




<p>Specification available from:</p> <p>Österreichischer Verband für Elektrotechnik (OVE) Eschenbachgasse 9 A-1010 VIENNA</p>	<p>IEC 60738-1-4 – AT0001 <a href="#">Issue 5 / 2018-10</a></p> <p>QC 440004</p>				
<p>Electronic Components of assessed quality in accordance with:</p> <p>IEC 60738-1: 2009-07 IEC 60730-1, Annex J15, J17: 2010-03</p>	<p>IEC 60738-1-4: 2008-02</p> <p>QC 440004</p> <p>Directly heated positive step-function temperature coefficient thermistors for sensing application (Limit temperature sensors)</p>				
<p>Outline drawing: SMD PTCs EIA sizes 0402, 0603, 0805.</p> <table border="1" data-bbox="221 855 737 1205"> <thead> <tr> <th>Type</th> <th>Case size</th> </tr> </thead> <tbody> <tr> <td> <p><b>SMD</b></p>  </td> <td> <p>0402, 0603, 0805</p> </td> </tr> </tbody> </table>	Type	Case size	<p><b>SMD</b></p> 	<p>0402, 0603, 0805</p>	<p>Modified ferro-electric ceramic material parts for over-temperature protection</p> <p>Assessment level: EZ</p>
Type	Case size				
<p><b>SMD</b></p> 	<p>0402, 0603, 0805</p>				

Information on the availability of components  
qualified to this detail specification is given in  
the Register of Approvals

## 1 GENERAL DATA

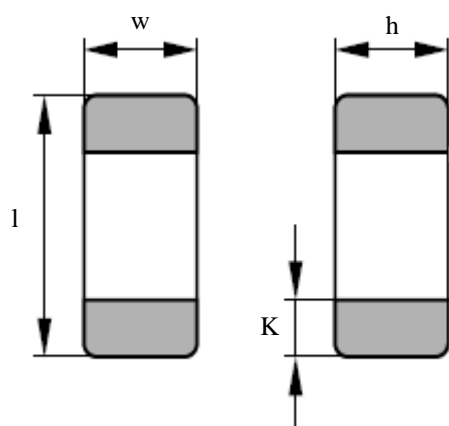
### 1.1 Method of mounting

If not otherwise specified the SMD Thermistors shall be soldered as follows, according to IEC60738-1, 7.30.:

- Soldering on 1,6 mm thick epoxide woven glass fabric laminated printed board.
- Method of soldering: Reflow. Peaktemperature 260°C.
- Solder paste: Sn96,5-Ag3,0-Cu0,5.

Note: After soldering a recovery time of 120h must be considered (before measurements on PCB).

### 1.2 Dimensions



Case size	Length l [mm]	Width w [mm]	Hight h [mm]	Termination Length K [mm]
<b>0402</b>	1,0 ± 0,1	0,5 ± 0,05	0,5 ± 0,05	0,25 ± 0,15
<b>0603</b>	1,6 ± 0,15	0,8 ± 0,1	0,8 ± 0,1	0,35 ± 0,15
<b>0805</b>	2,0 ± 0,2	1,25 ± 0,2	0,8 ± 0,2	0,75 – 0,6

### 1.3 Coating

Non-coated PTC thermistors.

### 1.4 Terminations

The terminations are suitable for soldering.

### 1.5 Flammability

Not applicable.

### 1.6 Resistance to solvents

Not applicable.

## 1.7 Packaging

PTC SMD thermistors are taped according to IEC 60286-3.

## 1.8 Electrical data/ratings and characteristics

### General technical data

<b>Max. operating DC voltage</b>	$V_{max}$	32V
<b>Lower category temperature, Minimum operating temperature (<math>V \leq V_{max}</math>)</b>	LCT, $T_{opmin}$	-40°C
<b>Upper category temperature, Maximum operating temperature (<math>V \leq V_{max}</math>)</b>	UCT, $T_{opmax}$	125°C or $T_{sense,1} + 25^\circ\text{C}$ whichever is higher
<b>Rated resistance @25°C</b>	$R_R$	Accordinging rating table
<b>Sensing Temperature</b>	$T_{sense}$	Accordinging rating table
<b>Maximum Power during measurement<sup>1)</sup></b>	$P_{max}$	2 mW for case size 0402 4 mW for case size 0603 6 mW for case size 0805

1) Note: In order to limit self heating effects, the electrical power during measurement should not exceed the indicated limits.

