

**120 ATC**

Vishay BCcomponents

Aluminum Capacitors

Axial High Temperature, High Ripple Current

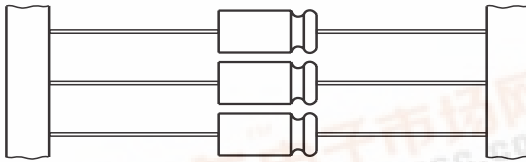
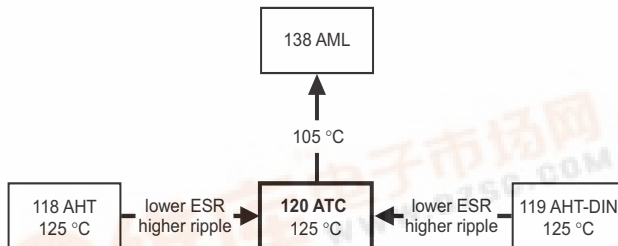


Fig.1 Component outlines

**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 $\varnothing 15 \times 30$ mm available for automatic insertion.
- Charge and discharge proof.
- Extra long useful life: up to 8000 hours at 125 °C, high reliability.
- Lowest ESR levels providing very high ripple current capability.
- Extended temperature range: usable up to 150 °C.
- Miniaturized, high CV-product per unit volume.
- Lead diameter $\varnothing d = 1.0$ mm, available on request
- Lead (Pb)-free versions are RoHS compliant.

**RoHS***
COMPLIANT**APPLICATIONS**

- Automotive, industrial and telecommunication
- Smoothing, filtering, buffering
- Low mounting height applications, vibration and shock resistant
- SMPS and standard power supplies.

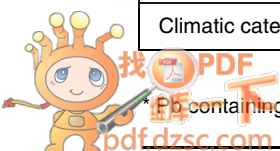
MARKING

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 $\pm 20\%$).
- Rated voltage (in V).
- Upper category temperature (125 °C).
- Date code in accordance with IEC 60062.
- Code for factory of origin.
- Name of manufacturer.
- Band to indicate the negative terminal.
- '+' sign to identify the positive terminal
- Series number (120).

QUICK REFERENCE DATA

| DESCRIPTION | VALUE |
|---|-------------------------------------|
| Nominal case sizes ($\varnothing D \times L$ in mm) | 10 \times 30 to 21 \times 38 |
| Rated capacitance range, C_R | 47 to 6800 μF |
| Tolerance on C_R | $\pm 20\%$ |
| Rated voltage range, U_R | 16 to 100 V |
| Category temperature range | -40 to +125 °C |
| Endurance test at 150 °C | 1 000 hours |
| Endurance test at 125 °C | 4 000 hours |
| Useful life at 125 °C | 8 000 hours |
| Useful life at 85 °C, $1.4 \times I_R$ applied | 40 000 hours |
| Shelf life at 0 V, 125 °C | 1 000 hours (100 V: 500 hours) |
| Shelf life at 0 V, 150 °C | ≤ 63 V: 500 hours |
| Based on sectional specification | IEC 60384-4/EN130300 |
| Climatic category IEC 60068 | 40/125/56 |



