

Aluminum Capacitors Axial High Temperature



Fig. 1

| 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 μ F to 10 000 μ F | |
| Tolerance on C_R | ± 20 % | |
| Rated voltage range, U_R | 6.3 V to 200 V | |
| Category temperature range | - 40 °C to + 125 °C | - 55 °C to + 125 °C |
| Endurance test at 150 °C (6.3 V to 100 V) | 500 h | 500 h |
| Endurance test at 125 °C | 2000 h | 3000 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: $U_R = 6.3$ V to 63 V $U_R = 100$ V and 200 V | 500 h 100 h | |
| Based on sectional specification | IEC 60384-4/EN130300 | |
| Climatic category IEC 60068 | 40/125/56 | 55/125/56 |

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 mm x 30 mm available for automatic insertion
- Charge and discharge proof
- Extra long useful life: Up to 8000 h at 125 °C, high reliability
- Extended temperature range: 125 °C (usable up to 150 °C)
- Miniaturized, high CV-product per unit volume
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

APPLICATIONS

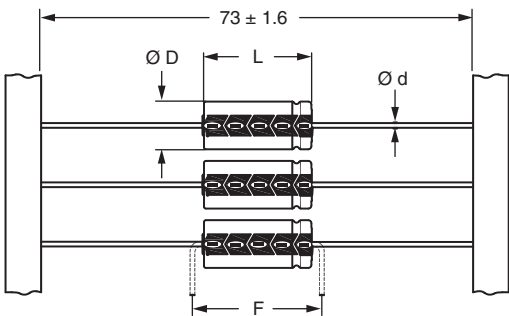
- Automotive, industrial and telecommunication
- Smoothing, filtering, coupling, decoupling, timing
- For use after very long storage (10 years) without voltage applied
- Portable and mobile equipment (small size, low mass)
- Low mounting height boards, vibration and shock resistant
- Outdoor applications, e.g. aerial amplifiers

MARKING

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

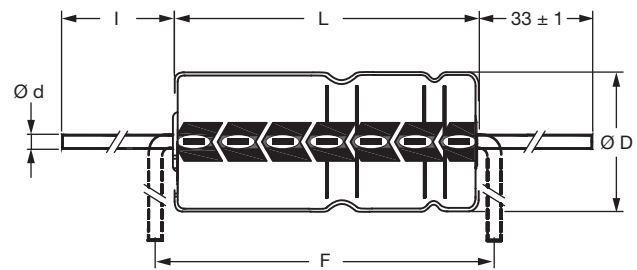
- Rated capacitance (in μ F)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V) at 125 °C and 85 °C
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (118)

| SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm) | | | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| C_R (μF) | U_R (V) | | | | | | | |
| | 6.3 | 10 | 16 | 25 | 40 | 63 | 100 | 200 |
| 1.0 | - | - | - | - | - | 6.5 x 18 | - | - |
| 2.2 | - | - | - | - | - | 6.5 x 18 | - | 6.5 x 18 |
| 4.7 | - | - | - | - | - | 6.5 x 18 | 6.5 x 18 | 8 x 18 |
| 10 | - | - | - | - | - | 6.5 x 18 | 6.5 x 18 | 10 x 25 |
| 15 | - | - | - | - | - | - | - | 10 x 30 |
| 22 | - | - | - | - | - | 6.5 x 18 | 8 x 18 | 12.5 x 30 |
| 33 | - | - | - | - | - | - | 10 x 25 | 15 x 30 |
| 47 | - | - | - | - | 6.5 x 18 | 8 x 18 | 10 x 25 | 18 x 30 |
| | - | - | - | - | - | - | 10 x 30 | - |
| 68 | - | - | - | - | - | - | 12.5 x 30 | 18 x 38 |
| 100 | - | - | - | 6.5 x 18 | 8 x 18 | 10 x 25 | 12.5 x 30 | 21 x 38 |
| | - | - | - | - | - | 10 x 30 | - | - |
| 150 | - | - | - | - | 10 x 18 | 12.5 x 30 | 15 x 30 | - |
| 220 | - | 6.5 x 18 | 8 x 18 | 10 x 18 | 10 x 25 | 12.5 x 30 | 18 x 30 | - |
| | - | - | - | - | 10 x 30 | - | - | - |
| 330 | - | 8 x 18 | 10 x 18 | 10 x 25 | 12.5 x 30 | 15 x 30 | 18 x 38 | - |
| 470 | - | 8 x 18 | 10 x 18 | 10 x 25 | 12.5 x 30 | 18 x 30 | 21 x 38 | - |
| | - | - | - | 10 x 30 | - | - | - | - |
| 680 | - | - | 10 x 30 | 12.5 x 30 | 15 x 30 | 18 x 38 | - | - |
| 1000 | 10 x 18 | 10 x 25 | 12.5 x 30 | 12.5 x 30 | 18 x 30 | 21 x 38 | - | - |
| | - | 10 x 30 | - | - | - | - | - | - |
| 1500 | 10 x 25 | 12.5 x 30 | 12.5 x 30 | 15 x 30 | 18 x 38 | - | - | - |
| 2200 | - | 12.5 x 30 | 15 x 30 | 18 x 30 | 21 x 38 | - | - | - |
| 3300 | - | 15 x 30 | 18 x 30 | 18 x 38 | - | - | - | - |
| 4700 | - | 18 x 30 | 18 x 38 | 21 x 38 | - | - | - | - |
| 6800 | - | 18 x 38 | 21 x 38 | - | - | - | - | - |
| 10 000 | - | 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 $21 \text{ mm} \times 38 \text{ mm}$

