



NTC thermistors for temperature measurement

High temperature glass-encapsulated NTC

Series/Type:	H650/822k/A1
Ordering code:	B57650H0824A001
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Version:	1

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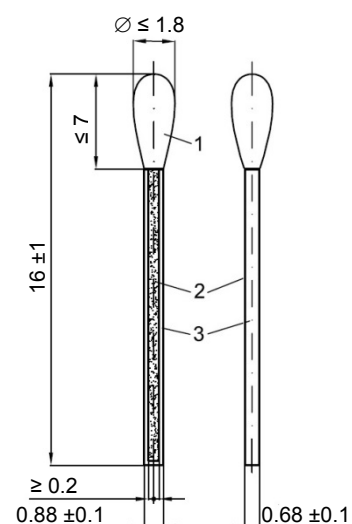
EPCOS AG is a TDK Group Company.

Application

- Temperature measurement for high temperatures

Features

- Glass-encapsulated, heat resistive and highly stable
- For temperature measurement up to 650 °C
- Short response time
- High measurement accuracy



Dimensions in mm

- 1) Glass-encapsulation
- 2) Ag conductive path
- 3) Al₂O₃ rod

Technical specification

Lower category temperature		°C	−40
Upper category temperature		°C	600
Mid-term temperature stability (1000 h)		°C	650
Rated resistance R_N // Tolerance	R_N	Ω // %	5000 // ± 2
Rated temperature	T_N	°C	200
R/T curve no. // R_{25}		n // Ω	6001 // 821970
B-value: $B_{(25/200)}$ // Tolerance	B_N	K // %	4113 // ± 1
Dissipation factor (in air)	δ_{th}	mW/K	approx. 1.5
Thermal cooling time constant (in air)	τ_C	s	approx. 10
Heat capacity	C_{th}	mJ/K	approx. 15
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Remarks

The NTC sensor element is not specified for direct contact with aggressive media in any aggregate state (liquid, solid or gas) incl. water.

Direct contact with aggressive media may lead to a defect and malfunction of the NTC sensor. Customers must take appropriate measures to avoid direct contact with aggressive media, e.g. covering or housing the NTC sensor.

NTC resistance temperature curve

R/T curve	6001	B_(25/200)	4113 K ±1%
R at 25 °C	821970 Ω	R_N at 200 °C	5000 Ω ±2%

T °C	R _{nom} Ω	R _{min} Ω	R _{max} Ω	ΔR ±%	ΔT ±°C	α %/K
-40	18 452 000	16 423 000	20 481 000	11.0	2.0	5.6
-35	14 011 000	12 522 000	15 500 000	10.6	2.0	5.4
-30	10 709 000	9 609 300	11 810 000	10.3	1.9	5.3
-25	8 239 000	7 420 700	9 057 300	9.9	1.9	5.2
-20	6 378 400	5 765 800	6 991 100	9.6	1.9	5.1
-15	4 968 300	4 506 800	5 429 900	9.3	1.9	4.9
-10	3 893 000	3 543 100	4 242 900	9.0	1.9	4.8
-5	3 068 000	2 801 300	3 334 800	8.7	1.8	4.7
0	2 431 500	2 226 900	2 636 100	8.4	1.8	4.6
5	1 937 500	1 779 700	2 095 300	8.1	1.8	4.5
10	1 552 000	1 429 600	1 674 300	7.9	1.8	4.4
15	1 249 500	1 154 200	1 344 900	7.6	1.8	4.3
20	1 011 000	936 330	1 085 700	7.4	1.8	4.2
25	821 970	763 180	880 760	7.2	1.7	4.1
30	671 380	624 890	717 870	6.9	1.7	4.0
35	550 860	513 930	587 790	6.7	1.7	3.9
40	453 950	424 480	483 420	6.5	1.7	3.8
45	375 680	352 070	399 290	6.3	1.7	3.7
50	312 180	293 190	331 180	6.1	1.7	3.7
55	260 450	245 110	275 800	5.9	1.6	3.6
60	218 140	205 700	230 580	5.7	1.6	3.5
65	183 380	173 260	193 500	5.5	1.6	3.4
70	154 720	146 460	162 990	5.3	1.6	3.4
75	131 010	124 230	137 780	5.2	1.6	3.3
80	111 310	105 740	116 880	5.0	1.6	3.2
85	94 883	90 289	99 476	4.8	1.5	3.2
90	81 144	77 344	84 944	4.7	1.5	3.1
95	69 613	66 460	72 766	4.5	1.5	3.0

