



Aluminum electrolytic capacitors

Snap-in capacitors

Series/Type: B43641

Date: December 2016

© EPCOS AG 2016. Reproduction, publication and dissemination of this publication, enclosures hereto and the information contained therein without EPCOS' prior express consent is prohibited.

EPCOS AG is a TDK Group Company.

Long-life grade capacitors

Applications

- Power supplies
- Frequency converters
- Uninterruptible power supplies
- Medical appliances
- Solar inverters

Features

- Extremely high CV product, ultra compact
- High reliability
- High ripple current capability
- Capacitors pass the needle flame test according to IEC 60695-11-5 for all flame exposure times up to 120 s
- RoHS-compatible

Construction

- Charge/discharge-proof, polar
- Aluminum case, insulated with PET sleeve without insulation sheet at the can bottom
- 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 base

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	400 ... 450 V DC							
Surge voltage V_S	$1.10 \cdot V_R$							
Rated capacitance C_R	120 ... 1200 μF							
Capacitance tolerance	$\pm 20\% \triangleq M$							
Dissipation factor $\tan \delta$ (20 °C, 120 Hz)	$\tan \delta \leq 0.20$							
Leakage current I_{leak} (5 min, 20 °C)	$I_{\text{leak}} \leq 0.3 \mu\text{A} \cdot \left(\frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right)^{0.7} + 4 \mu\text{A}$							
Self-inductance ESL	Approx. 20 nH							
Useful life ¹⁾ 105 °C; V_R ; $I_{\text{AC,R}}$	> 2000 h	Requirements: $ \Delta C/C \leq 20\%$ of initial value $\tan \delta \leq 2$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit						
Voltage endurance test 105 °C; V_R	2000 h	Post test requirements: $ \Delta C/C \leq 10\%$ of initial value $\tan \delta \leq 1.3$ times initial specified limit $I_{\text{leak}} \leq$ initial specified limit						
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 55 Hz, displacement amplitude 0.35 mm, acceleration max. 5 g, duration 3×2 h. Capacitor mounted by its body which is rigidly clamped to the work surface.							
Characteristics at low temperature	Max. impedance ratio at 100 Hz <table border="1" data-bbox="734 1388 1165 1534"> <tr> <td>V_R</td> <td>400 ... 450 V</td> </tr> <tr> <td>$Z_{-25^\circ\text{C}} / Z_{20^\circ\text{C}}$</td> <td>5</td> </tr> <tr> <td>$Z_{-40^\circ\text{C}} / Z_{20^\circ\text{C}}$</td> <td>14</td> </tr> </table>	V_R	400 ... 450 V	$Z_{-25^\circ\text{C}} / Z_{20^\circ\text{C}}$	5	$Z_{-40^\circ\text{C}} / Z_{20^\circ\text{C}}$	14	
V_R	400 ... 450 V							
$Z_{-25^\circ\text{C}} / Z_{20^\circ\text{C}}$	5							
$Z_{-40^\circ\text{C}} / Z_{20^\circ\text{C}}$	14							
IEC climatic category	To IEC 60068-1: 25/105/56 (–25 °C/+105 °C/56 days damp heat test) The capacitors can be operated in the temperature range of –40 °C to +105 °C but the impedance at –40 °C must be taken into consideration.							
Detail specification	Similar to CECC 30301-809							
Sectional specification	IEC 60384-4							

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.