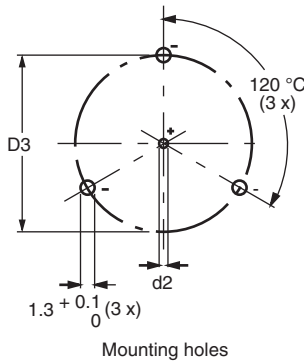
Fig. 3 - Form AA

Table 1

| AXIAL; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | | | | | | |
|--|-----------|---------------------------|--------|---------------------|-------------------|-------------------|----------|----------------------|---------|---------|
| NOMINAL CASE SIZE 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 |
| 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 | 0 | 0.8 | 55 ± 1 | 10.5 | 30.5 | 35 | 4.8 | 340 | - | 500 |
| 12.5 x 30 | 1 | 0.8 | 55 ± 1 | 13.0 | 30.5 | 35 | 7.4 | 260 | - | 400 |
| 15 x 30 | 2 | 0.8 | 55 ± 1 | 15.5 | 30.5 | 35 | 11.7 | 200 | - | 250 |
| 18 x 30 | 3 | 0.8 | 55 ± 1 | 18.5 | 30.5 | 35 | 12.9 | 120 | - | - |
| 18 x 38 | 4 | 0.8 | 55 ± 1 | 18.5 | 39.5 | 44 | 19 | 125 | - | - |
| 21 x 38 | 5 | 0.8 | 55 ± 1 | 21.5 | 39.5 | 44 | 24 | 100 | - | - |

Note

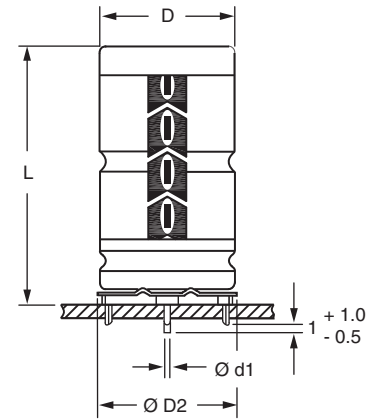
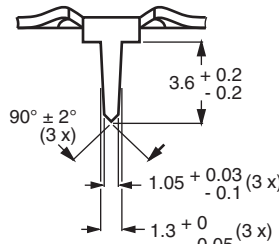
- Detailed tape dimensions see section "Packaging".



Mounting holes

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

| 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 | 2 | 0.8 | 1.0 + 0.4 | 15.5 | 17.5 | 16.5 ± 0.2 | 33 | ≈ 8.6 | 200 |
| 18 x 30 | 3 | 0.8 | 1.0 + 0.4 | 18.5 | 19.5 | 18.5 ± 0.2 | 33 | ≈ 11.5 | 240 |
| 18 x 38 | 4 | 0.8 | 1.0 + 0.4 | 18.5 | 19.5 | 18.5 ± 0.2 | 42 | ≈ 14.0 | 100 |
| 21 x 38 | 5 | 0.8 | 1.0 + 0.4 | 21.5 | 22.5 | 21.5 ± 0.2 | 42 | ≈ 19.0 | 100 |

| ELECTRICAL DATA | |
|------------------------|--|
| SYMBOL | DESCRIPTION |
| C _R | Rated capacitance at 100 Hz, tolerance ± 20 % |
| 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 δ | Max. dissipation factor at 100 Hz |
| ESR | Equivalent series resistance at 100 Hz (calculated from tan δ _{max.} and C _R) |
| Z | Max. impedance at 10 kHz |

Note

- Unless otherwise specified, all electrical values in Table 2 apply at T_{amb} = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %.

