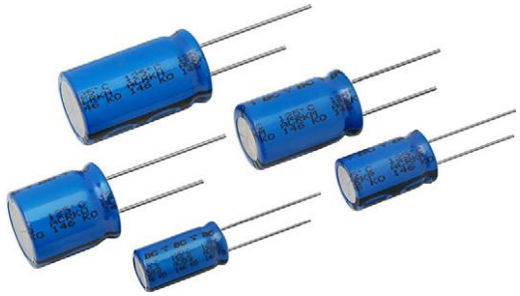
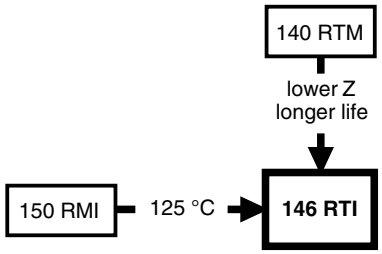
# Aluminum Electrolytic Capacitors
# Radial, High Temperature, Low Impedance






## FEATURES

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

- Very long useful life: 2500 h to 6000 h at 125 °C
- High stability, high reliability
- Very low ESR
- AEC-Q200 qualified
- Excellent ripple current capability
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case with pressure relief, insulated with a blue PET sleeve
- Charge and discharge proof
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

## APPLICATIONS

- Power supplies (SMPS, DC/DC converters) for industrial, automotive, telecommunications and military
- Smoothing, filtering and buffering

## 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)
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Logo of manufacturer
- Upper category temperature (125 °C)
- Negative terminal identification
- Series number (146)

| QUICK REFERENCE DATA | |
|---|---|
| **DESCRIPTION** | **VALUE** |
| Nominal case sizes (Ø D x L in mm) | 10 x 12 to 18 x 35 |
| Rated capacitance range, $C_R$ | 68 µF to 6800 µF |
| Tolerance on $C_R$ | ± 20 % |
| Rated voltage range, $U_R$ | 16 V to 63 V |
| Category temperature range | -55 °C to +125 °C |
| Endurance test at 125 °C | 2000 h to 5000 h |
| Useful life at 125 °C | 2500 h to 6000 h |
| Useful life at 40 °C, 1.8 x $I_R$ applied | 400 000 h |
| Shelf life at 0 V, 125 °C | 1000 h |
| Based on sectional specification | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068 | 55 / 125 / 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) | | | | |
|---|---|---|---|---|---|
| | **16** | **25** | **35** | **50** | **63** |
| 68 | - | - | - | - | 10 x 12 |
| 100 | - | - | - | 10 x 12 | 10 x 16 |
| 150 | - | - | - | - | 10 x 20 |
| 220 | - | - | 10 x 12 | 10 x 16 | 12.5 x 20 |
| 330 | - | 10 x 12 | 10 x 16 | 10 x 20 | 12.5 x 25 |
| 390 | - | - | - | - | 16 x 20 |
| 470 | 10 x 12 | 10 x 16 | 10 x 20 | 12.5 x 20 | 18 x 20 |
| 560 | - | - | - | - | 16 x 25 |
| 680 | 10 x 16 | 10 x 20 | 12.5 x 20 | 12.5 x 25 | 18 x 25 |
| | - | - | - | - | 16 x 31 |
| 820 | - | - | - | 16 x 20 | 16 x 35 |
| 1000 | 10 x 20 | 12.5 x 20 | 12.5 x 25 | 18 x 20 | 18 x 31 |
| | - | - | - | 16 x 25 | - |



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| SELECTION CHART FOR $C_R$, $U_R$, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm) | | | | | |
|---|---|---|---|---|---|
| $C_R$ (µF) | $U_R$ (V) | | | | |
| | 16 | 25 | 35 | 50 | 63 |
| 1200 | - | - | 16 x 20 | 18 x 25 | 18 x 35 |
| | - | - | - | 16 x 31 | - |
| 1500 | 12.5 x 20 | 12.5 x 25 | 18 x 20 | 16 x 35 | - |
| 1800 | - | 16 x 20 | 16 x 25 | 18 x 31 | - |
| 2200 | 12.5 x 25 | - | 18 x 25 | 18 x 35 | - |
| | - | - | 16 x 31 | - | - |
| 2700 | 16 x 20 | 18 x 20 | 16 x 35 | - | - |
| | - | 16 x 25 | 18 x 31 | - | - |
| 3300 | 18 x 20 | 16 x 31 | 18 x 35 | - | - |
| 3900 | 16 x 25 | 18 x 25 | - | - | - |
| 4700 | 18 x 25 | 16 x 35 | - | - | - |
| | 16 x 31 | 18 x 31 | - | - | - |
| 5600 | 16 x 35 | 18 x 35 | - | - | - |
| 6800 | 18 x 31 | - | - | - | - |