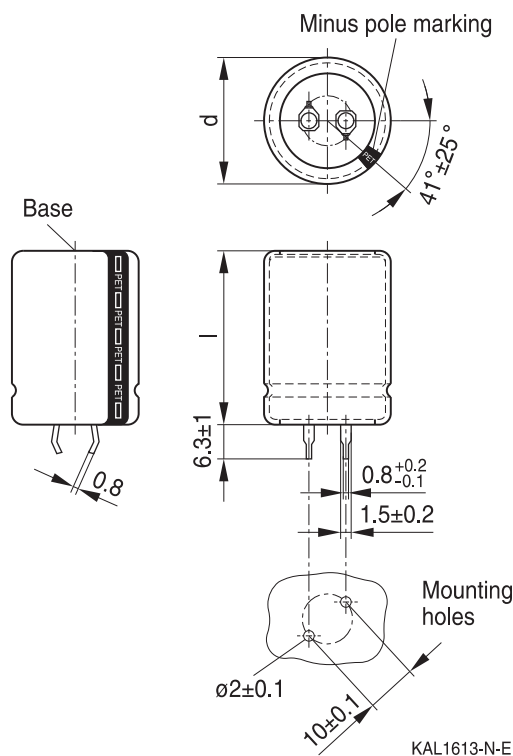


B43641

Ultra compact – 105 °C

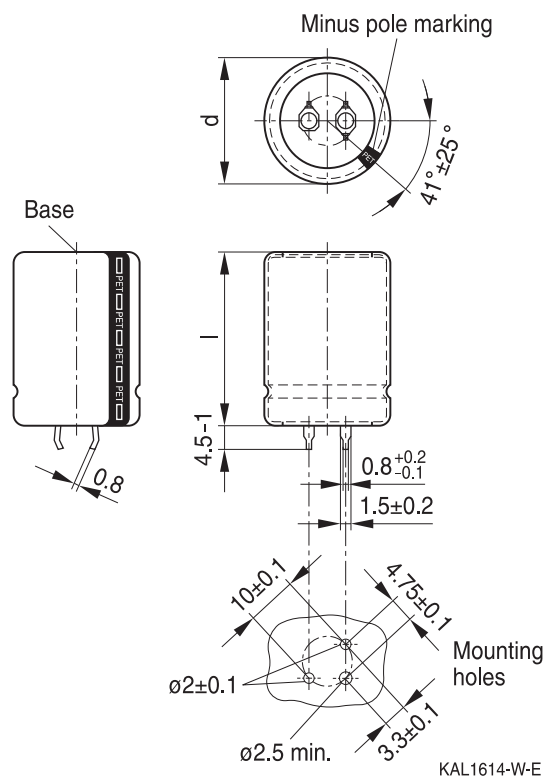
Dimensional drawings

Snap-in capacitors with PET insulation sleeve



Snap-in terminals, length (6.3 ± 1) mm. Also available in a shorter version with a length of ($4.5 - 1$) mm. Insulation is marked with "PET" on the sleeve. Safety vent on the base.

Dimensions (mm)		Approx. weight (g)	Packing units (pcs.)
d +1	l ±2		
22	25	9	160
22	30	12	160
22	35	15	160
22	40	18	160
22	45	20	160
22	50	24	160
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). Insulation is marked with "PET" on the sleeve. Safety vent on the base.

Dimensions (mm)		Approx. weight (g)	Packing units (pcs.)
d +1	l ±2		
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
Dimensions (mm)		Approx. weight (g)	Packing units (pcs.)
d +1	l +2.5/-2.0		
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.

Ordering codes for terminal styles and insulation features

Identification in 3rd block of ordering code

Snap-in capacitors

Terminal version	Insulation
	PET sleeve
Standard terminals 6.3 mm	M050
Short terminals 4.5 mm	M057
3 terminals 4.5 mm	M052

Ordering examples:

- B43641A9157M057 } snap-in capacitor with short terminals and PET sleeve
- B43641A9157M052 } snap-in capacitor with 3 terminals and PET sleeve



B43641

Ultra compact – 105 °C

Overview of available types

The capacitance and voltage ratings listed below are available in different case sizes upon request. Other voltage and capacitance ratings are also available upon request.

V_R (V DC)	400	420	450
	Case dimensions $d \times l$ (mm)		
C_R (μ F)			
120		22 × 25	22 × 25
150	22 × 25	22 × 30	22 × 30 25 × 25
180	22 × 30 25 × 25	22 × 35 25 × 25	22 × 35 25 × 30
220	22 × 35 25 × 30	22 × 40 25 × 30	22 × 40 25 × 35 30 × 25
270	22 × 40 25 × 30 30 × 25	22 × 45 25 × 35 30 × 25	22 × 50 25 × 40 30 × 30
330	22 × 45 25 × 35 30 × 30	22 × 50 25 × 40 30 × 30 35 × 25	25 × 45 30 × 35 35 × 25
390	25 × 40 30 × 30 35 × 25	25 × 45 30 × 35 35 × 30	25 × 50 30 × 35 35 × 30
470	25 × 50 30 × 35 35 × 30	25 × 55 30 × 40 35 × 30	30 × 45 35 × 35
560	25 × 55 30 × 40 35 × 30	30 × 45 35 × 35	30 × 50 35 × 40
680	30 × 45 35 × 35	30 × 55 35 × 40	30 × 55 35 × 45
820	30 × 55 35 × 40	35 × 45	35 × 50
1000	35 × 50	35 × 55	
1200	35 × 55		