Pb-containing terminations are not RoHS compliant, exemptions may apply

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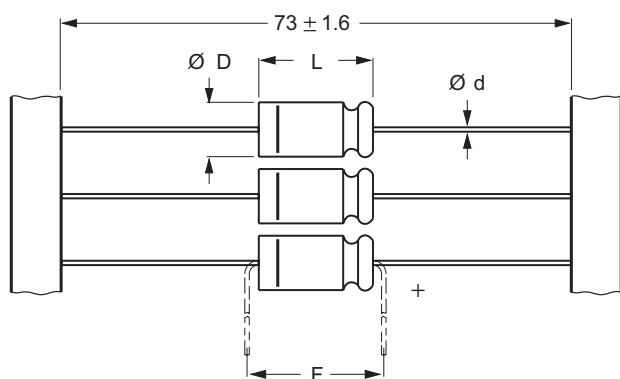
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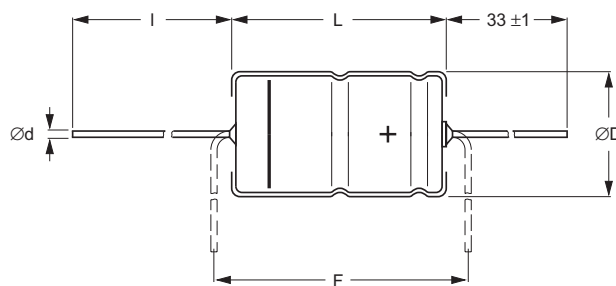
| SELECTION CHART FOR C_R , U_R AND RELEVANT NOMINAL CASE SIZE ($\varnothing D \times L$ in mm) | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|
| C_R (μF) | U_R (V) | | | | |
| | 16 | 25 | 40 | 63 | 100 |
| 47 | – | – | – | – | 10 × 30 |
| 68 | – | – | – | – | 12.5 × 30 |
| 100 | – | – | – | 10 × 30 | 12.5 × 30 |
| 150 | – | – | – | 12.5 × 30 | 15 × 30 |
| 220 | – | – | 10 × 30 | 12.5 × 30 | 18 × 30 |
| 330 | – | – | 12.5 × 30 | 15 × 30 | 18 × 38 |
| 470 | – | 10 × 30 | 12.5 × 30 | 18 × 30 | 21 × 38 |
| 680 | 10 × 30 | 12.5 × 30 | 15 × 30 | 18 × 38 | – |
| 1000 | 12.5 × 30 | 12.5 × 30 | 18 × 30 | 21 × 38 | – |
| 1500 | 12.5 × 30 | 15 × 30 | 18 × 38 | – | – |
| 2200 | 15 × 30 | 18 × 30 | 21 × 38 | – | – |
| 3300 | 18 × 30 | 18 × 38 | – | – | – |
| 4700 | 18 × 38 | 21 × 38 | – | – | – |
| 6800 | 21 × 38 | – | – | – | – |

DIMENSIONS in millimeters AND AVAILABLE FORMS



Form BR: Taped on reel,
case $\varnothing D \times L = 10 \times 30$ to 15×30 mm.

Fig.2 Form BR.



Form AA: Axial in box,
case $\varnothing D \times L = 10 \times 30$ to 21×38 mm.

Fig.3 Form AA.

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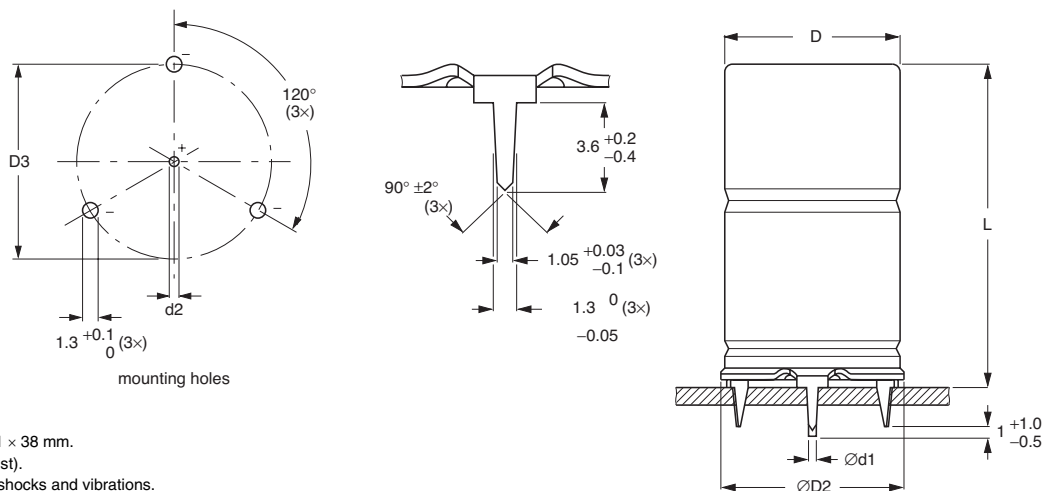
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Table 1

