

Aluminum Capacitors Axial Standard, High Voltage

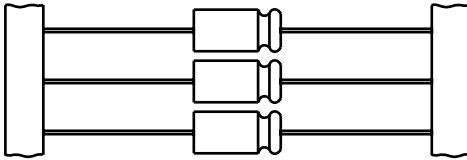
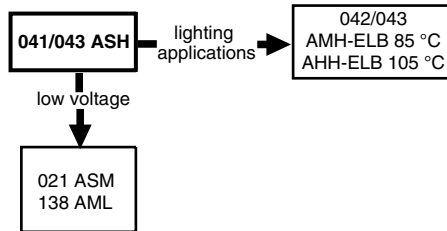


Fig.1 Component outlines


FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Mounting ring version not available in insulated form
- Taped versions up to case \varnothing 15 x 30 mm available for automatic insertion
- Useful life: 5000 to 15 000 hours at 85 °C
- High rated voltage: up to 450 V
- Lead (Pb)-free versions are RoHS compliant


**RoHS
COMPLIANT**
APPLICATIONS

- General purpose, industrial, power supply, audio-video
- Smoothing, filtering, buffering at high voltages
- Boards with restricted mounting height, vibration and shock resistant

MARKING

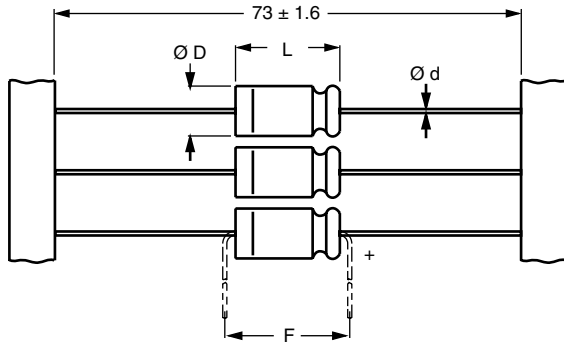
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in μF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (T for - 10 to + 50 %)
- Rated voltage (in V)
- Upper category temperature (85 °C)
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name of manufacturer
- Band to indicate the negative terminal
- '+' sign to identify the positive terminal
- Series number (041, 042 or 043)

| QUICK REFERENCE DATA | | |
|---|--|---|
| DESCRIPTION | VALUE | |
| Nominal case sizes (\varnothing D x L in mm) | 6.5 x 18 to 10 x 25 | 10 x 30 to 21 x 38 |
| Rated capacitance range, C_R | 1 to 220 μF | |
| Tolerance on C_R | - 10 to + 50 % | |
| Rated voltage range, U_R | 160 to 450 V | |
| Category temperature range | - 40 to + 85 °C (450 V: - 25 to + 85 °C) | |
| Endurance test at 85 °C | 2000 hours | 8000 hours (450 V: 5000 hours) |
| Useful life at 85 °C | 5000 hours | 15 000 hours (450 V: 10 000 hours) |
| Useful life at 40 °C | 1.4 x I_R applied: 120 000 hours | 1.8 x I_R applied: 240 000 hours (450 V: 160 000 hours) |
| Shelf life at 0 V, 85 °C | 500 hours | 500 hours |
| Based on sectional specification | IEC 60384-4/EN130300 | |
| Climatic category IEC 60068 | 40/085/56 (450 V: 25/085/56) | |

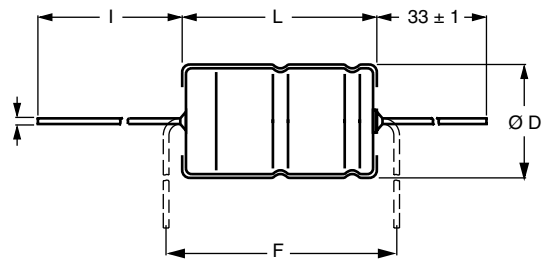
| C_R (μF) | U_R (V) | | | | | |
|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| | 160 | 250 | 350 | 385 | 400 | 450 |
| 1.0 | - | - | - | 6.5 x 18 | - | - |
| 2.2 | - | 6.5 x 18 | - | 8 x 18 | - | - |
| 4.7 | 6.5 x 18 | 8 x 18 | 10 x 18 | 10 x 25 | - | - |
| 6.8 | - | - | 10 x 30 | 10 x 30 | 10 x 30 | 10 x 30 |
| 10 | 8 x 18 | 10 x 25 | 12.5 x 30 | 12.5 x 30 | 12.5 x 30 | 12.5 x 30 |
| | - | 10 x 30 | - | - | - | - |
| 15 | - | 12.5 x 30 | 12.5 x 30 | 15 x 30 | 15 x 30 | 12.5 x 30 |
| 22 | 10 x 25 | 12.5 x 30 | 15 x 30 | 18 x 30 | 18 x 30 | 15 x 30 |
| | 10 x 30 | - | - | - | - | - |
| 33 | 12.5 x 30 | 15 x 30 | 18 x 30 | 18 x 38 | 18 x 38 | 18 x 30 |
| 47 | 15 x 30 | 18 x 30 | 18 x 38 | 18 x 38 | 18 x 38 | 18 x 38 |
| 68 | 15 x 30 | 18 x 38 | 21 x 38 | 21 x 38 | 21 x 38 | 21 x 38 |
| 100 | 18 x 30 | 21 x 38 | - | - | - | - |
| 150 | 18 x 38 | - | - | - | - | - |
| 220 | 21 x 38 | - | - | - | - | - |