## DIMENSIONS in millimeters AND AVAILABLE FORMS

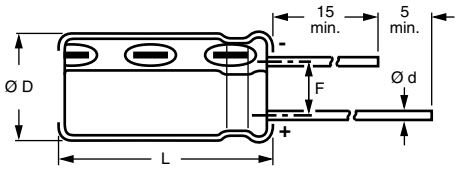



Fig. 2 - **Form CA**: Long leads

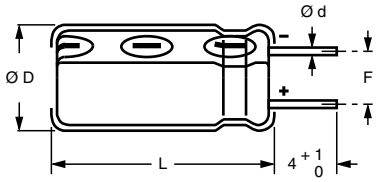



Fig. 3 - **Form CB:** Cut leads

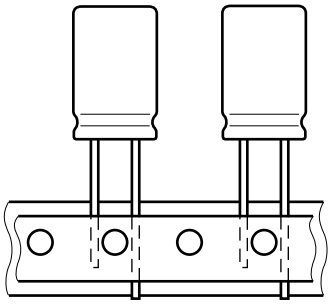


Fig. 4 - **Form TFA**: Taped in box (ammopack)

**Table 1**

| DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NOMINAL CASE SIZE Ø D x L | CASE CODE | Ø d | Ø $D_{max.}$ | $L_{max.}$ | F | MASS (g) | PACKAGING QUANTITIES | | |
| | | | | | | | FORM CA | FORM CB | FORM TFA |
| 10 x 12 | 14 | 0.6 | 10.5 | 13.5 | 5.0 ± 0.5 | ≈ 1.6 | 1000 | 500 | 800 |
| 10 x 16 | 15 | 0.6 | 10.5 | 17.5 | 5.0 ± 0.5 | ≈ 1.9 | 500 | 500 | 800 |
| 10 x 20 | 16 | 0.6 | 10.5 | 22.0 | 5.0 ± 0.5 | ≈ 2.2 | 500 | 500 | 800 |
| 12.5 x 20 | 17 | 0.6 | 13.0 | 22.0 | 5.0 ± 0.5 | ≈ 4.0 | 500 | 500 | 500 |
| 12.5 x 25 | 18 | 0.6 | 13.0 | 27.0 | 5.0 ± 0.5 | ≈ 5.0 | 250 | 250 | 500 |
| 16 x 20 | 19a | 0.8 | 16.5 | 22.0 | 7.5 ± 0.5 | ≈ 6.0 | 250 | 250 | 250 |
| 16 x 25 | 19 | 0.8 | 16.5 | 27.0 | 7.5 ± 0.5 | ≈ 8.0 | 250 | 250 | 250 |
| 16 x 31 | 20 | 0.8 | 16.5 | 33.5 | 7.5 ± 0.5 | ≈ 9.0 | 100 | 100 | 250 |
| 16 x 35 | 21 | 0.8 | 16.5 | 37.5 | 7.5 ± 0.5 | ≈ 11.0 | 100 | 100 | - |
| 18 x 20 | 1820 | 0.8 | 18.5 | 22.0 | 7.5 ± 0.5 | ≈ 8.0 | 100 | 100 | 250 |
| 18 x 25 | 1825 | 0.8 | 18.5 | 27.0 | 7.5 ± 0.5 | ≈ 10.0 | 100 | 100 | 250 |
| 18 x 31 | 1831 | 0.8 | 18.5 | 33.5 | 7.5 ± 0.5 | ≈ 12.5 | 100 | 100 | 250 |
| 18 x 35 | 22 | 0.8 | 18.5 | 37.5 | 7.5 ± 0.5 | ≈ 14.5 | 100 | 100 | - |



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| ELECTRICAL DATA | |
|---|---|
| SYMBOL | DESCRIPTION |
| $C_R$ | Rated capacitance at 100 Hz, tolerance ± 20 % |
| $I_R$ | Rated RMS ripple current at 100 kHz, 125 °C |
| $I_{L2}$ | Max. leakage current after 2 min at $U_R$ |
| tan δ | Max. dissipation factor at 100 Hz |
| Z | Max. impedance at 100 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 146 RTI series

