# Aluminum Electrolytic Capacitors
# Axial Standard, High Voltage

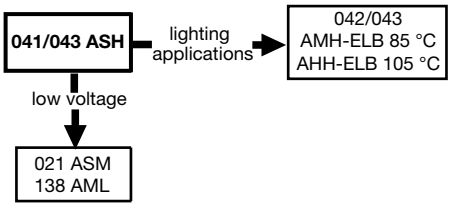



Fig. 1

## FEATURES

- Useful life: 5000 h to 15 000 h at 85 °C
- High rated voltage: up to 450 V
- Taped versions up to case Ø 15 mm x 30 mm available for automatic insertion
- 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
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

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
- Negative terminal identification
- Series number (041, 042 or 043)

| QUICK REFERENCE DATA | | |
|---|---|---|
| **DESCRIPTION** | **VALUE** | |
| Nominal case sizes (Ø D x L in mm) | 8 x 18 to 10 x 25 | 10 x 30 to 21 x 38 |
| Rated capacitance range, $C_R$ | 6.8 µF to 220 µF | |
| Tolerance on $C_R$ | -10 % to +50 % | |
| Rated voltage range, $U_R$ | 160 V to 450 V | |
| Category temperature range | -40 °C to +85 °C (450 V: -25 °C to +85 °C) | |
| Endurance test at 85 °C | 2000 h | 8000 h (450 V: 5000 h) |
| Useful life at 85 °C | 5000 h | 15 000 h (450 V: 10 000 h) |
| Useful life at 40 °C | 1.4 x $I_R$ applied: 120 000 h | 1.8 x $I_R$ applied: 240 000 h (450 V: 160 000 h) |
| Shelf life at 0 V, 85 °C | 500 h | |
| Based on sectional specification | IEC 60384-4 / EN130300 | |
| Climatic category IEC 60068 | 40 / 085 / 56 (450 V: 25 / 085 / 56) | |

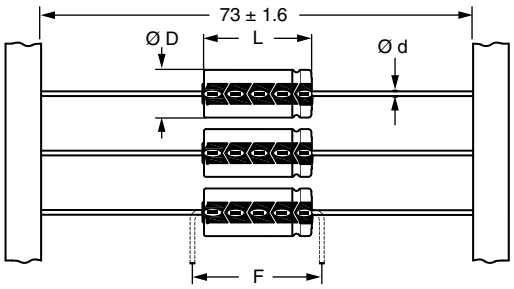
**SELECTION CHART FOR $C_R$, $U_R$, AND RELEVANT NOMINAL CASE SIZES** (Ø D x L in mm)

| $C_R$ (µF) | $U_R$ (V) | | | | | |
|---|---|---|---|---|---|---|
| | **160** | **250** | **350** | **385** | **400** | **450** |
| 6.8 | - | - | 10 x 30 | 10 x 30 | 10 x 30 | 10 x 30 |
| 10 | 8 x 18 | - | 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 | - | - | - | - | - |



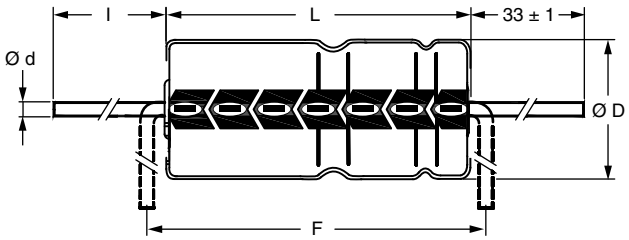
For technical questions, contact: aluminumcaps1@vishay.com

## **DIMENSIONS** in millimeters **AND AVAILABLE FORMS**




**Form BR:** Taped on reel
Case Ø D x L = 8 mm x 18 mm to 15 mm x 30 mm
**Form BA:** Taped in box (ammopack)
Case Ø D x L = 8 mm x 18 mm to 10 mm x 25 mm

