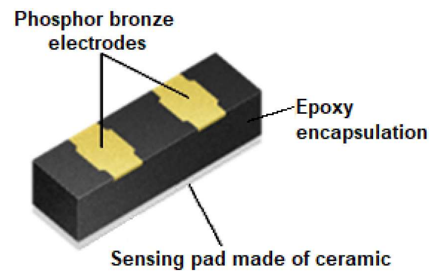
NTC thermistors for temperature measurement

Small-Outline No-Lead NTC

Series/Type:	**T850/10k/G**
Ordering code:	**B57850T0103G000**
Date:	2022-11-18
Version:	1

Applications

Surface temperature measurement



Features

- Lead free and Halogen free
- Miniature size thermistor 10 x 3 x 3 mm
- NTC chip is fully sealed with epoxy
- High humidity resistance
- High degree of electrical insulation between measurement surface and NTC provided by Al_2O_3 ceramic
- Wider sensing surface area
- Phosphor bronze electrodes
- Process automation friendly design
- Attachable to metal heatsink or bars and chassis directly
- Good mechanical robustness

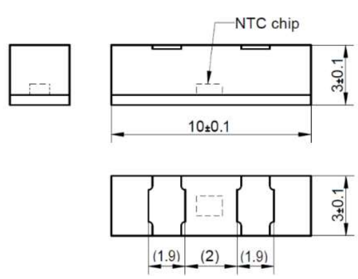
Ratings and characteristics

Climatic category (IEC 60068-1) (test without voltage)	-	-	40/155/56
Lower category temperature	-	°C	–40
Upper category temperature	-	°C	155
Rated resistance R_R // Tolerance	R_R	Ω // %	10000 // ±2
Rated temperature	T_R	°C	25
B-value: $B_{(25/100)}$ // Tolerance	B	K // %	3988 // ±1
R/T curve no. // R_{25}		n // Ω	8016 // 10000
Max power rating at 25°C	P_{25}	mW	60
Dissipation factor (in air)	δ_{th}	mW/K	4.2
Heat capacity	C_{th}	mJ/K	178
Thermal time constant – t(0.63)[1)] Response time	τ_a	s	approx. 2
Voltage proof	V_{is}	V_{AC} // t	2500 // 60 s

1) NTC sensor, from ambient temperature, is pressed to metal surface with temperature of 85 °C.

Delivery mode

According to typical semiconductor packaging tube 272 x 11 x 4.5 mm (drawing on page # 3).
50 components as packaging unit per tube.
Other options on request, e.g.: According to JEDEC standard tray 12.7 x 5.35 inches, 294 components per tray.



Dimensions in mm

Ordering code

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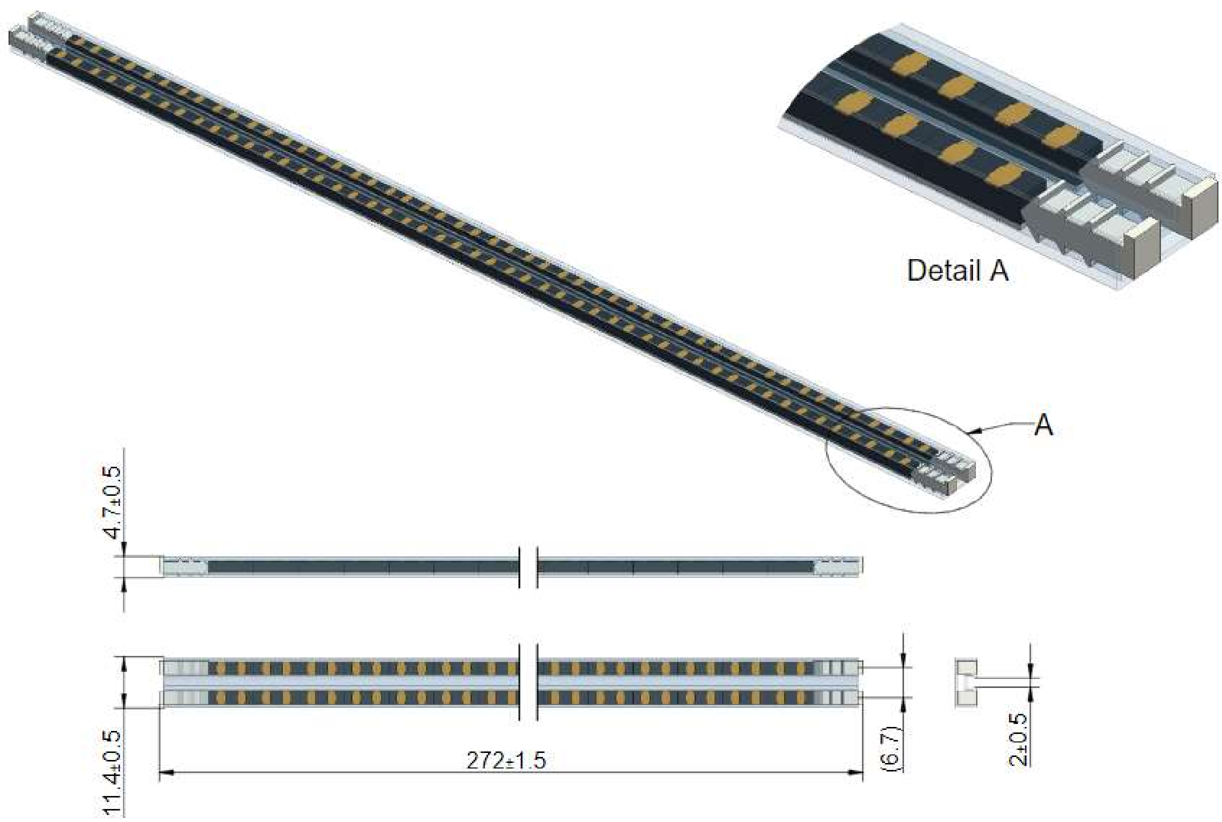
Packing drawing

