# Aluminum electrolytic capacitors

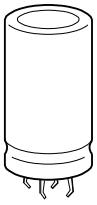
Capacitors with 4-pin snap-in terminals and solder pins

**Series/Type:** **B43511, B43521**

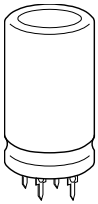
Date: November 2008

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**Long-life grade capacitors**



B43511



B43521

**Applications**

- Frequency converters
- Switch-mode power supplies in industrialand consumer electronics
- Uninterruptible power supplies

**Features**

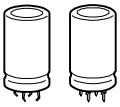
- Voltage derating ($0.93 \cdot V_R$) enables 105 °C operation, more details available upon request
- Long useful life
- Outstanding ripple current capability
- High volumetric efficiency
- Many different case sizes
- Pinning ensures correct insertion
- RoHS-compatible

**Construction**

- Charge/discharge-proof, polar
- Aluminum case, fully insulated with PVC
- Version with additional PET insulation cap on terminal side available for insulating the capacitor from the PCB (B43511 only)
- Overload protection by safety vent in case

**Terminals**

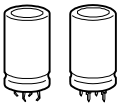
- 4-pin snap-in terminals (6.3 mm and 4.5 mm length)
- Solder pin mounting on printed circuit boards, pins fit standardized spacings on PCB



**Specifications and characteristics in brief**

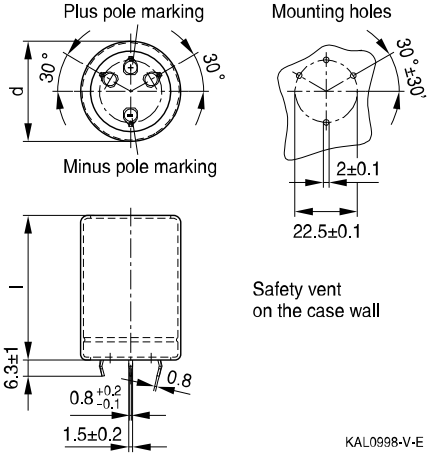
| | | |
|---|---|---|
| Rated voltage $V_R$<br>Surge voltage $V_S$ | 350 ... 450 V DC<br>$1.1 \cdot V_R$ | |
| Rated capacitance $C_R$<br>Capacitance tolerance | 390 ... 2200 µF<br>±20% ≙ M | |
| Leakage current $I_{leak}$<br>(5 min, 20 °C) | $I_{leak} \le 0.3\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)^{0.7} + 4\ \mu A$ | |
| Self-inductance ESL | Approx. 20 nH | |
| Useful life<br>85 °C; $V_R$; $I_{AC,R}$<br>40 °C; $V_R$; $1.6 \cdot I_{AC,R}$ | <br>> 12000 h<br>> 200000 h | Requirements:<br>ΔC/C ≤ ±30% of initial value<br>ESR ≤ 3 times initial specified limit<br>$I_{leak}$ ≤ initial specified limit |
| Voltage endurance test<br>85 °C; $V_R$ | <br>3000 h | Post test requirements:<br>ΔC/C ≤ ±10% of initial value<br>ESR ≤ 1.3 times initial specified limit<br>$I_{leak}$ ≤ initial specified limit |
| Vibration resistance test | To IEC 60068-2-6, test Fc:<br>Displacement amplitude 0.35 mm, frequency range 10 ... 55 Hz, acceleration max. 5 *g*, duration 3 × 2 h.<br>Capacitor mounted by its body which is rigidly clamped to the work surface. | |
| Characteristics at low temperature | Max. impedance ratio at 100 Hz | |
| IEC climatic category | To IEC 60068-1:<br>$V_R \le 400$ V DC: 40/085/56 (−40 °C/+85 °C/56 days damp heat test)<br>$V_R > 400$ V DC: 25/085/56 (−25 °C/+85 °C/56 days damp heat test)<br>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<br>Sectional specification | Similar to CECC 30301-805<br>IEC 60384-4 | |

| $V_R$ | ≤ 400 V | > 400 V |
|---|---|---|
| $Z_{-25\,°C} / Z_{20\,°C}$ | 4 | 7 |
| $Z_{-40\,°C} / Z_{20\,°C}$ | 7 | 14 |



