

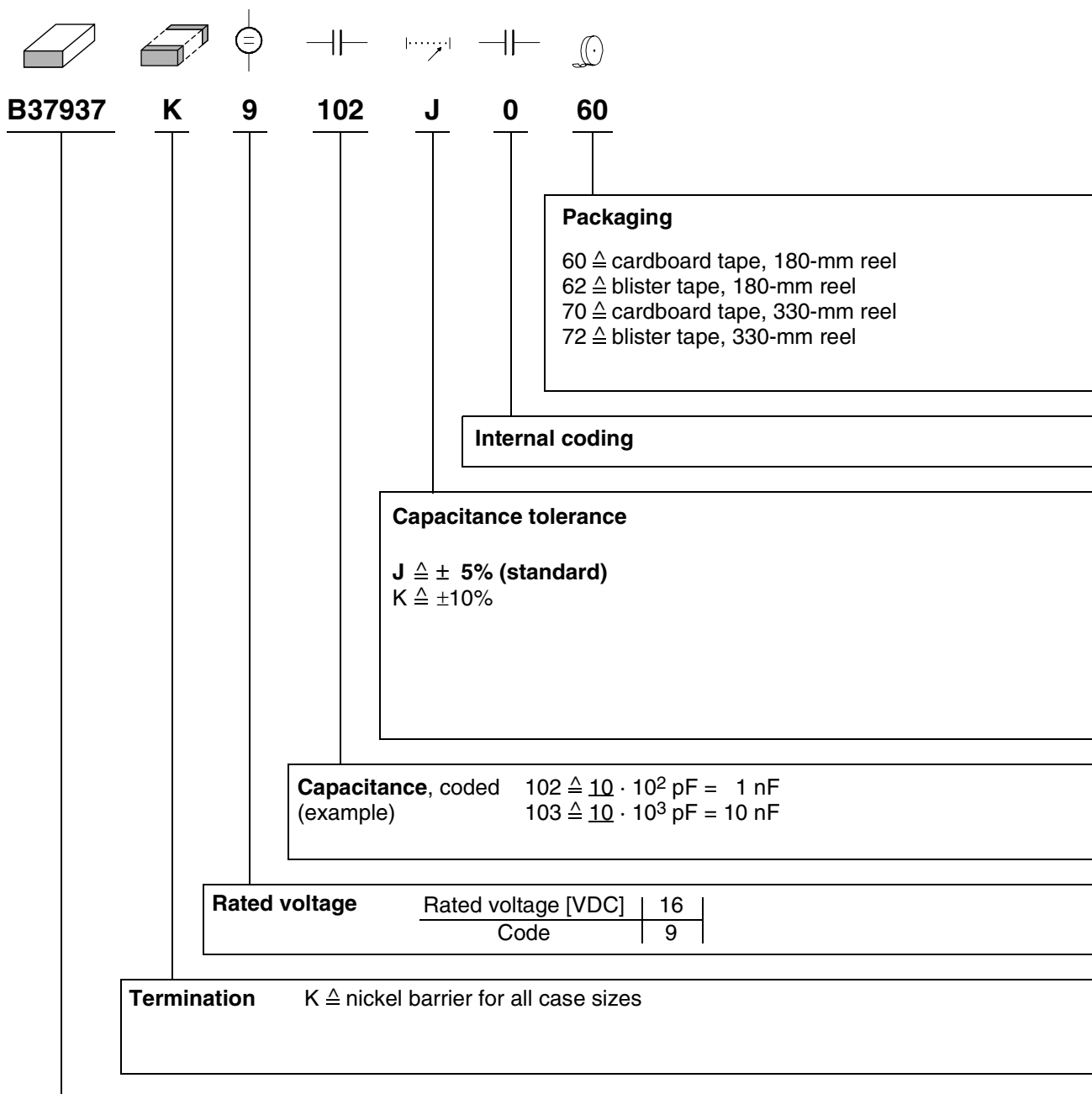


Multilayer ceramic capacitors

Chip capacitors, CPPS

Date: October 2006

Ordering code system



Type and size	
Chip size (inch / mm)	Temperature characteristic CPPS
0603 / 1608 0805 / 2012	B37937 B37947

