



# **Aluminum electrolytic capacitors**

Capacitors with screw terminals

**Series/Type:**        **B43455, B43457**

**Date:**                November 2008

## Long-life grade capacitors

### Applications

- Frequency converters
- Uninterruptible power supplies
- Professional power supplies

### Features

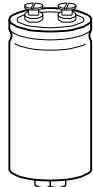
- Long useful life
- All-welded construction ensures reliable electrical contact
- Version with optimized construction for base cooling (heat sink mounting) available
- Version with low-inductance design available
- Self-extinguishing electrolyte
- RoHS-compatible

### Construction

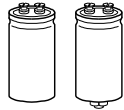
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Poles with screw terminal connections
- Mounting with ring clips, clamps or threaded stud
- The bases of types with threaded stud and  $d \leq 76.9$  mm are not insulated, types with  $d = 91$  mm have fully insulated bases



B43455

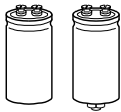


B43457



## Specifications and characteristics in brief

|                                                     |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------|-------|------------------------------------------------|---|---|------------------------------------------------|----|----|--|
| Rated voltage $V_R$                                 | 350 ... 450 V DC                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Surge voltage $V_S$                                 | $1.10 \cdot V_R$                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Rated capacitance $C_R$                             | 1000 ... 15000 $\mu\text{F}$                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Capacitance tolerance                               | $\pm 20\% \triangle M$                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Leakage current $I_{\text{leak}}$<br>(20 °C, 5 min) | $I_{\text{leak}} \leq 0.3 \mu\text{A} \cdot \left( \frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right)^{0.7} + 4 \mu\text{A}$                                                                                                  |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Self-inductance ESL                                 | d = 51.6 mm: approx. 15 nH<br>d $\geq$ 64.3 mm: approx. 20 nH<br>Capacitors with low-inductance design:<br>d $\geq$ 64.3 mm: approx. 13 nH                                                                                     |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Useful life                                         |                                                                                                                                                                                                                                | Requirements:                                                                                                                                                                                                                                                                                           |       |                      |       |                                                |   |   |                                                |    |    |  |
| 85 °C; $V_R$ ; $I_{AC,R}$                           | > 10000 h                                                                                                                                                                                                                      | $\Delta C/C \leq \pm 30\%$ of initial value                                                                                                                                                                                                                                                             |       |                      |       |                                                |   |   |                                                |    |    |  |
| 40 °C; $V_R$ ; $1.5 \cdot I_{AC,R}$                 | > 200000 h                                                                                                                                                                                                                     | ESR $\leq 3$ times initial specified limit                                                                                                                                                                                                                                                              |       |                      |       |                                                |   |   |                                                |    |    |  |
|                                                     |                                                                                                                                                                                                                                | $I_{\text{leak}} \leq$ initial specified limit                                                                                                                                                                                                                                                          |       |                      |       |                                                |   |   |                                                |    |    |  |
| Voltage endurance test                              |                                                                                                                                                                                                                                | Post test requirements:                                                                                                                                                                                                                                                                                 |       |                      |       |                                                |   |   |                                                |    |    |  |
| 85 °C; $V_R$                                        | 2 000 h                                                                                                                                                                                                                        | $\Delta C/C \leq \pm 10\%$ of initial value                                                                                                                                                                                                                                                             |       |                      |       |                                                |   |   |                                                |    |    |  |
|                                                     |                                                                                                                                                                                                                                | ESR $\leq 1.3$ times initial specified limit                                                                                                                                                                                                                                                            |       |                      |       |                                                |   |   |                                                |    |    |  |
|                                                     |                                                                                                                                                                                                                                | $I_{\text{leak}} \leq$ initial specified limit                                                                                                                                                                                                                                                          |       |                      |       |                                                |   |   |                                                |    |    |  |
| Vibration resistance test                           | To IEC 60068-2-6, test Fc:<br>Displacement amplitude 0.75 mm, frequency range 10 ... 55 Hz,<br>acceleration max. 10 g, duration 3 $\times$ 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                                                                                                                                                                                                 | <table><tr><td><math>V_R</math></td><td><math>\leq 400 \text{ V}</math></td><td>450 V</td></tr><tr><td><math>Z_{-25^\circ\text{C}} / Z_{20^\circ\text{C}}</math></td><td>4</td><td>3</td></tr><tr><td><math>Z_{-40^\circ\text{C}} / Z_{20^\circ\text{C}}</math></td><td>16</td><td>12</td></tr></table> | $V_R$ | $\leq 400 \text{ V}$ | 450 V | $Z_{-25^\circ\text{C}} / Z_{20^\circ\text{C}}$ | 4 | 3 | $Z_{-40^\circ\text{C}} / Z_{20^\circ\text{C}}$ | 16 | 12 |  |
| $V_R$                                               | $\leq 400 \text{ V}$                                                                                                                                                                                                           | 450 V                                                                                                                                                                                                                                                                                                   |       |                      |       |                                                |   |   |                                                |    |    |  |
| $Z_{-25^\circ\text{C}} / Z_{20^\circ\text{C}}$      | 4                                                                                                                                                                                                                              | 3                                                                                                                                                                                                                                                                                                       |       |                      |       |                                                |   |   |                                                |    |    |  |
| $Z_{-40^\circ\text{C}} / Z_{20^\circ\text{C}}$      | 16                                                                                                                                                                                                                             | 12                                                                                                                                                                                                                                                                                                      |       |                      |       |                                                |   |   |                                                |    |    |  |
| IEC climatic category                               | To IEC 60068-1:<br>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                                | Similar to CECC 30301-803, CECC 30301-807                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |
| Sectional specification                             | IEC 60384-4                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                         |       |                      |       |                                                |   |   |                                                |    |    |  |



