

Film Capacitors

Metallized Polypropylene Film Capacitors (MKP)

 Series/Type:
 B32620 ... B32621

 Date:
 May 2009

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Metallized polypropylene film capacitors (MKP)

B32620 ... B32621

High pulse (stacked)

Typical applications

- Compact fluorescent lamps (CFL)
- SMPS

Climatic

- Max. operating temperature: 105 °C
- Climatic category (IEC 60068-1): 55/100/56

Construction

- Dielectric: polypropylene (PP)
- Stacked-film technology
- Plastic case (UL 94 V-0)
- Epoxy resin sealing

Features

- Very high pulse strength
- Very good self-healing properties
- Smallest possible dimensions
- High contact reliability

Terminals

- Parallel wire leads, lead-free tinned
- Special lead lengths available on request

Marking

Manufacturer's logo, rated capacitance (coded), cap. tolerance (code letter), rated voltage, date of manufacture (coded), for lead spacing 7.5 mm: style (MKP), for lead spacing 10 mm: lot number, series number (621)

Delivery mode

Bulk (untaped) Taped (Ammo pack or reel) For notes on taping, refer to chapter "Taping and packing".

Dimensional drawing



Dimensions in mm

Lead spacing	Lead diameter	Туре
<i>e</i> ±0.4	d ₁	
7.5	0.5	B32620
10.0	0.61)	B32621

^{1) 0.5} mm for capacitor width w = 4 mm



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Overview of available types

Lead spacing 7.5 mm						10.0 mm					
Туре	B3262						B32621				
Page	4						6				
V _R (V DC)	160	250	400	630	1000	1000	160	250	400	630	1000
V _{RMS} (V AC)	90	140	200	400	500	600	90	140	200	400	500
C _R (nF)											
0.47											
0.68											
1.0											
1.5											
2.2											
3.3											
4.7											
6.8											
10											
15											
22											
33											
47											
68											
100											
150											
220											





B32620 High pulse (stacked)

Ordering codes and packing units (lead spacing 7.5 mm)

V _R	V_{RMS}	C _R	Max. dimensions	Ordering code	Ammo	Reel	Untaped
	f ≤1 kHz		$w \times h \times l$	(composition see	pack	pcs./	pcs./
V DC	V AC	nF	mm	below)	pcs./MOQ	MOQ	MOQ
160	90	33	$4.0\times8.5\times10.0$	B32620A5333+***	8000	7200	6000
		47	$4.0\times8.5\times10.0$	B32620A5473+***	8000	7200	6000
		68	$5.0\times10.5\times10.0$	B32620A5683+***	6400	5600	4000
		100	$5.0\times10.5\times10.0$	B32620A5104+***	6400	5600	4000
		150	$6.0\times12.0\times10.3$	B32620A5154+***	5200	4400	3000
250	140	22	$4.0\times~8.5\times10.0$	B32620A3223+***	8000	7200	6000
		33	$4.0\times 8.5\times10.0$	B32620A3333+***	8000	7200	6000
		47	$5.0\times10.5\times10.0$	B32620A3473+***	6400	5600	4000
		68	$5.0\times10.5\times10.0$	B32620A3683+***	6400	5600	4000
		100	$6.0\times12.0\times10.3$	B32620A3104+***	5200	4400	3000
400	200	6.8	$4.0\times~8.5\times10.0$	B32620A4682+***	8000	7200	6000
		10	$4.0\times 8.5\times10.0$	B32620A4103+***	8000	7200	6000
		15	$5.0\times10.5\times10.0$	B32620A4153+***	6400	5600	4000
		22	$5.0\times10.5\times10.0$	B32620A4223+***	6400	5600	4000
		33	$6.0\times12.0\times10.3$	B32620A4333+***	5200	4400	3000
630	400	1.5	$4.0\times 8.5\times10.0$	B32620A6152+***	8000	7200	6000
		2.2	$4.0\times 8.5\times10.0$	B32620A6222+***	8000	7200	6000
		3.3	$4.0\times 8.5\times10.0$	B32620A6332+***	8000	7200	6000
		4.7	$4.0\times 8.5\times10.0$	B32620A6472+***	8000	7200	6000
		6.8	$5.0\times10.5\times10.0$	B32620A6682+***	6400	5600	4000
		10	$5.0\times10.5\times10.0$	B32620A6103+***	6400	5600	4000
		15	$6.0\times12.0\times10.3$	B32620A6153+***	5200	4400	3000
1000	500	1.5	$4.0\times 8.5\times10.0$	B32620A0152+***	8000	7200	6000
		2.2	$4.0\times 8.5\times10.0$	B32620A0222+***	8000	7200	6000
		3.3	$5.0\times10.5\times10.0$	B32620A0332+***	6400	5600	4000
		4.7	$5.0\times10.5\times10.0$	B32620A0472+***	6400	5600	4000
		6.8	$6.0\times12.0\times10.3$	B32620A0682+***	5200	4400	3000

