

Aluminum Electrolytic Capacitors Axial Miniature High Voltage for E.L.B.

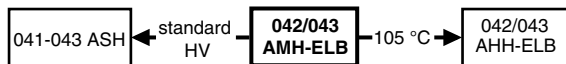
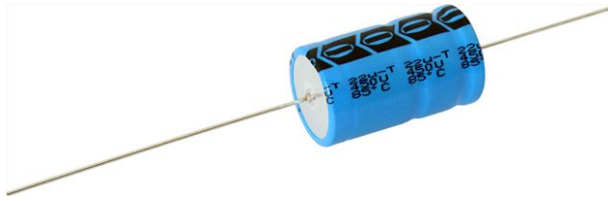


Fig. 1



FEATURES

- Useful life: 20 000 h at +85 °C
- Stable under overvoltage conditions: 550 V for 24 h at 85 °C
- High ripple current capability
- Smallest dimensions
- Taped versions up to case Ø 15 mm x 30 mm available for automatic insertion
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Axial leads, cylindrical aluminum case, insulated with a blue sleeve
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Electronic lighting ballast, power supply
- Smoothing, filtering, buffering at high voltages
- Boards with restricted mounting height, vibration, and shock resistant

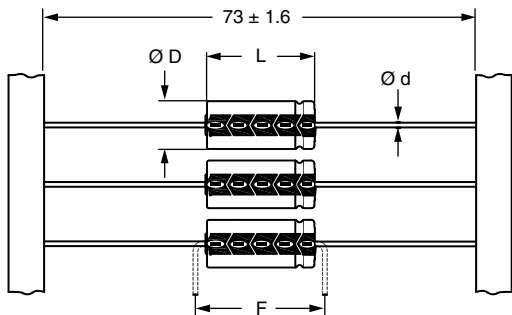
MARKING

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

- Rated capacitance (in μF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (T for -10 % to +50 %)
- Rated voltage (in V)
- Upper category temperature (85 °C)
- Date code in accordance with IEC 60062
- Code for factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (042 or 043)

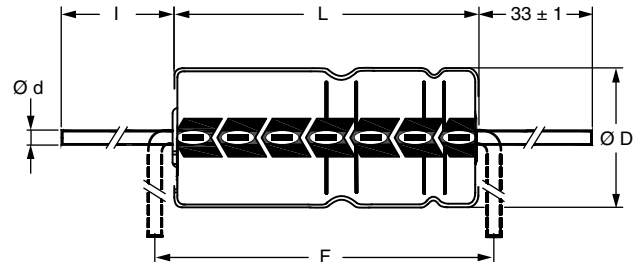
| QUICK REFERENCE DATA | |
|--|---------------------------------------|
| DESCRIPTION | VALUE |
| Nominal case sizes ($\varnothing D \times L$ in mm) | 12.5 x 30 to 18 x 38 |
| Rated capacitance range, C_R | 6.8 μF to 33 μF |
| Tolerance on C_R | -10 % to +50 % |
| Rated voltage, U_R | 450 V |
| Category temperature range | -25 °C to +85 °C |
| Endurance test at 85 °C | 8000 h |
| Useful life at 85 °C | 20 000 h |
| Useful life at 70 °C, I_R applied | 100 000 h |
| Shelf life at 0 V, 85 °C | 500 h |
| Based on sectional specification | IEC 60384-4 / EN 130300 |
| Climatic category IEC 60068 | 25 / 085 / 56 |

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 $15 \text{ mm} \times 30 \text{ mm}$

Fig. 2 - Form 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 (mm) | CASE CODE | AXIAL: FORM AA AND BR | | | | | MASS (g) | PACKAGING QUANTITIES | |
| | | Ø d | l | Ø D _{max.} | L _{max.} | F _{min.} | | FORM AA | FORM BR |
| 12.5 x 30 | 01 | 0.8 | 55 ± 1 | 13.0 | 30.5 | 35 | ≈ 6.1 | 260 | 400 |
| 15 x 30 | 02 | 0.8 | 55 ± 1 | 15.5 | 30.5 | 35 | ≈ 8.3 | 200 | 250 |
| 18 x 30 | 03 | 0.8 | 55 ± 1 | 18.5 | 30.5 | 35 | ≈ 11.6 | 120 | - |
| 18 x 38 | 04 | 0.8 | 34 ± 1 | 18.5 | 39.5 | 44 | ≈ 16.0 | 125 | - |

