NTC thermistors for temperature measurement

Probe assemblies

Series/Type: **Aluminum pipe metal clip-on sensors, HP100**
Ordering code: **B58101A0109A000**

Date: 2022-06-20
Version: 1.0

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Application

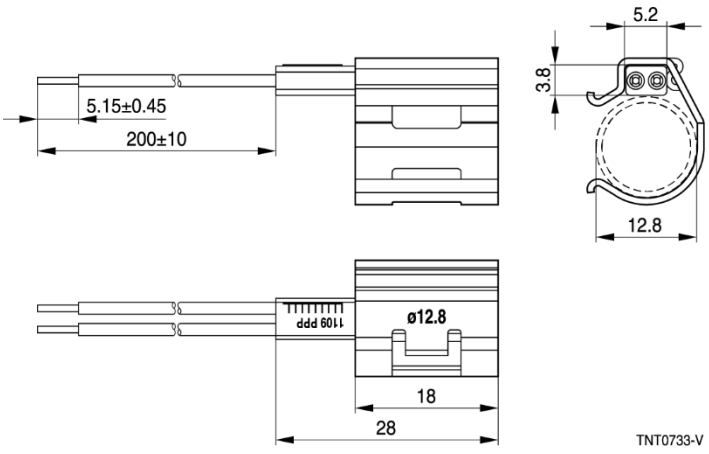
- Automotive HVAC / xEV: Thermal management
- Pipe surface temperature measurement (heat pump / battery cooling)

Features

- Strong humidity resistance
- High temperature resistance up to 150 °C
- High sensor accuracy at both minimum and maximum temperatures
- Fast response time
- Good insulation resistance
- Specific RT curve optimized for application
- Coated stainless steel clip for no corrosion when in contact with aluminum pipes
- For 12.8 mm (½") diameter aluminum pipe surface temperature measurement
- Qualified to AEC-Q200

Options

- Different wire lengths on request
- Different clip diameters on request (8 mm to 20 mm available)
- Different NTC R/T characteristics on request
- Different packaging sizes on request
- Available with connector (sealed / non-sealed)



For details refer to technical drawing B58101A0109A000, Ind. 02 dated 2022-02-22.

Delivery mode

- Cardboard box 100 pieces

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Technical data and specification

Climatic category (IEC 60068-1)			40/150/25
Lower category temperature		°C	–40
Upper category temperature		°C	150
Rated resistance R_R // Tolerance	R_R // $\Delta R_R/R_R$	Ω // %	1072 // ± 1
Rated temperature	T_R	°C	85
Resistance at 25 °C	R_{25}	Ω	10000
B-value $B_{(25/100)}$ // Tolerance	B_R	K // %	3988 // ± 1
R/T curve no.			8016
Thermal time constant (in water)	τ_{63}	s	< 7
Max. power rating (at 25 °C)	P_{25}	mW	60
Insulation resistance (500 V_{DC} for 60 s)	R_{ins}	MΩ	>100
Voltage proof (t = 10 s)	V_{test}	V_{AC}	1250
Sensor accuracy (-15 °C ≤ T ≤ 140 °C)	ΔT	K	< ±1
Sensor accuracy	Δ_{Tmax}	K	±1.2

Wire harness information

Wire temperature class	HT (-40 to 150 °C)
Wire length	200 mm
Wire Insulation color	Red
Wire outer diameter	1.2-1.3 mm

Remarks

- Sensors must be stored in original package prior to assembly
- The installation of cover materials is the customer's responsibility. TDK does not control the thermodynamic properties of the interface, the size and shape of any wrapping or the consistency of the wrapping. The performance of the component can be affected by debris and surface finish and may be compromised by improper installation.

Initial NTC element resistance / temperature curve

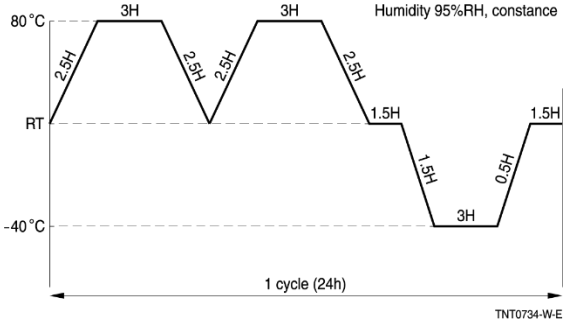
R/T-Curve	8016 / A01
R at 25°C	10000 Ω
B(25/100)	3988 K ± 1%
R_N at 85 °C	**1072 Ω ± 1%**