### Detailed electrical ratings

EIA case size 0402			Superior series	
Ordering code	$R_R$ $\Omega$	$\Delta R_R$ %	$T_{sense,1}$ (@ 4,7 k $\Omega$ ) °C	$T_{sense,2}$ (@ 47 k $\Omega$ ) °C
B59421A0075*	470	± 50	75 ± 5	-
B59421A0085*	470	± 50	85 ± 5	-
B59421A0095*	470	± 50	95 ± 5	-
B59421A0105*	470	± 50	105 ± 5	-
B59421A0115*	470	± 50	115 ± 5	-
<b>B59451A0115*</b>	<b>540</b>	<b>± 30</b>	<b>115 ± 5</b>	-
B59421A0125*	470	± 50	125 ± 5	-
B59421A0135*	470	± 50	135 ± 5	-

EIA case size 0603			Superior series	
Ordering code	$R_R$ $\Omega$	$\Delta R_R$ %	$T_{sense,1}$ (@ 4,7 k $\Omega$ ) °C	$T_{sense,2}$ (@ 47 k $\Omega$ ) <sup>1)</sup> °C
B59641A0075*	470	± 50	75 ± 5	90 ± 7
B59641A0085*	470	± 50	85 ± 5	100 ± 7
B59641A0095*	470	± 50	95 ± 5	110 ± 7
B59641A0105*	470	± 50	105 ± 5	120 ± 7
B59641A0115*	470	± 50	115 ± 5	130 ± 7
B59641A0125*	470	± 50	125 ± 5	140 ± 7
B59641A0135*	470	± 50	135 ± 5	150 ± 7
B59641A0145*	470	± 50	145 ± 5	-

1) Only specified for PTC Series B59641A0\*\*\*A062

EIA case size 0805				Superior series		
Ordering code	$R_R$ $\Omega$	$\Delta R_R$ %	$T_{\text{sense},1}$ $^{\circ}\text{C}$	$R_{T\text{sense},1 -5^{\circ}\text{C}}$ $\text{k}\Omega$	$R_{T\text{sense},1 +5^{\circ}\text{C}}$ $\text{k}\Omega$	$R_{T\text{sense},1 +15^{\circ}\text{C}}$ $\text{k}\Omega$
<b>B59721A0070*</b>	680	$\pm 50$	70	$\leq 5,7$	$\geq 5,7$	$\geq 40$ <sup>1)</sup>
<b>B59721A0080*</b>	680	$\pm 50$	80	$\leq 5,7$	$\geq 5,7$	$\geq 40$ <sup>1)</sup>
<b>B59721A0090*</b>	680	$\pm 50$	90	$\leq 5,5$	$\geq 13,3$	$\geq 40$
<b>B59721A0100*</b>	680	$\pm 50$	100	$\leq 5,5$	$\geq 13,3$	$\geq 40$
<b>B59721A0110*</b>	680	$\pm 50$	110	$\leq 5,5$	$\geq 13,3$	$\geq 40$
<b>B59721A0120*</b>	680	$\pm 50$	120	$\leq 5,5$	$\geq 13,3$	$\geq 40$
<b>B59721A0130*</b>	680	$\pm 50$	130	$\leq 5,5$	$\geq 13,3$	$\geq 40$

<sup>1)</sup>  $R_{(T_{\text{sense},1} +25^{\circ}\text{C})}$

## 1.9 Normative references

IEC 60738-1, thermistors – directly heated positive step-function temperature coefficient – Part 1: Generic specification.

IEC 60730-1, Annex J: Automatic electrical controls for household and similar use – Part 1: General requirements. Requirements for controls using thermistors.

## 1.10 Marking

No marking is stamped on SMD PTC parts.

On the reel packing of all shipped thermistors will be placed a bar code label stating type, part number, quantity, date of manufacture and batch number.

## 1.11 Ordering information

The ordering code consists of 3 blocks:

Ordering code:

B59xxx-A0yyy-A(B)zzz+
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1 <sup>st</sup> block:	type designation	B59xxx	B59... PTC Thermistor  xxx... type size code: 421, 451 size 0402 641 size 0603 721 size 0805
2 <sup>nd</sup> block	sensing temperature	A0yyy	yyy ... T <sub>sense</sub> [°C]
3 <sup>rd</sup> block:	Packing, processing, customer specific information	A(B)zzz+	zzz ... code for packing / processing and in case of B-types customer specific information not effecting IECQ specifications.  + ... can be followed by additional numbers and letters (3 digits) not effecting IEC specifications.

## 2. INSPECTION REQUIREMENTS

### 2.1 Procedures

**2.1.1** For qualification approval, the procedures shall be in accordance with the generic specification IEC 60738-1, 6.5.4.

**2.2.2** For quality conformance inspection has been used the test schedules (tables 1 and 2) include sampling, periodicity severity's and requirements. The formation of inspection lots is covered by 6.5.7 of the generic specification.

The following list applies to the test schedules developed in tables 1 and 2.