Features

- Replacement of PPS film capacitors
- Class 1 characteristic with high capacitance values
- High insulation resistance
- Excellent DC characteristic
- Excellent temperature characteristic
- No piezoelectric effects
- No ageing effects



Applications

- Wireless communication
- Loop filter
- PLL filter
- Telecom (mobile phones, Bluetooth, ADSL/XDSL)
- Automotive (keyless entry)

Termination

- For soldering: Nickel barrier terminations (Ni)

Options

- Alternative capacitance tolerances available on request

Delivery mode

- Cardboard and blister tape (blister tape for chip thickness $\geq 1.2 \pm 0.1$ mm), 180-mm and 330-mm reel available

Electrical data

Temperature characteristic		C0G	
Climatic category (IEC 60068-1)		55/125/56	
Standard		EIA	
Dielectric		Class 1	
Rated voltage	V_R	16	VDC
Test voltage	V_{test}	$2.5 \cdot V_R / 5$ s	VDC
Capacitance range / E series	C_R	560 pF ... 10 nF (E6)	
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.



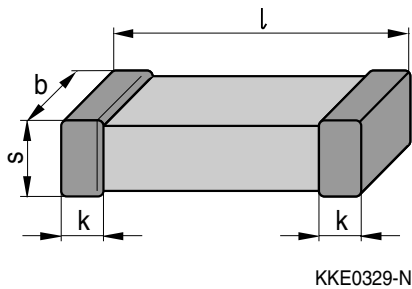
Multilayer ceramic capacitors

CPPS

Capacitance tolerances

Code letter	J (standard)	K
Tolerance	$\pm 5\%$	$\pm 10\%$

Dimensional drawing

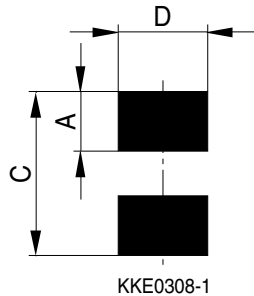


Dimensions (mm)

Case size	(inch)	0603	0805
	(mm)	1608	2012
l		1.6 ± 0.15	2.00 ± 0.20
b		0.8 ± 0.10	1.25 ± 0.15
s		0.8 ± 0.10	1.30 max.
k		0.1 – 0.40	0.13 – 0.75