## Dimensional drawings

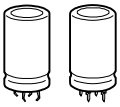
### B43511, 4-pin snap-in terminals, PVC insulation



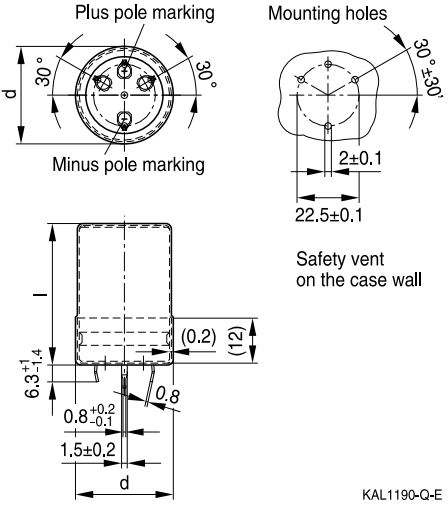

| Dimensions (mm) | | Approx. weight (g) | Packing units (pcs.) |
|---|---|---|---|
| d +1 | l ±2 | | |
| 35 | 50 | 63 | 60 |
| 35 | 60 | 76 | 36 |
| 35 | 70 | 88 | 36 |
| 35 | 80 | 101 | 36 |
| 35 | 100 | 126 | 36 |
| 40 | 40 | 71 | 33 |
| 40 | 50 | 89 | 33 |
| 40 | 60 | 107 | 33 |
| 40 | 70 | 125 | 33 |
| 40 | 80 | 143 | 33 |
| 40 | 100 | 178 | 33 |
| 45 | 40 | 90 | 28 |
| 45 | 50 | 113 | 28 |
| 45 | 60 | 136 | 28 |
| 45 | 70 | 158 | 28 |
| 45 | 80 | 181 | 28 |
| 45 | 100 | 226 | 28 |

Standard snap-in terminals:
length (6.3 ±1) mm.
Also available with length of (4.5 −1) mm.

All pin holes must be drilled into the PC-board, since the unconnected pins serve as mountings. These pins must be soldered to isolated pads or pads with the same potential as the negative pole.



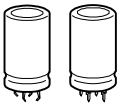
**B43511, 4-pin snap-in terminals, PVC insulation and PET insulation cap on terminal side**




| Dimensions (mm) | | Approx. weight (g) | Packing units (pcs.) |
|---|---|---|---|
| d +1.4 | l +2.2/–2 | | |
| 35 | 50 | 63 | 60 |
| 35 | 60 | 76 | 36 |
| 35 | 70 | 88 | 36 |
| 35 | 80 | 101 | 36 |
| 35 | 100 | 126 | 36 |
| 40 | 40 | 71 | 33 |
| 40 | 50 | 89 | 33 |
| 40 | 60 | 107 | 33 |
| 40 | 70 | 125 | 33 |
| 40 | 80 | 143 | 33 |
| 40 | 100 | 178 | 33 |
| 45 | 40 | 90 | 28 |
| 45 | 50 | 113 | 28 |
| 45 | 60 | 136 | 28 |
| 45 | 70 | 158 | 28 |
| 45 | 80 | 181 | 28 |
| 45 | 100 | 226 | 28 |

Standard snap-in terminals:
length 6.3 +1/–1.4 mm. Also available with length of 4.5 –1.4 mm. PET insulation cap is positioned under the insulation sleeve.

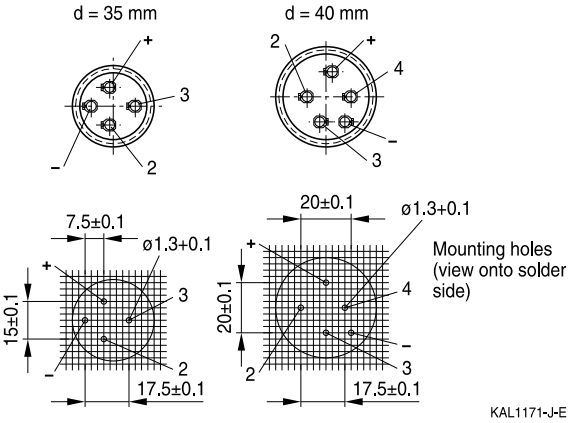
All pin holes must be drilled into the PC-board, since the unconnected pins serve as mountings. These pins must be soldered to isolated pads or pads with the same potential as the negative pole.