DIMENSIONS in millimeters **AND AVAILABLE FORMS**



Form BR: Taped on reel
case $\varnothing D \times L = 6.5 \times 18$ to 15×30 mm
Form BA: Taped in box (ammopack)
case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm

Fig.2 Forms BA and BR



Form AA: Axial in box
case $\varnothing D \times L = 10 \times 30$ to 21×38 mm

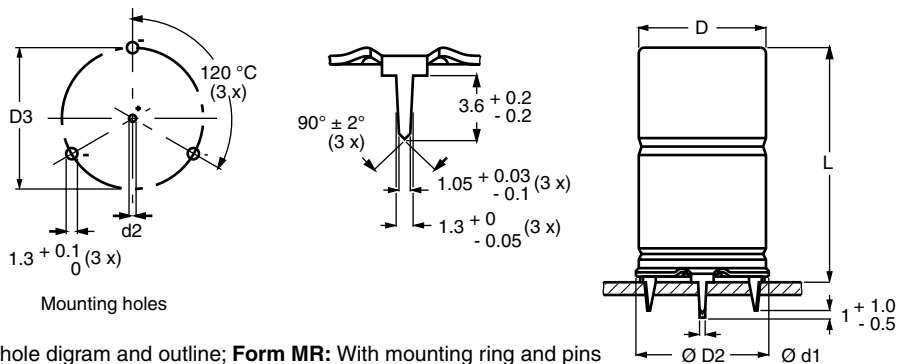
Fig.3 Form AA

Table 1

| AXIAL; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | | | | | | |
|---|-----------|----------------------------|--------|------------------------|------------|------------|----------|----------------------|---------|---------|
| NOMINAL CASE SIZE $\varnothing D \times L$ | CASE CODE | AXIAL: FORM AA, BA, AND BR | | | | | MASS (g) | PACKAGING QUANTITIES | | |
| | | $\varnothing d$ | l | $\varnothing D_{max.}$ | $L_{max.}$ | $F_{min.}$ | | FORM AA | FORM BA | FORM BR |
| 6.5 x 18 | 4 | 0.8 | - | 6.9 | 18.5 | 25 | ≈ 1.3 | - | 1000 | 1000 |
| 8 x 18 | 5 | 0.8 | - | 8.5 | 18.5 | 25 | ≈ 1.7 | - | 500 | 500 |
| 10 x 18 | 6 | 0.8 | - | 10.5 | 18.5 | 25 | ≈ 2.5 | - | 500 | 500 |
| 10 x 25 | 7 | 0.8 | - | 10.5 | 25.5 | 30 | ≈ 3.3 | - | 500 | 500 |
| 10 x 30 | 00 | 0.8 | 55 ± 1 | 10.5 | 30.5 | 35 | ≈ 4.8 | 340 | - | 500 |
| 12.5 x 30 | 01 | 0.8 | 55 ± 1 | 13.0 | 30.5 | 35 | ≈ 7.4 | 260 | - | 400 |
| 15 x 30 | 02 | 0.8 | 55 ± 1 | 15.5 | 30.5 | 35 | ≈ 11.7 | 200 | - | 250 |
| 18 x 30 | 03 | 0.8 | 55 ± 1 | 18.5 | 30.5 | 35 | ≈ 12.9 | 120 | - | - |
| 18 x 38 | 04 | 0.8 | 34 ± 1 | 18.5 | 39.5 | 44 | ≈ 19.0 | 125 | - | - |
| 21 x 38 | 05 | 0.8 | 34 ± 1 | 21.5 | 39.5 | 44 | ≈ 24.0 | 100 | - | - |

Note

Detailed tape dimensions see section 'PACKAGING'.



