

Aluminum Electrolytic Capacitors Axial High Temperature, DIN-Based



Fig. 1

| QUICK REFERENCE DATA | |
|---|---|
| DESCRIPTION | VALUE |
| Nominal case sizes (Ø 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 | 4.7 µF to 4700 µF |
| Tolerance on C _R | -10 % / +50 % |
| Rated voltage range, U _R | 10 V to 100 V |
| Category temperature range | -55 °C to +125 °C |
| Endurance test at 150 °C | 500 h 500 h |
| Endurance test at 125 °C | 2000 h 4000 h |
| Useful life at 125 °C | 4000 h 8000 h |
| Useful life at 40 °C, 1.8 x I _R applied | 500 000 h 1 000 000 h |
| Shelf life at 0 V, 125 °C: U _R = 10 V to 63 V U _R = 100 V | 500 h 100 h |
| Based on sectional specification | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068 | 55 / 125 / 56 |

FEATURES

- Extra long useful life: up to 8000 h at 125 °C
- High stability, high reliability
- Extended temperature range: 125 °C (usable up to 150 °C)
- High ripple current capability
- 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
- Charge and discharge proof
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

APPLICATIONS

- Military, industrial control, EDP and telecommunication
- Smoothing, filtering, buffering in SMPS; coupling, decoupling
- For use where low mounting height is important; vibration and shock resistant

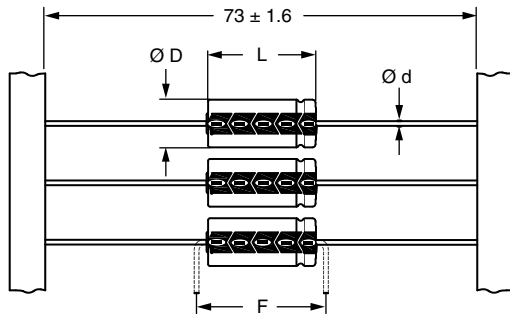
MARKING

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) at 125 °C and 85 °C
- Date code, in accordance with IEC 60062
- Code for factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (119)

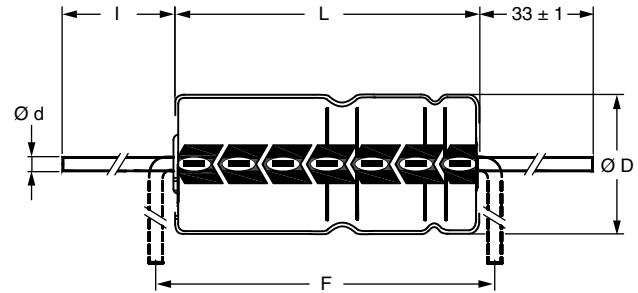
| SELECTION CHART FOR C _R , U _R , AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | | |
|---|--------------------|----------|----------|-----------|----------|-----------|
| C _R (µF) | U _R (V) | | | | | |
| | 10 | 16 | 25 | 40 | 63 | 100 |
| 4.7 | - | - | - | - | - | 6.5 x 18 |
| 10 | - | - | - | - | 6.5 x 18 | - |
| 22 | - | - | 6.5 x 18 | - | 8 x 18 | - |
| 47 | - | 6.5 x 18 | - | 8 x 18 | 10 x 18 | 10 x 25 |
| | - | - | - | - | - | 10 x 30 |
| 68 | - | - | - | - | 10 x 30 | 12.5 x 30 |
| 100 | 6.5 x 18 | 8 x 18 | 10 x 18 | 10 x 25 | 10 x 30 | 15 x 30 |
| 150 | - | - | - | 12.5 x 30 | 15 x 30 | 15 x 30 |

| SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm) | | | | | | |
|--|-----------|-----------|-----------|-----------|---------|---------|
| C_R (μF) | U_R (V) | | | | | |
| | 10 | 16 | 25 | 40 | 63 | 100 |
| 220 | 10 x 18 | 10 x 25 | 10 x 25 | 12.5 x 30 | 15 x 30 | 18 x 30 |
| | - | - | 12.5 x 30 | - | - | - |
| 330 | - | 12.5 x 30 | 12.5 x 30 | 15 x 30 | 18 x 30 | 18 x 38 |
| 470 | 10 x 25 | 12.5 x 30 | 12.5 x 30 | 15 x 30 | 18 x 38 | 21 x 38 |
| | 12.5 x 30 | - | - | - | - | - |
| 680 | 12.5 x 30 | 15 x 30 | 18 x 30 | 18 x 30 | 21 x 38 | - |
| 1000 | 15 x 30 | 15 x 30 | 18 x 30 | 18 x 38 | 21 x 38 | - |
| 1500 | 18 x 30 | 18 x 30 | 18 x 38 | 21 x 38 | - | - |
| 2200 | 18 x 30 | 18 x 38 | 21 x 38 | 21 x 38 | - | - |
| 3300 | 18 x 38 | 21 x 38 | - | - | - | - |
| 4700 | 21 x 38 | 21 x 38 | - | - | - | - |