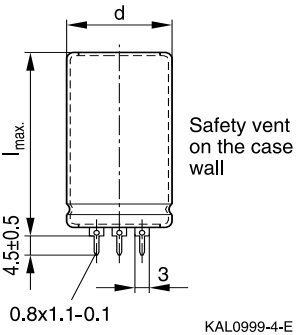


**B43511, B43521**

**Outstanding ripple current – 85 °C**

**B43521, solder pins**

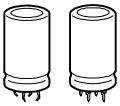



Pole markings: Plus: **+**; Minus: –

All pin holes must be drilled into the PC-board, since the unconnected pins serve as mountings. These pins must be soldered to isolated pads or pads with the same potential as the negative pole.

| Dimensions (mm) | | Approx. weight (g) | Packing units (pcs.) |
|---|---|---|---|
| d +1 | $I_{max}$ | | |
| 35 | 54 | 63 | 60 |
| 35 | 64 | 76 | 36 |
| 35 | 74 | 88 | 36 |
| 35 | 84 | 101 | 36 |
| 35 | 104 | 126 | 36 |
| 40 | 44 | 71 | 33 |
| 40 | 54 | 89 | 33 |
| 40 | 64 | 107 | 33 |
| 40 | 74 | 125 | 33 |
| 40 | 84 | 143 | 33 |
| 40 | 104 | 178 | 33 |



**Packing of 4-pin snap-in terminal and solder pin capacitors**



For ecological reasons the packing is pure cardboard.

**Ordering codes for terminal styles and insulation features**

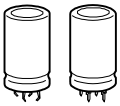
Identification in 3rd block of ordering code

| 4-pin snap-in terminal capacitors | | |
|---|---|---|
| Terminal version | Insulation version | |
| | PVC | PVC plus PET cap |
| Standard terminals 6.3 mm | M000 | M080 |
| Short terminals 4.5 mm | M007 | M087 |

Ordering examples:

B43511A9188M007 } 4-pin snap-in capacitor with short terminals and standard PVC insulation

B43511A9188M080 } 4-pin snap-in capacitor with standard terminals and PVC insulation with additional PET insulation cap on terminal side



**B43511, B43521**

**Outstanding ripple current – 85 °C**

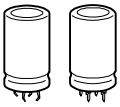
**Overview of available types**

| $V_R$ (V DC) | 350 | 400 | 420 | 450 |
|---|---|---|---|---|
| | Case dimensions d × l (mm) | | | |
| $C_R$ (µF) | | | | |
| 390 | | | | 35 × 50<br>40 × 40 |
| 470 | | 35 × 50<br>40 × 40 | 35 × 50<br>40 × 40 | 35 × 60<br>40 × 50<br>45 × 40 |
| 560 | 35 × 50 | 35 × 60<br>45 × 40 | 35 × 60<br>40 × 50 | 35 × 70<br>40 × 60 |
| 680 | 35 × 60<br>40 × 50 | 35 × 70<br>40 × 60<br>45 × 50 | 35 × 70<br>40 × 60<br>45 × 50 | 35 × 80<br>40 × 60<br>45 × 50 |
| 820 | 35 × 70<br>40 × 60 | 35 × 80<br>40 × 60 | 35 × 80<br>40 × 70<br>45 × 50 | 40 × 70<br>45 × 60 |
| 1000 | 35 × 80<br>40 × 60<br>45 × 50 | 35 × 100<br>40 × 70<br>45 × 60 | 35 × 100<br>40 × 80<br>45 × 60 | 40 × 100<br>45 × 70 |
| 1500 | 40 × 80<br>45 × 70 | 40 × 100<br>45 × 80 | 40 × 100<br>45 × 80 | 45 × 100 |
| 1800 | | 45 × 100 | 45 × 100 | |
| 2200 | 45 × 100 | | | |

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

Other voltage and capacitance ratings are also available upon request.