Case $\varnothing D \times L = 15 \times 30$ to 21×38 mm
Case not insulated (insulation on request)
Especially for applications with severe shocks and vibrations

Fig.4 Mounting hole diagram and outline; **Form MR:** With mounting ring and pins

Table 2

| MOUNTING RING; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | | | | | |
|---|-----------|------------------------|------------------|------------------------|-------------------------|------------|------------|----------|----------------------|
| Nominal CASE SIZE $\varnothing D \times L$ | CASE code | MOUNTING RING: Form MR | | | | | | MASS (g) | PACKAGING QUANTITIES |
| | | $\varnothing d1$ | $\varnothing d2$ | $\varnothing D_{max.}$ | $\varnothing D2_{max.}$ | D3 | $L_{max.}$ | | |
| 15 x 30 | 02 | 0.8 | 1.0 + 0.4 | 15.5 | 17.5 | 16.5 ± 0.2 | 33 | ≈ 11.7 | 200 |
| 18 x 30 | 03 | 0.8 | 1.0 + 0.4 | 18.5 | 19.5 | 18.5 ± 0.2 | 33 | ≈ 12.9 | 240 |
| 18 x 38 | 04 | 0.8 | 1.0 + 0.4 | 18.5 | 19.5 | 18.5 ± 0.2 | 42 | ≈ 19.0 | 100 |
| 21 x 38 | 05 | 0.8 | 1.0 + 0.4 | 21.5 | 22.5 | 21.5 ± 0.2 | 42 | ≈ 24.0 | 100 |



| ELECTRICAL DATA | |
|-----------------|---|
| SYMBOL | DESCRIPTION |
| C_R | rated capacitance at 100 Hz, tolerance - 10 to + 50 |
| I_R | rated RMS ripple current at 100 Hz, 85 °C |
| I_{L1} | max. leakage current after 1 minute at U_R |
| I_{L5} | max. leakage current after 5 minutes at U_R |
| $\tan \delta$ | max. dissipation factor at 100 Hz |
| ESR | equivalent series resistance at 100 Hz (calculated from $\tan \delta_{max}$ and C_R) |
| Z | max. impedance at 10 kHz |

ORDERING EXAMPLE

Electrolytic capacitor 041 series
 10 μ F/250 V; - 10/+ 50 %
 Nominal case size: \varnothing 10 x 25 mm; Form BA
 Ordering code: MAL204133109E3
 Former 12NC: 2222 041 33109

Note
 Unless otherwise specified, all electrical values in Table 3 apply at
 $T_{amb} = 20$ °C, P = 86 to 106 kPa, RH = 45 to 75 %.

