

**Long-life grade capacitors**

**Applications**

- Frequency converters
- Switch-mode power supplies in industrial and consumer electronics
- Uninterruptible power supplies

**Features**

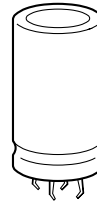
- Long useful life
- Outstanding ripple current capability
- High volumetric efficiency
- Many different case sizes
- Pinning ensures correct insertion

**Construction**

- Charge-discharge proof, polar
- Aluminum case, fully insulated
- Overload protection by preset break point in case

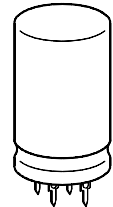
**Terminals**

- 4 snap-in terminals (6,3 mm and 4,5 mm length)
- Solder pin mounting on printed circuit boards, pins fit standardized spacings on PCB



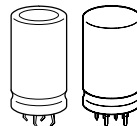
KAL0409-D

**B43511**

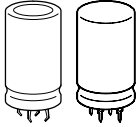


KAL0273-2

**B43521**


**Specifications and characteristics in brief**

|   |  |  |
|---|--|--|
| Rated voltage $U_R$   | 350 to 450 VDC   |  |
| Surge voltage $U_S$   | $1,1 \cdot U_R$  |  |
| Rated capacitance $C_R$   | 390 ... 2 200 $\mu\text{F}$  |  |
| Capacitance tolerance   | $\pm 20 \% \triangleq \text{M}$  |  |
| Leakage current $I_L$<br>(5 min, 20 °C)                                     | $I_L \leq 0,3 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{U_R}{\text{V}} \right)^{0,7} + 4 \mu\text{A}$   |  |
| Self-inductance $ESL$   | Approx. 20 nH  |  |
| Useful life<br>85 °C, $U_R$ ; $I_{-R}$<br>40 °C, $U_R$ ; $1,6 \cdot I_{-R}$ | > 12 000 h<br>> 200 000 h  | <b>Requirements:</b><br>$\Delta C/C \leq \pm 30 \%$ of initial value<br>$ESR \leq 3$ times initial specified limit<br>$I_L \leq$ initial specified limit<br>Failure percentage: $\leq 1 \%$<br>Failure rate: $\leq 40$ fit ( $\leq 40 \cdot 10^{-9}/\text{h}$ )<br>(for definition "fit", refer to chapter "Quality", page 62) |
| Voltage endurance test<br>85 °C; $U_R$                                      | 3 000 h  | <b>Post test requirements:</b><br>$\Delta C/C \leq \pm 10 \%$ of initial value<br>$ESR \leq 1,3$ times initial specified limit<br>$I_L \leq$ initial specified limit   |
| Vibration resistance  | To IEC 60068-2-6, test Fc:<br>displacement amplitude 0,35 mm, frequency range 10 ... 55 Hz,<br>acceleration max. 5 g, duration $3 \times 2$ h                    |  |
| IEC climatic category   | To IEC 60068-1:<br>$U_R \leq 400$ VDC: 40/085/56 (– 40 °C/+ 85 °C/56 days damp heat test)<br>$U_R > 400$ VDC: 25/085/56 (– 25 °C/+ 85 °C/56 days damp heat test) |  |
| Detail specification  | Similar to CECC 30301-805  |  |
| Sectional specification   | IEC 60384-4  |  |

