Aluminum electrolytic capacitors

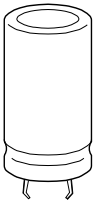
Snap-in capacitors

Series/Type: **B43540**

Date: December 2006

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Long-life grade capacitors



Applications

- Frequency converters
- Professional power supplies in industrial electronics and in data processing equipment
- Switch-mode power supplies in entertainment electronics

Features

- Long useful life
- High reliability
- Outstanding ripple current capability
- Extremely improved performance at high frequencies
- Outstanding low ESR at operating conditions above 50 °C
- High CV product, compact
- Optimized internal thermal resistance
- Different case sizes available for each capacitance value
- Voltage derating ($0.93 \cdot V_R$) enables 105 °C operation, more details available upon request

Construction

- Charge/discharge-proof, polar
- Aluminum case, fully insulated
- Snap-in solder pins to hold component in place on PC-board
- Minus pole marking on case surface
- Minus pole not insulated from case
- Overload protection by safety vent on the case wall

Terminals

- Standard version with 2 terminals, 2 lengths available: 6.3 and 4.5 mm
- 3 terminals to ensure correct insertion: length 4.5 mm



Specifications and characteristics in brief

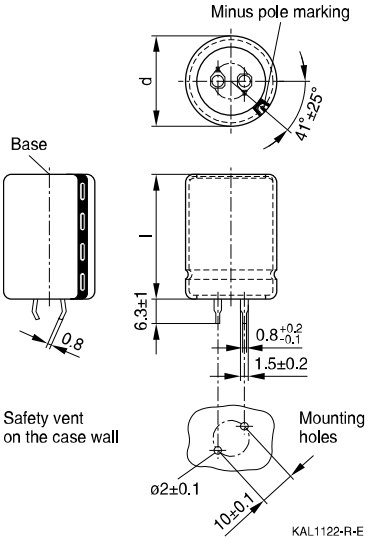
Rated voltage V_R Surge voltage V_S	200 ... 450 V DC 1.15 · V_R (for $V_R \leq$ 250 V DC) 1.10 · V_R (for $V_R \geq$ 400 V DC)	
Rated capacitance C_R Capacitance tolerance	68 ... 2200 µF ±20% ≙ M	
Leakage current I_{leak} (5 min, 20 °C)	$I_{leak} \leq 0.3\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)^{0.7} + 4\ \mu A$	
Self-inductance ESL	Approx. 20 nH	
Useful life 85 °C, V_R, $I_{AC,R}$ 40 °C, V_R, 1.15 · $I_{AC,R}$	 > 10000 h > 250000 h	Requirements: ΔC/C ≤ ±30% of initial value ESR ≤ 3 times initial specified limit I_{leak} ≤ initial specified limit
Voltage endurance test 85 °C, V_R	 5000 h	Post test requirements: ΔC/C ≤ ±10% of initial value ESR ≤ 1.3 times initial specified limit I_{leak} ≤ initial specified limit
Vibration resistance test	To IEC 60068-2-6, test Fc: Displacement amplitude 0.35 mm, frequency range 10 Hz ... 55 Hz, acceleration max. 5 *g*, duration 3 × 2 h. Capacitor mounted by its body which is rigidly clamped to the work surface.	
IEC climatic category	To IEC 60068-1: $V_R \leq$ 400 V DC: 40/085/56 (−40 °C/+85 °C/56 days damp heat test) V_R = 450 V DC: 25/085/56 (−25 °C/+85 °C/56 days damp heat test)	
Detail specification Sectional specification	Similar to CECC 30301-811 IEC 60384-4	



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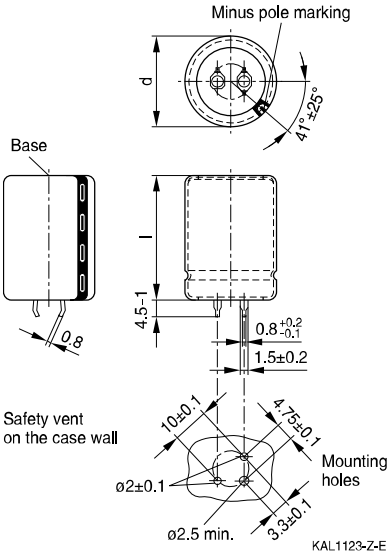
Outstanding ripple current – 85 °C

Dimensional drawings



Snap-in terminals, length 6.3 ±1 mm.
Also available in a shorter version with a length of 4.5 −1 mm. For packing mode and ordering example see next page.

