EPCOS

NTC thermistors

Inrush Current Limiters (ICLs)

Series/Type: **S234/xxx/M**
Ordering code: **B57234S0xxxM000**

Date: 2009-05-10
Version: 4

Content of header bars 1 and 2 of data sheet will be automatically entered in headers and footers! Please fill in the table and then change the color to "white". This ensures that the table disappears (invisible) for the customer PDF. Don't change formatting when entering or pasting text in the table and don't add any cell or line in and to it!

Identification/Classification 1 (header 1 + top left header bar):	NTC thermistors
Identification/Classification 2 (header 2 + bottom left header bar):	*Inrush Current Limiters (ICLs)*
Ordering code: (top right header bar)	***B57234S0xxxM000***
Series/Type: (top right header bar)	***S234/xxx/M***
Preliminary data (optional): (if necessary)	Data sheet
Department:	ZH FTZ KB VAR PD
Date:	2009-05-10
Version:	4
Prepared by:	Yaodong Pan
Release signed by:	Jeffrey Qin
Release signed QS:	Raymond Zhao
Modifications/Remarks:	☐ Customer, PN: ☐ Filename:
	☐ Specification No.:
	☐ Issue of specification: ☐ Date of specification:
	☐ Date of confirmation of specification by EPCOS:
	☐ PPAP issue: ☐ PPAP date:
	☐ Reliability ☐ Extended reliability (more than standard)

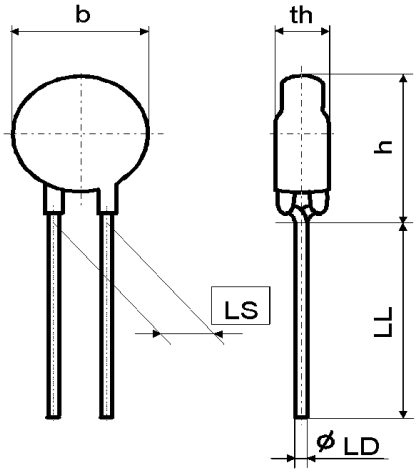
APPLICATION :

NTC-thermistor for inrush current limiting in peripheral communication equipment, e.g. in switch-mode power supplies

FEATURES :

- Black coated thermistor disk
- Coating material is flame retardant (UL 94 V-0 approved)
- Kinked leads of tinned copper wire
- Lead spacing 7.5 mm
- Manufacturer's logo, NTC and resistance value stamped in white
- High stability of electrical characteristic
- Terminals solderable in accordance with IEC 60068-2-20, test ta, method 1
- ICL support to fulfill the requirements according EN 61000 of power circuits
- Usable in series connections up to 265 V_{rms}
- UL approval (E 69802)
- The component is compliant with ROHS (DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
- Also available on tape

DRAWING :



b	15.0max	mm
th	7.0 max	mm
h	22.0 max	mm
LL	25.0 min	mm
LD	$0.8^{\pm 0.05}$	mm
LS	$7.5^{\pm 0.8}$	mm

Approx. weight : 2.0 [g]

RATINGS AND CHARACTERISTICS

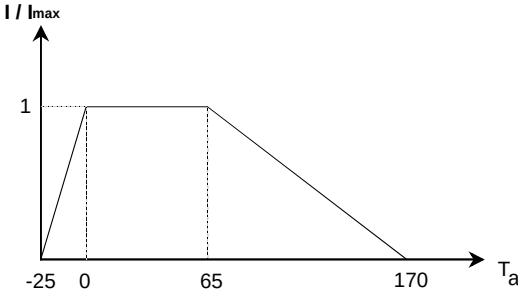
Lower/upper category temperature	T	[℃]	**-55/+170**
Resistance tolerance	$\Delta R/R_N$	[%]	**± 20**
Rated temperature	T_N	[℃]	**25**
B value tolerance	$\Delta B/B$	[%]	**± 3**
Max. power at 25℃	P_{max}	[W]	**3.6**
Dissipation factor (in air)	δ_{th}	[mW/K]	**approx. 17**
Thermal cooling time constant (in air)	τ_{th}	[s]	**approx. 90**
Heat capacity	C_{th}	[mJ/K]	**approx. 1530**

Ordering Code	R_{25} [Ω]	I_{max} [A]	$B_{25/100}$ [K]	C_T at 110 VAC [µF]	C_T at 230 VAC [µF]	Parameter for R(I) k	Parameter for R(I) n
B57234S0109M000	1.0	11.5	2700	2800	700	0.622	-1.27
B57234S0229M000	2.2	9.0	2800	2800	700	0.806	-1.30
B57234S0259M000	2.5	8.4	2800	2000	500	0.843	-1.30
B57234S0479M000	4.7	6.6	2900	2800	700	1.03	-1.32
B57234S0509M000	5.0	6.4	2900	2800	700	1.05	-1.32
B57234S0709M000	7.0	6.0	3000	2800	700	1.16	-1.33
B57234S0100M000	10	5.0	3060	2800	700	1.29	-1.34
B57234S0150M000	15	4.0	3000	2800	700	1.49	-1.33
B57234S0220M000	22	4.0	3300	2800	700	1.57	-1.37
B57234S0330M000	33	3.3	3300	3600	900	1.78	-1.37

Maximum continuous current I_{max} :

The I_{max} denotes the maximum permissable continuous current (dc or rms values for sine-shaped ac) in the temperature range 0 to 65℃.

Maximum current derating (I / I_{max}) :



$$\text{Percent of } I_{max} = 100\left[1 - \frac{T_A - 65°C}{T_{max} - 65°C}\right]$$

T_A = ambient temperature ($T_A > 65$℃)
$T_{max} = 170$℃

Fig. 1. - Maximum current derating (I / I_{max})

Maximum switchable capacity (C_T) :

The maximum switchable capacity (C_T) is the maximum capacity which may be discharged across the thermistor. See Fig.2 Maximum switchable capacity measuring circuit.

Dependence of NTC resistance on current :

The resistance effective in the usual current range can be approximated with the fit parameter **k** and **n.**

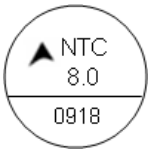
$R_{NTC} = \mathbf{k} * I^{\mathbf{n}}$ $\qquad 0.3 * I_{max} < I \leq I_{max}$

R_{NTC}	Resistance value to be determined at current I [Ω]
k, n	Fit parameter, see table with ordering codes
I	Current flowing through the NTC (insert numerical value in A)

The calculated values only serve as an estimate for operation in still air at an ambient temperature of 25℃.