## B43455, B43457

Long useful life – 85 °C

### Ripple current capability

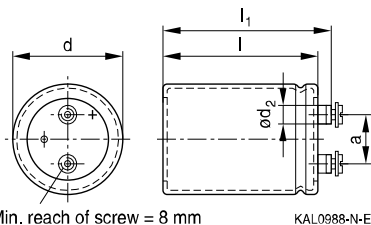
Due to the ripple current capability of the contact elements, the following current upper limits must not be exceeded:

| Capacitor diameter | 51.6 mm | 64.3 mm | 76.9 mm | 91 mm |
|--------------------|---------|---------|---------|-------|
| $I_{AC,max}$       | 34 A    | 45 A    | 57 A    | 80 A  |

### Dimensional drawings

#### B43455

Ring clip/clamp mounting



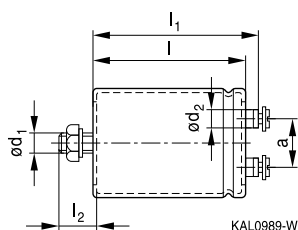
M5: Min. reach of screw = 8 mm  
M6: Min. reach of screw = 12 mm <sup>\*)</sup>

<sup>\*)</sup> 9.5 mm for low-inductance design

KAL0988-N-E

#### B43457

Threaded stud mounting



KAL0989-W

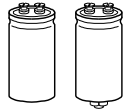
Positive pole marking: +

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

### Dimensions and weights

| Ter-<br>minal | Dimensions (mm) with insulating sleeve |       |                   |                      |                |                     |             | Approx.<br>weight (g) |
|---------------|----------------------------------------|-------|-------------------|----------------------|----------------|---------------------|-------------|-----------------------|
|               | d                                      | l ±1  | l <sub>1</sub> ±1 | l <sub>2</sub> +0/-1 | d <sub>1</sub> | d <sub>2</sub> max. | a +0.2/-0.4 |                       |
| 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                   |
| M6            | 76.9 +0/-0.7                           | 105.7 | 111.5             | 17                   | M12            | 17.7                | 31.7        | 620                   |
| M6            | 76.9 +0/-0.7                           | 143.2 | 149.0             | 17                   | M12            | 17.7                | 31.7        | 840                   |
| 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                             | 221.0 | 226.3             | 17                   | M12            | 17.7                | 31.7        | 1900                  |

Dimensions are also valid for low-inductance design.



