

# Aluminum electrolytic capacitors

## Capacitors with screw terminals

**Series/Type:** B41560, B41580

**Date:** November 2012

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### Long-life grade capacitors

#### Applications

- General industrial electronics
- Professional power supplies

#### Features

- High reliability, extremely good electrical characteristics
- High CV product, i.e. extremely compact
- High ripple current capability
- 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



B41560

B41580



### Specifications and characteristics in brief

Rated voltage $V_R$	25 ... 100 V DC	
Surge voltage $V_S$	$1.15 \cdot V_R$	
Rated capacitance $C_R$	1500 ... 330000 $\mu\text{F}$	
Capacitance tolerance	$\pm 20\% \triangle M$	
Leakage current $I_{\text{leak}}$ (20 °C, 5 min)	$I_{\text{leak}} \leq 0.018 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right)^{0.85} + 4 \mu\text{A}$	
Self-inductance ESL	Approx. 20 nH Capacitors with low-inductance design: $d \geq 64.3 \text{ mm}$ : approx. 13 nH	
Useful life <sup>1)</sup>		Requirements:
105 °C; $V_R$ ; $I_{\text{AC,R}}$	> 3000 h	$\Delta C/C \leq \pm 45\%$ of initial value
85 °C; $V_R$ ; $I_{\text{AC,max}}$	> 6000 h	ESR $\leq 3$ times initial specified limit
40 °C; $V_R$ ; $2.2 \cdot I_{\text{AC,R}}$	> 250000 h	$I_{\text{leak}} \leq$ initial specified limit
Voltage endurance test		Post test requirements:
105 °C; $V_R$	2000 h	$\Delta C/C \leq \pm 15\%$ of initial value
		ESR $\leq 1.3$ times initial specified limit
		$I_{\text{leak}} \leq$ initial specified limit
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 ... 55 Hz, displacement amplitude 0.75 mm, acceleration max. 10 g, duration $3 \times 2$ h. Capacitor mounted by its body which is rigidly clamped to the work surface.	
IEC climatic category	To IEC 60068-1: 40/105/56 (–40 °C/+105 °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

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



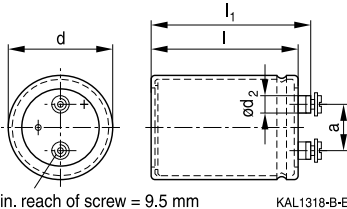
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### Dimensional drawings

#### B41560

Ring clip/clamp mounting



M5: Min. reach of screw = 9.5 mm  
9 mm for low inductance design  
M6: Min. reach of screw = 12 mm  
9.5 mm for low inductance design

#### B41580

Threaded stud mounting



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

For low-inductance design the following deviation applies:

$d = 64.3 \text{ mm}; l_1 -0.7 \text{ mm}$


**Packing**

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

Capacitor diameter d (mm)	length l (mm)	Packing units (pcs.)
64.3	all	25
76.9	all	16



For ecological reasons the packing is pure cardboard.



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### Special design

- Low-inductance design

Design	Identification in third 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	DIN 7985 / ISO 7045-M5 $\times$ 10-5.6-Z	2.5 Nm thread depth $t \geq 8$ mm
	M6	A 6.4 DIN 6797	DIN 7985 / ISO 7045-M6 $\times$ 12-5.6-Z	4.0 Nm thread depth $t \geq 9.5$ mm
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)	25	40	63	100
	Case dimensions d × l (mm)			
$C_R$ (μF)				
1500				35.7 × 55.7
2200				35.7 × 80.7
3300				35.7 × 80.7
4700			35.7 × 55.7	35.7 × 105.7
6800			35.7 × 80.7	51.6 × 80.7
10000		35.7 × 55.7	35.7 × 105.7	51.6 × 105.7
15000	35.7 × 55.7	35.7 × 80.7	51.6 × 80.7	64.3 × 105.7
22000	35.7 × 80.7	35.7 × 105.7	51.6 × 105.7	76.9 × 105.7
33000	35.7 × 80.7	51.6 × 80.7	64.3 × 105.7	76.9 × 143.2
47000	35.7 × 105.7	51.6 × 105.7	64.3 × 105.7	
68000	51.6 × 80.7	51.6 × 105.7	76.9 × 105.7	
100000	51.6 × 105.7	64.3 × 105.7	76.9 × 143.2	
150000	64.3 × 105.7	76.9 × 105.7		
220000	76.9 × 105.7	76.9 × 143.2		
330000	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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**Technical data and ordering codes**

