



Multilayer ceramic capacitors

Array, COG

Series/Type: **Array**

Date: February 2009

The following products presented in this data sheet are being withdrawn.

Substitute Products: See www.epcos.com/withdrawal_mlcc

Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37940R5220K041		2009-06-26	2010-06-30	2010-12-31
B37940R5220K043		2009-06-26	2010-06-30	2010-12-31
B37940R5330K041		2009-06-26	2010-06-30	2010-12-31

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Ordering Code	Substitute Product	Date of Withdrawal	Deadline Last Orders	Last Shipments
B37940R5330K043		2009-06-26	2010-06-30	2010-12-31
B37940R5470K041		2009-06-26	2010-06-30	2010-12-31
B37940R5470K043		2009-06-26	2010-06-30	2010-12-31
B37940R5101K041		2009-06-26	2010-06-30	2010-12-31
B37940R5101K043		2009-06-26	2010-06-30	2010-12-31
B37940R5221K041		2009-06-26	2010-06-30	2010-12-31
B37940R5221K043		2009-06-26	2010-06-30	2010-12-31
B37871R5100K041		2009-06-26	2010-06-30	2010-12-31
B37871R5100K043		2009-06-26	2010-06-30	2010-12-31
B37871R5150K041		2009-06-26	2010-06-30	2010-12-31
B37871R5150K043		2009-06-26	2010-06-30	2010-12-31
B37871R5220K041		2009-06-26	2010-06-30	2010-12-31
B37871R5220K043		2009-06-26	2010-06-30	2010-12-31
B37871R5330K041		2009-06-26	2010-06-30	2010-12-31
B37871R5330K043		2009-06-26	2010-06-30	2010-12-31
B37871R5470K041		2009-06-26	2010-06-30	2010-12-31
B37871R5470K043		2009-06-26	2010-06-30	2010-12-31
B37871R5101K041		2009-06-26	2010-06-30	2010-12-31
B37871R5101K043		2009-06-26	2010-06-30	2010-12-31
B37871R5221K041		2009-06-26	2010-06-30	2010-12-31
B37871R5221K043		2009-06-26	2010-06-30	2010-12-31
B37871R5331K041		2009-06-26	2010-06-30	2010-12-31
B37871R5331K043		2009-06-26	2010-06-30	2010-12-31
B37871R5471K041		2009-06-26	2010-06-30	2010-12-31
B37871R5471K043		2009-06-26	2010-06-30	2010-12-31
B37830R0100K021		2009-06-26	2010-06-30	2010-12-31
B37830R0100K023		2009-06-26	2010-06-30	2010-12-31
B37830R0150K021		2009-06-26	2010-06-30	2010-12-31
B37830R0150K023		2009-06-26	2010-06-30	2010-12-31
B37830R0220K021		2009-06-26	2010-06-30	2010-12-31
B37830R0220K023		2009-06-26	2010-06-30	2010-12-31
B37830R0330K021		2009-06-26	2010-06-30	2010-12-31
B37830R0330K023		2009-06-26	2010-06-30	2010-12-31
B37940R5100K041		2009-06-26	2010-06-30	2010-12-31
B37940R5100K043		2009-06-26	2010-06-30	2010-12-31
B37940R5150K041		2009-06-26	2010-06-30	2010-12-31
B37940R5150K043		2009-06-26	2010-06-30	2010-12-31

For further information please contact your nearest EPCOS sales office, which will also support you in selecting a suitable substitute. The addresses of our worldwide sales network are presented at www.epcos.com/sales.