MOQ = Minimum Order Quantity, consisting of 4 packing units. Further E series and intermediate capacitance values on request.

Composition of ordering code

+ = Capacitance tolerance code:

 $K = \pm 10\%$

 $J = \pm 5\%$

- *** = Packaging code:
 - 289 = Ammo pack
 - 189 = Reel
 - 000 = Untaped (lead length 6 -1 mm)

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High pulse (stacked)

B32620



Ordering codes and packing units (lead spacing 7.5 mm)

V _R	V _{RMS}	C _R	Max. dimensions	Ordering code	Ammo	Reel	Untaped
	f ≤1 kHz		$w \times h \times l$	(composition see	pack	pcs./	pcs./
V DC	V AC	nF	mm	below)	pcs./MOQ	MOQ	MOQ
1000	600	0.47	$4.0\times 8.5\times10.0$	B32620J0471+***	8000	7200	6000
		0.68	$5.0\times10.5\times10.0$	B32620J0681+***	6400	5600	4000
		1.0	$5.0\times10.5\times10.0$	B32620J0102+***	6400	5600	4000
		1.5	$5.0\times10.5\times10.0$	B32620J0152+***	6400	5600	4000
		2.2	$5.0\times10.5\times10.0$	B32620J0222+***	6400	5600	4000
		3.3	$5.0\times10.5\times10.0$	B32620J0332+***	6400	5600	4000
		4.7	$6.0\times12.0\times10.3$	B32620J0472+***	5200	4400	3000

MOQ = Minimum Order Quantity, consisting of 4 packing units. Further E series and intermediate capacitance values on request.

Composition of ordering code

- + = Capacitance tolerance code:
 - K = ±10%
 - $J = \pm 5\%$

*** = Packaging code:

- 289 = Ammo pack
- 189 = Reel
- 000 = Untaped (lead length 6 -1 mm)





High pulse (stacked)

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Ordering codes and packing units (lead spacing 10 mm)

V _R	V _{RMS}	C _R	Max. dimensions	Ordering code	Ammo	Reel	Untaped
	f≤1 kHz		$w \times h \times I$	(composition see	pack	pcs./	pcs./
V DC	V AC	nF	mm	below)	pcs./MOQ	MOQ	MOQ
160	90	47	$4.0\times~7.0\times13.0$	B32621A5473+***	4000	6800	4000
		68	$4.0\times 9.0\times 13.0$	B32621A5683+***	4000	6800	4000
		100	$5.0\times11.0\times13.0$	B32621A5104+***	3320	5200	4000
		150	$5.0\times11.0\times13.0$	B32621A5154+***	3320	5200	4000
		220	$6.0\times12.0\times13.0$	B32621A5224+***	2720	4400	4000
250	140	2.2	$4.0\times~7.0\times13.0$	B32621A3222+***	4000	6800	4000
		3.3	$4.0\times 9.0\times 13.0$	B32621A3332+***	4000	6800	4000
		4.7	$4.0\times 9.0\times 13.0$	B32621A3472+***	4000	6800	4000
		6.8	$4.0\times 9.0\times 13.0$	B32621A3682+***	4000	6800	4000
		10	$4.0\times 9.0\times 13.0$	B32621A3103+***	4000	6800	4000
		15	$4.0\times 9.0\times 13.0$	B32621A3153+***	4000	6800	4000
		22	$4.0\times 9.0\times 13.0$	B32621A3223+***	4000	6800	4000
		33	$4.0\times 9.0\times 13.0$	B32621A3333+***	4000	6800	4000
		47	$4.0\times 9.0\times 13.0$	B32621A3473+***	4000	6800	4000
		68	$5.0\times11.0\times13.0$	B32621A3683+***	3320	5200	4000
		100	$6.0\times12.0\times13.0$	B32621A3104+***	2720	4400	4000
400	200	10	$4.0\times 9.0\times 13.0$	B32621A4103+***	4000	6800	4000
		15	$4.0\times 9.0\times 13.0$	B32621A4153+***	4000	6800	4000
		22	$5.0\times11.0\times13.0$	B32621A4223+***	3320	5200	4000
		33	$5.0\times11.0\times13.0$	B32621A4333+***	3320	5200	4000
		47	$6.0\times12.0\times13.0$	B32621A4473+***	2720	4400	4000
630	400	2.2	$4.0\times~7.0\times13.0$	B32621A6222+***	4000	6800	4000
		3.3	$4.0\times 9.0\times 13.0$	B32621A6332+***	4000	6800	4000
		4.7	$4.0\times 9.0\times 13.0$	B32621A6472+***	4000	6800	4000
		6.8	$4.0\times 9.0\times 13.0$	B32621A6682+***	4000	6800	4000
		10	$4.0\times 9.0\times 13.0$	B32621A6103+***	4000	6800	4000
		15	$5.0\times11.0\times13.0$	B32621A6153+***	3320	5200	4000
		22	$6.0\times12.0\times13.0$	B32621A6223+***	2720	4400	4000
		33	$6.0\times12.0\times13.0$	B32621A6333+***	2720	4400	4000

