# Aluminum Capacitors
# Axial High Temperature

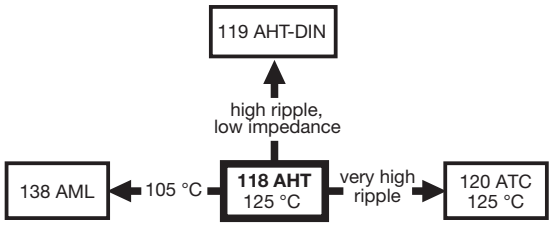



Fig. 1

| 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, $C_R$ | 1 µF to 10 000 µF | |
| 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<br>$U_R$ = 100 V and 200 V | 500 h<br>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 Ø 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

Pb-free
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 µF)
- 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)

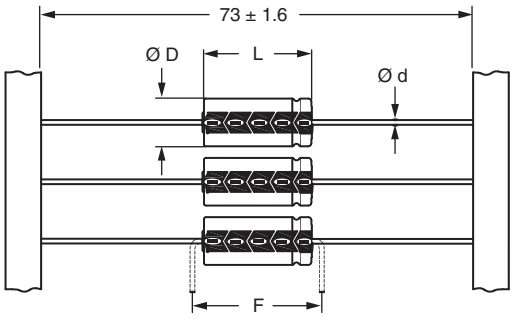


For technical questions, contact: aluminumcaps1@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| SELECTION CHART FOR $C_R$, $U_R$, AND RELEVANT NOMINAL CASE SIZES (Ø D x 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 | - | - | - | - | - | - |

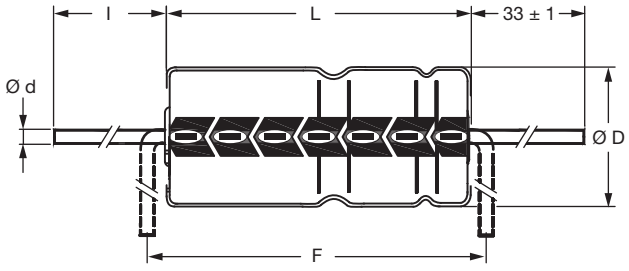
## DIMENSIONS in millimeters AND AVAILABLE FORMS




**Form BR:** Taped on reel
Case Ø D x L = 6.5 mm x 18 mm to 15 mm x 30 mm

**Form BA:** Taped in box (ammopack)
Case Ø D x L = 6.5 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**



For technical questions, contact: aluminumcaps1@vishay.com

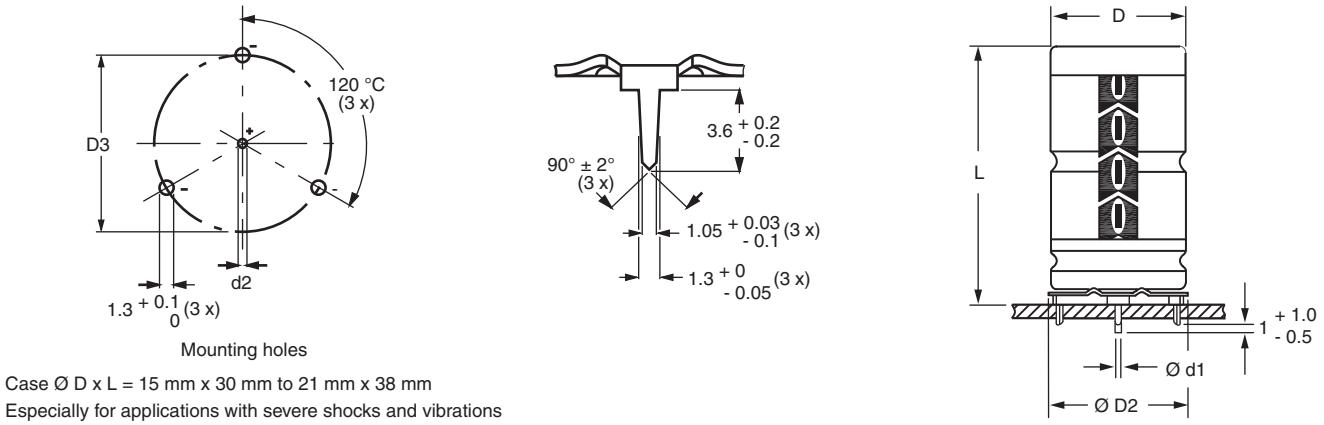
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

