Film capacitors

MKP Snubbers – box strapped type

Series/Type: **B32656Y**
Ordering code:

Date: Mar. 2009
Version: 1

Typical applications

- IGBT
- Snubbering

Climatic

- Maximum operating temperature: 100℃
- Climatic category (IEC 60068-1): 55/100/56

Construction

- Dielectric: Polypropylene (PP)
- Wound capacitor technology with internal series connection
- Plastic case (UL 94 V-0)
- Epoxy resin sealing (UL 94 V-0)

Features

- High pulse strength and high contact reliability
- Very low inductance

Terminals

- Strap terminals, tinned copper

Marking

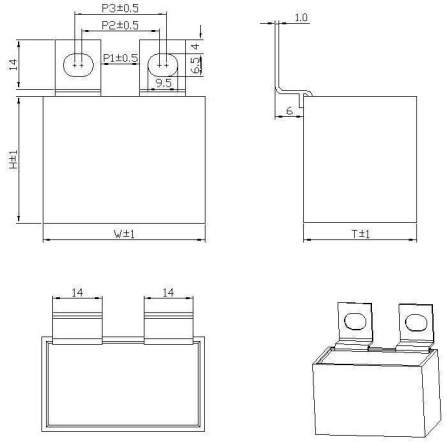
- Manufacturer's logo and lot number, ordering code, style (MKP) rated capacitance (coded), cap. tolerance (code letter), rated DC voltage, date of manufacture (coded)

Delivery mode

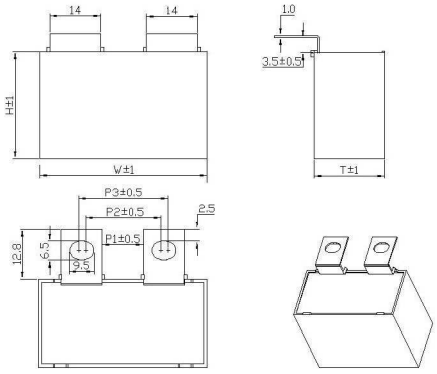
- Bulk

Dimensional drawings

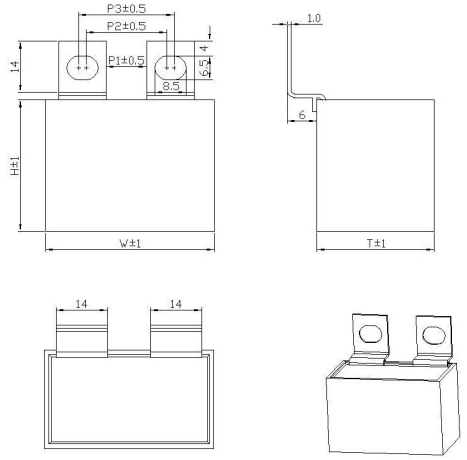
T1 (code no. 200)



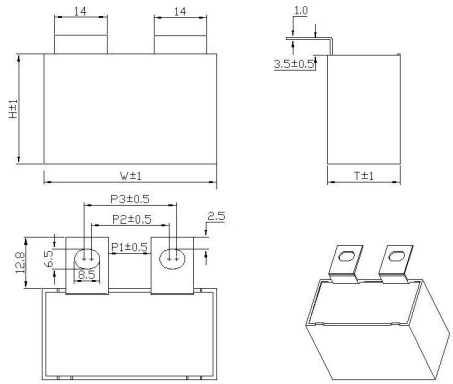
T2 (code no. 201)



T3 (code no. 500)



T4 (code no. 501)



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CHARACTERISTICS AND ORDERING CODES

