

# NTC thermistors for temperature measurement

Probe assemblies

Series/Type: B57276K
Date: March 2013

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Probe assemblies	K276

#### **Applications**

Washing machines

Temperature measurement

- Dish washers
- Tumble-dryers
- Water boilers

#### **Features**

- Suitable for use in corrosive environments
- Compact stainless steel case
- RAST 2.5 or RAST 5 connector
- Cost-effective ready-to-use sensor
- UL approval (E69802)
- VDE approval (DIN EN 60539-1: 2002)

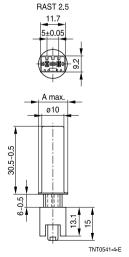
#### **Options**

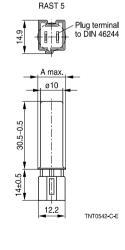
- Alternative resistance ratings, rated temperatures and resistance tolerances available on request.
- RAST 5 plug terminals or RAST 2.5 connector with bar available on request.
- Type Z276, Z277 and Z278 with different geometry and faster response time available on request.

#### **Delivery mode**

Bulk

#### **Dimensional drawings**





#### Dimensions

R <sub>60</sub>	A max.	Plug terminal
Ω	mm	mm
RAST 2.5 co	nnector	
1204	Ø 14.5	=
3243	Ø 12.4	-
RAST 5 conr	nector	
1082	Ø 14.5	6.3 x 0.8
3243	Ø 12.4	4.8 x 0.8

Approx. weight 9 g Approx. weight 9 g



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#### General technical data

Climatic category	(IEC 60068-1)		10/100/56	
Max. power	(at 25 °C)	P <sub>25</sub>	500	mW
Resistance tolerance		$\Delta R_R/R_R$	±2	%
Dissipation factor	(in water)	$\delta_{\text{th}}$	approx. 20	mW/K
Thermal time constant	(in water)	$\tau_{a}$	approx. 20	s
Heat capacity		$C_{th}$	approx. 500	mJ/K
Insulation resistance	$(V = 100 \ V \ DC)$	R <sub>ins</sub>	> 1000	$M\Omega$
Test voltage	(t = 1 s)	$V_{test}$	3750	V AC

# Electrical specification and ordering codes

T <sub>R</sub>	$R_R$	R <sub>25</sub>	No. of R/T	B <sub>25/100</sub>	Ordering code
°C	Ω	Ω	characteristic	K	
RAST 2.5 conn	nector				
60	1204	4829	2003	3980 ±1%	B57276K0482A007
60	3243	11981	2901	3760 ±1.5%	B57276K0123A028
RAST 5 conne	ctor				
63	1082	4829	2003	3980 ±1.5%	B57276K0482A009
60	3243	11981	2901	3760 ±1.5%	B57276K0123A024



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### 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: 100 °C t: 1000 h	< 2%	No visible damage
Storage in damp heat, steady state	IEC 60068-2-78	Temperature of air: 40 °C Relative humidity of air: 93% Duration: 56 days	< 1%	No visible damage
Rapid temperature cycling	IEC 60068-2-14	Lower test temperature: -10 °C Upper test temperature: 100 °C Number of cycles: 10	< 1%	No visible damage
Endurance		P <sub>max</sub> : 500 mW t: 1000 h	< 2%	No visible damage
Long-term stability (empirical value)		Temperature: 100 °C t: 10000 h	< 3%	No visible damage
Robustness of terminations	DIN 46 249	Pull-out force (both connectors together) F = 50 N		No visible damage

#### Note

- 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.



Temperature measurement	B5/2/6K
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#### R/T characteristics

R/T No.	2003		2901	
T (°C)	B <sub>25/100</sub> = 3980 K		B <sub>25/100</sub> = 3760 K	
	R <sub>T</sub> /R <sub>25</sub>	α (%/K)	R <sub>T</sub> /R <sub>25</sub>	α (%/K)
-55.0	97.578	7.5	63.969	6.7
-50.0	67.65	7.2	46.179	6.4
-45.0	47.538	7.0	33.738	6.2
-40.0	33.831	6.7	24.927	6.0
-35.0	24.359	6.5	18.611	5.8
-30.0	17.753	6.3	14.033	5.6
-25.0	13.067	6.0	10.679	5.4
-20.0	9.7228	5.8	8.198	5.3
-15.0	7.3006	5.6	6.3123	5.2
-10.0	5.5361	5.5	4.9014	5.1
-5.0	4.2332	5.3	3.821	4.9
0.0	3.266	5.1	3.0027	4.7
5.0	2.5392	5.0	2.3801	4.6
10.0	1.9902	4.8	1.9	4.5
15.0	1.5709	4.7	1.5257	4.3
20.0	1.2492	4.5	1.233	4.3
25.0	1.0000	4.4	1.0000	4.1
30.0	0.80575	4.3	0.81679	4.0
35.0	0.65326	4.1	0.67166	3.9
40.0	0.5329	4.0	0.55527	3.8
45.0	0.43715	3.9	0.46095	3.8
50.0	0.36064	3.8	0.38459	3.7
55.0	0.29908	3.7	0.32184	3.6
60.0	0.24932	3.6	0.27068	3.5
65.0	0.20886	3.5	0.22907	3.3
70.0	0.17578	3.4	0.19468	3.2
75.0	0.14863	3.3	0.16607	3.1
80.0	0.12621	3.2	0.14221	3.1
85.0	0.10763	3.1	0.12218	3.0
90.0	0.092159	3.1	0.10533	2.9
95.0	0.079225	3.0	0.09123	2.8
100.0	0.068356	2.9	0.079284	2.8
105.0	0.059247	2.8	0.069062	2.7
110.0	0.051531	2.8	0.06034	2.7
115.0	0.044921	2.7	0.052886	2.6
120.0	0.039282	2.7	0.046482	2.5
125.0	0.034387	2.6	0.040985	2.5
130.0	0.030186	2.5	0.036233	2.5
135.0	0.02665	2.5	0.032101	2.4
140.0	0.023594	2.4	0.02851	2.4
145.0	0.020931	2.4	0.025373	2.3
150.0	0.018616	2.3	0.022633	2.3
155.0	0.016612	2.3	0.020231	2.3