Fig. 2 - **Forms BA** and **BR**




**Form AA:** Axial in box
Case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm

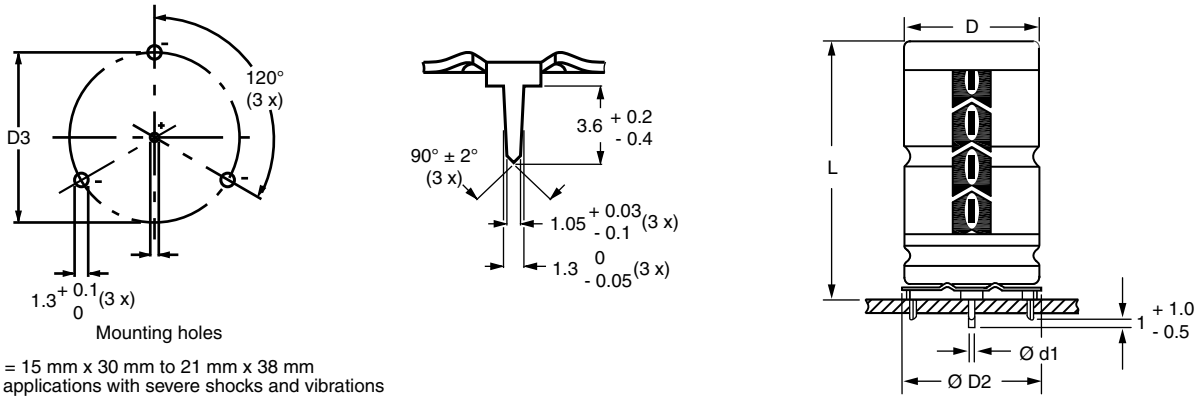
Fig. 3 - **Form AA**

**Table 1**

| **AXIAL; DIMENSIONS** in millimeters, **MASS AND PACKAGING QUANTITIES** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **NOMINAL CASE SIZE Ø D x L** | **CASE CODE** | **AXIAL: FORM AA, BA, AND BR** | | | | | **MASS (g)** | **PACKAGING QUANTITIES** | | |
| | | **Ø d** | **l** | **Ø $D_{max.}$** | **$L_{max.}$** | **$F_{min.}$** | | **FORM AA** | **FORM BA** | **FORM BR** |
| 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**

- For detailed tape dimensions please refer to packaging information: www.vishay.com/doc?28361




**Form MR:**
Case Ø D x L = 15 mm x 30 mm to 21 mm x 38 mm
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 Ø D x L** | **CASE CODE** | **MOUNTING RING: FORM MR** | | | | | | **MASS (g)** | **PACKAGING QUANTITIES** |
| | | **Ø d1** | **Ø d2** | **Ø $D_{max.}$** | **Ø $D2_{max.}$** | **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 min at $U_R$ |
| $I_{L5}$ | Max. leakage current after 5 min at $U_R$ |
| tan δ | 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 |

