NTC thermistors for temperature measurement

Glass-encapsulated NTC, coated

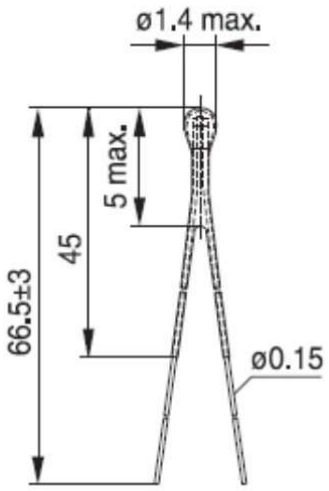
Series/Type: **G1541/10k/F**
Ordering code: **B57541G1103F000**

Date: 2017-03-20
Version: 1

EPCOS AG is a TDK Group Company.

Applications

- Temperature measurement



Dimensions in mm

Features

- Glass-encapsulated NTC thermistor, heat-resistant and highly stable
- Coating of glass body and leads for electrical insulation
- For temperature measurement up to 250°C
- Very short response time
- Small dimensions
- Leads: dumet wires (copper-clad FeNi)

Ratings and characteristics

Climatic category (IEC 60068-1)			: **55/250/56**
(test without voltage)			
Lower category temperature		[°C]	: **–55**
Upper category temperature		[°C]	: **250**
Rated resistance R_N // Tolerance	R_N	[Ω // %]	: **10000 // ± 1**
Rated temperature	T_N	[°C]	: **25**
R/T curve no. // R_{25}		[n // Ω]	: **8307 // 10000**
B-value : $B_{(25/100)}$ // Tolerance	B_N	[K // %]	: **3492 // ± 1**
Max. power rating at 25 °C	P_{25}	[mW]	: **18**
Dissipation factor (in air)	δ_{th}	[mW/K]	: **approx. 0.5**
Thermal cooling time constant (in air)	τ_C	[s]	: **approx. 4**
Heat capacity	C_{th}	[mJ/K]	: **approx. 2**
Insulation resistance (V = 100 V_{DC})	R_{is}	[MΩ]	: **≥ 100 ***
Test voltage (t = 1 s)	V_{test}	[V_{DC}]	: **500 ***

*Medium: NaCl-solution, Temperature: Room temperature

Contact with halogenated liquids at temperatures ≤0 °C can cause crazes in the coating. Separate tests with all liquids which are in contact with the element have to be performed.

Delivery mode

Bulk

NTC resistance temperature curve

R/T curve	8307	**$B_{(25/100)}$**	3492 [K] ± 1 [%]
R at 25 °C	10000 [Ω]	**R_N at 25 °C**	10000 [Ω] ± 1 [%]

T [°C]	R nom [Ω]	R min [Ω]	R max [Ω]	ΔR [±%]	ΔT [±°C]
–55	526240	498110	554360	5,3	0,8
–50	384520	365350	403700	5,0	0,8
–45	284010	270820	297200	4,6	0,8
–40	211940	202790	221090	4,3	0,7
–35	159720	153330	166110	4,0	0,7
–30	121490	117000	125990	3,7	0,7
–25	93246	90066	96425	3,4	0,7
–20	72181	69920	74441	3,1	0,6
–15	56332	54718	57946	2,9	0,6
–10	44308	43153	45464	2,6	0,6
–5	35112	34283	35941	2,4	0,5
0	28024	27429	28618	2,1	0,5
5	22520	22094	22946	1,9	0,4
10	18216	17911	18520	1,7	0,4
15	14827	14611	15043	1,5	0,4
20	12142	11990	12293	1,2	0,3
25	**10000**	**9900**	**10100**	**1,0**	**0,3**
30	8281,8	8178,9	8384,8	1,2	0,3
35	6895,4	6796,7	6994,0	1,4	0,4
40	5770,3	5677,4	5863,3	1,6	0,5
45	4852,5	4765,9	4939,2	1,8	0,5
50	4100,0	4019,8	4180,2	2,0	0,6
55	3479,8	3406,0	3553,6	2,1	0,7
60	2966,3	2898,7	3034,0	2,3	0,7
65	2539,2	2477,4	2601,1	2,4	0,8
70	2182,4	2126,0	2238,8	2,6	0,9
75	1883,0	1831,5	1934,4	2,7	0,9
80	1630,7	1583,9	1677,6	2,9	1,0
85	1417,4	1374,7	1460,0	3,0	1,1
90	1236,2	1197,3	1275,1	3,1	1,2
95	1081,8	1046,3	1117,2	3,3	1,2
100	949,73	917,40	982,06	3,4	1,3
105	836,40	806,89	865,90	3,5	1,4
110	738,81	711,85	765,76	3,6	1,5
115	654,50	629,85	679,15	3,8	1,6
120	581,44	558,88	604,00	3,9	1,7
125	517,94	497,27	538,62	4,0	1,7
130	462,59	443,62	481,56	4,1	1,8
135	414,20	396,78	431,63	4,2	1,9
140	371,79	355,76	387,81	4,3	2,0