DIMENSIONS in millimeters AND AVAILABLE FORMS


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

Fig. 2 - Forms BA and BR



Form AA: Axial in box
 Case $\varnothing D \times L = 10 \text{ mm} \times 30 \text{ mm}$ to $21 \text{ mm} \times 38 \text{ mm}$

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

- For detailed tape dimensions please see www.vishay.com/doc?28361



Mounting holes

Case $\varnothing D \times L = 15 \text{ mm} \times 30 \text{ mm}$ to $21 \text{ mm} \times 38 \text{ mm}$
 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 $\varnothing D \times L$ | 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 | ≈ 8.6 | 200 |
| 18 x 30 | 03 | 0.8 | $1.0 + 0.4$ | 18.5 | 19.5 | 18.5 ± 0.2 | 33 | ≈ 11.5 | 240 |
| 18 x 38 | 04 | 0.8 | $1.0 + 0.4$ | 18.5 | 19.5 | 18.5 ± 0.2 | 42 | ≈ 14.0 | 100 |
| 21 x 38 | 05 | 0.8 | $1.0 + 0.4$ | 21.5 | 22.5 | 21.5 ± 0.2 | 42 | ≈ 19.2 | 100 |

| ELECTRICAL DATA | |
|------------------------|--|
| SYMBOL | DESCRIPTION |
| C_R | Rated capacitance at 100 Hz, tolerance -10 % / +50 % |
| I_R | Rated RMS ripple current at 100 Hz, 125 °C |
| I_{L1} | Max. leakage current after 1 min at U_R |
| I_{L5} | Max. leakage current after 5 min 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 |