**Note**

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

## ORDERING EXAMPLE

Electrolytic capacitor 041 series

10 µF / 250 V; -10 % / +50 %

Nominal case size: Ø 10 mm x 25 mm; Form BA

Ordering code: MAL204133109E3
Former 12NC: 2222 041 33109

## 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) | LIFE CODE (1) | ORDERING CODE MAL2..... | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| | 10 | 8 x 18 | 5 | 70 | 68 | 14 | 0.15 | 24 | 12 | L1 | - | 04121109E3 | 04131109E3 | - |
| | 22 | 10 x 25 | 7 | 150 | 130 | 25 | 0.15 | 11 | 5.5 | L1 | - | 04121229E3 | 04131229E3 | - |
| | 22 | 10 x 30 | 00 | 190 | 42 | 25 | 0.10 | 6.8 | 5.5 | L2 | 04211229E3 | 04221229E3 | - | - |
| | 33 | 12.5 x 30 | 01 | 270 | 58 | 36 | 0.10 | 4.5 | 3.1 | L2 | 04211339E3 | 04221339E3 | - | - |
| 160 | 47 | 15 x 30 | 02 | 350 | 78 | 49 | 0.10 | 3.2 | 2.1 | L2 | 04211479E3 | 04221479E3 | - | 04241479E3 |
| | 68 | 15 x 30 | 02 | 420 | 110 | 69 | 0.10 | 2.2 | 1.4 | L2 | 04211689E3 | 04221689E3 | - | 04241689E3 |
| | 100 | 18 x 30 | 03 | 580 | 150 | 100 | 0.10 | 1.5 | 1.0 | L2 | 04211101E3 | - | - | 04241101E3 |
| | 150 | 18 x 38 | 04 | 760 | 230 | 150 | 0.10 | 1.0 | 0.7 | L2 | 04311151E3 | - | - | 04341151E3 |
| | 220 | 21 x 38 | 05 | 940 | 330 | 220 | 0.10 | 0.7 | 0.5 | L2 | 04311221E3 | - | - | 04341221E3 |
| | 10 | 10 x 30 | 00 | 130 | 33 | 19 | 0.10 | 15 | 11 | L2 | 04213109E3 | 04223109E3 | - | - |
| | 15 | 12.5 x 30 | 01 | 180 | 44 | 27 | 0.10 | 10 | 7.4 | L2 | 04213159E3 | 04223159E3 | - | - |
| | 22 | 12.5 x 30 | 01 | 220 | 60 | 37 | 0.10 | 6.8 | 5.0 | L2 | 04213229E3 | 04223229E3 | - | - |
| 250 | 33 | 15 x 30 | 02 | 290 | 84 | 54 | 0.10 | 4.5 | 3.4 | L2 | 04213339E3 | 04223339E3 | - | 04243339E3 |
| | 47 | 18 x 30 | 03 | 400 | 120 | 75 | 0.10 | 3.2 | 2.3 | L2 | 04213479E3 | - | - | 04243479E3 |
| | 68 | 18 x 38 | 04 | 520 | 160 | 110 | 0.10 | 2.2 | 1.7 | L2 | 04313689E3 | - | - | 04343689E3 |
| | 100 | 21 x 38 | 05 | 650 | 240 | 150 | 0.10 | 1.5 | 1.1 | L2 | 04313101E3 | - | - | 04343101E3 |
| | 6.8 | 10 x 30 | 00 | 110 | 32 | 18 | 0.10 | 22 | 14 | L2 | 04215688E3 | 04225688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 42 | 25 | 0.10 | 15 | 10 | L2 | 04215109E3 | 04225109E3 | - | - |
| | 15 | 12.5 x 30 | 01 | 180 | 57 | 36 | 0.10 | 10 | 6.7 | L2 | 04215159E3 | 04225159E3 | - | - |
| 350 | 22 | 15 x 30 | 02 | 250 | 79 | 50 | 0.10 | 6.8 | 4.5 | L2 | 04215229E3 | 04225229E3 | - | 04245229E3 |
| | 33 | 18 x 30 | 03 | 350 | 110 | 73 | 0.10 | 4.5 | 3.1 | L2 | 04215339E3 | - | - | 04245339E3 |
