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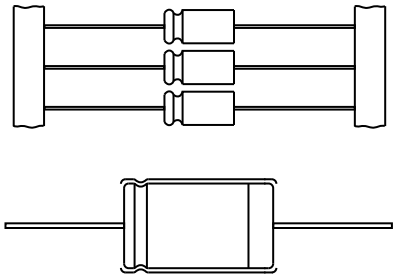
ELM/EBM

Vishay Roederstein

Aluminum Capacitors
Axial Capacitors Style



FEATURES

- Polarized aluminum electrolytic capacitors
- High CU product
- Miniature size
- Charge/discharge proof
- High ripple current capability
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT

APPLICATIONS

- General purpose, industrial electronics, audio/video systems
- Coupling, smoothing, filtering, buffering and timing
- Portable and mobile units
- Vibration and shock resistant

QUICK REFERENCE DATA

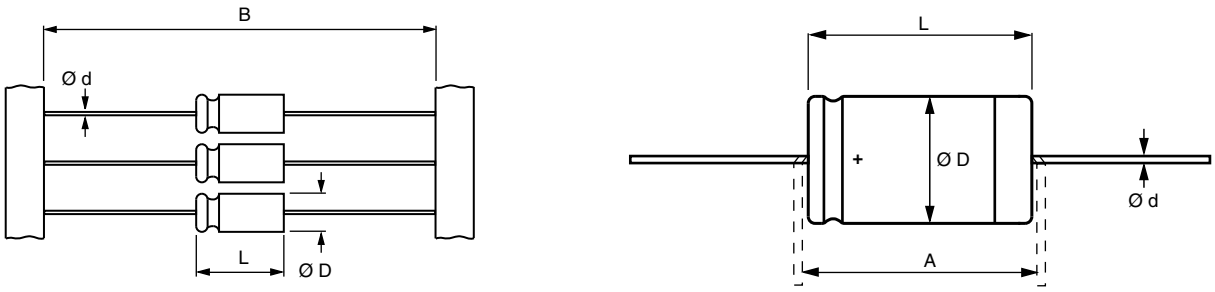
DESCRIPTION	UNIT	VALUE	
Nominal case size (Ø D x L)	mm	4.5 x 10	6 x 10 to 10 x 25
Rated capacitance range C_R	µF	1.0 to 2200	
Capacitance tolerance	%	± 20	
Rated voltage range	V	6.3 to 100	
Category temperature range	°C	-40 to +85	
Endurance test at upper category temp.	h	1000	
Useful life at 105 °C and I_R applied	h	500	750
Useful life at 85 °C and I_R applied	h	2500	
Useful life at 40 °C and I_R applied	h	70 000	
Shelf life at (0 V, upper category temperature)	h	500	
Failure rate (0.8 U_R, 40 °C)	10^{-9}/h	≤ 130	
Based on sectional specification		IEC 60384-4/EN 130300	
Based on detailed specifications		Similar to CECC 30301-044, similar to DIN 45910 part 126, without quality assessment	
Climatic category IEC 68068		40/085/56 GPF	

SELECTION CHART FOR C_R, U_R > 100 V, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

C_R (µF)	U_R (V)							
	6.3	10	16	25	40	50	63	100
1.0	→	→	→	→	→	→	→	4.5 x 11
2.2	→	→	→	→	→	→	→	4.5 x 11
4.7	→	→	→	→	→	→	→	4.5 x 11
10	→	**ELM**	→	→	→	→	4.5 x 11	6 x 10
22	→	→	→	→	4.5 x 11	→	6 x 10	6.5 x 18
33	→	→	→	4.5 x 11	-	-	-	-
47	→	→	→	4.5 x 11	6 x 10	→	6.5 x 18	8 x 18
100	→	4.5 x 11	→	6 x 10	6.5 x 18	→	8 x 18	10 x 25
220	→	6 x 10	→	6.5 x 18	10 x 18	**EBM**	10 x 25	-
470	→	6.5 x 18	8 x 18	10 x 18	10 x 25	-	-	-
680	→	8 x 18	10 x 18	10 x 25	-	-	-	-
1000	8 x 18	10 x 18	10 x 25	-	-	-	-	-
1500	10 x 18	10 x 25	-	-	-	-	-	-
2200	10 X 25	-	-	-	-	-	-	-

For technical questions, contact: aluminumcaps1@vishay.com

DIMENSIONS in millimeters AND AVAILABLE FORMS



DIMENSIONS in millimeters, MASS, PACKAGING QUANTITIES, AND ORDERING CODE

NOMINAL CASE SIZE Ø D x L	Ø d	Ø $D_{max.}$	$L_{max.}$	$A_{min.}$	B	MASS APPROX. g	PACKAGING, ENDING OF ORDERING CODE, QUANTITIES			
							TAPED ON REEL		TAPED AMMO	
							CODE	PCS.	CODE	PCS.
4.5 x 11	0.6	5	11.0	15	63.5 ± 1.5	0.5	..A0W	3000	..B0W	1000
6 x 10	0.6	6.3	10.5	15	63.5 ± 1.5	0.7	..A0W	1000	..B0W	1000
6.5 x 18	0.8	6.9	18.5	25	73.0 ± 1.6	1.3	..A0W	1000	..B0W	1000
8 x 18	0.8	8.5	18.5	25	73.0 ± 1.6	1.7	..A0W	500	..B0W	500
10 x 18	0.8	10.5	18.5	25	73.0 ± 1.6	2.5	..A0W	500	..B0W	500
10 x 25	0.8	10.5	25.0	30	73.0 ± 1.6	3.3	..A0W	500	..B0W	500

Note

- Axial style capacitors are insulated.

