

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



Fig. 1

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes (Ø D x L in mm)	12.5 x 30 to 18 x 38
Rated capacitance range, C <sub>R</sub>	6.8 µF to 33 µF
Tolerance on C <sub>R</sub>	-10 % to +50 %
Rated voltage, U <sub>R</sub>	450 V
Category temperature range	-25 °C to +105 °C
Endurance test at 105 °C	5000 h
Useful life at 105 °C	10 000 h
Useful life at 85 °C I <sub>R</sub> applied	100 000 h
Shelf life at 0 V, 105 °C	500 h
Based on sectional specification	IEC 60384-4 / EN 130300
Climatic category IEC 60068	25 / 105 / 56

**FEATURES**

- Useful life: 10 000 h at 105 °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)

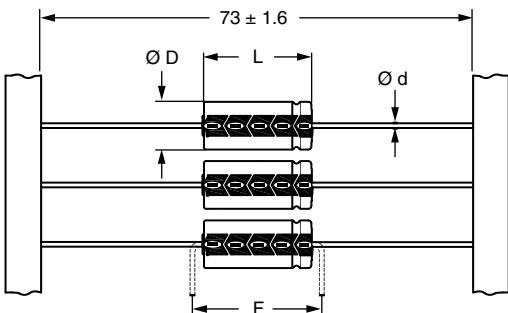

**RoHS  
COMPLIANT**
**APPLICATIONS**

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

**MARKING**

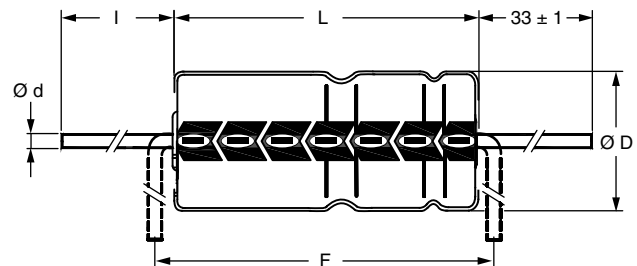
The capacitors are marked (where possible) with the following information:

- 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 (105 °C)
- Date code, in accordance with IEC 60062
- Code for factory of origin
- Name of manufacturer
- Negative terminal identification
- Series number (042 or 043)

**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

Fig. 2 - Form 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

**Table 1**

<b>AXIAL; DIMENSIONS</b> in millimeters, <b>MASS AND PACKAGING QUANTITIES</b>									
NOMINAL CASE SIZE Ø D x L	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)

<b>ELECTRICAL DATA</b>	
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, 105 °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: MAL204272109E3

Former 12NC: 2222 042 72109

**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**

<b>ELECTRICAL DATA AND ORDERING INFORMATION</b>										
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 105 °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	390	106	4.2	8.7	3.1	5.1	04271688E3	04272688E3
	10	12.5 x 30	470	110	2.9	5.9	2.0	3.3	04271109E3	04272109E3
	15	15 x 30	600	115	1.9	3.9	1.3	2.3	04271159E3	04272159E3
	22	18 x 30	750	120	1.2	2.5	1.0	1.5	04271229E3	-
	33	18 x 38	1020	130	0.9	1.8	0.7	1.1	04371339E3	-

<b>ADDITIONAL ELECTRICAL DATA</b>		
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)

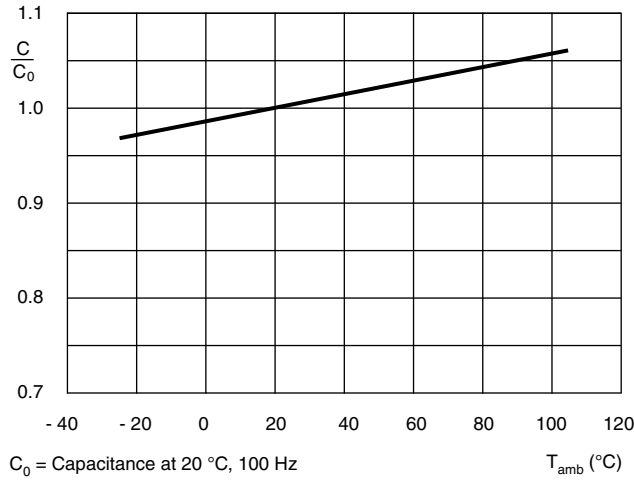


Fig. 4 - Typical multiplier of capacitance as a function of ambient temperature

EQUIVALENT SERIES RESISTANCE (ESR)

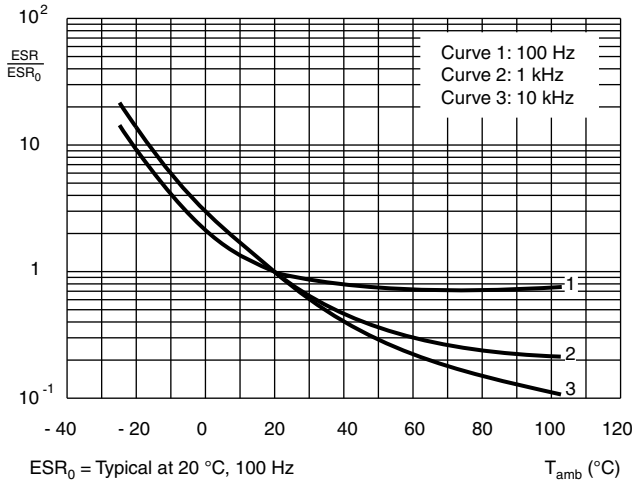


Fig. 5 - Typical multiplier of ESR as a function of ambient temperature at different frequencies