Tolerances to CECC 32101-801

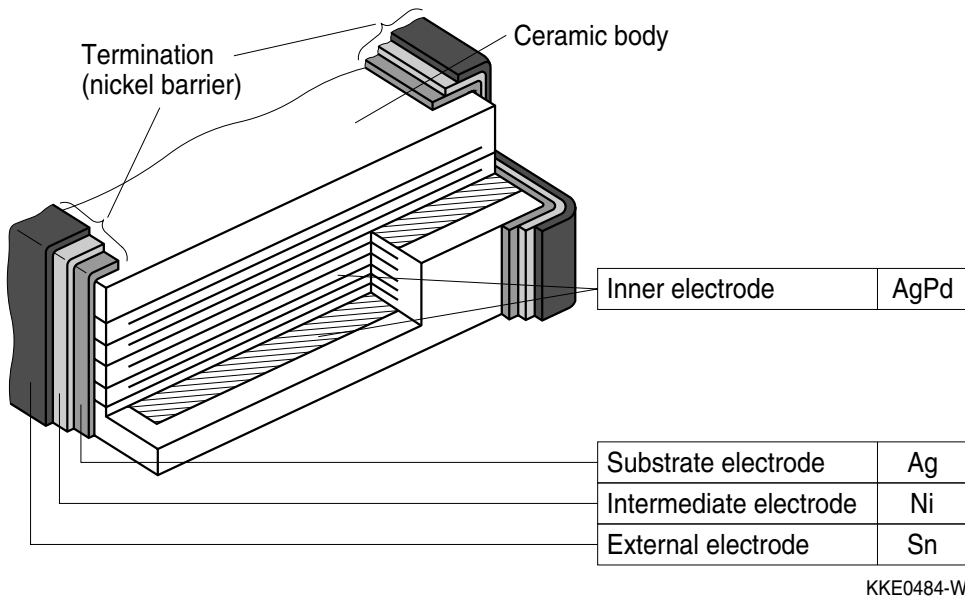
Recommended solder pad



Recommended dimensions (mm) for reflow soldering

Case size	(inch/mm)	Type	A	C	D
0603/1608		single chip	0.6 ... 0.7	1.8 ... 2.2	0.6 ... 0.8
0805/2012		single chip	0.6 ... 0.7	2.2 ... 2.6	0.8 ... 1.1

Termination





Multilayer ceramic capacitors

CPPS

Product range for CPPS chip capacitors

Size ¹⁾ inch mm	0603 1608		0805 2012	
Type	B37937		B37947	
V_R (VDC)	16		16	
C_R				
560 pF				
680 pF				
1.0 nF				
1.5 nF				
2.2 nF				
3.3 nF				
4.7 nF				
6.8 nF				
10 nF				

1) $l \times b$ (inch) / $l \times b$ (mm)

Ordering codes and packing for CPPS capacitors, 16 VDC, nickel barrier terminations

$C_R^{1)}$	Ordering code ²⁾	Chip thickness mm	Cardboard tape, Ø 180-mm reel	Cardboard tape, Ø 330-mm reel
			** \triangleq 60	** \triangleq 70
			pcs/reel	pcs/reel

Case size 0603, 16 VDC

560 pF	B37937K9561J0**	0.8 ± 0.1	4000	16000
680 pF	B37937K9681J0**	0.8 ± 0.1	4000	16000
1.0 nF	B37937K9102J0**	0.8 ± 0.1	4000	16000
1.5 nF	B37937K9152J0**	0.8 ± 0.1	4000	16000
2.2 nF	B37937K9222J0**	0.8 ± 0.1	4000	16000

Case size 0805, 16 VDC

1.0 nF	B37947K9102J0**	0.6 ± 0.1	5000	20000
1.5 nF	B37947K9152J0**	0.8 ± 0.1	4000	16000
2.2 nF	B37947K9222J0**	1.2 ± 0.1	3000 ³⁾	12000 ⁴⁾
3.3 nF	B37947K9332J0**	1.2 ± 0.1	3000 ³⁾	12000 ⁴⁾
4.7 nF	B37947K9472J0**	1.2 ± 0.1	3000 ³⁾	12000 ⁴⁾
6.8 nF	B37947K9682J0**	1.2 ± 0.1	3000 ³⁾	12000 ⁴⁾
10 nF	B37947K9103J0**	1.2 ± 0.1	3000 ³⁾	12000 ⁴⁾

1) Other capacitance values on request.

2) The table contains the ordering codes for the standard capacitance tolerance.
For other available capacitance tolerances see page 168.