**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”.




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 $\delta_{max.}$ 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



For technical questions, contact: aluminumcaps1@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

**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 |


For technical questions, contact: aluminumcaps1@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## 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 |


For technical questions, contact: aluminumcaps1@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| ADDITIONAL ELECTRICAL DATA | | | |
|---|---|---|---|
| PARAMETER | CONDITIONS | VALUE | |
| | | AXIAL | MOUNTING RING |
| **Voltage** | | | |
| Surge voltage | | $U_s \leq 1.15 \times U_R$ | |
| Reverse voltage | | $U_{rev} \leq 1$ V | |
| **Current** | | | |
| Leakage current | After 1 min at $U_R$ | $I_{L1} \leq 0.006\ C_R \times U_R + 4\ \mu A$ or 20 µA (whichever is greater) | |
| | After 5 min at $U_R$ | $I_{L5} \leq 0.002\ C_R \times U_R + 4\ \mu A$ | |
| **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 |

**Table 3**

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

**Note**

- For applications at ambient temperatures of ≤ 85 °C, the rated voltage ($U_R$) may be raised to $U_{R2}$.

## CAPACITANCE

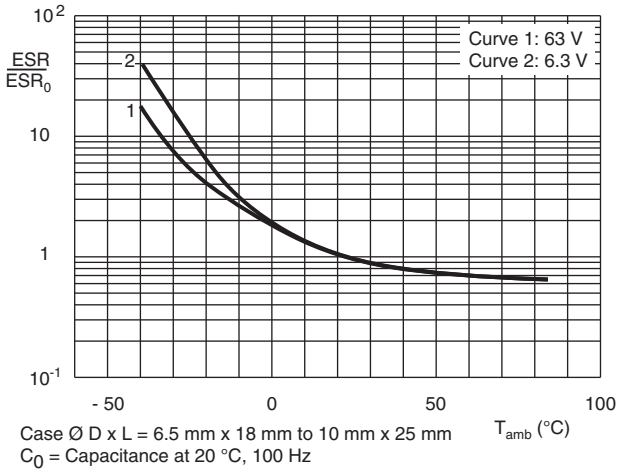



Fig. 5 - Typical multiplier of capacitance as a function of ambient temperature

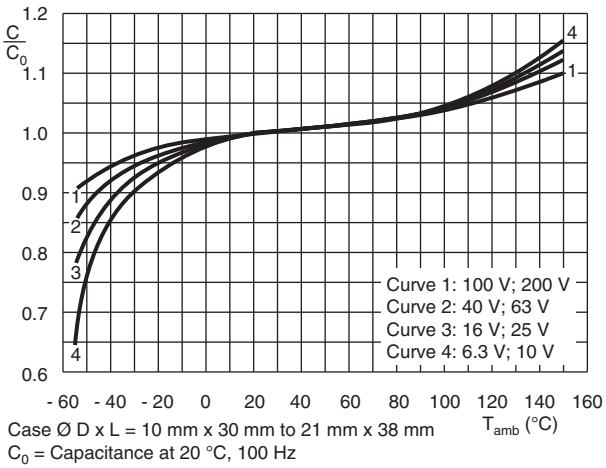
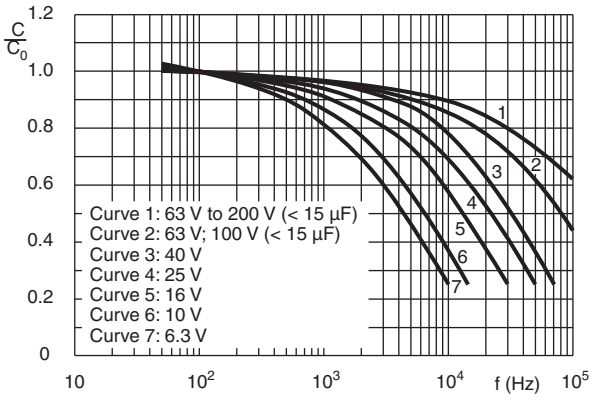