Capacitors with solder pins are only available in 35 and 40 mm case diameters.



### Technical data and ordering codes

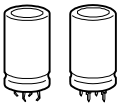
| $C_R$ 100 Hz 20 °C µF | Case dimensions d × l mm | $ESR_{typ}$ 100 Hz 20 °C mΩ | $ESR_{max}$ 100 Hz 20 °C mΩ | $Z_{max}$ 10 kHz 20 °C mΩ | $I_{AC,max}$ 100 Hz 60 °C A | $I_{AC,R}$ 100 Hz 85 °C A | Ordering code (composition see below) |
|---|---|---|---|---|---|---|---|
| $V_R$ = 350 V DC | | | | | | | |
| 560 | 35 × 50 | 160 | 230 | 190 | 5.7 | 3.2 | B435*1A4567M0## |
| 680 | 35 × 60 | 140 | 190 | 150 | 6.7 | 3.7 | B435*1A4687M0## |
| 680 | 40 × 50 | 140 | 190 | 150 | 6.6 | 3.7 | B435*1C4687M0## |
| 820 | 35 × 70 | 110 | 160 | 130 | 7.8 | 4.4 | B435*1A4827M0## |
| 820 | 40 × 60 | 110 | 160 | 130 | 7.8 | 4.3 | B435*1C4827M0## |
| 1000 | 35 × 80 | 90 | 130 | 110 | 9.2 | 5.1 | B435*1A4108M0## |
| 1000 | 40 × 60 | 90 | 130 | 110 | 8.6 | 4.8 | B435*1C4108M0## |
| 1000 | 45 × 50 | 90 | 130 | 110 | 8.1 | 4.5 | B43511E4108M0## |
| 1500 | 40 × 80 | 60 | 90 | 70 | 11.8 | 6.5 | B435*1A4158M0## |
| 1500 | 45 × 70 | 60 | 90 | 70 | 11.2 | 6.2 | B43511C4158M0## |
| 2200 | 45 × 100 | 50 | 60 | 50 | 15.6 | 8.6 | B43511A4228M0## |
| $V_R$ = 400 V DC | | | | | | | |
| 470 | 35 × 50 | 190 | 280 | 220 | 5.2 | 2.9 | B435*1A9477M0## |
| 470 | 40 × 40 | 190 | 280 | 220 | 5.1 | 2.8 | B435*1C9477M0## |
| 560 | 35 × 60 | 160 | 230 | 190 | 6.1 | 3.4 | B435*1A9567M0## |
| 560 | 45 × 40 | 160 | 230 | 190 | 5.6 | 3.1 | B43511C9567M0## |
| 680 | 35 × 70 | 140 | 190 | 150 | 7.1 | 4.0 | B435*1A9687M0## |
| 680 | 40 × 60 | 140 | 190 | 150 | 7.1 | 3.9 | B435*1C9687M0## |
| 680 | 45 × 50 | 140 | 190 | 150 | 6.6 | 3.7 | B43511E9687M0## |
| 820 | 35 × 80 | 110 | 160 | 130 | 8.3 | 4.6 | B435*1A9827M0## |

Capacitors with solder pins are only available in 35 and 40 mm case diameters.

**Composition of ordering code**

* = Terminal type
- 1 = 4-pin snap-in terminals
- 2 = solder pin

## = Terminal style and insulation feature
- 00 = solder pin or 4-pin snap-in standard terminals and PVC insulation
- 07 = 4-pin snap-in short terminals and PVC insulation
- 80 = 4-pin snap-in standard terminals and PVC insulation with additional PET insulation cap on terminal side
- 87 = 4-pin snap-in short terminals and PVC insulation with additional PET insulation cap on terminal side