| AXIAL; DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES | | | | | | | | |
|---|-----------------------|-------|------------------------|------------|------------|-------------|----------------------|------------|
| NOMINAL CASE SIZE $\varnothing D \times L$ (mm) | AXIAL: FORM AA AND BR | | | | | MASS (G) | PACKAGING QUANTITIES | |
| | $\varnothing d(1)$ | I | $\varnothing D_{\max}$ | L_{\max} | F_{\min} | | FORM AA | FORM BR |
| 10 × 30 | 0.8 | 55 ±1 | 10.5 | 30.5 | 35 | ≈4.8 | 340 | 500 |
| 12.5 × 30 | 0.8 | 55 ±1 | 13.0 | 30.5 | 35 | ≈7.4 | 260 | 400 |
| 15 × 30 | 0.8 | 55 ±1 | 15.5 | 30.5 | 35 | ≈11.7 | 300 | 250 |
| 18 × 30 | 0.8 | 55 ±1 | 18.5 | 30.5 | 35 | ≈12.9 | 200 | – |
| 18 × 38 | 0.8 | 34 ±1 | 18.5 | 39.0 | 44 | ≈19.0 | 125 | – |
| 21 × 38 | 0.8 | 34 ±1 | 21.5 | 39.0 | 44 | ≈24.0 | 100 | – |

Note

1. Lead diameter $\varnothing d = 1.0$ mm, available on request.
2. Detailed tape dimensions see section 'PACKAGING'.

Fig.4 Mounting hole diagram and outline; **Form MR**; with mounting ring and pins.

Form MR: case $\varnothing D \times L = 15 \times 30$ to 21×38 mm.
Case not insulated (insulation on request).
Especially for applications with severe shocks and vibrations.

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 × 30 | 02 | 0.8 | 1.0 +0.4 | 15.5 | 17.5 | 16.5 ±0.2 | 33 | ≈8.6 | 200 |
| 18 × 30 | 03 | 0.8 | 1.0 +0.4 | 18.5 | 19.5 | 18.5 ±0.2 | 33 | ≈11.5 | 240 |
| 18 × 38 | 04 | 0.8 | 1.0 +0.4 | 18.5 | 19.5 | 18.5 ±0.2 | 42 | ≈14.0 | 100 |
| 21 × 38 | 05 | 0.8 | 1.0 +0.4 | 21.5 | 22.5 | 21.5 ±0.2 | 42 | ≈19.2 | 100 |

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| ELECTRICAL DATA | |
|-----------------|--|
| SYMBOL | DESCRIPTION |
| C_R | rated capacitance at 100 Hz, tolerance $\pm 20\%$ |
| I_R | rated RMS ripple current at 10 kHz, 125 °C |
| I_{L1} | max. leakage current after 1 minute at U_R |
| I_{L5} | max. leakage current after 5 minutes at U_R |
| ESR | equivalent series resistance at 100 Hz (calculated from $\tan \delta_{\max}$ and C_R) |
| Z | max. impedance at 10 kHz |