ELECTRICAL DATA

SYMBOL	DESCRIPTION
U_R	Rated voltage
C_R	Rated capacitance at 100 Hz
tan δ	Max. dissipation factor at 100 Hz
R_{ESR}	Equivalent series resistance at 100 Hz (calculated from tan $\delta_{max.}$ and C_R)
Z	Max. impedance at 10 kHz
I_R	Rated alternating current (RMS) at 100 Hz and upper category temperature
T_a	Ambient temperature
T_{uc}	Upper category temperature
RH	Relative humidity
P	Ambient pressure

Note

- Unless otherwise specified, all electrical values apply at T_a = 20 °C, P = 80 kPa to 106 kPa, RH = 45 % to 75 %.

ORDERING EXAMPLE

The following table gives the ordering number.

The 16th place of ordering code refers to packaging for axial lead capacitors:

MALAEBM00GD422B...EBM	2200 µF 6.3 V 10 x 25
MALAEBM00GD422BA0W	A = taped on reel
MALAEBM00GD422BB0W	B = taped ammo

Please see Dimensions table for available versions.

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	tan δ 100 Hz MAX.	R_{ESR} 100 Hz (Ω)	Z 10 kHz MAX. (Ω)	I_R 100 Hz T_{UC} (A)	CATALOG NUMBER MALA...
6.3	1000	8 x 18	0.25	0.400	0.500	0.44	EBM00FL410BB0W
	1500	10 x 18	0.25	0.270	0.320	0.56	EBM00GL415BB0W
	2200	10 x 25	0.29	0.210	0.160	0.71	EBM00GD422BB0W
10	100	4.5 x 11	0.20	3.200	2.000	0.10	ELM00BA310CB0W
	220	6 x 10	0.20	1.500	0.910	0.16	EBM00CK322CB0W
	470	6.5 x 18	0.20	0.680	0.430	0.31	EBM00DL347CB0W
	680	8 x 18	0.20	0.470	0.290	0.40	EBM00FL368CB0W
	1000	10 x 18	0.20	0.320	0.200	0.55	EBM00GL410CB0W
	1500	10 x 25	0.23	0.250	0.180	0.69	EBM00GD415CB0W
16	470	8 x 18	0.16	0.550	0.340	0.38	EBM00FL347DB0W
	680	10 x 18	0.16	0.380	0.240	0.50	EBM00GL368DB0W
	1000	10 x 25	0.16	0.260	0.180	0.66	EBM00GD410DB0W
25	33	4.5 x 11	0.14	6.700	3.500	0.07	ELM00BA233EB0W
	47	4.5 x 11	0.14	4.800	2.600	0.08	ELM00BA247EB0W
	100	6 x 10	0.14	2.300	1.200	0.15	EBM00CK310EB0W
	220	6.5 x 18	0.14	1.000	0.550	0.25	EBM00DL322EB0W
	470	10 x 18	0.14	0.480	0.260	0.45	EBM00GL347EB0W
	680	10 x 25	0.14	0.330	0.180	0.56	EBM00GD368EB0W
40	22	4.5 x 11	0.11	8.000	3.200	0.06	ELM00BA222GB0W
	47	6 x 10	0.11	3.800	1.500	0.11	EBM00CK247GB0W
	100	6.5 x 18	0.11	1.800	0.700	0.19	EBM00DL310GB0W
	220	10 x 18	0.11	0.800	0.320	0.33	EBM00GL322GB0W
	470	10 x 25	0.11	0.370	0.160	0.52	EBM00GD347GB0W
63	10	4.5 x 11	0.08	13.000	5.500	0.05	ELM00BA210JB0W
	22	6 x 10	0.08	5.800	2.500	0.09	EBM00CK222JB0W
	47	6.5 x 18	0.08	2.700	1.200	0.15	EBM00DL247JB0W
	100	8 x 18	0.08	1.300	0.550	0.25	EBM00FL310JB0W
	220	10 x 25	0.08	0.600	0.250	0.43	EBM00GD322JB0W
100	1.0	4.5 x 11	0.08	130.000	90.000	0.01	ELM00BA110LB0W
	2.2	4.5 x 11	0.08	58.000	41.000	0.02	ELM00BA122LB0W
	4.7	4.5 x 11	0.08	27.000	19.000	0.03	ELM00BA147LB0W
	10	6 x 10	0.08	13.000	9.000	0.07	EBM00CK210LB0W
	22	6.5 x 18	0.08	5.800	4.100	0.10	EBM00DL222LB0W
	47	8 x 18	0.08	2.700	1.900	0.16	EBM00FL247LB0W
	100	10 x 25	0.08	1.300	0.900	0.30	EBM00GD310LB0W