ORDERING EXAMPLE

Electrolytic capacitor 118 series

1000 µF/10 V; ± 20 %

Nominal case size: Ø 10 mm x 30 mm; Form BR

Ordering code: MAL211824102E3

Former 12NC: 2222 118 24102



Table 2

| 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 MAL2118..... | | | |
| | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| 6.3 | 1000 | 10 x 18 | 6 | 251 | 42 | 17 | 0.50 | 0.790 | 0.80 | - | 23102E3 | 33102E3 | - |
| | 1500 | 10 x 25 | 7 | 352 | 61 | 23 | 0.50 | 0.530 | 0.53 | - | 90502E3 | 90503E3 | - |
| 10 | 220 | 6.5 x 18 | 4 | 109 | 20 | 8.4 | 0.35 | 2.530 | 2.10 | - | 24221E3 | 34221E3 | - |
| | 330 | 8 x 18 | 5 | 150 | 24 | 11 | 0.35 | 1.690 | 1.40 | - | 24331E3 | 34331E3 | - |
| | 470 | 8 x 18 | 5 | 179 | 32 | 13 | 0.35 | 1.190 | 1.00 | - | 24471E3 | 34471E3 | - |
| | 1000 | 10 x 25 | 7 | 343 | 64 | 24 | 0.35 | 0.560 | 0.55 | - | 90504E3 | 90505E3 | - |
| | 1000 | 10 x 30 | 00 | 550 | 64 | 24 | 0.32 | 0.505 | 0.45 | 14102E3 | 24102E3 | - | - |
| | 1500 | 12.5 x 30 | 01 | 740 | 94 | 34 | 0.32 | 0.340 | 0.28 | 14152E3 | 24152E3 | - | - |
| | 2200 | 12.5 x 30 | 01 | 830 | 136 | 48 | 0.40 | 0.290 | 0.27 | 14222E3 | 24222E3 | - | - |
| | 3300 | 15 x 30 | 02 | 1070 | 202 | 70 | 0.40 | 0.190 | 0.18 | 14332E3 | 24332E3 | - | 44332E3 |
| | 4700 | 18 x 30 | 03 | 1350 | 286 | 98 | 0.46 | 0.155 | 0.15 | 14472E3 | - | - | 44472E3 |
| 6800 | 18 x 38 | 04 | 1730 | 412 | 140 | 0.53 | 0.100 | 0.10 | 14682E3 | - | - | 44682E3 | |
| 10 000 | 21 x 38 | 05 | 1860 | 604 | 200 | 0.53 | 0.084 | 0.10 | 14103E3 | - | - | 44103E3 | |
| 16 | 220 | 8 x 18 | 5 | 145 | 25 | 11 | 0.25 | 1.810 | 1.50 | - | 25221E3 | 35221E3 | - |
| | 330 | 10 x 18 | 6 | 204 | 36 | 15 | 0.25 | 1.210 | 1.20 | - | 25331E3 | 35331E3 | - |
| | 470 | 10 x 18 | 6 | 243 | 49 | 19 | 0.25 | 0.850 | 0.83 | - | 25471E3 | 35471E3 | - |
| | 680 | 10 x 30 | 00 | 510 | 69 | 30 | 0.22 | 0.525 | 0.45 | 15681E3 | 25681E3 | - | - |
| | 1000 | 12.5 x 30 | 01 | 720 | 100 | 36 | 0.22 | 0.345 | 0.28 | 15102E3 | 25102E3 | - | - |
| | 1500 | 12.5 x 30 | 01 | 790 | 148 | 52 | 0.29 | 0.305 | 0.27 | 15152E3 | 25152E3 | - | - |
| | 2200 | 15 x 30 | 02 | 1010 | 215 | 74 | 0.29 | 0.205 | 0.18 | 15222E3 | 25222E3 | - | 45222E3 |
| | 3300 | 18 x 30 | 03 | 1300 | 321 | 110 | 0.34 | 0.165 | 0.15 | 15332E3 | - | - | 45332E3 |
| | 4700 | 18 x 38 | 04 | 1670 | 455 | 150 | 0.34 | 0.105 | 0.10 | 15472E3 | - | - | 45472E3 |
| 6800 | 21 x 38 | 05 | 1790 | 657 | 220 | 0.38 | 0.088 | 0.10 | 15682E3 | - | - | 45682E3 | |
| 25 | 100 | 6.5 x 18 | 4 | 102 | 20 | 9 | 0.18 | 2.860 | 2.30 | - | 26101E3 | 36101E3 | - |
| | 220 | 10 x 18 | 6 | 196 | 37 | 15 | 0.18 | 1.300 | 1.25 | - | 26221E3 | 36221E3 | - |
