NTC thermistors for temperature measurement

Miniature sensors with individual calibration

Series/Type:	**S868/2k/H**
Ordering code:	**B57868S0202H000**
Date:	2024-03-21
Version:	2

Applications

- Temperature measurement
- Digital temperature control circuits

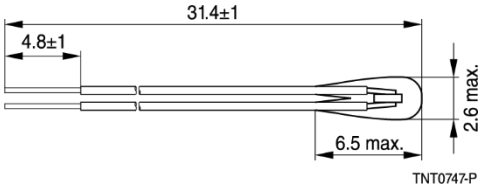
Features

- NTC with individual calibration data
- Wire: AWG30, Ni-core, silver-plated ∅ 0.25 mm
  PEEK insulation, color black
- Coating: epoxy, color black

Ratings and characteristics

Climatic category (IEC 60068-1) (test without voltage)		40/155/56	
Lower category temperature		–40	[°C]
Upper category temperature		155	[°C]
Rated resistance R_R // tolerance	R_R	181.55 // ±3	[Ω // %]
Individual part resistance tolerance		±0.3	[%]
Rated temperature	T_R	100	[°C]
B-value: $B_{(25/100)}$ // tolerance	B	3560 // ±0.5	[K // %]
R/T curve no. // R_{25}		1038 // 2000	[n // Ω]
Max. power rating at 25 °C	P_{25}	60	[mW]
Dissipation factor (in air)	δ_{th}	approx. 1.7	[mW/K]
Thermal cooling time constant (in air)	τ_C	approx. 21	[s]
Heat capacity	C_{th}	approx. 36	[mJ/K]

Dimensional drawing



Delivery mode

Taped on carrier strips, please refer to taping specification.

Ordering code

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Overall NTC resistance temperature curve

R/T curve	1038	**$B_{(25/100)}$**	3560 [K] ±0.5 [%]
R at 25 °C	2000 [Ω]	**R_R at 100 °C**	181.55 [Ω] ±3 [%]

T [°C]	R_{NOM} [Ω]	R_{MIN} [Ω]	R_{MAX} [Ω]	ΔR/R [±%]	ΔT [±°K]
–40	45983	43264	48703	5.9	1.0
–35	34354	32377	36330	5.8	1.0
–30	25920	24468	27371	5.6	1.0
–25	19741	18665	20818	5.5	1.0
–20	15172	14366	15977	5.3	1.0
–15	11760	11151	12368	5.2	1.0
–10	9190.3	8726.7	9653.8	5.0	1.0
–5	7238.6	6882.6	7594.5	4.9	1.0
0	5744.1	5468.6	6019.6	4.8	1.1
5	4590.9	4376.0	4805.7	4.7	1.1
10	3694.3	3525.6	3863.0	4.6	1.1
15	2992.4	2859.0	3125.8	4.5	1.1
20	2439.0	2332.9	2545.2	4.4	1.1
25	2000.0	1915.0	2085.0	4.2	1.1
30	1649.4	1581.0	1717.9	4.2	1.1
35	1367.9	1312.4	1423.3	4.1	1.1
40	1140.4	1095.1	1185.6	4.0	1.1
45	955.53	918.51	992.55	3.9	1.1
50	804.58	774.10	835.05	3.8	1.1
55	680.65	655.44	705.86	3.7	1.1
60	578.41	557.45	599.36	3.6	1.1
65	493.66	476.16	511.15	3.5	1.1
70	423.08	408.41	437.75	3.5	1.1
75	364.05	351.70	376.40	3.4	1.1
80	314.44	304.00	324.88	3.3	1.1
85	272.62	263.76	281.48	3.2	1.2
90	237.22	229.67	244.77	3.2	1.2
95	207.15	200.70	213.60	3.1	1.2
100	181.55	176.10	187.00	3.0	1.1
105	159.68	154.71	164.65	3.1	1.2
110	140.87	136.39	145.34	3.2	1.3
115	124.62	120.59	128.65	3.2	1.3
120	110.56	106.92	114.20	3.3	1.4
125	98.339	95.045	101.63	3.3	1.4
130	87.701	84.715	90.687	3.4	1.5
135	78.414	75.701	81.126	3.5	1.6
140	70.284	67.815	72.752	3.5	1.6
145	63.148	60.898	65.398	3.6	1.7
150	56.870	54.815	58.925	3.6	1.7
155	51.332	49.451	53.212	3.7	1.8