Technical data and ordering codes

C_R 100 Hz 20 °C μF	Case dimensions $d \times l$ mm	ESR_{typ} 100 Hz 20 °C m Ω	ESR_{typ} 300 Hz 60 °C m Ω	Z_{max} 10 kHz 20 °C m Ω	$I_{\text{AC,max}}$ 100 Hz 60 °C A	$I_{\text{AC,max}}$ 100 Hz 85 °C A	$I_{\text{AC,R}}$ 100 Hz 105 °C A	Ordering code (composition see below)
$V_R = 400 \text{ V DC}$								
150	22 × 25	620	170	900	2.07	1.59	0.86	B43641A9157M05#
180	22 × 30	520	140	750	2.39	1.84	0.99	B43641A9187M05#
180	25 × 25	520	150	760	2.27	1.75	0.95	B43641B9187M05#
220	22 × 35	420	120	620	2.82	2.17	1.17	B43641A9227M05#
220	25 × 30	430	120	620	2.66	2.05	1.11	B43641B9227M05#
270	22 × 40	350	95	500	3.35	2.58	1.39	B43641A9277M05#
270	25 × 30	350	100	520	3.12	2.40	1.29	B43641B9277M05#
270	30 × 25	360	120	540	2.87	2.21	1.20	B43641C9277M05#
330	22 × 45	280	80	410	3.98	3.05	1.65	B43641A9337M05#
330	25 × 35	290	85	420	3.68	2.82	1.52	B43641B9337M05#
330	30 × 30	300	95	440	3.37	2.59	1.41	B43641C9337M05#
390	25 × 40	240	75	360	4.23	3.25	1.75	B43641A9397M05#
390	30 × 30	260	85	380	3.78	2.90	1.57	B43641B9397M05#
390	35 × 25	270	100	410	3.45	2.65	1.44	B43641C9397M05#
470	25 × 50	200	60	300	4.99	3.83	2.07	B43641A9477M05#
470	30 × 35	210	70	320	4.39	3.37	1.82	B43641B9477M05#
470	35 × 30	220	80	330	4.02	3.08	1.54	B43641C9477M05#
560	25 × 55	170	50	250	5.79	4.44	2.40	B43641A9567M05#
560	30 × 40	180	60	270	5.06	3.87	1.93	B43641B9567M05#
560	35 × 30	200	80	300	4.42	3.38	1.69	B43641C9567M05#
680	30 × 45	150	50	220	5.92	4.52	2.26	B43641A9687M05#
680	35 × 35	160	65	240	5.16	3.94	1.97	B43641B9687M05#
820	30 × 55	120	40	180	6.98	5.34	2.67	B43641A9827M05#
820	35 × 40	130	55	200	5.97	4.56	2.28	B43641B9827M05#
1000	35 × 50	110	40	170	7.15	5.47	2.74	B43641A9108M05#
1200	35 × 55	90	38	140	8.21	6.27	3.13	B43641A9128M05#

Composition of ordering code

= Terminal style

0 = snap-in standard terminals (6.3 mm)

2 = snap-in 3 terminals (4.5 mm)

7 = snap-in short terminals (4.5 mm)