$C_R$ 100 Hz 20 °C μF	Case dimensions $d \times l$ mm	$ESR_{typ}$ 100 Hz 20 °C mΩ	$ESR_{max}$ 100 Hz 20 °C mΩ	$Z_{max}$ 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 40 °C A	$I_{AC,max}$ 100 Hz 85 °C A	$I_{AC,R}$ 100 Hz 105 °C A	Ordering code (composition see below)
<b><math>V_R = 25</math> V DC</b>								
15000	35.7 × 55.7	21	42	31	18	11	5.3	B415*0A5159M000
22000	35.7 × 80.7	14	29	22	25	15	7.4	B415*0A5229M000
33000	35.7 × 80.7	15	20	17	30	18	8.8	B415*0A5339M000
47000	35.7 × 105.7	8.0	16	13	30	23	11	B415*0A5479M000
68000	51.6 × 80.7	4.8	12	9.3	34	26	13	B415*0A5689M000
100000	51.6 × 105.7	4.7	9.4	7.6	34	32	15	B415*0A5100M000
150000	64.3 × 105.7	4.0	8.0	6.4	45	38	18	B415*0A5150M00#
220000	76.9 × 105.7	3.5	5.3	5.6	57	40	20	B415*0A5220M00#
330000	76.9 × 143.2	3.0	4.5	5.1	57	50	24	B415*0A5330M00#
<b><math>V_R = 40</math> V DC</b>								
10000	35.7 × 55.7	17	42	37	18	11	5.3	B415*0A7109M000
15000	35.7 × 80.7	12	23	16	25	15	7.4	B415*0A7159M000
22000	35.7 × 105.7	8.5	17	14	30	20	9.5	B415*0A7229M000
33000	51.6 × 80.7	6.0	12	13	34	23	11	B415*0A7339M000
47000	51.6 × 105.7	5.0	10	10	34	29	14	B415*0A7479M000
68000	51.6 × 105.7	4.5	9.0	8.4	34	30	15	B415*0A7689M000
100000	64.3 × 105.7	4.1	8.2	7.0	45	38	18	B415*0A7100M00#
150000	76.9 × 105.7	3.6	7.2	6.0	57	41	20	B415*0A7150M00#
220000	76.9 × 143.2	3.3	5.0	5.4	57	49	24	B415*0A7220M00#
<b><math>V_R = 63</math> V DC</b>								
4700	35.7 × 55.7	30	60	64	15	9.2	4.4	B415*0A8478M000
6800	35.7 × 80.7	22	44	46	20	12	6.0	B415*0A8688M000
10000	35.7 × 105.7	14	27	16	28	17	8.1	B415*0A8109M000
15000	51.6 × 80.7	9.5	19	14	31	19	9.1	B415*0A8159M000
22000	51.6 × 105.7	7.0	14	14	34	25	12	B415*0A8229M000
33000	64.3 × 105.7	5.5	11	12	45	31	15	B415*0A8339M00#
47000	64.3 × 105.7	4.8	10	9.4	45	35	17	B415*0A8479M00#
68000	76.9 × 105.7	3.3	5.0	7.8	57	39	19	B415*0A8689M00#
100000	76.9 × 143.2	3.3	5.0	6.6	57	48	23	B415*0A8100M00#

**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 for capacitors with diameter  $d \geq 64.3$  mm)




**Technical data and ordering codes**

$C_R$	Case dimensions	$ESR_{typ}$	$ESR_{max}$	$Z_{max}$	$I_{AC,max}$	$I_{AC,max}$	$I_{AC,R}$	Ordering code (composition see below)
100 Hz	$d \times l$	100 Hz	100 Hz	10 kHz	100 Hz	100 Hz	100 Hz	
20 °C	mm	20 °C	20 °C	20 °C	40 °C	85 °C	105 °C	
$\mu F$		$m\Omega$	$m\Omega$	$m\Omega$	A	A	A	
<b><math>V_R = 100</math> V DC</b>								
1500	35.7 × 55.7	52	104	90	11	7.0	3.4	B415*0A9158M000
2200	35.7 × 80.7	35	70	77	16	9.9	4.7	B415*0A9228M000
3300	35.7 × 80.7	24	48	53	19	12	5.7	B415*0A9338M000
4700	35.7 × 105.7	18	35	39	26	16	7.5	B415*0A9478M000
6800	51.6 × 80.7	12	24	25	30	18	8.7	B415*0A9688M000
10000	51.6 × 105.7	7.0	14	12	34	24	11	B415*0A9109M000
15000	64.3 × 105.7	5.0	10	10	45	30	15	B415*0A9159M00#
22000	76.9 × 105.7	4.0	6.0	6.0	57	35	17	B415*0A9229M00#
33000	76.9 × 143.2	3.3	5.0	8.4	57	44	21	B415*0A9339M00#

