NTC thermistors for temperature measurement

Probe assemblies

Series/Type: **M1703**
Ordering code: **B58703M1103A00***

Date: 2019-09-23
Version: 2.0

Applications

- Busbar temperature measurement

Features

- Screw-on mounting with good thermal contact
- Accurate busbar temperature readings
- HV insulation acc. LV123 Class H3
- Wire acc. LV112-4 (0.13 mm² CuMg alloy with reduced weight)
- Up to 50 N pull force during installation allowed
- Twisted wire for EMC

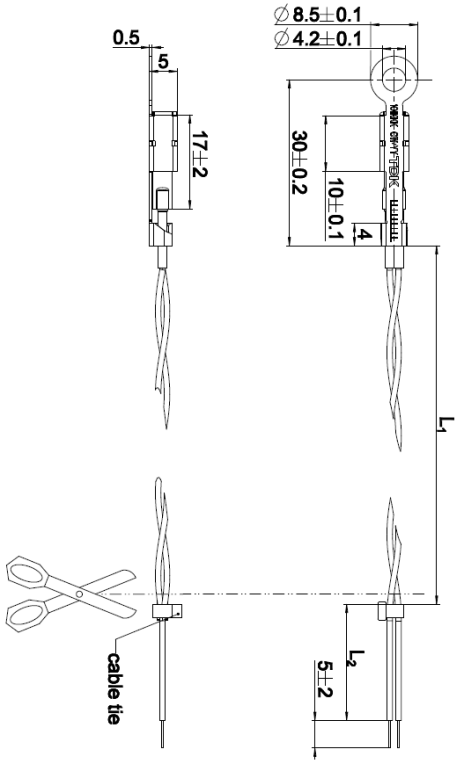
Options

- Alternative wire lengths, R/T characteristics and connectors available on request

Delivery mode

- Bulk, bundled in plastic bags in cardboard box
- Cable tie and wire scrap L_2 must be removed before sensor installation

Dimensional drawing



Dimensions in mm

General technical data

Climatic category	(IEC 60068-1)		40/150/21	
Lower category temperature			–40	°C
Upper category temperature			150	°C
Maximum operating temperature	(for 6 h max.)	$T_{op,max}$	200	°C
Max. power	(at 25 °C)	P_{25}	50	mW
Rated temperature		T_R	25	°C
Rated resistance		R_R	10000	Ω
Resistance tolerance[1)]		$\Delta R_R/R_R$	±1	%
B-value[1)]		$B_{25/100}$	3625 ±1%	K
No. of R/T charactericstic			7003	
Thermal time constant	(in water)	τ_a	< 10	s
Insulation resistance		R_{ins}	100	MΩ
Test voltage	(t = 60 s)	V_{test}	2500	V DC
Sensor accuracy[2)]	(-30 °C ≤ T ≤ 150 °C)	ΔT	±5	K
Sensor accuracy[2)]	(T < -30 °C / T > 150 °C)	ΔT	±10	K

[1)] Values for initial glass-encapsulated NTC G1561.

[2)] Sensor accuracy is criteria for reliability testing.

Wire lengths, units per box and ordering codes

Usable wire length L_1 mm	Wire scrap L_2[3] mm	Unit per box pcs.	Detailed drawing[4]	Ordering codes
max. 655	min. 45	800	Ind. 06b dated 2017-11-13	B58703M1103A001
max. 1000	min. 45	600	Ind. 04 dated 2017-11-13	B58703M1103A002

Reliability data

Test	Standard	Test conditions	Criteria	Remarks
Initial RT parameter	LV124 – K02 (modified)	–40 °C, 25 °C, 85 °C; 150 °C; 200 °C	ΔT ±5 K	No visible damage
Insulation strength test	LV123 H3	1000 V DC for 60 s	R_{iso} > 1 GΩ	No visible damage
Voltage strength test	LV123 H3	2500 V DC for 60 s	I_{leak} < 10 mA	No flashover
Response time test		25 °C water to 85 °C water	τ_a < 10 s	No visible damage
ESD test	AEC-Q200-002 ISO / DIS 10605	ESD network 2000 Ω, 330 pF Direct contact discharge up to 8 kV Air discharge 25 kV	ΔT ± 5 K	No visible damage
Temperature storage test	LV124 K-01 sequence	–40 °C for 12 h 150 °C for 12 h 2 cycles (48 h in total)	ΔT ± 5 K	No visible damage
Low temperature operation test	LV124 K-01 sequence	–40 °C for 48 h in operation	ΔT ± 5 K	No visible damage
Thermal shock test	LV124 K-05 sequence	–40 °C / 150 °C for 100 cycles dwell time 30 min, transition < 30 s	ΔT ± 5 K	No visible damage
Cyclic damp heat test	LV124 K-08 sequence	25 °C / 55 °C, 97% r. H., 6 cycles of 24 h (144 h in total) in operation	ΔT ± 5 K	No visible damage
Mechanical shock test	LV124 M-05 sequence	Accelaration half sine: 50 *g* / 6 ms, 60 shocks (10 shocks in 6 directions) in operation	ΔT ± 5 K	No visible damage

[3] Not intended for use, must be removed before sensor installation and operation.

[4] On request.

