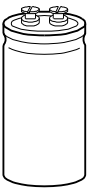
Aluminum electrolytic capacitors

Capacitors with screw terminals

Series/Type: **B43454, B43474**

Date: November 2008

General-purpose grade capacitors



B43454 B43474

Applications

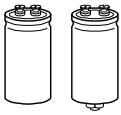
- Uninterruptible power supplies
- Frequency converters

Features

- All-welded construction ensures reliable electrical contact
- Self-extinguishing electrolyte
- 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 and d ≤ 76.9 mm are not insulated



Specifications and characteristics in brief

Rated voltage V_R Surge voltage V_S	350 ... 450 V DC 1.10 · V_R	
Rated capacitance C_R Capacitance tolerance	1000 ... 12000 µF ±20% ≙ M	
Leakage current I_{leak} (20 °C, 5 min)	$I_{leak} \le 0.3\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)^{0.7} + 4\ \mu A$	
Self-inductance ESL	d = 51.6 mm: approx. 15 nH d ≥ 64.3 mm: approx. 20 nH	
Useful life 85 °C; V_R; $I_{AC,R}$ 40 °C; V_R; 1.5 · $I_{AC,R}$	 > 5000 h > 75000 h	Requirements: ΔC/C ≤ ±30% of initial value ESR ≤ 3 times initial specified limit I_{leak} ≤ initial specified limit
Voltage endurance test 85 °C; V_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.	
Characteristics at low temperature	Max. impedance ratio at 100 Hz	

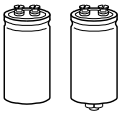
V_R	350 V	400 V	450 V
$Z_{-25°C} / Z_{20°C}$	6	5	4
$Z_{-40°C} / Z_{20°C}$	22	20	16

IEC climatic category	To IEC 60068-1: 25/085/56 (−25 °C/+85 °C/56 days damp heat test) The capacitors can be operated in the temperature range of −40 °C to +85 °C but the impedance at −40 °C should be taken into consideration.
Detail specification Sectional specification	Similar to CECC 30301-810 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	51.6 mm	64.3 mm	76.9 mm
$I_{AC,max}$	30 A	40 A	50 A

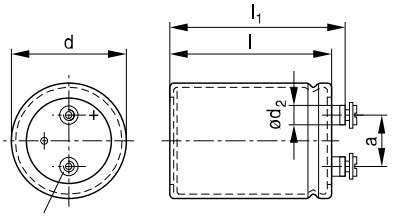


B43454, B43474

Standard − 85 °C

Dimensional drawings

B43454
Ring clip/clamp mounting

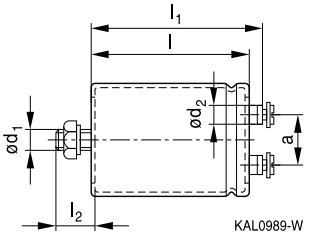


Min. reach of screw = 8 mm

Positive pole marking: +

KAL0992-G-E

B43474
Threaded stud mounting

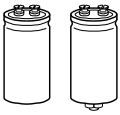


KAL0989-W

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	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	80.7	87.2	17	M12	13.2	28.5	370
M5	64.3 +0/−0.8	105.7	112.2	17	M12	13.2	28.5	440
M5	64.3 +0/−0.8	143.2	149.7	17	M12	13.2	28.5	630
M5	76.9 +0/−0.7	105.7	111.5	17	M12	13.2	31.7	620
M5	76.9 +0/−0.7	143.2	149.0	17	M12	13.2	31.7	840
M5	76.9+0/−0.7	168.7	174.5	17	M12	13.2	31.7	1000
M5	76.9 +0/−0.7	220.7	226.5	17	M12	13.2	31.7	1300



Packing

Capacitor diameter d (mm)	lenght l (mm)	Packing units (pcs.)
51.6	all	36
64.3	all	25
76.9	97.0 - 168.7	16
	191.0 - 220.7	12

For ecological reasons the packing is pure cardboard.

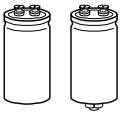
Accessories

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

For terminals	M5	A 5.1 DIN 6797	Cylinder-head screw M5 × 8 DIN 84-4.8	2.0 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 "Screw terminals – Accessories".