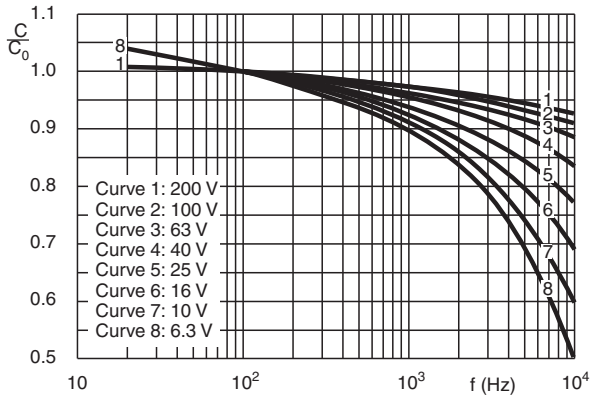

Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature


For technical questions, contact: aluminumcaps1@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000




Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm
$C_0$ = Capacitance at 20 °C, 100 Hz

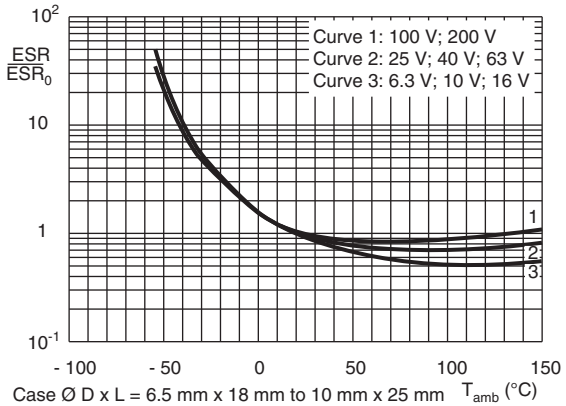
Fig. 7 - Typical multiplier of capacitance as a function of frequency




Case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm
$C_0$ = Capacitance at 20 °C, 100 Hz

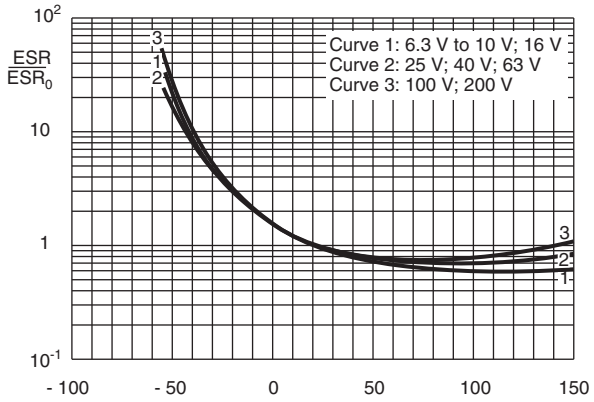
Fig. 8 - Typical multiplier of capacitance as a function of frequency

## EQUIVALENT SERIES RESISTANCE (ESR)



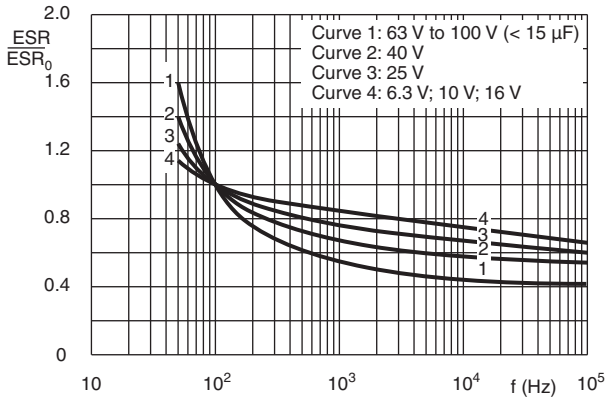

Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm
$ESR_0$ = Typical at 20 °C, 100 Hz