Temp. °C	R_{nom} Ω	R_{min} Ω	R_{max} Ω	ΔR ±%	ΔT ±°C	α %/K
-40	336500	312878	360122	7	1.1	6.7
-30	177000	165820	188180	6.3	1	6.2
-20	97070	91568	102572	5.7	1	5.8
-10	55330	52525	58135	5.1	0.9	5.4
0	32650	31176	34124	4.5	0.9	5.1
10	19900	19104	20696	4	0.8	4.8
20	12490	12050	12930	3.5	0.8	4.5
25	10000	9671.0	10329	3.3	0.7	4.4
30	8057.0	7810.0	8304.0	3.1	0.7	4.3
40	5327.0	5186.0	5468.0	2.7	0.7	4
50	3603.0	3522.0	3684.0	2.3	0.6	3.8
60	2488.0	2441.0	2535.0	1.9	0.5	3.6
70	1752.0	1725.0	1779.0	1.5	0.5	3.4
80	1258.0	1243.0	1273.0	1.2	0.4	3.2
85	**1072.0**	**1062.0**	**1083.0**	**1**	**0.3**	**3.2**
90	917.70	906.70	928.70	1.2	0.4	3.1
100	680.00	669.80	690.20	1.5	0.5	2.9
110	511.20	502.10	520.30	1.8	0.6	2.8
120	389.30	381.40	397.20	2	0.8	2.7
130	300.90	294.00	307.80	2.3	0.9	2.5
140	234.80	228.90	240.70	2.5	1	2.4
150	185.30	180.20	190.40	2.8	1.2	2.3

Reliability data

Tests	Description/ Reference	Criteria
ELECTRICAL TESTS		
Resistance / Temperature check	Take measurements at specified temperatures in oil bath	Resistance at -40 °C. 0 °C. 25 °C. 85 °C. Resistance readings within min/max values listed in RT charts.
Response time	Response time of the sensor in a transition from Ti=10 °C to Tf =35 °C (in water)	τ 63 < 7 s
Insulation resistance	Tested between the housing of the temperature sensor and terminals. Sensor head is immersed into a water solution containing 5% NaCl. Test voltage = 500 V DC Rise / fall time: < 1 s Duration = 60 s	100 MΩ or more ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C)
High voltage test	Analog to insulation resistance test: Voltage: 1250 V AC Rise / fall time: < 5 s Duration: 10 s	Leakage current < 10 mA No flash over ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C)
Electrostatic discharge	Levels: -Air discharge @ +/-4 kV // +/- 8 kV // +/-10 kV @150 pF / 330 Ω -Contact discharge @ +/-4 kV // +/- 8 kV @150 pF / 330 Ω Apply 10 pulses of each level and polarity	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
MECHANICAL TESTS		
Powered vibration	Frequency: 5 ~ 200 Hz Acceleration: 68 ~ 29 m/s² Vibration direction: x. y. z Sweep time/type: 20 min logarithmic Sweeps per axis: 18 Test duration: 6 h per axis U = (5 ± 0.25) V DC over pull-up resistor mounted on pipe	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ No signs of physical deformation
Mechanical shock	Acceleration: 300 m/s² Shock type: Half sine shocks 3 axis (6 shocks per axis) Duration: 18 ms mounted on pipe	ΔR/R < 3% (Resistance before and after test at -40°C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ No signs of physical deformation
Lead pull test	Pull force on sensor side: 50 N	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ No signs of physical deformation

ENVIRONMENTAL TESTS		
Low temperature storage	Test temperature: -40 °C Storage time: 72 h Not powered	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
High temperature storage	Test temperature: +125 °C Storage time: 72 h Not powered	ΔR/R < 3% (Resistance before and after test -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Low temperature operation	Test temperature: -40 °C Storage time: 1000 h V = (5 ± 0.25) V DC over pull-up resistor	ΔR/R < 3% (Resistance before and after test -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
High temperature operation	Test temperature: +125 °C Storage time: 1000h V = (5 ± 0.25) V DC over pull-up resistor	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Heat Shock: Temperature cycling	T_{max}: +125 °C T_{min}: -40 °C t_{dwell}: 20 min $t_{transfer}$: <30 s n = 1000 cycles Test media: air Not powered	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Heat Shock: Shock resistance	T_{max}: +100 °C T_{min}: 0 °C t_{dwell}@T_{min}: 2 min t_{dwell}@T_{max}: 4 min $t_{transfer}$: <30 s n = 10000 cycles Test media: galden V = (5 ± 0.25) VDC over pull-up resistor	ΔR/R < 5% (Resistance before and after test -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Water resistance	IP Classification: IPX7	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Dust resistance	IP Classification: IP6KX	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Warm water immersion	T_{min}: +80 °C t_{dwell}: 500 h Test media: DI water V = 0.3 V DC on NTC	ΔR/R < 5% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ

Temperature Humidity cylce	T_{max}: +80 °C T_{min}: -40 °C Profile:  Relative humidity: (95±5)% constant at +T Not controlled at -T Cycles: 15 Total duration: 360 h	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ
Salt mist atmosphere	According to IEC 60068-2-11 Ka Chamber temperature: (35±2) °C Salt water solution: (5±1)% NaCl pH-value of the NaCl solution: 6.5-7.2 at (35±2) °C Test duration: 96 h	ΔR/R < 3% (Resistance before and after test at -40 °C. 0 °C. 25 °C. 85 °C) Riso ≥ 100 MΩ No signs of physical deformation

Cautions and warnings

Storage

- Store thermistors only in original packaging. Do not open the package prior to storage.
- 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 factory seals i.e. the polyvinyl-sealed packages.
- Solder thermistors within the time specified after shipment from TDK Electronics.
  For leaded components this is 24 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.

Mounting

- Ensure that no thermo-mechanical stress occurs due to production processes (curing or over molding 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.

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.
- Ensure that no significant thermo-mechanical stress occurs during operation due to the mounting situation. Fixtures must not overstress the sensor by an excessive mechanical preload.
- 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. 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 Electronics AG.

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