SMD

Ordering code system



B37830

R

0

101

K

0

2

1

Type and size

Chip size (inch/mm) = Temperature characteristic

C0G:

0405/1012 \triangleq B37830

0508/1220 \triangleq B37940

0612/1632 \triangleq B37871

X7R:

0405/1012 \triangleq B37831

0508/1220 \triangleq B37941

0612/1632 \triangleq B37872

Internal coding

"R" indicates array capacitor

Rated voltage

9 (Code) \triangleq 16 VDC

0 (Code) \triangleq 25 VDC

5 (Code) \triangleq 50 VDC

Capacitance, coded (example)

100 \triangleq 10 · 10⁰ pF = 10 pF

101 \triangleq 10 · 10¹ pF = 100 pF

220 \triangleq 22 · 10⁰ pF = 22 pF

Capacitance tolerance

J \triangleq \pm 5%

K \triangleq \pm 10% (standard for C0G)

M \triangleq \pm 20% (standard for X7R)

Internal coding: 0

or decimal place for cap. value <10 pF

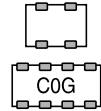
2 \triangleq 2-fold array

4 \triangleq 4-fold array

Packaging

1 \triangleq cardboard tape, 180-mm reel

3 \triangleq cardboard tape, 330-mm reel


Features

- Reduction of mounting time and mounting costs
- Space saving on the PCB
- Based on AEC-Q200 Rev-C

Applications

- Suitable for electronic circuits with parallel line layout
- Coupling and filtering, particularly in RF circuits
- Resonant circuits
- Filter circuits

Termination

- Nickel barrier terminations (Ni) for lead-free soldering

Options

- Alternative capacitance values and tolerances available on request

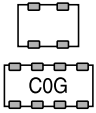
Delivery mode

- Cardboard and blister tape, 180-mm and 330-mm reel available

Electrical data

Temperature characteristic			COG	
Climatic category	(IEC 60068-1)		55/125/56	
Standard			EIA	
Dielectric			Class 1	
Rated voltage		V_R	25, 50	VDC
Test voltage		V_{test}	$2.5 \cdot V_R/5$ s	VDC
Capacitance range		C_R	4.7 pF ... 1.0 nF	
Temperature coefficient			$0 \pm 30 \cdot 10^{-6}/K$	
Dissipation factor	(limit value)	$\tan \delta$	$< 1.0 \cdot 10^{-3}$	
Insulation resistance ¹⁾	(at +25 °C)	R_{ins}	$> 10^5$	MΩ
Insulation resistance ¹⁾	(at +125 °C)	R_{ins}	$> 10^4$	MΩ
Time constant ¹⁾	(at +25 °C)	τ	> 1000	s
Time constant ¹⁾	(at +125 °C)	τ	> 100	s
Operating temperature range		T_{op}	-55 ... +125	°C
Ageing			none	

1) For $C_R > 10$ nF the time constant $\tau = C \cdot R_{ins}$ is given.



Multilayer ceramic capacitors

C0G

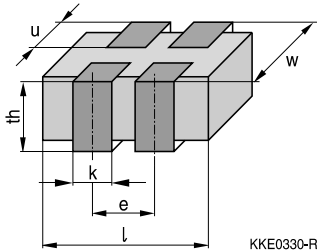
SMD

Capacitance tolerances

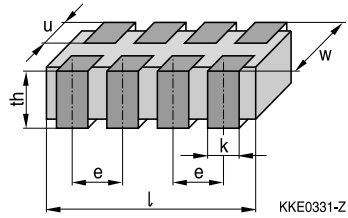
Code letter	J	K (standard)
Tolerance	±5%	±10%

Dimensional drawing

2-fold array (case size 0405)



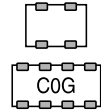
4-fold array (case sizes 0508 and 0612)



Dimensions (mm)

	2-fold array	4-fold array	
Case size	(inch) 0405	0508	0612
	(mm) 1012	1220	1632
l	1.37 ±0.15	2.00 ±0.20	3.20 ±0.20
w	1.00 +0/-0.15	1.25 ±0.15	1.60 ±0.20
th	0.70 max.	0.85 ±0.10	0.85 ±0.10
k	0.36 ±0.10	0.30 ±0.10	0.40 ±0.15
e	0.64	0.50 ±0.10	0.80 ±0.15
u	0.20 ±0.10	0.20 +0.3/-0.10	0.20 +0.3/-0.10