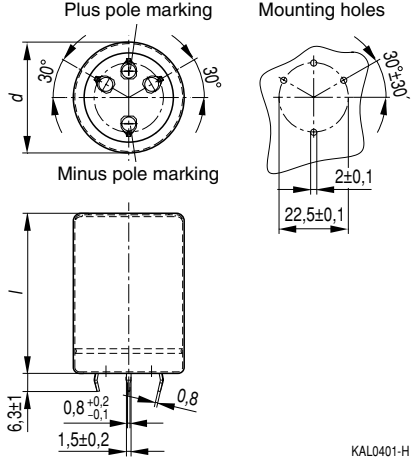


B43511 / B43521

Max. Ripple Current – 85 °C

**Dimensional drawings**

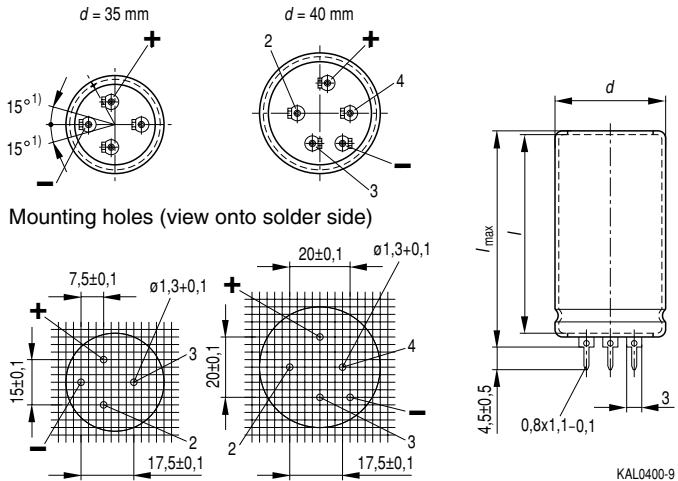
**B43511, 4 snap-in terminals**



Standard snap-in terminals: length  $(6,3 \pm 1)$  mm.  
 Also available with a length of  $(4,5 - 1)$  mm.  
 For ordering example cf. page 191

| Dimensions (mm) |           |           | Approx. weight (g) | Packing units (pieces) |
|-----------------|-----------|-----------|--------------------|------------------------|
| $d+1$           | $l \pm 2$ | $l_{max}$ |                    |                        |
| 35              | 50        | 54        | 63                 | 60                     |
| 35              | 60        | 64        | 76                 | 36                     |
| 35              | 70        | 74        | 88                 | 36                     |
| 35              | 80        | 84        | 101                | 36                     |
| 35              | 100       | 104       | 126                | 36                     |
| 40              | 40        | 44        | 71                 | 33                     |
| 40              | 50        | 54        | 89                 | 33                     |
| 40              | 60        | 64        | 107                | 33                     |
| 40              | 70        | 74        | 125                | 33                     |
| 40              | 80        | 84        | 143                | 33                     |
| 40              | 100       | 104       | 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                     |

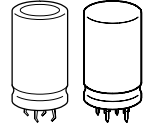
**B43521, solder pins**



- 1) Permissible range of positions for pole identification marks

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 (solder pin and 4 snap-in terminals).



Packing

B43511 / B43521

Max. Ripple Current – 85 °C

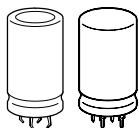
### Packing of 4 snap-in terminals and solder pins



For ecological reasons the packing is pure cardboard.

### Ordering codes

|                                 |  |
|---------------------------------|--|
| 4 snap-in terminals<br>Version  | Identification in 3rd block of ordering code |
| Standard terminals (6,3 ± 1) mm | M000   |
| Short terminals (4,5 – 1) mm    | M007   |

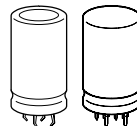

**Overview of available types**

| $U_R$ (VDC)      | 350                               | 400                            | 420                            | 450                           |
|------------------|-----------------------------------|--------------------------------|--------------------------------|-------------------------------|
| $C_R$ ( $\mu$ F) | Case dimensions $d \times l$ (mm) |                                |                                |                               |
| 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            |
| 1 000            | 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           |
| 1 500            | 40 × 80<br>45 × 70                | 40 × 100<br>45 × 80            | 40 × 100<br>45 × 80            | 45 × 100                      |
| 1 800            |                                   | 45 × 100                       | 45 × 100                       |                               |
| 2 200            | 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.