Note

- For detailed tape dimensions please refer to packaging information: www.vishay.com/doc?28361

| ELECTRICAL DATA | |
|-----------------|---|
| SYMBOL | DESCRIPTION |
| C _R | Rated capacitance at 100 Hz, tolerance -10 % to +50 % |
| I _R | Rated RMS ripple current at 10 kHz, 85 °C |
| I _{L5} | Max. leakage current after 5 min at U _R |
| ESR | Typ. / max. equivalent series resistance at 100 Hz |
| Z | Typ. / max. impedance at 10 kHz |

ORDERING EXAMPLE

Electrolytic capacitor 042 series

10 µF / 450 V; -10 % / +50 %

Nominal case size: Ø 12.5 mm x 30 mm; Form BR

Ordering code: MAL204282109E3

Former 12NC: 2222 042 82109

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 %.

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 10 kHz 85 °C (mA) | I _{L5} 5 min (µA) | ESR TYP. 100 Hz (Ω) | ESR MAX. 100 Hz (Ω) | Z TYP. 10 kHz (Ω) | Z MAX. 10 kHz (Ω) | ORDERING CODE MAL2..... | |
| | | | | | | | | | AXIAL | |
| | | | | | | | | | IN BOX FORM AA | TAPED ON REEL FORM BR |
| 450 | 6.8 | 12.5 x 30 | 540 | 106 | 3.8 | 8.3 | 2.8 | 4.8 | 04281688E3 | 04282688E3 |
| | 10 | 12.5 x 30 | 710 | 110 | 2.6 | 5.6 | 1.8 | 3.1 | 04281109E3 | 04282109E3 |
| | 15 | 15 x 30 | 910 | 115 | 1.7 | 3.7 | 1.2 | 2.1 | 04281159E3 | 04282159E3 |
| | 22 | 18 x 30 | 1190 | 120 | 1.1 | 2.4 | 0.9 | 1.4 | 04281229E3 | - |
| | 33 | 18 x 38 | 1610 | 130 | 0.8 | 1.7 | 0.6 | 1.0 | 04381339E3 | - |

| ADDITIONAL ELECTRICAL DATA | | |
|------------------------------|------------------------|--|
| PARAMETER | CONDITIONS | VALUE |
| Voltage | | |
| Surge voltage | U _R = 450 V | U _s ≤ 550 V |
| Overvoltage test | 24 h at 85 °C | 550 V ⁽¹⁾ |
| Reverse voltage | | U _{rev} ≤ 1 V |
| Current | | |
| Leakage current | After 1 min | I _{L1} ≤ 0.009 x C _R x U _R + 200 µA |
| | After 5 min | I _{L5} ≤ 0.002 x C _R x U _R + 100 µA |
| Inductance | | |
| Equivalent series inductance | Case Ø D x L in mm: | |
| | 12.5 x 30 | Typ. 46 nH |
| | 15 x 30 | Typ. 48 nH |
| | 18 x 30 | Typ. 50 nH |
| | 18 x 38 | Typ. 54 nH |

Note

- ⁽¹⁾ Test conditions on request.



CAPACITANCE (C)