Note

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

Table 3

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | | | | | | | |
|--|--------------------------------------|--|-----------------------------------|--|--|--|--|--|--|--------------------------------------|-------------------------------|-----------------------------|-----------------------------|
| U_R (V) | C_R 100 Hz (μF) | NOMINAL CASE SIZE $\varnothing D \times L$ (mm) | I_R 10 KHZ 125 °C (mA) | I_{L1} 1 MIN (μA) | I_{L5} 5 MIN (μA) | TYP. ESR 100 Hz (m Ω) | MAX. ESR 100 Hz (m Ω) | TYP. ESR 10 KHZ (m Ω) | MAX. ESR 10 KHZ (m Ω) | Z MAX. 10 KHZ (m Ω) | CATALOG NUMBER 2222 120 | | |
| | | | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR | MOUNTING RING FORM MR |
| 16 | 680 | 10 × 30 | 2100 | 171 | 84 | 106 | 177 | 44 | 74 | 78 | 15681 | 25681 | – |
| | 1000 | 12.5 × 30 | 2550 | 232 | 104 | 77 | 128 | 35 | 58 | 61 | 15102 | 25102 | – |
| | 1500 | 12.5 × 30 | 2650 | 328 | 136 | 60 | 100 | 32 | 53 | 53 | 15152 | 25152 | – |
| | 2200 | 15 × 30 | 2940 | 462 | 181 | 48 | 79 | 28 | 46 | 46 | 15222 | 25222 | 45222 |
| | 3300 | 18 × 30 | 3430 | 674 | 251 | 41 | 68 | 26 | 43 | 43 | 15332 | – | 45332 |
| | 4700 | 18 × 38 | 4350 | 942 | 341 | 27 | 45 | 18 | 29 | 29 | 15472 | – | 45472 |
| | 6800 | 21 × 38 | 4590 | 1346 | 475 | 26 | 43 | 18 | 29 | 29 | 15682 | – | 45682 |
| 25 | 470 | 10 × 30 | 2100 | 181 | 87 | 112 | 187 | 45 | 74 | 84 | 16471 | 26471 | – |
| | 680 | 12.5 × 30 | 2550 | 244 | 108 | 81 | 136 | 35 | 59 | 64 | 16681 | 26681 | – |
| | 1000 | 12.5 × 30 | 2600 | 340 | 140 | 64 | 107 | 32 | 53 | 55 | 16102 | 26102 | – |
| | 1500 | 15 × 30 | 2890 | 490 | 190 | 49 | 82 | 28 | 46 | 46 | 16152 | 26152 | 46152 |
| | 2200 | 18 × 30 | 3310 | 700 | 260 | 43 | 71 | 27 | 44 | 44 | 16222 | – | 46222 |
| | 3300 | 18 × 38 | 4350 | 1030 | 370 | 28 | 47 | 18 | 29 | 29 | 16332 | – | 46332 |
| | 4700 | 21 × 38 | 4470 | 1450 | 510 | 27 | 44 | 18 | 29 | 29 | 16472 | – | 46472 |
| 40 | 220 | 10 × 30 | 1990 | 146 | 75 | 192 | 320 | 52 | 87 | 124 | 17221 | 27221 | – |
| | 330 | 12.5 × 30 | 2430 | 198 | 93 | 130 | 216 | 37 | 62 | 83 | 17331 | 27331 | – |
| | 470 | 12.5 × 30 | 2550 | 266 | 115 | 101 | 169 | 35 | 58 | 70 | 17471 | 27471 | – |
| | 680 | 15 × 30 | 2840 | 366 | 149 | 75 | 125 | 30 | 50 | 55 | 17681 | 27681 | 47681 |
| | 1000 | 18 × 30 | 3150 | 520 | 200 | 59 | 99 | 28 | 47 | 49 | 17102 | – | 47102 |
| | 1500 | 18 × 38 | 4130 | 760 | 280 | 39 | 65 | 19 | 31 | 32 | 17152 | – | 47152 |
| | 2200 | 21 × 38 | 4170 | 1096 | 392 | 34 | 56 | 19 | 31 | 31 | 17222 | – | 47222 |
| 63 | 100 | 10 × 30 | 1560 | 116 | 65 | 297 | 495 | 92 | 154 | 249 | 18101 | 28101 | – |
| | 150 | 12.5 × 30 | 2050 | 153 | 78 | 195 | 325 | 61 | 102 | 162 | 18151 | 28151 | – |
| | 220 | 12.5 × 30 | 2150 | 206 | 95 | 149 | 249 | 55 | 92 | 126 | 18221 | 28221 | – |
| | 330 | 15 × 30 | 2510 | 289 | 123 | 105 | 175 | 44 | 73 | 91 | 18331 | 28331 | 48331 |
| | 470 | 18 × 30 | 2860 | 395 | 158 | 81 | 135 | 38 | 64 | 74 | 18471 | – | 48471 |
| | 680 | 18 × 38 | 3720 | 554 | 211 | 55 | 92 | 26 | 43 | 49 | 18681 | – | 48681 |
| | 1000 | 21 × 38 | 3780 | 796 | 292 | 44 | 74 | 25 | 41 | 43 | 18102 | – | 48102 |
| 100 | 47 | 10 × 30 | 760 | 96 | 59 | 760 | 1269 | 349 | 581 | 720 | 19479 | 29479 | – |
| | 68 | 12.5 × 30 | 1030 | 122 | 67 | 531 | 885 | 246 | 410 | 503 | 19689 | 29689 | – |
| | 100 | 12.5 × 30 | 1140 | 160 | 80 | 389 | 648 | 196 | 327 | 381 | 19101 | 29101 | – |
| | 150 | 15 × 30 | 1480 | 220 | 100 | 266 | 443 | 137 | 229 | 262 | 19151 | 29151 | 49151 |
| | 220 | 18 × 30 | 1960 | 304 | 128 | 181 | 302 | 95 | 158 | 179 | 19221 | – | 49221 |
| | 330 | 18 × 38 | 2550 | 436 | 172 | 120 | 200 | 62 | 104 | 117 | 19331 | – | 49331 |
| | 470 | 21 × 38 | 2800 | 604 | 228 | 92 | 154 | 52 | 86 | 94 | 19471 | – | 49471 |

ORDERING EXAMPLE*

Electrolytic capacitor 120 series

1000 $\mu\text{F}/16\text{ V}$; $\pm 20\%$

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

Catalog number: 2222 120 25102.