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#### Cautions and warnings

Tomporature measurement

See "Important notes".

#### 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.</p>
- 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<sub>x</sub>, 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, for SMD components with nickel barrier termination 12 months, for SMD components with AgPd termination 6 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.
- Twisting (torsion) by 180° of a lead bent by 90° is permissible at 6 mm from the bottom of the thermistor body.

#### 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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Tomporo	ture measurement	

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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.
- 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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# Symbols and terms

Symbol	English	German
A AWG	Area American Wire Gauge	Fläche Amerikanische Norm für Drahtquerschnitte
B B <sub>25/100</sub>	B value B value determined by resistance measurement at 25 °C and 100 °C	B-Wert B-Wert, ermittelt durch Widerstands- messungen bei 25 °C und 100 °C
$C_{th}$	Heat capacitance	Wärmekapazität
1	Current	Strom
N	Number (integer)	Anzahl (ganzzahliger Wert)
$\begin{aligned} &P_{25} \\ &P_{diss} \\ &P_{el} \\ &P_{max} \end{aligned}$	Maximum power at 25 °C Power dissipation Electrical power Maximum power within stated temperature range	Maximale Leistung bei 25 °C Verlustleistung Elektrische Leistung Maximale Leistung im angegebenenTemperaturbereich
$\begin{array}{l} \Delta R_{\text{B}}/R_{\text{B}} \\ \\ R_{\text{ins}} \\ R_{\text{P}} \\ \\ R_{\text{R}} \\ \Delta R_{\text{P}}/R_{\text{R}} \\ \\ R_{\text{S}} \\ \\ R_{\text{T}} \end{array}$	Resistance tolerance caused by spread of B value Insulation resistance Parallel resistance Rated resistance Resistance tolerance Series resistance Resistance at temperature T (e.g. R <sub>25</sub> = resistance at 25 °C)	Widerstandstoleranz, die durch die Streuung des B-Wertes verursacht wird Isolationswiderstand Parallelwiderstand Nennwiderstand Widerstandstoleranz Serienwiderstand Widerstand bei Temperatur T (z.B. R <sub>25</sub> = Widerstand bei 25 °C)
$T \\ \Delta T \\ t \\ T_A \\ T_{max} \\ T_{min} \\ T_{op} \\ T_{R}$	Temperature Temperature tolerance Time Ambient temperature Upper category temperature Lower category temperature Operating temperature Rated temperature	Temperatur Temperaturtoleranz Zeit Umgebungstemperatur Obere Grenztemperatur (Kategorietemperatur) Untere Grenztemperatur (Kategorietemperatur) Betriebstemperatur Nenntemperatur
$T_{surf}$ $V_{ins}$	Surface temperature  Voltage Insulation test voltage	Oberflächentemperatur Spannung Isolationsprüfspannung
V ins V <sub>op</sub> V <sub>test</sub>	Operating voltage Test voltage	Betriebsspannung Prüfspannung



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Symbol	English	German
α	Temperature coefficient	Temperaturkoeffizient
Δ	Tolerance, change	Toleranz, Änderung
$\delta_{\text{th}}$	Dissipation factor	Wärmeleitwert
$ au_c$ $ au_a$	Thermal cooling time constant Thermal time constant	Thermische Abkühlzeitkonstante Thermische Zeitkonstante

### Abbreviations / Notes

Symbol	English	German
SMD	Surface-mounted devices	Oberflächenmontierbares Bauelement
*	To be replaced by a number in ordering codes, type designations etc.	Platzhalter für Zahl im Bestellnummern- code oder für die Typenbezeichnung.
+	To be replaced by a letter.	Platzhalter für einen Buchstaben.
	All dimensions are given in mm.	Alle Maße sind in mm angegeben.
	The commas used in numerical values denote decimal points.	Verwendete Kommas in Zahlenwerten bezeichnen Dezimalpunkte.



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# Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru\_6 moschip.ru\_4 moschip.ru\_9