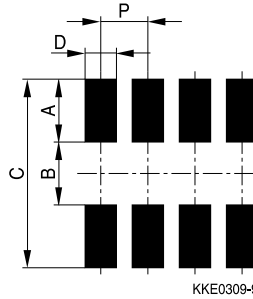
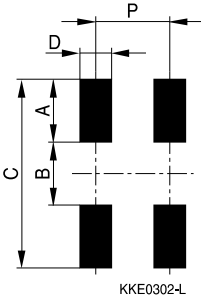
Tolerances to CECC 32101-801



Recommended solder pad

2-fold array (case size 0405)

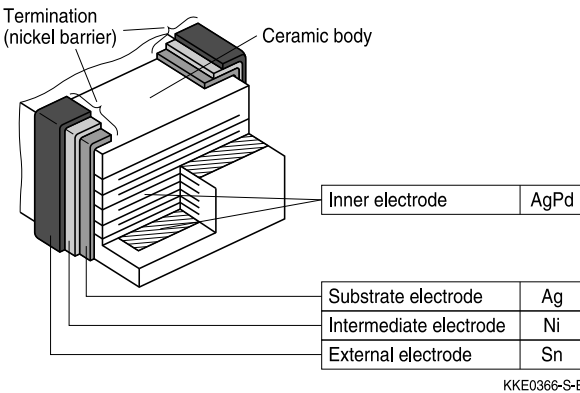
4-fold array (case sizes 0508 and 0612)

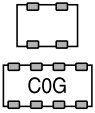


Recommended dimensions (mm) for reflow soldering

Case size	(inch/mm)	Type	A	B	C	D	P
0405/1012		2-fold array	0.50 ...	0.45 ...	1.45 ...	0.30 ...	0.64
			0.55	0.50	1.60	0.35	±0.10
0508/1220		4-fold array	0.50 ...	0.60 ...	1.60 ...	0.25 ...	0.50
			0.70	0.70	2.10	0.35	±0.005
0612/1632		4-fold array	0.70 ...	0.80 ...	2.20 ...	0.30 ...	0.80
			0.90	1.00	2.80	0.40	±0.005

Termination





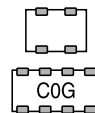
Multilayer ceramic capacitors

C0G

SMD

Product range for array capacitors, C0G

	2-fold arrays	4-fold arrays	
Size			
inch (l x w)	0405	0508	0612
mm (l x w)	1012	1220	1632
Type	B37830R	B37940R	B37871R
$C_R \setminus V_R$ (VDC)	25	50	50
10 pF			
15 pF			
22 pF			
33 pF			
47 pF			
100 pF			
220 pF			
330 pF			
470 pF			

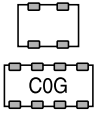


Ordering codes and packing for C0G, 25 VDC, nickel barrier terminations

C _R	Ordering code	Chip thickness mm	Cardboard tape, Ø180-mm reel	Cardboard tape, Ø330-mm reel
			* \triangle 1	* \triangle 3
			pcs./reel	pcs./reel

Case size 0405, 25 VDC, 2-fold arrays

10 pF	B37830R0100K02*	0.6 ±0.1	5000	20000
15 pF	B37830R0150K02*	0.6 ±0.1	5000	20000
22 pF	B37830R0220K02*	0.6 ±0.1	5000	20000
33 pF	B37830R0330K02*	0.6 ±0.1	5000	20000


Multilayer ceramic capacitors
COG
SMD
Ordering codes and packing for COG, 50 VDC, nickel barrier terminations

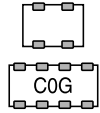
C _R	Ordering code	Chip thickness mm	Cardboard tape, Ø180-mm reel	Cardboard tape, Ø330-mm reel
			* \triangle 1	* \triangle 3
			pcs./reel	pcs./reel

Case size 0508, 50 VDC, 4-fold arrays

10 pF	B37940R5100K04*	0.85 ±0.1	4000	16000
15 pF	B37940R5150K04*	0.85 ±0.1	4000	16000
22 pF	B37940R5220K04*	0.85 ±0.1	4000	16000
33 pF	B37940R5330K04*	0.85 ±0.1	4000	16000
47 pF	B37940R5470K04*	0.85 ±0.1	4000	16000
100 pF	B37940R5101K04*	0.85 ±0.1	4000	16000
220 pF	B37940R5221K04*	0.85 ±0.1	4000	16000