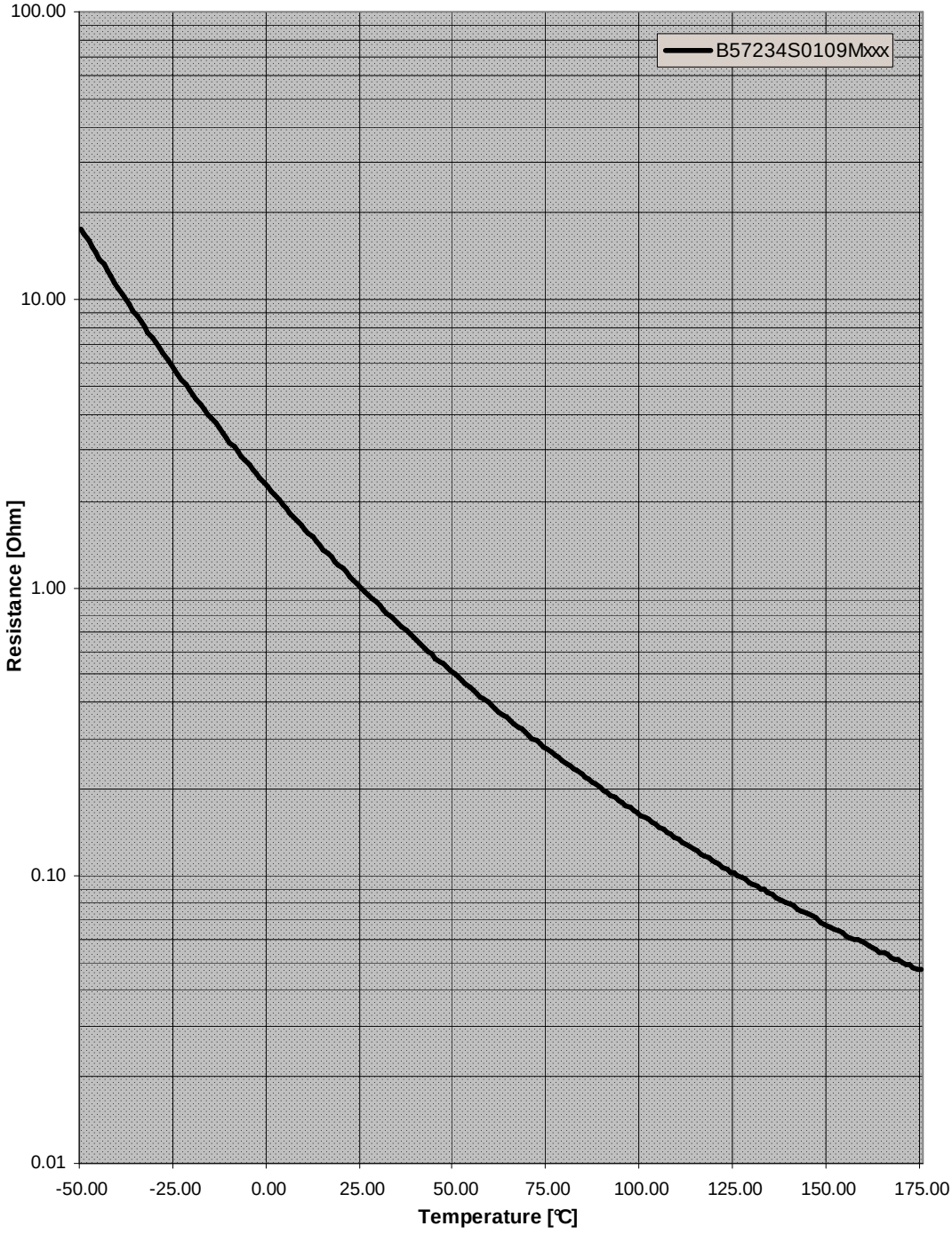
MARKING :