**Composition of ordering code**

\* = Mounting style

6 = for capacitors with ring clip/clamp mounting

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3 = for capacitors with low inductance (13 nH)

(only for capacitors with diameter  $d \geq 64.3$  mm)



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**Useful life<sup>1)</sup>**

depending on ambient temperature  $T_A$  under ripple current operating conditions



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



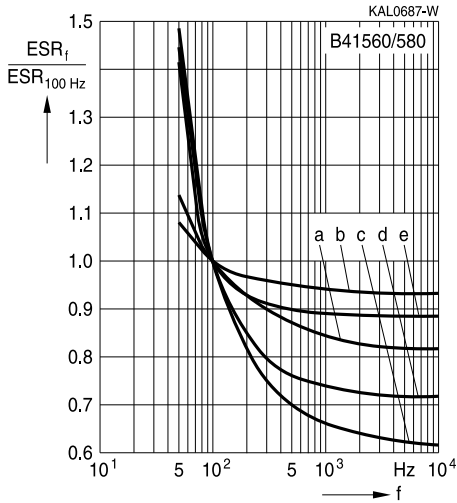
$V_R$ (V DC)	$\leq 63$	100
$d = 35.7$ mm	a	c
$d = 51.6$ mm	a	d
$d = 64.3$ mm	a	d
$d = 76.9$ mm	b	e

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



### Frequency characteristics of ESR

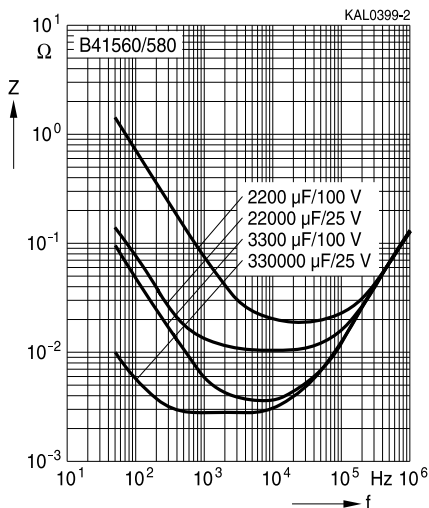
Typical behavior



$V_R$ (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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## 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. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. However, the amount of dangerous materials used in our products is limited 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.



## 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 polarity classes should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
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"
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, such as fire or electricity.	8.1 "Passive flammability"



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Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	<p>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.</p> <p>Do not apply any mechanical stress to the capacitor terminals.</p>	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 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"


**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	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
$\Delta T$	Temperature difference	Temperaturdifferenz
$T_A$	Ambient temperature	Umgebungstemperatur
$T_C$	Case temperature	Gehäusetemperatur
$T_B$	Capacitor base temperature	Temperatur des Becherbodens
t	Time	Zeit
$\Delta t$	Period	Zeitraum
$t_b$	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



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Symbol	English	German
V	Voltage	Spannung
V <sub>F</sub>	Forming voltage	Formierspannung
V <sub>op</sub>	Operating voltage	Betriebsspannung
V <sub>R</sub>	Rated voltage, DC voltage	Nennspannung, Gleichspannung
V <sub>S</sub>	Surge voltage	Spitzenspannung
X <sub>C</sub>	Capacitive reactance	Kapazitiver Blindwiderstand
X <sub>L</sub>	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
Z <sub>T</sub>	Impedance at temperature T	Scheinwiderstand bei Temperatur T
tan δ	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ε <sub>0</sub>	Absolute permittivity	Elektrische Feldkonstante
ε <sub>r</sub>	Relative permittivity	Dielektrizitätszahl
ω	Angular velocity; $2 \cdot \pi \cdot f$	Kreisfrequenz; $2 \cdot \pi \cdot f$

**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.**
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