Dimensions (mm)		Approx	Packing
d +1	l ±2	weight(g)	units (pcs.)
25	25	13	130
25	30	17	130
25	35	19	130
25	40	22	130
25	45	25	130
25	50	29	130
25	55	32	130



Snap-in capacitors are also available with 3 terminals (length 4.5 −1 mm).
For packing mode and ordering example see next page.

Dimensions (mm)		Approx	Packing
d +1	l ±2	weight(g)	units (pcs.)
30	25	17	80
30	30	23	80
30	35	29	80
30	40	36	80
30	45	41	80
30	50	46	80
30	55	53	80
35	25	22	60
35	30	29	60
35	35	36	60
35	40	41	60
35	45	56	60
35	50	70	60
35	55	81	60



Packing of snap-in capacitors



For ecological reasons the packing is pure cardboard. Components can be withdrawn (in full or in part) in the correct position for insertion.

Ordering codes for terminal styles

Snap-in capacitors Terminal versions	Identification in 3rd block of ordering code
Standard terminals (6.3 ±1) mm	M000
Short terminals (4.5 −1) mm	M007
3 terminals (4.5 −1) mm	M002

Ordering examples:

B43540A5107M007 } snap-in capacitor with short terminals
B43540A5107M002 } snap-in capacitor with 3 terminals



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Outstanding ripple current – 85 °C

Overview of available types

V_R (V DC)	200	250	400	450
	Case dimensions d × l (mm)			
C_R (µF)				
68				25 × 25
82				25 × 30
100			25 × 25	25 × 30 30 × 25
120			25 × 30	25 × 35 30 × 30
150			25 × 35 30 × 25	25 × 35 30 × 30 35 × 25
180			25 × 40 30 × 30 35 × 25	25 × 45 30 × 35 35 × 30
220			25 × 40 30 × 30 35 × 30	25 × 50 30 × 40 35 × 30
270		25 × 25	25 × 45 30 × 35 35 × 30	25 × 55 30 × 40 35 × 35
330	25 × 25	25 × 30	25 × 55 30 × 45 35 × 35	30 × 50 35 × 40
390	25 × 30 30 × 25	25 × 35 30 × 25	30 × 45 35 × 35	30 × 55 35 × 45
470	25 × 30 30 × 25	25 × 35 30 × 30	30 × 50 35 × 45	35 × 50
560	25 × 35 30 × 30	25 × 40 30 × 30 35 × 25	35 × 50	35 × 55
680	25 × 40 30 × 30 35 × 25	25 × 45 30 × 35 35 × 30	35 × 55	
820	25 × 45 30 × 35 35 × 30	25 × 55 30 × 40 35 × 35		



V_R (V DC)	200	250	400	450
	Case dimensions d × l (mm)			
C_R (µF)				
1000	25 × 50 30 × 40 35 × 35	30 × 45 35 × 35		
1200	30 × 45 35 × 35	30 × 55 35 × 40		
1500	30 × 50 35 × 40	35 × 50		
1800	35 × 45	35 × 55		
2200	35 × 55			

The capacitance and voltage ratings listed above are available in different cases upon request. Other voltage and capacitance ratings are also available upon request.



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Outstanding ripple current – 85 °C

Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{max} 100 Hz 20 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,R}$ [1] 100 Hz 85 °C A	Ordering code (composition see below)
V_R = 200 V DC							
330	25 × 25	250	450	340	3.11	1.59	B43540A2337M00*
390	25 × 30	210	380	290	3.55	1.81	B43540A2397M00*
390	30 × 25	210	380	290	3.69	1.88	B43540B2397M00*
470	25 × 30	180	310	240	3.90	1.99	B43540A2477M00*
470	30 × 25	180	310	240	4.05	2.06	B43540B2477M00*
560	25 × 35	150	260	200	4.43	2.26	B43540A2567M00*
560	30 × 30	150	260	200	4.62	2.36	B43540B2567M00*
680	25 × 40	120	220	170	5.06	2.58	B43540A2687M00*
680	30 × 30	120	220	170	5.10	2.60	B43540B2687M00*
680	35 × 25	120	220	170	5.07	2.58	B43540C2687M00*
820	25 × 45	100	180	140	5.73	2.92	B43540A2827M00*
820	30 × 35	100	180	140	5.82	2.97	B43540B2827M00*
820	35 × 30	100	180	140	6.32	3.22	B43540C2827M00*
1000	25 × 50	85	150	120	6.51	3.32	B43540A2108M00*
1000	30 × 40	85	150	120	7.24	3.69	B43540B2108M00*
1000	35 × 35	85	150	120	7.26	3.70	B43540C2108M00*
1200	30 × 45	70	130	100	8.18	4.17	B43540A2128M00*
1200	35 × 35	70	130	100	7.95	4.05	B43540B2128M00*
1500	30 × 50	55	100	75	9.41	4.80	B43540A2158M00*
1500	35 × 40	55	100	75	9.20	4.69	B43540B2158M00*
1800	35 × 45	45	85	65	10.3	5.30	B43540A2188M00*
2200	35 × 55	40	70	55	12.1	6.17	B43540A2228M00*
V_R = 250 V DC							
270	25 × 25	310	540	420	2.99	1.52	B43540E2277M00*
330	25 × 30	250	450	340	3.46	1.76	B43540E2337M00*
390	25 × 35	210	380	290	3.92	2.00	B43540E2397M00*
390	30 × 25	210	380	290	3.91	1.99	B43540F2397M00*
470	25 × 35	180	310	240	4.30	2.19	B43540E2477M00*
470	30 × 30	180	310	240	4.49	2.29	B43540F2477M00*
560	25 × 40	150	260	200	4.87	2.48	B43540E2567M00*
560	30 × 30	150	260	200	4.90	2.50	B43540F2567M00*
560	35 × 25	150	260	200	4.95	2.52	B43540G2567M00*

Composition of ordering code

* = Terminal style

0 = snap-in standard terminals (6.3 ±1) mm

2 = snap-in 3 terminals (4.5 −1) mm

7 = snap-in short terminals (4.5 −1) mm

1) 120-Hz conversion factor of ripple current: I_{AC} (120 Hz) = 1.03 · I_{AC} (100 Hz)



Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{max} 100 Hz 20 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,R}$ [2] 100 Hz 85 °C A	Ordering code (composition see below)
V_R = 250 V DC							
680	25 × 45	120	220	170	5.54	2.82	B43540E2687M00*
680	30 × 35	120	220	170	5.62	2.87	B43540F2687M00*
680	35 × 30	120	220	170	6.08	3.10	B43540G2687M00*
820	25 × 55	100	180	140	6.42	3.27	B43540E2827M00*
820	30 × 40	100	180	140	6.81	3.47	B43540F2827M00*
820	35 × 35	100	180	140	6.93	3.54	B43540G2827M00*
1000	30 × 45	85	150	120	7.76	3.96	B43540E2108M00*
1000	35 × 35	85	150	120	7.66	3.90	B43540F2108M00*
1200	30 × 55	70	130	100	8.97	4.58	B43540E2128M00*
1200	35 × 40	70	130	100	8.68	4.43	B43540F2128M00*
1500	35 × 50	55	100	75	10.2	5.25	B43540E2158M00*
1800	35 × 55	45	85	65	11.5	5.89	B43540E2188M00*
V_R = 400 V DC							
100	25 × 25	730	1280	980	2.04	1.04	B43540A9107M00*
120	25 × 30	530	930	720	2.34	1.19	B43540A9127M00*
150	25 × 35	420	740	570	2.73	1.39	B43540A9157M00*
150	30 × 25	490	850	660	2.72	1.39	B43540B9157M00*
180	25 × 40	350	620	480	3.10	1.58	B43540A9187M00*
180	30 × 30	350	620	480	3.12	1.59	B43540B9187M00*
180	35 × 25	350	620	480	3.14	1.60	B43540C9187M00*
220	25 × 40	330	580	450	3.43	1.75	B43540A9227M00*
220	30 × 30	330	580	450	3.45	1.76	B43540B9227M00*
220	35 × 30	290	510	390	3.86	1.97	B43540C9227M00*
270	25 × 45	270	480	370	3.92	2.00	B43540A9277M00*
270	30 × 35	270	480	370	3.98	2.03	B43540B9277M00*
270	35 × 30	230	420	320	4.28	2.18	B43540C9277M00*
330	25 × 55	220	390	300	4.58	2.33	B43540C9337M00*
330	30 × 45	190	340	260	5.01	2.55	B43540A9337M00*
330	35 × 35	190	340	260	4.92	2.51	B43540B9337M00*
390	30 × 45	190	330	260	5.45	2.78	B43540A9397M00*