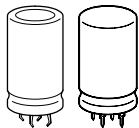

**Technical data and ordering codes**

| $U_R$<br>VDC | $C_R$<br>100 Hz<br>20 °C<br>$\mu\text{F}$ | Case<br>dimensions<br>$d \times l$<br>mm | $ESR_{\text{max}}$<br>100 Hz<br>20 °C<br>m $\Omega$ | $Z_{\text{max}}$<br>10 kHz<br>20 °C<br>m $\Omega$ | $I_{\text{max}}$<br>100 Hz<br>40 °C<br>A | $I_{\text{R}}$<br>100 Hz<br>85 °C<br>A | Ordering code <sup>1)</sup><br><br>* 1 = 4 snap-in<br>2 = solder pin |
|--------------|---|--|---|---|--|--|--|
| 350          | 560                                       | 35 × 50                                  | 230   | 190   | 7,0                                      | 3,2                                    | B435*1A4567M000  |
|              | 680                                       | 35 × 60                                  | 190   | 150   | 8,2                                      | 3,7                                    | B435*1A4687M000  |
|              | 680                                       | 40 × 50                                  | 190   | 150   | 8,1                                      | 3,7                                    | B435*1C4687M000  |
|              | 820                                       | 35 × 70                                  | 160   | 130   | 9,6                                      | 4,4                                    | B435*1A4827M000  |
|              | 820                                       | 40 × 60                                  | 160   | 130   | 9,5                                      | 4,3                                    | B435*1C4827M000  |
|              | 1 000                                     | 35 × 80                                  | 130   | 110   | 11                                       | 5,1                                    | B435*1A4108M000  |
|              | 1 000                                     | 40 × 60                                  | 130   | 110   | 10                                       | 4,8                                    | B435*1C4108M000  |
|              | 1 000                                     | 45 × 50                                  | 130   | 110   | 9,9                                      | 4,5                                    | B43511E4108M000  |
|              | 1 500                                     | 40 × 80                                  | 90  | 70  | 14                                       | 6,5                                    | B435*1A4158M000  |
|              | 1 500                                     | 45 × 70                                  | 90  | 70  | 14                                       | 6,2                                    | B43511C4158M000  |
| 2 200        | 45 × 100                                  | 60                                       | 50  | 19  | 8,6                                      | B43511A4228M000                        |  |
| 400          | 470                                       | 35 × 50                                  | 280   | 220   | 6,4                                      | 2,9                                    | B435*1A9477M000  |
|              | 470                                       | 40 × 40                                  | 280   | 220   | 6,2                                      | 2,8                                    | B435*1C9477M000  |
|              | 560                                       | 35 × 60                                  | 230   | 190   | 7,5                                      | 3,4                                    | B435*1A9567M000  |
|              | 560                                       | 45 × 40                                  | 230   | 190   | 6,9                                      | 3,1                                    | B43511C9567M000  |
|              | 680                                       | 35 × 70                                  | 190   | 150   | 8,7                                      | 4,0                                    | B435*1A9687M000  |
|              | 680                                       | 40 × 60                                  | 190   | 150   | 8,7                                      | 3,9                                    | B435*1C9687M000  |
|              | 680                                       | 45 × 50                                  | 190   | 150   | 8,1                                      | 3,7                                    | B43511E9687M000  |
|              | 820                                       | 35 × 80                                  | 160   | 130   | 10                                       | 4,6                                    | B435*1A9827M000  |
|              | 820                                       | 40 × 60                                  | 160   | 130   | 9,5                                      | 4,3                                    | B435*1C9827M000  |
|              | 1 000                                     | 35 × 100                                 | 130   | 110   | 12                                       | 5,6                                    | B435*1C9108M000  |
|              | 1 000                                     | 40 × 70                                  | 130   | 110   | 11                                       | 5,1                                    | B435*1A9108M000  |
|              | 1 000                                     | 45 × 60                                  | 130   | 110   | 11                                       | 4,8                                    | B43511B9108M000  |
|              | 1 500                                     | 40 × 100                                 | 90  | 70  | 16                                       | 7,2                                    | B435*1A9158M000  |
|              | 1 500                                     | 45 × 80                                  | 90  | 70  | 14                                       | 6,5                                    | B43511C9158M000  |
|              | 1 800                                     | 45 × 100                                 | 80  | 60  | 17                                       | 7,8                                    | B43511A9188M000  |

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

Preferred types

1) For capacitors with short 4 snap-in terminals, see page 191.

