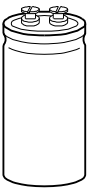
Aluminum electrolytic capacitors

Capacitors with screw terminals

Series/Type: **B43560, B43580**

Date: December 2006

Long-life grade capacitors



B43560 B43580

Applications

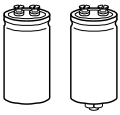
- Frequency converters
- Traction
- Professional power supplies

Features

- High reliability
- Good thermal characteristics and high ripple current capability
- Compact design
- Long useful life
- Wide temperature range
- All-welded construction ensures reliable electrical contact
- Version with optimized construction for base cooling (heat sink mounting) available
- Version with low-inductance design available

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 and $d \leq 76.9$ mm are not insulated, types with d = 91mm have fully insulated bases



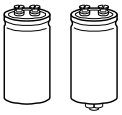
Specifications and characteristics in brief

Rated voltage V_R Surge voltage V_S	350 ... 450 V DC 1.10 · V_R (105 °C; $V_R \leq$ 400 V DC, 85 °C; V_R = 450 V DC)	
Rated capacitance C_R Capacitance tolerance	2200 ... 15000 µF ±20% ≙ M	
Leakage current I_{leak} (20 °C, 5 min)	$I_{leak} \leq 0.3\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)^{0.7} + 4\ \mu A$	
Self-inductance ESL	d = 51.6 mm: approx. 15 nH d ≥ 64.3 mm: approx. 20 nH Capacitors with low-inductance design: d ≥ 64.3 mm: approx. 13 nH	
Useful life 105 °C; V_R; $I_{AC,R}$ 85 °C; V_R; $I_{AC,R}$ 40 °C; V_R; 2.0 · $I_{AC,R}$	 > 6000 h > 30000 h > 250000 h	Requirements: ΔC/C ≤ ±30% of initial value ESR ≤ 3 times initial specified limit I_{leak} ≤ initial specified limit
Voltage endurance test 105 °C; V_R; $I_{AC,R}$	 2000 h	Post test requirements: ΔC/C ≤ ±10% of initial value ESR ≤ 1.3 times initial specified limit I_{leak} ≤ 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: 40/105/56 (−40 °C/+105 °C/56 days damp heat test)	
Detail specification Sectional specification	Similar to CECC 30301-803, CECC 30301-807 IEC 60384-4	

Ripple current capability

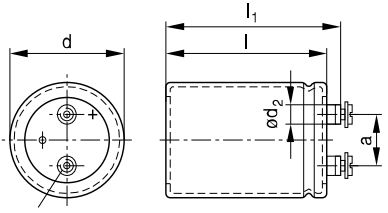
Due to the ripple current capability of the contact elements, the following current upper limits must not be exceeded:

Capacitor diameter	64.3 mm	76.9 mm	91 mm
$I_{AC,max}$	45 A	57 A	80 A



Dimensional drawings

B43560
Ring clip/clamp mounting

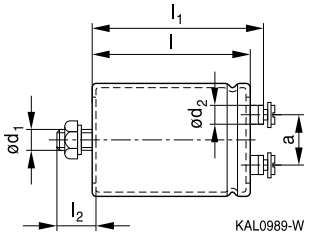


KAL0988-N-E

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

*) 9.5 mm for low-inductance design

B43580
Threaded stud mounting



KAL0989-W

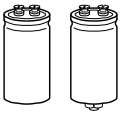
Positive pole marking: +

The base of types with threaded stud and d = 91 mm is fully insulated (the lenghts l and l_1 are increased by 0.5 mm in these cases). For types with threaded stud and d ≤ 76 mm the base is not insulated. Also refer to the mounting instructions in chapter "Capacitors with screw terminals − Accessories".