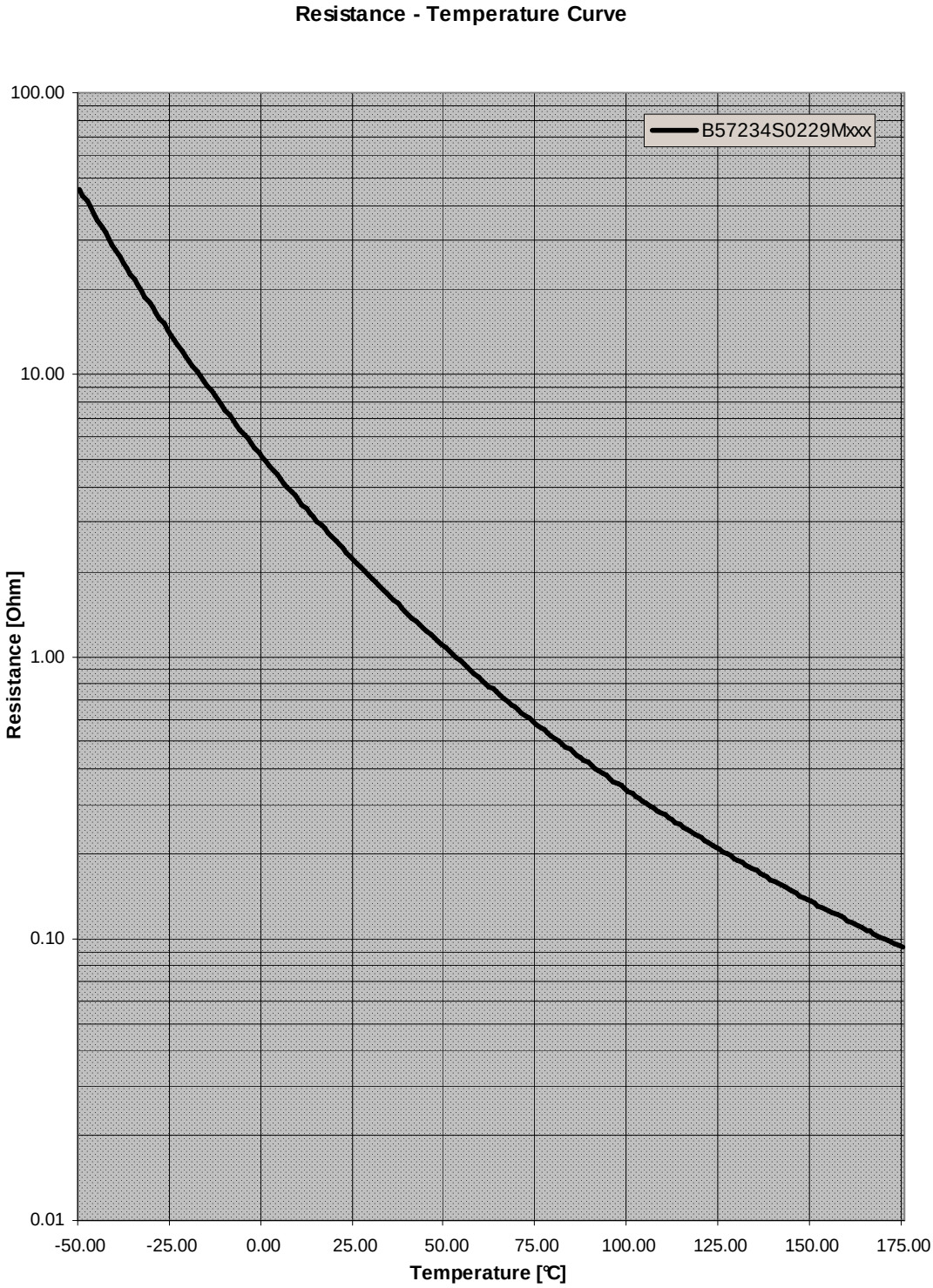
Example for marking

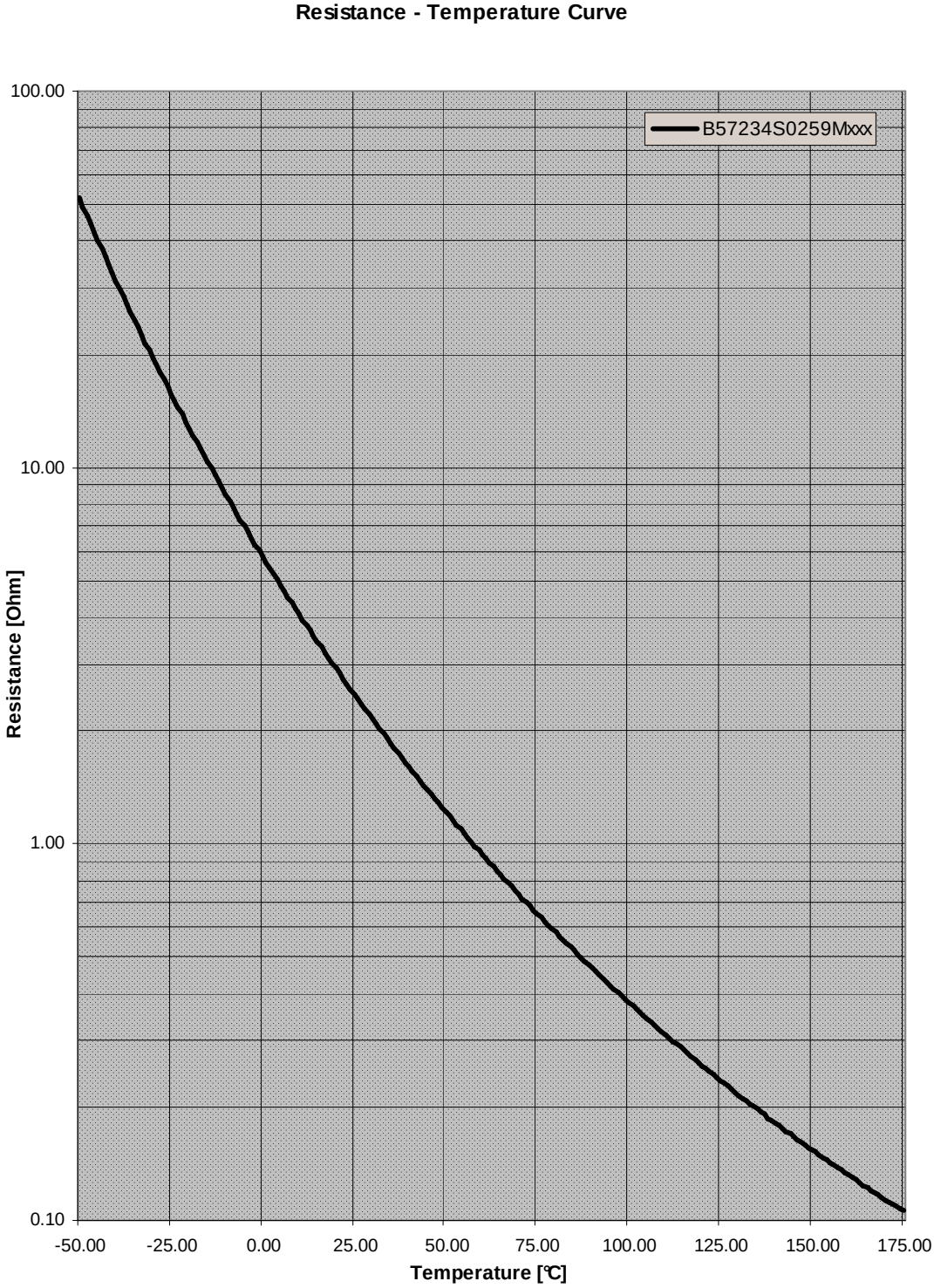


- EPCOS – logo
- Resistance value
- NTC
- Date code with 4 digits (year and week of production): 0918 (example for week 18 in year 2009)