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | | | | |
|--|-------------------------------|--|--------------|----------------------------------|---------------------------------|---------------------------------|-------------------------|-------------------------------|-----------------------------|-------------------------|-----------------------------|----------------------------|-----------------------------|
| U_R (V) | C_R 100 Hz (μ F) | NOMINAL CASE SIZE \varnothing D x L (mm) | CASE CODE | I_R 100 Hz 85 °C (mA) | I_{L1} 1 min (μ A) | I_{L5} 5 min (μ A) | $\tan \delta$ 100 Hz | ESR 100 Hz (Ω) | Z 10 kHz (Ω) | ORDERING CODE MAL2..... | | | |
| | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| 160 | 4.7 | 6.5 x 18 | 4 | 50 | 38 | 8 | 0.15 | 51 | 26 | - | 04121478E3 | 04131478E3 | - |
| | 10 | 8 x 18 | 5 | 70 | 68 | 14 | 0.15 | 24 | 12 | - | 04121109E3 | 04131109E3 | - |
| | 22 | 10 x 25 | 7 | 150 | 130 | 25 | 0.15 | 11 | 5.5 | - | 04121229E3 | 04131229E3 | - |
| | 22 | 10 x 30 | 00 | 190 | 42 | 25 | 0.10 | 6.8 | 5.5 | 04211229E3 | 04221229E3 | - | - |
| | 33 | 12.5 x 30 | 01 | 270 | 58 | 36 | 0.10 | 4.5 | 3.1 | 04211339E3 | 04221339E3 | - | - |
| | 47 | 15 x 30 | 02 | 350 | 78 | 49 | 0.10 | 3.2 | 2.1 | 04211479E3 | 04221479E3 | - | 04241479E3 |
| | 68 | 15 x 30 | 02 | 420 | 110 | 69 | 0.10 | 2.2 | 1.4 | 04211689E3 | 04221689E3 | - | 04241689E3 |
| | 100 | 18 x 30 | 03 | 580 | 150 | 100 | 0.10 | 1.5 | 1.0 | 04211101E3 | - | - | 04241101E3 |
| | 150 | 18 x 38 | 04 | 760 | 230 | 150 | 0.10 | 1.0 | 0.7 | 04311151E3 | - | - | 04341151E3 |
| 220 | 21 x 38 | 05 | 940 | 330 | 220 | 0.10 | 0.7 | 0.5 | 04311221E3 | - | - | 04341221E3 | |
| 250 | 2.2 | 6.5 x 18 | 4 | 35 | 28 | 6 | 0.10 | 72 | 50 | - | 04123228E3 | 04133228E3 | - |
| | 4.7 | 8 x 18 | 5 | 55 | 55 | 11 | 0.10 | 34 | 23 | - | 04123478E3 | 04133478E3 | - |
| | 10 | 10 x 25 | 7 | 90 | 95 | 19 | 0.10 | 16 | 11 | - | 04123109E3 | 04133109E3 | - |
| | 10 | 10 x 30 | 00 | 130 | 33 | 19 | 0.10 | 15 | 11 | 04213109E3 | 04223109E3 | - | - |
| | 15 | 12.5 x 30 | 01 | 180 | 44 | 27 | 0.10 | 10 | 7.4 | 04213159E3 | 04223159E3 | - | - |
| | 22 | 12.5 x 30 | 01 | 220 | 60 | 37 | 0.10 | 6.8 | 5.0 | 04213229E3 | 04223229E3 | - | - |
| | 33 | 15 x 30 | 02 | 290 | 84 | 54 | 0.10 | 4.5 | 3.4 | 04213339E3 | 04223339E3 | - | 04243339E3 |
| | 47 | 18 x 30 | 03 | 400 | 120 | 75 | 0.10 | 3.2 | 2.3 | 04213479E3 | - | - | 04243479E3 |
| | 68 | 18 x 38 | 04 | 520 | 160 | 110 | 0.10 | 2.2 | 1.7 | 04313689E3 | - | - | 04343689E3 |
| 100 | 21 x 38 | 05 | 650 | 240 | 150 | 0.10 | 1.5 | 1.1 | 04313101E3 | - | - | 04343101E3 | |
| 350 | 4.7 | 10 x 18 | 6 | 60 | 69 | 14 | 0.10 | 34 | 22 | - | 04125478E3 | 04135478E3 | - |
| | 6.8 | 10 x 30 | 00 | 110 | 32 | 18 | 0.10 | 22 | 14 | 04215688E3 | 04225688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 42 | 25 | 0.10 | 15 | 10 | 04215109E3 | 04225109E3 | - | - |
| | 15 | 12.5 x 30 | 01 | 180 | 57 | 36 | 0.10 | 10 | 6.7 | 04215159E3 | 04225159E3 | - | - |
| | 22 | 15 x 30 | 02 | 250 | 79 | 50 | 0.10 | 6.8 | 4.5 | 04215229E3 | 04225229E3 | - | 04245229E3 |
| | 33 | 18 x 30 | 03 | 350 | 110 | 73 | 0.10 | 4.5 | 3.1 | 04215339E3 | - | - | 04245339E3 |
| | 47 | 18 x 38 | 04 | 450 | 160 | 100 | 0.10 | 3.2 | 2.1 | 04315479E3 | - | - | 04345479E3 |
| 68 | 21 x 38 | 05 | 560 | 220 | 150 | 0.10 | 2.2 | 1.4 | 04315689E3 | - | - | 04345689E3 | |
| 385 | 1 | 6.5 x 18 | 4 | 20 | 19 | 4 | 0.10 | 160 | 100 | - | 04128108E3 | 04138108E3 | - |
| | 2.2 | 8 x 18 | 5 | 40 | 42 | 8 | 0.10 | 72 | 45 | - | 04128228E3 | 04138228E3 | - |
| | 4.7 | 10 x 25 | 7 | 70 | 71 | 15 | 0.10 | 34 | 22 | - | 04128478E3 | 04138478E3 | - |
| | 6.8 | 10 x 30 | 00 | 110 | 34 | 20 | 0.10 | 22 | 14 | 04218688E3 | 04228688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 45 | 27 | 0.10 | 15 | 10 | 04218109E3 | 04228109E3 | - | - |
| | 15 | 15 x 30 | 02 | 210 | 62 | 39 | 0.10 | 10 | 6.0 | 04218159E3 | 04228159E3 | - | 04248159E3 |
| | 22 | 18 x 30 | 03 | 290 | 86 | 55 | 0.10 | 6.8 | 4.1 | 04218229E3 | - | - | 04248229E3 |
| | 33 | 18 x 38 | 04 | 380 | 120 | 80 | 0.10 | 4.5 | 2.7 | 04318339E3 | - | - | 04348339E3 |
| | 47 | 18 x 38 | 04 | 450 | 170 | 110 | 0.10 | 3.2 | 2.1 | 04318479E3 | - | - | 04348479E3 |
| 68 | 21 x 38 | 05 | 570 | 250 | 160 | 0.10 | 2.2 | 1.4 | 04318689E3 | - | - | 04348689E3 | |