C_R µF	Max. dimensions W × H × T mm	Ordering code	dv/dt V/us	ESR m Ω	ESL nH	Ipk A	Irms 100 KHz Arms	P1 (±0.5) mm	P2-P3 (±0.5) mm	Terminal
V_R = 1000 VDC / V_{rms} = 525 VAC										
0.47	42.5 x 27.5 x 24.5	B32656Y0474+200	1000	11	21	470	8.4	11	22-28	T1
	42.5 x 27.5 x 24.5	B32656Y0474+201	1000	11	21	470	8.4	11	22-28	T2
	42.5 x 27.5 x 24.5	B32656Y0474+500	1000	11	21	470	8.4	12	24-28	T3
	42.5 x 27.5 x 24.5	B32656Y0474+501	1000	11	21	470	8.4	12	24-28	T4
0.68	42.5 x 27.5 x 24.5	B32656Y0684+200	1000	8	23	680	9.5	11	22-28	T1
	42.5 x 27.5 x 24.5	B32656Y0684+201	1000	8	23	680	9.5	11	22-28	T2
	42.5 x 27.5 x 24.5	B32656Y0684+500	1000	8	23	680	9.5	12	24-28	T3
	42.5 x 27.5 x 24.5	B32656Y0684+501	1000	8	23	680	9.5	12	24-28	T4
1.0	42.5 x 35.5 x 33.5	B32656Y0105+200	900	6	20	900	12.4	11	22-28	T1
	42.5 x 35.5 x 33.5	B32656Y0105+201	900	6	20	900	12.4	11	22-28	T2
	42.5 x 35.5 x 33.5	B32656Y0105+500	900	6	20	900	12.4	12	24-28	T3
	42.5 x 35.5 x 33.5	B32656Y0105+501	900	6	20	900	12.4	12	24-28	T4
1.5	42.5 x 45 x 33	B32656Y0155+200	900	6	19	1350	13.6	11	22-28	T1
	42.5 x 45 x 33	B32656Y0155+201	900	6	19	1350	13.6	11	22-28	T2
	42.5 x 45 x 33	B32656Y0155+500	900	6	19	1350	13.6	12	24-28	T3
	42.5 x 45 x 33	B32656Y0155+501	900	6	19	1350	13.6	12	24-28	T4
2.0	42.5 x 45 x 33	B32656Y0205+200	800	5	16	1600	15.5	11	22-28	T1
	42.5 x 45 x 33	B32656Y0205+201	800	5	16	1600	15.5	11	22-28	T2
	42.5 x 45 x 33	B32656Y0205+500	800	5	16	1600	15.5	12	24-28	T3
	42.5 x 45 x 33	B32656Y0205+501	800	5	16	1600	15.5	12	24-28	T4
2.5	57.5 x 45 x 30	B32656Y0255+200	800	5	16	2000	18.4	11	22-28	T1
	57.5 x 45 x 30	B32656Y0255+201	800	5	16	2000	18.4	11	22-28	T2
	57.5 x 45 x 30	B32656Y0255+500	800	5	16	2000	18.4	12	24-28	T3
	57.5 x 45 x 30	B32656Y0255+501	800	5	16	2000	18.4	12	24-28	T4
VR = 1200 VDC / Vrms = 550 VAC										
0.22	41.0 x 28.5 x 16.0	B32656Y7224+200	1200	12	21	264	6.0	11	22-28	T1
	41.0 x 28.5 x 16.0	B32656Y7224+201	1200	12	21	264	6.0	11	22-28	T2
	41.0 x 28.5 x 16.0	B32656Y7224+500	1200	12	21	264	6.0	11	23-27	T3
	41.0 x 28.5 x 16.0	B32656Y7224+501	1200	12	21	264	6.0	11	23-27	T4
0.47	42.5 x 27.5 x 24.5	B32656Y7474+200	1200	11	21	564	8.8	11	22-28	T1
	42.5 x 27.5 x 24.5	B32656Y7474+201	1200	11	21	564	8.8	11	22-28	T2
	42.5 x 27.5 x 24.5	B32656Y7474+500	1200	11	21	564	8.8	12	24-28	T3
	42.5 x 27.5 x 24.5	B32656Y7474+501	1200	11	21	564	8.8	12	24-28	T4
0.68	42.5 x 35.5 x 33.5	B32656Y7684+200	1200	7	23	816	11.4	11	22-28	T1
	42.5 x 35.5 x 33.5	B32656Y7684+201	1200	7	23	816	11.4	11	22-28	T2
	42.5 x 35.5 x 33.5	B32656Y7684+500	1200	7	23	816	11.4	12	24-28	T3
	42.5 x 35.5 x 33.5	B32656Y7684+501	1200	7	23	816	11.4	12	24-28	T4
1.0	42.5 x 35.5 x 33.5	B32656Y7105+200	1100	6	20	1100	13.6	11	22-28	T1
	42.5 x 35.5 x 33.5	B32656Y7105+201	1100	6	20	1100	13.6	11	22-28	T2
	42.5 x 35.5 x 33.5	B32656Y7105+500	1100	6	20	1100	13.6	12	24-28	T3
	42.5 x 35.5 x 33.5	B32656Y7105+501	1100	6	20	1100	13.6	12	24-28	T4