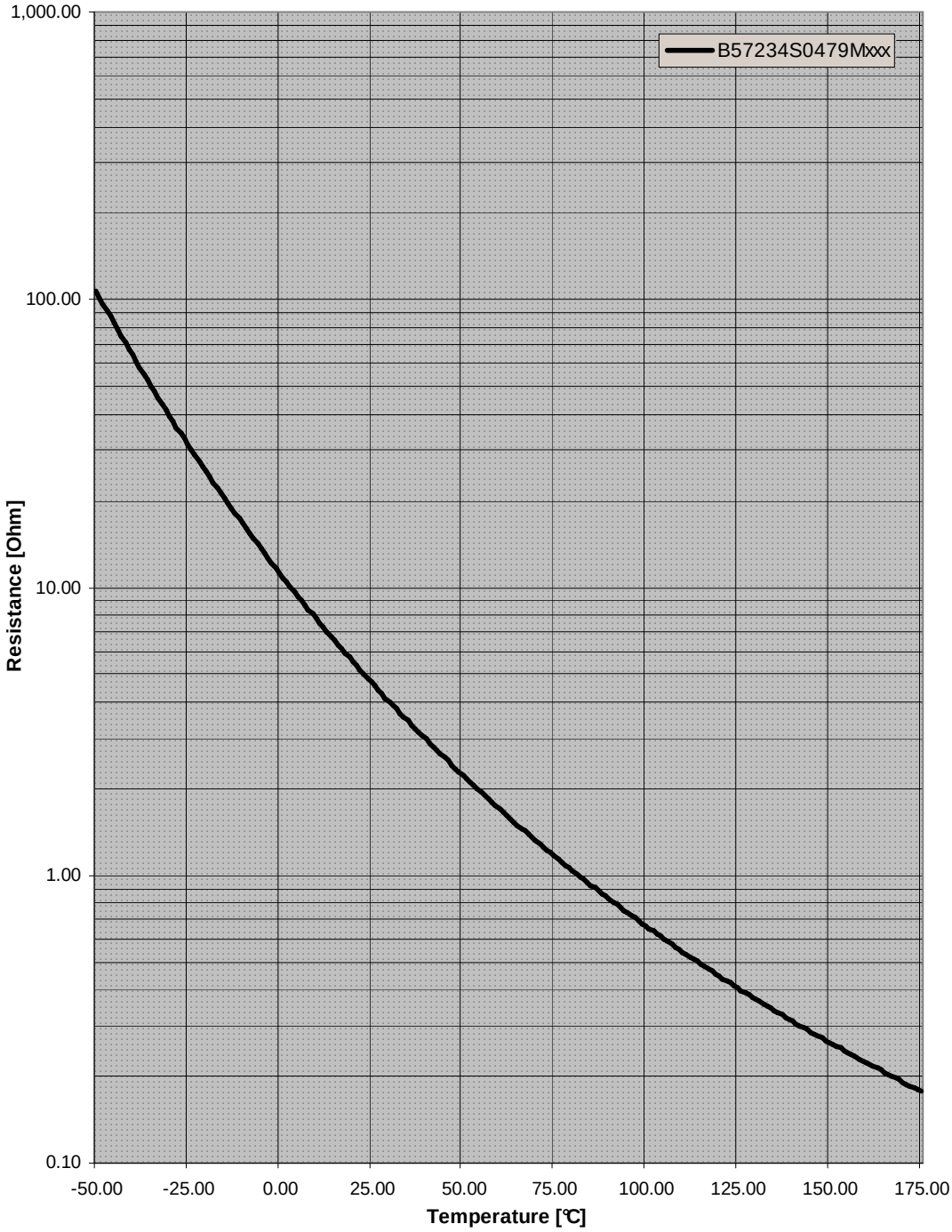
Resistance - Temperature Curve



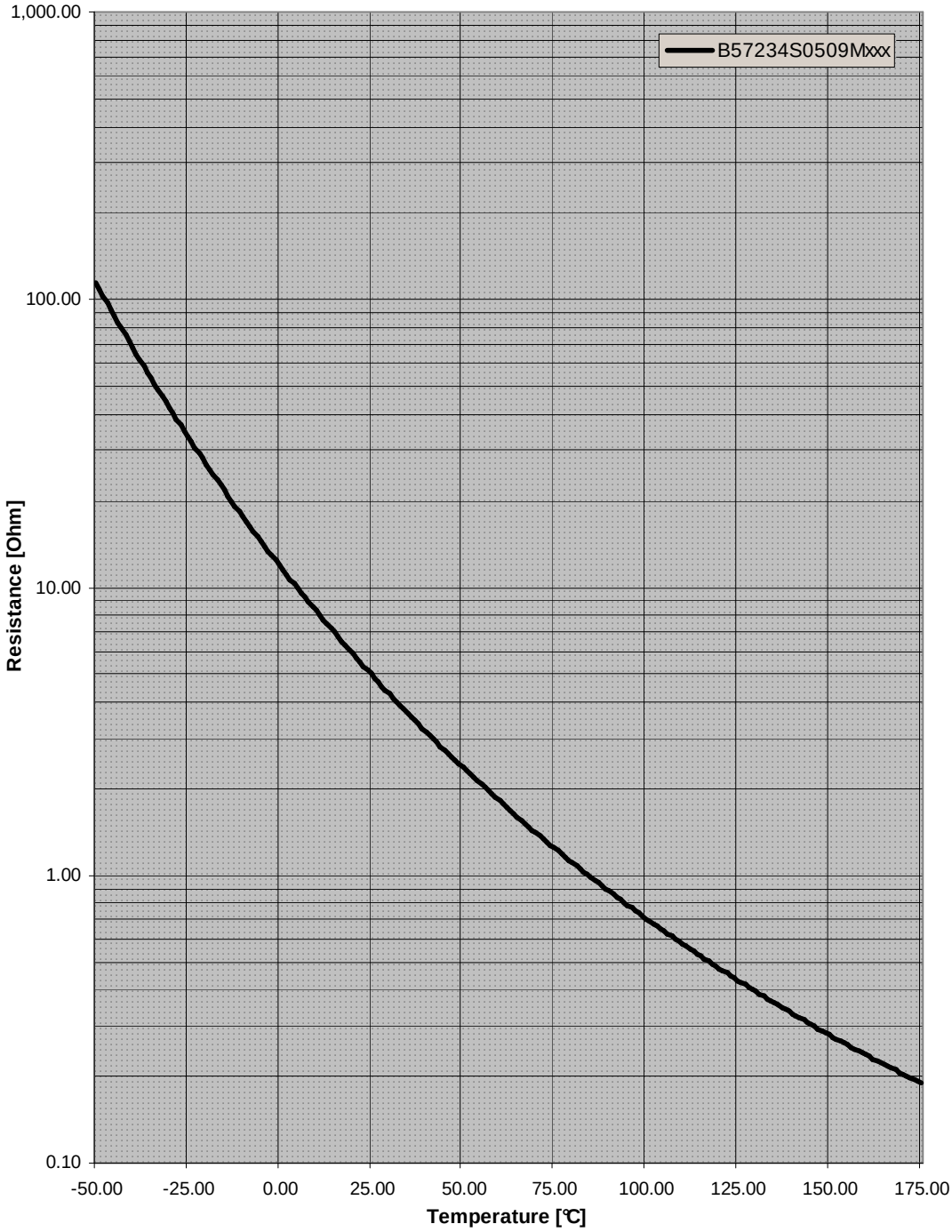

Resistance - Temperature Curve
B57234S0229Mxxx
100.00
10.00
1.00
0.10
0.01
Resistance [Ohm]
-50.00
-25.00
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
Temperature [°C]


Resistance - Temperature Curve
B57234S0259Mxxx
100.00
10.00
1.00
0.10
Resistance [Ohm]
-50.00
-25.00
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
Temperature [°C]