50 components packed inside one ESD IC plastic tube



NTC resistance temperature curve

R/T curve 8016 / A01 | $\mathbf{B_{(25/100)}}$ 3988 K ±1%
R at 25 °C 10000 Ω | $\mathbf{R_R}$ **at 25 °C** 10000 Ω ±2%

T °C	R_{Nom} Ω	R_{Min} Ω	R_{Max} Ω	ΔR ±%	ΔT ±°C
-40	336500	317050	355950	5.8	0.9
-35	242590	229440	255740	5.4	0.8
-30	177000	168020	185980	5.1	0.8
-25	130370	124180	136560	4.7	0.8
-20	97070	92772	101370	4.4	0.8
-15	72929	69923	75936	4.1	0.7
-10	55330	53211	57449	3.8	0.7
-5	42315	40814	43816	3.5	0.7
0	32650	31581	33719	3.3	0.6
5	25388	24623	26152	3.0	0.6
10	19900	19351	20449	2.8	0.6
15	15708	15313	16103	2.5	0.5
20	12490	12205	12775	2.3	0.5
25	**10000**	**9800.0**	**10200**	**2.0**	**0.5**
30	8057.0	7874.1	8239.9	2.3	0.5
35	6531.3	6369.1	6693.6	2.5	0.6
40	5327.0	5183.7	5470.3	2.7	0.7
45	4368.7	4242.4	4495.0	2.9	0.7
50	3603.0	3491.9	3714.1	3.1	0.8
55	2986.2	2888.5	3084.0	3.3	0.9
60	2488.0	2402.0	2574.0	3.5	1.0
65	2083.0	2007.4	2158.7	3.6	1.0
70	1752.0	1685.4	1818.6	3.8	1.1
75	1481.4	1422.5	1540.2	4.0	1.2
80	1258.0	1206.0	1310.0	4.1	1.3
85	1072.3	1026.3	1118.4	4.3	1.4
90	917.70	876.92	958.48	4.4	1.4
95	788.52	752.30	824.74	4.6	1.5
100	680.00	647.78	712.22	4.7	1.6
105	588.59	559.87	617.31	4.9	1.7
110	511.20	485.55	536.85	5.0	1.8
115	445.41	422.46	468.35	5.2	1.9
120	389.30	368.74	409.86	5.3	2.0
125	341.70	323.22	360.18	5.4	2.1
130	300.90	284.25	317.55	5.5	2.2
135	265.44	250.43	280.45	5.7	2.3
140	234.80	221.24	248.36	5.8	2.4
145	208.32	196.05	220.59	5.9	2.5
150	185.30	174.18	196.42	6.0	2.6
155	165.35	155.24	175.45	6.1	2.7

Reliability data

Test	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
Storage in dry heat	Storage at T = 155 °C, Duration: 1000 h	< 3%	No visible damage
Storage in coldness	Storage at T = -40 °C, Duration: 1000 h	< 3%	No visible damage
Storage in damp heat, steady state with test voltage	Temperature of air: 85 °C; Relative humidity of air: 85% Duration: 56 days Voltage across NTC: 0.3 V_{DC}	< 2%	No visible damage
Rapid change of temperature in air	Lower test temperature: –40 °C Upper test temperature: 155 °C Dwell time: 10 min; Transition time: < 30 s Number of cycles: 1000	< 3%	No visible damage
Voltage proof test	The sensors are placed on a metal plate surface at ambient temperature, max relative humidity 75% The applied voltage, between metal plate and NTC electrodes, is 2500 V_{AC}/60 s/1 mA		No flash over
Insulation test	The sensors are placed on a metal plate surface at ambient temperature, max relative humidity 75% The applied voltage, between metal plate and NTC electrodes, is 500 V_{DC}		Above 100 MΩ