ELECTRICAL DATA AND ORDERING INFORMATION

| U _R (V) | C _R 100 Hz (μF) | NOMINAL CASE SIZE Ø D x L (mm) | CASE CODE | I _R 100 Hz 85 °C (mA) | I _{L1} 1 min (μA) | I _{L5} 5 min (μA) | tan δ 100 Hz | ESR 100 Hz (Ω) | Z 10 kHz (Ω) | ORDERING CODE MAL2..... | | | |
|-----------------------|----------------------------------|--|--------------|---|----------------------------------|----------------------------------|-----------------|----------------------|--------------------|-------------------------|-----------------------------|----------------------------|-----------------------------|
| | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| 400 | 6.8 | 10 x 30 | 00 | 110 | 220 | 110 | 0.055 | 11.5 | 7.3 | 04216688E3 | 04226688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 240 | 110 | 0.055 | 7.5 | 4.6 | 04216109E3 | 04226109E3 | - | - |
| | 15 | 15 x 30 | 02 | 210 | 250 | 110 | 0.055 | 5.0 | 3.1 | 04216159E3 | 04226159E3 | - | 04246159E3 |
| | 22 | 18 x 30 | 03 | 290 | 280 | 120 | 0.055 | 3.5 | 2.1 | 04216229E3 | - | - | 04246229E3 |
| | 33 | 18 x 38 | 04 | 380 | 320 | 130 | 0.055 | 2.3 | 1.4 | 04316339E3 | - | - | 04346339E3 |
| | 47 | 18 x 38 | 04 | 450 | 370 | 140 | 0.055 | 1.7 | 1.1 | 04316479E3 | - | - | 04346479E3 |
| | 68 | 21 x 38 | 05 | 560 | 440 | 150 | 0.055 | 1.2 | 0.7 | 04316689E3 | - | - | 04346689E3 |
| 450 | 6.8 | 10 x 30 | 00 | 110 | 230 | 110 | 0.10 | 22 | 14 | 04217688E3 | 04227688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 240 | 110 | 0.10 | 15 | 10 | 04217109E3 | 04227109E3 | - | - |
| | 15 | 12.5 x 30 | 01 | 180 | 260 | 110 | 0.10 | 10 | 6 | 04217159E3 | 04227159E3 | - | - |
| | 22 | 15 x 30 | 02 | 240 | 290 | 120 | 0.10 | 6.8 | 4.1 | 04217229E3 | 04227229E3 | - | 04247229E3 |
| | 33 | 18 x 30 | 03 | 350 | 330 | 130 | 0.10 | 4.5 | 2.7 | 04217339E3 | - | - | 04247339E3 |
| | 47 | 18 x 38 | 04 | 440 | 390 | 140 | 0.10 | 3.2 | 2.1 | 04317479E3 | - | - | 04347479E3 |
| | 68 | 21 x 38 | 05 | 550 | 460 | 160 | 0.10 | 2.2 | 1.4 | 04317689E3 | - | - | 04347689E3 |

ADDITIONAL ELECTRICAL DATA

| PARAMETER | Conditions | Value | |
|------------------------------------|---|--|---------------|
| | | Axial | mounting ring |
| Voltage | | | |
| Surge voltage | U _R = 160 to 250 V | U _s ≤ 1.15 x U _R | |
| | U _R = 350 to 450 V | U _s ≤ 1.1 x U _R | |
| Reverse voltage | | U _{rev} ≤ 1 V | |
| Current | | | |
| Leakage current | After 1 minute: case Ø D x L = 6.5 x 18 to 10 x 25 mm: CV ≤ 1000 μC CV > 1000 μC case Ø D x L = 10 x 30 to 21 x 38 mm: U _R = 160 to 385 V U _R = 400 and 450 V | I _{L1} ≤ 0.05 C _R x U _R or 5 μA, whichever is greater I _{L1} ≤ 0.03 C _R x U _R + 20 μA | |
| | After 5 minutes: U _R = 160 to 385 V: CV ≤ 1000 μC CV > 1000 μC U _R = 400 and 450 V | I _{L1} ≤ 0.009 C _R x U _R + 10 μA I _{L1} ≤ 0.009 C _R x U _R + 200 μA | |
| Inductance | | | |
| Equivalent series inductance (ESL) | case Ø D x L mm: | | |
| | 6.5 x 18 | typ. 15 nH | - |
| | 8 x 18 | typ. 35 nH | - |
| | 10 x 18 | typ. 69 nH | - |
| | 10 x 25 | typ. 38 nH | - |
| | 10 x 30 | typ. 38 nH | - |
| | 12.5 x 30 | typ. 46 nH | - |
| | 15 x 30 | typ. 48 nH | typ. 39 nH |
| | 18 x 30 | typ. 50 nH | typ. 39 nH |
| | 18 x 38 | typ. 54 nH | typ. 39 nH |
| 21 x 38 | typ. 59 nH | typ. 39 nH | |

CAPACITANCE (C)