Note

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

ORDERING EXAMPLE

Electrolytic capacitor 119 series

 $470 \mu\text{F} / 16 \text{ V}; -10 \text{ %} / +50 \text{ %}$

 Nominal case size: $\varnothing 12.5 \text{ mm} \times 30 \text{ mm}$; form BR

Ordering code: MAL211925471E3

Former 12NC: 2222 119 25471



Table 3

| 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 125 °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 MAL2119..... | | | |
| | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| 10 | 100 | 6.5 x 18 | 4 | 130 | 10 | 6 | 0.20 | 3.50 | 2.20 | - | 24101E3 | 34101E3 | - |
| | 220 | 10 x 18 | 6 | 240 | 17 | 8.4 | 0.18 | 1.30 | 1.00 | - | 24221E3 | 34221E3 | - |
| | 470 | 10 x 25 | 7 | 380 | 32 | 13 | 0.18 | 0.61 | 0.49 | - | 90501E3 | 90502E3 | - |
| | 470 | 12.5 x 30 | 01 | 550 | 32 | 13 | 0.16 | 0.54 | 0.38 | 14471E3 | 24471E3 | - | - |
| | 680 | 12.5 x 30 | 01 | 640 | 45 | 18 | 0.20 | 0.47 | 0.38 | 14681E3 | 24681E3 | - | - |
| | 1000 | 15 x 30 | 02 | 830 | 64 | 24 | 0.20 | 0.32 | 0.24 | 14102E3 | 24102E3 | - | 44102E3 |
| | 1500 | 18 x 30 | 03 | 1100 | 94 | 34 | 0.22 | 0.23 | 0.17 | 14152E3 | - | - | 44152E3 |
| | 2200 | 18 x 30 | 03 | 1190 | 136 | 48 | 0.26 | 0.19 | 0.17 | 14222E3 | - | - | 44222E3 |
| | 3300 | 18 x 38 | 04 | 1550 | 202 | 70 | 0.27 | 0.13 | 0.10 | 14332E3 | - | - | 44332E3 |
| | 4700 | 21 x 38 | 05 | 1700 | 286 | 90 | 0.30 | 0.10 | 0.09 | 14472E3 | - | - | 44472E3 |
| 16 | 47 | 6.5 x 18 | 4 | 110 | 10 | 5.5 | 0.13 | 4.40 | 2.20 | - | 25479E3 | 35479E3 | - |
| | 100 | 8 x 18 | 5 | 170 | 14 | 7.2 | 0.13 | 2.10 | 1.30 | - | 25101E3 | 35101E3 | - |
| | 220 | 10 x 25 | 7 | 300 | 25 | 11 | 0.13 | 0.94 | 0.55 | - | 25221E3 | 35221E3 | - |
| | 330 | 12.5 x 30 | 01 | 560 | 36 | 15 | 0.13 | 0.63 | 0.38 | 15331E3 | 25331E3 | - | - |
| | 470 | 12.5 x 30 | 01 | 570 | 50 | 19 | 0.15 | 0.51 | 0.38 | 15471E3 | 25471E3 | - | - |
| | 680 | 15 x 30 | 02 | 750 | 69 | 26 | 0.15 | 0.35 | 0.24 | 15681E3 | 25681E3 | - | 45681E3 |
| | 1000 | 15 x 30 | 02 | 850 | 100 | 36 | 0.19 | 0.30 | 0.24 | 15102E3 | 25102E3 | - | 45102E3 |
| | 1500 | 18 x 30 | 03 | 1120 | 148 | 52 | 0.20 | 0.21 | 0.17 | 15152E3 | - | - | 45152E3 |
| | 2200 | 18 x 38 | 04 | 1440 | 215 | 74 | 0.20 | 0.14 | 0.10 | 15222E3 | - | - | 45222E3 |
| | 3300 | 21 x 38 | 05 | 1650 | 321 | 110 | 0.22 | 0.11 | 0.09 | 15332E3 | - | - | 45332E3 |
| 4700 | 21 x 38 | 05 | 1710 | 455 | 154 | 0.28 | 0.09 | 0.09 | 15472E3 | - | - | 45472E3 | |
| 25 | 22 | 6.5 x 18 | 4 | 85 | 10 | 5.1 | 0.10 | 7.20 | 3.20 | - | 26229E3 | 36229E3 | - |
| | 100 | 10 x 18 | 6 | 210 | 19 | 9 | 0.10 | 1.60 | 1.00 | - | 26101E3 | 36101E3 | - |
| | 220 | 10 x 25 | 7 | 350 | 37 | 15 | 0.10 | 0.72 | 0.58 | - | 90503E3 | 90504E3 | - |
| | 220 | 12.5 x 30 | 01 | 500 | 37 | 15 | 0.09 | 0.65 | 0.38 | 16221E3 | 26221E3 | - | - |
| | 330 | 12.5 x 30 | 01 | 580 | 54 | 21 | 0.11 | 0.53 | 0.38 | 16331E3 | 26331E3 | - | - |
| | 470 | 12.5 x 30 | 01 | 630 | 75 | 28 | 0.13 | 0.44 | 0.38 | 16471E3 | 26471E3 | - | - |
| | 680 | 18 x 30 | 03 | 990 | 106 | 38 | 0.13 | 0.30 | 0.17 | 16681E3 | - | - | 46681E3 |
| | 1000 | 18 x 30 | 03 | 1090 | 154 | 54 | 0.13 | 0.21 | 0.17 | 16102E3 | - | - | 46102E3 |
| | 1500 | 18 x 38 | 04 | 1420 | 229 | 79 | 0.13 | 0.14 | 0.10 | 16152E3 | - | - | 46152E3 |
| | 2200 | 21 x 38 | 05 | 1550 | 334 | 114 | 0.13 | 0.11 | 0.09 | 16222E3 | - | - | 46222E3 |
| 40 | 47 | 8 x 18 | 5 | 150 | 15 | 7.8 | 0.08 | 2.70 | 1.50 | - | 27479E3 | 37479E3 | - |
| | 100 | 10 x 25 | 7 | 260 | 28 | 12 | 0.08 | 1.30 | 0.70 | - | 27101E3 | 37101E3 | - |
| | 150 | 12.5 x 30 | 01 | 440 | 40 | 16 | 0.08 | 0.85 | 0.51 | 17151E3 | 27151E3 | - | - |
| | 220 | 12.5 x 30 | 01 | 500 | 57 | 22 | 0.09 | 0.65 | 0.48 | 17221E3 | 27221E3 | - | - |
| | 330 | 15 x 30 | 02 | 630 | 83 | 30 | 0.09 | 0.43 | 0.37 | 17331E3 | 27331E3 | - | 47331E3 |
| | 470 | 15 x 30 | 02 | 720 | 117 | 42 | 0.12 | 0.41 | 0.37 | 17471E3 | 27471E3 | - | 47471E3 |
| | 680 | 18 x 30 | 03 | 970 | 167 | 58 | 0.12 | 0.28 | 0.22 | 17681E3 | - | - | 47681E3 |
| | 1000 | 18 x 38 | 04 | 1250 | 244 | 84 | 0.12 | 0.19 | 0.14 | 17102E3 | - | - | 47102E3 |
| | 1500 | 21 x 38 | 05 | 1410 | 364 | 124 | 0.14 | 0.15 | 0.12 | 17152E3 | - | - | 47152E3 |
| | 2200 | 21 x 38 | 05 | 1550 | 532 | 180 | 0.18 | 0.13 | 0.11 | 17222E3 | - | - | 47222E3 |