470 µF / 25 V; ± 20 %

Nominal case size: Ø 10 mm x 16 mm; Form TFA

Ordering code: MAL214636471E3

**Table 2**

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $U_R$ (V) | $C_R$ 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | $I_R$ 100 kHz 125 °C (mA) | $I_{L2}$ 2 min (µA) | tan δ 100 Hz | Z 100 kHz +20 °C (Ω) | Z 100 kHz -40 °C (Ω) | ORDERING CODE MAL2146..... | | |
| | | | | | | | | BULK PACKAGING | | TAPED |
| | | | | | | | | FORM CA | FORM CB | FORM TFA |
| 16 | 470 | 10 x 12 | 620 | 78 | 0.16 | 0.120 | 0.750 | 55471E3 | 65471E3 | 35471E3 |
| | 680 | 10 x 16 | 1100 | 112 | 0.16 | 0.075 | 0.450 | 55681E3 | 65681E3 | 35681E3 |
| | 1000 | 10 x 20 | 1250 | 163 | 0.16 | 0.060 | 0.360 | 55102E3 | 65102E3 | 35102E3 |
| | 1500 | 12.5 x 20 | 1600 | 243 | 0.16 | 0.043 | 0.258 | 55152E3 | 65152E3 | 35152E3 |
| | 2200 | 12.5 x 25 | 2000 | 355 | 0.18 | 0.033 | 0.198 | 55222E3 | 65222E3 | 35222E3 |
| | 2700 | 16 x 20 | 1900 | 435 | 0.18 | 0.034 | 0.204 | 55272E3 | 65272E3 | 35272E3 |
| | 3300 | 18 x 20 | 2000 | 531 | 0.20 | 0.033 | 0.198 | 55332E3 | 65332E3 | 35332E3 |
| | 3900 | 16 x 25 | 2500 | 627 | 0.20 | 0.024 | 0.144 | 55392E3 | 65392E3 | 35392E3 |
| | 4700 | 18 x 25 | 2800 | 755 | 0.22 | 0.025 | 0.150 | 55472E3 | 65472E3 | 35472E3 |
| | 4700 | 16 x 31 | 3000 | 755 | 0.22 | 0.021 | 0.126 | 95475E3 | 95476E3 | 95473E3 |
| | 5600 | 16 x 35 | 3200 | 899 | 0.24 | 0.018 | 0.108 | 55562E3 | 65562E3 | - |
| | 6800 | 18 x 31 | 3100 | 1091 | 0.24 | 0.022 | 0.132 | 55682E3 | 65682E3 | 35682E3 |
| 25 | 330 | 10 x 12 | 620 | 85 | 0.14 | 0.120 | 0.750 | 56331E3 | 66331E3 | 36331E3 |
| | 470 | 10 x 16 | 1100 | 121 | 0.14 | 0.075 | 0.450 | 56471E3 | 66471E3 | 36471E3 |
| | 680 | 10 x 20 | 1250 | 173 | 0.14 | 0.060 | 0.360 | 56681E3 | 66681E3 | 36681E3 |
| | 1000 | 12.5 x 20 | 1600 | 253 | 0.14 | 0.043 | 0.258 | 56102E3 | 66102E3 | 36102E3 |
| | 1500 | 12.5 x 25 | 2000 | 378 | 0.14 | 0.033 | 0.198 | 56152E3 | 66152E3 | 36152E3 |
| | 1800 | 16 x 20 | 1900 | 453 | 0.14 | 0.034 | 0.204 | 56182E3 | 66182E3 | 36182E3 |
| | 2700 | 18 x 20 | 2000 | 678 | 0.16 | 0.033 | 0.198 | 56272E3 | 66272E3 | 36272E3 |
| | 2700 | 16 x 25 | 2500 | 678 | 0.16 | 0.024 | 0.144 | 96275E3 | 96276E3 | 96273E3 |
| | 3300 | 16 x 31 | 3000 | 828 | 0.18 | 0.021 | 0.126 | 56332E3 | 66332E3 | 36332E3 |
| | 3900 | 18 x 25 | 2800 | 978 | 0.18 | 0.025 | 0.150 | 56392E3 | 66392E3 | 36392E3 |
| | 4700 | 16 x 35 | 3200 | 1178 | 0.20 | 0.018 | 0.108 | 56472E3 | 66472E3 | - |
| | 4700 | 18 x 31 | 3100 | 1178 | 0.20 | 0.022 | 0.132 | 96475E3 | 96476E3 | 96473E3 |
| | 5600 | 18 x 35 | 3100 | 1403 | 0.22 | 0.019 | 0.114 | 56562E3 | 66562E3 | - |
| 35 | 220 | 10 x 12 | 620 | 80 | 0.12 | 0.120 | 0.750 | 50221E3 | 60221E3 | 30221E3 |
| | 330 | 10 x 16 | 1100 | 119 | 0.12 | 0.075 | 0.450 | 50331E3 | 60331E3 | 30331E3 |
| | 470 | 10 x 20 | 1250 | 168 | 0.12 | 0.060 | 0.360 | 50471E3 | 60471E3 | 30471E3 |
| | 680 | 12.5 x 20 | 1600 | 241 | 0.12 | 0.043 | 0.258 | 50681E3 | 60681E3 | 30681E3 |
| | 1000 | 12.5 x 25 | 2000 | 353 | 0.12 | 0.033 | 0.198 | 50102E3 | 60102E3 | 30102E3 |
| | 1200 | 16 x 20 | 1900 | 423 | 0.12 | 0.034 | 0.204 | 50122E3 | 60122E3 | 30122E3 |
| | 1500 | 18 x 20 | 2000 | 528 | 0.12 | 0.033 | 0.198 | 50152E3 | 60152E3 | 30152E3 |
| | 1800 | 16 x 25 | 2500 | 633 | 0.12 | 0.024 | 0.144 | 50182E3 | 60182E3 | 30182E3 |
| | 2200 | 18 x 25 | 2800 | 773 | 0.14 | 0.025 | 0.150 | 50222E3 | 60222E3 | 30222E3 |
| | 2200 | 16 x 31 | 3000 | 773 | 0.14 | 0.021 | 0.126 | 90225E3 | 90226E3 | 90223E3 |
| | 2700 | 16 x 35 | 3200 | 948 | 0.14 | 0.018 | 0.108 | 50272E3 | 60272E3 | - |
| | 2700 | 18 x 31 | 3100 | 948 | 0.14 | 0.022 | 0.132 | 90275E3 | 90276E3 | 90273E3 |
| | 3300 | 18 x 35 | 3100 | 1158 | 0.16 | 0.019 | 0.114 | 50332E3 | 60332E3 | - |