T °C	R _{nom} Ω	R _{min} Ω	R _{max} Ω	ΔR ±%	ΔT ±°C	α %/K
100	59 902	57 279	62 526	4.4	1.5	3.0
105	51 699	49 510	53 888	4.2	1.5	2.9
110	44 747	42 916	46 578	4.1	1.4	2.9
115	38 839	37 303	40 374	4.0	1.4	2.8
120	33 802	32 511	35 093	3.8	1.4	2.8
125	29 497	28 409	30 584	3.7	1.4	2.7
130	25 806	24 887	26 724	3.6	1.3	2.6
135	22 633	21 856	23 410	3.4	1.3	2.6
140	19 899	19 240	20 558	3.3	1.3	2.6
145	17 536	16 976	18 096	3.2	1.3	2.5
150	15 490	15 013	15 966	3.1	1.2	2.5
155	13 713	13 306	14 119	3.0	1.2	2.4
160	12 167	11 820	12 514	2.9	1.2	2.4
165	10 815	10 518	11 112	2.7	1.2	2.3
170	9632.2	9378.0	9886.3	2.6	1.1	2.3
175	8595.6	8377.7	8813.5	2.5	1.1	2.3
180	7685.2	7498.2	7872.2	2.4	1.1	2.2
185	6883.9	6723.2	7044.6	2.3	1.1	2.2
190	6177.2	6039.0	6315.5	2.2	1.0	2.1
195	5552.8	5433.8	5671.8	2.1	1.0	2.1
200	5000.0	4900.0	5100.0	2.0	1.0	2.1
205	4509.7	4413.1	4606.2	2.1	1.0	2.0
210	4074.0	3983.2	4164.9	2.2	1.1	2.0
215	3686.2	3600.8	3771.6	2.3	1.2	2.0
220	3340.5	3260.2	3420.7	2.4	1.2	2.0
225	3031.7	2956.3	3107.0	2.5	1.3	1.9
230	2755.4	2684.6	2826.2	2.6	1.4	1.9
235	2507.9	2441.4	2574.3	2.6	1.4	1.9
240	2285.7	2223.4	2348.1	2.7	1.5	1.8
245	2086.1	2027.6	2144.6	2.8	1.5	1.8
250	1906.4	1851.5	1961.3	2.9	1.6	1.8
255	1744.4	1692.9	1796.0	3.0	1.7	1.8
260	1598.2	1549.8	1646.6	3.0	1.7	1.7
265	1466.1	1420.6	1511.5	3.1	1.8	1.7
270	1346.5	1303.8	1389.2	3.2	1.9	1.7
275	1238.1	1198.0	1278.2	3.2	1.9	1.7
280	1139.7	1102.0	1177.4	3.3	2.0	1.6
285	1050.3	1014.9	1085.8	3.4	2.1	1.6
290	969.04	935.71	1002.4	3.4	2.1	1.6

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T °C	R _{nom} Ω	R _{min} Ω	R _{max} Ω	ΔR ±%	ΔT ±°C	α %/K
295	894.99	863.63	926.34	3.5	2.2	1.6
300	826.76	797.27	856.24	3.6	2.3	1.6
305	764.39	736.65	792.13	3.6	2.4	1.5
310	707.62	681.51	733.72	3.7	2.4	1.5
315	655.83	631.24	680.42	3.7	2.5	1.5
320	608.52	585.35	631.70	3.8	2.6	1.5
325	565.23	543.37	587.08	3.9	2.6	1.5
330	525.55	504.93	546.18	3.9	2.7	1.4
335	489.14	469.68	508.61	4.0	2.8	1.4
340	455.68	437.29	474.07	4.0	2.9	1.4
345	424.89	407.52	442.27	4.1	2.9	1.4
350	396.53	380.10	412.95	4.1	3.0	1.4
355	370.37	354.83	385.91	4.2	3.1	1.4
360	346.22	331.51	360.92	4.2	3.2	1.3
365	323.90	309.98	337.81	4.3	3.2	1.3
370	303.25	290.06	316.43	4.3	3.3	1.3
375	284.12	271.63	296.62	4.4	3.4	1.3
380	266.40	254.56	278.25	4.4	3.5	1.3
385	249.97	238.73	261.20	4.5	3.5	1.3
390	234.71	224.05	245.36	4.5	3.6	1.3
395	220.53	210.41	230.64	4.6	3.7	1.2
400	207.35	197.74	216.95	4.6	3.8	1.2
405	195.08	185.95	204.20	4.7	3.9	1.2
410	183.66	174.98	192.33	4.7	3.9	1.2
415	173.01	164.77	181.26	4.8	4.0	1.2
420	163.09	155.25	170.93	4.8	4.1	1.2
425	153.83	146.37	161.29	4.9	4.2	1.2
430	145.18	138.08	152.29	4.9	4.3	1.2
435	137.11	130.34	143.87	4.9	4.3	1.1
440	129.56	123.11	136.00	5.0	4.4	1.1
445	122.49	116.35	128.64	5.0	4.5	1.1
450	115.88	110.02	121.74	5.1	4.6	1.1
455	109.69	104.10	115.28	5.1	4.7	1.1
460	103.89	98.559	109.22	5.1	4.7	1.1
465	98.453	93.362	103.54	5.2	4.8	1.1
470	93.351	88.489	98.213	5.2	4.9	1.1
475	88.563	83.918	93.208	5.2	5.0	1.0
480	84.066	79.626	88.507	5.3	5.1	1.0
485	79.842	75.596	84.087	5.3	5.2	1.0