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C_R	Max. dimensions W × H × T	Ordering code	dv/dt	ESR	ESL	Ipk	Irms 100 KHz	P1 (±0.5)	P2-P3 (±0.5)	Terminal
µF	mm		V/us	m Ω	nH	A	Arms	mm	mm	
1.5	42.5 x 45 x 33	B32656Y7155+200	1100	4	19	1650	17.6	11	22-28	T1
	42.5 x 45 x 33	B32656Y7155+201	1100	4	19	1650	17.6	11	22-28	T2
	42.5 x 45 x 33	B32656Y7155+500	1100	4	19	1650	17.6	12	24-28	T3
	42.5 x 45 x 33	B32656Y7155+501	1100	4	19	1650	17.6	12	24-28	T4
2.0	57.5 x 45 x 30	B32656Y7205+200	1000	3.3	15	2000	17.6	11	22-28	T1
	57.5 x 45 x 30	B32656Y7205+201	1000	3.3	15	2000	17.6	11	22-28	T2
	57.5 x 45 x 30	B32656Y7205+500	1000	3.3	15	2000	17.6	12	24-28	T3
	57.5 x 45 x 30	B32656Y7205+501	1000	3.3	15	2000	17.6	12	24-28	T4
2.5	57.5 x 50 x 35	B32656Y7255+200	1000	3	16	2500	21.2	11	22-28	T1
	57.5 x 50 x 35	B32656Y7255+201	1000	3	16	2500	21.2	11	22-28	T2
	57.5 x 50 x 35	B32656Y7255+500	1000	3	16	2500	21.2	12	24-28	T3
	57.5 x 50 x 35	B32656Y7255+501	1000	3	16	2500	21.2	12	24-28	T4
V_R = 1700 VDC / V_{rms} = 600 VAC										
0.22	41.0 x 28.5 x 16.0	B32656Y1224+200	1300	11	21	286	6.5	11	22-28	T1
	41.0 x 28.5 x 16.0	B32656Y1224+201	1300	11	21	286	6.5	11	22-28	T2
	41.0 x 28.5 x 16.0	B32656Y1224+500	1300	11	21	286	6.5	11	23-27	T3
	41.0 x 28.5 x 16.0	B32656Y1224+501	1300	11	21	286	6.5	11	23-27	T4
0.47	42.5 x 27.5 x 24.5	B32656Y1474+200	1300	10	22	611	8.8	11	22-28	T1
	42.5 x 27.5 x 24.5	B32656Y1474+201	1300	10	22	611	8.8	11	22-28	T2
	42.5 x 27.5 x 24.5	B32656Y1474+500	1300	10	22	611	8.8	12	24-28	T3
	42.5 x 27.5 x 24.5	B32656Y1474+501	1300	10	22	611	8.8	12	24-28	T4
0.68	42.5 x 35.5 x 33.5	B32656Y1684+200	1300	7	21	884	11.4	11	22-28	T1
	42.5 x 35.5 x 33.5	B32656Y1684+201	1300	7	21	884	11.4	11	22-28	T2
	42.5 x 35.5 x 33.5	B32656Y1684+500	1300	7	21	884	11.4	12	24-28	T3
	42.5 x 35.5 x 33.5	B32656Y1684+501	1300	7	21	884	11.4	12	24-28	T4
1.0	425. x 45 x 26	B32656Y1105+200	1200	6	20	1200	14.3	11	22-28	T1
	425. x 45 x 26	B32656Y1105+201	1200	6	20	1200	14.3	11	22-28	T2
	425. x 45 x 26	B32656Y1105+500	1200	6	20	1200	14.3	12	24-28	T3
	425. x 45 x 26	B32656Y1105+501	1200	6	20	1200	14.3	12	24-28	T4
1.5	57.5 x 45 x 30	B32656Y1155+200	1200	4	19	1800	18	11	22-28	T1
	57.5 x 45 x 30	B32656Y1155+201	1200	4	19	1800	18	11	22-28	T2
	57.5 x 45 x 30	B32656Y1155+500	1200	4	19	1800	18	12	24-28	T3
	57.5 x 45 x 30	B32656Y1155+501	1200	4	19	1800	18	12	24-28	T4
2.0	57.5 x 50 x 35	B32656Y1205+200	1100	4	17	2200	18	11	22-28	T1
	57.5 x 50 x 35	B32656Y1205+201	1100	4	17	2200	18	11	22-28	T2
	57.5 x 50 x 35	B32656Y1205+500	1100	4	17	2200	18	12	24-28	T3
	57.5 x 50 x 35	B32656Y1205+501	1100	4	17	2200	18	12	24-28	T4
2.5	57.5 x 50 x 35	B32656Y1255+200	1100	4	17	2750	20	11	22-28	T1
	57.5 x 50 x 35	B32656Y1255+201	1100	4	17	2750	20	11	22-28	T2
	57.5 x 50 x 35	B32656Y1255+500	1100	4	17	2750	20	12	24-28	T3
	57.5 x 50 x 35	B32656Y1255+501	1100	4	17	2750	20	12	24-28	T4