T [°C]	R nom [Ω]	R min [Ω]	R max [Ω]	ΔR [±%]	ΔT [±°C]
145	334,51	319,75	349,26	4,4	2,1
150	301,66	288,05	315,26	4,5	2,2
155	272,64	260,08	285,20	4,6	2,3
160	246,94	235,34	258,55	4,7	2,4
165	224,14	213,40	234,88	4,8	2,5
170	203,85	193,90	213,81	4,9	2,6
175	185,77	176,53	195,00	5,0	2,7
180	169,61	161,03	178,18	5,1	2,8
185	155,14	147,16	163,11	5,1	2,9
190	142,16	134,74	149,58	5,2	3,0
195	130,49	123,57	137,41	5,3	3,1
200	119,99	113,53	126,45	5,4	3,2
205	110,51	104,48	116,54	5,5	3,3
210	101,94	96,297	107,58	5,5	3,5
215	94,181	88,899	99,463	5,6	3,6
220	87,144	82,193	92,095	5,7	3,7
225	80,751	76,106	85,396	5,8	3,8
230	74,933	70,571	79,296	5,8	3,9
235	69,631	65,530	73,732	5,9	4,1
240	64,791	60,931	68,651	6,0	4,2
245	60,366	56,731	64,002	6,0	4,3
250	56,316	52,888	59,744	6,1	4,4

Reliability data

Test	Standard	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
Storage in dry heat	IEC 60068-2-2	Storage at upper category temperature T: 250°C Duration: 1000 h	< 3%	No visible damage
Storage in damp heat, steady state	IEC 60068-2-67	Temperature of air: 85°C Relative humidity of air: 85% Duration: 1000 h	< 2%	No visible damage
Rapid temperature cycling	IEC 60068-2-14	Lower test temperature: –55°C Upper test temperature: 200°C Dwell time: 15 min each temp. Number of cycles: 1000	< 2%	No visible damage

Reliability Data according to AEC Q200, Rev. D

Test	Standard	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
High temperature exposure (storage)	MIL-STD-202, method 108	Storage at T = +125°C t = 1000h, unpowered	< 2%	No visible damage
Operational Life	MIL-STD-202, method 108	Storage at T = +125°C t=1000h Test voltage max. 0.3 V_{DC} on NTC[1)]	< 2%	No visible damage
Temperature cycling	JESD 22, method JA-104	Lower test temperature: –55°C Upper test temperature: 125°C 1000 cycles Dwell time: max. 30 min at each temperature Transition time in air: max. 1 min	< 2%	No visible damage
Terminal Strength (leaded)	MIL-STD-202, method 211	Test leaded device integrity Condition A: F = 2.27 N[2)]	< 1%	No visible damage
Mechanical Shock	MIL-STD-202 method 213, condition C	Acceleration: 40 g[2)] Pulse duration: 6 ms Number of bumps: 3, each direction	< 1%	No visible damage
Vibration	MIL-STD-202 method 204	Acceleration: 5 g t = 20 min per cycle 12 cycles in each of 3 directions Frequency range: 10 to 2000 Hz	< 1%	No visible damage

1) Self heating of the NTC thermistor must not exceed 0.2K, steady state. Test conditions deviating from AEC Q200, Rev. D
2) Deviating from AEC Q200, Rev. D

Notes

- 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).
- Avoid dewing and condensation unless thermistor is specified for these conditions.

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 ... +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 EPCOS.
  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.

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.
- 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 EPCOS AG.

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