**B43511, B43521**

**Outstanding ripple current – 85 °C**

### Technical data and ordering codes

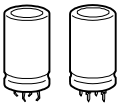
| $C_R$ 100 Hz 20 °C µF | Case dimensions d × l mm | $ESR_{typ}$ 100 Hz 20 °C mΩ | $ESR_{max}$ 100 Hz 20 °C mΩ | $Z_{max}$ 10 kHz 20 °C mΩ | $I_{AC,max}$ 100 Hz 60 °C A | $I_{AC,R}$ 100 Hz 85 °C A | Ordering code (composition see below) |
|---|---|---|---|---|---|---|---|
| $V_R$ = 400 V DC | | | | | | | |
| 820 | 40 × 60 | 110 | 160 | 130 | 7.8 | 4.3 | B435*1C9827M0## |
| 1000 | 35 × 100 | 90 | 130 | 110 | 10.1 | 5.6 | B435*1C9108M0## |
| 1000 | 40 × 70 | 90 | 130 | 110 | 9.1 | 5.1 | B435*1A9108M0## |
| 1000 | 45 × 60 | 90 | 130 | 110 | 8.6 | 4.8 | B43511B9108M0## |
| 1500 | 40 × 100 | 60 | 90 | 70 | 12.9 | 7.2 | B435*1A9158M0## |
| 1500 | 45 × 80 | 60 | 90 | 70 | 11.8 | 6.5 | B43511C9158M0## |
| 1800 | 45 × 100 | 50 | 80 | 60 | 14.1 | 7.8 | B43511A9188M0## |
| $V_R$ = 420 V DC | | | | | | | |
| 470 | 35 × 50 | 320 | 430 | 340 | 5.2 | 2.9 | B435*1A0477M0## |
| 470 | 40 × 40 | 320 | 430 | 340 | 5.1 | 2.8 | B435*1C0477M0## |
| 560 | 35 × 60 | 270 | 360 | 290 | 6.1 | 3.4 | B435*1A0567M0## |
| 560 | 40 × 50 | 270 | 360 | 290 | 6.0 | 3.3 | B435*1C0567M0## |
| 680 | 35 × 70 | 230 | 300 | 240 | 7.1 | 4.0 | B435*1A0687M0## |
| 680 | 40 × 60 | 230 | 300 | 240 | 7.1 | 3.9 | B435*1C0687M0## |
| 680 | 45 × 50 | 230 | 300 | 240 | 6.6 | 3.7 | B43511E0687M0## |
| 820 | 35 × 80 | 190 | 250 | 200 | 8.3 | 4.6 | B435*1A0827M0## |
| 820 | 40 × 70 | 190 | 250 | 200 | 8.2 | 4.6 | B435*1C0827M0## |
| 820 | 45 × 50 | 190 | 250 | 200 | 7.3 | 4.1 | B43511E0827M0## |
| 1000 | 35 × 100 | 160 | 200 | 160 | 10.1 | 5.6 | B435*1A0108M0## |
| 1000 | 40 × 80 | 160 | 200 | 160 | 9.6 | 5.3 | B435*1C0108M0## |
| 1000 | 45 × 60 | 160 | 200 | 160 | 8.6 | 4.8 | B43511E0108M0## |
| 1500 | 40 × 100 | 110 | 140 | 110 | 12.9 | 7.2 | B435*1A0158M0## |
| 1500 | 45 × 80 | 110 | 140 | 110 | 11.8 | 6.5 | B43511C0158M0## |
| 1800 | 45 × 100 | 90 | 120 | 90 | 14.1 | 7.8 | B43511A0188M0## |

Capacitors with solder pins are only available in 35 and 40 mm case diameters.