| | 47 | 18 x 38 | 04 | 450 | 160 | 100 | 0.10 | 3.2 | 2.1 | L2 | 04315479E3 | - | - | 04345479E3 |
| | 68 | 21 x 38 | 05 | 560 | 220 | 150 | 0.10 | 2.2 | 1.4 | L2 | 04315689E3 | - | - | 04345689E3 |
| | 6.8 | 10 x 30 | 00 | 110 | 34 | 20 | 0.10 | 22 | 14 | L2 | 04218688E3 | 04228688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 45 | 27 | 0.10 | 15 | 10 | L2 | 04218109E3 | 04228109E3 | - | - |
| | 15 | 15 x 30 | 02 | 210 | 62 | 39 | 0.10 | 10 | 6.0 | L2 | 04218159E3 | 04228159E3 | - | 04248159E3 |
| 385 | 22 | 18 x 30 | 03 | 290 | 86 | 55 | 0.10 | 6.8 | 4.1 | L2 | 04218229E3 | - | - | 04248229E3 |
| | 33 | 18 x 38 | 04 | 380 | 120 | 80 | 0.10 | 4.5 | 2.7 | L2 | 04318339E3 | - | - | 04348339E3 |
| | 47 | 18 x 38 | 04 | 450 | 170 | 110 | 0.10 | 3.2 | 2.1 | L2 | 04318479E3 | - | - | 04348479E3 |
| | 68 | 21 x 38 | 05 | 570 | 250 | 160 | 0.10 | 2.2 | 1.4 | L2 | 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) | LIFE CODE (1) | ORDERING CODE MAL2..... | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| | 6.8 | 10 x 30 | 00 | 110 | 220 | 110 | 0.055 | 11.5 | 7.3 | L2 | 04216688E3 | 04226688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 240 | 110 | 0.055 | 7.5 | 4.6 | L2 | 04216109E3 | 04226109E3 | - | - |
| | 15 | 15 x 30 | 02 | 210 | 250 | 110 | 0.055 | 5.0 | 3.1 | L2 | 04216159E3 | 04226159E3 | - | 04246159E3 |
| 400 | 22 | 18 x 30 | 03 | 290 | 280 | 120 | 0.055 | 3.5 | 2.1 | L2 | 04216229E3 | - | - | 04246229E3 |
| | 33 | 18 x 38 | 04 | 380 | 320 | 130 | 0.055 | 2.3 | 1.4 | L2 | 04316339E3 | - | - | 04346339E3 |
| | 47 | 18 x 38 | 04 | 450 | 370 | 140 | 0.055 | 1.7 | 1.1 | L2 | 04316479E3 | - | - | 04346479E3 |
| | 68 | 21 x 38 | 05 | 560 | 440 | 150 | 0.055 | 1.2 | 0.7 | L2 | 04316689E3 | - | - | 04346689E3 |
| | 6.8 | 10 x 30 | 00 | 110 | 230 | 110 | 0.10 | 22 | 14 | L3 | 04217688E3 | 04227688E3 | - | - |
| | 10 | 12.5 x 30 | 01 | 150 | 240 | 110 | 0.10 | 15 | 10 | L3 | 04217109E3 | 04227109E3 | - | - |
| | 15 | 12.5 x 30 | 01 | 180 | 260 | 110 | 0.10 | 10 | 6.0 | L3 | 04217159E3 | 04227159E3 | - | - |
| 450 | 22 | 15 x 30 | 02 | 240 | 290 | 120 | 0.10 | 6.8 | 4.1 | L3 | 04217229E3 | 04227229E3 | - | 04247229E3 |
| | 33 | 18 x 30 | 03 | 350 | 330 | 130 | 0.10 | 4.5 | 2.7 | L3 | 04217339E3 | - | - | 04247339E3 |
| | 47 | 18 x 38 | 04 | 440 | 390 | 140 | 0.10 | 3.2 | 2.1 | L3 | 04317479E3 | - | - | 04347479E3 |
| | 68 | 21 x 38 | 05 | 550 | 460 | 160 | 0.10 | 2.2 | 1.4 | L3 | 04317689E3 | - | - | 04347689E3 |