| 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 125 °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 MAL2119..... | | | |
| | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| 63 | 10 | 6.5 x 18 | 4 | 68 | 20 | 5.3 | 0.07 | 11.0 | 5.60 | - | 28109E3 | 38109E3 | - |
| | 22 | 8 x 18 | 5 | 110 | 20 | 6.7 | 0.07 | 5.10 | 2.80 | - | 28229E3 | 38229E3 | - |
| | 47 | 10 x 18 | 6 | 180 | 22 | 9.9 | 0.07 | 2.40 | 1.30 | - | 28479E3 | 38479E3 | - |
| | 68 | 10 x 25 | 7 | 230 | 30 | 13 | 0.07 | 1.60 | 1.00 | - | 90505E3 | 90506E3 | - |
| | 68 | 10 x 30 | 00 | 300 | 30 | 13 | 0.07 | 1.60 | 0.92 | 18689E3 | 28689E3 | - | - |
| | 100 | 10 x 30 | 00 | 360 | 42 | 17 | 0.08 | 1.30 | 0.75 | 18101E3 | 28101E3 | - | - |
| | 150 | 15 x 30 | 02 | 560 | 61 | 23 | 0.08 | 0.85 | 0.37 | 18151E3 | 28151E3 | - | 48151E3 |
| | 220 | 15 x 30 | 02 | 640 | 87 | 32 | 0.08 | 0.58 | 0.37 | 18221E3 | 28221E3 | - | 48221E3 |
| | 330 | 18 x 30 | 03 | 880 | 129 | 46 | 0.09 | 0.43 | 0.23 | 18331E3 | - | - | 48331E3 |
| | 470 | 18 x 38 | 04 | 1130 | 182 | 63 | 0.09 | 0.30 | 0.15 | 18471E3 | - | - | 48471E3 |
| | 680 | 21 x 38 | 05 | 1290 | 261 | 90 | 0.09 | 0.21 | 0.12 | 18681E3 | - | - | 48681E3 |
| 1000 | 21 x 38 | 05 | 1430 | 382 | 130 | 0.10 | 0.16 | 0.11 | 18102E3 | - | - | 48102E3 | |
| 100 | 4.7 | 6.5 x 18 | 4 | 44 | 20 | 10 | 0.08 | 27.00 | 10.0 | - | 29478E3 | 39478E3 | - |
| | 47 | 10 x 25 | 7 | 178 | 32 | 13 | 0.08 | 2.70 | 2.00 | - | 90518E3 | 90519E3 | - |
| | 47 | 10 x 30 | 00 | 240 | 32 | 13 | 0.08 | 2.70 | 2.00 | 19479E3 | 29479E3 | - | - |
| | 68 | 12.5 x 30 | 01 | 330 | 45 | 18 | 0.08 | 1.90 | 1.20 | 19689E3 | 29689E3 | - | - |
| | 100 | 15 x 30 | 02 | 440 | 64 | 24 | 0.09 | 1.40 | 0.96 | 19101E3 | 29101E3 | - | 49101E3 |
| | 150 | 15 x 30 | 02 | 520 | 94 | 34 | 0.10 | 1.10 | 0.78 | 19151E3 | 29151E3 | - | 49151E3 |
| | 220 | 18 x 30 | 03 | 710 | 136 | 48 | 0.10 | 0.72 | 0.55 | 19221E3 | - | - | 49221E3 |
| | 330 | 18 x 38 | 04 | 920 | 202 | 70 | 0.10 | 0.48 | 0.37 | 19331E3 | - | - | 49331E3 |
| 470 | 21 x 38 | 05 | 1070 | 286 | 98 | 0.10 | 0.34 | 0.28 | 19471E3 | - | - | 49471E3 | |

