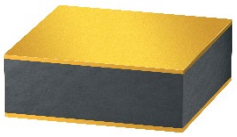
NTC thermistors for temperature measurement

Leadless NTC chip

Series/Type:	**L860/ 5.2 k/ J500**
Ordering code:	**B57860L0522J500**
Date:	2021-08-26
Version:	1

Application



- Temperature measurement within power modules

Features

- Top side Ni/Au termination developed for direct Al wire bonding[1)]
- Bottom side for Ag sintering or soldering
- Lead-free

Delivery mode

On 8” frame, on UV (ultraviolet) curable tape. See page 6.

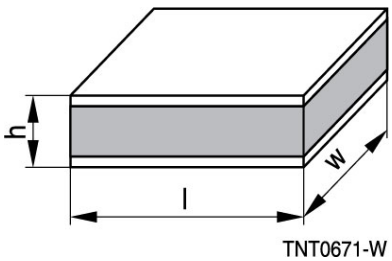
Ratings and characteristics

Climatic category (IEC 60068-1) (test without voltage)	-	-	40/175/21
Lower category temperature	-	°C	-40
Upper category temperature	-	°C	175
Rated resistance R_R // Tolerance	R_R	Ω // %	493.3 // ±5 [2)]
Rated temperature	T_R	°C	100
B-value: $B_{(25/100)}$ // Tolerance	$B_{(25/100)}$	K // %	3480 // ±1
R/T curve no. // R_{25}	-	n // Ω	2917 // 5151.7
Max. power rating at 25 °C	P_{25}	mW	Depending on mounting situation

[1)] Verified with 150 µm Al wire.

[2)] Sample inspection: from each diced substrate 5 NTC chips are measured at T_R. The mean value ±3 sigma must be within the specified acceptance criteria (±5%).

Dimensional drawing



TNT0671-W

Chip geometry:

l = w = 1.6 ±0.15 mm
h = 0.5 ±0.1 mm

NTC resistance temperature curve

R/T curve	2917	**$B_{(25/100)}$**	3480 [K] ± 1 [%]
R at 25 °C	5151.7 [Ω]	**R_R at 100 °C**	493.3 [Ω] ± 5 [%]

T [°C]	R nom [Ω]	R min [Ω]	R max [Ω]	ΔR [±%]	ΔT [±°C]
-40	99901	89262	110540	10.7	1.9
-35	76235	68355	84115	10.3	1.9
-30	58646	52761	64532	10.0	1.9
-25	45468	41036	49900	9.7	1.9
-20	35515	32151	38878	9.5	1.9
-15	27940	25368	30512	9.2	1.9
-10	22134	20153	24114	8.9	1.9
-5	17651	16115	19187	8.7	2.0
0	14166	12967	15366	8.5	2.0
5	11440	10498	12382	8.2	2.0
10	9293.4	8548.6	10038	8.0	2.0
15	7592.9	7000.6	8185.2	7.8	2.0
20	6237.7	5764.0	6711.5	7.6	2.0
25	5151.7	4770.7	5532.7	7.4	2.0
30	4276.6	3968.5	4584.7	7.2	2.0
35	3567.7	3317.3	3818.0	7.0	2.0
40	2990.5	2786.0	3194.9	6.8	2.0
45	2518.2	2350.4	2685.9	6.7	2.0
50	2129.8	1991.5	2268.1	6.5	2.0
55	1809.1	1694.6	1923.6	6.3	2.0
60	1543.0	1447.8	1638.2	6.2	2.0
65	1321.3	1241.8	1400.8	6.0	2.0
70	1135.8	1069.2	1202.4	5.9	2.0
75	979.98	923.93	1036.0	5.7	2.0
80	848.57	801.23	895.90	5.6	2.0
85	737.33	697.21	777.44	5.4	2.0
90	642.82	608.70	676.93	5.3	2.0
95	562.24	533.13	591.34	5.2	2.0
100	**493.30**	**468.64** [3)]	**517.97** [3)]	**5.0** [3)]	**1.9**
105	434.13	411.67	456.59	5.2	2.0
110	383.18	362.89	403.46	5.3	2.1
115	339.16	320.81	357.51	5.4	2.2
120	301.03	284.40	317.66	5.5	2.3
125	267.90	252.80	283.00	5.6	2.4
130	239.03	225.30	252.76	5.7	2.5
135	213.80	201.29	226.31	5.8	2.7
140	191.70	180.29	203.11	6.0	2.8

[3)] Acceptance criteria for sample inspection.