**Note**

(1) Determines the applicable row in the table “Endurance Test Duration and Useful Life”

## ADDITIONAL ELECTRICAL DATA

| PARAMETER | CONDITIONS | VALUE | |
|---|---|---|---|
| | | AXIAL | MOUNTING RING |
| **Voltage** | | | |
| Surge voltage | $U_R$ = 160 V to 250 V | $U_s \leq 1.15 \times U_R$ | |
| | $U_R$ = 350 V to 450 V | $U_s \leq 1.1 \times U_R$ | |
| Reverse voltage | | $U_{rev} \leq 1$ V | |
| **Current** | | | |
| Leakage current | After 1 min:<br>case Ø D x L = 8 mm x 18 mm to 10 mm x 25 mm:<br>CV ≤ 1000 µC<br>CV > 1000 µC<br>case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm:<br>$U_R$ = 160 V to 385 V<br>$U_R$ = 400 V and 450 V | <br><br>$I_{L1} \leq 0.05\ C_R \times U_R$ or 5 µA, whichever is greater<br>$I_{L1} \leq 0.03\ C_R \times U_R + 20$ µA<br><br>$I_{L1} \leq 0.009\ C_R \times U_R + 10$ µA<br>$I_{L1} \leq 0.009\ C_R \times U_R + 200$ µA | |
| | After 5 min:<br>$U_R$ = 160 V to 385 V:<br>CV ≤ 1000 µC<br>CV > 1000 µC<br>$U_R$ = 400 V and 450 V | <br><br>$I_{L5} \leq 0.01\ C_R \times U_R$ or 1 µA, whichever is greater<br>$I_{L5} \leq 0.006\ C_R \times U_R + 4$ µA<br>$I_{L5} \leq 0.002\ C_R \times U_R + 100$ µA | |
| **Inductance** | | | |
| Equivalent series inductance (ESL) | Case Ø D x L mm:<br>8 x 18<br>10 x 18<br>10 x 25<br>10 x 30<br>12.5 x 30<br>15 x 30<br>18 x 30<br>18 x 38<br>21 x 38 | <br>Typ. 35 nH<br>Typ. 69 nH<br>Typ. 38 nH<br>Typ. 38 nH<br>Typ. 46 nH<br>Typ. 48 nH<br>Typ. 50 nH<br>Typ. 54 nH<br>Typ. 59 nH | <br>-<br>-<br>-<br>-<br>-<br>Typ. 39 nH<br>Typ. 39 nH<br>Typ. 39 nH<br>Typ. 39 nH |