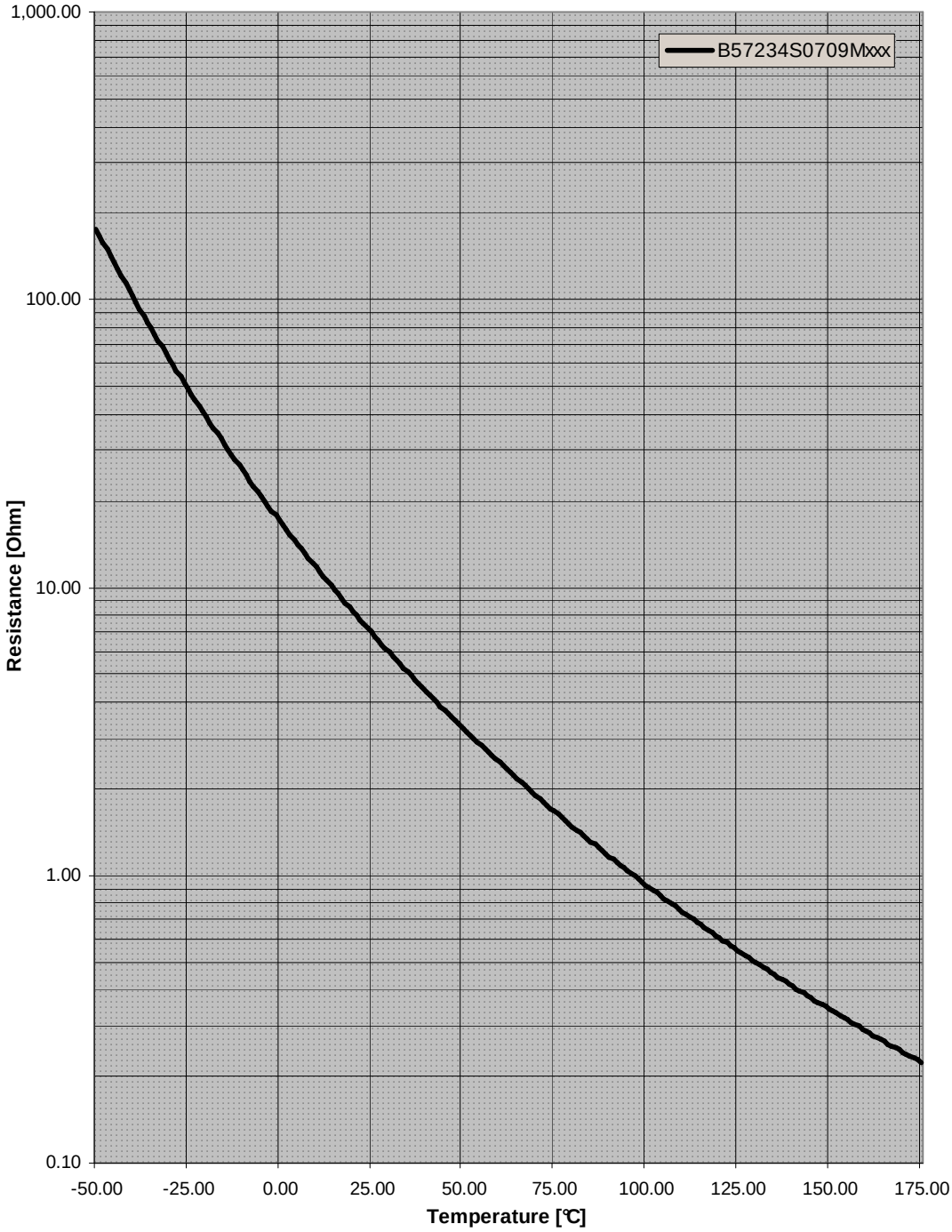
Resistance - Temperature Curve



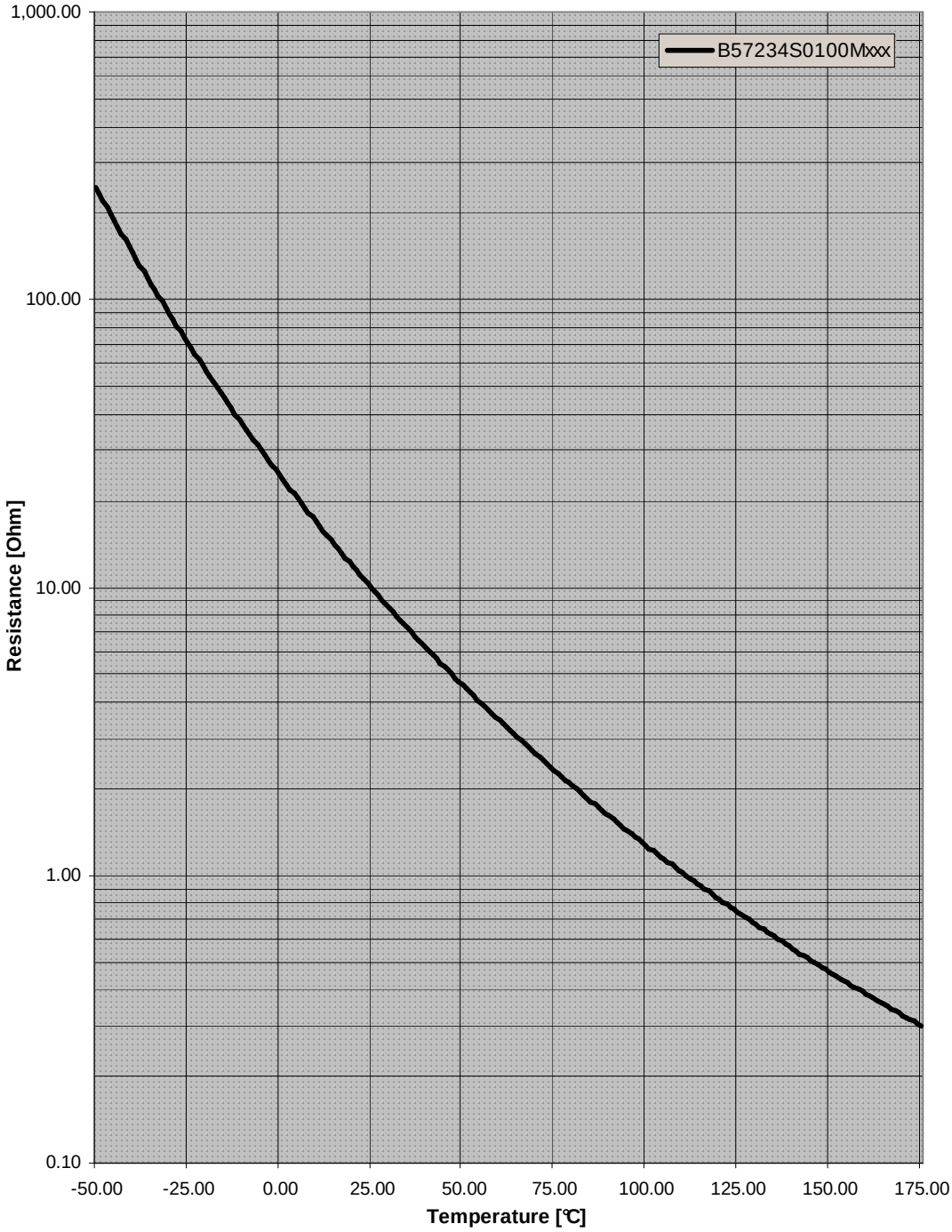
Resistance - Temperature Curve



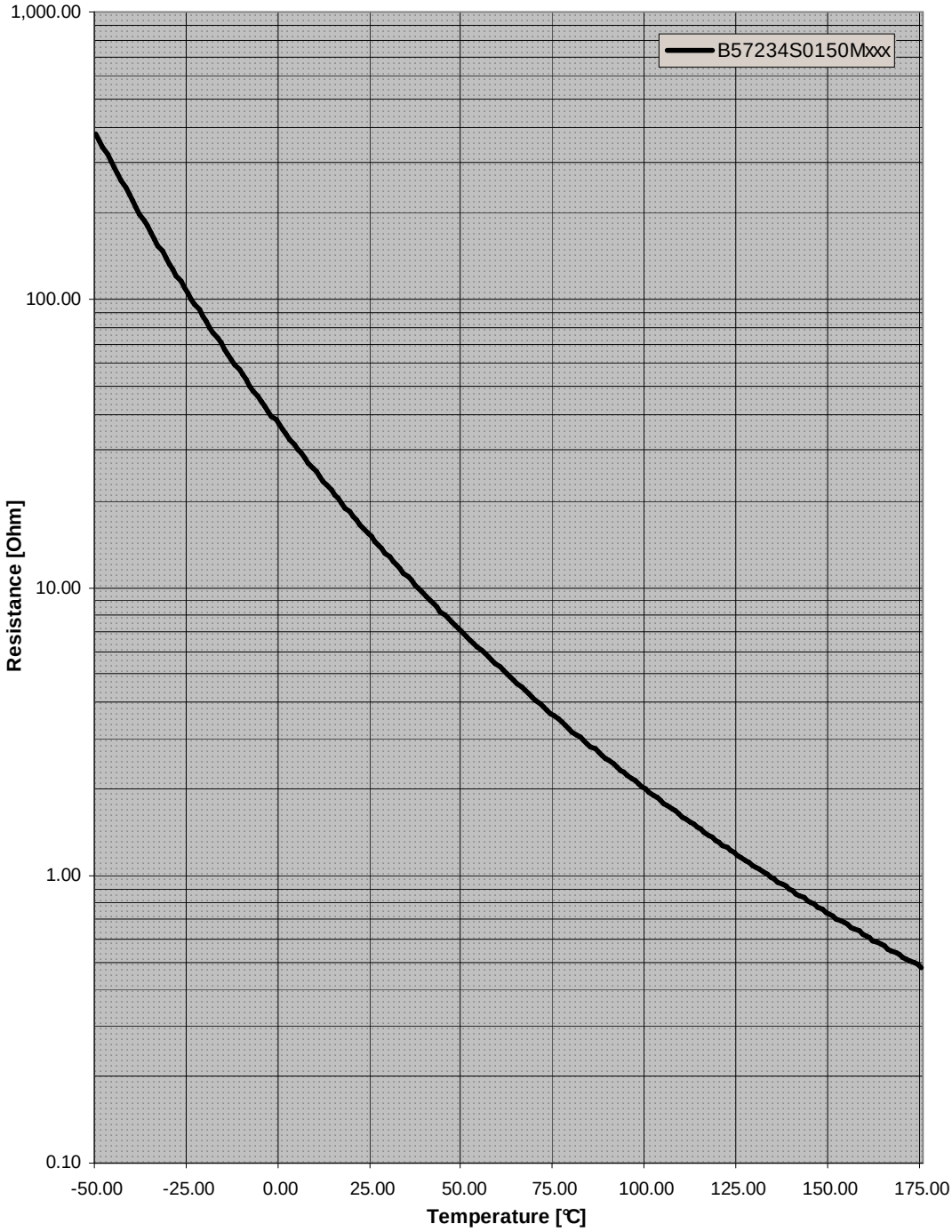
Resistance - Temperature Curve



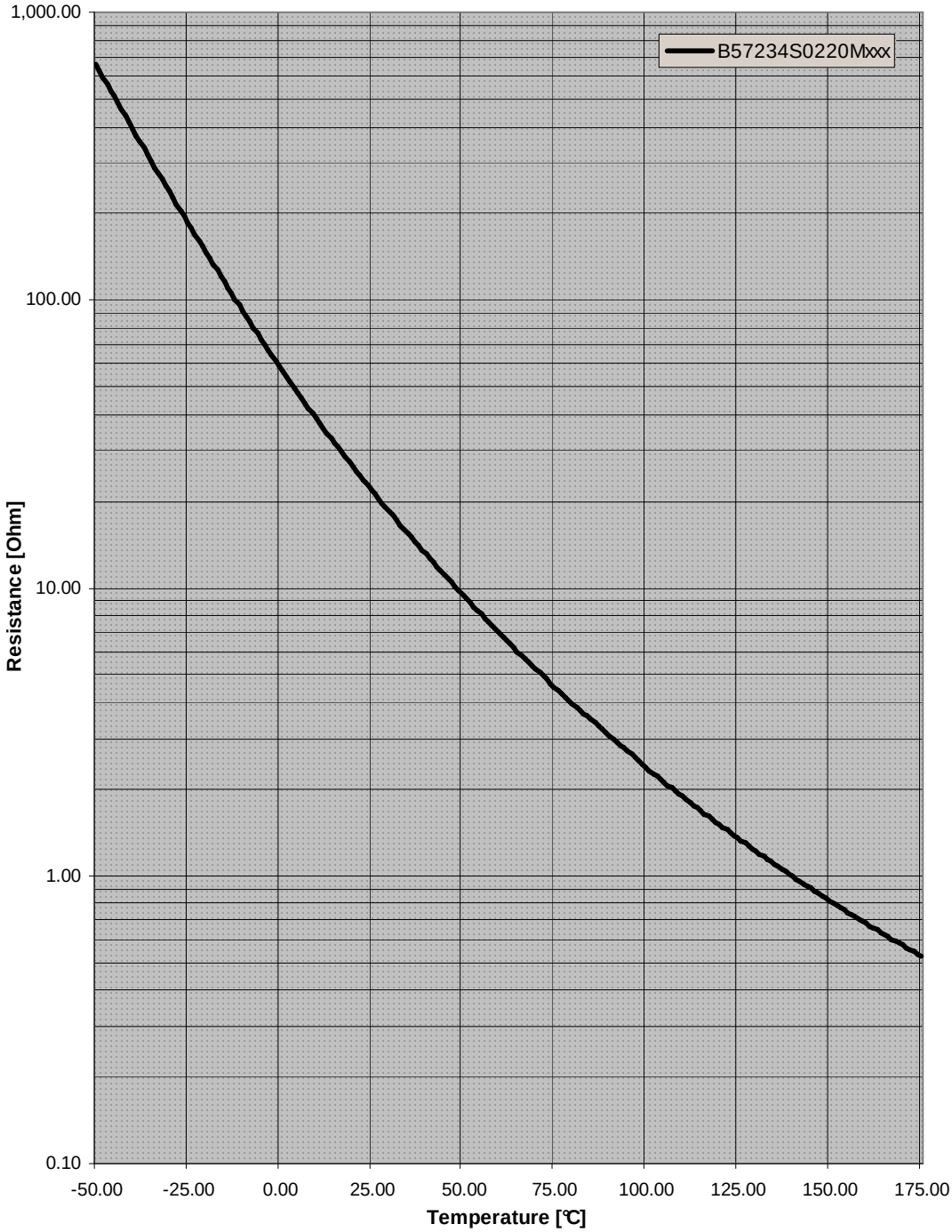