3) Blister tape, 180-mm reel, ordering code ** \triangleq 62

4) Blister tape, 330-mm reel, ordering code ** \triangleq 72

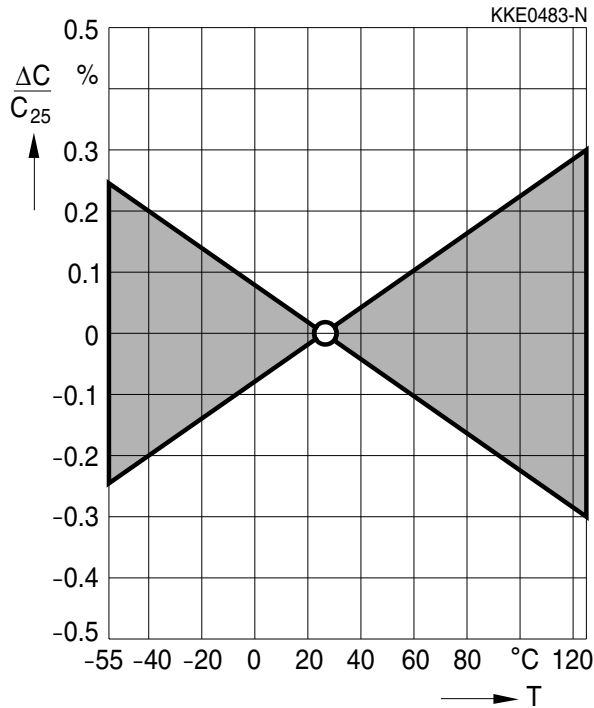


Multilayer ceramic capacitors

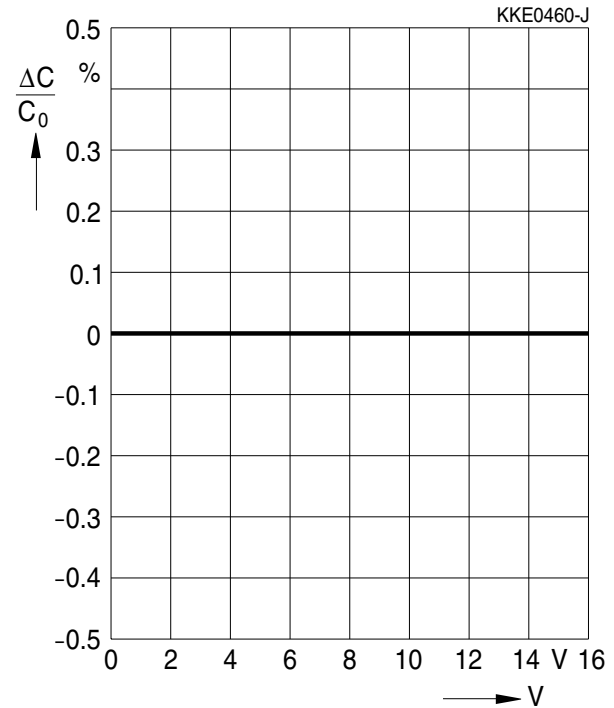
CPPS

Typical characteristics¹⁾

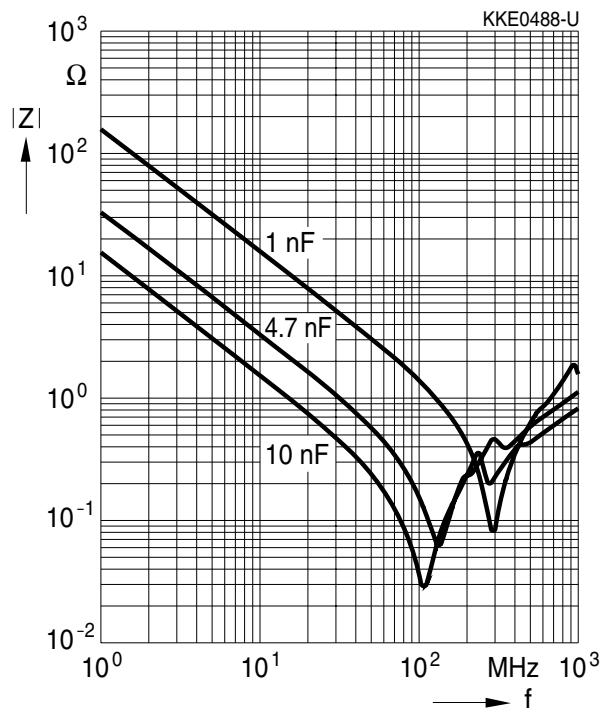
Capacitance change $\Delta C/C_{25}$ versus temperature T (tolerance range $\pm 0.3\%$)