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## ELECTRICAL DATA AND ORDERING INFORMATION

| $U_R$ (V) | $C_R$ 100 Hz (µF) | NOMINAL CASE SIZE Ø D x L (mm) | $I_R$ 100 kHz 125 °C (mA) | $I_{L2}$ 2 min (µA) | tan δ 100 Hz | Z 100 kHz +20 °C (Ω) | Z 100 kHz -40 °C (Ω) | ORDERING CODE MAL2146..... | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | BULK PACKAGING | | TAPED |
| | | | | | | | | FORM CA | FORM CB | FORM TFA |
| 50 | 100 | 10 x 12 | 420 | 53 | 0.10 | 0.190 | 1.330 | 51101E3 | 61101E3 | 31101E3 |
| | 220 | 10 x 16 | 900 | 113 | 0.10 | 0.120 | 0.720 | 51221E3 | 61221E3 | 31221E3 |
| | 330 | 10 x 20 | 1000 | 168 | 0.10 | 0.090 | 0.540 | 51331E3 | 61331E3 | 31331E3 |
| | 470 | 12.5 x 20 | 1250 | 238 | 0.10 | 0.065 | 0.390 | 51471E3 | 61471E3 | 31471E3 |
| | 680 | 12.5 x 25 | 1700 | 343 | 0.10 | 0.050 | 0.300 | 51681E3 | 61681E3 | 31681E3 |
| | 820 | 16 x 20 | 1650 | 413 | 0.10 | 0.047 | 0.282 | 51821E3 | 61821E3 | 31821E3 |
| | 1000 | 18 x 20 | 1800 | 503 | 0.10 | 0.039 | 0.234 | 51102E3 | 61102E3 | 31102E3 |
| | 1000 | 16 x 25 | 2100 | 503 | 0.10 | 0.031 | 0.186 | 91105E3 | 91106E3 | 91103E3 |
| | 1200 | 18 x 25 | 2400 | 603 | 0.10 | 0.030 | 0.180 | 51122E3 | 61122E3 | 31122E3 |
| | 1200 | 16 x 31 | 2550 | 603 | 0.10 | 0.027 | 0.162 | 91125E3 | 91126E3 | 91123E3 |
| | 1500 | 16 x 35 | 2800 | 753 | 0.10 | 0.022 | 0.132 | 51152E3 | 61152E3 | - |
| | 1800 | 18 x 31 | 2700 | 903 | 0.10 | 0.026 | 0.156 | 51182E3 | 61182E3 | 31182E3 |
| | 2200 | 18 x 35 | 3000 | 1103 | 0.12 | 0.022 | 0.132 | 51222E3 | 61222E3 | - |
| 63 | 68 | 10 x 12 | 400 | 46 | 0.10 | 0.360 | 2.160 | 58689E3 | 68689E3 | 38689E3 |
| | 100 | 10 x 16 | 600 | 66 | 0.10 | 0.220 | 1.320 | 58101E3 | 68101E3 | 38101E3 |
