805	10	±3 (H), ±5 (J)	4386	4455	4480	±3	B57471V2103+062
0805	22	±3 (H), ±5 (J)	4386	4455	4480	±3	B57471V2223+062
0805	47	±3 (H), ±5 (J)	4386	4455	4480	±3	B57471V2473+062
0805	100	±3 (H), ±5 (J)	4386	4455	4480	±3	B57471V2104+062
0805	470	±3 (H), ±5 (J)	4386	4455	4480	±3	B57471V2474+062

+ = resistance tolerance

Features

- Accurate temperature sensing from -55 °C to +125 °C
- Excellent long-term stability

Applications

- Smartphones, computer and consumer electronics
- Wearable devices
- Healthcare
- Smart meters
- Engine control units
- Battery packs and sensors
- Industrial automation
- Household electronics & Smart home
- Air-conditioning, cooling fan control units
- Lighting: LED lighting modules and retrofits

Other resources

 [NTC Thermistors Design Tools](#)

 [Product Center \(Standard series\)](#)

SMD NTC thermistors

Automotive series overview

EIA case size	R ₂₅ kΩ	ΔR _R %	B _{25/50} K	B _{25/85} K	B _{25/100} K	ΔB _{25/100} %	Ordering code + = R _{tol}
0402	4.7	±5 (J)	3940	3980	4000	±3	B57251V5472J060
0402	10	±0.5 (D), ±1 (F), ±3 (H), ±5 (J)	3380	3435	3455	±1 (D: ±0.7)	B57232V5103+360
0402	10	±5 (J)	3940	3980	4000	±3	B57251V5103J060
0402	47	±1 (F), ±3 (H), ±5 (J)	4050	4108	4131	±1	B57259V5473+360
0402	100	±1 (F), ±3 (H), ±5 (J)	4250	4311	4334	±1	B57254V5104+360
0603	10	±0.5 (D), ±1 (F), ±3 (H), ±5 (J)	3380	3435	3455	±1 (D: ±0.7)	B57332V5103+360
0603	10	±3 (H), ±5 (J)	3590	3635	3650	±3	B57342V5103+060
0603	10	±3 (H), ±5 (J)	3940	3980	4000	±3	B57351V5103+060
0603	10	±3 (H), ±5 (J)	4386	4455	4480	±3	B57352V5103+060
0603	10	±1 (F), ±3 (H), ±5 (J)	3940	3980	4000	±1	B57358V5103+360
0603	22	±3 (H), ±5 (J)	3940	3980	4000	±3	B57351V5223+060
0603	22	±3 (H), ±5 (J)	4386	4455	4480	±3	B57352V5223+060
0603	47	±3 (H), ±5 (J)	4386	4455	4480	±3	B57352V5473+060
0603	47	±1 (F), ±3 (H), ±5 (J)	4050	4108	4131	±1	B57359V5473+260
0603	100	±1 (F), ±3 (H), ±5 (J)	4386	4455	4480	±1	B57352V5104+360
0603	100	±3 (H), ±5 (J)	4386	4455	4480	±3	B57352V5104+060
0805	4.7	±3 (H), ±5 (J)	3590	3635	3650	±3	B57442V5472+062
0805	4.7	±3 (H), ±5 (J)	4386	4455	4480	±3	B57452V5472+062
0805	10	±3 (H), ±5 (J)	3590	3635	3650	±3	B57442V5103+062
0805	10	±3 (H), ±5 (J)	3940	3980	4000	±3	B57451V5103+062
0805	10	±3 (H), ±5 (J)	4386	4455	4480	±3	B57452V5103+062
0805	33	±3 (H), ±5 (J)	3940	3980	4000	±3	B57451V5333+062
0805	47	±3 (H), ±5 (J)	3940	3980	4000	±3	B57451V5473+062
0805	100	±3 (H), ±5 (J)	4386	4455	4480	±3	B57452V5104+062

Features

- Accurate temperature sensing from -40 °C to +150 °C
- Excellent long-term stability
- Qualification based on AEC-Q200, Rev. D

Applications

- Engine control units
- Displays
- Air-conditions
- Radiator cooling fan control units
- Battery packs in conventional, hybrid electric and full-electric vehicles
- Gear box controls
- LED temperature controls

Other resources

 [NTC Thermistors Design Tools](#)

 [Product Center \(Automotive series\)](#)



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