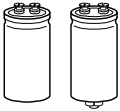
## Packing

| Capacitor diameter d (mm) | length l (mm) | Packing units (pcs.) |
|---------------------------|---------------|----------------------|
| 51.6                      | all           | 36                   |
| 64.3                      | all           | 25                   |

| Capacitor diameter d (mm) | length l (mm) | Packing units (pcs.) |
|---------------------------|---------------|----------------------|
| 76.9                      | 97.0 - 168.7  | 16                   |
|                           | 191.0 - 220.7 | 12                   |
| 91.0                      | all           | 9                    |



For ecological reasons the packing is pure cardboard.



**B43455, B43457**

**Long useful life – 85 °C**

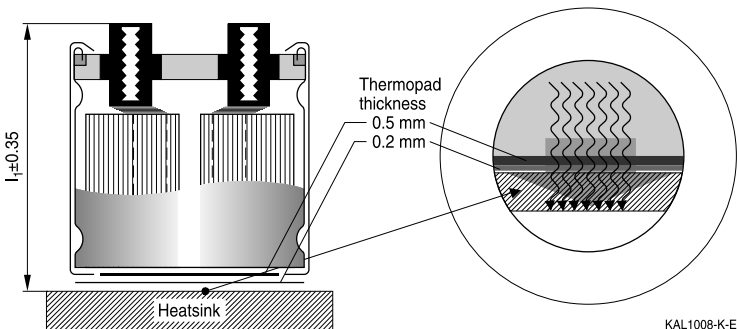
### Special designs

- 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"):

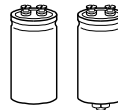
- Electrical insulation of the capacitors base with 2 overlapping thermal pads for optimal heat flow (minimal thermal resistance at the capacitor base)
- Minimal overall length tolerance ( $\pm 0.35$  mm) for mounting between heat sink and bus bar
- Case with extra groove near the base for clamp mounting (recommended ring clamp B44030A0165B ... A0190B)

This version is available only for capacitors without threaded stud and for diameters  $\geq 64.3$  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 $d \geq 64.3$ mm                           |
| For heat sink mounting | M007                                         | For capacitors with diameter $d \geq 64.3$ mm and without threaded stud |



Dimensions and weights for heat sink mounting:

| Ter-<br>minal | Dimensions (mm) with insulating sleeve |         |                         |                         |                |                        |                | Min. reach<br>of screw<br>mm | Approx.<br>weight<br>g |
|---------------|----------------------------------------|---------|-------------------------|-------------------------|----------------|------------------------|----------------|------------------------------|------------------------|
|               | d                                      | l<br>±1 | l <sub>1</sub><br>±0.35 | l <sub>2</sub><br>+0/–1 | d <sub>1</sub> | d <sub>2</sub><br>max. | a<br>+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.

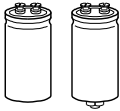
## Accessories

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  | M8     | J 8.2 DIN 6797  | Hex nut BM 8 DIN 439                   | 4 Nm           |
|               | M12    | J 12.5 DIN 6797 | Hex nut BM 12 DIN 439                  | 10 Nm          |

The following items must be ordered separately. For details, refer to chapter "Capacitors with screw terminals – Accessories".