Individual measured resistance values R_{Meas} at T_R

NTC thermistors delivered on strips can be distinguished by the unique strip identification number and the position of each individual part on the strip.

The individual thermistor resistance R_{Meas} at the rated temperature T_R can be identified by the production order number, the strip number, and the position of the part on the strip.

Example of delivered file in CSV format with R_{Meas} data:

Material	Production order number	Strip number	Part	R_{Meas}	R-factor
B57868S0202H	120012345	413798765	1	180.59	0.99471
B57868S0202H	120012345	413798765	2	181.18	0.99796
B57868S0202H	120012345	413798765	3	182.72	1.00644
B57868S0202H	120012345	413798765	4	183.28	1.00953
B57868S0202H	120012345	413798765	5	182.21	1.00364
B57868S0202H	120012345	413798765	6	181.40	0.99917
B57868S0202H	120012345	413798765	7	181.92	1.00204
B57868S0202H	120012345	413798765	8	181.79	1.00132
B57868S0202H	120012345	413798765	9	181.70	1.00083
B57868S0202H	120012345	413798765	10	181.47	0.99956
B57868S0202H	120012345	413798765	11	180.46	0.99400
B57868S0202H	120012345	413798765	12	182.72	1.00644
B57868S0202H	120012345	413798765	13	181.48	0.99961
B57868S0202H	120012345	413798765	14	183.13	1.00870
B57868S0202H	120012345	413798765	15	181.34	0.99884
B57868S0202H	120012345	413798765	16	181.14	0.99774
B57868S0202H	120012345	413798765	17	180.32	0.99323
B57868S0202H	120012345	413798765	18	181.71	1.00088
B57868S0202H	120012345	413798765	19	182.88	1.00733
B57868S0202H	120012345	413798765	20	182.86	1.00722
B57868S0202H	120012345	413798765	21	183.04	1.00821

Example of resistance value at T_R for an individual NTC part:

Based on the example from above data file, for the production order 120012345 and strip 413798765, part no. 7 has a resistance at rated temperature T_R of

R_{Meas} = 181.92 Ω and R-factor = 1.00204

This value can be used to calculate an individual R_{IND} table from the R_{NOM} values in the overall NTC resistance temperature curve on page 3 by:

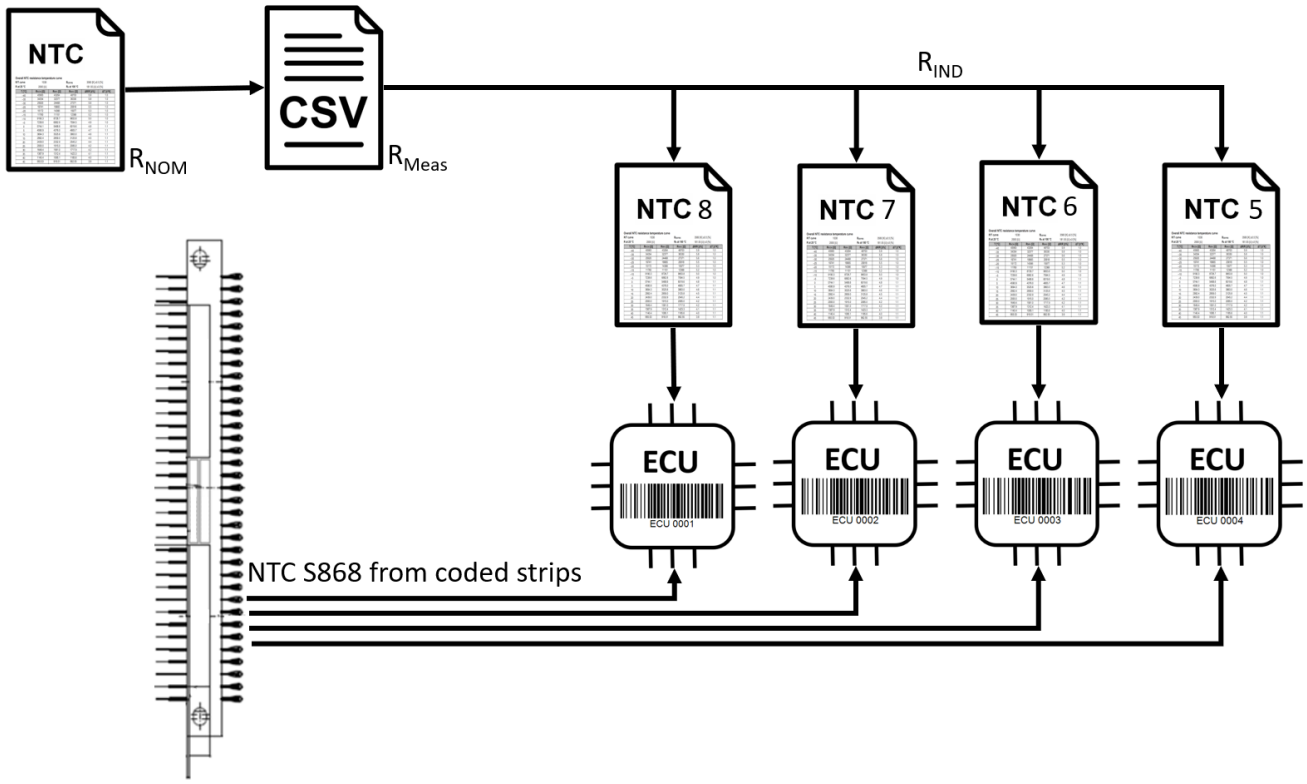
$R_{IND} = R_{NOM} * R\text{-factor}$

Typical use case for individually measured resistance values

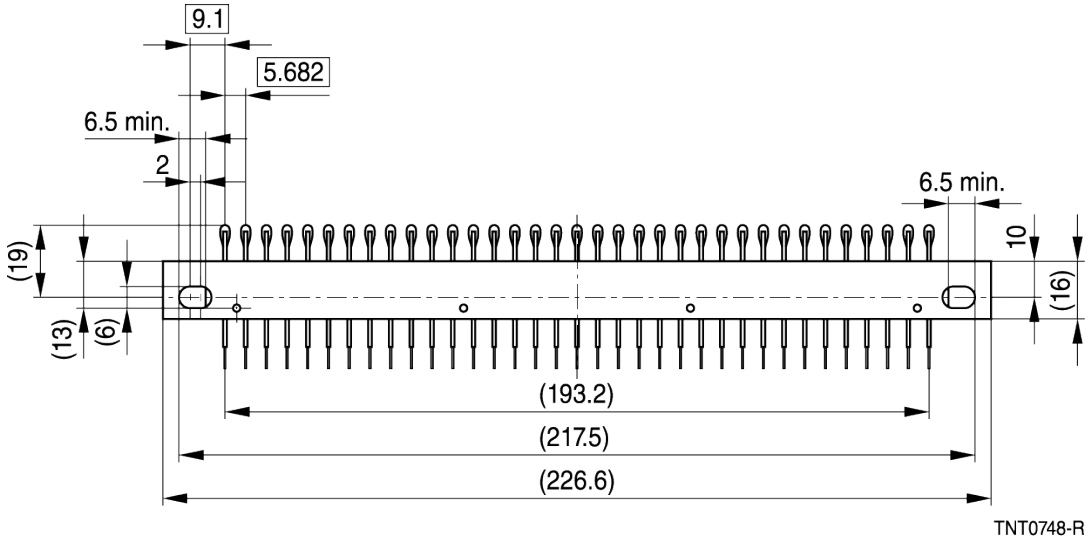
A typical use case of individual calibration data is shown in the next diagram.