## CAPACITANCE (C)

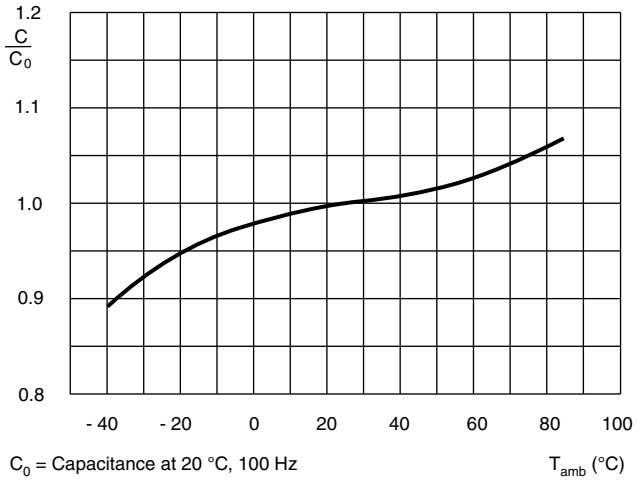



Fig. 5 - Typical multiplier of capacitance as a function of ambient temperature

## EQUIVALENT SERIES RESISTANCE (ESR)

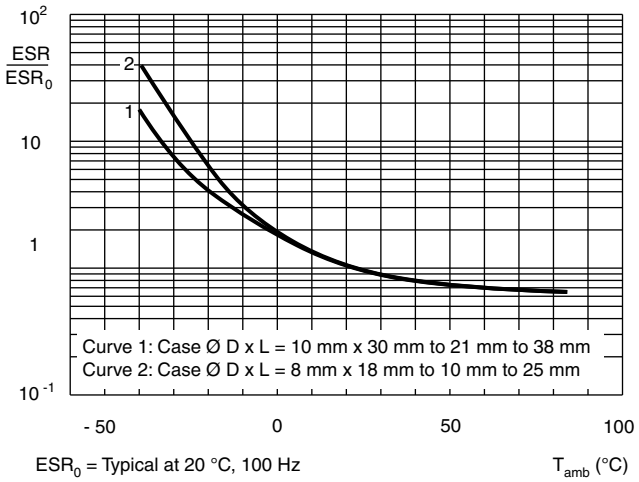



Fig. 6 - Typical multiplier of ESR
as a function of ambient temperature

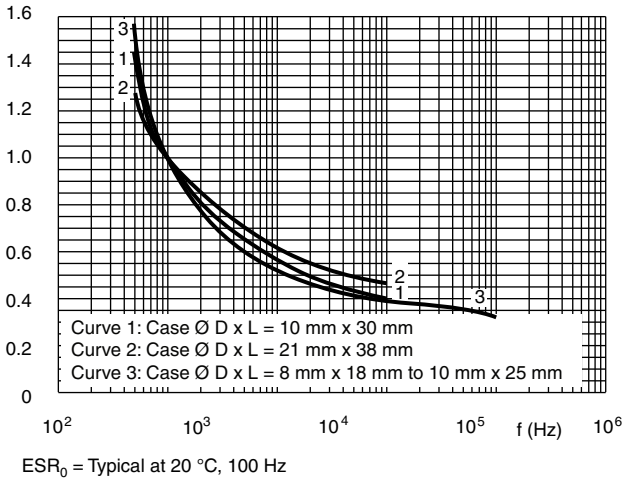



Fig. 7 - Typical multiplier of ESR as a function of frequency

## IMPEDANCE (Z)

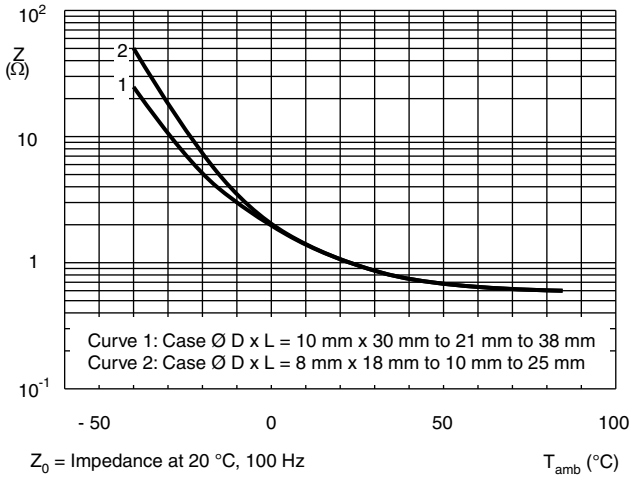



Fig. 8 - Typical impedance of capacitance as a function of ambient temperature

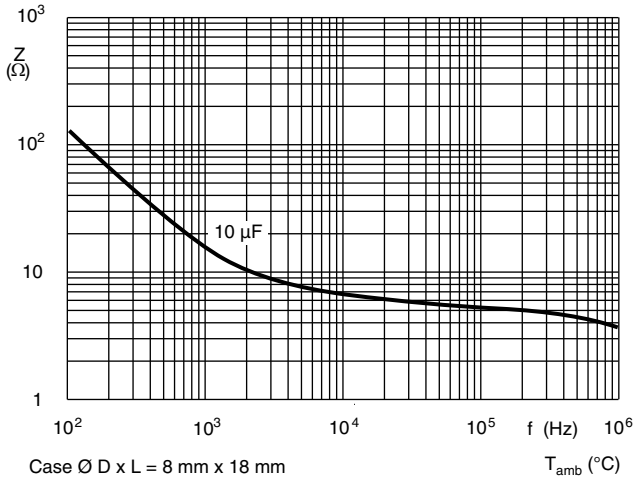