MOQ = Minimum Order Quantity, consisting of 4 packing units.

Further E series and intermediate capacitance values on request.

Composition of ordering code

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Ordering codes and packing units (lead spacing 10 mm)

V _R	V _{RMS}	C _R	Max. dimensions	Ordering code	Ammo	Reel	Untaped
	f≤1 kHz		$w \times h \times I$	(composition see	pack	pcs./	pcs./
V DC	V AC	nF	mm	below)	pcs./MOQ	MOQ	MOQ
1000	500	2.2	$4.0\times~7.0\times13.0$	B32621A0222+***	4000	6800	4000
		3.3	$4.0\times 9.0\times 13.0$	B32621A0332+***	4000	6800	4000
		4.7	$4.0\times 9.0\times 13.0$	B32621A0472+***	4000	6800	4000
		6.8	$5.0\times11.0\times13.0$	B32621A0682+***	3320	5200	4000
		10	$6.0\times12.0\times13.0$	B32621A0103+***	2720	4400	4000

MOQ = Minimum Order Quantity, consisting of 4 packing units.

Further E series and intermediate capacitance values on request.

Composition of ordering code

- + = Capacitance tolerance code:
 - $K = \pm 10\%$

 $J = \pm 5\%$

*** = Packaging code:

289 = Ammo pack

- 189 = Reel
- 000 = Untaped (lead length 6 -1 mm)



МКР

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High pulse (stacked)