| | 150 | 10 x 20 | 750 | 98 | 0.10 | 0.150 | 0.900 | 58151E3 | 68151E3 | 38151E3 |
| | 220 | 12.5 x 20 | 1000 | 142 | 0.10 | 0.098 | 0.950 | 58221E3 | 68221E3 | 38221E3 |
| | 330 | 12.5 x 25 | 1300 | 211 | 0.10 | 0.076 | 0.456 | 58331E3 | 68331E3 | 38331E3 |
| | 390 | 16 x 20 | 1250 | 249 | 0.10 | 0.075 | 0.450 | 58391E3 | 68391E3 | 38391E3 |
| | 470 | 18 x 20 | 1500 | 299 | 0.10 | 0.055 | 0.330 | 58471E3 | 68471E3 | 38471E3 |
| | 560 | 16 x 25 | 1800 | 356 | 0.10 | 0.048 | 0.288 | 58561E3 | 68561E3 | 38561E3 |
| | 680 | 18 x 25 | 2100 | 431 | 0.10 | 0.041 | 0.246 | 58681E3 | 68681E3 | 38681E3 |
| | 680 | 16 x 31 | 2200 | 431 | 0.10 | 0.036 | 0.216 | 98685E3 | 98686E3 | 98683E3 |
| | 820 | 16 x 35 | 2500 | 520 | 0.10 | 0.029 | 0.174 | 58821E3 | 68821E3 | - |
| | 1000 | 18 x 31 | 2400 | 633 | 0.10 | 0.032 | 0.192 | 58102E3 | 68102E3 | 38102E3 |
| | 1200 | 18 x 35 | 2600 | 759 | 0.10 | 0.029 | 0.174 | 58122E3 | 68122E3 | - |

## ADDITIONAL ELECTRICAL DATA

| PARAMETER | CONDITIONS | VALUE |
|---|---|---|
| **Voltage** | | |
| Surge voltage | | $U_s \leq 1.15 \times U_R$ |
| Reverse voltage | | $U_{rev} \leq 0.5$ V |
| **Current** | | |
| Leakage current | After 2 min at $U_R$ | $I_{L2} \leq 0.01\ C_R \times U_R + 3$ µA |
| **Inductance** | | |
| Equivalent series inductance (ESL) | Case Ø D = 10 mm | Typ. 16 nH |
| | Case Ø D ≥ 12.5 mm | Typ. 18 nH |
| **Resistance** | | |
| Equivalent series resistance (ESR) | Calculated from tan $\delta_{max.}$ and $C_R$ (see Table 2) | ESR = tan $\delta/2\ \pi\ f\ C_R$ |


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## CAPACITANCE (C)

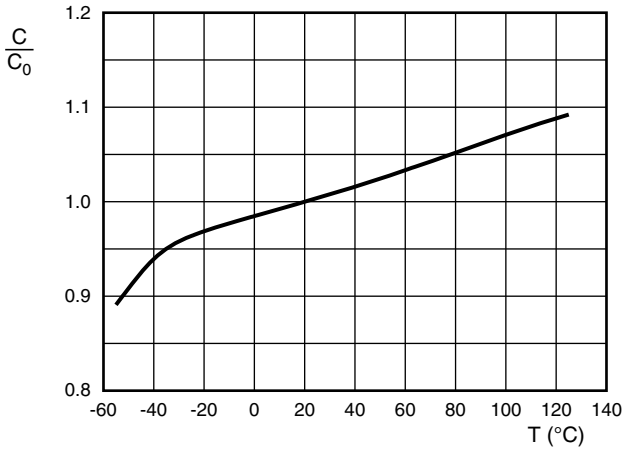



Fig. 5 - Typical multiplier of capacitance at 100 Hz as a function of temperature ($C_0$ = C at 20 °C)

