



Aluminum electrolytic capacitors

Capacitors with screw terminals

Series/Type: B41456, B41458

Date: November 2008

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Long-life grade capacitors

Applications

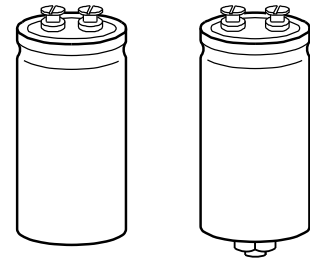
- General industrial electronics
- For switch-mode power supplies in professional equipment

Features

- High ripple current capability
- Compact design
- High reliability
- All-welded construction ensures reliable electrical contact
- Version with low-inductance design available
- RoHS-compatible

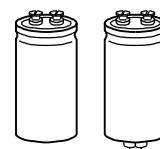
Construction

- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Poles with screw terminal connections
- Mounting with ring clips, clamps or threaded stud
- The bases of types with threaded stud are not insulated



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B41458

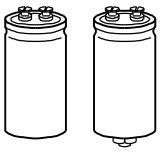

Specifications and characteristics in brief

Rated voltage V_R	16 ... 100 V DC	
Surge voltage V_S	$1.15 \cdot V_R$	
Rated capacitance C_R	2200 ... 680000 μF	
Capacitance tolerance	$\pm 20\% \triangleq M$	
Leakage current I_{leak} (20 °C, 5 min)	$I_{\text{leak}} \leq 0.3 \mu\text{A} \cdot \left(\frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{\text{V}} \right)^{0.7} + 4 \mu\text{A}$	
Self-inductance ESL	Approx. 20 nH Capacitors with low-inductance design: $d \geq 64.3 \text{ mm}$: approx. 13 nH	
Useful life 85 °C; V_R ; $I_{\text{AC,R}}$ 40 °C; V_R ; $2.9 \cdot I_{\text{AC,R}}$	> 12000 h > 200000 h	Requirements: $\Delta C/C \leq \pm 45\%$ of initial value ESR ≤ 3 times initial specified limit $I_{\text{leak}} \leq$ initial specified limit
Voltage endurance test 85 °C; V_R	2000 h	Post test requirements: $\Delta C/C \leq \pm 15\%$ of initial value ESR ≤ 1.3 times initial specified limit $I_{\text{leak}} \leq$ initial specified limit
Vibration resistance test	To IEC 60068-2-6, test Fc: Displacement amplitude 0.75 mm, frequency range 10 ... 55 Hz, acceleration max. 10 g, duration 3×2 h. Capacitor mounted by its body which is rigidly clamped to the work surface.	
IEC climatic category	To IEC 60068-1: 40/085/56 (–40 °C/+85 °C/56 days damp heat test)	
Detail specification	Similar to CECC 30301-810	
Sectional specification	IEC 60384-4	

Ripple current capability

Due to the ripple current capability of the contact elements, the following current upper limits must not be exceeded:

Capacitor diameter	$\leq 51.6 \text{ mm}$	64.3 mm	76.9 mm
$I_{\text{AC,max}}$	34 A	45 A	57 A



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Compact – 85 °C

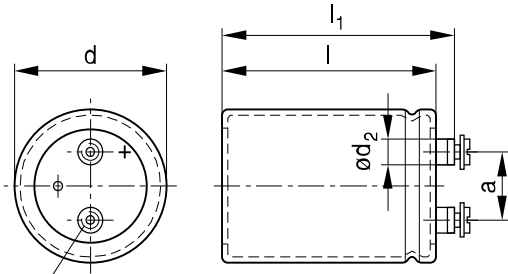
Dimensional drawings

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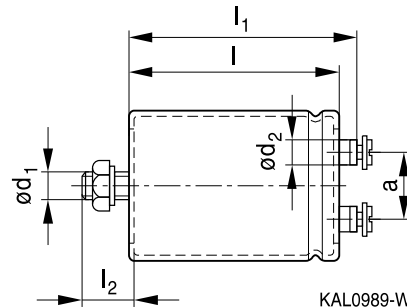
Ring clip/clamp mounting

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Threaded stud mounting



KAL0988-N-E



KAL0989-W

M5: Min. reach of screw = 8 mm
M6: Min. reach of screw = 12 mm^{*)}

^{*)} 9.5 mm for low-inductance design

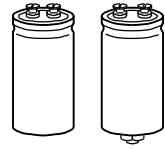
Positive pole marking: +

Screw terminals with UNF threads are available upon request.