Resistance - Temperature Curve



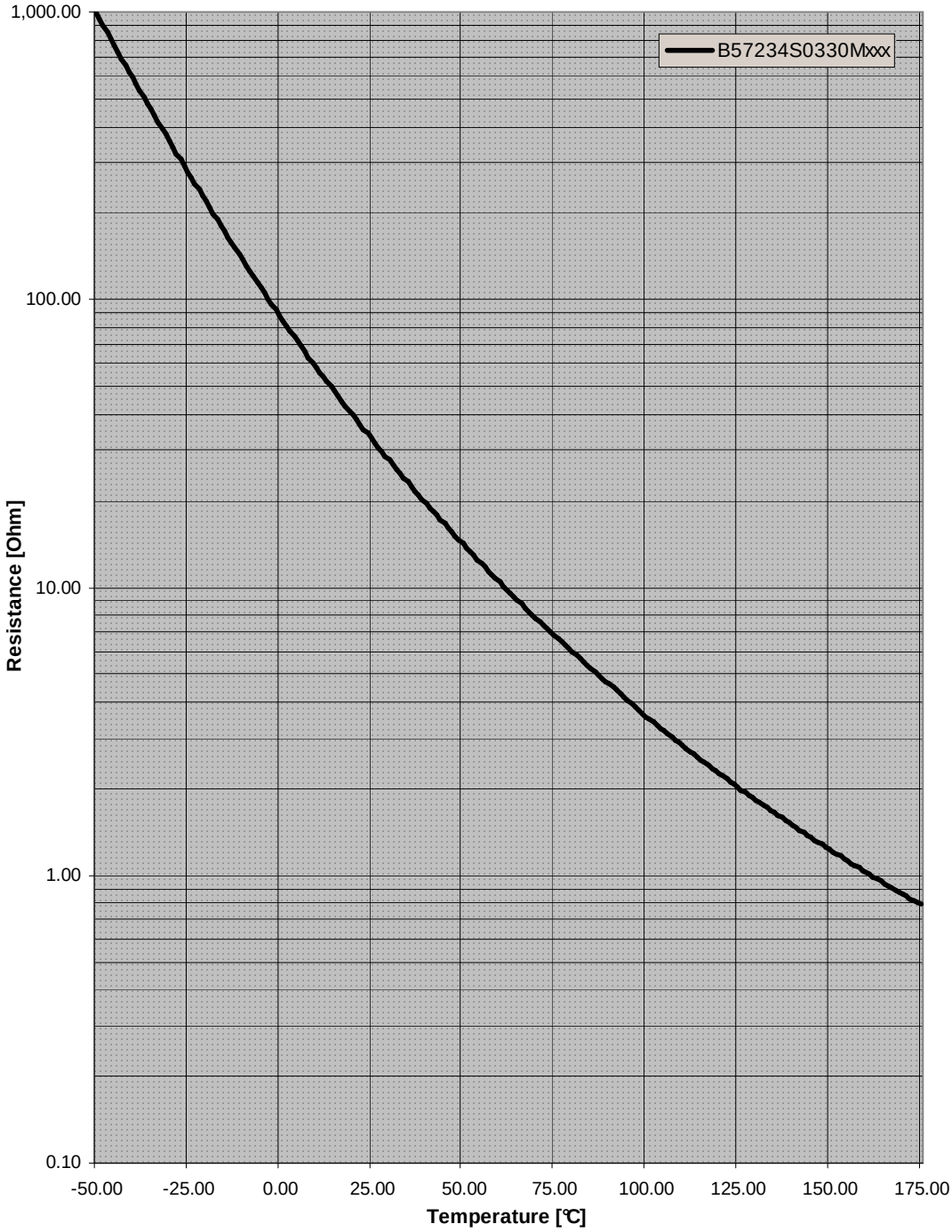
Resistance - Temperature Curve



Resistance - Temperature Curve



Resistance - Temperature Curve



ROBUSTNESS OF TERMINATIONS :

The leads meet the requirements of IEC 60068-2-21.