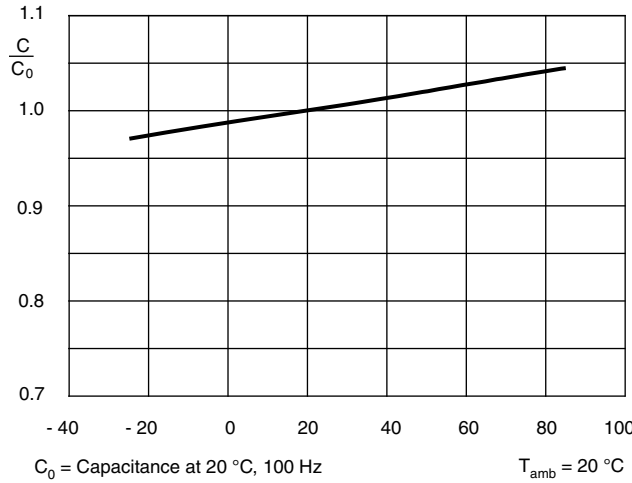
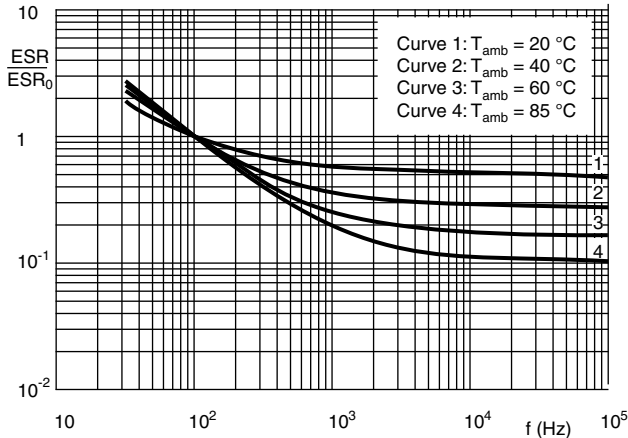


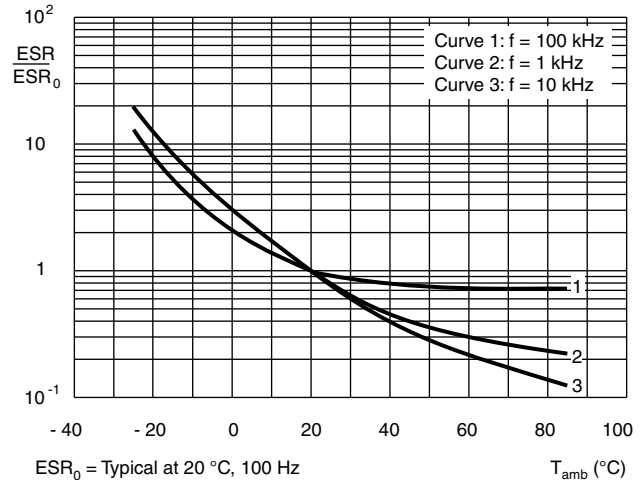
Fig. 4 - Typical multiplier of capacitance as a function of ambient temperature

EQUIVALENT SERIES RESISTANCE (ESR)



ESR_0 = Typical at 20 °C, 100 Hz

Fig. 5 - Typical multiplier of ESR as a function of frequency at different ambient temperatures



ESR_0 = Typical at 20 °C, 100 Hz

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

IMPEDANCE (Z)