| ADDITIONAL ELECTRICAL DATA | | |
|----------------------------|---|--|
| PARAMETER | CONDITIONS | VALUE |
| | | AXIAL |
| Voltage | | |
| Surge voltage | | $U_s \leq 1.15 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 1 V$ |
| Current | | |
| Leakage current | After 1 min: $U_R = 10 V$ to $40 V$ $U_R = 63 V$ to $100 V$ | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu A$, or $10 \mu A$ (whichever is greater) $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu A$, or $20 \mu A$ (whichever is greater) |
| | After 5 min: $U_R = 10 V$ to $63 V$ $U_R = 100 V$ | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu A$ $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu A$, or $10 \mu A$ (whichever is greater) |

| ADDITIONAL ELECTRICAL DATA | | | |
|------------------------------------|------------------------------|------------|---------------|
| PARAMETER | CONDITIONS | VALUE | |
| | | AXIAL | MOUNTING RING |
| Inductance | | | |
| Equivalent series inductance (ESL) | Case \varnothing 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 | |

Table 4

| OPERATING VALUES AT REDUCED AMBIENT TEMPERATURE | | | | | | | | |
|---|---|--------|----|----|----|-----|-----|------|
| SYMBOL | CONDITIONS | VALUES | | | | | | UNIT |
| U_R | $T_{amb} > 85\text{ }^\circ\text{C}$ to $125\text{ }^\circ\text{C}$ | 10 | 16 | 25 | 40 | 63 | 100 | V |
| U_{R2} | $T_{amb} \leq 85\text{ }^\circ\text{C}$ | 16 | 25 | 40 | 63 | 100 | 125 | |

Note

- For applications at ambient temperatures of $\leq 85\text{ }^\circ\text{C}$, the rated voltage (U_R) may be raised to U_{R2} .

CAPACITANCE (C)

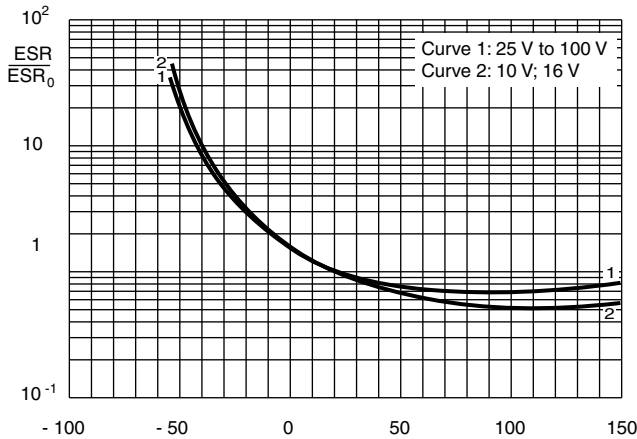

Fig. 5 - Typical multiplier of capacitance as a function of ambient temperature



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



EQUIVALENT SERIES RESISTANCE (ESR)



Case Ø D x L = 6.5 mm x 18 mm to 15 mm x 30 mm
ESR₀ = Typical at 20 °C, 100 Hz

Fig. 7 - Typical multiplier of ESR as a function of ambient temperature



Case Ø D x L = 18 mm x 30 mm to 21 mm x 38 mm
ESR₀ = Typical at 20 °C, 100 Hz

Fig. 8 - Typical multiplier of ESR as a function of ambient temperature



Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm
ESR₀ = Typical at 20 °C, 100 Hz

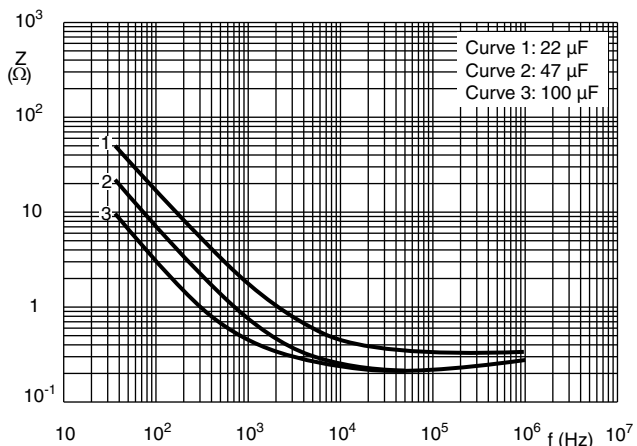
Fig. 9 - Typical multiplier of ESR as a function of frequency