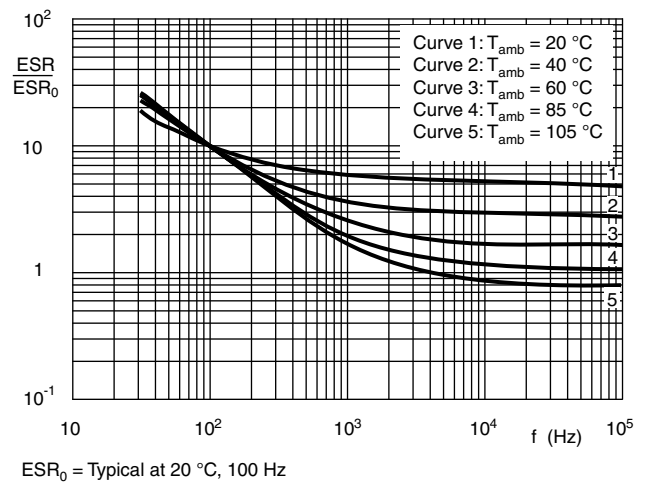


Fig. 6 - Typical multiplier of ESR as a function of frequency at different ambient temperatures

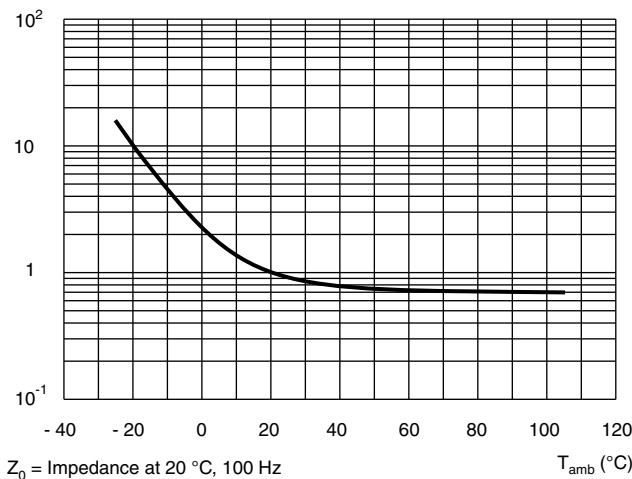


Fig. 7 - Typical multiplier of impedance as a function of ambient temperature

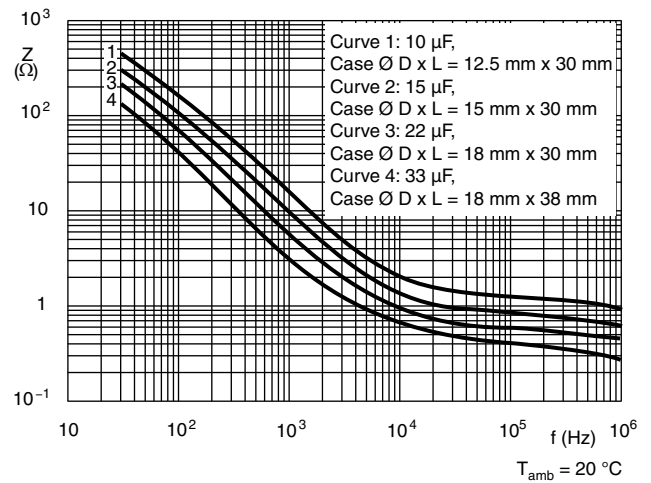


Fig. 8 - Typical impedance as a function of frequency

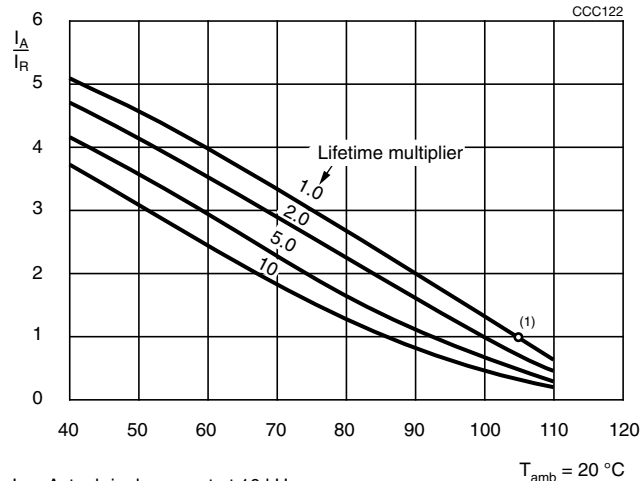
**RIPPLE CURRENT AND USEFUL LIFE**

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 105 °C (h)	USEFUL LIFE AT 105 °C (h)
5000	10 000

**Note**

- Multiplier of useful life code: CCC122



$I_A$  = Actual ripple current at 10 kHz  
 $I_R$  = Rated ripple current at 10 kHz, 105 °C  
 (1) Useful life at 105 °C and  $I_R$  applied: 10 000 h

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					
0.20	0.27	0.45	0.68	0.82	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:

$$I_A = \sqrt{\left(\frac{I(100 \text{ Hz})}{0.27}\right)^2 + \left(\frac{I(50 \text{ kHz})}{1.0}\right)^2} \quad (1)$$



Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN130300 subclause 4.13	T <sub>amb</sub> = 105 °C; U <sub>R</sub> applied; 5000 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> = 105 °C; U <sub>R</sub> and I <sub>R</sub> applied; 10 000 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 / EN130300 subclause 4.17	T <sub>amb</sub> = 105 °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.



## 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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.