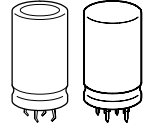


| $U_R$ | $C_R$<br>100 Hz<br>20 °C<br>$\mu\text{F}$ | Case<br>dimensions<br>$d \times l$<br>mm | $ESR_{\text{max}}$<br>100 Hz<br>20 °C<br>m $\Omega$ | $Z_{\text{max}}$<br>10 kHz<br>20 °C<br>m $\Omega$ | $I_{\text{~max}}$<br>100 Hz<br>40 °C<br>A | $I_{\text{~R}}$<br>100 Hz<br>85 °C<br>A | Ordering code <sup>1)</sup><br><br>* 1 = 4 snap-in<br>2 = solder pin |                 |
|-------|---|--|---|---|---|---|--|-----------------|
| VDC   | 420                                       | 470                                      | 35 × 50   | 430   | 340                                       | 6,4                                     | 2,9  | B435*1A0477M000 |
|       |   | 470                                      | 40 × 40   | 430   | 340                                       | 6,2                                     | 2,8  | B435*1C0477M000 |
|       |   | 560                                      | 35 × 60   | 360   | 290                                       | 7,5                                     | 3,4  | B435*1A0567M000 |
|       |   | 560                                      | 40 × 50   | 360   | 290                                       | 7,3                                     | 3,3  | B435*1C0567M000 |
|       |   | 680                                      | 35 × 70   | 300   | 240                                       | 8,7                                     | 4,0  | B435*1A0687M000 |
|       |   | 680                                      | 40 × 60   | 300   | 240                                       | 8,7                                     | 3,9  | B435*1C0687M000 |
|       |   | 680                                      | 45 × 50   | 300   | 240                                       | 8,1                                     | 3,7  | B43511E0687M000 |
|       |   | 820                                      | 35 × 80   | 250   | 200                                       | 10                                      | 4,6  | B435*1A0827M000 |
|       |   | 820                                      | 40 × 70   | 250   | 200                                       | 10                                      | 4,6  | B435*1C0827M000 |
|       |   | 820                                      | 45 × 50   | 250   | 200                                       | 8,9                                     | 4,1  | B43511E0827M000 |
|       |   | 1 000                                    | 35 × 100  | 200   | 160                                       | 12                                      | 5,6  | B435*1A0108M000 |
|       |   | 1 000                                    | 40 × 80   | 200   | 160                                       | 11                                      | 5,3  | B435*1C0108M000 |
|       |   | 1 000                                    | 45 × 60   | 200   | 160                                       | 10                                      | 4,8  | B43511E0108M000 |
|       |   | 1 500                                    | 40 × 100  | 140   | 110                                       | 15                                      | 7,2  | B435*1A0158M000 |
|       |   | 1 500                                    | 45 × 80   | 140   | 110                                       | 14                                      | 6,5  | B43511C0158M000 |
|       |   | 1 800                                    | 45 × 100  | 120   | 90  | 17                                      | 7,8  | B43511A0188M000 |
| VDC   | 450                                       | 390                                      | 35 × 50   | 520   | 410                                       | 5,8                                     | 2,6  | B435*1A5397M000 |
|       |   | 390                                      | 40 × 40   | 520   | 410                                       | 5,7                                     | 2,6  | B435*1C5397M000 |
|       |   | 470                                      | 35 × 60   | 430   | 340                                       | 6,8                                     | 3,1  | B435*1A5477M000 |
|       |   | 470                                      | 40 × 50   | 430   | 340                                       | 6,7                                     | 3,1  | B435*1C5477M000 |
|       |   | 470                                      | 45 × 40   | 430   | 340                                       | 6,3                                     | 2,9  | B43511E5477M000 |
|       |   | 560                                      | 35 × 70   | 360   | 290                                       | 7,9                                     | 3,6  | B435*1A5567M000 |
|       |   | 560                                      | 40 × 60   | 360   | 290                                       | 7,9                                     | 3,6  | B435*1C5567M000 |
|       |   | 680                                      | 35 × 80   | 300   | 240                                       | 9,2                                     | 4,2  | B435*1A5687M000 |
|       |   | 680                                      | 40 × 60   | 300   | 240                                       | 8,7                                     | 3,9  | B435*1C5687M000 |
|       |   | 680                                      | 45 × 50   | 300   | 240                                       | 8,1                                     | 3,7  | B43511E5687M000 |
|       |   | 820                                      | 40 × 70   | 250   | 200                                       | 10                                      | 4,6  | B435*1A5827M000 |
|       |   | 820                                      | 45 × 60   | 250   | 200                                       | 9,5                                     | 4,3  | B43511C5827M000 |
|       |   | 1 000                                    | 40 × 100  | 200   | 160                                       | 13                                      | 5,8  | B435*1A5108M000 |
|       |   | 1 000                                    | 45 × 70   | 200   | 160                                       | 11                                      | 5,1  | B43511C5108M000 |
|       |   | 1 500                                    | 45 × 100  | 140   | 110                                       | 16                                      | 7,1  | B43511A5158M000 |

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

Preferred types

1) For capacitors with short 4 snap-in terminals, see page 191.