Dimensions and weights

Ter-	Dimensions (mm) with insulating sleeve							Approx.
minal	d	l ±1	l_1 ±1	l_2 +0/−1	d_1	d_2 max.	a +0.2/−0.4	weight (g)
M5	64.3 +0/−0.8	105.7	112.2	17	M12	13.2	28.5	440
M5	64.3 +0/−0.8	130.7	137.2	17	M12	13.2	28.5	600
M5	64.3 +0/−0.8	143.2	149.7	17	M12	13.2	28.5	630
M6	76.9 +0/−0.7	105.7	111.5	17	M12	17.7	31.7	620
M6	76.9 +0/−0.7	130.7	136.5	17	M12	17.7	31.7	800
M6	76.9 +0/−0.7	143.2	149.0	17	M12	17.7	31.7	840
M6	76.9 +0/−0.7	168.7	174.5	17	M12	17.7	31.7	1000
M6	76.9 +0/−0.7	220.7	226.5	17	M12	17.7	31.7	1300
M6	91.0 +0/−2	144.5	149.8	17	M12	17.7	31.7	1200
M6	91.0 +0/−2	170.0	175.3	17	M12	17.7	31.7	1500
M6	91.0 +0/−2	191.0	196.3	17	M12	17.7	31.7	1700
M6	91.0 +0/−2	221.0	226.3	17	M12	17.7	31.7	1900

Dimensions are also valid for low-inductance design.



Packing

Capacitor diameter d	Packing units (pcs.)
64.3 mm	15
76.9 mm	12
91.0 mm	8

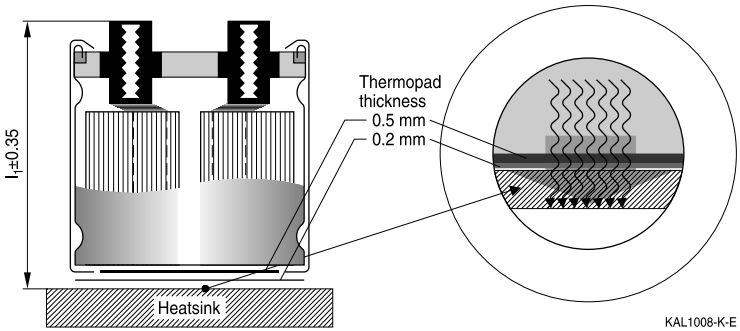
For ecological reasons the packing is pure cardboard.

Special designs

- Low-inductance design
- For heat sink mounting

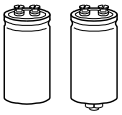
  Design for optimal connection of capacitors to the heat sink when using base cooling with the following features (refer to chapter "General technical information, 5.2 Cooling"):
  - Electrical insulation of the capacitors base with 2 overlapping thermal pads for optimal heat flow (minimal thermal resistance at the capacitor base)
  - Minimal overall length tolerance (±0.35 mm) for mounting between heat sink and bus bar
  - Case with extra groove near the base for clamp mounting (recommended ring clamp B44030A0165B ... A0190B)

  This version is available only for capacitors without threaded stud and for diameters ≥64.3 mm. Regarding ripple current and useful life, please refer to column $I_{AC,R}$(B) in the table "Technical data and ordering codes" and in the useful life curves.



Ordering codes:

Design	Identification in 3rd block of ordering code	Remark
Low inductance (13 nH)	M003	For capacitors with diameter d ≥ 64.3 mm
For heat sink mounting	M007	For capacitors with diameter d ≥ 64.3 mm and without threaded stud



Dimensions and weights for heat sink mounting:

Terminal	Dimensions (mm) with insulating sleeve							Min. reach of screw mm	Approx. weight g
	d	l ±1	l_1 ±0.35	l_2 +0/−1	d_1	d_2 max.	a +0.2/−0.4		
M5	64.3 +0/−0.8	80.7	86.3	17	M12	13.2	28.5	7.3	370
M5	64.3 +0/−0.8	105.7	111.3	17	M12	13.2	28.5	7.3	440
M6	76.9 +0/−0.7	105.7	110.6	17	M12	17.7	31.7	9.7	620
M6	76.9 +0/−0.7	143.2	148.1	17	M12	17.7	31.7	9.7	840
M6	91.0 +0/−2	97.0	101.4	17	M12	17.7	31.7	9.7	1000
M6	91.0 +0/−2	144.5	148.9	17	M12	17.7	31.7	9.7	1200

Dimensions for other sizes are available upon request.