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



**B43455, B43457**

**Long useful life – 85 °C**

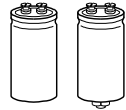
### Overview of available types

| $V_R$ (V DC) | 350                               | 400                         | 450                          |
|--------------|-----------------------------------|-----------------------------|------------------------------|
|              | Case dimensions $d \times l$ (mm) |                             |                              |
| $C_R$ (μF)   |                                   |                             |                              |
| 1000         |                                   |                             | 51.6 × 80.7                  |
| 1500         | 51.6 × 80.7                       | 51.6 × 80.7                 | 51.6 × 105.7<br>64.3 × 80.7  |
| 2200         | 51.6 × 105.7                      | 51.6 × 105.7<br>64.3 × 80.7 | 64.3 × 105.7                 |
| 3300         | 64.3 × 105.7                      | 64.3 × 105.7                | 64.3 × 143.2<br>76.9 × 105.7 |
| 4700         | 64.3 × 143.2<br>76.9 × 105.7      | 76.9 × 105.7                | 76.9 × 143.2                 |
| 5600         | 76.9 × 105.7                      | 76.9 × 143.2                | 76.9 × 168.7                 |
| 6800         | 76.9 × 143.2                      | 76.9 × 143.2                | 76.9 × 220.7                 |
| 8200         | 76.9 × 168.7                      | 91.0 × 144.5                | 76.9 × 220.7                 |
| 10000        | 76.9 × 220.7                      | 76.9 × 220.7                | 91.0 × 221.0                 |
| 12000        | 76.9 × 220.7                      | 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.




**Technical data and ordering codes**

| $C_R$                              | Case dimensions | $ESR_{typ}$<br>100 Hz | $ESR_{max}$<br>100 Hz | $Z_{max}$<br>10 kHz | $I_{AC,max}$<br>100 Hz | $I_{AC,R}$<br>100 Hz | $I_{AC,R(B)}$<br>100 Hz | Ordering code<br>(composition see below) |
|------------------------------------|-----------------|-----------------------|-----------------------|---------------------|------------------------|----------------------|-------------------------|------------------------------------------|
| 100 Hz                             | d × l           | 20 °C                 | 20 °C                 | 20 °C               | 40 °C                  | 85 °C                | 85 °C                   |                                          |
| μF                                 | mm              | mΩ                    | mΩ                    | mΩ                  | A                      | A                    | A                       |                                          |
| <b><math>V_R = 350</math> V DC</b> |                 |                       |                       |                     |                        |                      |                         |                                          |
| 1500                               | 51.6 × 80.7     | 80                    | 120                   | 96                  | 14                     | 4.9                  | 9.4                     | B4345*C4158M000                          |
| 2200                               | 51.6 × 105.7    | 48                    | 72                    | 58                  | 20                     | 7.1                  | 12.7                    | B4345*D4228M000                          |
| 3300                               | 64.3 × 105.7    | 32                    | 48                    | 38                  | 22                     | 8.1                  | 14.2                    | B4345*C4338M00#                          |
| 4700                               | 64.3 × 143.2    | 25                    | 38                    | 30                  | 27                     | 9.9                  | 15.1                    | B4345*C4478M00#                          |
| 4700                               | 76.9 × 105.7    | 25                    | 38                    | 30                  | 28                     | 10.2                 | 19.7                    | B4345*B4478M00#                          |
| 5600                               | 76.9 × 105.7    | 21                    | 32                    | 25                  | 31                     | 11.3                 | 22.4                    | B4345*A4568M00#                          |
| 6800                               | 76.9 × 143.2    | 18                    | 27                    | 22                  | 35                     | 12.8                 | 21.4                    | B4345*A4688M00#                          |
| 8200                               | 76.9 × 168.7    | 15                    | 23                    | 18                  | 42                     | 15.4                 | 23.7                    | B4345*B4828M00#                          |
| 10000                              | 76.9 × 220.7    | 10                    | 15                    | 12                  | 55                     | 19.8                 | 27.5                    | B4345*C4109M00#                          |
| 12000                              | 76.9 × 220.7    | 9.0                   | 14                    | 11                  | 57                     | 22.5                 | 31.7                    | B4345*B4129M00#                          |
| 15000                              | 91.0 × 221.0    | 7.0                   | 11                    | 8.0                 | 73                     | 26.5                 | 39.2                    | B4345*A4159M00#                          |
| <b><math>V_R = 400</math> V DC</b> |                 |                       |                       |                     |                        |                      |                         |                                          |
| 1500                               | 51.6 × 80.7     | 69                    | 104                   | 83                  | 15                     | 5.4                  | 10.9                    | B4345*D9158M000                          |
| 2200                               | 51.6 × 105.7    | 59                    | 89                    | 71                  | 18                     | 6.5                  | 11.6                    | B4345*B9228M000                          |
| 2200                               | 64.3 × 80.7     | 59                    | 89                    | 71                  | 18                     | 6.4                  | 12.3                    | B4345*C9228M00#                          |
| 3300                               | 64.3 × 105.7    | 36                    | 54                    | 43                  | 25                     | 9.0                  | 15.9                    | B4345*A9338M00#                          |
| 4700                               | 76.9 × 105.7    | 27                    | 41                    | 32                  | 27                     | 9.9                  | 19.3                    | B4345*A9478M00#                          |
| 5600                               | 76.9 × 143.2    | 22                    | 33                    | 26                  | 31                     | 11.4                 | 18.8                    | B4345*A9568M00#                          |
| 6800                               | 76.9 × 143.2    | 20                    | 30                    | 24                  | 35                     | 12.6                 | 21.9                    | B4345*A9688M00#                          |
| 8200                               | 91.0 × 144.5    | 17                    | 26                    | 20                  | 40                     | 14.5                 | 24.6                    | B4345*A9828M00#                          |
| 10000                              | 76.9 × 220.7    | 15                    | 23                    | 18                  | 47                     | 17.1                 | 23.8                    | B4345*A9109M00#                          |
| 12000                              | 91.0 × 221.0    | 12                    | 18                    | 14                  | 54                     | 19.6                 | 28.5                    | B4345*A9129M00#                          |