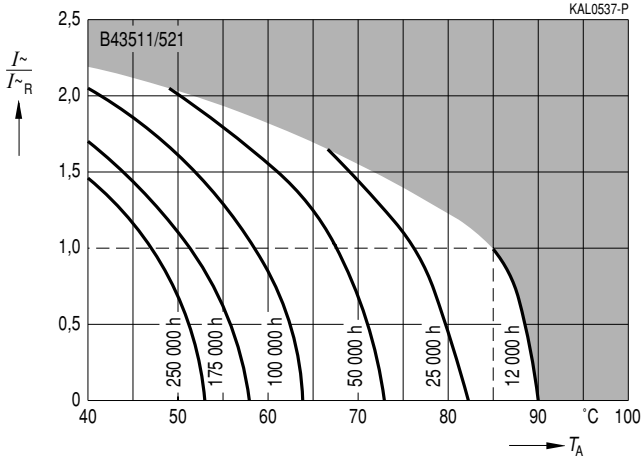


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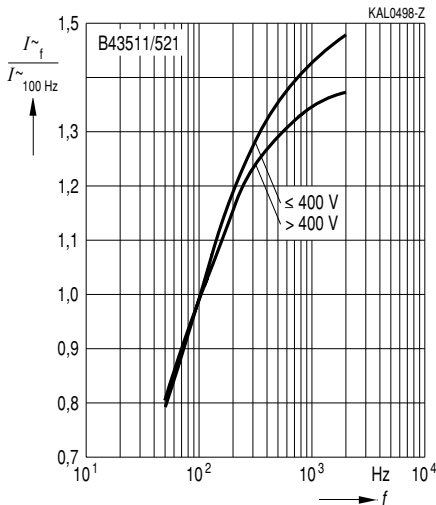
Max. Ripple Current – 85 °C

### Useful life

depending on ambient temperature  $T_A$  under ripple current operating conditions<sup>1)</sup>

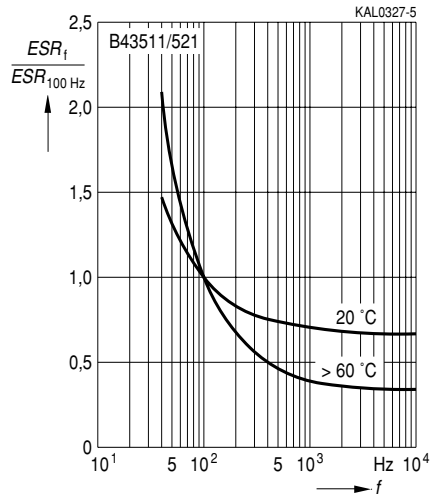


### Frequency factor of permissible ripple current $I_{\sim}$ versus frequency $f$



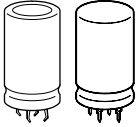
### Frequency characteristics of ESR

Typical behavior



1) Refer to page 40 for an explanation on how to interpret the useful life graphs.

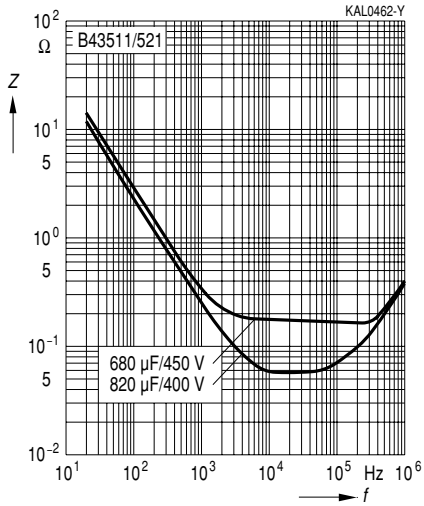




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Max. Ripple Current – 85 °C

**Impedance  $Z$**  at  $f = 10$  kHz  
 versus frequency  $f$   
 Typical behavior at 20 °C



**Herausgegeben von EPCOS AG**

**Unternehmenskommunikation, Postfach 80 17 09, 81617 München, DEUTSCHLAND**

**☎ ++49 89 636 09, FAX (0 89) 636-2 26 89**

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