| | 330 | 10 x 25 | 7 | 274 | 54 | 21 | 0.18 | 0.870 | 0.82 | - | 26331E3 | 36331E3 | - |
| | 470 | 10 x 25 | 7 | 327 | 75 | 28 | 0.18 | 0.610 | 0.57 | - | 90508E3 | 90509E3 | - |
| | 470 | 10 x 30 | 00 | 490 | 75 | 28 | 0.18 | 0.610 | 0.50 | 16471E3 | 26471E3 | - | - |
| | 680 | 12.5 x 30 | 01 | 680 | 106 | 38 | 0.18 | 0.420 | 0.30 | 16681E3 | 26681E3 | - | - |
| | 1000 | 12.5 x 30 | 01 | 760 | 154 | 54 | 0.24 | 0.375 | 0.28 | 16102E3 | 26102E3 | - | - |
| | 1500 | 15 x 30 | 02 | 980 | 229 | 79 | 0.25 | 0.263 | 0.22 | 16152E3 | 26152E3 | - | 46152E3 |
| | 2200 | 18 x 30 | 03 | 1240 | 334 | 110 | 0.26 | 0.185 | 0.17 | 16222E3 | - | - | 46222E3 |
| | 3300 | 18 x 38 | 04 | 1610 | 499 | 170 | 0.26 | 0.120 | 0.11 | 16332E3 | - | - | 46332E3 |
| 4700 | 21 x 38 | 05 | 1710 | 709 | 240 | 0.28 | 0.095 | 0.10 | 16472E3 | - | - | 46472E3 | |
| 40 | 47 | 6.5 x 18 | 4 | 89.8 | 20 | 7.8 | 0.11 | 3.720 | 2.80 | - | 27479E3 | 37479E3 | - |
| | 100 | 8 x 18 | 5 | 147 | 28 | 12 | 0.11 | 1.750 | 1.30 | - | 27101E3 | 37101E3 | - |
| | 150 | 10 x 18 | 6 | 207 | 40 | 16 | 0.11 | 1.170 | 1.00 | - | 27151E3 | 37151E3 | - |
| | 220 | 10 x 25 | 7 | 287 | 57 | 22 | 0.11 | 0.800 | 0.68 | - | 90511E3 | 90512E3 | - |
| | 220 | 10 x 30 | 00 | 390 | 57 | 22 | 0.10 | 0.700 | 0.55 | 17221E3 | 27221E3 | - | - |
| | 330 | 12.5 x 30 | 01 | 570 | 83 | 30 | 0.10 | 0.430 | 0.33 | 17331E3 | 27331E3 | - | - |
| | 470 | 12.5 x 30 | 01 | 620 | 117 | 42 | 0.11 | 0.380 | 0.30 | 17471E3 | 27471E3 | - | - |
| | 680 | 15 x 30 | 02 | 810 | 167 | 58 | 0.11 | 0.255 | 0.23 | 17681E3 | 27681E3 | - | 47681E3 |
| | 1000 | 18 x 30 | 03 | 1070 | 244 | 84 | 0.13 | 0.205 | 0.18 | 17102E3 | - | - | 47102E3 |
| | 1500 | 18 x 38 | 04 | 1390 | 364 | 120 | 0.13 | 0.130 | 0.11 | 17152E3 | - | - | 47152E3 |
| | 2200 | 21 x 38 | 05 | 1540 | 532 | 180 | 0.15 | 0.105 | 0.10 | 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 MAL2118..... | | | |
| | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | TAPED IN BOX FORM BA | MOUNTING RING FORM MR |
| 63 | 1.0 | 6.5 x 18 | 4 | 16.4 | 20 | 4.1 | 0.07 | 110 | 22.0 | - | 28108E3 | 38108E3 | - |
| | 2.2 | 6.5 x 18 | 4 | 24.3 | 20 | 4.3 | 0.07 | 51.0 | 15.0 | - | 28228E3 | 38228E3 | - |
| | 4.7 | 6.5 x 18 | 4 | 35.6 | 20 | 4.6 | 0.07 | 24.0 | 8.90 | - | 28478E3 | 38478E3 | - |
| | 10 | 6.5 x 18 | 4 | 51.9 | 20 | 5.3 | 0.07 | 11.0 | 5.60 | - | 28109E3 | 38109E3 | - |
| | 22 | 6.5 x 18 | 4 | 77.0 | 20 | 6.8 | 0.07 | 5.10 | 3.20 | - | 28229E3 | 38229E3 | - |
| | 47 | 8 x 18 | 5 | 126 | 22 | 9.9 | 0.07 | 2.40 | 1.50 | - | 28479E3 | 38479E3 | - |