MKP Snubbers – box strapped type B32656Y

C_R	Max. dimensions W × H × T	Ordering code	dv/dt	ESR	ESL	Ipk	Irms 100 KHz	P1 (±0.5)	P2-P3 (±0.5)	Terminal
µF	mm		V/us	m Ω	nH	A	Arms	mm	mm	
V_R = 2000 VDC / V_{rms} = 700 VAC										
0.22	42.5 x 27.5 x 24.5	B32656Y2224+200	1500	10	21	330	8	11	22-28	T1
	42.5 x 27.5 x 24.5	B32656Y2224+201	1500	10	21	330	8	11	22-28	T2
	42.5 x 27.5 x 24.5	B32656Y2224+500	1500	10	21	330	8	12	24-28	T3
	42.5 x 27.5 x 24.5	B32656Y2224+501	1500	10	21	330	8	12	24-28	T4
0.47	42.5 x 35.5 x 33.5	B32656Y2474+200	1500	10	21	705	9.6	11	22-28	T1
	42.5 x 35.5 x 33.5	B32656Y2474+201	1500	10	21	705	9.6	11	22-28	T2
	42.5 x 35.5 x 33.5	B32656Y2474+500	1500	10	21	705	9.6	12	24-28	T3
	42.5 x 35.5 x 33.5	B32656Y2474+501	1500	10	21	705	9.6	12	24-28	T4
0.68	42.5 x 35.5 x 33.5	B32656Y2684+200	1500	7	20	1020	12.4	11	22-28	T1
	42.5 x 35.5 x 33.5	B32656Y2684+201	1500	7	20	1020	12.4	11	22-28	T2
	42.5 x 35.5 x 33.5	B32656Y2684+500	1500	7	20	1020	12.4	12	24-28	T3
	42.5 x 35.5 x 33.5	B32656Y2684+501	1500	7	20	1020	12.4	12	24-28	T4
1.0	57.5 x 45 x 30	B32656Y2105+200	1400	5	17	1400	15	11	22-28	T1
	57.5 x 45 x 30	B32656Y2105+201	1400	5	17	1400	15	11	22-28	T2
	57.5 x 45 x 30	B32656Y2105+500	1400	5	17	1400	15	12	24-28	T3
	57.5 x 45 x 30	B32656Y2105+501	1400	5	17	1400	15	12	24-28	T4
1.5	57.5 x 50 x 35	B32656Y2155+200	1400	4	16	2100	18	11	22-28	T1
	57.5 x 50 x 35	B32656Y2155+201	1400	4	16	2100	18	11	22-28	T2
	57.5 x 50 x 35	B32656Y2155+500	1400	4	16	2100	18	12	24-28	T3
	57.5 x 50 x 35	B32656Y2155+501	1400	4	16	2100	18	12	24-28	T4
2.0	57.5 x 54 x 38	B32656Y2205+200	1300	4	16	2600	21	11	22-28	T1
	57.5 x 54 x 38	B32656Y2205+201	1300	4	16	2600	21	11	22-28	T2
	57.5 x 54 x 38	B32656Y2205+500	1300	4	16	2600	21	12	24-28	T3
	57.5 x 54 x 38	B32656Y2205+501	1300	4	16	2600	21	12	24-28	T4

Intermediate capacitance values are available on request.