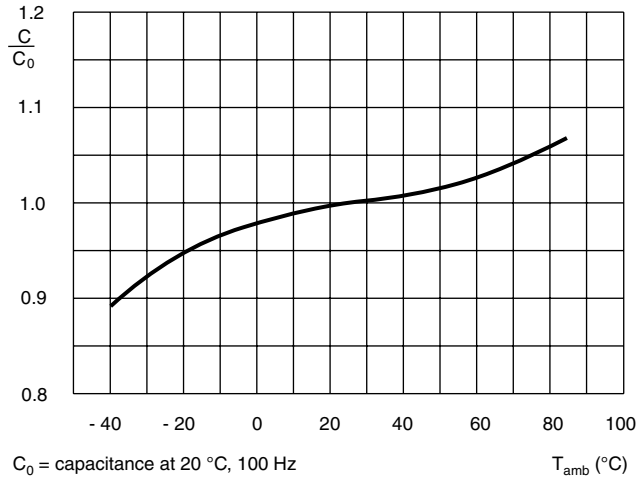


Fig.5 Typical multiplier of capacitance as a function of ambient temperature

EQUIVALENT SERIES RESISTANCE (ESR)

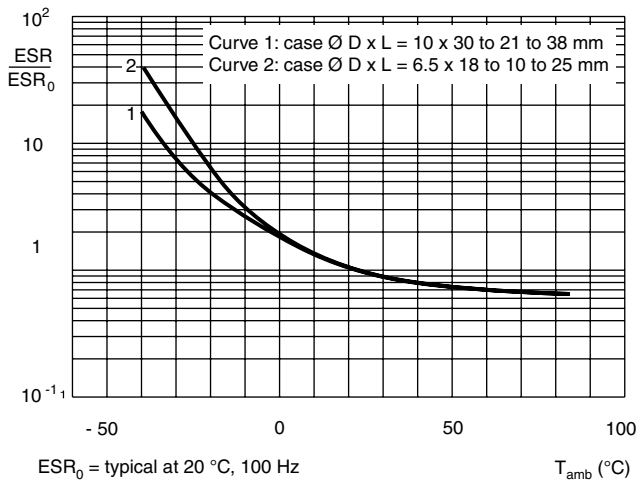


Fig.6 Typical multiplier of ESR as a function of ambient temperature

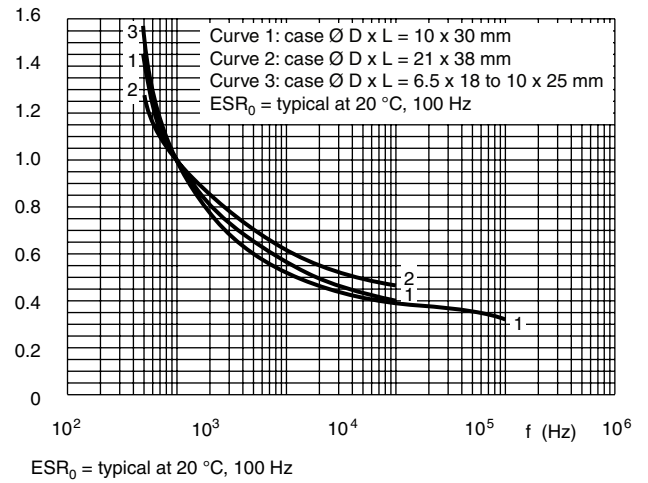


Fig.7 Typical multiplier of ESR as a function of frequency

IMPEDANCE (Z)