Case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm
ESR₀ = Typical at 20 °C, 100 Hz

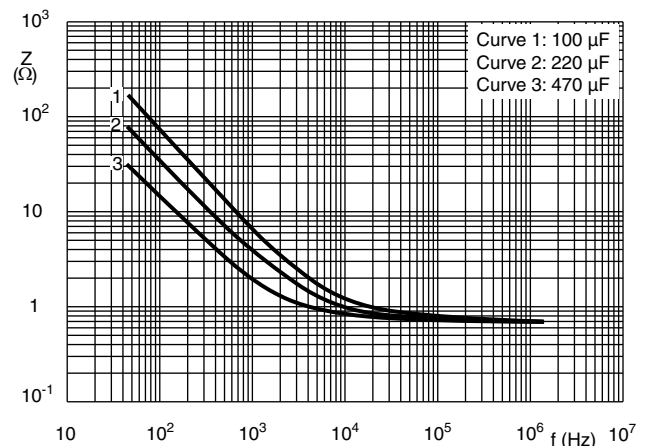
Fig. 10 - Typical multiplier of ESR as a function of frequency

IMPEDANCE (Z)



Case Ø D x L = 8 mm x 18 mm

Fig. 11 - Typical impedance as a function of frequency



Case Ø D x L = 8 mm x 18 mm

Fig. 12 - Typical impedance as a function of frequency



IMPEDANCE (Z)