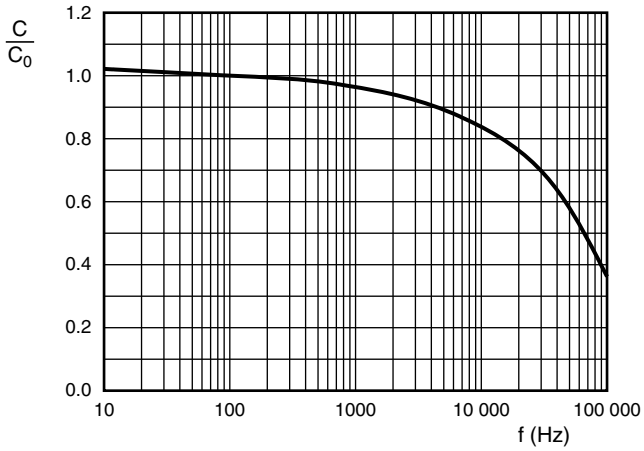



Fig. 6 - Typical multiplier of capacitance as a function of frequency at 20 °C ($C_0$ = C at 100 Hz)

## EQUIVALENT SERIES RESISTANCE (ESR)

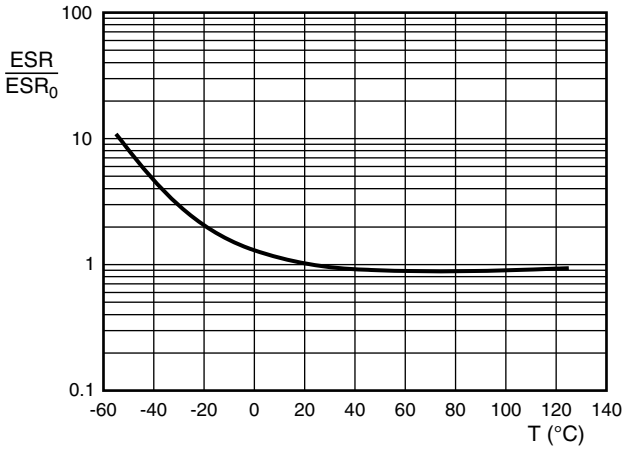



Fig. 7 - Typical multiplier of ESR at 100 Hz as a function of temperature ($ESR_0$ = ESR at 20 °C)

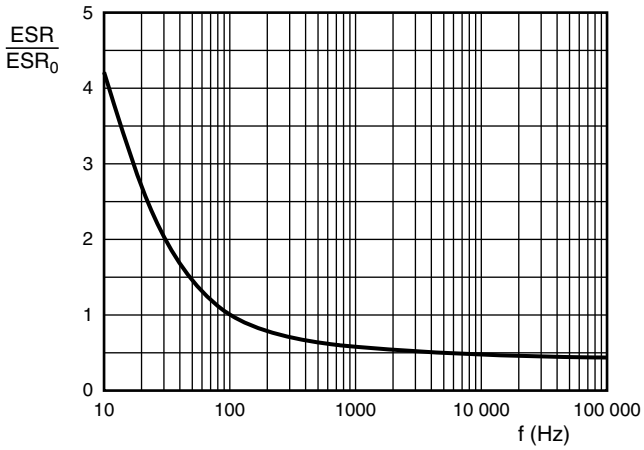



Fig. 8 - Typical multiplier of ESR at 20 °C as a function of frequency ($ESR_0$ = ESR at 100 Hz)