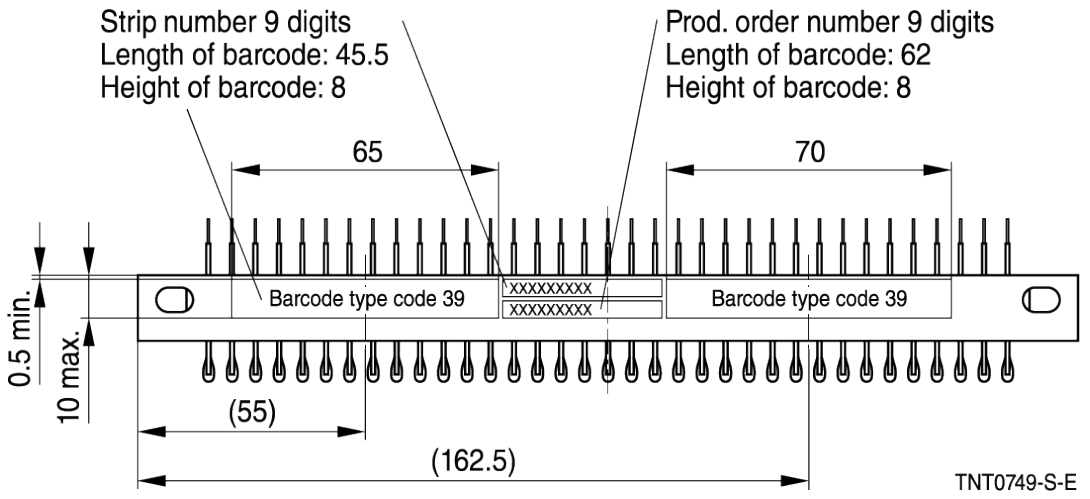
The nominal R/T tables together with the individual measurement data can be used to create individual resistance values or correction factors for each NTC on the strip. These data can be used to integrate individual lookup tables or correction parameters within the firmware of the control units during manufacturing.

Single piece tracking of data and goods in production is necessary to realize individual calibrated circuits. Please note that the NTC does not carry an individual marker and can only be identified while in the strips.



Taping specification





Remark

15 to 35 NTC elements per strip

Reliability data

Testing, acc. to AEC-Q200 REV D, by type representatives.

Test	Standard	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
High temperature storage	MIL-STD-202, method 108	Storage at T = 125 °C, t = 1000 h unpowered	< 3%	No visible damage
Biased humidity	MIL-STD-202, method 103	T = 85 °C Relative humidity of air: 85% t = 1000 h Test voltage max. 0.2 V DC on NTC [1)]	< 3%	No visible damage
Rapid change of temperature	JESD 22, method JA-104	Lower test temperature: –55 °C (time: 15 min) Upper test temperature: 125 °C (time: 15 min) Time to change from lower to upper temperature: < 10 sec. Number of cycles: 1000	< 3%	No visible damage

[1)] Self heating of the NTC thermistor must not exceed 0.2 K, steady state.

Cautions and warnings

Storage

- Store thermistors only in original packaging. Do not open the package prior to processing.
- Storage conditions in original packaging: storage temperature −25 °C to +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 (SOx, Cl etc).
- Use the components as soon as possible after opening the original packaging.
- Solder thermistors within the time specified after shipment from TDK.
  For leaded components this is 12 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 over-molded 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.
- The use of no-clean solder products is recommended. In any case mild, non-activated fluxes should be used. Flux residues after soldering should be minimized.

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 TDK.

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Important notes

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