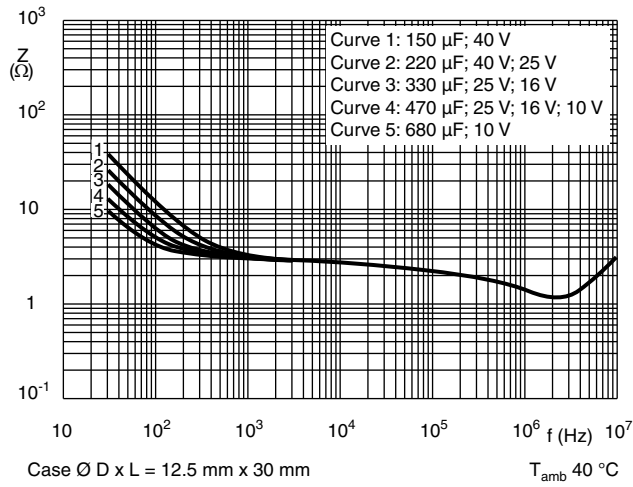


Fig. 13 - Typical impedance as a function of frequency

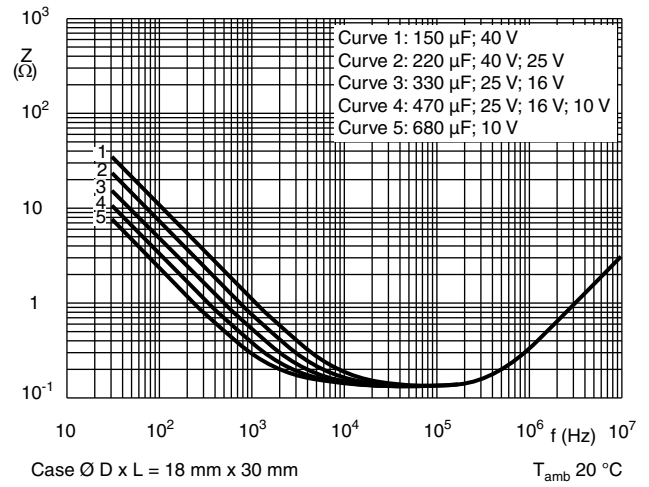


Fig. 14 - Typical impedance as a function of frequency

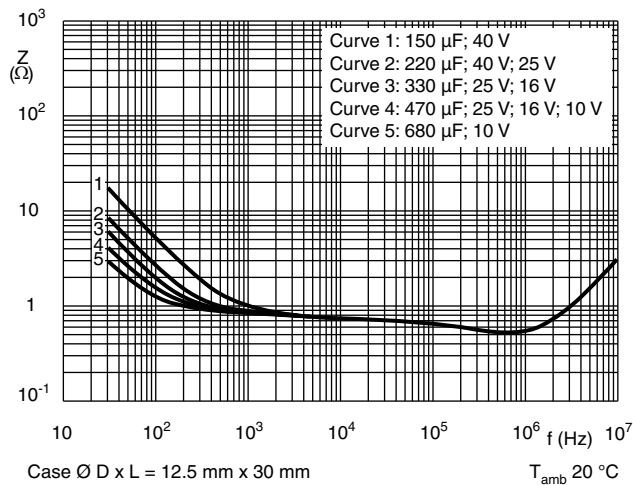


Fig. 15 - Typical impedance as a function of frequency

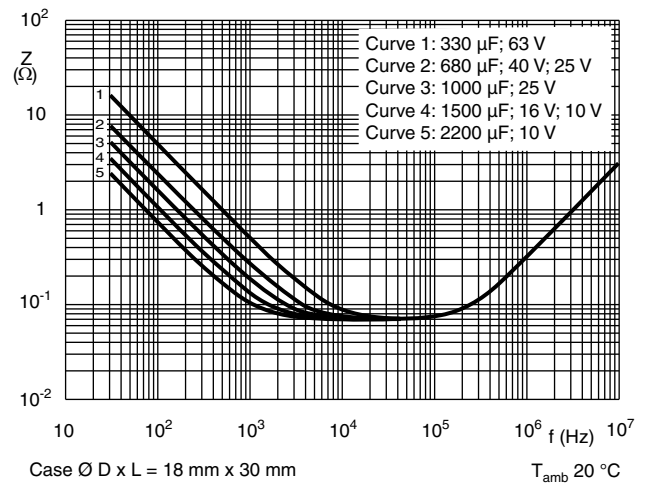


Fig. 16 - Typical impedance as a function of frequency

RIPPLE CURRENT AND USEFUL LIFE

Table 5

| ENDURANCE TEST DURATION AND USEFUL LIFE | | |
|---|-------------------------------|---------------------------------|
| NOMINAL CASE SIZE Ø D x L (mm) | ENDURANCE AT 125 °C (h) | USEFUL LIFE AT 125 °C (h) |
| 6.5 x 18 | 2000 | 4000 |
| 8 x 18 | 2000 | 4000 |
| 10 x 18 | 2000 | 4000 |
| 10 x 25 | 2000 | 4000 |
| 10 x 30 | 4000 | 8000 |
| 12.5 x 30 | 4000 | 8000 |
| 15 x 30 | 4000 | 8000 |
| 18 x 30 | 4000 | 8000 |
| 18 x 38 | 4000 | 8000 |
| 21 x 38 | 4000 | 8000 |