Composition of ordering code

* = Terminal style

0 = snap-in standard terminals (6.3 ±1) mm
2 = snap-in 3 terminals (4.5 −1) mm
7 = snap-in short terminals (4.5 −1) mm

2) 120-Hz conversion factor of ripple current: I_{AC} (120 Hz) = 1.03 · I_{AC} (100 Hz)



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Outstanding ripple current – 85 °C

Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{max} 100 Hz 20 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 60 °C A	$I_{AC,R}$ [3] 100 Hz 85 °C A	Ordering code (composition see below)
V_R = 400 V DC							
390	35 × 35	190	330	260	5.35	2.72	B43540B9397M00*
470	30 × 50	150	280	210	6.15	3.14	B43540A9477M00*
470	35 × 45	130	240	190	6.26	3.19	B43540B9477M00*
560	35 × 50	110	200	160	7.03	3.58	B43540A9567M00*
680	35 × 55	95	170	130	7.94	4.05	B43540A9687M00*
V_R = 450 V DC							
68	25 × 25	1600	2800	2240	1.56	0.80	B43540A5686M00*
82	25 × 30	1320	2320	1860	1.80	0.92	B43540A5826M00*
100	25 × 30	1090	1900	1520	1.99	1.01	B43540A5107M00*
100	30 × 25	1090	1900	1520	2.07	1.05	B43540B5107M00*
120	25 × 35	900	1590	1270	2.27	1.16	B43540A5127M00*
120	30 × 30	900	1590	1270	2.37	1.21	B43540B5127M00*
150	25 × 35	830	1460	1170	2.54	1.29	B43540A5157M00*
150	30 × 30	720	1270	1020	2.65	1.35	B43540B5157M00*
150	35 × 25	720	1270	1020	2.67	1.36	B43540C5157M00*
180	25 × 45	600	1060	850	2.97	1.51	B43540A5187M00*
180	30 × 35	600	1060	850	3.02	1.54	B43540B5187M00*
180	35 × 30	600	1060	850	3.32	1.69	B43540C5187M00*
220	25 × 50	490	870	700	3.38	1.72	B43540A5227M00*
220	30 × 40	490	870	700	3.76	1.92	B43540B5227M00*
220	35 × 30	490	870	700	3.68	1.87	B43540C5227M00*
270	25 × 55	460	810	650	3.85	1.96	B43540C5277M00*
270	30 × 40	460	810	650	4.17	2.12	B43540A5277M00*
270	35 × 35	400	710	570	4.23	2.16	B43540B5277M00*
330	30 × 50	330	580	470	4.89	2.49	B43540A5337M00*
330	35 × 40	330	580	470	4.84	2.47	B43540B5337M00*
390	30 × 55	320	560	450	5.45	2.78	B43540B5397M00*
390	35 × 45	280	490	390	5.43	2.77	B43540A5397M00*
470	35 × 50	230	410	330	6.17	3.15	B43540A5477M00*
560	35 × 55	220	390	320	6.86	3.50	B43540A5567M00*

Composition of ordering code

* = Terminal style

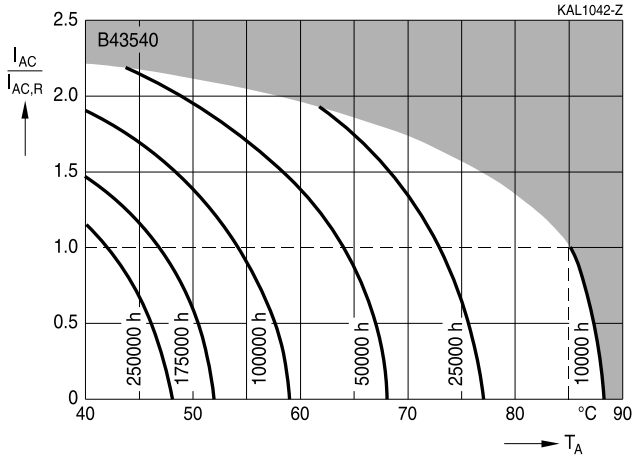
0 = snap-in standard terminals (6.3 ±1) mm
2 = snap-in 3 terminals (4.5 −1) mm
7 = snap-in short terminals (4.5 −1) mm

3) 120-Hz conversion factor of ripple current: I_{AC} (120 Hz) = 1.03 · I_{AC} (100 Hz)

