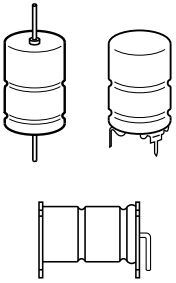
# Aluminum electrolytic capacitors

Axial-lead and soldering star capacitors

**Series/Type:** **B41689, B41789**

Date: November 2012



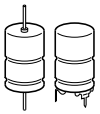
### Applications
- Automotive electronics

### Features
- Very high ripple current capability
- Long useful life, 2000 h at up to 150 °C
- Low ESR also at 63 V DC
- High vibration stability
- Shelf life up to 15 years at storage temperatures up to 40 °C. To ensure solderability, the capacitors should be built into the application within one year of delivery. After a total of two years' storage, the operating voltage must be applied for one hour to ensure the specified leakage current.
- RoHS-compatible

### Construction
- Charge/discharge-proof, polar
- Aluminum case with insulating sleeve
- Negative pole connected to case

### Terminals
- Axial leads, welded to ensure perfect electrical contact
- Soldering star for upright mounting on PCB available
- Alternative axial-lead design with double-sided plates for horizontal mounting available upon request

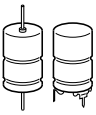
### Taping and packing
- Axial-lead capacitors will be delivered in pallet package Capacitors with $d \times l \leq 16 \times 30$ mm are also available taped on reel
- Soldering star capacitors are packed in cardboard



**Specifications and characteristics in brief**

| | | | | | |
|---|---|---|---|---|---|
| Rated voltage $V_R$ | 25 ... 63 V DC | | | | |
| Surge voltage $V_S$ | 1.15 · $V_R$ for ≤ 40 V DC<br>1.10 · $V_R$ for 63 V DC | | | | |
| Rated capacitance $C_R$ | 270 ... 4500 µF | | | | |
| Capacitance tolerance | –10/+30% ≙ Q | | | | |
| Leakage current $I_{leak}$ (5 min, 20 °C) | $I_{leak} \leq 0.006\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right) + 4\ \mu A$ | | | | |
| Self-inductance ESL[1] | Diameter d (mm) | | 16 | 18 | 20/21 |
| | Terminals | Length l (mm) | Approx. ESL (nH) | | |
| | axial | 25 | 26 | 30 | – |
| | | 29 | – | – | 38 |
| | | 30 | 29 | 34 | – |
| | | 35 | 31 | – | – |
| | | 39 | 33 | 38 | 45 |
| | | 49 | – | – | 50 |
| | soldering star | 25 | 7 | 8 | – |
| | | 30 | 8 | 10 | – |
| | | 35 | 9 | – | – |
| | | 39 | 9 | 11 | 13 |
| | | 49 | – | – | 14 |
| Useful life[2] | | Requirements: | | | |
| 150 °C; $V_R$; 0.5 · $I_{AC,R}$ | > 2000 h | ΔC/C | ≤ ±30% of initial value | | |
| 125 °C; $V_R$; $I_{AC,R}$ | > 10000 h | ESR | ≤ 3 times initial specified limit[3] | | |
| 125 °C; $V_R$; $I_{AC,max}$ | > 4000 h | $I_{leak}$ | ≤ initial specified limit | | |
| 40 °C; $V_R$; 2.1 · $I_{AC,R}$ | > 500000 h | | | | |
| Voltage endurance test | | Post test requirements: | | | |
| 125 °C; $V_R$ | 4000 h | ΔC/C | ≤ ±10% of initial value | | |
| | | ESR | ≤ 1.3% initial specified limit[3] | | |
| | | $I_{leak}$ | ≤ initial specified limit | | |
| Vibration resistance test | To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 2 kHz, displacement amplitude max. 1.5 mm, acceleration max. 20 *g*, duration 3 × 2 h. Capacitor mounted by its wire leads at a distance of (6 ±1) mm from the case and additionally clamped by the case. | | | | |
| IEC climatic category | To IEC 60068-1: 55/125/56 (–55 °C/+125 °C/56 days damp heat test) | | | | |
| Detail specification<br>Sectional specification | Similar to CECC 30301-802<br>IEC 60384-4 | | | | |

1) If optimum circuit design is used, the values are lower by 30%.
2) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.
3) $ESR_{max}$ at 100 Hz, 20 °C