Composition of ordering code

+ = Capacitance tolerance code
- M = ±20%
- K = ±10%
- J = ±5%

*** = Terminal configuration
- T1 = 200
- T2 = 201
- T3 = 500
- T4 = 501

TECHNICAL DATA

Operating temperature range	Max. operating temperature $T_{op,max}$ +100℃			
	Upper category temperature T_{max} +100℃			
	Lower category temperature T_{min} -40℃			
	Rated temperature T_R +85℃			
Dissipation factor tan δ (in 10^{-3}) at 20℃ (upper limit values)	at	$C_R \leq 0.1$ µF	0.1 µF $< C_R \leq 1$ µF	$C_R > 1$ µF
	1 KHz	-	0.5	0.5
	10 KHz	-	0.8	1.5
	100 KHz	5.0	-	-
Insulation Resistance R_{INS}, given as time constant $\tau = C_R \cdot R_{INS}$, rel. humidity ≤ 65% (minimum as-delivered values)	$C_R \leq 0.33$ µF		$C_R > 0.33$ µF	
	100 GΩ		30000 s	
DC test voltage	$1.5 \cdot V_R$, 2s			
Category voltage V_C (continuous operation with V_{DC} or V_{AC} at f ≤ 1 KHz)	T_A (ºC)	DC voltage derating	AC voltage derating	
	$T_A \leq 85$ $85 < T_A \leq 100$	$V_C = V_R$ $V_C = V_R \frac{165 - T_A}{80}$	$V_{C,rms} = V_{rms}$ $V_{C,rms} = V_{C,rms} \frac{165 - T_A}{80}$	
Operating voltage V_{op} for short operation periods (V_{DC} or V_{AC} at f ≤ 60 Hz)	T_A (ºC)	DC voltage (max. hours)	AC voltage (max. hours)	
	$T_A \leq 85$	$V_{op} = 1.25 \cdot V_C$ (2000 h)	$V_{op} = 1.0 \cdot V_{C,rms}$ (2000 h)	
	$85 < T_A \leq 100$	$V_{op} = 1.25 \cdot V_C$ (1000 h)	$V_{op} = 1.25 \cdot V_{C,rms}$ (1000 h)	
Damp heat test **Limit values after damp heat test**	56 days / 40ºC / 93% relative humidity Capacitance change $\lvert \Delta C/C \rvert$ ≤ 3% Dissipation factor change, Δtanδ ≤ $0.5 \cdot 10^{-3}$ (at 1KHz) ≤ $1.0 \cdot 10^{-3}$ (at 10 KHz) Insulation Resistance R_{ins} ≥ 50% of minimum or time constant $\tau = C_R \cdot R_{ins}$ as-delivered values			
Reliability: **Failure rate λ** **Service life t_{SL}**	1 fit (≤ 1•10-9) at 0.5•VR, 40ºC Up to 200.000 h @ VR and 40ºC For conversion to other operating conditions, refer to chapter “Quality assurance”, data book 2005 “Film capacitors”, page 390			
Failure criteria: **Total failure** **Failure due to variation of parameters**	Short circuit or open circuit Capacitance change $\lvert \Delta C/C \rvert$ ≥ 10% Dissipation factor tanδ ≥ 4 times upper limit value Insulation Resistance Rins ≥ 1500 MΩ (CR ≤ 0.33 µF) or time constant τ = CR · Rins < 500 s (CR > 0.33 µF)			

CAUTIONS AND WARNINGS

- Do not exceed the upper category temperature (UCT).
- Do not apply any mechanical stress to the capacitor terminals.
- Avoid any compressive, tensile or flexural stress.
- Do not move the capacitor after it has been soldered to the PC board.
- Do not pick up the PC board by the soldered capacitor.
- Do not place the capacitor on a PC board whose hole space differs from the specified lead space.
- Do not exceed the specified time or temperature limits during soldering.
- Avoid external energy inputs, such as fire or electricity.
- Avoid overload of the capacitors.