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



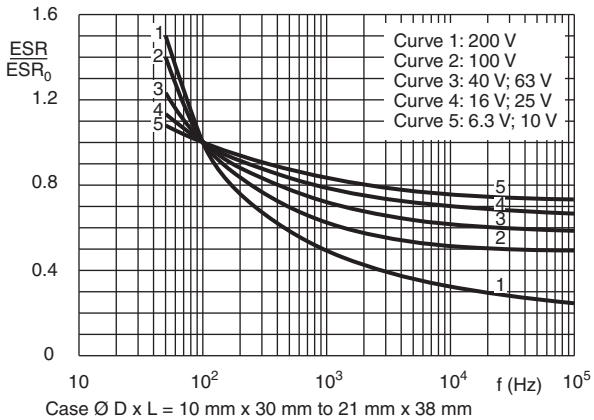

Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm
$ESR_0$ = Typical at 20 °C, 100 Hz

Fig. 10 - 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
$ESR_0$ = Typical at 20 °C, 100 Hz

Fig. 11 - 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
$ESR_0$ = Typical at 20 °C, 100 Hz

Fig. 12 - Typical multiplier of ESR as a function of frequency



For technical questions, contact: aluminumcaps1@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## IMPEDANCE (Z)

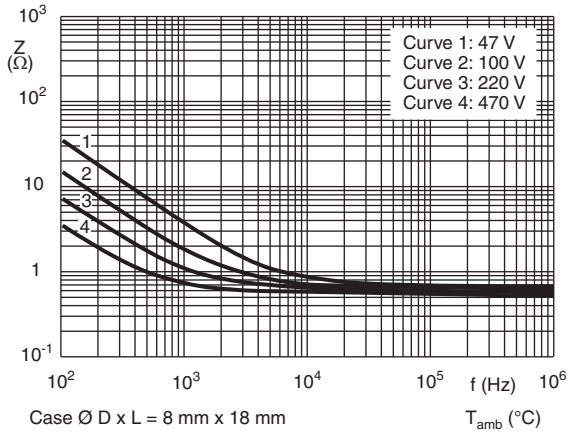



Fig. 13 - Typical impedance as a function of frequency

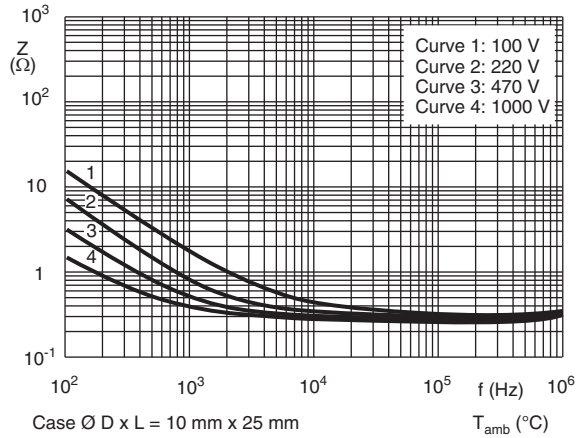



Fig. 14 - Typical impedance as a function of frequency

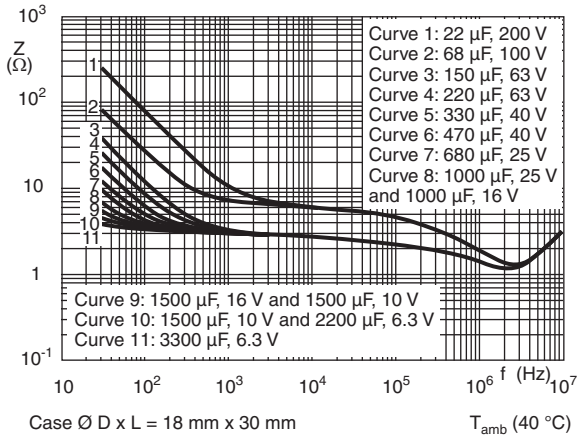



Fig. 15 - Typical impedance as a function of frequency

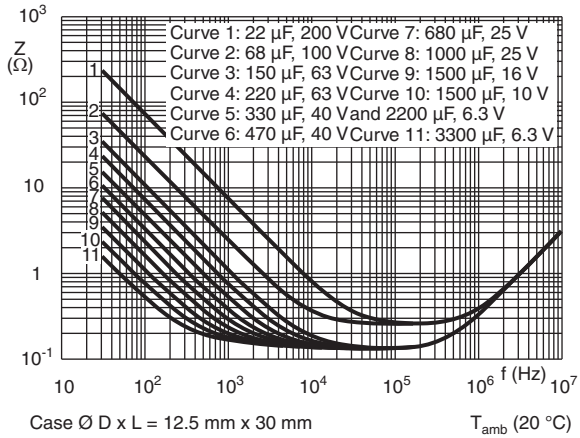



Fig. 16 - Typical impedance as a function of frequency

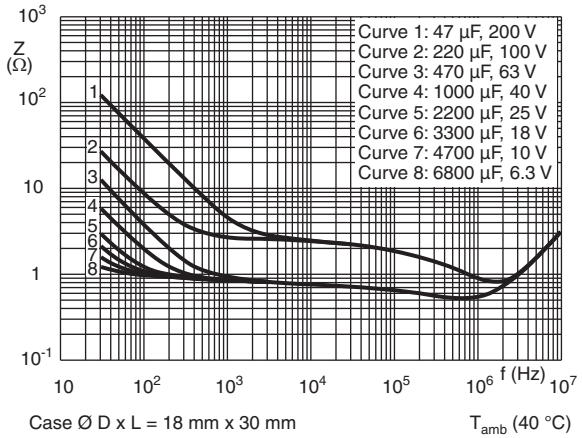



Fig. 17 - Typical impedance as a function of frequency

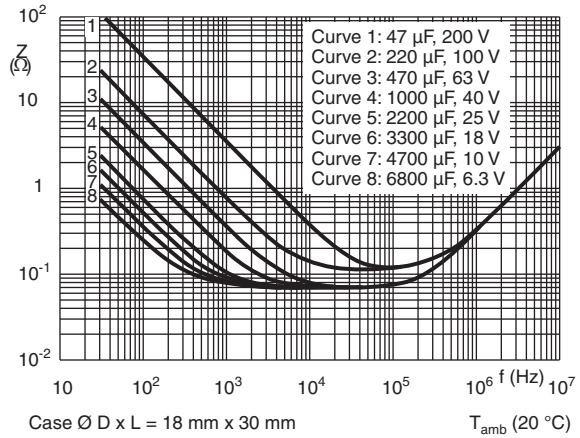


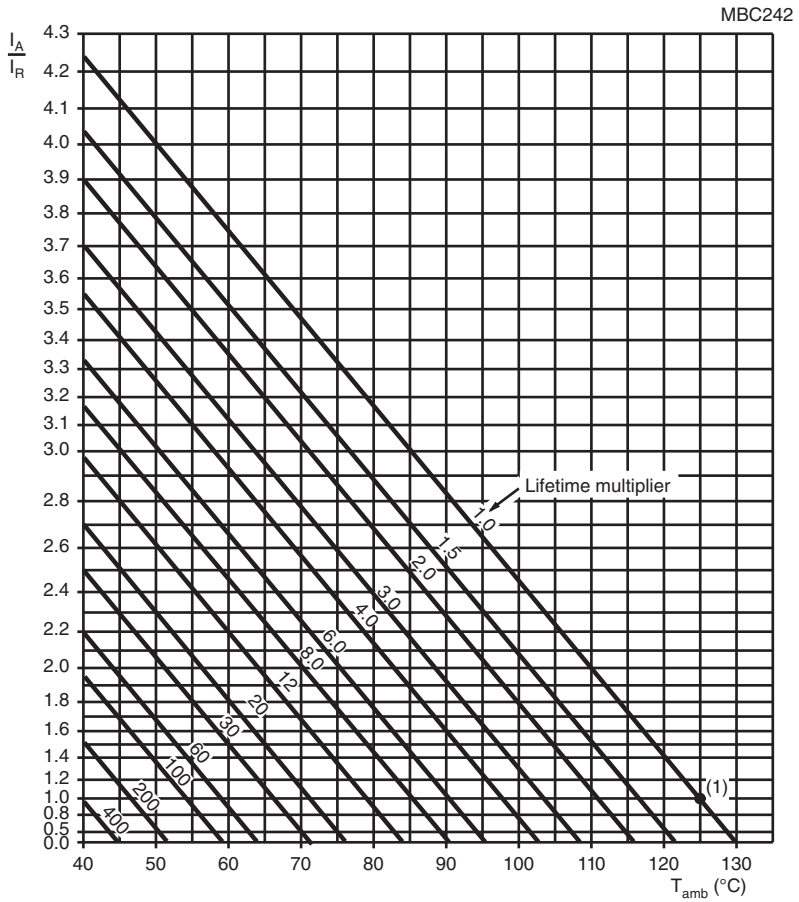

Fig. 18 - Typical impedance as a function of frequency