Test	Test conditions	Remarks
Tensile strength	Test Ua1: Fasten body with a force applied to each lead 10 [N] for 10 [s]	No visible damage
Bending strength	Test Ub: Fasten body with two 90°-bends in opposite direction at a force of 10 [N]	No visible damage (Peel off of coating along the lead accepted)

RELIABILITY REQUIREMENTS :

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: 170°C t: 1 000 h	< 10 %	No visible damage
Storage in damp heat, steady state	IEC 60068-2-3	Temperature of air: 40°C Relative humidity of air: 93 % Duration: 21 days	< 5 %	No visible damage
Rapid change of temperature	IEC 60068-2-14	Lower test temperature: -55°C (time: 15 min) Upper test temperature: 170°C (time: 15 min) Time to change from lower to upper temperature : < 30 sec Number of cycles: 10	< 10 %	No visible damage
Endurance (storage at max. current)		$I = I_{max}$ t = 1000 h T = 25°C	< 10 %	No visible damage
Electrical cycling test	*	$I = I_{max}$ load on: 1 min load off: 6 min Number of cycles: 1000	< 10 %	No visible damage
Maximum switchable capacity test	**	Capacity = C_T Number of cycles: 1000	< 5 %	No visible damage

Soldering of Components

Process	Conditions	Remarks
Soldering	**Dip soldering** : 260℃ max, 4 sec max, 6mm min from thermistor body **Iron soldering** : 360℃ max, 2 sec max, 6 mm min from thermistor body	Low resistance drift

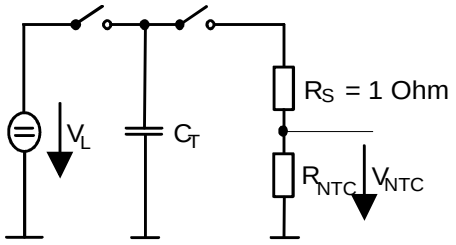
* Electrical cycling Test

Each cycle has to start with parts cooled down to room temperature. It has to cover the portion of the R/T curve between room temperature and the resistance of the components as stabilized at the maximum continous current I_{max} (that is the minimum operating resistance). One cycle lasts 7 minutes.

** Maximum switchable capacity test

The capacitor (C_T) is discharged across a series fixed resistor and the thermistor, shown in Figure 2. The charge voltage is chosen so that the voltage applied to the thermistor at the beginning of discharge is 170/345 [V], corresponding to (110/230V+ΔV)*1.41.

The capacitor is discharged across a series fixed resistor and the thermistor 1 000 times at ambient temperature of between 15℃ and 35℃. Each cycle ha s to start with thermistors cooled down to ambient temperature.



V_L ... Load voltage
C_T ... Test capacitance
R_S ... Fixed resistance
V_{NTC} ... Voltage drop across the NTC
V_{NTC} = 170/345 V
(corresponds (110/230 V + dV) x 1.41)

Fig. 2. - Maximum switchable capacity measuring circuit

TAPING AND PACKING :

Packing codes :

The last two digits of the complete ordering code state the packing mode :

Packing		Code	Number of Pieces
Bulk packing	Bulk	00	500
Reel packing	Tape	51	1000
AMMO packing	Tape	54	750

Example : B57234S0100M000 untaped
B57234S0100M051 taped reel packing

Table 1: Package dimensions and weights of unit packages

Packing	Pcs / unit	Approx. Weight (g)	Dimensions (mm)
Bulk	500	1100	x=65, y=230, z=125
Ammo	750	2100	x=56, y=355, z=355
Reel	1000	2500	d=500, f=23±1, n=approx. 59, w=72 max

Dimensions x, y, z acc. to fig. 1
Dimensions d, f, n, w acc. to fig. 2

Drawings

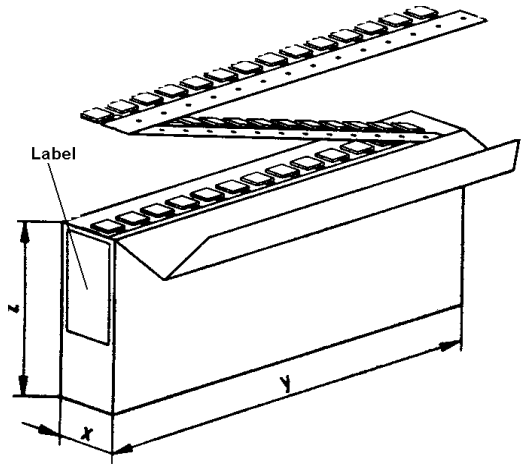


Fig. 1: AMMO packing

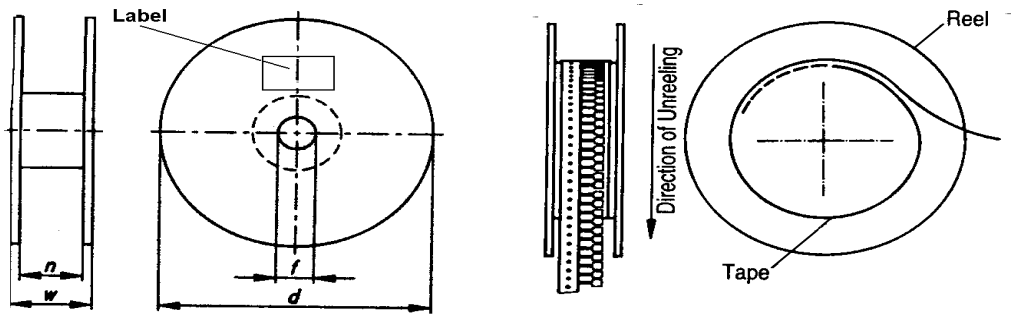


Fig. 2: Reel packing

Shipping package

Table 2: Dimensions and weights of shipping package.

BULK		
Dimensions L x W x H (mm)	Pcs/package -	Approx. Weight (kg)
330x230x100	1000	3.1
260x180x190	1500	4.3
360x360x130	4000	11.5
370x270x270	6000	16.8
354x354x274	7500	21.2

AMMO		
Dimensions L x W x H (mm)	Pcs/package -	Approx. Weight (kg)
354x354x58	750	2.6
354x354x112	1500	4.8
354x354x166	2250	7.0
354x354x220	3000	9.2
354x354x274	3750	11.4

REEL		
Dimensions L x W x H (mm)	Pcs/package -	Approx. Weight (kg)
505x505x74	1000	3.5
505x505x220	3000	9.8
505x505x360	5000	15.7

L x W x H acc. to fig. 3.