**Composition of ordering code**

\* = Mounting style

5 = for capacitors with ring clip/clamp mounting

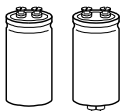
7 = for capacitors with threaded stud

# = Design

0 = for capacitors with standard inductance

3 = for capacitors with low inductance (13 nH) - only capacitors with diameter  $d \geq 64.3$  mm

7 = for heat sink mounting - only capacitors with diameter  $d \geq 64.3$  mm and without threaded stud



**B43455, B43457**

**Long useful life – 85 °C**

## Technical data and ordering codes

| $C_R$                    | Case dimensions | $ESR_{typ}$<br>100 Hz | $ESR_{max}$<br>100 Hz | $Z_{max}$<br>10 kHz | $I_{AC,max}$<br>100 Hz | $I_{AC,R}$<br>100 Hz | $I_{AC,R(B)}$<br>100 Hz | Ordering code<br>(composition see below) |
|--------------------------|-----------------|-----------------------|-----------------------|---------------------|------------------------|----------------------|-------------------------|------------------------------------------|
| 100 Hz                   | d × l           | 20 °C                 | 20 °C                 | 20 °C               | 40 °C                  | 85 °C                | 85 °C                   |                                          |
| μF                       | mm              | mΩ                    | mΩ                    | mΩ                  | A                      | A                    | A                       |                                          |
| $V_R = 450 \text{ V DC}$ |                 |                       |                       |                     |                        |                      |                         |                                          |
| 1000                     | 51.6 × 80.7     | 99                    | 149                   | 119                 | 12                     | 4.5                  | 8.6                     | B4345*D5108M000                          |
| 1500                     | 51.6 × 105.7    | 63                    | 95                    | 76                  | 17                     | 6.2                  | 10.7                    | B4345*C5158M000                          |
| 1500                     | 64.3 × 80.7     | 63                    | 95                    | 76                  | 17                     | 6.1                  | 11.4                    | B4345*D5158M00#                          |
| 2200                     | 64.3 × 105.7    | 50                    | 75                    | 60                  | 21                     | 7.5                  | 12.8                    | B4345*C5228M00#                          |
| 3300                     | 64.3 × 143.2    | 30                    | 45                    | 36                  | 26                     | 9.4                  | 14.3                    | B4345*B5338M00#                          |
| 3300                     | 76.9 × 105.7    | 30                    | 45                    | 36                  | 26                     | 9.4                  | 17.7                    | B4345*C5338M00#                          |
| 4700                     | 76.9 × 143.2    | 23                    | 35                    | 28                  | 32                     | 11.7                 | 19.6                    | B4345*B5478M00#                          |
| 5600                     | 76.9 × 168.7    | 20                    | 30                    | 24                  | 36                     | 13.2                 | 20.0                    | B4345*A5568M00#                          |
| 6800                     | 76.9 × 220.7    | 16                    | 24                    | 19                  | 43                     | 15.7                 | 21.0                    | B4345*A5688M00#                          |
| 8200                     | 76.9 × 220.7    | 13                    | 20                    | 16                  | 51                     | 18.5                 | 25.6                    | B4345*B5828M00#                          |
| 10000                    | 91.0 × 221.0    | 11                    | 17                    | 13                  | 57                     | 20.7                 | 29.9                    | B4345*A5109M00#                          |