## IMPEDANCE (Z)

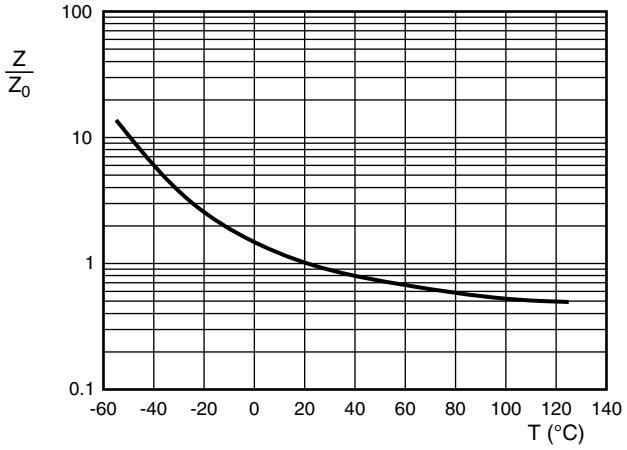



Fig. 9 - Typical multiplier of impedance at 100 kHz as a function of temperature ($Z_0$ = Z at 20 °C)

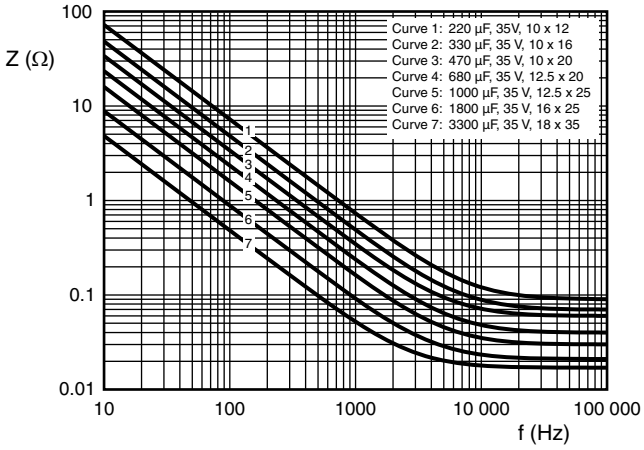



Fig. 10 - Typical impedance Z at 20 °C as a function of frequency


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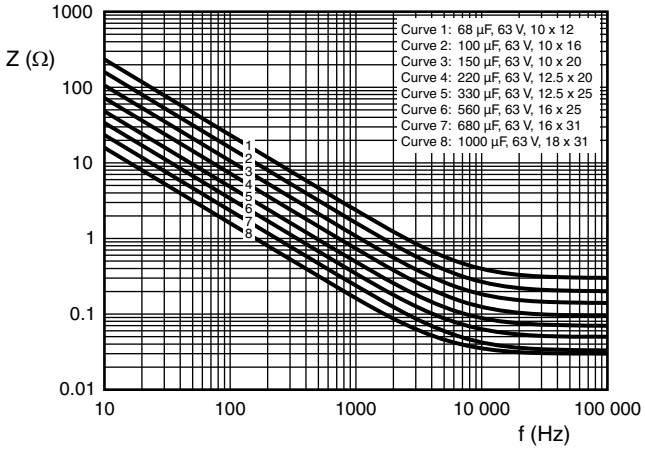