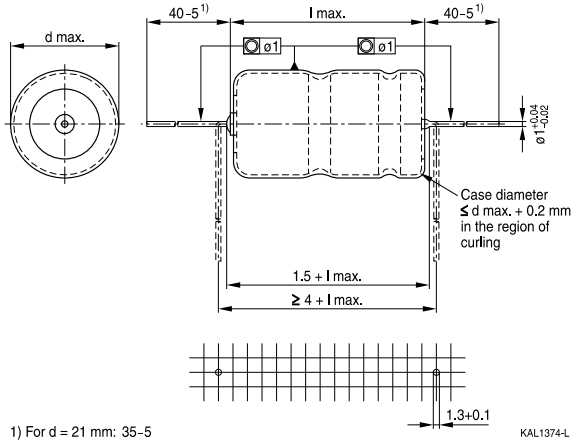


**B41689, B41789**

**Very high ripple current – up to 150 °C**

## B41689, Axial-lead capacitors

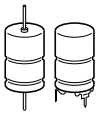
### Dimensional drawing




1) For d = 21 mm: 35–5

### Dimensions, weights and packing units

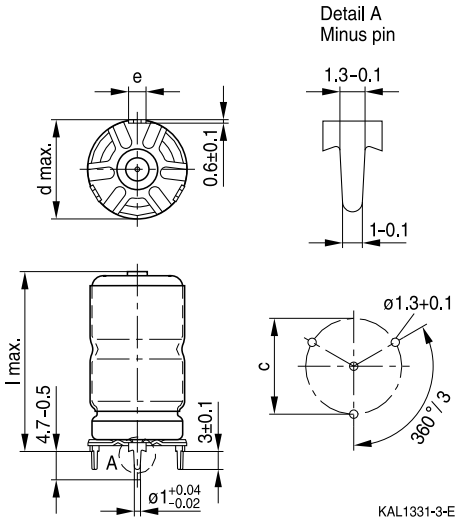
| d × l | $d_{max} \times l_{max}$ | Approx. weight | Packing units (pcs.) | |
|---|---|---|---|---|
| mm | mm | g | Pallet | Reel |
| 16 × 25 | 16.5 × 25.5 | 7.4 | 180 | 250 |
| 16 × 30 | 16.5 × 30.5 | 8.9 | 180 | 250 |
| 16 × 35 | 16.5 × 35.5 | 10.4 | 180 | – |
| 16 × 39 | 16.5 × 40 | 11.7 | 180 | – |
| 18 × 25 | 18.5 × 25.5 | 9.3 | 160 | – |
| 18 × 30 | 18.5 × 30.5 | 11.1 | 160 | – |
| 18 × 39 | 18.5 × 40 | 14.7 | 160 | – |
| 20 × 29 | 20.5 × 29.5 | 13.5 | 140 | – |
| 21 × 39 | 21.5 × 40 | 20.0 | 140 | – |
| 21 × 49 | 21.5 × 50 | 25.0 | 110 | – |



## B41789, Soldering star capacitors

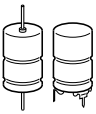
### Dimensional drawings

Mounting holes d = 16 mm ... 21 mm




### Dimensions, weights and packing units

| d × l<br>mm | $d_{max} \times l_{max}$<br>mm | c ±0.1<br>mm | e ±0.1<br>mm | Approx. weight<br>g | Packing units<br>pcs. |
|---|---|---|---|---|---|
| 16 × 25 | 17.5 × 27 | 16.5 | 3.0 | 7.9 | 300 |
| 16 × 30 | 17.5 × 32 | 16.5 | 3.0 | 9.4 | 300 |
| 16 × 35 | 17.5 × 37 | 16.5 | 3.0 | 10.9 | 200 |
| 16 × 39 | 17.5 × 41.5 | 16.5 | 3.0 | 12.2 | 200 |
| 18 × 25 | 19.5 × 27 | 18.5 | 3.0 | 9.9 | 300 |
| 18 × 30 | 19.5 × 32 | 18.5 | 3.0 | 11.8 | 300 |
| 18 × 39 | 19.5 × 41.5 | 18.5 | 3.0 | 15.4 | 200 |
| 21 × 39 | 22.5 × 41.5 | 21.5 | 3.5 | 21.0 | 324 |
| 21 × 49 | 22.5 × 51.5 | 21.5 | 3.5 | 26.0 | 264 |