For technical questions, contact: aluminumcaps1@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## RIPPLE CURRENT AND USEFUL LIFE




$I_A$ = Actual ripple current at 100 Hz
$I_R$ = Rated ripple current at 100 Hz, 125 °C
(1) Useful life at 125 °C and $I_R$ applied:
Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm: 4000 h
Case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm: 8000 h

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 V TO 25 V | $U_R$ = 40 V TO 63 V | $U_R$ = 100 V TO 200 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 |
| ≥ 10 000 | 1.20 | 1.30 | 1.40 |



For technical questions, contact: aluminumcaps1@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

**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 °C; $U_R$ applied;<br>Case sizes:<br>6.5 mm x 18 mm to 10 mm x 25 mm: 2000 h;<br>10 mm x 30 mm to 21 mm x 38 mm: 3000 h | $U_R \leq$ 6.3 V; ΔC/C: + 15 %/- 30 %<br>$U_R >$ 6.3 V; ΔC/C: ± 15 %<br>tan δ ≤ 1.3 x spec. limit<br>Z ≤ 2 x spec. limit<br>$I_{L5} \leq$ spec. limit |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb}$ = 125 °C; $U_R$ and $I_R$ applied;<br>Case Ø D x L = 6.5 mm x 18 mm to 10 mm x 25 mm: 4000 h<br>Case Ø D x L = 10 mm x 30 mm to 21 mm x 38 mm: 8000 h | $U_R \leq$ 6.3 V; ΔC/C: + 45 %/- 50 %<br>$U_R >$ 6.3 V; ΔC/C: ± 45 %<br>tan δ ≤ 3 x spec. limit<br>Z ≤ 3 x spec. limit<br>$I_{L5} \leq$ spec. limit<br>no short or open circuit<br>total failure percentage: ≤ 1 %<br>(200 V ≤ 3 %) |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN130300 subclause 4.17 | $T_{amb}$ = 125 °C; no voltage applied;<br>$U_R$ = 6.3 V to 63 V: 500 h;<br>$U_R$ = 100 V and 200 V: 100 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>$I_{L5} \leq$ 2 x spec. limit |
| Reverse voltage | IEC 60384-4/ EN130300 subclause 4.15 | $T_{amb}$ = 125 °C:<br>125 h at U = - 1 V<br>followed by 125 h at $U_R$ | ΔC/C: ± 20 %<br>tan δ ≤ spec. limit<br>$I_{L5} \leq$ spec. limit |


For technical questions, contact: aluminumcaps1@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

# Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

# Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

**Данный компонент на территории Российской Федерации**

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

**Офис по работе с юридическими лицами:**

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9