**Composition of ordering code**

* = Terminal type
- 1 = 4-pin snap-in terminals
- 2 = solder pin

## = Terminal style and insulation feature
- 00 = solder pin or 4-pin snap-in standard terminals and PVC insulation
- 07 = 4-pin snap-in short terminals and PVC insulation
- 80 = 4-pin snap-in standard terminals and PVC insulation with additional PET insulation cap on terminal side
- 87 = 4-pin snap-in short terminals and PVC insulation with additional PET insulation cap on terminal side



### 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 60 °C A | $I_{AC,R}$ 100 Hz 85 °C A | Ordering code (composition see below) |
|---|---|---|---|---|---|---|---|
| $V_R$ = 450 V DC | | | | | | | |
| 390 | 35 × 50 | 390 | 520 | 410 | 4.7 | 2.6 | B435*1A5397M0## |
| 390 | 40 × 40 | 390 | 520 | 410 | 4.6 | 2.6 | B435*1C5397M0## |
| 470 | 35 × 60 | 320 | 430 | 340 | 5.6 | 3.1 | B435*1A5477M0## |
| 470 | 40 × 50 | 320 | 430 | 340 | 5.5 | 3.1 | B435*1C5477M0## |
| 470 | 45 × 40 | 320 | 430 | 340 | 5.1 | 2.9 | B43511E5477M0## |
| 560 | 35 × 70 | 270 | 360 | 290 | 6.5 | 3.6 | B435*1A5567M0## |
| 560 | 40 × 60 | 270 | 360 | 290 | 6.4 | 3.6 | B435*1C5567M0## |
| 680 | 35 × 80 | 230 | 300 | 240 | 7.5 | 4.2 | B435*1A5687M0## |
| 680 | 40 × 60 | 230 | 300 | 240 | 7.1 | 3.9 | B435*1C5687M0## |
| 680 | 45 × 50 | 230 | 300 | 240 | 6.6 | 3.7 | B43511E5687M0## |
| 820 | 40 × 70 | 190 | 250 | 200 | 8.2 | 4.6 | B435*1A5827M0## |
| 820 | 45 × 60 | 190 | 250 | 200 | 7.8 | 4.3 | B43511C5827M0## |
| 1000 | 40 × 100 | 160 | 200 | 160 | 10.5 | 5.8 | B435*1A5108M0## |
| 1000 | 45 × 70 | 160 | 200 | 160 | 9.1 | 5.1 | B43511C5108M0## |
| 1500 | 45 × 100 | 110 | 140 | 110 | 12.9 | 7.1 | B43511A5158M0## |

Capacitors with solder pins are only available in 35 and 40 mm case diameters.

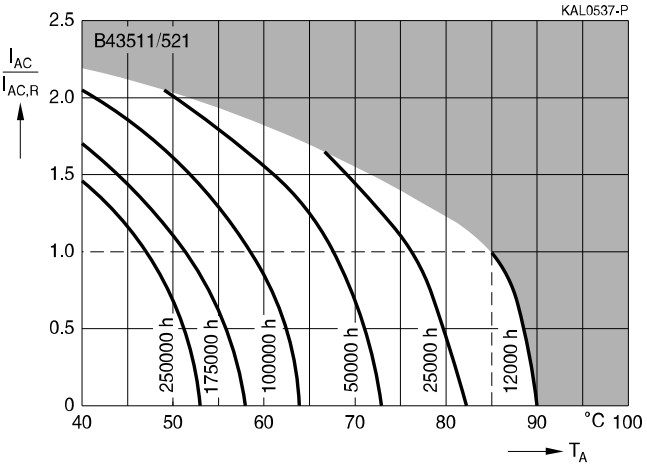
**Composition of ordering code**

* = Terminal type
- 1 = 4-pin snap-in terminals
- 2 = solder pin

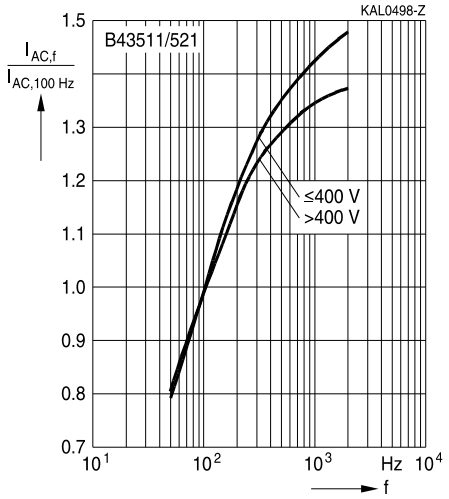
## = Terminal style and insulation feature
- 00 = solder pin or 4-pin snap-in standard terminals and PVC insulation
- 07 = 4-pin snap-in short terminals and PVC insulation
- 80 = 4-pin snap-in standard terminals and PVC insulation with additional PET insulation cap on terminal side
- 87 = 4-pin snap-in short terminals and PVC insulation with additional PET insulation cap on terminal side