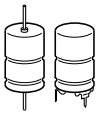


**B41689, B41789**

**Very high ripple current – up to 150 °C**

**Overview of available types**

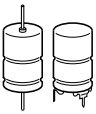
| $V_R$ (V DC) | 25 | 40 | 63 |
|---|---|---|---|
| | Case dimensions d × l (mm) | | |
| $C_R$ (µF) | | | |
| 270 | | | 16 × 25 |
| 330 | | | 16 × 30 |
| 390 | | | 18 × 25 |
| 470 | | | 16 × 35 |
| 560 | | 16 × 25 | 18 × 30 |
| 590 | | | 16 × 39 |
| 600 | | | 20 × 29 |
| 680 | | 18 × 25 | |
| 720 | | 16 × 30 | |
| 820 | | 16 × 35 | 18 × 39 |
| 900 | | 18 × 30 | |
| 1000 | 16 × 25 | 16 × 39 | 21 × 39 |
| 1200 | 18 × 25 | 20 × 29 | |
| 1300 | 16 × 30 | | 21 × 49 |
| 1400 | | 18 × 39 | |
| 1500 | 16 × 35 | | |
| 1700 | 18 × 30 | | |
| 1800 | 16 × 39 | | |
| 1900 | 20 × 29 | | |
| 2000 | | 21 × 39 | |
| 2200 | 18 × 39 | | |
| 2700 | | 21 × 49 | |
| 3300 | 21 × 39 | | |
| 4500 | 21 × 49 | | |



**Case dimensions and ordering codes**

| $V_R$ | $C_R$ 120 Hz 20 °C | Case dimensions d × l | Ordering code Axial pallet | Ordering code Axial reel | Ordering code Soldering star |
|---|---|---|---|---|---|
| V DC | µF | mm | | | |
| 25 | 1000 | 16 × 25 | B41689A5108Q001 | B41689A5108Q003 | B41789A5108Q001 |
| | 1000 ∇ | 16 × 25 | B41689K5108Q001 | B41689K5108Q003 | B41789K5108Q001 |
| | 1200 | 18 × 25 | B41689A5128Q001 | | B41789A5128Q001 |
| | 1200 ∇ | 18 × 25 | B41689K5128Q001 | | B41789K5128Q001 |
| | 1300 | 16 × 30 | B41689A5138Q001 | B41689A5138Q003 | B41789A5138Q001 |
| | 1300 ∇ | 16 × 30 | B41689K5138Q001 | B41689K5138Q003 | B41789K5138Q001 |
| | 1500 | 16 × 35 | B41689A5158Q001 | | B41789A5158Q001 |
| | 1500 ∇ | 16 × 35 | B41689K5158Q001 | | B41789K5158Q001 |
| | 1700 | 18 × 30 | B41689A5178Q001 | | B41789A5178Q001 |
| | 1700 ∇ | 18 × 30 | B41689K5178Q001 | | B41789K5178Q001 |
| | 1800 | 16 × 39 | B41689A5188Q001 | | B41789A5188Q001 |
| | 1800 ∇ | 16 × 39 | B41689K5188Q001 | | B41789K5188Q001 |
| | 1900 | 20 × 29 | B41689A5198Q001 | | |
| | 1900 ∇ | 20 × 29 | B41689K5198Q001 | | |
| | 2200 | 18 × 39 | B41689A5228Q001 | | B41789A5228Q001 |
| | 2200 ∇ | 18 × 39 | B41789K5228Q001 | | B41789K5228Q001 |
| | 3300 | 21 × 39 | B41689A5338Q001 | | B41789A5338Q001 |
| | 3300 ∇ | 21 × 39 | B41689K5338Q001 | | B41789K5338Q001 |
| | 4500 | 21 × 49 | B41689A5458Q001 | | B41789A5458Q001 |
| | 4500 ∇ | 21 × 49 | B41689K5458Q001 | | B41789K5458Q001 |
| 40 | 560 | 16 × 25 | B41689A7567Q001 | B41689A7567Q003 | B41789A7567Q001 |
| | 560 ∇ | 16 × 25 | B41689K7567Q001 | B41689K7567Q003 | B41789K7567Q001 |
| | 680 | 18 × 25 | B41689A7687Q001 | | B41789A7687Q001 |
| | 680 ∇ | 18 × 25 | B41689K7687Q001 | | B41789K7687Q001 |
| | 720 | 16 × 30 | B41689A7727Q001 | B41689A7727Q003 | B41789A7727Q001 |
| | 720 ∇ | 16 × 30 | B41689K7727Q001 | B41689K7727Q003 | B41789K7727Q001 |
| | 820 | 16 × 35 | B41689A7827Q001 | | B41789A7827Q001 |
| | 820 ∇ | 16 × 35 | B41689K7827Q001 | | B41789K7827Q001 |
| | 900 | 18 × 30 | B41689A7907Q001 | | B41789A7907Q001 |
| | 900 ∇ | 18 × 30 | B41689K7907Q001 | | B41789K7907Q001 |