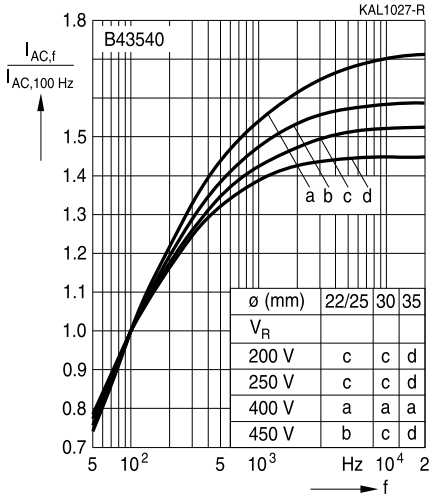


Useful life

depending on ambient temperature T_A under ripple current operating conditions[1)]

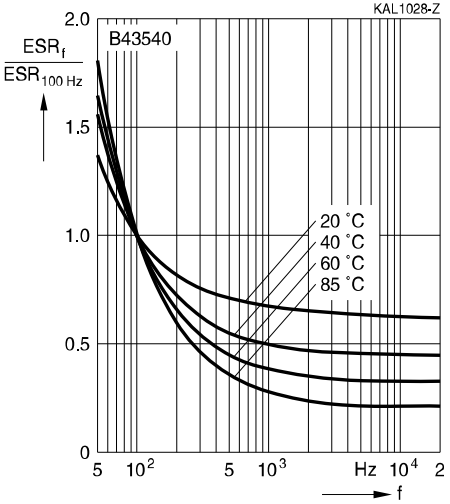


Frequency factor of permissible ripple current I_{AC} versus frequency f



Frequency characteristics of ESR

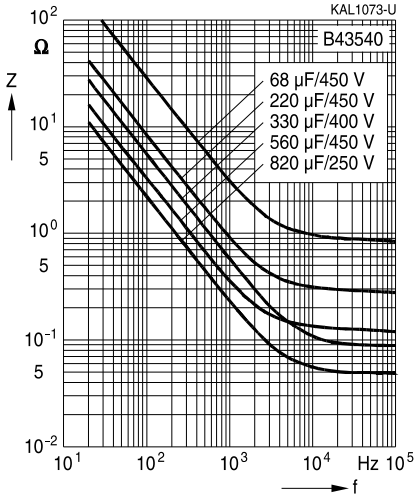
Typical behavior



1) Refer to chapter "General technical information, 5.3 Calculation of useful life" for an explanation on how to interpret the useful life graphs.

Impedance Z versus frequency f

Typical behavior at 20 °C





Cautions and warnings

Personal safety

The electrolytes used by EPCOS have not only been optimized with a view to the intended application, but also with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC).

Furthermore, part of the high-voltage electrolytes used by EPCOS are self-extinguishing. They contain flame-retarding substances which will quickly extinguish any flame that may have been ignited.

As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no safe substitute materials are currently known. However, the amount of dangerous materials used in our products has been limited to an absolute minimum. Nevertheless, the following rules should be observed when handling Al electrolytic capacitors:

- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment.
- Avoid breathing in electrolyte vapor or mists. Workplaces and other affected areas should be well ventilated. Clothing that has been contaminated by electrolyte must be changed and rinsed in water.



Product safety

The table below summarize the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

Topic	Safety information	Reference Chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages polarity classes should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Upper category temperature	Do not exceed the upper category temperatur.	7.2 "Maximum permissible operating temperature"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors. Do not apply any mechanical stress to the capacitor terminals.	10 "Maintenance"
Mounting position of screw terminal capacitors	Do not mount the capacitor with the terminals (safety vent) upside down.	11.1. "Mounting positions of capacitors with screw terminals"
Mounting of single-ended capacitors	The internal structure of single-ended capacitors might be damaged if excessive force is applied to the lead wires. Avoid any compressive, tensile or flexural stress. Do not move the capacitor after soldering to PC board. Do not pick up the PC board by the soldered capacitor. Do not insert the capacitor on the PC board with a hole space different to the lead space specified.	11.4 "Mounting considerations for single-ended capacitors"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2 Nm M6: 2.5 Nm	11.3 "Mounting torques"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"



Topic	Safety information	Reference Chapter "General technical information"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Passive flammability	Avoid external energy, such as fire or electricity.	8.1 "Passive flammability"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
		Reference Chapter "Capacitors with screw terminals"
Breakdown strength of insulating sleeves	Do not damage the insulating sleeve, especially when ring clips are used for mounting.	"Screw terminals - accessories"

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 passive 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 a passive 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 a passive 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.
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