NTC thermistors for temperature measurement

Probe assemblies

Series/Type:	**Oil Circuit Temperature Sensor OCTS**
Ordering code:	**B58101A0851A000**
Date:	2024-02-27
Version:	1.0

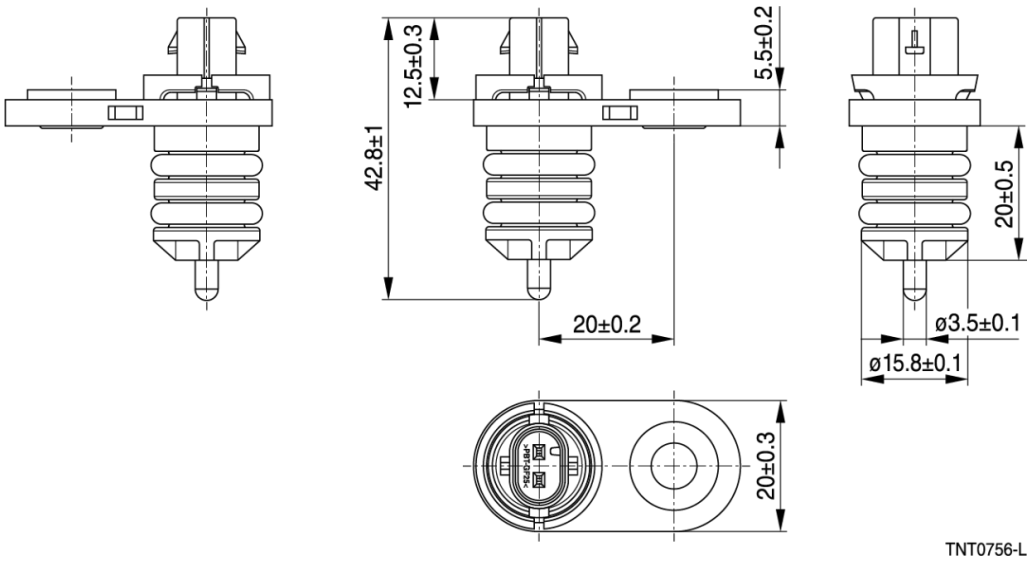
Applications

- Automotive: thermal management
- Immersion temperature measurement sensor

Features

- Very fast response time
- High temperature resistance up to 150 °C
- Fully sealed system for immersion applications
- Specific RT curve optimized for the application
- Very light weight (< 11 g)

Dimensional drawings



Delivery mode

Cardboard box, 150 pieces

Ordering code

B58101A0851A000

Technical data and specification

Climatic category (IEC 60068-1)			40/150/56
Lower category temperature		°C	-40
Upper category temperature		°C	150
Maximum system pressure		bar	10
Rated resistance R_R // Tolerance	R_R // $\Delta R_R/R_R$	Ω // %	876 // ±1
Rated temperature	T_R	°C	70
Resistance at 25 °C	R_{25}	Ω	5000
B-value $B_{(25/100)}$ // Tolerance	B_R	K // %	3988 // ±1
R/T curve no.			8016
Thermal time constant (in water)	τ_{63}	s	< 4
Max. power rating (at 25 °C)	P_{25}	mW	60
Insulation resistance (500 V_{DC} for 60 s)	R_{ins}	MΩ	>100
Sensor accuracy (-40 °C ≤ T ≤ 125 °C)	ΔT	K	< ±1
Sensor accuracy	Δ_{Tmax}	K	±1.4

Remark

Sensors must be stored in original package prior to assembly.

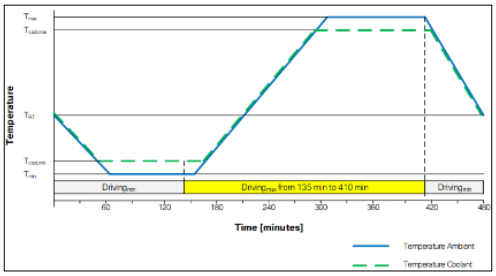
Initial NTC element resistance / temperature curve

R/T curve 8016 / A01
R at 25°C 5000 Ω
B (25/100) 3988 K ±1%
R_N at 70 °C **876 Ω ±1%**