∇ Increased ripple current due to optimized thermal design

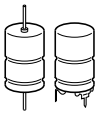


## B41689, B41789

### Very high ripple current – up to 150 °C

| $V_R$ | $C_R$ 120 Hz 20 °C | Case dimensions d × l | Ordering code Axial pallet | Ordering code Axial reel | Ordering code Soldering star |
|---|---|---|---|---|---|
| V DC | µF | mm | | | |
| 40 | 1000 | 16 × 39 | B41689A7108Q001 | | B41789A7108Q001 |
| | 1000 ∇ | 16 × 39 | B41689K7108Q001 | | B41789K7108Q001 |
| | 1200 | 20 × 29 | B41689A7128Q001 | | |
| | 1200 ∇ | 20 × 29 | B41689K7128Q001 | | |
| | 1400 | 18 × 39 | B41689A7148Q001 | | B41789A7148Q001 |
| | 1400 ∇ | 18 × 39 | B41689K7148Q001 | | B41789K7148Q001 |
| | 2000 | 21 × 39 | B41689A7208Q001 | | B41789A7208Q001 |
| | 2000 ∇ | 21 × 39 | B41689K7208Q001 | | B41789K7208Q001 |
| | 2700 | 21 × 49 | B41689A7278Q001 | | B41789A7278Q001 |
| | 2700 ∇ | 21 × 49 | B41689K7278Q001 | | B41789K7278Q001 |
| 63 | 270 | 16 × 25 | B41689A8277Q001 | B41689A8277Q003 | B41789A8277Q001 |
| | 270 ∇ | 16 × 25 | B41689K8277Q001 | B41689K8277Q003 | B41789K8277Q001 |
| | 330 | 16 × 30 | B41689A8337Q001 | B41689A8337Q003 | B41789A8337Q001 |
| | 330 ∇ | 16 × 30 | B41689K8337Q001 | B41689K8337Q003 | B41789K8337Q001 |
| | 390 | 18 × 25 | B41689A8397Q001 | | B41789A8397Q001 |
| | 390 ∇ | 18 × 25 | B41689K8397Q001 | | B41789K8397Q001 |
| | 470 | 16 × 35 | B41689A8477Q001 | | B41789A8477Q001 |
| | 470 ∇ | 16 × 35 | B41689K8477Q001 | | B41789K8477Q001 |
| | 560 | 18 × 30 | B41689A8567Q001 | | B41789A8567Q001 |
| | 560 ∇ | 18 × 30 | B41689K8567Q001 | | B41789K8567Q001 |
| | 590 | 16 × 39 | B41689A8597Q001 | | B41789A8597Q001 |
| | 590 ∇ | 16 × 39 | B41689K8597Q001 | | B41789K8597Q001 |
| | 600 | 20 × 29 | B41689A8607Q001 | | |
| | 600 ∇ | 20 × 29 | B41689K8607Q001 | | |
| | 820 | 18 × 39 | B41689A8827Q001 | | B41789A8827Q001 |
| | 820 ∇ | 18 × 39 | B41689K8827Q001 | | B41789K8827Q001 |
| | 1000 | 21 × 39 | B41689A8108Q001 | | B41789A8108Q001 |
| | 1000 ∇ | 21 × 39 | B41689K8108Q001 | | B41789K8108Q001 |
| | 1300 | 21 × 49 | B41689A8138Q001 | | B41789A8138Q001 |
| | 1300 ∇ | 21 × 49 | B41689K8138Q001 | | B41789K8138Q001 |