For information only

Achievable performance, indicated as a design reference for applications

Test	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
Immersion test	Medium: Deionized water Temperature: 80 °C; Voltage across NTC: 0.3 V_{DC} Tested on NTC assembly with extension wires, soldered onto electrodes. Solder joints and electrodes are sealed with a hydrophobic coating material. Duration: 1000 h	< 2%	No visible damage
Rapid change of temperature in water (T-shock)	Medium: Deionized water Lower test temperature: 5 °C Upper test temperature: 95 °C Dwell time: 10 min; Transition time: < 30 s 5 V_{DC} applied with series resistor 10 kΩ Tested on NTC assembly with extension wires, soldered onto electrodes. Solder joints and electrodes are sealed with a hydrophobic coating material. Number of cycles: 500	< 2%	No visible damage

Reliability data according to AEC-Q200, Rev. D

Test	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
High temperature exposure (storage)	Storage at T = 125 °C t = 1000 h	< 2%	No visible damage
Biased humidity	T = 85 °C Relative humidity of air: 85% t = 1000 h Test voltage 0.3 V_{DC} on NTC[1)]	< 2%	No visible damage
Operational life	T = 125 °C t = 1000 h Test voltage 0.3 V_{DC} on NTC[1)]	< 2%	No visible damage
Temperature cycling	Lower test temperature: –55 °C Upper test temperature: 125 °C Dwell time: max. 30 min. at each temperature Transition time in air: max. 1 min Number of cycles: 1000	< 2%	No visible damage
Mechanical shock	Acceleration: 40 *g*[2)] Pulse duration: 6 ms Number of bumps: 3, each direction	< 1%	No visible damage
Vibration	Acceleration: 5 *g* t = 20 min. 12 cycles in each of 3 directions Frequency range: 10 ... 2000 Hz	< 1%	No visible damage

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

Cautions and warnings

Storage

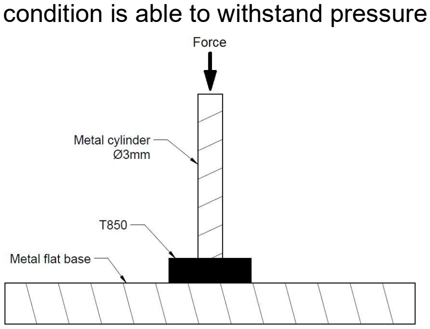
- Store thermistors only in original packaging, Moisture Barrier Bag. Do not open the MBB prior to storage.
- Storage conditions in original MBB : storage temperature −25 °C ... +45 °C, relative humidity ≤75% annual mean, <95% maximum 30 days per annum.
- Do not store thermistors where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed, causing problems during processing.
- Avoid any sort of aggressive and harmful contamination of alumina ceramic sensing pad surface and the electrode surface during storage, handling and processing.
- Avoid storage of thermistors in harmful environments like corrosive gases (SOx, Cl etc).
- Use up the components from the IC packaging tube after opening the MBB.
- Use thermistors within the time specified after shipment. For leadless components this is 12 months.

Handling

- The alumina ceramic sensing pad surface and the electrodes must not be scratched or damaged before/during/after the mounting and assembly process.
- Use suitable surface cleaning and activating agent prior to the process and avoid aggressive contamination of the ceramic sensing pad surface and the electrode surface during mounting and assembly.
- 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.

Soldering / Welding

- Soldering process:
    - Use rosin type flux in soldering process. Do not use strong acid flux, water soluble flux or flux exceeding 0.1wt% halogen and halogenated substances, as this might affect the product characteristics or reliability.
    - Perform cleaning to fully remove flux and cleaning solvents from the product. Prompt drying of the products after cleaning is required.
    - The applied solder bit temperature and time shall not exceed 400°C and 2 seconds respectively on each thermistor electrodes.
    - Not all available soldering processes are suitable. Please take precautions in selection of your desired process.
- Welding process:
    - Excessive pressure to the phosphor bronze electrodes must be avoided, thermistor in normal condition is able to withstand pressure of 30 N/mm².



    - Excessive heating may damage the epoxy compound. Welding parameters must be defined accordingly.
    - Not all available welding processes are suitable. Consider the risk of porosity of the welded joint and take precautions in selection of your desired process.

Mounting

- Make sure a flat base fixture is used to place thermistor before soldering/welding to avoid alumina ceramic sensing pad surface getting cracked during mounting and processing.
- Make sure no inclination or lift-up of the ceramic sensing pad occurs during the mounting and assembly process. This might cause deviations in the response time.
- Avoid contamination of the thermistor surface during handling and processing.
- The connections of sensors (e.g. cable end, wire end, plug terminal) may only be exposed to an environment with normal atmospheric conditions within the defined operating temperature range.
- 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 using aggressive chemical substances as mounting aids. It must be ensured that no water or other liquids enter the 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.

Do not use NTC thermistors under following environments and conditions, as it might lead to some failures like deterioration of product characteristics:

- In close proximity to splashing water. A water droplet between the outer electrodes needs to be avoided. Dewing and condensation must be avoided.
- Corrosive or deoxidizing gas (Cl_2, H_2S, NH_3, SO_X, NO_X, etc.)
- Volatile or flammable gas.
- Environment with salt water, oils, chemical liquids or organic solvents.
- High vibration environment.
- 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.

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