| | 100 | 10 x 25 | 7 | 243 | 42 | 17 | 0.07 | 1.10 | 0.70 | - | 90513E3 | 90514E3 | - |
| | 100 | 10 x 30 | 00 | 340 | 42 | 17 | 0.07 | 1.91 | 1.62 | 18101E3 | 28101E3 | - | - |
| | 150 | 12.5 x 30 | 01 | 490 | 61 | 23 | 0.07 | 1.00 | 0.79 | 18151E3 | 28151E3 | - | - |
| | 220 | 12.5 x 30 | 01 | 550 | 87 | 32 | 0.08 | 0.94 | 0.82 | 18221E3 | 28221E3 | - | - |
| | 330 | 15 x 30 | 02 | 730 | 129 | 46 | 0.09 | 0.63 | 0.56 | 18331E3 | 28331E3 | - | 48331E3 |
| | 470 | 18 x 30 | 03 | 970 | 182 | 63 | 0.09 | 0.44 | 0.39 | 18471E3 | - | - | 48471E3 |
| | 680 | 18 x 38 | 04 | 1230 | 261 | 90 | 0.09 | 0.30 | 0.26 | 18681E3 | - | - | 48681E3 |
| 1000 | 21 x 38 | 05 | 1400 | 383 | 130 | 0.10 | 0.16 | 0.20 | 18102E3 | - | - | 48102E3 | |
| 100 | 4.7 | 6.5 x 18 | 4 | 36 | 20 | 4.9 | 0.07 | 24.0 | 19.0 | - | 29478E3 | 39478E3 | - |
| | 10 | 6.5 x 18 | 4 | 52 | 20 | 6.0 | 0.07 | 11.0 | 9.00 | - | 29109E3 | 39109E3 | - |
| | 22 | 8 x 18 | 5 | 91 | 20 | 8.4 | 0.07 | 5.10 | 4.00 | - | 29229E3 | 39229E3 | - |
| | 33 | 10 x 25 | 7 | 140 | 24 | 11 | 0.07 | 3.40 | 2.70 | - | 29339E3 | 39339E3 | - |
| | 47 | 10 x 25 | 7 | 170 | 33 | 13 | 0.07 | 2.60 | 2.00 | - | 90535E3 | 90536E3 | - |
| | 47 | 10 x 30 | 00 | 240 | 33 | 13 | 0.08 | 2.60 | 2.00 | 19479E3 | 29479E3 | - | - |
| | 68 | 12.5 x 30 | 01 | 320 | 45 | 18 | 0.08 | 1.80 | 1.20 | 19689E3 | 29689E3 | - | - |
| | 100 | 12.5 x 30 | 01 | 380 | 64 | 24 | 0.09 | 1.40 | 1.15 | 19101E3 | 29101E3 | - | - |
| | 150 | 15 x 30 | 02 | 500 | 94 | 34 | 0.10 | 0.94 | 0.78 | 19151E3 | 29151E3 | - | 49151E3 |
| | 220 | 18 x 30 | 03 | 690 | 136 | 48 | 0.10 | 0.66 | 0.55 | 19221E3 | - | - | 49221E3 |
| | 330 | 18 x 38 | 04 | 890 | 202 | 70 | 0.10 | 0.45 | 0.37 | 19331E3 | - | - | 49331E3 |
| 470 | 21 x 38 | 05 | 1050 | 286 | 98 | 0.10 | 0.33 | 0.28 | 19471E3 | - | - | 49471E3 | |
| 200 | 2.2 | 6.5 x 18 | 4 | 27 | 20 | 4.9 | 0.06 | 44.0 | 23.0 | - | 90537E3 | 90538E3 | - |
| | 4.7 | 8 x 18 | 5 | 46 | 20 | 5.9 | 0.06 | 21.0 | 11.0 | - | 90539E3 | 90541E3 | - |
| | 10 | 10 x 25 | 7 | 85 | 20 | 8.0 | 0.06 | 9.40 | 5.00 | - | 90542E3 | 90543E3 | - |
| | 15 | 10 x 30 | 00 | 150 | 22 | 10 | 0.046 | 4.76 | 3.75 | 92159E3 | 90012E3 | - | - |
| | 22 | 12.5 x 30 | 01 | 210 | 31 | 13 | 0.046 | 3.17 | 2.22 | 92229E3 | 90013E3 | - | - |
| | 33 | 15 x 30 | 02 | 290 | 44 | 17 | 0.046 | 2.11 | 1.11 | 92339E3 | 90014E3 | - | 90002E3 |
| | 47 | 18 x 30 | 03 | 390 | 61 | 23 | 0.046 | 1.48 | 0.60 | 92479E3 | - | - | 90003E3 |
| | 68 | 18 x 38 | 04 | 500 | 86 | 31 | 0.046 | 1.02 | 0.42 | 92689E3 | - | - | 90004E3 |
| 100 | 21 x 38 | 05 | 610 | 124 | 44 | 0.046 | 0.96 | 0.39 | 92101E3 | - | - | 90005E3 | |