- 1) The Subclause numbers of tests and performance requirements refer to the generic specification IEC 60738-1 and to the data of this specification.
- 2) Number to be tested: sample size as directly allotted to the code letter for IL in table IIA of IEC 60410 /alternatively IEC 61193-2 (Single sampling plan for normal inspection).
- 3) In these tables:
  - p = periodicity in months
  - n = number of devices in the samples
  - c = the acceptance criterion (permitted number of non-confor. items)
  - D = indicates a destructive test
  - ND = indicates a non destructive test
  - IL = is the inspection level
- 4) The temperature at which the zero-power resistance shall be measured is the temperature specified in the detail specification. This temperature shall be stated, where required, in the test schedule.
- 5) The specimens used for this group may, at the discretion of the manufacturer, be used for any subsequent group which is identified as being „destructive“.
- 6) The soldering – solderability and soldering – resistance to heat tests shall only be applied where the thermister has terminations which are appropriate for soldering.
- 7) Where the terminations are stated to be suitable for printed wiring applications, the appropriate test conditions in IEC 60068-2-58 shall apply.
- 8) The termistors shall be mounted by their normal means.
- 9) The bump test and the shock test are alternatives. The test selected in the detail specification shall be used.
- 10) The detail specification shall specify which of the endurance tests in groups C4, C5 and D1 respectively are appropriate to the construction and application of the termistor.
- 11) Any deviation from annex B of the generic specification shall be given in the detail specification.
- 12) 100% testing shall be followed by re-inspection by sampling in order to monitor outgoing quality level by non-conforming items per million ( $\times 10^{-6}$ ). The sampling level shall be established by the manufacturer. For the calculation of  $\times 10^{-6}$  values any parametric failure shall be counted as non-conforming item. In case one or more non-conforming items occur in a sample, this lot shall be rejected.

**Table 1- Test schedule for quality conformance inspection: lot-by-lot**

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	IL	n	c	Performance requirements (see list item 1)
			(see list item 3)			
<b>GROUP A INSPECTION</b>	ND		100 %			According par. 1.8
<b>Subgroup A0</b>						
7.5 Zero-power resistance $R_R$		Zero-power resistance $R_{25}$ $P_{max}$ according par. 1.8				
<b>Subgroup A1</b>	ND		S-4	2)	0	As in 7.4.1
7.4.1 Visual examination						
<b>Subgroup A2</b>	ND		S-3	2)	0	
7.4.2 Marking						
7.4.3 Dimensions (gauging)		Not applicable				
<b>GROUP B INSPECTION</b>	ND		S-2	2)	0	According par. 1.8
<b>Subgroup B1</b>						
7.5 Zero-power rated resistance $R_{25}$						
7.9 Functioning resistance $R_{NF}$ at $T_{NF}$		$R@25^{\circ}C \pm 2^{\circ}C$  $R@T_{sense,1} \pm \Delta T$ , respectively if specified: $R@T_{sense,2} \pm \Delta T$ .  according par. 1.8 $P_{max}$ according par. 1.8				
7.27 Residual current (if specified)		Not applicable				
<b>Subgroup B2</b>	ND		S-2	2)	0	The terminations should be uniformly tinned.
7.8 Voltage proof						
7.16 Soldering - Solderability		Not applicable IEC 60068-2-58 Reflow method (Pb-free solder): $T_{Peak} = 230 \pm 5^{\circ}C$ $t_{Peak} = 20s$ .				

**Table 2- Test schedule for quality conformance inspection: periodic**

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and acceptance criterion (see list item 3)			Performance Requirements (see list item 1)
			P	N	c	
<b>GROUP C INSPECTION</b>						
<b>Subgroup C1A</b>						
<b>Part of sample</b>						
7.17 Soldering – resistance to soldering heat	D	IEC 60068-2-58 Reflow soldering with peak temperature 260°C: $T_{Peak} = 260 \pm 5^{\circ}C$ $t_{Peak} = 20s$ Zero-power resistance $R_{25}$ Visual examination Remark: Minimum period of recovery after soldering: $t_{min} = 120h$ .	6	5	0	$\Delta R_{25}/R_{25}: \pm 20\%$ No visible damage
7.31 Robustness of termination – Shear test		According to IEC 60068-2-21 Test Ue3: Force $F = 5 N$ , $t = 10 \pm 1s$ . Zero-power resistance $R_{25}$ Visual examination				$\Delta R_{25}/R_{25}: \pm 10\%$ No visible damage
7.32 Robustness of termination - Bord flex		According to IEC 60068-2-21 Test Ue1: Bending $d = 2 mm$ , $t = 20 \pm 1s$ . One bending. Zero-power resistance $R_{25}$ Visual examination				$\Delta R_{25}/R_{25}: \pm 10\%$ No visible damage
<b>Subgroup C1B</b>						
<b>Other part of sample</b>						
7.18 Rapid change of temperature	D	IEC 60068-2-14; Na $T1 = -40^{\circ}C$ $T2 = T_{opmax} \pm 2^{\circ}C$ 5 cycles; $t=30min$  Zero-power resistance $R_{25}$ Visual examination	6	5	0	$\Delta R_{25}/R_{25}: \pm 10\%$ No visible damage