Technical data

	1		
Operating temperature range	Max. opera	ting temperature T _{op,max}	+105 °C
	Upper cates	gory temperature T _{max}	+100 °C
	Lower cates	gory temperature T _{min}	−55 °C
	Rated temp	erature T _R	+85 °C
Dissipation factor tan δ (in 10 ⁻³)	at	$C_{\text{R}} \leq 0.1 \ \mu\text{F}$	$0.1 \ \mu F < C_R \le 0.22 \ \mu F$
at 20 °C	1 kHz	-	1.0
(upper limit values)	10 kHz	-	1.5
	100 kHz	4.0	-
Insulation resistance R _{ins}	100 GΩ		
at 20 °C, rel. humidity \leq 65%			
(minimum as-delivered values)			
DC test voltage	1.6 · V _R , 2 s	3	
Category voltage V _c	T _A (°C)	DC voltage derating	AC voltage derating
(continuous operation with $V_{\mbox{\tiny DC}}$	$T_A \le 85$	$V_{\rm C} = V_{\rm R}$	$V_{C,RMS} = V_{RMS}$
or V_{AC} at f \leq 1 kHz)	85 <t<sub>A≤100</t<sub>	$V_{c} = V_{R} \cdot (165 - T_{A})/80$	$V_{C,RMS} = V_{RMS} \cdot (165 - T_A)/80$
Operating voltage V _{op}	T _A (°C)	DC voltage (max. hours)	AC voltage (max. hours)
for short operating periods	$T_A \le 85$	$V_{op} = 1.25 \cdot V_{C} (2000 \text{ h})$	$V_{op} = 1.0 \cdot V_{C,RMS} (2000 \text{ h})$
$(V_{DC} \text{ or } V_{AC} \text{ at } f \leq 1 \text{ kHz})$	85 <t<sub>A≤100</t<sub>	$V_{op} = 1.25 \cdot V_{C} (1000 \text{ h})$	$V_{op} = 1.0 \cdot V_{C,RMS} (1000 \text{ h})$
Damp heat test	56 days/40	°C/93% relative humidity	
Limit values after damp	Capacitanc	e change ∆C/C	≤ 3%
heat test	Dissipation	factor change Δ tan δ	\leq 0.5 \cdot 10 ⁻³ (at 1 kHz)
			\leq 1.0 \cdot 10 ⁻³ (at 10 kHz)
	Insulation re	esistance R _{ins}	\geq 50% of minimum
			as-delivered values
Reliability:			
Failure rate λ	1 fit (≤ 1 · 1	0 ⁻⁹ /h) at 0.5 · V _R , 40 °C	
Service life t _{SL}	200 000 h a	at 1.0 · V _R , 85 °C	
		sion to other operating cor pter "Quality, 2 Reliability'	nditions and temperatures, '.
Failure criteria:			
Total failure	Short circui	t or open circuit	
Failure due to variation	Capacitanc	e change ∆C/C	> ±10%
of parameters	Dissipation	factor tan δ	> 4 \cdot upper limit value
	Insulation re	esistance R _{ins}	< 1500 MΩ



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Pulse handling capability

"dV/dt" represents the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in $V/\mu s$.

 $"k_0"$ represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in $V^2/\mu s.$

Note:

The values of dV/dt and k_0 provided below must not be exceeded in order to avoid damaging the capacitor.

dV/dt values

Lead spacing		7.5 mm	10 mm
V DC	V AC	dV/dt in V/μs	
160	90	750	600
250	140	1 200	900
400	200	1 500	1 050
630	400	2 700	1 800
1 000	500	3 200	2 400
1 000	600	4 000	-

k₀ values

Lead spa	cing	7.5 mm	10 mm
V _R	V _{RMS}		·
V DC	V AC	k₀ in V²/μs	
160	90	240 000	190 000
250	140	600 000	450 000
400	200	1 200 000	840 000
630	400	3 400 000	2 250 000
1 000	500	6 400 000	4 800 000
1 000	600	8 000 000	-





Impedance Z versus frequency f

(typical values)





Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C)

For T_A >90 °C, please refer to "General technical information", section 3.2.3.

Lead spacing 7.5 mm





250 V DC/140 V AC





- f



Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C) For $T_A > 90$ °C, please refer to "General technical information", section 3.2.3.

Lead spacing 7.5 mm

1000 V DC/500 V AC



1000 V DC/600 V AC





Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C) For $T_A > 90$ °C, please refer to "General technical information", section 3.2.3.

250 V DC/140 V AC

Lead spacing 10 mm

160 V DC/90 V AC



- f

- f



Permissible AC voltage V_{RMS} versus frequency f (for sinusoidal waveforms, $T_A \leq 90$ °C) For $T_A > 90$ °C, please refer to "General technical information", section 3.2.3.

Lead spacing 10 mm

1000 V DC/500 V AC







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Sinus-wave application, lighting Permissible voltage and current / waveform







Sinus-wave application, lighting

Permissible current $I_{\mbox{\tiny pp}}$ versus rated capacitance $C_{\mbox{\tiny R}}$

Lead spacing 7.5 mm

160 V DC/90 V AC



250 V DC/140 V AC KMK0640-D 1,6 B32620/250 V DC App I_{pp} 1.4 100 kHz 1.2 1.0 50 kHz 0.8 0.6 0.4 0.2 0 0 20 40 60 nF 80 С 630 V DC/400 V AC KMK0642-U 0.6 B32620/630 V DC App pp 0.5 100 kHz 0.4 0.3 50 kHz 0.2



0.1

0∟ 0

5

10

15 nF 20

- C

Please read *Cautions and warnings* and *Important notes* at the end of this document.