145	172.29	161.86	182.71	6.1	2.9
150	155.19	145.64	164.74	6.2	3.0
155	140.10	131.35	148.85	6.2	3.1
160	126.75	118.71	134.79	6.3	3.2
165	114.91	107.51	122.30	6.4	3.3
170	104.38	97.572	111.19	6.5	3.4
175	95.005	88.724	101.29	6.6	3.5

[3] Acceptance criteria for sample inspection.

Reliability data

Test	Standard	Test conditions	$\Delta R_{25}/R_{25}$ typ.	Remarks
Storage in dry heat	IEC 60068-2-2	Storage at upper category temperature Temperature: 175 °C Duration: 1000 h	< 2%	No visible damage
Rapid change of temperature	IEC 60068-2-14	Lower test temperature: -40 °C Upper test temperature: 175 °C Number of cycles: 100 Dwell time: max. 30 min at each temperature Transition time in air: max. 1 min	< 3%	No visible damage

Reliability data according to AEC-Q200, Rev. D

Test	Standard	Test conditions	$\Delta R_{25}/R_{25}$ typ.	Remarks
High temperature exposure (storage)	MIL-STD-202, method 108	Storage at T = 125 °C t = 1000 h, unpowered	< 2%	No visible damage
Operational life	MIL-STD-202, method 108	Storage at T = 125 °C t=1000 h Test voltage max. 0.3 V DC on NTC[4)]	< 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	< 3%	No visible damage
Biased humidity	MIL-STD-202, Method 103	Storage at T = 85 °C, rH = 85% 1000 h Test voltage max. 0.3 V DC on NTC[4)]	< 2%	No visible damage

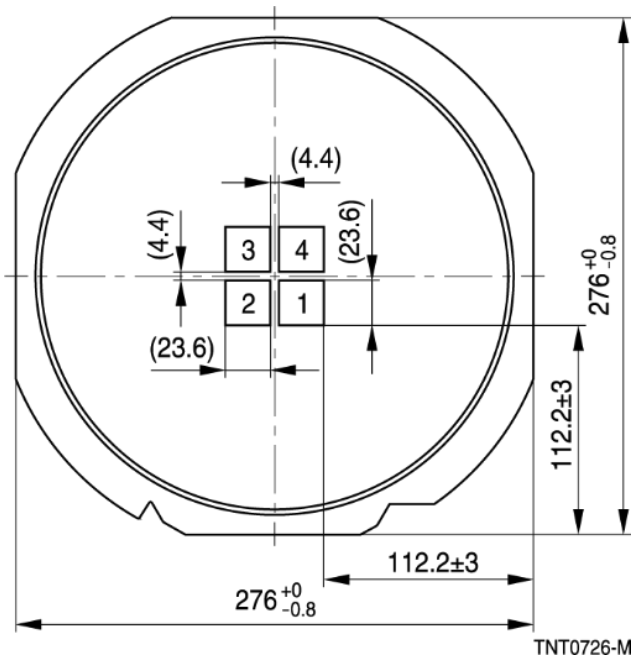
- Self heating of the NTC thermistor must not exceed 0.2 K, steady state. Test conditions deviating from AEC-Q200, Rev. D.

Storage of NTC in original packaging units.

Recommendation: Usage of opened packaging units within one week.

TPS NTC E PD Self heating of the NTC thermistor must not exceed 0.2 K, steady state. Test conditions deviating from AEC-Q200, Rev. D.

Frame for delivery: size 8”



The 8" frame is loaded with chips, arranged in 1 to 4 arrays, beginning with array 1.
Single chip positions can be empty because of removed parts for optical or electrical inspection.

The UV curable tape *Nitto NBD 5172 K* can be expanded one time.

TPS NTC E PD Self heating of the NTC thermistor must not exceed 0.2 K, steady state. Test conditions deviating from AEC-Q200, Rev. D.

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.
- For leadless components with Ag metallization this is 3 months. This period can be extended to 6 months provided the frame is stored protected from light and under inert atmosphere.

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.

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.

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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.
- 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.
- 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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TPS NTC E PD Self heating of the NTC thermistor must not exceed 0.2 K, steady state. Test conditions deviating from AEC-Q200, Rev. D.

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Important notes

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