T °C	R _{nom} Ω	R _{min} Ω	R _{max} Ω	ΔR ±%	ΔT ±°C	α %/K
490	75.870	71.808	79.931	5.4	5.3	1.0
495	72.134	68.247	76.021	5.4	5.4	1.0
500	68.619	64.898	72.340	5.4	5.5	1.0
505	65.309	61.745	68.873	5.5	5.5	1.0
510	62.191	58.777	65.606	5.5	5.6	1.0
515	59.253	55.980	62.526	5.5	5.7	1.0
520	56.483	53.344	59.621	5.6	5.8	1.0
525	53.869	50.858	56.880	5.6	5.9	0.9
530	51.402	48.512	54.292	5.6	6.0	0.9
535	49.073	46.299	51.847	5.7	6.1	0.9
540	46.872	44.208	49.537	5.7	6.2	0.9
545	44.792	42.232	47.353	5.7	6.3	0.9
550	42.826	40.365	45.286	5.7	6.4	0.9
555	40.965	38.599	43.331	5.8	6.5	0.9
560	39.204	36.928	41.480	5.8	6.6	0.9
565	37.537	35.346	39.727	5.8	6.8	0.9
570	35.957	33.848	38.066	5.9	6.9	0.9
575	34.460	32.429	36.491	5.9	7.0	0.8
580	33.041	31.084	34.997	5.9	7.1	0.8
585	31.694	29.808	33.580	5.9	7.2	0.8
590	30.417	28.598	32.235	6.0	7.3	0.8
595	29.203	27.450	30.957	6.0	7.4	0.8
600	28.051	26.359	29.744	6.0	7.5	0.8
605	26.957	25.323	28.590	6.1	7.7	0.8
610	25.916	24.339	27.493	6.1	7.8	0.8
615	24.926	23.403	26.450	6.1	7.9	0.8
620	23.985	22.513	25.457	6.1	8.0	0.8
625	23.089	21.666	24.512	6.2	8.1	0.8
630	22.236	20.860	23.612	6.2	8.3	0.7
635	21.423	20.092	22.754	6.2	8.4	0.7
640	20.649	19.361	21.937	6.2	8.5	0.7
645	19.911	18.664	21.158	6.3	8.7	0.7
650	19.207	17.999	20.414	6.3	8.8	0.7

Reliability data

Test	Standard	Test conditions	$\Delta R_{100}/R_{100}$ (typical)	Remarks
High temperature exposure (storage)		Temperature of air: 650 °C Duration: 1000 h	< 2%	No visible damage
Temperature exposure (storage)		Temperature of air: 300 °C Duration: 5000 h	< 1%	No visible damage
Biased humidity	MIL-STD-202, method 103	Temperature of air: 85 °C Relative humidity of air: 85% Sensor voltage: 0.3 V Duration: 1000 h	< 2%	No visible damage
Operational life	MIL-STD-202, method 108	Temperature of air: 150 °C Test voltage: 0.2 V Duration: 1000 h	< 2%	No visible damage
Rapid temperature cycling	JESD22, method JA-104	Lower test temperature: -40 °C Upper test temperature: 200 °C Dwell time at each temperature: 15 min Maximum transition time: 1 min Number of cycles: 1000	< 2%	No visible damage
Rapid temperature cycling		Lower test temperature: 105 °C Upper test temperature: 500 °C Dwell time at each temperature: 5 min Maximum transition time: 1 min Number of cycles: 1000	< 2%	No visible damage
Mechanical shock	MIL-STD-202, method 213, condition C	Acceleration: 40 g Pulse duration: 6 ms Number of bumps in each direction: 3	< 1%	No visible damage
Vibration	MIL-STD-202, method 204	Acceleration: 5 g Duration: 20 min Number of cycles in each of 3 orientations: 12 Frequency range: 10 ... 2000 Hz	< 1%	No visible damage

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 $-25\text{ }^{\circ}\text{C}$ to $45\text{ }^{\circ}\text{C}$, relative humidity $\leq 75\%$ 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 (SO_x, 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 leadless components with Ag metallization this is 12 months.

Handling

- NTC thermistors must not be dropped. Chip-offs or any other damage must not be caused during handling.
- 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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