B43641

Ultra compact – 105 °C

Technical data and ordering codes

C_R 100 Hz 20 °C μF	Case dimensions $d \times l$ mm	ESR_{typ} 100 Hz 20 °C $\text{m}\Omega$	ESR_{typ} 300 Hz 60 °C $\text{m}\Omega$	Z_{max} 10 kHz 20 °C $\text{m}\Omega$	$I_{\text{AC,max}}$ 100 Hz 60 °C A	$I_{\text{AC,max}}$ 100 Hz 85 °C A	$I_{\text{AC,R}}$ 100 Hz 105 °C A	Ordering code (composition see below)
$V_R = 420 \text{ V DC}$								
120	22 × 25	980	250	1510	1.67	1.26	0.74	B43641A0127M05#
150	22 × 30	780	200	1210	2.00	1.51	0.89	B43641A0157M05#
180	22 × 35	650	160	1000	2.33	1.76	1.04	B43641A0187M05#
180	25 × 25	660	180	1030	2.20	1.66	0.98	B43641B0187M05#
220	22 × 40	540	140	820	2.75	2.08	1.23	B43641A0227M05#
220	25 × 30	540	140	840	2.58	1.95	1.15	B43641B0227M05#
270	22 × 45	440	110	670	3.28	2.47	1.46	B43641A0277M05#
270	25 × 35	440	120	680	3.05	2.30	1.36	B43641B0277M05#
270	30 × 25	460	140	710	2.79	2.10	1.24	B43641C0277M05#
330	22 × 50	360	90	550	3.89	2.93	1.73	B43641A0337M05#
330	25 × 40	360	95	560	3.60	2.71	1.60	B43641B0337M05#
330	30 × 30	370	110	580	3.27	2.46	1.46	B43641C0337M05#
330	35 × 25	390	120	610	3.06	2.31	1.36	B43641D0337M05#
390	25 × 45	310	80	480	4.15	3.13	1.84	B43641A0397M05#
390	30 × 35	310	90	490	3.74	2.82	1.67	B43641B0397M05#
390	35 × 30	320	100	510	3.51	2.65	1.44	B43641C0397M05#
470	25 × 55	250	70	400	4.89	3.69	2.18	B43641A0477M05#
470	30 × 40	260	75	410	4.35	3.28	1.78	B43641B0477M05#
470	35 × 30	280	95	440	3.92	2.95	1.60	B43641C0477M05#
560	30 × 45	220	65	350	5.02	3.79	2.06	B43641A0567M05#
560	35 × 35	230	75	370	4.50	3.39	1.84	B43641B0567M05#
680	30 × 55	180	50	280	5.95	4.49	2.44	B43641A0687M05#
680	35 × 40	190	65	300	5.23	3.94	2.14	B43641B0687M05#
820	35 × 45	160	55	260	6.05	4.56	2.47	B43641A0827M05#
1000	35 × 55	130	45	210	7.20	5.42	2.95	B43641A0108M05#

Composition of ordering code

- # = Terminal style
 - 0 = snap-in standard terminals (6.3 mm)
 - 2 = snap-in 3 terminals (4.5 mm)
 - 7 = snap-in short terminals (4.5 mm)


Technical data and ordering codes

C_R 100 Hz 20 °C μF	Case dimensions $d \times l$ mm	ESR_{typ} 100 Hz 20 °C m Ω	ESR_{typ} 300 Hz 60 °C m Ω	Z_{max} 10 kHz 20 °C m Ω	$I_{\text{AC,max}}$ 100 Hz 60 °C A	$I_{\text{AC,max}}$ 100 Hz 85 °C A	$I_{\text{AC,R}}$ 100 Hz 105 °C A	Ordering code (composition see below)
$V_R = 450 \text{ V DC}$								
120	22 × 25	910	240	1380	1.75	1.32	0.78	B43641A5127M05#
150	22 × 30	730	190	1110	2.09	1.57	0.93	B43641A5157M05#
150	25 × 25	740	200	1120	1.99	1.50	0.88	B43641B5157M05#
180	22 × 35	610	160	920	2.43	1.83	1.08	B43641A5187M05#
180	25 × 30	610	160	930	2.30	1.73	1.02	B43641B5187M05#
220	22 × 40	500	130	760	2.88	2.17	1.28	B43641A5227M05#
220	25 × 35	500	130	760	2.70	2.04	1.21	B43641B5227M05#
220	30 × 25	520	150	790	2.51	1.89	1.12	B43641C5227M05#
270	22 × 50	400	100	620	3.44	2.60	1.53	B43641A5277M05#
270	25 × 40	410	110	620	3.20	2.41	1.43	B43641B5277M05#
270	30 × 30	420	120	640	2.94	2.22	1.31	B43641C5277M05#
330	25 × 45	340	90	510	3.79	2.86	1.69	B43641A5337M05#
330	30 × 35	340	95	530	3.45	2.60	1.54	B43641B5337M05#
330	35 × 25	360	120	570	3.14	2.37	1.40	B43641C5337M05#
390	25 × 50	280	75	440	4.37	3.29	1.94	B43641A5397M05#
390	30 × 35	290	90	450	3.90	2.94	1.73	B43641B5397M05#
390	35 × 30	300	100	470	3.61	2.72	1.48	B43641C5397M05#
470	30 × 45	240	70	370	4.59	3.47	1.89	B43641A5477M05#
470	35 × 35	250	80	390	4.18	3.15	1.71	B43641B5477M05#
560	30 × 50	200	60	320	5.30	3.99	2.17	B43641A5567M05#
560	35 × 40	210	70	330	4.79	3.62	1.97	B43641B5567M05#
680	30 × 55	170	50	260	6.22	4.68	2.54	B43641A5687M05#
680	35 × 45	180	60	270	5.56	4.19	2.28	B43641B5687M05#
820	35 × 50	150	50	230	6.43	4.84	2.63	B43641A5827M05#