Dimensions and weights

Ter- minal	Dimensions (mm) with insulating sleeve							Approx. weight (g)
	d	$l \pm 1$	$l_1 \pm 1$	$l_2 +0/-1$	d_1	$d_2 \text{ max.}$	$a +0.2/-0.4$	
M5	35.7 +0/-0.8	55.7	62.2	13	M8	8.2	12.7	65
M5	35.7 +0/-0.8	80.7	87.2	13	M8	8.2	12.7	105
M5	35.7 +0/-0.8	105.7	112.2	13	M8	8.2	12.7	135
M5	51.6 +0/-0.8	80.7	87.2	17	M12	10.2	22.2	220
M5	51.6 +0/-0.8	105.7	112.2	17	M12	10.2	22.2	280
M5	64.3 +0/-0.8	105.7	112.2	17	M12	13.2	28.5	440
M6	76.9 +0/-0.7	105.7	111.5	17	M12	17.7	31.7	620
M6	76.9 +0/-0.7	143.2	149.0	17	M12	17.7	31.7	840
M6	76.9 +0/-0.7	220.7	226.5	17	M12	17.7	31.7	1300

Dimensions are also valid for low-inductance design.



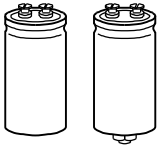
Packing

Capacitor diameter d (mm)	length l (mm)	Packing units (pcs.)
35.7	all	36
51.6	all	36
64.3	all	25

Capacitor diameter d (mm)	length l (mm)	Packing units (pcs.)
76.9	97.0 - 168.7	16
	191.0 - 220.7	12



For ecological reasons the packing is pure cardboard.



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Compact – 85 °C

Special design

- Low-inductance design

Design	Identification in 3rd block of ordering code	Remark
Low inductance (13 nH)	M003	For capacitors with diameter $d \geq 64.3$ mm

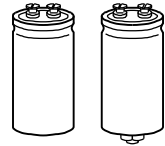
Accessories

The following items are included in the delivery package, but are not fastened to the capacitors:

	Thread	Toothed washers	Screws/nuts	Maximum torque
For terminals	M5	A 5.1 DIN 6797	Cylinder-head screw $M5 \times 8$ DIN 84-4.8	2 Nm
	M6	A 6.4 DIN 6797	Cylinder-head screw $M6 \times 12$ DIN 85-4.8	2.5 Nm
For mounting	M8	J 8.2 DIN 6797	Hex nut BM 8 DIN 439	4 Nm
	M12	J 12.5 DIN 6797	Hex nut BM 12 DIN 439	10 Nm

The following items must be ordered separately. For details, refer to chapter "Capacitors with screw terminals – Accessories".

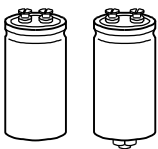
Item	Type
Ring clips	B44030
Clamps for capacitors with $d \geq 64.3$ mm	B44030
Insulating parts	B44020