Item	Type
Ring clips	B44030
Clamps for capacitors with d ≥ 64.3 mm	B44030
Insulating parts	B44020

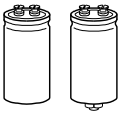


Overview of available types

V_R (V DC)	350	400	450
	Case dimensions d × l (mm)		
C_R (µF)			
1000		51.6 × 80.7	51.6 × 105.7
1500	51.6 × 80.7	51.6 × 105.7	64.3 × 80.7
2200	51.6 × 105.7 64.3 × 80.7	64.3 × 80.7	64.3 × 105.7
2700	64.3 × 80.7	64.3 × 105.7	76.9 × 105.7
3300	64.3 × 105.7	64.3 × 105.7	64.3 × 143.2
3900	64.3 × 105.7	76.9 × 105.7	76.9 × 143.2
4700	64.3 × 143.2 76.9 × 105.7	76.9 × 143.2	76.9 × 168.7
5600	64.3 × 143.2	76.9 × 143.2	76.9 × 220.7
6800	76.9 × 143.2	76.9 × 168.7	76.9 × 220.7
8200	76.9 × 168.7	76.9 × 220.7	76.9 × 220.7
10000	76.9 × 220.7	76.9 × 220.7	
12000	76.9 × 220.7		

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

Other voltage and capacitance ratings are also available upon request.



Technical data and ordering codes

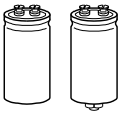
C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{max} 100 Hz 20 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 40 °C A	$I_{AC,R}$ 100 Hz 85 °C A	Ordering code (composition see below)
V_R = 350 V DC							
1500	51.6 × 80.7	82	123	98	14	5.3	B434*4A4158M000
2200	51.6 × 105.7	58	87	70	18	6.8	B434*4A4228M000
2200	64.3 × 80.7	58	87	70	18	6.8	B434*4B4228M000
2700	64.3 × 80.7	48	72	58	21	7.7	B434*4A4278M000
3300	64.3 × 105.7	40	60	48	24	8.9	B434*4A4338M000
3900	64.3 × 105.7	35	53	42	26	9.8	B434*4A4398M000
4700	64.3 × 143.2	30	45	36	30	11.2	B434*4A4478M000
4700	76.9 × 105.7	30	45	36	29	10.9	B434*4B4478M000
5600	64.3 × 143.2	25	38	30	34	12.8	B434*4A4568M000
6800	76.9 × 143.2	20	30	24	40	14.9	B434*4A4688M000
8200	76.9 × 168.7	16	24	19	47	17.4	B434*4A4828M000
10000	76.9 × 220.7	12	18	14	50	21.5	B434*4A4109M000
12000	76.9 × 220.7	10	15	12	50	24.8	B434*4A4129M000
V_R = 400 V DC							
1000	51.6 × 80.7	99	149	119	12	4.6	B434*4A9108M000
1500	51.6 × 105.7	76	114	91	15	5.7	B434*4A9158M000
2200	64.3 × 80.7	62	93	74	18	6.8	B434*4A9228M000
2700	64.3 × 105.7	52	78	62	21	7.7	B434*4A9278M000
3300	64.3 × 105.7	43	65	52	24	8.9	B434*4A9338M000
3900	76.9 × 105.7	35	53	42	28	10.3	B434*4A9398M000
4700	76.9 × 143.2	28	42	34	32	12.0	B434*4A9478M000
5600	76.9 × 143.2	23	35	28	37	13.8	B434*4A9568M000
6800	76.9 × 168.7	21	32	25	40	15.1	B434*4A9688M000
8200	76.9 × 220.7	18	27	22	46	17.4	B434*4A9828M000
10000	76.9 × 220.7	16	24	19	50	19.4	B434*4A9109M000

Composition of ordering code

* = Mounting style

5 = for capacitors with ring clip/clamp mounting

7 = for capacitors with threaded stud



Technical data and ordering codes

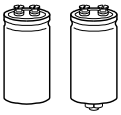
C_R 100 Hz 20 °C µF	Case dimensions d × l mm	ESR_{typ} 100 Hz 20 °C mΩ	ESR_{max} 100 Hz 20 °C mΩ	Z_{max} 10 kHz 20 °C mΩ	$I_{AC,max}$ 100 Hz 40 °C A	$I_{AC,R}$ 100 Hz 85 °C A	Ordering code (composition see below)
V_R = 450 V DC							
1000	51.6 × 105.7	120	180	144	12	4.4	B434*4A5108M000
1500	64.3 × 80.7	74	111	89	16	6.0	B434*4A5158M000
2200	64.3 × 105.7	54	81	65	20	7.6	B434*4A5228M000
2700	76.9 × 105.7	46	69	55	23	8.8	B434*4A5278M000
3300	64.3 × 143.2	39	59	47	26	9.9	B434*4A5338M000
3900	76.9 × 143.2	34	51	41	29	11.0	B434*4A5398M000
4700	76.9 × 168.7	29	44	35	33	12.4	B434*4A5478M000
5600	76.9 × 220.7	25	38	30	38	14.1	B434*4A5568M000
6800	76.9 × 220.7	21	32	25	43	16.1	B434*4A5688M000
8200	76.9 × 220.7	19	29	23	48	17.8	B434*4A5828M000