Test	Standard	Test conditions	Criteria	Remarks
Vibration test	LV124 M-04 sequence (profile D)	–40 °C / 125 °C, 5 Hz … 2000 Hz, 4.2 *g* 8 h per axis (in total 24 h), intermittent operation	ΔT ± 5 K	No visible damage
Damp heat test (steady state)	LV124 K-14	40 °C / 93 % r. H, in operation for 21 days	ΔT ± 5 K	No visible damage
Corrosion test with flow of mixed gas	LV124 K-18	SO_2 0.2 ppm, H_2S 0.01 ppm, NO_2 0.2 ppm, Cl_2 0.01 ppm, Test duration 21 days	ΔT ± 5 K	No visible damage
Chemical media test	LV124-C01	Diesel fuel, petrol/gasoline unleaded, engine oil, transmission fluid, grease, battery fluid, brake fluid, antifreeze fluid, windscreen washer fluid, vehicle washing chemicals, Test duration 24 h	ΔT ± 5 K	No visible damage
High temperature endurance test	LV124 L-02	125 °C for 2000 h, in operation with overvoltage 900 V DC	ΔT ± 5 K	No visible damage
Temperature cycle endurance test	LV124 L-03	–40 °C / 125 °C for 140 cycles, dwell time 30 min., in operation with overvoltage 900 V DC	ΔT ± 5 K	No visible damage

Note

- NTC element qualified acc. To AEC-Q200 rev. D.
- Details of reliability tests on request.

R/T characteristics

R/T No.	**7003**					
T (°C)	$B_{25/100}$ = 3625 K					
	R_{nom} (Ω)	R_{min} (Ω)	R_{max} (Ω)	$\Delta R/R_{nom}$ (±%)	ΔT (±K)	α (%/K)
–40	243240	232440	254040	4.4	0.7	6.0
–35	180810	173370	188240	4.1	0.7	5.8
–30	135750	130590	140910	3.8	0.7	5.6
–25	102900	99302	106510	3.5	0.6	5.4
–20	78716	76188	81244	3.2	0.6	5.3
–15	60739	58957	62521	2.9	0.6	5.1
–10	47258	45998	48519	2.7	0.5	4.9
–5	37062	36169	37955	2.4	0.5	4.8
0	29287	28653	29920	2.2	0.5	4.6
5	23311	22862	23759	1.9	0.4	4.5
10	18684	18367	19000	1.7	0.4	4.4
15	15075	14853	15297	1.5	0.3	4.2
20	12240	12087	12394	1.3	0.3	4.1
25	10000	9900	10100	1.0	0.3	4.0
30	8217.6	8114.8	8320.3	1.3	0.3	3.9
35	6790.9	6692.8	6889	1.4	0.4	3.8
40	5642.2	5550.1	5734.3	1.6	0.4	3.7
45	4712.2	4626.7	4797.7	1.8	0.5	3.6
50	3955	3876.3	4033.8	2.0	0.6	3.5
55	3335.5	3263.4	3407.6	2.2	0.6	3.4
60	2826	2760.2	2891.7	2.3	0.7	3.3
65	2404.9	2345	2464.7	2.5	0.8	3.2
70	2055.3	2000.9	2109.6	2.6	0.9	3.1
75	1763.7	1714.4	1813	2.8	0.9	3.0
80	1519.5	1474.7	1564.2	2.9	1.0	2.9
85	1314.1	1273.5	1354.6	3.1	1.1	2.9
90	1140.6	1103.8	1177.4	3.2	1.2	2.8
95	993.52	960.12	1026.9	3.4	1.2	2.7
100	868.37	838.04	898.71	3.5	1.3	2.7
105	761.49	733.91	789.08	3.6	1.4	2.6
110	669.89	644.79	694.99	3.7	1.5	2.5

R/T No.	**7003**					
T (°C)	$B_{25/100}$ = 3625 K					
	R_{nom} (Ω)	R_{min} (Ω)	R_{max} (Ω)	$\Delta R/R_{nom}$ (±%)	ΔT (±K)	α (%/K)
115	591.12	568.25	613.99	3.9	1.6	2.5
120	523.16	502.29	544.02	4.0	1.7	2.4
125	464.33	445.28	483.39	4.1	1.7	2.4
130	413.27	395.84	430.69	4.2	1.8	2.3
135	368.8	352.85	384.76	4.3	1.9	2.3
140	329.98	315.34	344.61	4.4	2.0	2.2
145	295.98	282.54	309.41	4.5	2.1	2.2
150	266.12	253.77	278.48	4.6	2.2	2.1
155	239.84	228.47	251.22	4.7	2.3	2.1
160	216.65	206.17	227.13	4.8	2.4	2.0
165	196.13	186.45	205.81	4.9	2.5	2.0
170	177.93	168.99	186.88	5.0	2.6	1.9
175	161.76	153.48	170.04	5.1	2.7	1.9
180	147.35	139.67	155.02	5.2	2.8	1.8
185	134.48	127.36	141.61	5.3	2.9	1.8
190	122.97	116.36	129.59	5.4	3.0	1.8
195	112.65	106.5	118.81	5.5	3.1	1.7
200	103.38	97.649	109.12	5.5	3.3	1.7

Cautions and warnings

Do not apply continuous pull-force between sensor and wire ends. Pull force requirement of 50 N is for short-term mounting conditions only. Consider metal compliance when mounting the sensor. Brass is not suitable for mounting sensor to an aluminum surface as contact corrosion may occur.

Storage

- Store thermistors only in original packaging. Do not open the package prior to storage.
- Storage conditions in original packaging: storage temperature −10 °C ... +45 °C, relative humidity 45% up to 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.
- Crimping the wire ends is permissible until 36 months after delivery because the formed oxide layer is destroyed during the crimping process. Insulation decelerates the oxidation of copper, so the wires ends must be stripped directly prior crimping.
- Soldering or welding the wire ends is only permissible within 6months after delivery.

Handling

- NTC thermistors must not be dropped. Chip-offs or any other damage must not be caused during handling of NTCs.
- Avoid contamination of thermistor surface during handling. Gloves are recommended.
- 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 overmolded 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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