Overview of available types

V_R (V DC)	16	25	40	63	100
	Case dimensions $d \times l$ (mm)				
C_R (μ F)					
2200					35.7 × 55.7
3300					35.7 × 80.7
4700				35.7 × 55.7	35.7 × 80.7
6800				35.7 × 55.7	35.7 × 105.7
10000			35.7 × 55.7	35.7 × 80.7	51.6 × 80.7
15000			35.7 × 80.7	35.7 × 105.7	51.6 × 105.7
22000	35.7 × 55.7	35.7 × 55.7	35.7 × 80.7	51.6 × 80.7	64.3 × 105.7
33000	35.7 × 55.7	35.7 × 80.7	35.7 × 105.7	51.6 × 105.7	76.9 × 105.7
47000	35.7 × 80.7	35.7 × 105.7	51.6 × 80.7	64.3 × 105.7	76.9 × 143.2
68000	35.7 × 105.7	51.6 × 80.7	51.6 × 105.7	76.9 × 105.7	
100000	51.6 × 80.7	51.6 × 105.7	64.3 × 105.7	76.9 × 143.2	
150000	51.6 × 80.7	64.3 × 105.7	76.9 × 105.7	76.9 × 220.7	
220000	64.3 × 105.7	64.3 × 105.7	76.9 × 143.2		
330000	64.3 × 105.7	76.9 × 143.2			
470000	76.9 × 143.2	76.9 × 220.7			
680000	76.9 × 143.2				

The capacitance and voltage ratings listed above are available in different cases upon request.

Other voltage and capacitance ratings are also available upon request.



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Compact – 85 °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 m Ω	ESR_{max} 100 Hz 20 °C m Ω	Z_{max} 10 kHz 20 °C m Ω	$I_{\text{AC,max}}$ 100 Hz 40 °C A	$I_{\text{AC,R}}$ 100 Hz 85 °C A	Ordering code (composition see below)
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$V_R = 16 \text{ V DC}$

22000	35.7 × 55.7	14	28	23	21	7.1	B4145*B4229M000
33000	35.7 × 55.7	11	21	17	24	8.3	B4145*B4339M000
47000	35.7 × 80.7	8.0	16	13	30	11	B4145*B4479M000
68000	35.7 × 105.7	6.5	13	10	30	13	B4145*B4689M000
100000	51.6 × 80.7	5.0	10	8.2	34	14	B4145*B4100M000
150000	51.6 × 80.7	4.2	8.4	6.8	34	15	B4145*B4150M000
220000	64.3 × 105.7	3.7	7.3	5.9	45	20	B4145*B4220M00#
330000	64.3 × 105.7	3.3	6.6	5.3	45	21	B4145*B4330M00#
470000	76.9 × 143.2	3.0	6.1	4.9	57	25	B4145*B4470M00#
680000	76.9 × 143.2	3.0	5.8	4.6	57	26	B4145*B4680M00#

$V_R = 25 \text{ V DC}$

22000	35.7 × 55.7	13	25	20	22	7.7	B4145*B5229M000
33000	35.7 × 80.7	10	19	15	29	10	B4145*B5339M000
47000	35.7 × 105.7	8.0	15	12	30	12	B4145*B5479M000
68000	51.6 × 80.7	6.0	12	9.3	34	13	B4145*B5689M000
100000	51.6 × 105.7	5.0	9.5	7.6	34	16	B4145*B5100M000
150000	64.3 × 105.7	4.0	8.0	6.4	45	20	B4145*B5150M00#
220000	64.3 × 105.7	3.5	7.0	5.6	45	21	B4145*B5220M00#
330000	76.9 × 143.2	3.2	6.4	5.1	57	25	B4145*B5330M00#
470000	76.9 × 220.7	3.0	4.0	4.8	57	31	B4145*B5470M00#

$V_R = 40 \text{ V DC}$

10000	35.7 × 55.7	19	37	34	18	6.3	B4145*B7109M000
15000	35.7 × 80.7	14	27	24	24	8.3	B4145*B7159M000
22000	35.7 × 80.7	10	20	18	28	9.6	B4145*B7229M000
33000	35.7 × 105.7	8.0	15	13	30	12	B4145*B7339M000
47000	51.6 × 80.7	6.0	12	10	34	13	B4145*B7479M000
68000	51.6 × 105.7	5.0	10	8.4	34	16	B4145*B7689M000
100000	64.3 × 105.7	4.1	8.2	7.0	45	19	B4145*B7100M00#
150000	76.9 × 105.7	3.0	5.5	6.0	57	21	B4145*B7150M00#
220000	76.9 × 143.2	3.0	5.0	5.4	57	25	B4145*B7220M00#