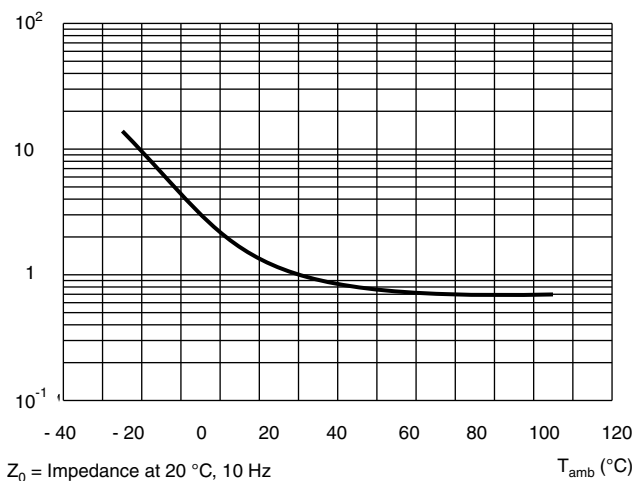


Fig. 7 - Typical multiplier of impedance as a function of ambient temperature

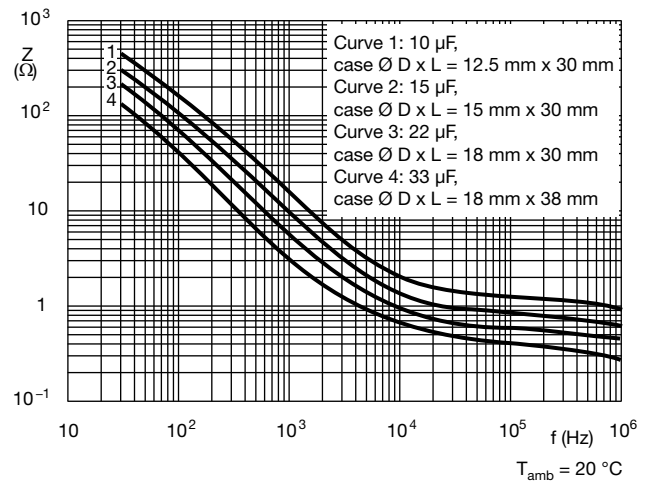


Fig. 8 - Typical impedance as a function of frequency

RIPPLE CURRENT AND USEFUL LIFE

Table 3

| ENDURANCE TEST DURATION AND USEFUL LIFE | |
|---|---------------------------|
| ENDURANCE AT 105 °C (h) | USEFUL LIFE AT 105 °C (h) |
| 8000 | 20 000 |

Note

- Multiplier of useful life code: CCB886

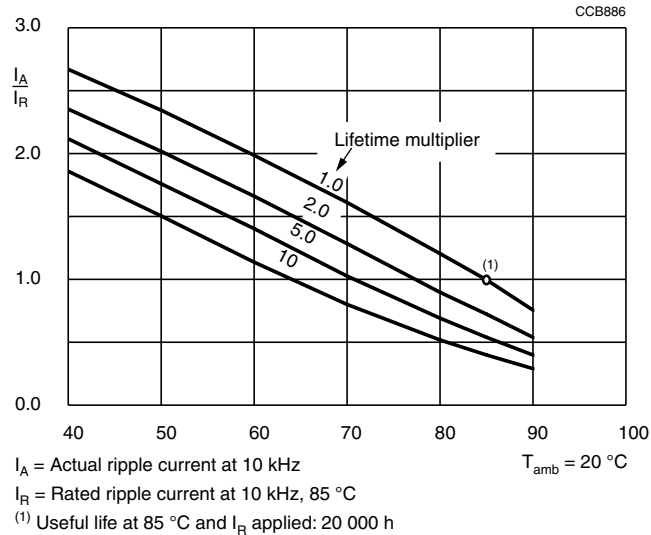


Fig. 9 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

| MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY | | | | | |
|---|------|------|------|------|----------|
| FREQUENCY (Hz) | | | | | |
| 50 | 100 | 300 | 1000 | 3000 | ≥ 10 000 |
| I_R MULTIPLIER | | | | | |
| 0.22 | 0.30 | 0.49 | 0.72 | 0.89 | 1.00 |

Note

- Formula (1) should be used to calculate the actual ripple current at 10 kHz (see Fig. 9) when multiple frequencies are present. For an example of the values 100 Hz and 50 kHz:

$$I_A = \sqrt{\left(\frac{1(100 \text{ Hz})}{0.30}\right)^2 + \left(\frac{1(50 \text{ kHz})}{1.0}\right)^2} \quad (1)$$



Table 5

| TEST PROCEDURES AND REQUIREMENTS | | | |
|--|--|---|--|
| TEST | | PROCEDURE (quick reference) | REQUIREMENTS |
| NAME OF TEST | REFERENCE | | |
| Endurance | IEC 60384-4 / EN 130300 subclause 4.13 | $T_{amb} = 85\text{ }^{\circ}\text{C}$; U_R applied; 8000 h | $\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ |
| Useful life | CECC 30301 subclause 1.8.1 | $T_{amb} = 85\text{ }^{\circ}\text{C}$; U_R and I_R applied; 20 000 h | $\Delta C/C: \pm 30\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ No short or open circuit Total failure percentage: $\leq 3\%$ |
| Shelf life (storage at high temperature) | IEC 60384-4 / EN 130300 subclause 4.17 | $T_{amb} = 85\text{ }^{\circ}\text{C}$; no voltage applied; 500 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 $I_{L5} \leq 2 \times \text{spec. limit}$ |

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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