∇ Increased ripple current due to optimized thermal design

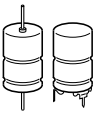


**Technical data**

| $C_R$ 120 Hz 20 °C µF | Case dimensions d × l mm | $ESR_{max}$ 100 Hz 20 °C mΩ | $ESR_{max}$ 100 Hz −40 °C mΩ | $ESR_{max}$ 10 kHz 20 °C mΩ | $Z_{max}$ 100 kHz 20 °C mΩ | $I_{AC,max}$ [1] 10 kHz $T_C$ 125 °C A | $I_{AC,max}$ 10 kHz 125 °C A | $I_{AC,R}$ 10 kHz 125 °C A | $I_{AC,max}$ 10 kHz 150 °C A |
|---|---|---|---|---|---|---|---|---|---|
| $V_R$ = 25 V DC | | | | | | | | | |
| 1000 | 16 × 25 | 98 | 565 | 53 | 50 | 9.2 | 5.7 | 3.5 | 1.7 |
| 1000 ∇ | 16 × 25 | 98 | 565 | 53 | 50 | 10.1 | 6.0 | 3.6 | 1.8 |
| 1200 | 18 × 25 | 80 | 470 | 43 | 41 | 11.1 | 6.9 | 4.2 | 2.1 |
| 1200 ∇ | 18 × 25 | 80 | 470 | 43 | 41 | 12.2 | 7.2 | 4.4 | 2.2 |
| 1300 | 16 × 30 | 75 | 435 | 41 | 39 | 11.4 | 7.1 | 4.3 | 2.2 |
| 1300 ∇ | 16 × 30 | 75 | 435 | 41 | 39 | 12.5 | 7.4 | 4.5 | 2.2 |
| 1500 | 16 × 35 | 65 | 377 | 35 | 34 | 13.3 | 8.3 | 5.0 | 2.5 |
| 1500 ∇ | 16 × 35 | 65 | 377 | 35 | 34 | 14.6 | 8.6 | 5.2 | 2.6 |
| 1700 | 18 × 30 | 57 | 332 | 31 | 29 | 14.1 | 8.8 | 5.3 | 2.7 |
| 1700 ∇ | 18 × 30 | 57 | 332 | 31 | 29 | 15.5 | 9.1 | 5.5 | 2.8 |
| 1800 | 16 × 39 | 55 | 314 | 30 | 28 | 15.1 | 9.4 | 5.7 | 2.9 |
| 1800 ∇ | 16 × 39 | 55 | 314 | 30 | 28 | 16.6 | 9.8 | 5.9 | 3.0 |
| 1900 | 20 × 29 | 52 | 297 | 28 | 27 | 14.5 | 9.1 | 5.5 | 2.7 |
| 1900 ∇ | 20 × 29 | 52 | 297 | 28 | 27 | 16.0 | 9.5 | 5.7 | 2.9 |
| 2200 | 18 × 39 | 44 | 257 | 24 | 23 | 18.3 | 11.4 | 6.9 | 3.4 |
| 2200 ∇ | 18 × 39 | 44 | 257 | 24 | 23 | 20.1 | 11.8 | 7.2 | 3.6 |
| 3300 | 21 × 39 | 31 | 172 | 17 | 16 | 21.0 | 13.1 | 7.9 | 4.0 |
| 3300 ∇ | 21 × 39 | 31 | 172 | 17 | 16 | 23.2 | 13.6 | 8.3 | 4.1 |
| 4500 | 21 × 49 | 23 | 126 | 13 | 12 | 26.5 | 16.5 | 10.0 | 5.0 |
| 4500 ∇ | 21 × 49 | 23 | 126 | 13 | 12 | 29.2 | 17.2 | 10.4 | 5.2 |
| $V_R$ = 40 V DC | | | | | | | | | |
| 560 | 16 × 25 | 129 | 587 | 53 | 50 | 9.2 | 5.7 | 3.5 | 1.7 |
| 560 ∇ | 16 × 25 | 129 | 587 | 53 | 50 | 10.1 | 6.0 | 3.6 | 1.8 |
| 680 | 18 × 25 | 105 | 483 | 43 | 41 | 11.1 | 6.9 | 4.2 | 2.1 |
| 680 ∇ | 18 × 25 | 105 | 483 | 43 | 41 | 12.3 | 7.2 | 4.4 | 2.2 |
| 720 | 16 × 30 | 100 | 457 | 42 | 39 | 11.4 | 7.1 | 4.3 | 2.1 |
| 720 ∇ | 16 × 30 | 100 | 457 | 42 | 39 | 12.5 | 7.4 | 4.5 | 2.2 |
| 820 | 16 × 35 | 88 | 401 | 36 | 34 | 13.2 | 8.2 | 5.0 | 2.5 |
| 820 ∇ | 16 × 35 | 88 | 401 | 36 | 34 | 14.5 | 8.6 | 5.2 | 2.6 |
| 900 | 18 × 30 | 80 | 365 | 33 | 31 | 13.9 | 8.6 | 5.2 | 2.6 |
| 900 ∇ | 18 × 30 | 80 | 365 | 33 | 31 | 15.2 | 9.0 | 5.4 | 2.7 |