**Useful life**

depending on ambient temperature $T_A$ under ripple current operating conditions[1)]
Voltage derating (0.93 · $V_R$) enables 105 °C operation

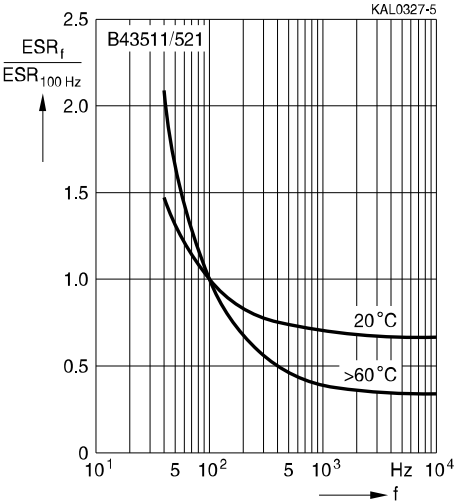



**Frequency factor of permissible ripple current $I_{AC}$ versus frequency f**

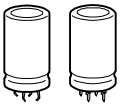



**Frequency characteristics of ESR**

Typical behavior

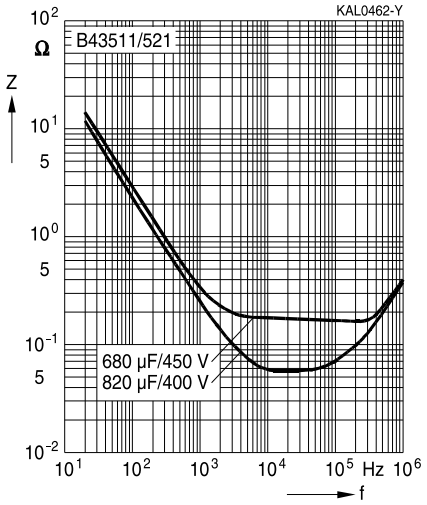


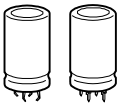

1) Refer to chapter "General technical information, 5.3 Calculation of useful life" on how to interpret the useful life graphs.



**Impedance Z versus frequency f**

Typical behavior at 20 °C







## Cautions and warnings

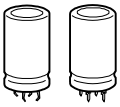
### Personal safety

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:

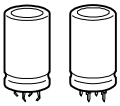
- Any escaping electrolyte should not come into contact with eyes or skin.
- If electrolyte does come into contact with the skin, wash the affected parts immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment.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

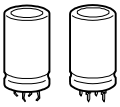
| Topic | Safety information | Reference Chapter "General technical information" |
|---|---|---|
| Polarity | Make sure that polar capacitors are connected with the right polarity. | 1 "Basic construction of aluminum electrolytic capacitors" |
| Reverse voltage | Voltages polarity classes should be prevented 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.<br>Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors.<br>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.<br>Avoid any compressive, tensile or flexural stress.<br>Do not move the capacitor after soldering to PC board.<br>Do not pick up the PC board by the soldered capacitor.<br>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:<br>M5: 2 Nm<br>M6: 2.5 Nm | 11.3 "Mounting torques" |
| Soldering | Do not exceed the specified time or temperature limits during soldering. | 11.5 "Soldering" |



**B43511, B43521**

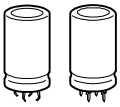
**Outstanding ripple current – 85 °C**

| 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 |
| $\Delta T$ | 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) |





| 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 $\delta$ | Dissipation factor | Verlustfaktor |
| $\lambda$ | Failure rate | Ausfallrate |
| $\varepsilon_0$ | Absolute permittivity | Elektrische Feldkonstante |
| $\varepsilon_r$ | Relative permittivity | Dielektrizitätszahl |
| $\omega$ | 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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