## Composition of ordering code

\* = Mounting style

5 = for capacitors with ring clip/clamp mounting

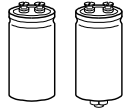
7 = for capacitors with threaded stud

# = Design

0 = for capacitors with standard inductance

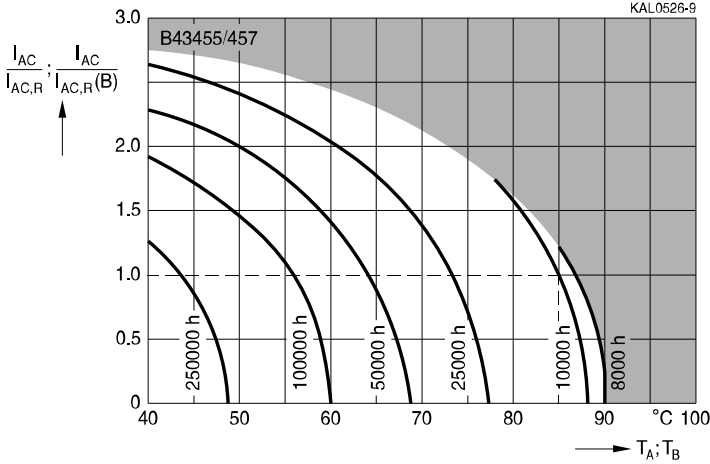
3 = for capacitors with low inductance (13 nH) - only capacitors with diameter  $d \geq 64.3 \text{ mm}$

7 = for heat sink mounting - only capacitors with diameter  $d \geq 64.3 \text{ mm}$  and without threaded stud

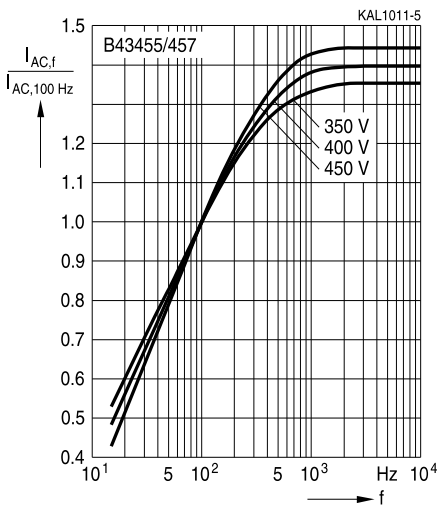


## Useful life

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<sup>1) 2)</sup>

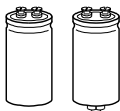


## Frequency factor of permissible ripple current $I_{AC}$ versus frequency $f$



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.