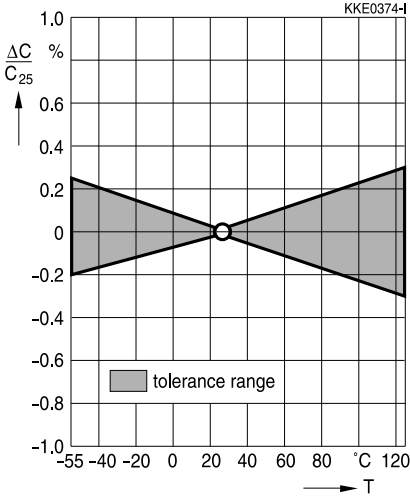
Case size 0612, 50 VDC, 4-fold arrays

10 pF	B37871R5100K04*	0.85 ±0.1	4000	16000
15 pF	B37871R5150K04*	0.85 ±0.1	4000	16000
22 pF	B37871R5220K04*	0.85 ±0.1	4000	16000
33 pF	B37871R5330K04*	0.85 ±0.1	4000	16000
47 pF	B37871R5470K04*	0.85 ±0.1	4000	16000
100 pF	B37871R5101K04*	0.85 ±0.1	4000	16000
220 pF	B37871R5221K04*	0.85 ±0.1	4000	16000
330 pF	B37871R5331K04*	0.85 ±0.1	4000	16000
470 pF	B37871R5471K04*	0.85 ±0.1	4000	16000

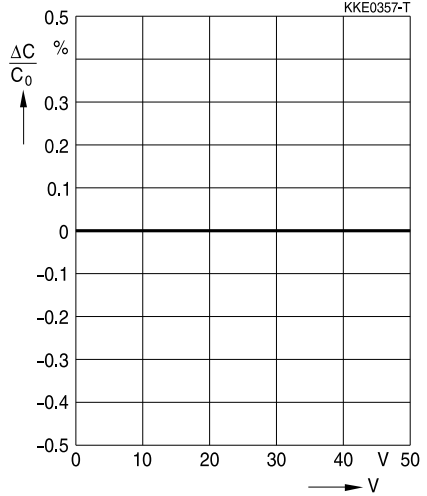


Typical characteristics¹⁾

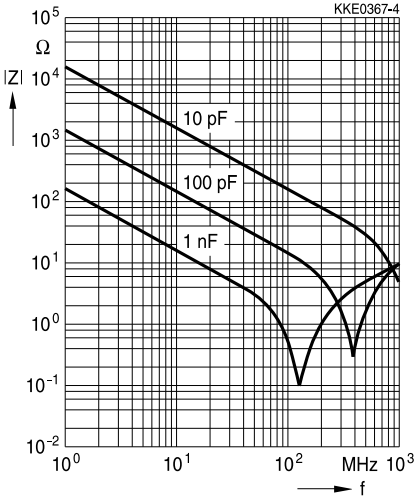
Capacitance change $\Delta C/C_{25}$ versus temperature T



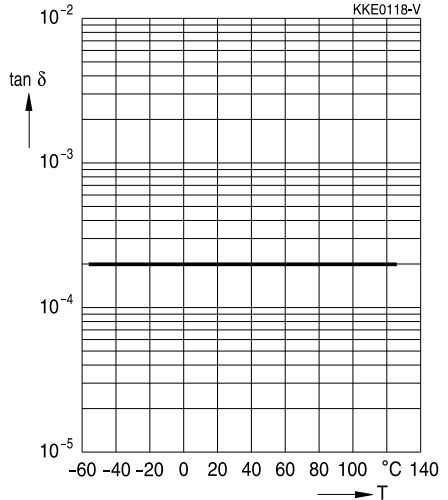
Capacitance change $\Delta C/C_0$ versus superimposed DC voltage V



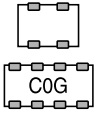
Impedance |Z| versus frequency f



Dissipation factor $\tan \delta$ versus temperature T



1) For more detailed information on frequency behavior and characteristics see www.epcos.com/mlcc_impedance.