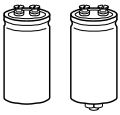
Accessories

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 × 8 DIN 84-4.8	2 Nm
	M6	A 6.4 DIN 6797	Cylinder-head screw M6 × 12 DIN 85-4.8	2.5 Nm
For mounting	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 ≥ 64.3 mm	B44030
Insulating parts	B44020

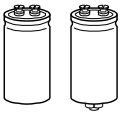


Overview of available types

V_R (V DC)	350	400	450
	Case dimensions d × l (mm)		
C_R (µF)			
2200		64.3 × 105.7	64.3 × 130.7
2700	64.3 × 105.7		
3300		64.3 × 130.7	76.9 × 130.7
3900	76.9 × 105.7		
4700	64.3 × 143.2 76.9 × 105.7	76.9 × 130.7	76.9 × 168.7 91.0 × 144.5
6000	76.9 × 130.7		76.9 × 220.7
6800	76.9 × 143.2	91.0 × 144.5	91.0 × 191.0
8200	91.0 × 144.5	76.9 × 220.7 91.0 × 170.0	91.0 × 221.0
10000	76.9 × 220.7		
12000		91.0 × 221.0	
15000	91.0 × 221.0		

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

Other voltage and capacitance ratings are also available upon request.



B43560, B43580

High reliability – 105 °C

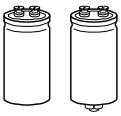
Technical data and ordering codes

C_R 100 Hz 20 °C µF	Case dimensions d × 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	$I_{AC,R}$ 100 Hz 105 °C A	$I_{AC,R}(B)$ 100 Hz 105 °C A	Ordering code (composition see below)
V_R = 350 V DC								
2700	64.3 × 105.7	46	69	55	27	8.6	15.3	B435*0A4278M00#
3900	76.9 × 105.7	32	48	38	35	11.4	22.1	B435*0A4398M00#
4700	64.3 × 143.2	27	40	32	40	12.8	20.8	B435*0A4478M00#
4700	76.9 × 105.7	27	40	32	39	12.5	25.1	B435*0C4478M00#
6000	76.9 × 130.7	21	31	25	47	15.2	28.2	B435*0A4608M00#
6800	76.9 × 143.2	18	27	22	51	16.7	30.1	B435*0A4688M00#
8200	91.0 × 144.5	15	23	18	61	19.8	35.5	B435*0A4828M00#
10000	76.9 × 220.7	13	19	15	57	24.0	34.4	B435*0A4109M00#
15000	91.0 × 221.0	8	12	10	80	31.2	49.1	B435*0A4159M00#
V_R = 400 V DC								
2200	64.3 × 105.7	56	84	68	24	7.8	14.1	B435*0A9228M00#
3300	64.3 × 130.7	37	56	45	32	10.3	17.2	B435*0A9338M00#
4700	76.9 × 130.7	27	40	32	41	13.4	24.7	B435*0A9478M00#
6800	91.0 × 144.5	18	27	22	56	18.0	32.3	B435*0A9688M00#
8200	76.9 × 220.7	15	23	18	57	21.6	31.0	B435*0C9828M00#
8200	91.0 × 170.0	15	23	18	65	20.9	35.3	B435*0A9828M00#
12000	91.0 × 221.0	10	15	12	80	27.8	43.5	B435*0A9129M00#
V_R = 450 V DC								
2200	64.3 × 130.7	56	84	68	26	8.4	14.2	B435*0A5228M00#
3300	76.9 × 130.7	37	56	45	35	11.2	20.6	B435*0A5338M00#
4700	76.9 × 168.7	27	40	32	45	14.7	23.9	B435*0A5478M00#
4700	91.0 × 144.5	27	40	32	46	15.0	26.8	B435*0C5478M00#
6000	76.9 × 220.7	21	31	25	57	18.4	26.6	B435*0C5608M00#
6800	91.0 × 191.0	18	27	22	61	19.8	32.3	B435*0C5688M00#
8200	91.0 × 221.0	15	23	18	70	22.9	35.7	B435*0C5828M00#