Fig. 9 - Typical impedance as a function of frequency

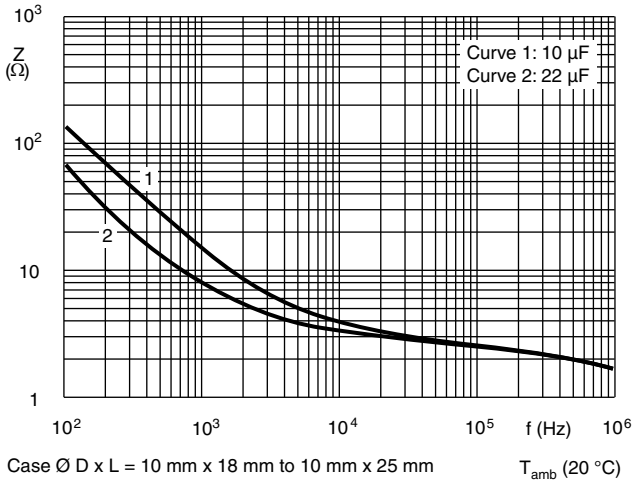



Fig. 10 - Typical impedance as a function of frequency

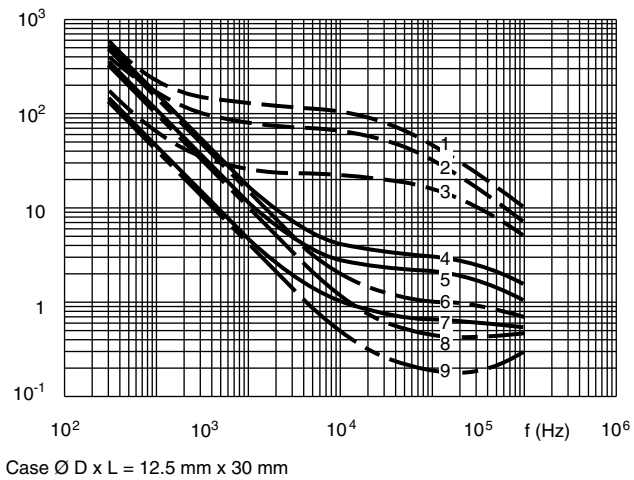



Fig. 11 - Typical impedance as a function of frequency at different ambient temperatures

Curve 1: 10 µF, 350 V and 385 V; -40 °C
Curve 2: 15 µF, 250 V; -40 °C
Curve 3: 33 µF, 160 V; -40 °C
Curve 4: 10 µF, 350 V and 385 V; 20 °C
Curve 5: 15 µF, 250 V; 20 °C
Curve 6: 33 µF, 160 V; 20 °C
Curve 7: 10 µF, 350 V and 385 V; 85 °C
Curve 8: 15 µF, 250 V; 85 °C
Curve 9: 33 µF, 160 V; 85 °C