| ADDITIONAL ELECTRICAL DATA | | | |
|------------------------------------|-----------------------------------|---|---------------|
| PARAMETER | CONDITIONS | VALUE | |
| | | AXIAL | MOUNTING RING |
| Voltage | | | |
| Surge voltage | | $U_S \leq 1.15 \times U_R$ | |
| Reverse voltage | | $U_{rev} \leq 1 \text{ V}$ | |
| Current | | | |
| Leakage current | After 1 min at U_R | $I_{L1} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$ or $20 \mu\text{A}$ (whichever is greater) | |
| | After 5 min at U_R | $I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$ | |
| Inductance | | | |
| Equivalent series inductance (ESL) | Case $\varnothing D \times L$ 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 3

| UPRATING VALUES AT REDUCED AMBIENT TEMPERATURE | | | | | | | | | | |
|--|---|--------|----|----|----|----|-----|-----|-----|------|
| SYMBOL | CONDITIONS | VALUES | | | | | | | | UNIT |
| U_R | $T_{amb} > 85 \text{ }^\circ\text{C}$ to $125 \text{ }^\circ\text{C}$ | 6.3 | 10 | 16 | 25 | 40 | 63 | 100 | 200 | V |
| U_{R2} | $T_{amb} \leq 85 \text{ }^\circ\text{C}$ | 10 | 16 | 25 | 40 | 63 | 100 | 125 | 250 | V |