Composition of ordering code

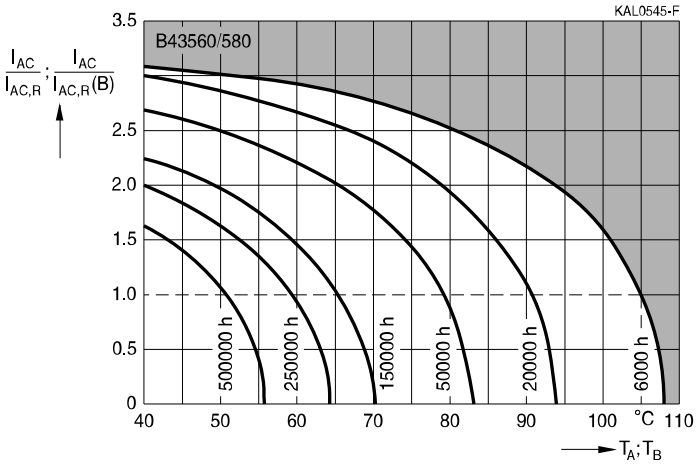
* = Mounting style
- 6 = for capacitors with ring clip/clamp mounting
- 8 = for capacitors with threaded stud

\# = Design
- 0 = for capacitors with standard inductance
- 3 = for capacitors with low inductance (13 nH) - only capacitors with diameter d ≥ 64.3 mm
- 7 = for heat sink mounting - only capacitors with diameter d ≥ 64.3 mm and without threaded stud

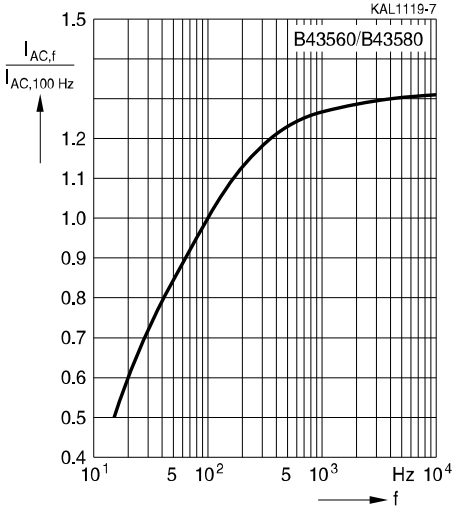


Useful life

depending on ambient temperature T_A (for natural cooling) and versus temperature of case base T_B (for base cooling) under ripple current operating conditions[1) 2)]

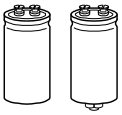


Frequency factor of permissible ripple current I_{AC} versus frequency f



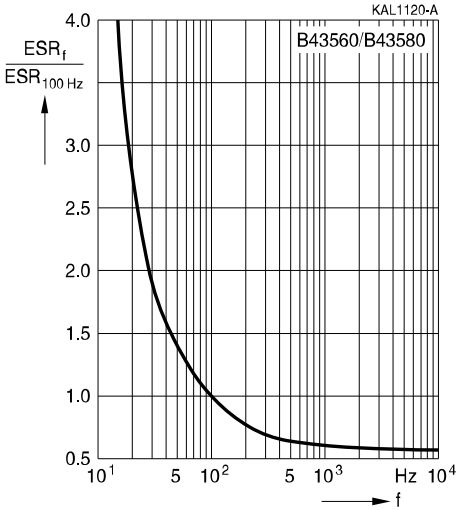
1) The ripple current refers to $I_{AC,R}$ for natural cooling or $I_{AC,R}(B)$ for base cooling, respectively.

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



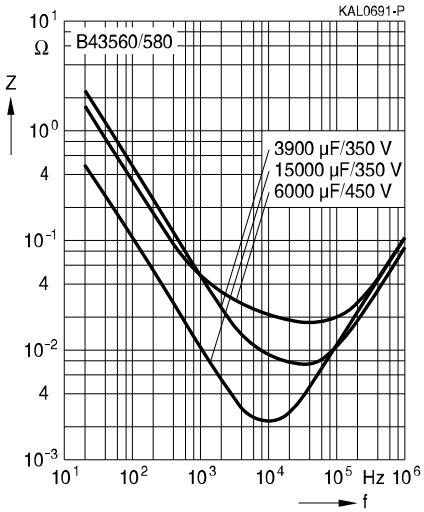
Frequency characteristics of ESR

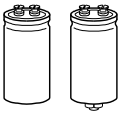
Typical behavior



Impedance Z versus frequency f

Typical behavior at 20 °C





Cautions and warnings

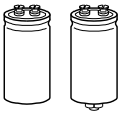
Personal safety

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:

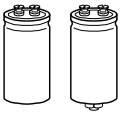
- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment.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



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"

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 passive electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of a passive electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of a passive electronic component.
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.
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