∇ Increased ripple current due to optimized thermal design

1) Maximum ripple current at 125 °C capacitor case temperature $T_C$ (measured at aluminum case surface), when mounted to a heat sink. Further details available upon request.



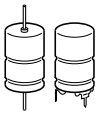
## B41689, B41789

### Very high ripple current – up to 150 °C

| $C_R$ 120 Hz 20 °C µF | Case dimensions d × l mm | $ESR_{max}$ 100 Hz 20 °C mΩ | $ESR_{max}$ 100 Hz −40 °C mΩ | $ESR_{max}$ 10 kHz 20 °C mΩ | $Z_{max}$ 100 kHz 20 °C mΩ | $I_{AC,max}$ [2] 10 kHz $T_C$ 125 °C A | $I_{AC,max}$ 10 kHz 125 °C A | $I_{AC,R}$ 10 kHz 125 °C A | $I_{AC,max}$ 10 kHz 150 °C A |
|---|---|---|---|---|---|---|---|---|---|
| $V_R$ = 40 V DC | | | | | | | | | |
| 1000 | 16 × 39 | 73 | 329 | 30 | 29 | 15.1 | 9.4 | 5.7 | 2.8 |
| 1000 ∇ | 16 × 39 | 73 | 329 | 30 | 29 | 16.6 | 9.8 | 5.9 | 3.0 |
| 1200 | 20 × 29 | 61 | 274 | 26 | 24 | 14.9 | 9.3 | 5.6 | 2.8 |
| 1200 ∇ | 20 × 29 | 61 | 274 | 26 | 24 | 16.5 | 9.7 | 5.9 | 2.9 |
| 1400 | 18 × 39 | 52 | 235 | 22 | 20 | 18.9 | 11.8 | 7.1 | 3.6 |
| 1400 ∇ | 18 × 39 | 52 | 235 | 22 | 20 | 20.8 | 12.2 | 7.4 | 3.7 |
| 2000 | 21 × 39 | 38 | 165 | 16 | 16 | 21.3 | 13.2 | 8.0 | 4.0 |
| 2000 ∇ | 21 × 39 | 38 | 165 | 16 | 16 | 23.4 | 13.8 | 8.4 | 4.2 |
| 2700 | 21 × 49 | 28 | 123 | 12 | 12 | 26.8 | 16.7 | 10.1 | 5.0 |
| 2700 ∇ | 21 × 49 | 28 | 123 | 12 | 12 | 29.5 | 17.4 | 10.5 | 5.3 |
| $V_R$ = 63 V DC | | | | | | | | | |
| 270 | 16 × 25 | 218 | 777 | 66 | 63 | 8.4 | 5.2 | 3.2 | 1.6 |
| 270 ∇ | 16 × 25 | 218 | 777 | 66 | 63 | 9.2 | 5.4 | 3.3 | 1.6 |
| 330 | 16 × 30 | 178 | 636 | 54 | 51 | 10.3 | 6.4 | 3.9 | 1.9 |
| 330 ∇ | 16 × 30 | 178 | 636 | 54 | 51 | 11.2 | 6.6 | 4.0 | 2.0 |
| 390 | 18 × 25 | 160 | 602 | 54 | 51 | 9.5 | 5.9 | 3.6 | 1.8 |
| 390 ∇ | 18 × 25 | 160 | 602 | 54 | 51 | 10.4 | 6.1 | 3.7 | 1.9 |
| 470 | 16 × 35 | 131 | 498 | 43 | 41 | 12.3 | 7.7 | 4.6 | 2.3 |
| 470 ∇ | 16 × 35 | 131 | 498 | 43 | 41 | 13.4 | 7.9 | 4.8 | 2.4 |
| 560 | 18 × 30 | 113 | 420 | 39 | 37 | 12.0 | 7.5 | 4.5 | 2.3 |
| 560 ∇ | 18 × 30 | 113 | 420 | 39 | 37 | 13.1 | 7.7 | 4.7 | 2.3 |
| 590 | 16 × 39 | 105 | 397 | 35 | 33 | 14.2 | 8.8 | 5.3 | 2.7 |
| 590 ∇ | 16 × 39 | 105 | 397 | 35 | 33 | 15.5 | 9.1 | 5.5 | 2.8 |
| 600 | 20 × 29 | 99 | 350 | 31 | 29 | 13.9 | 8.7 | 5.3 | 2.6 |
| 600 ∇ | 20 × 29 | 99 | 350 | 31 | 29 | 15.2 | 9.0 | 5.4 | 2.7 |
| 820 | 18 × 39 | 78 | 287 | 27 | 26 | 16.1 | 10.0 | 6.1 | 3.0 |
| 820 ∇ | 18 × 39 | 78 | 287 | 27 | 26 | 17.6 | 10.4 | 6.3 | 3.1 |
| 1000 | 21 × 39 | 61 | 211 | 19 | 18 | 20.0 | 12.4 | 7.5 | 3.8 |
| 1000 ∇ | 21 × 39 | 61 | 211 | 19 | 18 | 21.8 | 12.9 | 7.8 | 3.9 |
| 1300 | 21 × 49 | 47 | 162 | 15 | 14 | 25.1 | 15.6 | 9.5 | 4.7 |
| 1300 ∇ | 21 × 49 | 47 | 162 | 15 | 14 | 27.4 | 16.2 | 9.8 | 4.9 |