Composition of ordering code

= Terminal style

0 = snap-in standard terminals (6.3 mm)

2 = snap-in 3 terminals (4.5 mm)

7 = snap-in short terminals (4.5 mm)



B43641

Ultra compact – 105 °C

Useful life¹⁾

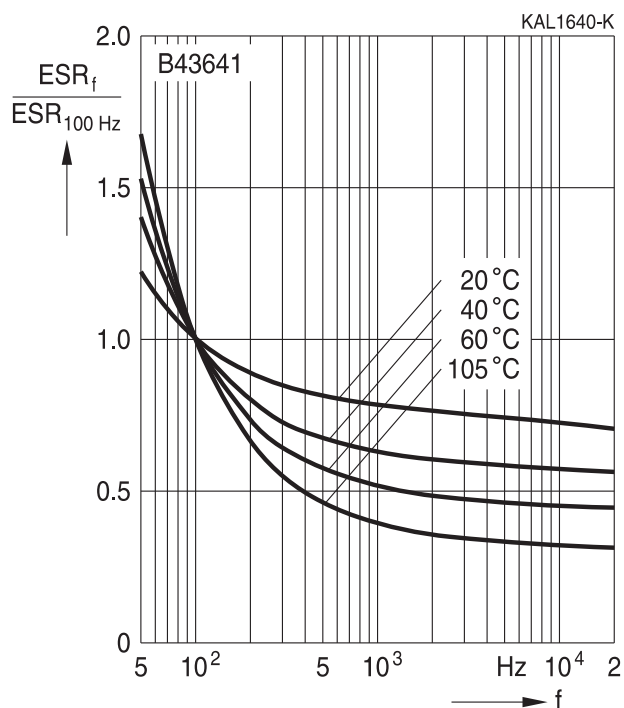
For useful life calculations, please use our web-based "AlCap Useful Life Calculation Tool", which can be found on the Internet under the following link:

http://www.epcos.com/designtools/alu_useful_life/Useful_life.swf

The AlCap Useful Life Calculation Tool provides calculations of useful life as well as additional data for selected capacitor types under operating conditions defined by the user.

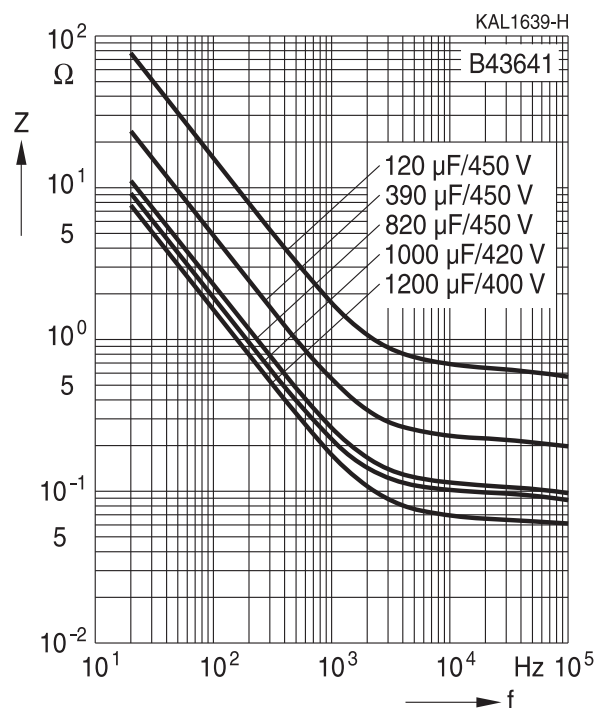
Frequency characteristics of ESR

Typical behavior



Impedance Z versus frequency f

Typical behavior at 20 °C



1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



Cautions and warnings

Personal safety

The electrolytes used by EPCOS have been optimized both with a view to the intended application and 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, some of the high-voltage electrolytes used by EPCOS are self-extinguishing.