Composition of ordering code

* = Mounting style

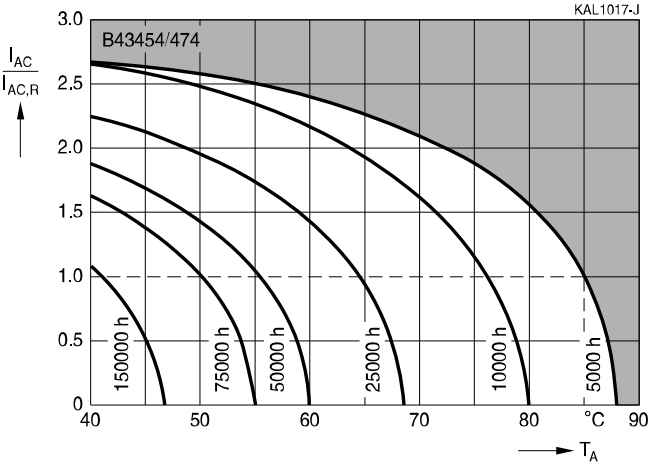
5 = for capacitors with ring clip/clamp mounting

7 = for capacitors with threaded stud

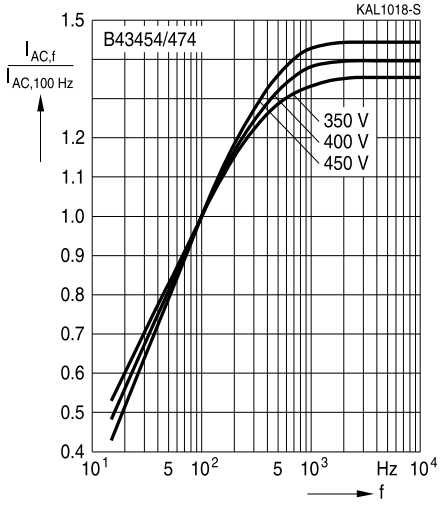


Useful life

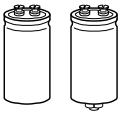
depending on ambient temperature T_A under ripple current operating conditions[1)]



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

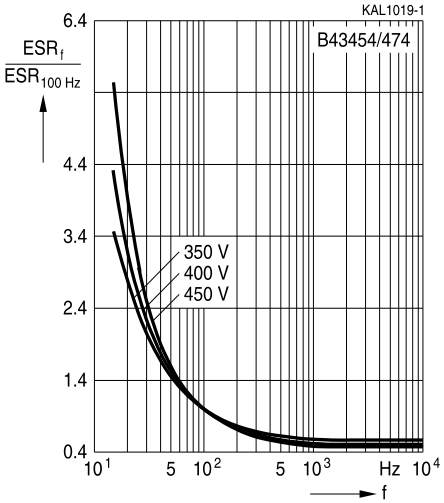


1) Refer to chapter "General technical information, 5.3 Calculation of useful life" on how to interpret the useful life graphs.



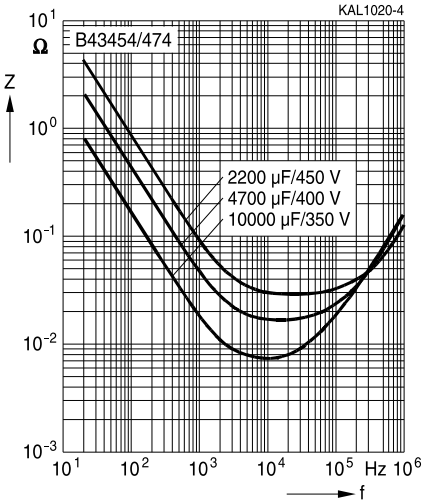
Frequency characteristics of ESR

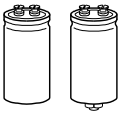
Typical behavior



Impedance Z versus frequency f

Typical behavior at 20 °C





Cautions and warnings

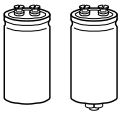
Personal safety

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:

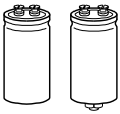
- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment.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

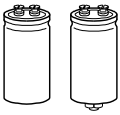
Topic	Safety information	Reference Chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages polarity classes should be prevented by connecting a diode.	3.1.6 "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"

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)



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; $2 \cdot \pi \cdot f$	Kreisfrequenz; $2 \cdot \pi \cdot f$

Notes

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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