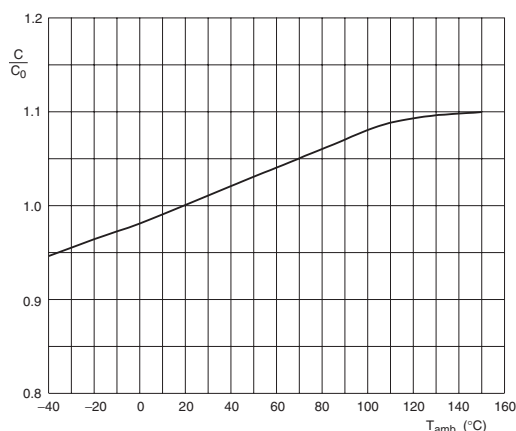
*Note: To ensure delivery of lead (Pb)-free parts during the transition period, please contact your Vishay sales agent.

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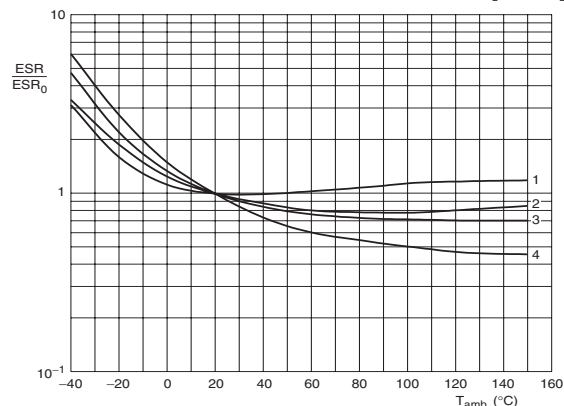
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| ADDITIONAL ELECTRICAL DATA | | | |
|------------------------------------|-----------------------------------|---|---------------|
| PARAMETER | CONDITIONS | VALUE | |
| | | AXIAL | MOUNTING RING |
| Voltage | | | |
| Surge voltage | | $U_s \leq 1.15 \times U_R$ | |
| Reverse voltage | | $U_{rev} \leq 1 \text{ V}$ | |
| Current | | | |
| Leakage current | after 1 minute at U_R | $I_{L1} \leq 0.012 C_R \times U_R + 40 \mu A$ | |
| | after 5 minutes at U_R | $I_{L5} \leq 0.004 C_R \times U_R + 40 \mu A$ | |
| Inductance | | | |
| Equivalent series inductance (ESL) | case $\varnothing D \times L$ mm: | | |
| | 10 × 30 | typ. 38 nH | |
| | 12.5 × 30 | typ. 46 nH | |
| | 15 × 30 | typ. 48 nH | typ. 39 nH |
| | 18 × 30 | typ. 50 nH | typ. 39 nH |
| | 18 × 38 | typ. 54 nH | typ. 39 nH |
| | 21 × 38 | typ. 59 nH | typ. 39 nH |

CAPACITANCE (C)

All voltages; all case sizes.
 C_0 = capacitance at 20 °C, 100 Hz.

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

EQUIVALENT SERIES RESISTANCE (ESR)

$\leq 40 \text{ V}$ types.

ESR_0 = typical at 20 °C.

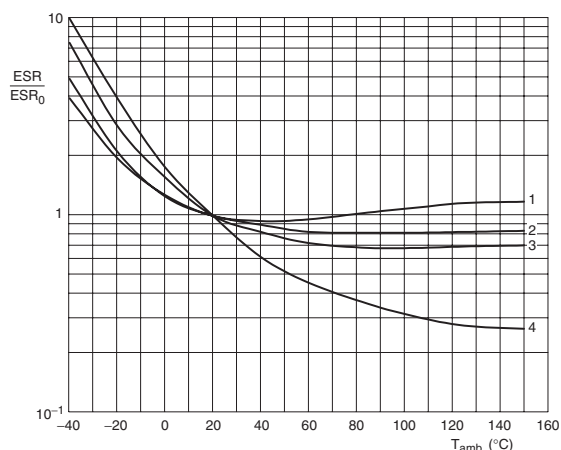
Curve 1: All case sizes; 100 Hz.