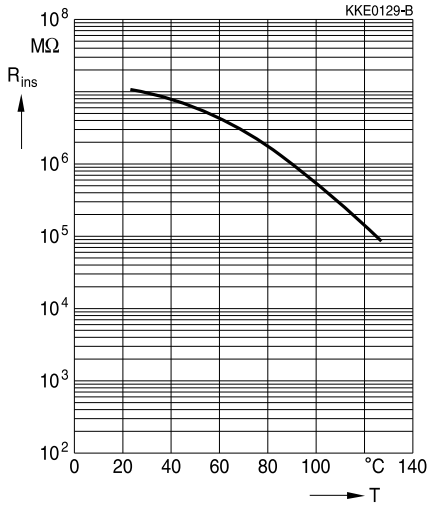
Multilayer ceramic capacitors

COG

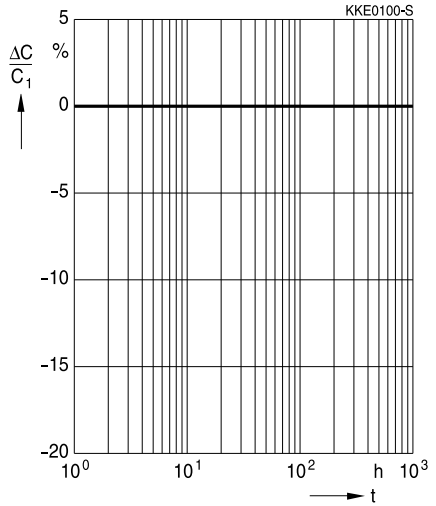
SMD

Typical characteristics¹⁾

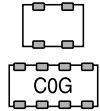
Insulation resistance R_{ins} versus temperature T



Capacitance change $\Delta C/C_1$ versus time t



1) For more detailed information on frequency behavior and characteristics see www.epcos.com/mlcc_impedance.



Cautions and warnings

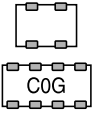
How to select ceramic capacitors

Remember the following when selecting ceramic capacitors:

1. Ceramic capacitors that must fulfill high quality requirements must be qualified based on AEC-Q200 Rev-C.
2. When ceramic capacitors are used at the connection to a battery or power supply (e.g. clamp 15 or 30 in an automobile) or for safety-relevant applications, two single ceramic capacitors should be connected in series. Alternatively a ceramic capacitor with integrated series circuits should be used in order to reduce the possibility of a short circuit caused by a fracture. The MLSC from EPCOS contains such a series circuit in a single component.
3. The use of multilayer varistors (MLVs) is recommended for ESD protection (see chapter “Effects on mechanical, thermal and electrical stress”, section 1.4).
4. Additional stress factors such as continuous operating voltage or application-specific derating must be taken into account in the selection of components (refer to chapter “Reliability”).

Recommendations for the circuit board design

1. Components with an optimized geometrical design are preferable where permitted by the application.
2. Use at least FR4 circuit board material.
3. Geometrically optimized circuit boards are preferable, especially those that cannot be deformed.
4. Ceramic capacitors should be placed with a sufficient minimum distance from the edge of a circuit board. High bending forces may be exerted there when boards are separated and during further processing of a board (e.g. when incorporating it in a housing).
5. Ceramic capacitors should always be placed parallel to the possible bending axis of a circuit board.
6. Screw connections should not be used to fix a board or connect several boards. Components should not be placed near screw holes. If screw connections are unavoidable, they should be cushioned, for instance using rubber pads.