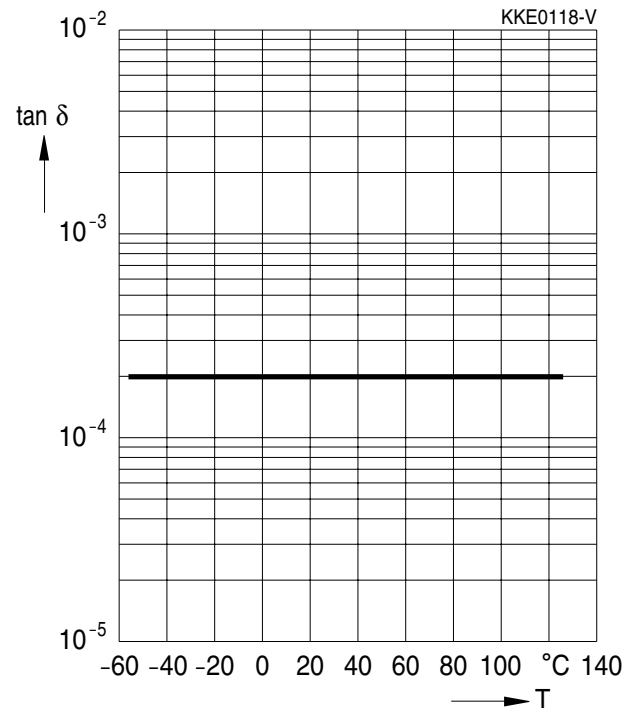
Capacitance change $\Delta C/C_0$ versus superimposed DC voltage V



Impedance $|Z|$ versus frequency f



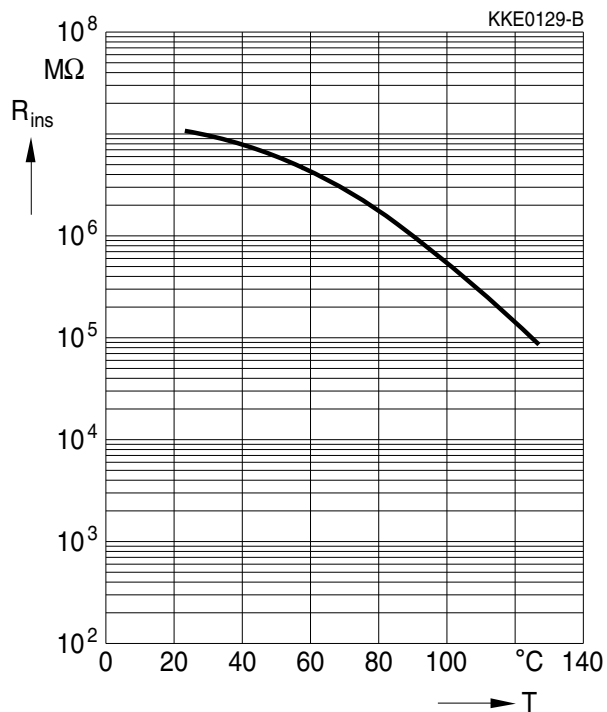
Dissipation factor $\tan \delta$ versus temperature T



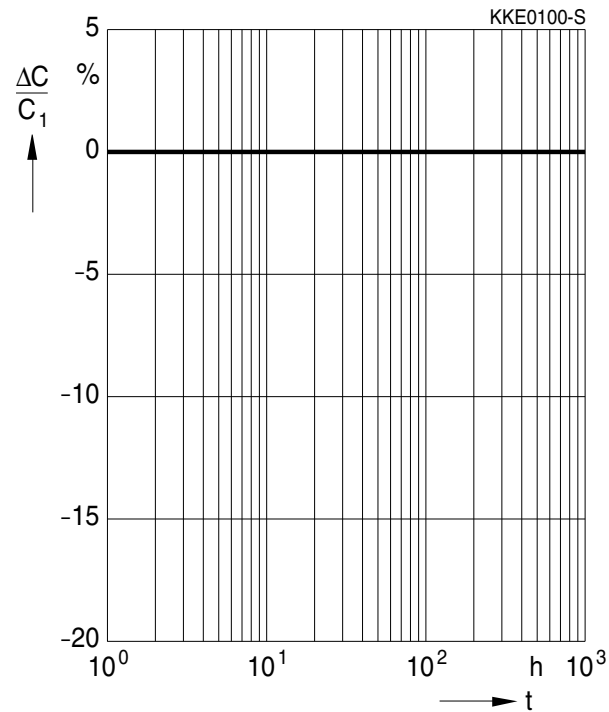
1) For more detailed information on frequency behavior and characteristics see www.epcos.com/mlcc_impedance.