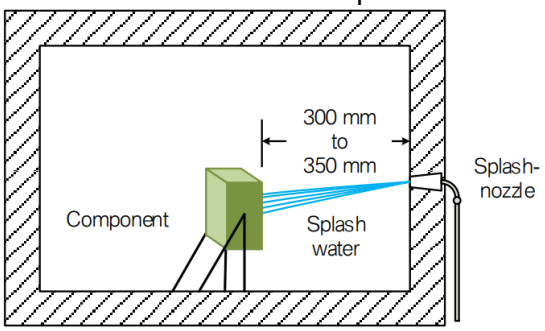
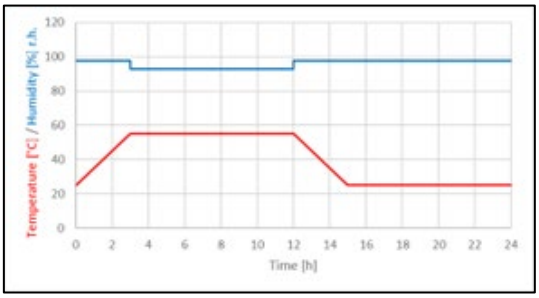
Temp. °C	R_{nom} Ω	R_{min} Ω	R_{max} Ω	ΔR ±%	ΔT ±°C	α %/K
-40	168,250	157,258	179,242	6.50	1.00	6.70
-35	121,295	113,806	128,783	6.20	1.00	6.40
-30	88,500	83,341	93,659	5.80	0.90	6.20
-25	65,185	61,600	68,770	5.50	0.90	6.00
-20	48,535	46,020	51,050	5.20	0.90	5.80
-15	36,465	34,686	38,243	4.90	0.90	5.60
-10	27,665	26,397	28,933	4.60	0.80	5.40
-5	21,158	20,248	22,067	4.30	0.80	5.30
0	16,325	15,667	16,983	4.00	0.80	5.10
5	12,694	12,216	13,172	3.80	0.80	5.00
10	9,950.0	9,600.0	10,300	3.50	0.70	4.80
15	7,854.0	7,597.0	8,111.0	3.30	0.70	4.70
20	6,245.0	6,056.0	6,434.0	3.00	0.70	4.50
25	5,000.0	4,860.0	5,140.0	2.80	0.60	4.40
30	4,029.0	3,924.0	4,133.0	2.60	0.60	4.30
35	3,266.0	3,188.0	3,343.0	2.40	0.60	4.10
40	2,663.0	2,606.0	2,721.0	2.20	0.50	4.00
45	2,184.0	2,141.0	2,227.0	2.00	0.50	3.90
50	1,802.0	1,770.0	1,833.0	1.80	0.50	3.80
55	1,493.0	1,469.0	1,517.0	1.60	0.40	3.70
60	1,244.0	1,227.0	1,261.0	1.40	0.40	3.60
65	1,042.0	1,029.0	1,054.0	1.20	0.30	3.50
70	**876.00**	**867.20**	**884.80**	**1.00**	**0.30**	**3.40**
75	740.70	731.70	749.70	1.20	0.40	3.30
80	629.00	620.30	637.70	1.40	0.40	3.20
85	536.20	527.90	544.40	1.50	0.50	3.20
90	458.80	451.10	466.60	1.70	0.50	3.10
95	394.30	387.00	401.50	1.80	0.60	3.00

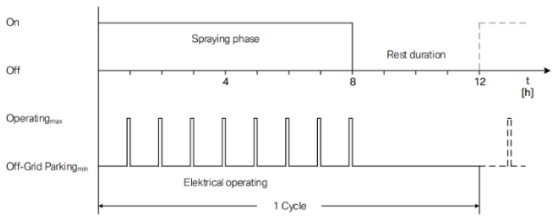
Temp. °C	R_{nom} Ω	R_{min} Ω	R_{max} Ω	ΔR ±%	ΔT ±°C	α %/K
100	340.00	333.30	346.70	2.00	0.70	2.90
105	294.30	288.00	300.60	2.10	0.70	2.90
110	255.60	249.80	261.40	2.30	0.80	2.80
115	222.70	217.40	228.00	2.40	0.90	2.70
120	194.60	189.70	199.60	2.50	1.00	2.70
125	170.80	166.30	175.40	2.70	1.00	2.60
130	150.40	146.30	154.60	2.80	1.10	2.50
135	132.70	128.90	136.60	2.90	1.20	2.50
140	117.40	113.90	120.90	3.00	1.20	2.40
145	104.20	100.90	107.40	3.10	1.30	2.40
150	92.65	89.64	95.66	3.20	1.40	2.30