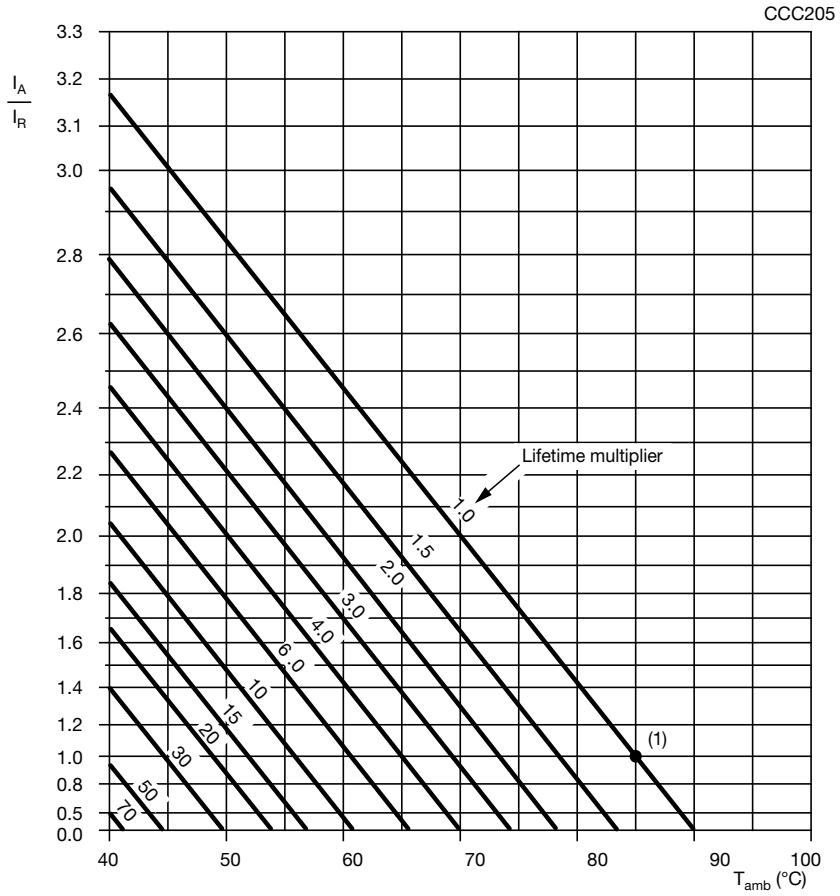
## RIPPLE CURRENT AND USEFUL LIFE

**Table 3**

| ENDURANCE TEST DURATION AND USEFUL LIFE | | |
|---|---|---|
| LIFE CODE | ENDURANCE AT 85 °C (h) | USEFUL LIFE AT 85 °C (h) |
| L1 | 2000 | 5000 |
| L2 | 8000 | 15 000 |
| L3 | 5000 | 10 000 |

**Note**

- Multiplier of useful life code: CCC205




$I_A$ = Actual ripple current at 100 Hz
$I_R$ = Rated ripple at 100 Hz, 85 °C

(1) Useful life at 85 °C and $I_R$ applied;
Case Ø D x L = 8 mm x 18 mm to 10 mm x 25 mm: 5000 h
Case Ø D x L = 8 mm x 18 mm to 10 mm x 25 mm: 5000 h (450 V: 10 000 h)

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

**Table 4**

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

**Table 5**

| TEST PROCEDURE REQUIREMENTS | | | |
|---|---|---|---|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4 / EN130300 subclause 4.13 | $T_{amb}$ = 85 °C; $U_R$ applied;<br>Case Ø D x L:<br>8 mm x 18 mm to 10 mm x 25 mm:<br>2000 h;<br>10 mm x 30 mm to 21 mm x 38 mm:<br>8000 h (450 V: 5000 h) | $U_R$ = 160 V; ΔC/C: ± 15 %<br>$U_R$ = 250 V to 450 V; ΔC/C: ± 10 %<br>tan δ ≤ 1.3 x spec. limit<br>Z ≤ 2 x spec. limit<br>$I_{L5}$ ≤ spec. limit |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb}$ = 85 °C; $U_R$ and $I_R$ applied;<br>Case Ø D x L:<br>8 mm x 18 mm to 10 mm x 25 mm:<br>5000 h;<br>10 mm x 30 mm to 21 mm x 38 mm:<br>15 000 h (450 V: 10 000 h) | $U_R$ = 160 V; ΔC/C: ± 45 %<br>$U_R$ = 250 V to 450 V; ΔC/C: ± 30 %<br>tan δ ≤ 3 x spec. limit<br>Z ≤ 3 x spec. limit<br>$I_{L5}$ ≤ spec. limit<br>No short or open circuit<br>Total failure percentage: ≤ 3 % |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb}$ = 85 °C; no voltage applied;<br>500 h<br>After test: $U_R$ to be applied for 30 min,<br>24 h to 48 h before measurement | ΔC/C, tan δ, Z:<br>for requirements<br>see “Endurance test” above<br>$I_{L5}$ ≤ 2 x spec. limit |

*Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.*

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