Composition of ordering code

* = Mounting style

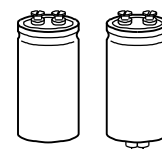
6 = for capacitors with ring clip/clamp mounting

8 = for capacitors with threaded stud

= Design

0 = for capacitors with standard inductance

3 = for capacitors with low inductance (13 nH) -
only capacitors with diameter $d \geq 64.3 \text{ mm}$


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_{max} 100 Hz 20 °C m Ω	Z_{max} 10 kHz 20 °C m Ω	$I_{\text{AC,max}}$ 100 Hz 40 °C A	$I_{\text{AC,R}}$ 100 Hz 85 °C A	Ordering code (composition see below)
$V_R = 63 \text{ V DC}$							
4700	35.7 × 55.7	30	60	58	14	4.9	B4145*B8478M000
6800	35.7 × 55.7	22	43	42	17	5.9	B4145*B8688M000
10000	35.7 × 80.7	16	31	30	23	7.7	B4145*B8109M000
15000	35.7 × 105.7	11	22	21	30	10	B4145*B8159M000
22000	51.6 × 80.7	8.0	16	16	33	11	B4145*B8229M000
33000	51.6 × 105.7	6.0	12	12	34	14	B4145*B8339M000
47000	64.3 × 105.7	5.0	10	9.4	45	18	B4145*B8479M00#
68000	76.9 × 105.7	3.0	5.0	6.5	57	20	B4145*B8689M00#
100000	76.9 × 143.2	3.0	4.0	6.0	57	25	B4145*B8100M00#
150000	76.9 × 220.7	3.0	4.0	5.0	57	31	B4145*B8150M00#
$V_R = 100 \text{ V DC}$							
2200	35.7 × 55.7	40	80	70	13	4.3	B4145*B9228M000
3300	35.7 × 80.7	28	55	48	17	5.8	B4145*B9338M000
4700	35.7 × 80.7	20	40	35	20	6.7	B4145*B9478M000
6800	35.7 × 105.7	15	29	25	25	8.7	B4145*B9688M000
10000	51.6 × 80.7	9.0	18	14	30	10	B4145*B9109M000
15000	51.6 × 105.7	8.0	15	12	34	13	B4145*B9159M000
22000	64.3 × 105.7	5.0	10	10	45	17	B4145*B9229M00#
33000	76.9 × 105.7	3.0	6.0	7.0	56	19	B4145*B9339M00#
47000	76.9 × 143.2	3.0	5.0	6.0	57	24	B4145*B9479M00#

Composition of ordering code

* = Mounting style

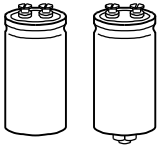
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only capacitors with diameter $d \geq 64.3 \text{ mm}$