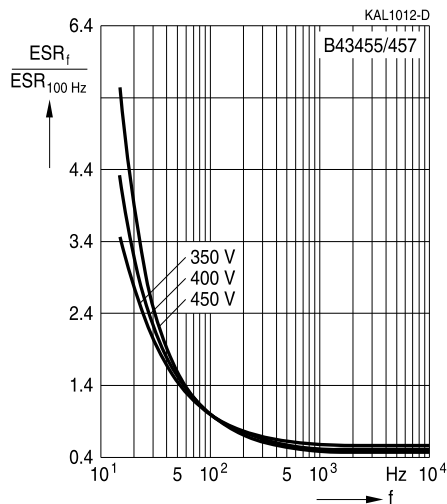


**B43455, B43457**

**Long useful life – 85 °C**

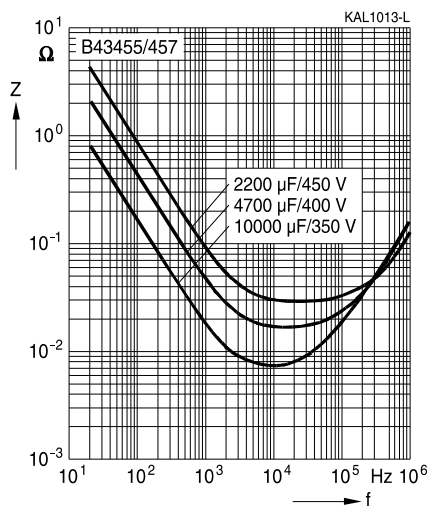
## Frequency characteristics of ESR

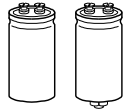
Typical behavior



## Impedance Z versus frequency f

Typical behavior at 20 °C





## Cautions and warnings

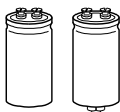
### Personal safety

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.



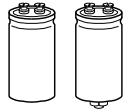
**B43455, B43457**

**Long useful life – 85 °C**

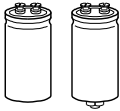
## Product safety

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<br>Chapter "General<br>technical information"          |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Polarity                                       | Make sure that polar capacitors are connected with the right polarity.                                                                                                                                                                                                                                                                                                                                | 1<br>"Basic construction of aluminum electrolytic capacitors"    |
| Reverse voltage                                | Voltages polarity classes should be prevented by connecting a diode.                                                                                                                                                                                                                                                                                                                                  | 3.1.6<br>"Reverse voltage"                                       |
| Upper category temperature                     | Do not exceed the upper category temperatur.                                                                                                                                                                                                                                                                                                                                                          | 7.2<br>"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<br>"Maintenance"                                              |
| Mounting position of screw terminal capacitors | Do not mount the capacitor with the terminals (safety vent) upside down.                                                                                                                                                                                                                                                                                                                              | 11.1.<br>"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<br>"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<br>"Mounting torques"                                       |
| Soldering                                      | Do not exceed the specified time or temperature limits during soldering.                                                                                                                                                                                                                                                                                                                              | 11.5<br>"Soldering"                                              |



| Topic                                          | Safety information                                                                                | Reference<br>Chapter "General<br>technical information"   |
|------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Soldering,<br>cleaning agents                  | Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors. | 11.6<br>"Cleaning agents"                                 |
| Passive<br>flammability                        | Avoid external energy, such as fire or electricity.                                               | 8.1<br>"Passive flammability"                             |
| Active<br>flammability                         | Avoid overload of the capacitors.                                                                 | 8.2<br>"Active flammability"                              |
|                                                |                                                                                                   | Reference<br>Chapter "Capacitors<br>with screw terminals" |
| Breakdown strength<br>of insulating<br>sleeves | Do not damage the insulating sleeve, especially when ring clips are used for mounting.            | "Screw terminals -<br>accessories"                        |



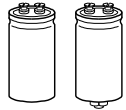
**B43455, B43457**

**Long useful life – 85 °C**

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

## Notes

All dimensions are given in mm.

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