**Table 2- continued**



Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and acceptance criterion (see list item 3)			Performance Requirements (see list item 1)
			P	N	c	
7.19 Vibration		IEC 60068-2-6, Fc Frequency range: 10 ... 2000 Hz Amplitude: 0.75 mm Acceleration: 98 m/s <sup>2</sup> Sweep endurance: Total duration 6h (3x2h in x,y,z) Zero-power resistance R <sub>25</sub> Visual examination				$\Delta R_{25}/R_{25}: \pm 10\%$ No visible damage
7.20 Bump		IEC 60068-2-27, Ea Acceleration: 400 m/s <sup>2</sup> ; t = 6ms Number of shocks: 6 x 5000 (see list item 8) Zero-power resistance R <sub>25</sub> Visual examination				$\Delta R_{25}/R_{25}: \pm 10\%$ No visible damage
7.21 Shock (or bump, see list item 9)		Not specified				
<b>Subgroup C1</b> <b>Combined sample of specimens of subgroups C1A and C1B</b>	D		6	10	0	
7.22 Climatic sequence		IEC 60068-2-30 Db, IEC60068-2-1 A, IEC 60068-2-2 B (low air pressure test not applicable) Category: -40/T <sub>opmax</sub> /56 - Dry heat: T = T <sub>opmax</sub> ±2°C, t = 16h - Damp heat, cyclic, first cycle - Cold: T = -40±2°C, t = 2h - Damp heat, cyclic, remaining 5 cycles  Zero-power resistance R <sub>25</sub> Visual examination				$\Delta R_{25}/R_{25}: \pm 20\%$ No visible damage

Table 2- continued

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and acceptance criterion (see list item 3)			Performance Requirements (see list item 1)
			P	N	c	
<b>Subgroup C2</b>						
7.11	ND	Response time by ambient temperature $t_a$ (if specified)				
7.12		Response time by power change $t_b$ (if specified)				
<b>Subgroup C3</b>						
7.6	ND	Temperature coefficient of resistance (if applicable)				
7.4.4		Dimensions (detail)	6	10	0	According par. 1.2
7.10		Dissipation factor at $U_{max}$ (if specified) (see list item 11)				
<b>Subgroup C4</b>						
7.24.2	ND	Endurance at upper category temperature (J.17.18.3.1, J.17.18.3.2, acc. IEC60730-1)	6	10	0	$\Delta R_{25}/R_{25}: \pm 20\%$ No visible damage
<b>GROUP D INSPECTION</b>						
<b>Subgroup D1</b>						
7.24.1	D	Endurance at room temperature (cycl.) (J.17.18.2 acc. IEC60730-1)	12	10	0	$\Delta R_{25}/R_{25}: \pm 10\%$ No visible damage

Table 2- continued

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and acceptance criterion (see list item 3)			Performance Requirements (see list item 1)
			P	N	c	
<b>Subgroup D2</b> 7.24.3 Endurance at maximum operating temperature and maximum voltage	D	IEC 60068-2-2, B T = Topmax ±2°C V = Vmax, t = 1000h  Examination at 168 h, 500 h and at 1000 h Zero-power resistance R <sub>25</sub> Visual examination	12	10	0	ΔR <sub>25</sub> /R <sub>25</sub> : ±20% No visible damage
<b>Subgroup D4</b> 7.23 Damp heat, steady state	D	IEC 60068-2-78, Ca T = 40±2°C, r.H. = 93 (+2/-3)% t = 56d  Zero-power resistance R <sub>25</sub> Visual examination	12	10	0	ΔR <sub>25</sub> /R <sub>25</sub> : ±10% No visible damage

Table 3- Additional requirements according IEC 60730-1, Annex J.

Subclause number and test	D or ND	Conditions of test	Sample size and acceptance criterion (see list item 3)			Performance Requirements
			P	N	c	
J17.18.4 Cold environmental thermal cycling (7.24.4 acc. IEC60738-1)	D	IEC 60068-2-14; Na T1 = -40°C, T2 = T <sub>opmax</sub> ±2°C Applied voltage: V <sub>max</sub> 1000 cycles; t = 15min  Zero-power resistance R <sub>25</sub> Visual examination	12	10	0	ΔR <sub>25</sub> /R <sub>25</sub> : ±25% No visible damage
J.17.18.5 Thermal runaway (7.24.5 acc. IEC60738-1)	D	200% V <sub>max</sub> Starting with V <sub>max</sub> and increase 10%V <sub>max</sub> , t = 2min/step  Visual examination	12	10	0	No visible damage. There shall be no electrical or mechanical breakdown, expulsion of particles, or evidence of risk of fire or electrical shock.