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Sinus-wave application, lighting Permissible current I_{pp} versus rated capacitance C_R

Lead spacing 7.5 mm

1000 V DC/500 V AC



0.4 A_{pp}
B32620/1000 V DC/600 V AC 100 kHz 0.3 0.25 0.2 0.15 KMK0644-B 100 kHz 50 kHz 0.15

1000 V DC/600 V AC

0.1

0.05

0

1

2

3

4 nF 5

- C





Sinus-wave application, lighting

Permissible current $I_{\mbox{\tiny pp}}$ versus rated capacitance $C_{\mbox{\tiny R}}$



100 kHz

50 kHz

30

40 nF 50

- C

20

250 V DC/140 V AC



10

1.0

0.8

0.6

0.4

0.2

0

0





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Sinus-wave application, lighting Permissible current $I_{\rm pp}$ versus rated capacitance $C_{\rm R}$

Lead spacing 10 mm

1000 V DC/500 V AC







Mounting guidelines

1 Soldering

1.1 Solderability of leads

The solderability of terminal leads is tested to IEC 60068-2-20, test Ta, method 1.

Before a solderability test is carried out, terminals are subjected to accelerated ageing (to IEC 60068-2-2, test Ba: 4 h exposure to dry heat at 155 °C). Since the ageing temperature is far higher than the upper category temperature of the capacitors, the terminal wires should be cut off from the capacitor before the ageing procedure to prevent the solderability being impaired by the products of any capacitor decomposition that might occur.

Solder bath temperature	235 ±5 °C
Soldering time	2.0 ±0.5 s
Immersion depth	2.0 + 0/-0.5 mm from capacitor body or seating plane
Evaluation criteria:	
Visual inspection	Wetting of wire surface by new solder \ge 90%, free-flowing solder

1.2 Resistance to soldering heat

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

Series		Solder bath temperature	Soldering time
MKT	boxed (except $2.5 \times 6.5 \times 7.2$ mm) coated uncoated (lead spacing > 10 mm)	260 ±5 °C	10 ±1 s
MFP MKP	(lead spacing > 7.5 mm)		
MKT	boxed (case $2.5 \times 6.5 \times 7.2$ mm)		5±1 s
МКР МКТ	(lead spacing \leq 7.5 mm) uncoated (lead spacing \leq 10 mm) insulated (B32559)		< 4 s recommended soldering profile for MKT uncoated (lead spacing \leq 10 mm) and insulated (B32559)







1.3 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 change irreversibly a capacitor's electrical characteristics. For short exposures (as in practical soldering processes) the heat load (and thus the possible effects on a capacitor) will also depend on other factors like:

- Pre-heating temperature and time
- Forced cooling immediately after soldering
- Terminal characteristics:
- diameter, length, thermal resistance, special configurations (e.g. crimping)
- Height of capacitor above solder bath
- Shadowing by neighboring components
- Additional heating due to heat dissipation by neighboring components
- Use of solder-resist 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 possibly have to be included.

EPCOS recommends the following conditions:

- Pre-heating with a maximum temperature of 110 °C
- Temperature inside the capacitor should not exceed the following limits:
 - MKP/MFP 110 °C
 - MKT 160 °C
- When SMD components are used together with leaded ones, the leaded film capacitors should not pass into the SMD adhesive curing oven. The leaded components should be assembled after the SMD curing step.
- Leaded film capacitors are not suitable for reflow soldering.

Uncoated capacitors

For uncoated MKT capacitors with lead spacings \leq 10 mm (B32560/B32561) the following measures are recommended:

- pre-heating to not more than 110 °C in the preheater phase
- rapid cooling after soldering



MKP

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2 Cleaning

To determine whether the following solvents, often used to remove flux residues and other substances, are suitable for the capacitors described, refer to the table below:

Туре	Ethanol, isopropanol, n-propanol	n-propanol-water mixtures, water with surface tension-reducing tensides (neutral)	Solvent from table A (see next page)	Solvent from table B (see next page)
MKT (uncoated)	Suitable	Unsuitable	In part suitable	Unsuitable
MKT, MKP, MFP (coated/boxed)		Suitable	Suitable	

Even when suitable solvents are used, a reversible change of the electrical characteristics may occur in uncoated capacitors immediately after they are washed. Thus it is always recommended to dry the components (e.g. 4 h at 70 $^{\circ}$ C) before they are subjected to subsequent electrical testing.