Curve 2: Case $\varnothing D \times L = 18 \times 38$ and 21×38 mm; 10 to 100 kHz.

Curve 3: Case $\varnothing D \times L = 15 \times 30$ and 18×30 mm; 10 to 100 kHz.

Curve 4: Case $\varnothing D \times L = 10 \times 30$ and 12.5×30 mm; 10 to 100 kHz.

Fig.6 Typical multiplier of ESR as a function of ambient temperature at different frequencies.



63 V types.

ESR_0 = typical at 20 °C.

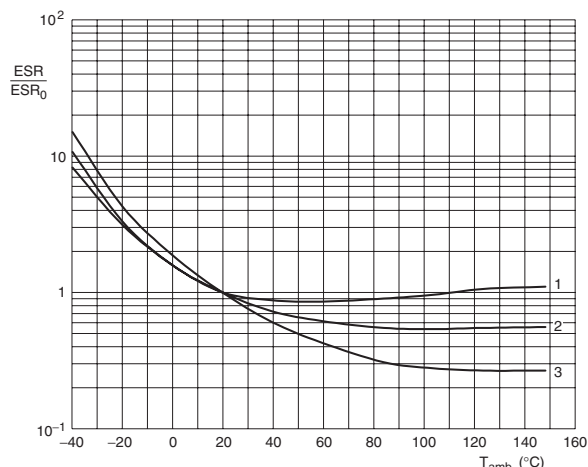
Curve 1: All case sizes; 100 Hz.

Curve 2: Case $\varnothing D \times L = 18 \times 38$ and 21×38 mm; 10 to 100 kHz.

Curve 3: Case $\varnothing D \times L = 15 \times 30$ and 18×30 mm; 10 to 100 kHz.

Curve 4: Case $\varnothing D \times L = 10 \times 30$ and 12.5×30 mm; 10 to 100 kHz.

Fig.7 Typical multiplier of ESR as a function of ambient temperature at different frequencies.



100 V types.

ESR_0 = typical at 20 °C.

Curve 1: All case sizes; 100 Hz.

Curve 2: Case $\varnothing D \times L = 18 \times 38$ and 21×38 mm; 10 to 100 kHz.

Curve 3: Case $\varnothing D \times L = 10 \times 30$ to 18×30 mm; 10 to 100 kHz.

Fig.8 Typical multiplier of ESR as a function of ambient temperature at different frequencies.

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RIPPLE CURRENT AND USEFUL LIFE