Note

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

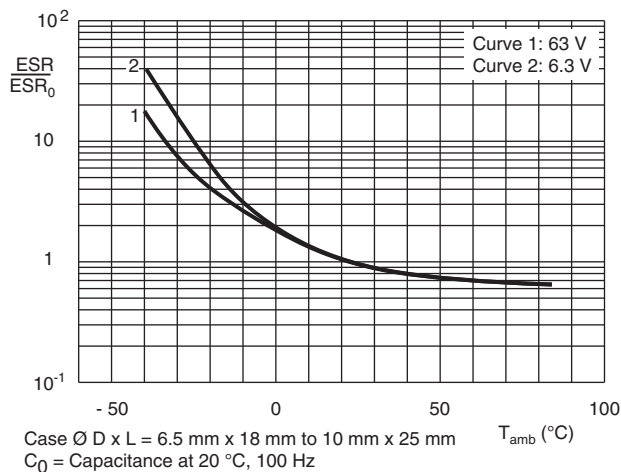
CAPACITANCE


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

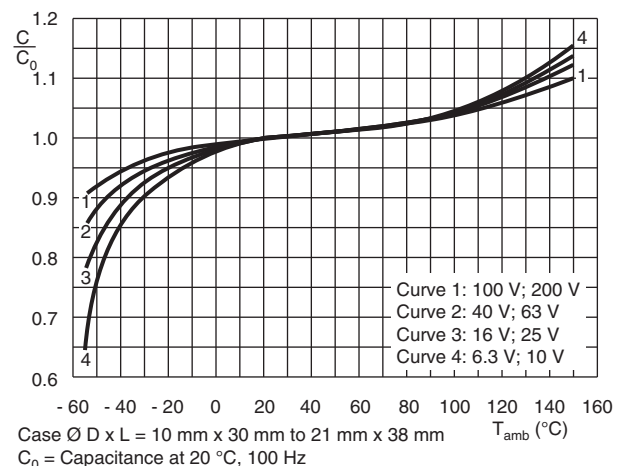


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature



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



Fig. 8 - Typical multiplier of capacitance as a function of frequency

EQUIVALENT SERIES RESISTANCE (ESR)



Fig. 9 - Typical multiplier of ESR as a function of ambient temperature

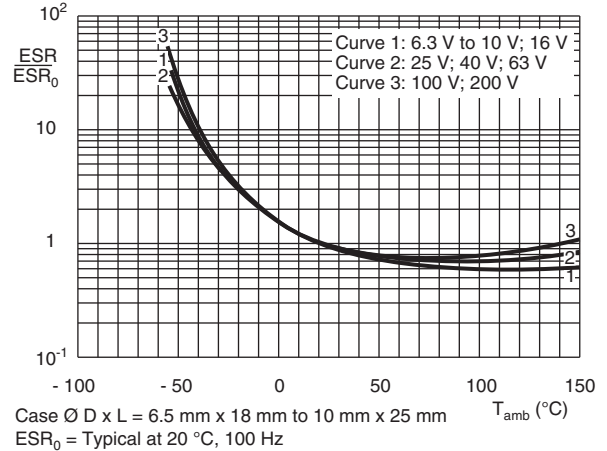


Fig. 10 - Typical multiplier of ESR as a function of ambient temperature



Fig. 11 - Typical multiplier of ESR as a function of frequency



Fig. 12 - Typical multiplier of ESR 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



Fig. 17 - Typical impedance as a function of frequency



Fig. 18 - Typical impedance as a function of frequency

RIPPLE CURRENT AND USEFUL LIFE

MBC242



Fig. 19 - 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) | I_R MULTIPLIER | | |
| | $U_R = 6.3 \text{ V TO } 25 \text{ V}$ | $U_R = 40 \text{ V TO } 63 \text{ V}$ | $U_R = 100 \text{ V TO } 200 \text{ V}$ |
| 50 | 0.95 | 0.90 | 0.85 |
| 100 | 1.00 | 1.00 | 1.00 |
| 300 | 1.07 | 1.12 | 1.20 |
| 1000 | 1.12 | 1.20 | 1.30 |
| 3000 | 1.15 | 1.25 | 1.35 |
| $\geq 10\ 000$ | 1.20 | 1.30 | 1.40 |

Table 5

| TEST PROCEDURES AND REQUIREMENTS | | | |
|--|--|---|---|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4/ EN130300 subclause 4.13 | $T_{amb} = 125\text{ °C}$; U_R applied; Case sizes: 6.5 mm x 18 mm to 10 mm x 25 mm: 2000 h; 10 mm x 30 mm to 21 mm x 38 mm: 3000 h | $U_R \leq 6.3\text{ V}$; $\Delta C/C$: + 15 %/- 30 % $U_R > 6.3\text{ V}$; $\Delta C/C$: $\pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 125\text{ °C}$; U_R and I_R applied; Case $\emptyset D \times L = 6.5\text{ mm} \times 18\text{ mm}$ to $10\text{ mm} \times 25\text{ mm}$: 4000 h Case $\emptyset D \times L = 10\text{ mm} \times 30\text{ mm}$ to $21\text{ mm} \times 38\text{ mm}$: 8000 h | $U_R \leq 6.3\text{ V}$; $\Delta C/C$: + 45 %/- 50 % $U_R > 6.3\text{ V}$; $\Delta C/C$: $\pm 45\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$ (200 V $\leq 3\%$) |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN130300 subclause 4.17 | $T_{amb} = 125\text{ °C}$; no voltage applied; $U_R = 6.3\text{ V}$ to 63 V : 500 h; $U_R = 100\text{ V}$ and 200 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/ EN130300 subclause 4.15 | $T_{amb} = 125\text{ °C}$: 125 h at $U = -1\text{ V}$ followed by 125 h at U_R | $\Delta C/C$: $\pm 20\%$ $\tan \delta \leq \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |



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