Fig. 11 - Typical impedance Z at 20 °C as a function of frequency

## RIPPLE CURRENT AND USEFUL LIFE

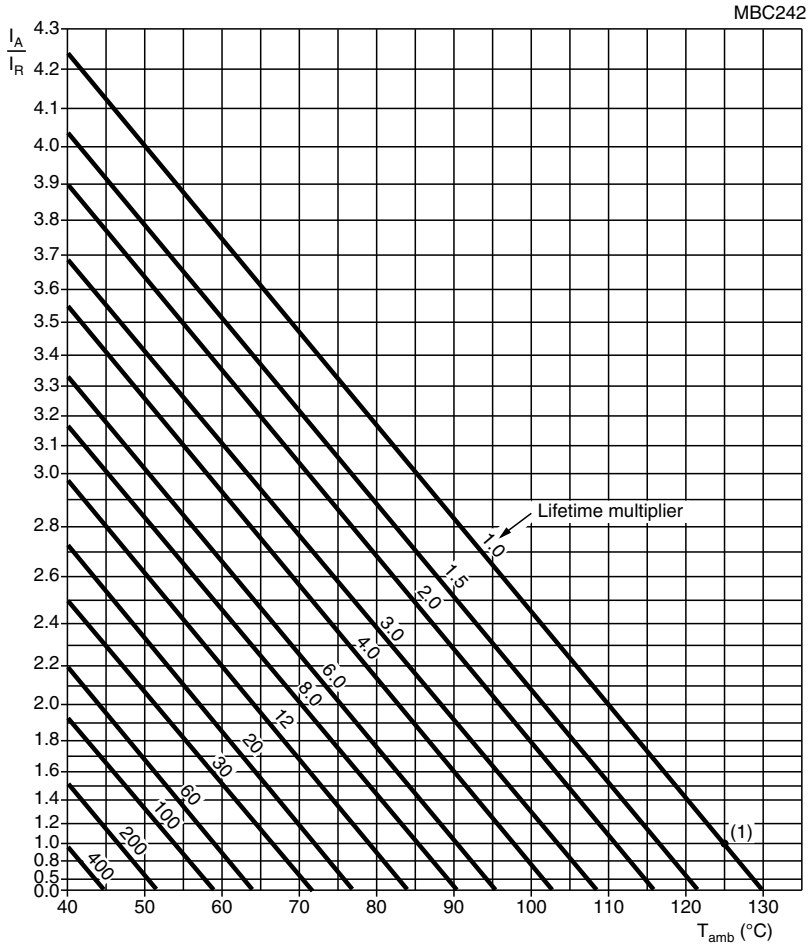
**Table 3**

| ENDURANCE TEST DURATION AND USEFUL LIFE | | | |
|---|---|---|---|
| **NOMINAL CASE SIZE Ø D x L (mm)** | **CASE CODE** | **ENDURANCE AT 125 °C (h)** | **USEFUL LIFE AT 125 °C (h)** |
| 10 x 12 | 14 | 2000 | 2500 |
| 10 x 16 | 15 | 2000 | 2500 |
| 10 x 20 | 16 | 2000 | 3000 |
| 12.5 x 20 | 17 | 2000 | 3000 |
| 12.5 x 25 | 18 | 3000 | 5000 |
| 16 x 20 | 19a | 3000 | 4000 |
| 16 x 25 | 19 | 3000 | 5000 |
| 16 x 31 | 20 | 4000 | 6000 |
| 16 x 35 | 21 | 5000 | 6000 |
| 18 x 20 | 1820 | 3000 | 4000 |
| 18 x 25 | 1825 | 3000 | 5000 |
| 18 x 31 | 1831 | 4000 | 6000 |
| 18 x 35 | 22 | 5000 | 6000 |

**Note**

- Multiplier of useful life code: MBC242


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$I_A$ = Actual ripple current at 100 kHz
$I_R$ = Rated ripple current at 100 kHz, 125 °C

(1) Useful life at 125 °C and $I_R$ applied; see Table 4

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 | | | | | | | |
|---|---|---|---|---|---|---|---|
| $U_R$ (V) | FREQUENCY (Hz) | | | | | | |
| | 50 | 100 | 300 | 1000 | 3000 | 10 000 | 100 000 |
| | $I_R$ MULTIPLIER | | | | | | |
| 16 | 0.60 | 0.70 | 0.85 | 0.90 | 0.95 | 1.00 | 1.00 |
| 25 | 0.60 | 0.70 | 0.85 | 0.90 | 0.95 | 1.00 | 1.00 |
| 35 | 0.50 | 0.65 | 0.80 | 0.85 | 0.90 | 0.95 | 1.00 |
| 50 | 0.35 | 0.50 | 0.65 | 0.80 | 0.90 | 0.90 | 1.00 |
| 63 | 0.35 | 0.50 | 0.65 | 0.80 | 0.90 | 0.90 | 1.00 |


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**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; for test duration see Table 3 | $\Delta C/C$: ± 15 %<br>tan $\delta \leq$ 1.3 x spec. limit<br>$Z \leq$ 2 x spec. limit<br>$I_{L2} \leq$ spec. limit |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb}$ = 125 °C; $U_R$ and $I_R$ applied; for test duration see Table 3 | $\Delta C/C$: ± 30 %<br>tan $\delta \leq$ 3 x spec. limit<br>$Z \leq$ 3 x spec. limit<br>$I_{L2} \leq$ spec. limit<br>no short or open circuit<br>total failure percentage: ≤ 1 % |
| Shelf life | IEC 60384-4 / EN130300 subclause 4.17 | $T_{amb}$ = 125 °C; no voltage applied; 1000 h<br>after test: $U_R$ to be applied for 30 min, 24 h o 48 h before measurement | $\Delta C/C$: ± 15 %<br>tan $\delta \leq$ 1.3 x spec. limit<br>$Z \leq$ 3 x spec. limit<br>$I_{L2} \leq$ 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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