As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes, although in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. We do, however, restrict the amount of dangerous materials used in our products to an absolute minimum.

Materials and chemicals used in EPCOS aluminum electrolytic capacitors are continuously adapted in compliance with the EPCOS Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on the EPCOS website for all types listed in the data book. MDS for customer specific capacitors are available upon request.

MSDS (Material Safety Data Sheets) are available for all of our electrolytes upon request.

Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas 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 inhaling 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.



B43641

Ultra compact – 105 °C

Product safety

The table below summarizes 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 of opposite polarity should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Mounting position of screw-terminal capacitors	Screw terminal capacitors must not be mounted with terminals facing down unless otherwise specified.	11.1. "Mounting positions of capacitors with screw terminals"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2.5 Nm M6: 4.0 Nm	11.3 "Mounting torques"
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"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Upper category temperature	Do not exceed the upper category temperature.	7.2 "Maximum permissible operating temperature"
Passive flammability	Avoid external energy, e.g. fire.	8.1 "Passive flammability"



Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the capacitors. Do not apply excessive mechanical stress to the capacitor terminals when mounting.	10 "Maintenance"
Storage	Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%.	7.3 "Shelf life and storage conditions"
		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"

Display of ordering codes for EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.

Detailed information can be found on the Internet under www.epcos.com/orderingcodes.



B43641

Ultra compact – 105 °C

Symbols and terms

Symbol	English	German
C	Capacitance	Kapazität
C_R	Rated capacitance	Nennkapazität
C_S	Series capacitance	Serienkapazität
$C_{S,T}$	Series capacitance at temperature T	Serienkapazität bei Temperatur T
C_f	Capacitance at frequency f	Kapazität bei Frequenz f
d	Case diameter, nominal dimension	Gehäusedurchmesser, Nennmaß
d_{max}	Maximum case diameter	Maximaler Gehäusedurchmesser
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatzserienwiderstand
ESR_f	Equivalent series resistance at frequency f	Ersatzserienwiderstand bei Frequenz f
ESR_T	Equivalent series resistance at temperature T	Ersatzserienwiderstand bei Temperatur T
f	Frequency	Frequenz
I	Current	Strom
I_{AC}	Alternating current (ripple current)	Wechselstrom
$I_{AC,RMS}$	Root-mean-square value of alternating current	Wechselstrom, Effektivwert
$I_{AC,f}$	Ripple current at frequency f	Wechselstrom bei Frequenz f
$I_{AC,max}$	Maximum permissible ripple current	Maximal zulässiger Wechselstrom
$I_{AC,R}$	Rated ripple current	Nennwechselstrom
I_{leak}	Leakage current	Reststrom
$I_{leak,op}$	Operating leakage current	Betriebsreststrom
l	Case length, nominal dimension	Gehäuselänge, Nennmaß
l_{max}	Maximum case length (without terminals and mounting stud)	Maximale Gehäuselänge (ohne Anschlüsse und Gewindebolzen)
R	Resistance	Widerstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_{symm}	Balancing resistance	Symmetrierwiderstand
T	Temperature	Temperatur
ΔT	Temperature difference	Temperaturdifferenz
T_A	Ambient temperature	Umgebungstemperatur
T_C	Case temperature	Gehäusetemperatur
T_B	Capacitor base temperature	Temperatur des Gehäusebodens
t	Time	Zeit
Δt	Period	Zeitraum
t_b	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



Symbol	English	German
V	Voltage	Spannung
V _F	Forming voltage	Formierspannung
V _{op}	Operating voltage	Betriebsspannung
V _R	Rated voltage, DC voltage	Nennspannung, Gleichspannung
V _S	Surge voltage	Spitzenspannung
X _C	Capacitive reactance	Kapazitiver Blindwiderstand
X _L	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
Z _T	Impedance at temperature T	Scheinwiderstand bei Temperatur T
tan δ	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ε ₀	Absolute permittivity	Elektrische Feldkonstante
ε _r	Relative permittivity	Dielektrizitätszahl
ω	Angular velocity; 2 · π · f	Kreisfrequenz; 2 · π · f

Note

All dimensions are given in mm.

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.**
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. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.

Important notes

7. The trade names EPCOS, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.