Resistance to soldering heat

Resistance to soldering heat is tested to IEC 60068-2-20, test Tb, method 1A. Conditions:

Series	Solder bath temp.	Soldering time
MKT boxed (except 2.5 x 6.5 x 7.2 mm); coated; MKP/MFP	260 ±5 °C	10 ±1 s
MKT boxed (case 2.5 x 6.5 x 7.2 mm)	260 ±5 °C	5 ±1 s

General notes on soldering

Permissible heat-exposure loads on film capacitors are primarily characterized by the upper category temperature T_{max}. Long exposure to temperatures above this type-related temperature limit can lead to changes in the plastic dielectric and thus irreversibly change a capacitor's electrical characteristics. For short exposure times (as in practical soldering processes), the heat load (and thus the possible effects on the capacitor) will also depend on other factors such as:

- The pre-heating temperature and time.
- The forced cooling immediately after soldering.
- The terminal characteristics: diameter, length, thermal resistance, special configurations (e.g. crimping).
- The height of the capacitor above the solder bath.
- Shadowing by neighboring components.
- Additional heating due to heat dissipation by neighboring components.
- Use of solder-resistant coatings.

The overheating associated with some of these factors can usually be reduced by suitable countermeasures. For example, if a pre-heating step cannot be avoided, an additional or reinforced cooling process may have to be included.

Cleaning

To determine whether a particular solvent, often used to remove flux residues and other substances, is suitable for the capacitors described, please refer to data book 2005 "Film Capacitors", in which this information is available. Even when suitable solvents are used, a reversible change of the electrical characteristics may occur in uncoated capacitors immediately after they have been washed. Thus it is always recommended to dry the components (e.g. 4 h at 70 °C) before they are subjected to subsequent electrical testing.

Embedding of capacitors in finished assemblies

In many applications, finished circuit assemblies are embedded in plastic resins. In this case, both chemical and thermal influences of the embedding ("potting") and curing processes must be taken into account. Our experience has shown that the following potting materials can be recommended considering maximum curing temperature 100 °C:

- Non-flexible epoxy resins with acid-anhydride hardeners
- Chemically inert, non-conducting fillers

Caution: Consult us first if you also wish to embed other uncoated component types!

Storage conditions

All capacitors listed in this product profile can be stored for short periods at any temperature within the entire range of category temperatures . For long storage periods, however, the following conditions should be observed:

- Storage temperature –40 to +40 °C
- Maximum relative humidity 80%, no dew allowed on the capacitor
- Maximum duration 24 months (12 months for taped components)

Resistance to vibration

A capacitor's ability to withstand vibration (e.g. such as that occurring in applications involving rotating machinery) is tested to IEC 60068-2-6. The test procedure used here involves continuous sinusoidal vibration along three orthogonal axes, with a continuously varying frequency (10 … 500 Hz), an acceleration amplitude of 10 *g*, a displacement amplitude of 0.75 mm and a duration of 360 minutes for each axis. EPCOS offers film capacitors specially designed for operation under more severe vibration regimes such as those found in automotive applications. Consult our catalog "Film Capacitors for Automotive Electronics".

Passive flammability

The passive flammability test is applied to ensure that components bearing the corresponding qualification contribute less energy to the combustion behavior of their immediate vicinity than is required to ignite them. This measure is designed to contain any localized fire that may occur. In the respective tests, the capacitors are subjected to a standardized flame to evaluate their combustion behavior by checking whether the flame persists for longer than a maximum permissible period or not. The severity of the test is determined essentially by the test flame and exposure time in accordance with various international standards (IEC 60040 CO 752 (amendment to IEC 60384-1), IEC 60695-2-2 and UL 1414). Unless the detail specifications stipulate otherwise, EMI suppression capacitors are tested to IEC 60384-14, section 4.17, test severity categories B and C.

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.
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