

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

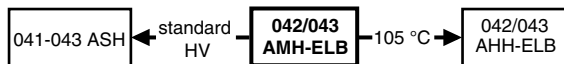
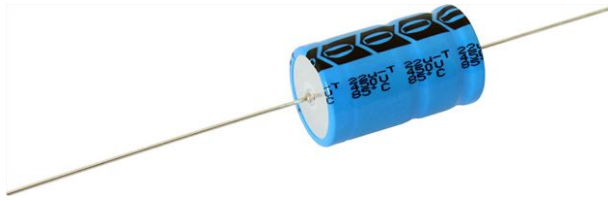


Fig. 1


**RoHS  
COMPLIANT**

### 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](http://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

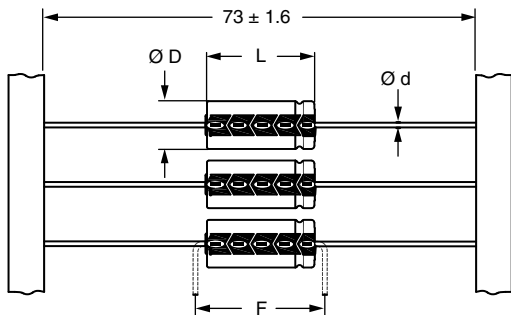
### MARKING

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

- Rated capacitance (in  $\mu\text{F}$ )
- 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)

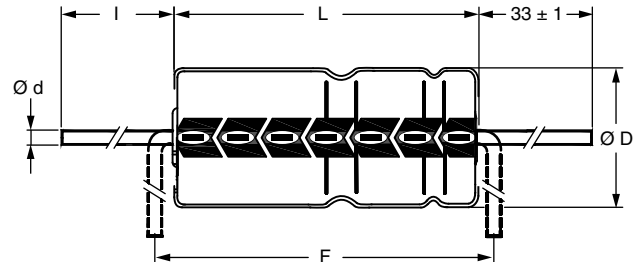
QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes ( $\varnothing$ D x L in mm)	12.5 x 30 to 18 x 38
Rated capacitance range, $C_R$	6.8 $\mu\text{F}$ to 33 $\mu\text{F}$
Tolerance on $C_R$	-10 % to +50 %
Rated voltage, $U_R$	450 V
Category temperature range	-25 °C to +85 °C
Endurance test at 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 x L = 6.5 mm x 18 mm to 15 mm x 30 mm

Fig. 2 - Form BR



**Form AA:** Axial in box  
Case  $\varnothing$  D x L = 10 mm x 30 mm to 21 mm x 38 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 <sub>max.</sub>	L <sub>max.</sub>	F <sub>min.</sub>		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](http://www.vishay.com/doc?28361)

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C <sub>R</sub>	Rated capacitance at 100 Hz, tolerance -10 % to +50 %
I <sub>R</sub>	Rated RMS ripple current at 10 kHz, 85 °C
I <sub>L5</sub>	Max. leakage current after 5 min at U <sub>R</sub>
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<sub>amb</sub> = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %.

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION										
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I <sub>R</sub> 10 kHz 85 °C (mA)	I <sub>L5</sub> 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
<b>Voltage</b>		
Surge voltage	U <sub>R</sub> = 450 V	U <sub>s</sub> ≤ 550 V
Overvoltage test	24 h at 85 °C	550 V <sup>(1)</sup>
Reverse voltage		U <sub>rev</sub> ≤ 1 V
<b>Current</b>		
Leakage current	After 1 min	I <sub>L1</sub> ≤ 0.009 x C <sub>R</sub> x U <sub>R</sub> + 200 µA
	After 5 min	I <sub>L5</sub> ≤ 0.002 x C <sub>R</sub> x U <sub>R</sub> + 100 µA
<b>Inductance</b>		
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**

- <sup>(1)</sup> Test conditions on request.

**CAPACITANCE (C)**

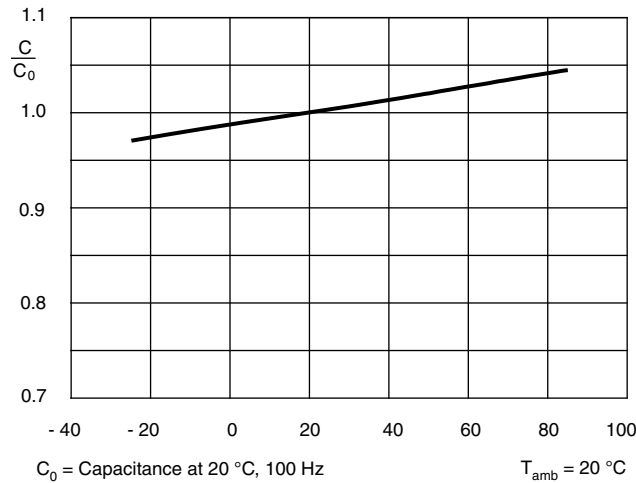
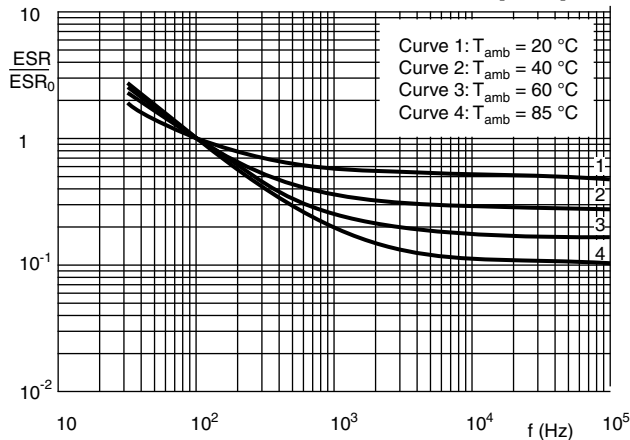