Multilayer ceramic capacitors

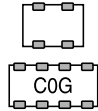
COG

SMD

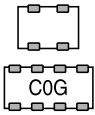
Recommendations for processing

1. Ensure correct positioning of a ceramic capacitor on the solder pad.
2. Be careful when using casting, injection-molded and molding compounds and cleaning agents. They can damage a capacitor.
3. Support a circuit board and reduce placement forces.
4. Do not straighten a board (manually) if it is distorted by soldering.
5. Separate boards with a peripheral saw, or preferably with a milling head (no dicing or breaking).
6. Be careful when subsequently placing heavy or leaded components (e.g. transformers or snap-in components) because of the danger of bending and fracture.
7. When testing, transporting, packing or inserting a board, avoid any deformation of it so that components are not damaged.
8. Avoid excessive force when plugging a connector into a device soldered onto a board.
9. Only mount ceramic capacitors using the soldering process (reflow or wave) that is permissible for them (see chapter "Soldering directions").
10. When soldering, select the softest solder profile possible (heating time, peak temperature, cooling time) to avoid thermal stress and damage.
11. Ensure the correct solder meniscus height and solder quantity.
12. Ensure correct dosing of the cement.
13. Ceramic capacitors with external silver-palladium terminations are intended for conductive adhesion - they are not suited for lead-free soldering processes.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.


SMD
Symbols and terms

Symbol	English	German
A	Area	Fläche
C	Capacitance	Kapazität
C ₀	Initial (original) capacitance	Anfangskapazität
C ₁	Capacitance value after one hour's use	Kapazitätswert nach einer Stunde
C _R	Rated capacitance	Nennkapazität
C ₂₀	Capacitance at 20 °C	Kapazität bei 20 °C
C ₂₅	Capacitance at 25 °C	Kapazität bei 25 °C
ΔC	Capacitance change	Kapazitätsänderung
D	Bending displacement	Durchbiegung
E _a	Activation energy	Aktivierungsenergie
ESR	Equivalent series resistance	Ersatzserienwiderstand
F	Force	Kraft
f	Frequency	Frequenz
f _{meas}	Measuring frequency	Messfrequenz
f _{res}	Self-resonant frequency	Eigenresonanzfrequenz
I _{test}	Test current	Prüfstrom
k	Ageing constant	Alterungskonstante
L	Inductance	Induktivität
N	Quantity (integer values)	Anzahl (ganzzahliger Wert)
P _{loss}	Power dissipation or loss	Verlustleistung
Q _{el}	Electrical charge	Elektrische Ladung
Q	Quality	Güte
R _{ins}	Insulation resistance	Isolationswiderstand
R _p	Parallel resistance	Parallelwiderstand
R _s	Series resistance (circuit resistance)	Serienwiderstand
S _v	Rate of rise of a voltage pulse	Flankensteilheit eines Spannungsimpulses
T	Temperature	Temperatur
T _{meas}	Measuring temperature	Messtemperatur
T _{op}	Operating temperature	Betriebstemperatur
T _{ref}	Reference temperature	Bezugstemperatur
T _{test}	Test temperature	Prüftemperatur
t	Time	Zeit
t _r	Rise time of a voltage pulse	Anstiegszeit eines Spannungsimpulses
t _{test}	Test duration	Prüfdauer
tan δ	Dissipation factor	Verlustfaktor


Multilayer ceramic capacitors
COG
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Symbol	English	German
V	Voltage	Spannung
V ₀	Initial (original) voltage (basic voltage level)	Anfangsspannung (Spannungsgrundpegel)
V _{meas}	Measuring voltage	Messspannung
V _R	Rated voltage	Nennspannung
V _S	Amplitude of a voltage pulse	Hub des Spannungsimpulses
V _{RMS}	Measuring (root-mean-square or effective) AC voltage	Effektivspannung
V _{test}	Test voltage	Prüfspannung
Z	Magnitude of impedance (AC resistance)	Betrag der Impedanz (Wechselstromwiderstand)
α	Temperature coefficient	Temperaturkoeffizient
ε ₀	Absolute dielectric constant	Absolute Dielektrizitätskonstante
ε _r	Relative dielectric constant	Relative Dielektrizitätskonstante
λ	Failure rate	Ausfallrate
τ	Time constant	Zeitkonstante

Abbreviations / Notes

Symbol	English	German
$\square e$	Lead spacing (in mm)	Rastermaß (in mm)
<u>SMD</u>	Surface-mounted devices	Oberflächenmontierbares Bauelement
*	To be replaced by a number in ordering codes, type designations etc.	Platzhalter für Zahl im Bestellnummerncode 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.

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 lifesaving 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.**
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