Table A

Manufacturers' designations for trifluoro-trichloro-ethane-based cleaning solvents (selection)

Trifluoro-trichloro- ethane	Mixtures of trifluoro-trichloro-ethane with ethanol and isopropanol	Manufacturer
Freon TF	Freon TE 35; Freon TP 35; Freon TES	Du Pont
Frigen 113 TR	Frigen 113 TR-E; Frigen 113 TR-P; Frigen TR-E 35	Hoechst
Arklone P	Arklone A; Arklone L; Arklone K	ICI
Kaltron 113 MDR	Kaltron 113 MDA; Kaltron 113 MDI; Kaltron 113 MDI 35	Kali-Chemie
Flugene 113	Flugene 113 E; Flugene 113 IPA	Rhone-Progil

Table B (worldwide banned substances)

Manufacturers' designations for unsuitable cleaning solvents (selection)

Mixtures of chlorinated hydrocarbons and ketones with fluorated hydrocarbons	Manufacturer
Freon TMC; Freon TA; Freon TC	Du Pont
Arklone E	ICI
Kaltron 113 MDD; Kaltron 113 MDK	Kali-Chemie
Flugene 113 CM	Rhone-Progil



3 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: non-flexible epoxy resins with acid-anhydride hardeners; chemically inert, non-conducting fillers; maximum curing temperature of 100 $^{\circ}$ C.

Caution:

Consult us first if you wish to embed uncoated types!



MKF

High pulse (stacked)

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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 PTH hole spacing differs from the specified lead spacing.
- 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.

The table below summarizes the safety instructions that must always be observed. A detailed description can be found in the relevant sections of the chapters "General technical information" and "Mounting guidelines".

Торіс	Safety information	Reference chapter "General technical information"
Storage conditions	Make sure that capacitors are stored within the specified range of time, temperature and humidity conditions.	4.5 "Storage conditions"
Flammability	Avoid external energy, such as fire or electricity (passive flammability), avoid overload of the capacitors (active flammability) and consider the flammability of materials.	5.3 "Flammability"
Resistance to vibration	Do not exceed the tested ability to withstand vibration. The capacitors are tested to IEC 60068-2-6. 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".	5.2 "Resistance to vibration"



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Торіс	Safety information	Reference chapter "Mounting guidelines"
Soldering	Do not exceed the specified time or temperature limits during soldering.	1 "Soldering"
Cleaning	Use only suitable solvents for cleaning capacitors.	2 "Cleaning"
Embedding of capacitors in finished assemblies	When embedding finished circuit assemblies in plastic resins, chemical and thermal influences must be taken into account. Caution: Consult us first, if you also wish to embed other uncoated component types!	3 "Embedding of capacitors in finished assemblies"



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Symbols and terms

Symbol	English	German
α	Heat transfer coefficient	Wärmeübergangszahl
α_{c}	Temperature coefficient of capacitance	Temperaturkoeffizient der Kapazität
A	Capacitor surface area	Kondensatoroberfläche
β _c	Humidity coefficient of capacitance	Feuchtekoeffizient der Kapazität
С	Capacitance	Kapazität
C _R	Rated capacitance	Nennkapazität
ΔC	Absolute capacitance change	Absolute Kapazitätsänderung
$\Delta C/C$	Relative capacitance change (relative	Relative Kapazitätsänderung (relative
	deviation of actual value)	Abweichung vom Ist-Wert)
$\Delta C/C_R$	Capacitance tolerance (relative deviation	Kapazitätstoleranz (relative Abweichung
	from rated capacitance)	vom Nennwert)
dt	Time differential	Differentielle Zeit
Δt	Time interval	Zeitintervall
ΔT	Absolute temperature change	Absolute Temperaturänderung
	(self-heating)	(Selbsterwärmung)
∆tan δ	Absolute change of dissipation factor	Absolute Änderung des Verlustfaktors
ΔV	Absolute voltage change	Absolute Spannungsänderung
dV/dt	Time differential of voltage function (rate	Differentielle Spannungsänderung
	of voltage rise)	(Spannungsflankensteilheit)
$\Delta V / \Delta t$	Voltage change per time interval	Spannungsänderung pro Zeitintervall
E	Activation energy for diffusion	Aktivierungsenergie zur Diffusion
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatz-Serienwiderstand
f	Frequency	Frequenz
f ₁	Frequency limit for reducing permissible	Grenzfrequenz für thermisch bedingte
	AC voltage due to thermal limits	Reduzierung der zulässigen
		Wechselspannung
f ₂	Frequency limit for reducing permissible	Grenzfrequenz für strombedingte
	AC voltage due to current limit	Reduzierung der zulässigen
		Wechselspannung
f _r	Resonant frequency	Resonanzfrequenz
F _D	Thermal acceleration factor for diffusion	Therm. Beschleunigungsfaktor zur Diffusion
F⊤	Derating factor	Deratingfaktor
i	Current (peak)	Stromspitze
I _c	Category current (max. continuous	Kategoriestrom (max. Dauerstrom)
U U	current)	