Fig. 4 - Typical multiplier of capacitance as a function of ambient temperature

**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

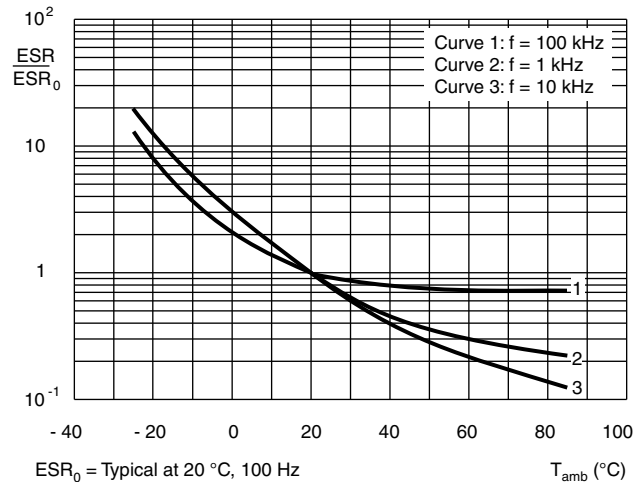


Fig. 6 - Typical multiplier of ESR as a function of ambient temperature at different frequencies

**IMPEDANCE (Z)**

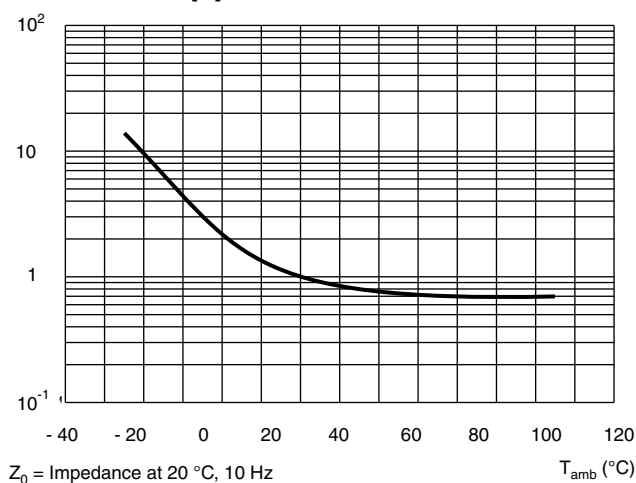


Fig. 7 - Typical multiplier of impedance as a function of ambient temperature

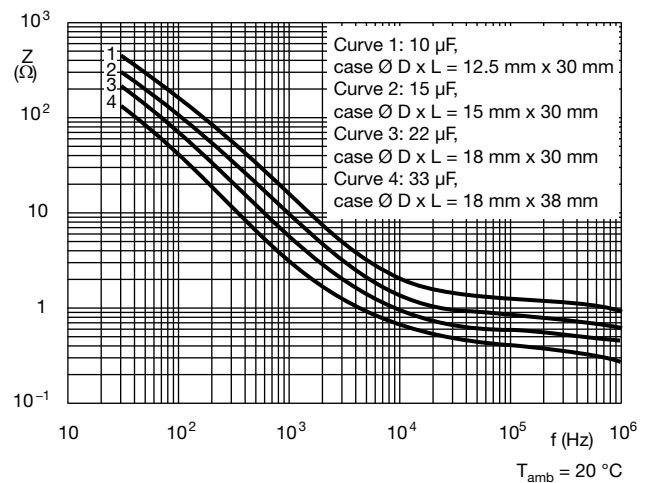


Fig. 8 - Typical impedance as a function of frequency



**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

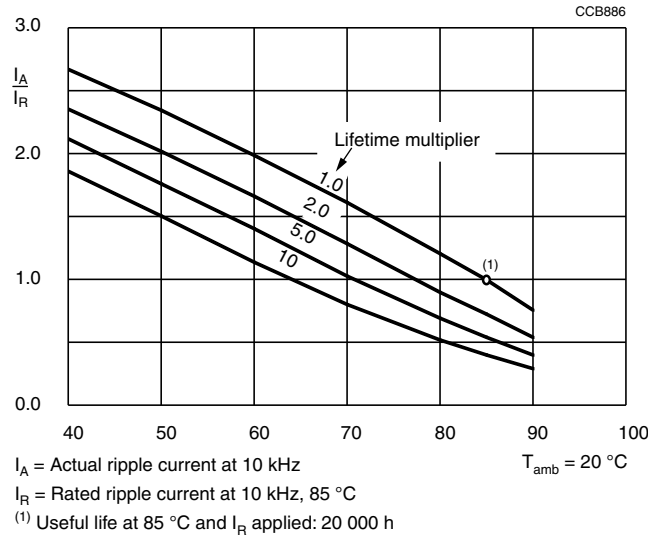


Fig. 9 - Multiplier of useful life as a function of ambient temperature and ripple current load

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 <sub>amb</sub> = 85 °C; U <sub>R</sub> applied; 8000 h	ΔC/C: ± 10 % tan δ ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I <sub>L5</sub> ≤ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T <sub>amb</sub> = 85 °C; U <sub>R</sub> and I <sub>R</sub> applied; 20 000 h	ΔC/C: ± 30 % tan δ ≤ 3 x spec. limit Z ≤ 3 x spec. limit I <sub>L5</sub> ≤ spec. limit No short or open circuit Total failure percentage: ≤ 3 %
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300 subclause 4.17	T <sub>amb</sub> = 85 °C; no voltage applied; 500 h  After test: U <sub>R</sub> to be applied for 30 min, 24 h to 48 h before measurement	ΔC/C, tan δ, Z: for requirements see "Endurance test" above I <sub>L5</sub> ≤ 2 x 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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