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.

Multilayer ceramic capacitors

Cautions and warnings

Notes on the selection of ceramic capacitors

In the selection of ceramic capacitors, the following criteria must be considered:

1. Depending on the application, ceramic capacitors used to meet high quality requirements should at least satisfy the specifications to AEC-Q200. They must meet quality requirements going beyond this level in terms of ruggedness (e.g. mechanical, thermal or electrical) in the case of critical circuit configurations and applications (e.g. in safety-relevant applications such as ABS and airbag equipment or durable industrial goods).
2. At the connection to the battery or power supply (e.g. clamp 15 or 30 in the automobile) and at positions with stranding potential, to reduce the probability of short circuits following a fracture, two ceramic capacitors must be connected in series and/or a ceramic capacitor with integrated series circuit should be used. The MLSC from EPCOS contains such a series circuit in a single component.
3. Ceramic capacitors with the temperature characteristics Z5U and Y5V do not satisfy the requirements to AEC-Q200 and are mechanically and electrically less rugged than C0G or X7R/X8R ceramic capacitors. In applications that must satisfy high quality requirements, therefore, these capacitors should not be used as discrete components (see the chapter “Effects on mechanical, thermal and electrical stress”, point 1.4).
4. For ESD protection, preference should be given to the use of multilayer varistors (MLV) (see the chapter “Effects on mechanical, thermal and electrical stress”, point 1.4).
5. An application-specific derating or continuous operating voltage must be considered in order to cushion (unexpected) additional stresses (see the chapter “Reliability”).

The following should be considered in circuit board design

1. If technically feasible in the application, preference should be given to components having an optimal geometrical design.
2. At least FR4 circuit board material should be used.
3. Geometrically optimal circuit boards should be used, ideally those that cannot be deformed.
4. Ceramic capacitors must always be placed a sufficient minimum distance from the edge of the circuit board. High bending forces may be exerted there when the panels are separated and during further processing of the board (such as when incorporating it into a housing).
5. Ceramic capacitors should always be placed parallel to the possible bending axis of the circuit board.
6. No screw connections should be used to fix the board or to connect several boards. Components should not be placed near screw holes. If screw connections are unavoidable, they must be cushioned (for instance by rubber pads).

Multilayer ceramic capacitors

Cautions and warnings

The following should be considered in the placement process

1. Ensure correct positioning of the ceramic capacitor on the solder pad.
2. Caution when using casting, injection-molded and molding compounds and cleaning agents, as these may damage the capacitor.
3. Support the circuit board and reduce the placement forces.
4. A board should not be straightened (manually) if it has been distorted by soldering.
5. Separate panels with a peripheral saw, or better with a milling head (no dicing or breaking).
6. Caution in the subsequent placement of heavy or leaded components (e.g. transformers or snap-in components): danger of bending and fracture.
7. When testing, transporting, packing or incorporating the board, avoid any deformation of the board not to damage the components.
8. Avoid the use of excessive force when plugging a connector into a device soldered onto the board.
9. Ceramic capacitors must be soldered only by the mode (reflow or wave soldering) permissible for them (see the chapter "Soldering directions").
10. When soldering the most gentle solder profile feasible should be selected (heating time, peak temperature, cooling time) in order to avoid thermal stresses and damage.
11. Ensure the correct solder meniscus height and solder quantity.
12. Ensure correct dosing of the cement quantity.
13. Ceramic capacitors with an AgPd external termination are not suited for the lead-free solder process: they were developed only for conductive adhesion technology.

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

Multilayer ceramic capacitors

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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.
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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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