Reliability data

Tests	Description/Reference	Criteria
ELECTRICAL TESTS		
Response time	Response time of the sensor in a transition from Ti = 20 °C to Tf = 80 °C (in water)	t63% < 4 s
Insulation resistance	Sensor head is immersed into a metal ball bath Test voltage: 500 V DC Rise/fall time: 1 s Duration: 60 s	5 MΩ or more Resistance before and after test within min/max values listed in RT charts
MECHANICAL TESTS		
Vibration test (with temperature superposition)	Sinusoidal Vibration profile: Frequency: 5 Hz; 10 Hz; 500 Hz; 1000 Hz; 2000 Hz Amplitude: 21.57 m/s² Duration per axis: 22 h Total axis: 3 (X, Y, Z) Temperature profile:  Time in min / Temperature in °C: 0 / T_{RT}; 60 / T_{min}; 150 / T_{min}; 300 / T_{max}; 410 / T_{max}; 480 / T_{RT} T_{max}: +150 °C T_{min}: -40 °C n: 2.75 (until end of vibration test) V: 5 V DC over pull-up resistor Connected and intermittent powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s No signs of physical deformation
Mechanical shock	Pulse shape: half sinusoidal Acceleration: 500 m/s² Pulse duration: 6 ms V: 5 V DC over pull-up resistor n: 10 shocks Number of directions: 3 (±X, ±Y, ±Z) Connected and powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s No signs of physical deformation

Drop test	Surface: concrete floor Fall height: 1 m Temperature: room temperature Fall axis: ±X, ±Y, ±Z n: 1 time in each direction Not connected and not powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Leakage test	Pressure 500 mbar (0.5 bar) Gas: helium Leakage rate: 150 Pa/min Temperature: room temperature Not connected and not powered.	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
ENVIRONMENTAL TESTS		
Step temperature test	$T_{change / step}$: 5 °C T_{RT}: 25 °C T_{max}: +150 °C T_{min}: -40 °C t_{dwell}: 5 + 15 min $t_{transfer}$: 1 min n: 1 cycle V: 5 V DC over pull-up resistor Test medium: air Connected and constant powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Thermal cycling test	T_{max}: +150 °C T_{min}: -40 °C t_{dwell}: 5 + 15 min $t_{transfer}$: 4 °K/min n: 100 cycles V: 5 V DC over pull-up resistor Test medium: air Connected and intermittent powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Thermal shock in air	T_{max}: +150 °C T_{min}: -40 °C t_{dwell}: 31 min $t_{transfer}$: < 30 s n: 100 cycles Test medium: air Not connected and not powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Hot water jet inspection	IP Classification: IPX9K Water temperature: 80 °C	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s

Thermal shock with splash water/surge water	T_{max}: +150 °C T_{min}: 0 … 4 °C n: 100 cycles Splash duration: 3 s Flow rate: 3 to 4 liters per water splash/ nozzle V: 5 V DC over pull-up resistor Connected and intermittent powered 	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Thermal cycling test in oil (endurance test)	T_{min}: +20 °C T_{max}: +150 °C t_{dwell}: 10 min $t_{transfer}$: < 30 s Test medium: ATF oil n: 1500 cycles Immersion range: up to sealing element Not connected and not powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Temperature humidity cycle	T_{max}: +55 °C T_{min}: +25 °C Profile:  Upper humidity: 97.5% RH Lower humidity: 93% RH n: 6 cycles (1 cycle: 24 h) Total duration: 360 h V: 5 V DC over pull-up resistor Connected and not powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s

Humidity heat constant	Humidity: 93% RH Temperature: +40 °C Test duration: 21 days (504 h) Test medium: air Not connected and not powered	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s
Salt spray test	Temperature pre storage test: Temperature: 150 °C Dwell time: 168 h Salt spray test: Chamber temperature: 35 °C n: 2 cycles Total duration: 24 h V: 5 V DC over pull-up resistor Connected and intermittent powered 	ΔR/R ≤ 3% at (-40 °C, 20 °C, 60 °C, 100 °C, 140 °C) R_{insu} > 5 MΩ Response time t63% ≤ 4 s No signs of physical deformation Evaluation of sealing surfaces for corrosive infiltration

Cautions and warnings

Storage

- Store sensors 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 sensors where they are exposed to heat or direct sunlight.
- Avoid contamination of sensor surface during storage handling and processing.
- Avoid storage of sensors 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.

Handling

- NTC sensors 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 sensor 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.

Mounting

- Ensure that no thermo-mechanical stress occurs due to production processes. The maximum temperature of the thermistor must not be exceeded.
- Electrodes/contacts must not be scratched or damaged before/during/after the mounting process.
- Contacts and housing used for assembly with the sensor must be clean before mounting.
- Ensure that adjacent materials are designed for operation at temperatures comparable to the surface temperature of the sensor. Be sure that surrounding parts and materials can withstand the temperature.
- Avoid contamination of the sensor 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.
- Avoid using chemical substances as mounting aids. It must be ensured that no water or other liquids enter the NTC sensor (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 sensors only within the specified operating temperature range.
- Use sensors only within the specified power range.
- Environmental conditions must not harm the sensors. Only use the sensors 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.
- It must be ensured that no water enters the NTC thermistors (e.g. through plug terminals).
- Avoid dewing and condensation unless sensor 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 AG.

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