Note

- Multiplier of useful life code: MBC242

MBC242

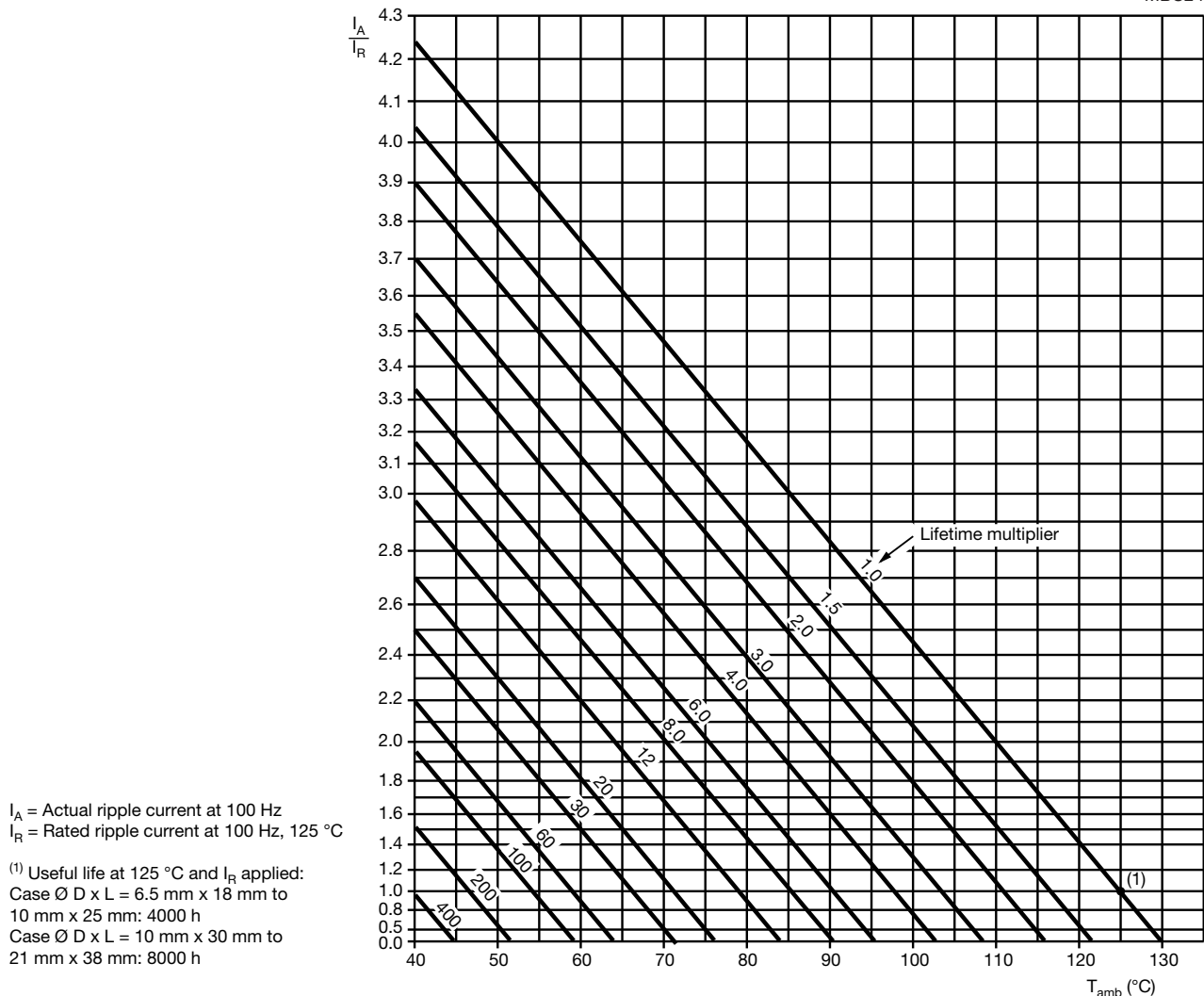


Fig. 17 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 6

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | | | | | | |
|---|------------------|------|------|------|------|----------------|
| U_R (V) | FREQUENCY (Hz) | | | | | |
| | 50 | 100 | 300 | 1000 | 3000 | $\geq 10\ 000$ |
| | I_R MULTIPLIER | | | | | |
| 10 | 0.95 | 1.00 | 1.07 | 1.12 | 1.15 | 1.20 |
| 16 | 0.95 | 1.00 | 1.07 | 1.12 | 1.15 | 1.20 |
| 25 | 0.90 | 1.00 | 1.12 | 1.20 | 1.25 | 1.30 |
| 40 | 0.90 | 1.00 | 1.12 | 1.20 | 1.25 | 1.30 |
| 63 | 0.85 | 1.00 | 1.20 | 1.30 | 1.35 | 1.40 |
| 100 | 0.85 | 1.00 | 1.20 | 1.30 | 1.35 | 1.40 |

Table 7

| TEST PROCEDURES AND REQUIREMENTS | | | |
|--|--|--|--|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4 / EN 130300 subclause 4.13 | $T_{amb} = 125\ ^\circ\text{C}$; U_R applied; Case $\varnothing D \times L = 6.5\ \text{mm} \times 18\ \text{mm}$ to 10 mm x 25 mm: 2000 h; Case $\varnothing D \times L = 10\ \text{mm} \times 30\ \text{mm}$ to 21 mm x 38 mm: 4000 h | $\Delta C/C: \pm 15\ \%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 125\ ^\circ\text{C}$; U_R and I_R applied; Case $\varnothing D \times L = 6.5\ \text{mm} \times 18\ \text{mm}$ to 10 mm x 25 mm: 4000 h; Case $\varnothing D \times L = 10\ \text{mm} \times 30\ \text{mm}$ to 21 mm x 38 mm: 8000 h | $\Delta C/C: \pm 45\ \%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\ \%$ |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN 130300 subclause 4.17 | $T_{amb} = 125\ ^\circ\text{C}$; no voltage applied; $U_R = 10\ \text{V}$ to 63 V: 500 h; $U_R = 100\ \text{V}$: 100 h After test: U_R to be applied for 30 min, 24 h to 48 h before measurement | $\Delta C/C, \tan \delta, Z$: for requirements see "Endurance test" above $I_{L5} \leq 2 \times \text{spec. limit}$ |
| Reverse voltage | IEC 60384-4 / EN 130300 subclause 4.15 | $T_{amb} = 125\ ^\circ\text{C}$: 125 h at $U = -1\ \text{V}$ followed by 125 h at U_R | $\Delta C/C: \pm 20\ \%$ $\tan \delta \leq \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |

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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