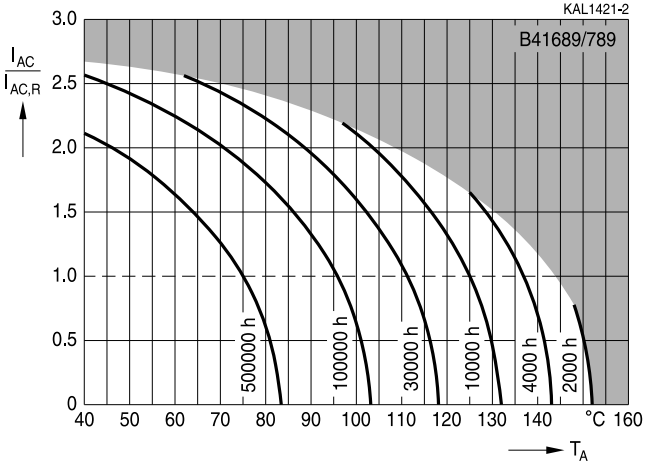
∇ Increased ripple current due to optimized thermal design

2) Maximum ripple current at 125 °C capacitor case temperature $T_C$ (measured at aluminum case surface), when mounted to a heat sink. Further details available upon request.

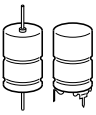


**Useful life**[1)]

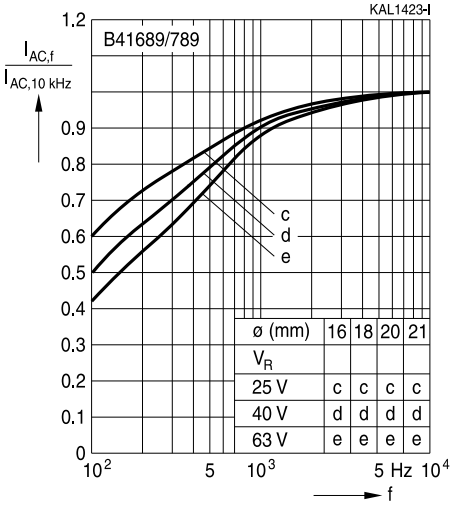
depending on ambient temperature $T_A$ under ripple current operating conditions at $V_R$