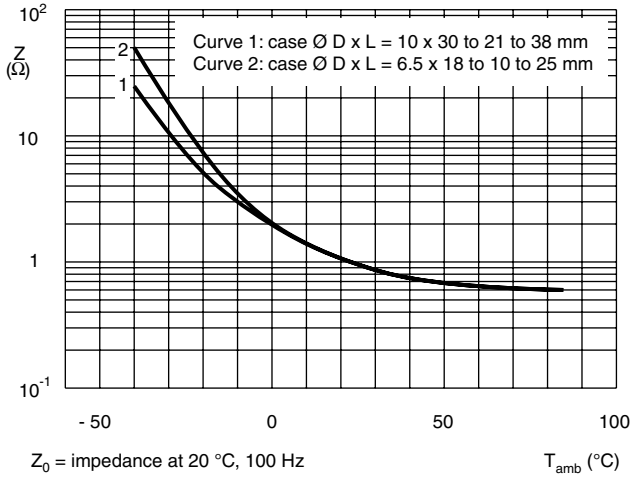


Fig.8 Typical impedance of capacitance as a function of ambient temperature

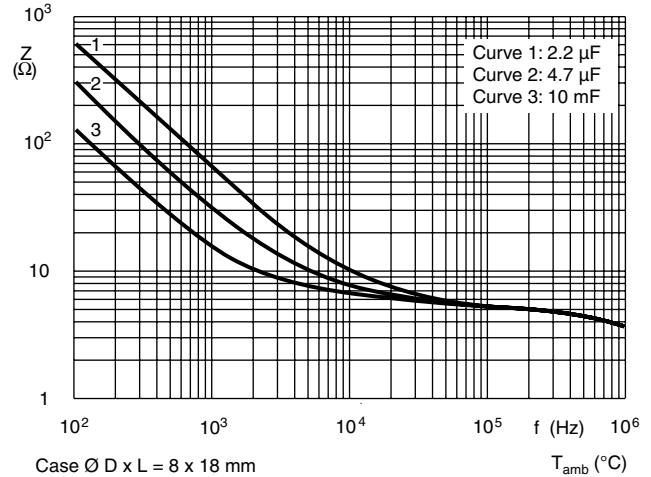


Fig.7 Typical impedance as a function of frequency

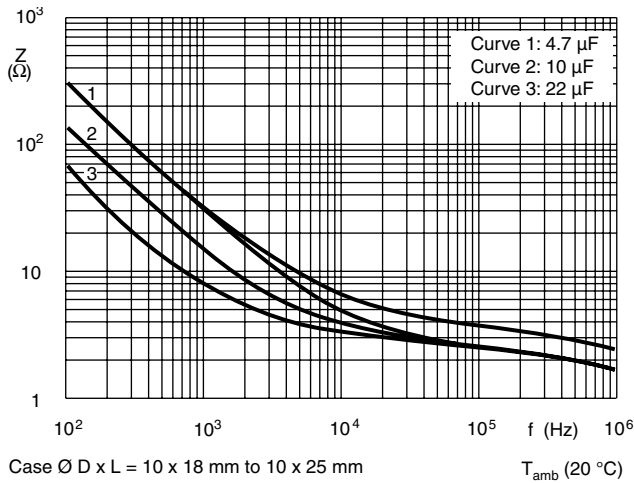


Fig.10 Typical impedance as a function of frequency

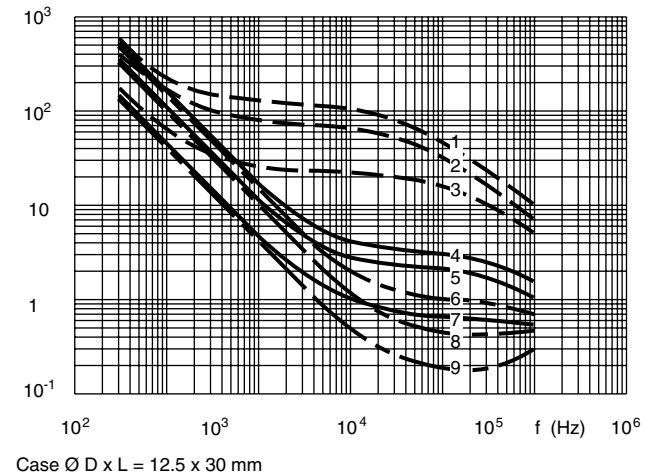


Fig.11 Typical impedance as a function of frequency at different ambient temperatures

- Curve 1: $10 \mu F$, 350 and 385 V; $-40^{\circ}C$
- Curve 2: $15 \mu F$, 250 V; $-40^{\circ}C$
- Curve 3: $33 \mu F$, 160 V; $-40^{\circ}C$
- Curve 4: $10 \mu F$, 350 and 385 V; $20^{\circ}C$
- Curve 5: $15 \mu F$, 250 V; $20^{\circ}C$
- Curve 6: $33 \mu F$, 160 V; $20^{\circ}C$
- Curve 7: $10 \mu F$, 350 and 385 V; $85^{\circ}C$
- Curve 8: $15 \mu F$, 250 V; $85^{\circ}C$
- Curve 9: $33 \mu F$, 160 V; $85^{\circ}C$