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Symbol	English	German
I _{RMS}	(Sinusoidal) alternating current,	(Sinusförmiger) Wechselstrom
	root-mean-square value	
i _z	Capacitance drift	Inkonstanz der Kapazität
k _o	Pulse characteristic	Impulskennwert
Ls	Series inductance	Serieninduktivität
λ	Failure rate	Ausfallrate
λο	Constant failure rate during useful	Konstante Ausfallrate in der
	service life	Nutzungsphase
λ_{test}	Failure rate, determined by tests	Experimentell ermittelte Ausfallrate
P_{diss}	Dissipated power	Abgegebene Verlustleistung
P_{gen}	Generated power	Erzeugte Verlustleistung
Q	Heat energy	Wärmeenergie
ρ	Density of water vapor in air	Dichte von Wasserdampf in Luft
R	Universal molar constant for gases	Allg. Molarkonstante für Gas
R	Ohmic resistance of discharge circuit	Ohmscher Widerstand des
		Entladekreises
Ri	Internal resistance	Innenwiderstand
R _{ins}	Insulation resistance	Isolationswiderstand
R _P	Parallel resistance	Parallelwiderstand
Rs	Series resistance	Serienwiderstand
S	severity (humidity test)	Schärfegrad (Feuchtetest)
t	Time	Zeit
Т	Temperature	Temperatur
τ	Time constant	Zeitkonstante
tan δ	Dissipation factor	Verlustfaktor
$tan \delta_{\scriptscriptstyle D}$	Dielectric component of dissipation factor	Dielektrischer Anteil des Verlustfaktors
tan δ _P	Parallel component of dissipation factor	Parallelanteil des Verlfustfaktors
tan δ_s	Series component of dissipation factor	Serienanteil des Verlustfaktors
T _A	Ambient temperature	Umgebungstemperatur
T _{max}	Upper category temperature	Obere Kategorietemperatur
T _{min}	Lower category temperature	Untere Kategorietemperatur
toL	Operating life at operating temperature	Betriebszeit bei Betriebstemperatur und
	and voltage	-spannung
Top	Operating temperature	Beriebstemperatur
T _B	Rated temperature	Nenntemperatur
T _{ref}	Reference temperature	Referenztemperatur
t _{SL}	Reference service life	Referenz-Lebensdauer
V _{AC}	AC voltage	Wechselspannung



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Symbol	English	German
Vc	Category voltage	Kategoriespannung
V _{C,RMS}	Category AC voltage	(Sinusförmige)
		Kategorie-Wechselspannung
V_{CD}	Corona-discharge onset voltage	Teilentlade-Einsatzspannung
V_{ch}	Charging voltage	Ladespannung
V _{DC}	DC voltage	Gleichspannung
V_{FB}	Fly-back capacitor voltage	Spannung (Flyback)
Vi	Input voltage	Eingangsspannung
Vo	Output voltage	Ausgangssspannung
V _{op}	Operating voltage	Betriebsspannung
V _p	Peak pulse voltage	Impuls-Spitzenspannung
V_{pp}	Peak-to-peak voltage Impedance	Spannungshub
V _R	Rated voltage	Nennspannung
ν̂ _R	Amplitude of rated AC voltage	Amplitude der Nenn-Wechselspannung
V _{RMS}	(Sinusoidal) alternating voltage,	(Sinusförmige) Wechselspannung
	root-mean-square value	
V _{SC}	S-correction voltage	Spannung bei Anwendung "S-correction"
V_{sn}	Snubber capacitor voltage	Spannung bei Anwendung
		"Beschaltung"
Z	Impedance	Scheinwiderstand
е	Lead spacing	Rastermaß

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