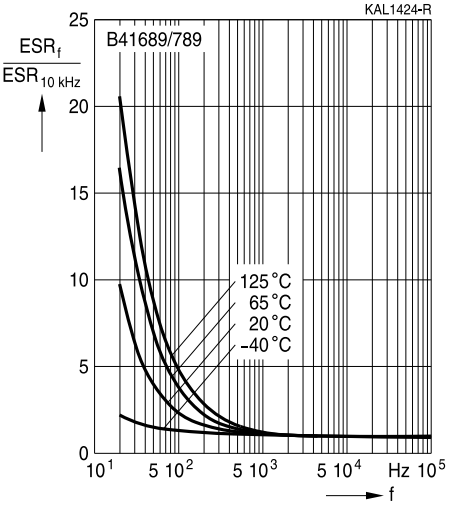

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



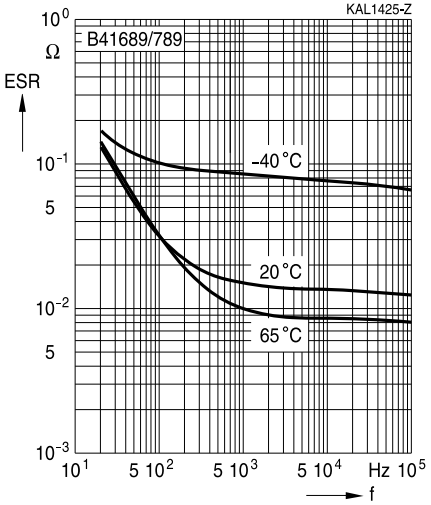
**Frequency factor of permissible ripple current $I_{AC}$ versus frequency f**



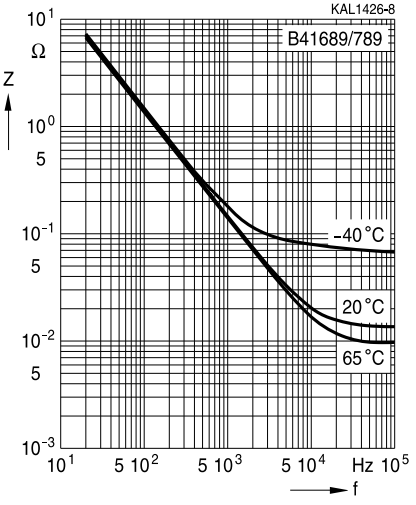

**Frequency characteristics of ESR**
Typical behavior

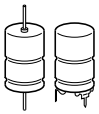



**Equivalent series resistance ESR versus frequency f**
Typical behavior for 470 µF/63 V




**Impedance Z versus frequency f**
Typical behavior for 470 µF/63 V





## Cautions and warnings

### Personal safety

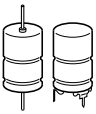
The electrolytes used by EPCOS have been optimized both with a view to the intended application and with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC).
Furthermore, some of the high-voltage electrolytes used by EPCOS are self-extinguishing.

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 alternative materials are currently known. However, the amount of dangerous materials used in our products is limited to an absolute minimum.

Materials and chemicals used in EPCOS aluminum electrolytic capacitors are continuously adapted in compliance with the EPCOS Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on the EPCOS website for all types listed in the data book. MDS for customer specific capacitors are available upon request.
MSDS (Material Safety Data Sheets) are available for all of our electrolytes upon request.

Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas 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 inhaling 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.

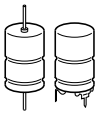




**Product safety**

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

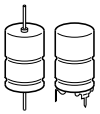
| Topic | Safety information | Reference chapter "General technical information" |
|---|---|---|
| Polarity | Make sure that polar capacitors are connected with the right polarity. | 1 "Basic construction of aluminum electrolytic capacitors" |
| Reverse voltage | Voltages polarity classes should be prevented by connecting a diode. | 3.1.6 "Reverse voltage" |
| 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" |
| Robustness of terminals | The following maximum tightening torques must not be exceeded when connecting screw terminals:<br>M5: 2.5 Nm<br>M6: 4.0 Nm | 11.3 "Mounting torques" |
| 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" |
| Soldering | Do not exceed the specified time or temperature limits during soldering. | 11.5 "Soldering" |
| Soldering, cleaning agents | Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors. | 11.6 "Cleaning agents" |
| Upper category temperature | Do not exceed the upper category temperature. | 7.2 "Maximum permissible operating temperature" |
| Passive flammability | Avoid external energy, such as fire or electricity. | 8.1 "Passive flammability" |



| Topic | Safety information | Reference chapter "General technical information" |
|---|---|---|
| Active flammability | Avoid overload of the capacitors. | 8.2 "Active flammability" |
| Maintenance | Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors. Do not apply any mechanical stress to the capacitor terminals. | 10 "Maintenance" |
| Storage | Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%. | 7.3 Storage conditions |
| | | 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 | Reststrom |
| $I_{leak,op}$ | Operating leakage current | Betriebsreststrom |
| 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; $2 \cdot \pi \cdot f$ |

**Note**

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.
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