RIPPLE CURRENT AND USEFUL LIFE

CCC205

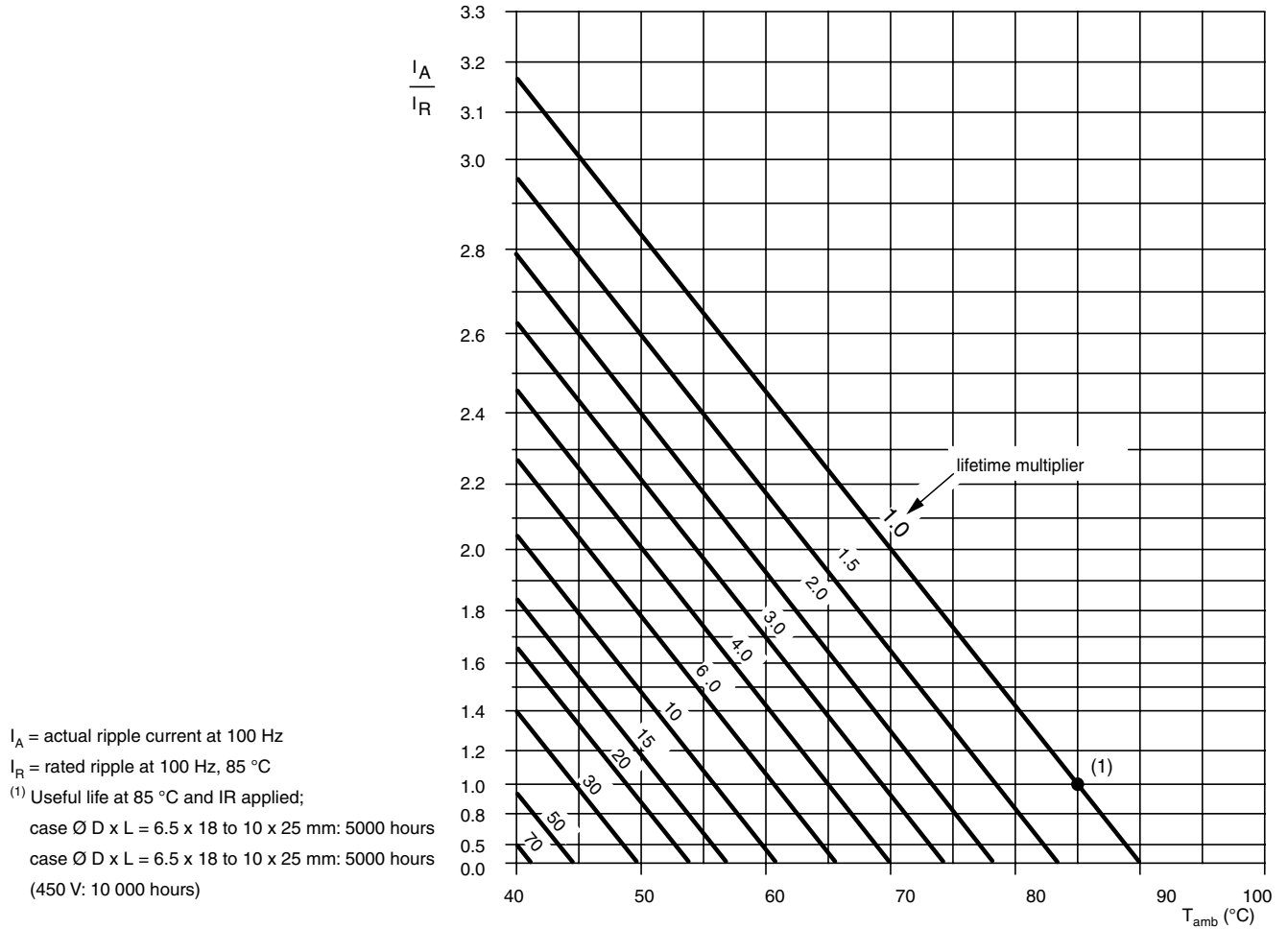


Fig.12 Multiplier of useful life as a function of ambient temperature and ripple current load

Table 3

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | |
|---|------------------|
| FREQUENCY (Hz) | I_R MULTIPLIER |
| 50 | 0.75 |
| 100 | 1.00 |
| 300 | 1.15 |
| 1000 | 1.30 |
| 3000 | 1.40 |
| $\geq 10\ 000$ | 1.50 |

Table 4

| TEST PROCEDURES AND REQUIREMENTS | | | |
|--|--|--|--|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4/ EN130300 subclause 4.13 | $T_{amb} = 85\text{ }^{\circ}\text{C}$; U_R applied; case $\varnothing D \times L$: 6.5 x 18 to 10 x 25 mm: 2000 hours; 10 x 30 to 21 x 38 mm 8000 hours (450 V: 5000 hours) | $U_R = 160\text{ V}$; $\Delta C/C: \pm 15\%$ $U_R = 250\text{ to }450\text{ V}$; $\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 85\text{ }^{\circ}\text{C}$; U_R and I_R applied; case $\varnothing D \times L$: 6.5 x 18 to 10 x 25 mm: 5000 hours; 10 x 30 to 21 x 38 mm: 15 000 hours (450 V: 10 000 hours) | $U_R = 160\text{ V}$; $\Delta C/C: \pm 45\%$ $U_R = 250\text{ to }450\text{ V}$; $\Delta C/C: \pm 30\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 3\%$ |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN130300 subclause 4.17 | $T_{amb} = 85\text{ }^{\circ}\text{C}$; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement | $\Delta C/C$, $\tan \delta$, Z : for requirements see 'Endurance test' above $I_{L5} \leq 2 \times \text{spec. limit}$ |



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