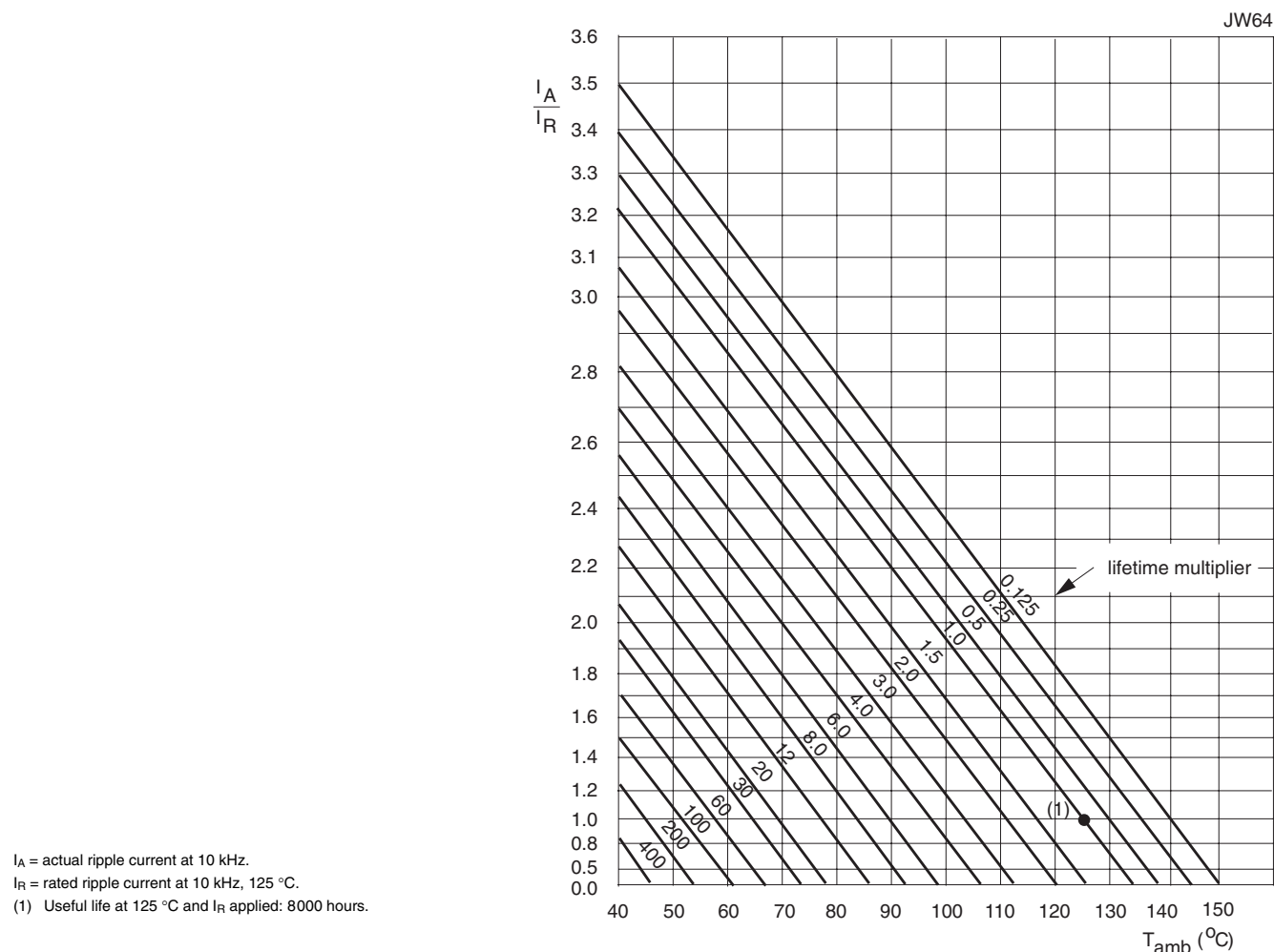


Fig.9 Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | | | | |
|---|---|---|---|---|
| FREQUENCY (Hz) | I_R MULTIPLIER | | | |
| | $U_R = 16$ to 40 V case sizes 10×30 to 15×30 mm | $U_R = 16$ to 40 V case sizes 18×30 to 21×38 mm | $U_R = 63$ and 100 V case sizes 10×30 to 15×30 mm | $U_R = 63$ and 100 V case sizes 18×30 to 21×38 mm |
| 50 | 0.37 | 0.54 | 0.23 | 0.44 |
| 100 | 0.48 | 0.63 | 0.32 | 0.56 |
| 300 | 0.69 | 0.75 | 0.53 | 0.76 |
| 1000 | 0.86 | 0.81 | 0.77 | 0.88 |
| 3000 | 0.96 | 0.87 | 0.93 | 0.94 |
| ≥ 10000 | 1.00 | 1.00 | 1.00 | 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 | $T_{amb} = 125\text{ }^{\circ}\text{C}$; U_R applied; 4000 hours $T_{amb} = 150\text{ }^{\circ}\text{C}$; U_R applied; 1000 hours | $\Delta C/C: \pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 125\text{ }^{\circ}\text{C}$; U_R and I_R applied; 8000 hours | $\Delta C/C: \pm 45\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$ |
| Shelf life (storage at high temperature) | IEC 60384-4/ EN130300 subclause 4.17 | $T_{amb} = 125\text{ }^{\circ}\text{C}$; no voltage applied; 1000 hours (100 V: 500 hours) $T_{amb} = 150\text{ }^{\circ}\text{C}$; no voltage applied; 500 hours for voltages: $\leq 63\text{ V}$ after test: U_R to be applied for 30 minutes, 24 to 48 hours 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 | $T_{amb} = 125\text{ }^{\circ}\text{C}$: 125 hours at $U = -1\text{ V}$ followed by 125 hours at U_R | $\Delta C/C: \pm 20\%$ $\tan \delta \leq \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Vibration | IEC 60068-2 subclause 4.15 test method Fc | 10 to 2000 Hz; 1.5 mm or 20 g (whichever is less severe); in 3 directions; 2.5 hours per direction | no visible damage; no leakage of electrolyte; markings legible $\Delta C/C: \pm 5\%$ with respect to initial measurement |



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