Drawing

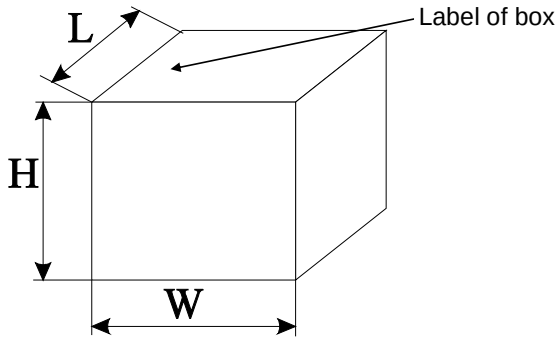
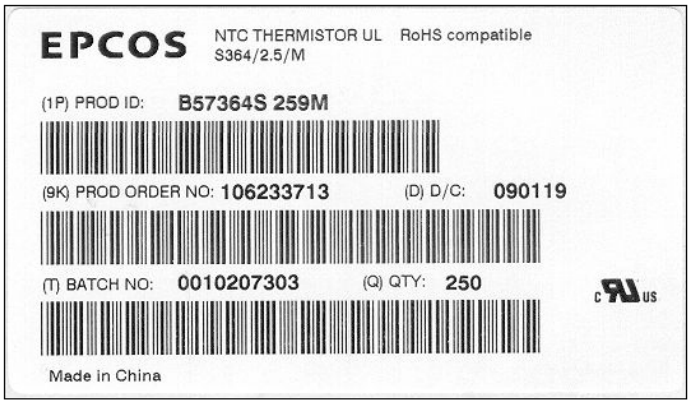


Fig. 3: Shipping Package

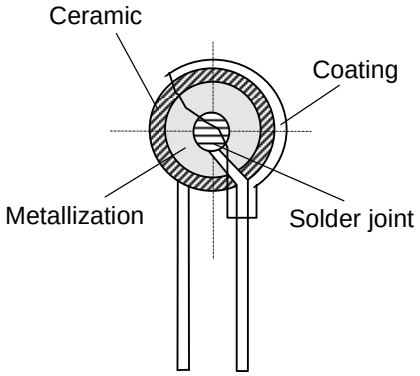
Packing material: Cardboard box

Label

The shown label is an example for bulk packing. Type code and ordering code do not refer to the actual type.



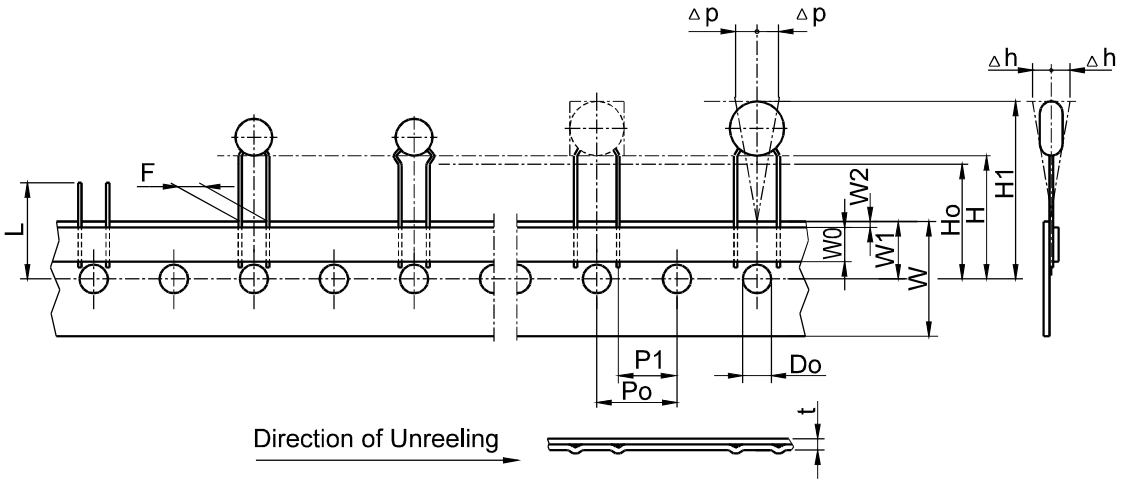
Internal Construction



The above picture shows the internal construction of EPCOS ICL's.

Note: Coating may have cracks or chips due to acting mechanical force on the wire, but this does not affect the performance of the component

Taping specification :



Dimensions and tolerances (taping in accordance with IEC 60286-2) :

Designation	Symbol	Nominal size [mm]	Tolerance [mm]	Remarks
Lead Spacing	F	7.5	± 0.8	
Pitch of holes	P0	12.7	± 0.3	± 1 mm/20 sprocket holes
Spacing hole center	P1	8.95	± 0.8	
Slope of component	Δ h	0	± 2.0	measured at top of component body
Slope of component	Δ p	0	± 2.0	
Spacing hole center / bottom edge of component	H	18.0	+2.0/-0	
Spacing hole center / niveau NTC	H0	16.0	± 0.5	
Spacing hole center / upper edge of component	H1	45.0	max.	
carrier type width	W	18.0	± 0.5	
hot adhesive tape width	W0	5.5	min.	peel-off force ≥ 5 N
position of holes	W1	9.0	+0.75/-0.5	
position of adhesive tape	W2	3.0	max.	
hole diameter	D0	4.0	± 0.2	
tape thickness	t	0.9	max.	without wires
length of remaining wire after removal of component	L	11.0	max.	

Cautions and warnings

See “Important notes” of this data sheet

Storage

- Store thermistors only in original packaging. Do not open the package before storage.
- Storage conditions in original packaging: storage temperature -25℃ …+45℃, relative humidity ≤ 75% annual mean, maximum 95%, dew precipitation is inadmissible.
- Do not store SMDs where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed or SMDs may stick together, causing problems during mounting.
- Avoid contamination of thermistors surface during storage, handling and processing.
- Avoid storage of thermistor in harmful environments like corrosive gases (Sox, Cl etc.)
- After opening the factory seals, such as polyvinyl-sealed packages, use the SMDs as soon as possible.
- Solder thermistors after shipment from EPCOS within the time specified:
  SMDs: 12 months
  Leaded components: 24 months

Handling

- NTC thermistors must not be dropped. Chip-offs must not be caused during handling of NTCs.
- Components must not be touched with bare hands.
  Gloves are recommended.
- Avoid contamination of thermistor surface during handling.

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.

Mounting

- When NTC thermistors are encapsulated with sealing material or overmolded with plastic material, the precautions given in chapter “Mounting instructions”, “Sealing, potting and overmolding” must be observed.
- Electrode must not be scratched before/during/after the mounting process.
- Contacts and housing used for assembly with thermistor have to be clean before mounting.
- During operation, the thermistor´s surface temperature can be very high (ICL). Ensure that adjacent components are placed at a sufficient distance from the thermistor to allow for proper cooling of the thermistors.
- 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.
- Make sure that thermistors (ICLs) are adequately ventilated to avoid overheating.
- Avoid contamination of thermistor surface during processing.

Operation

- Use thermistors only within the specified operating temperature range.
- Use thermistors only within the specified voltage and current ranges (ICLs).
- Environmental conditions must not harm the thermistors. Use thermistors only in normal atmospheric conditions.
- Contact of NTC thermistors with any liquids and solvents should 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.
- Be sure to provide an appropriate fail-safe function to prevent secondary product damage caused by malfunction (e.g. use VDR for limitation of overvoltage condition).

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

   We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
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