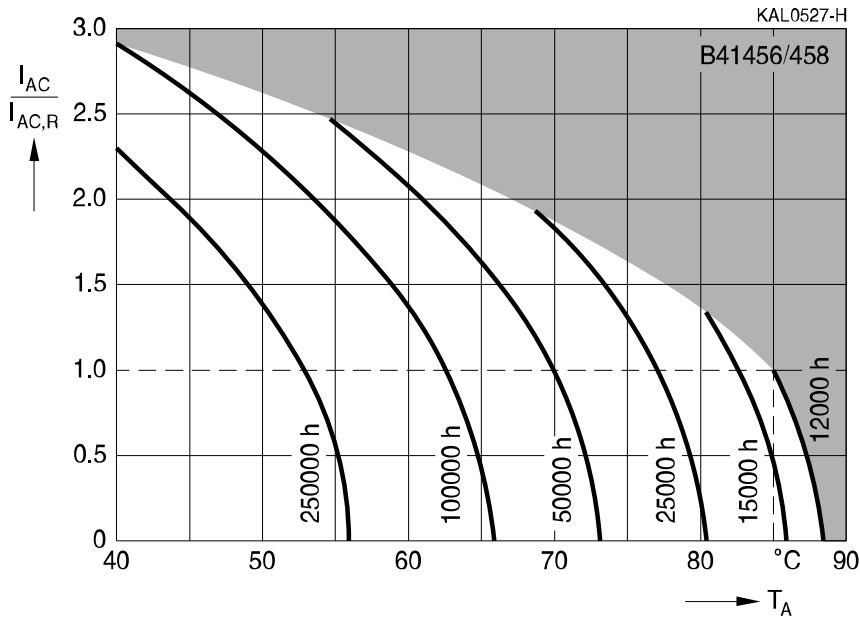


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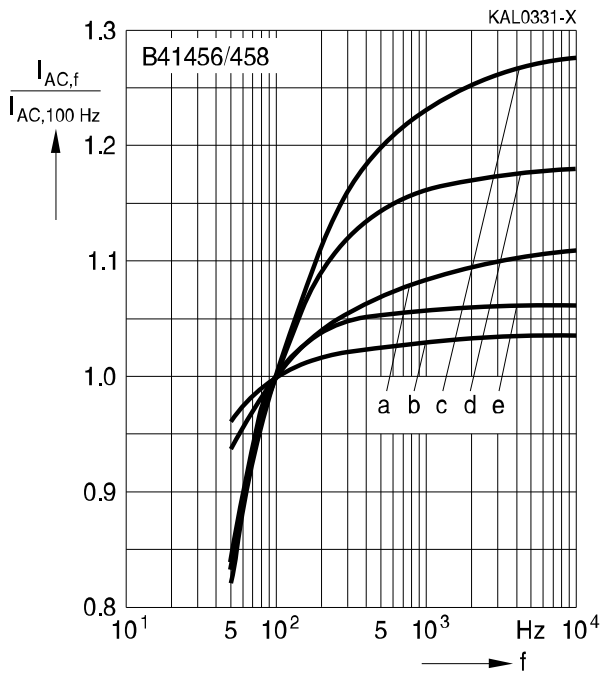
Compact – 85 °C

Useful life

depending on ambient temperature T_A under ripple current operating conditions¹⁾

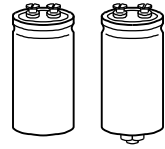


Frequency factor of permissible ripple current I_{AC} versus frequency f



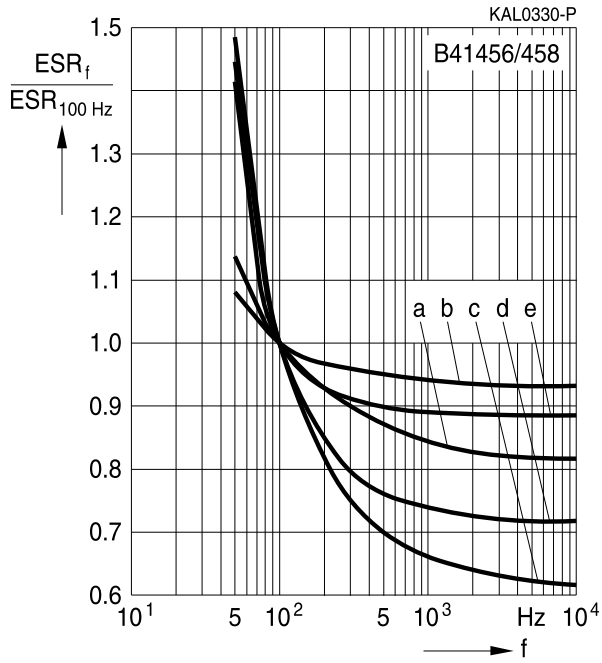
V_R (V DC)	≤ 63	100
$d = 35.7$ mm	a	c
$d = 51.6$ mm	a	d
$d = 64.3$ mm	a	d
$d = 76.9$ mm	b	e

1) Refer to chapter "General technical information, 5.3 Calculation of useful life" on how to interpret the useful life graphs.



Frequency characteristics of ESR

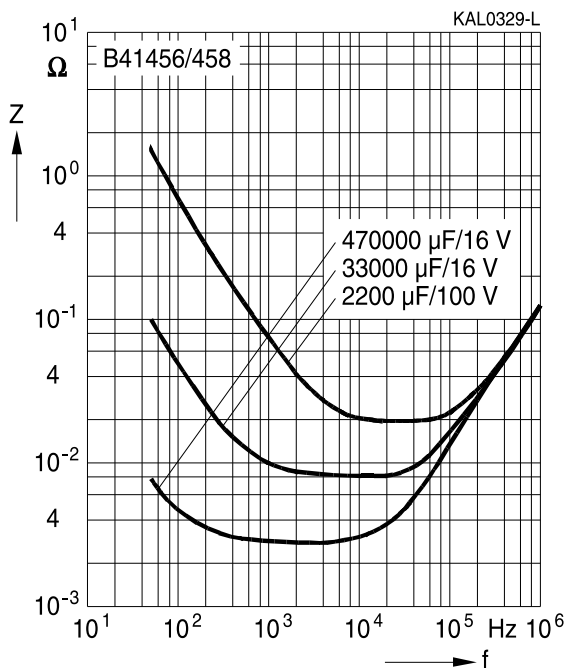
Typical behavior

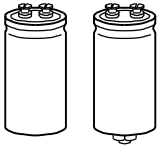


V_R (V DC)	≤ 63	100
$d = 35.7$ mm	a	c
$d = 51.6$ mm	a	d
$d = 64.3$ mm	a	d
$d = 76.9$ mm	b	e

Impedance Z versus frequency f

Typical behavior at 20 °C





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Compact – 85 °C

Cautions and warnings

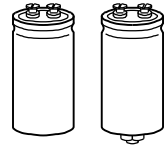
Personal safety

The electrolytes used by EPCOS have not only been optimized with a view to the intended application, but also 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, part of the high-voltage electrolytes used by EPCOS are self-extinguishing. They contain flame-retarding substances which will quickly extinguish any flame that may have been ignited.

As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no safe substitute materials are currently known. However, the amount of dangerous materials used in our products has been limited to an absolute minimum. Nevertheless, the following rules should be observed when handling Al electrolytic capacitors:

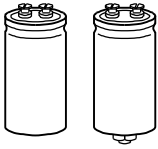
- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment.
- Avoid breathing in 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.



Product safety

The table below summarize the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

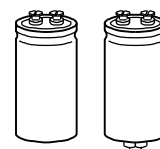
Topic	Safety information	Reference Chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages polarity classes should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Upper category temperature	Do not exceed the upper category temperatur.	7.2 "Maximum permissible operating temperature"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors. Do not apply any mechanical stress to the capacitor terminals.	10 "Maintenance"
Mounting position of screw terminal capacitors	Do not mount the capacitor with the terminals (safety vent) upside down.	11.1. "Mounting positions of capacitors with screw terminals"
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"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2 Nm M6: 2.5 Nm	11.3 "Mounting torques"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"



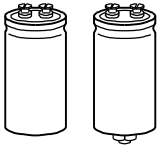
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Compact – 85 °C

Topic	Safety information	Reference Chapter "General technical information"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Passive flammability	Avoid external energy, such as fire or electricity.	8.1 "Passive flammability"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
		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"


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
$I_{AC,R} (B)$	Rated ripple current for base cooling	Nennwechselstromstrom für Bodenkühlung
I_{leak}	Leakage current	Ableitstrom
$I_{leak,op}$	Operating leakage current	Ableitstrom bei Betrieb
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 Becherbodens
t	Time	Zeit
Δt	Period	Zeitraum
t_b	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



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Compact – 85 °C

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

Notes

All dimensions are given in mm.

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