ADDITIONAL ELECTRICAL DATA

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	$U_R \leq 100$ V	$U_s = 1.15 \times U_R$
Reverse voltage	-	$U_{Rev} \leq 1$ V
Current		
Leakage current	$U_R \leq 100$ V U_R, 300 s	$I_L/\mu A \leq 0.002 \times C_R/\mu F \times U_R/V + 3$

LOW TEMPERATURE BEHAVIOUR

Table for the calculation of the maximum 10 kHz impedance at low temperatures:

$$Z\,(10\ \text{kHz})\ [\Omega] = \frac{\text{Tabular value}}{C_R\ [\mu F]}$$

T_A (°C)	RATED VOLTAGE (V)							
	6.3	10	16	25	40	50	63	100
-25	2100	1600	1250	680	390	375	240	200
-40	7600	5700	3500	1870	1150	1100	650	500

In practical operation the lower limit of the series resistance and impedance is given by the ohmic part of the contact points and the foil resistance values. Therefore it will not always be possible to achieve calculated values below 0.05 Ω.

LIFETIME TABLE $U_R \leq 100$ V

INTERRELATION BETWEEN ALTERNATING CURRENT, AMBIENT TEMPERATURE, AND LIFETIME

I/I_R (frequency dependent)							LIFETIME MULTIPLIER L (depending on I/I_R and T_a)													
FREQUENCY [Hz]							AMBIENT TEMPERATURE T_a [°C]													
50	100	250	500	1000	> 2500	10 K	40	45	50	55	60	65	70	75	80	85	90	95	100	105
0	0	0	0	0	0	0	56	35	23	15	9.7	6.4	4.3	3.0	2.0	1.42	1.00	0.71	0.51	0.37
0.18	0.20	0.22	0.23	0.24	0.25	0.26	54	34	22	14	9.4	6.3	4.2	2.9	2.0	1.40	0.98	0.70	0.50	0.36
0.36	0.40	0.44	0.46	0.48	0.50	0.52	49	31	20	13	8.8	5.9	4.0	2.7	1.9	1.33	0.94	0.67	0.48	0.35
0.54	0.60	0.66	0.69	0.72	0.75	0.78	43	28	18	12	8.0	5.4	3.7	2.5	1.8	1.24	0.88	0.63	0.45	0.33
0.72	0.80	0.88	0.92	0.96	1.00	1.04	36	24	16	10	7.0	4.8	3.3	2.3	1.6	1.13	0.80	0.58	0.42	0.31
0.90	1.00	1.10	1.15	1.20	1.25	1.30	29	19	13	8.8	6.0	4.1	2.9	2.0	1.4	1.00	0.72	0.52	0.38	0.28
1.08	1.20	1.32	1.38	1.44	1.50	1.56	23	16	11	7.3	5.0	3.5	2.4	1.7	1.2	0.88	0.63	0.46	0.34	
1.26	1.40	1.54	1.61	1.68	1.75	1.82	18	12	8.5	5.9	4.1	2.9	2.0	1.5	1.0	0.75	0.55	0.40	0.29	
1.44	1.60	1.76	1.84	1.92	2.00	2.08	13	9.4	6.6	4.7	3.3	2.3	1.7	1.2	0.87	0.64	0.47	0.34		
1.62	1.80	1.98	2.07	2.16	2.25	2.34	10	7.1	5.1	3.6	2.6	1.9	1.4	1.0	0.72	0.53	0.39	0.29		
1.80	2.00	2.20	2.30	2.40	2.50	2.60	7.3	5.3	3.8	2.8	2.0	1.5	1.1	0.80	0.59	0.43	0.32			
1.98	2.20	2.42	2.53	2.64	2.75	2.86	5.3	3.9	2.9	2.1	1.6	1.2	0.85	0.63	0.47	0.35				
2.16	2.40	2.64	2.76	2.88	3.00	3.12	3.8	2.8	2.1	1.6	1.2	0.89	0.66	0.50	0.37	0.28				
2.34	2.60	2.86	2.99	3.12	3.25	3.38	2.7	2.1	1.6	1.2	0.89	0.67	0.51	0.39	0.29					
2.52	2.80	3.08	3.22	3.36	3.50	3.64	1.9	1.5	1.1	0.87	0.67	0.51	0.39	0.30						
2.70	3.00	3.30	3.45	3.60	3.75	3.90	1.4	1.1	0.82	0.64	0.49	0.38	0.30							
2.88	3.20	3.52	3.68	3.84	4.00	4.16	0.95	0.75	0.59	0.46	0.36	0.28								
3.06	3.40	3.74	3.91	4.08	4.25	4.42	0.66	0.53	0.42	0.34										
3.24	3.60	3.96	4.14	4.32	4.50	4.68	0.46	0.37												
3.42	3.80	4.18	4.37	4.56	4.75	4.94	0.32													

combination not permitted

Note

I_R 100 Hz alternating current [A] at upper category temperature T_{UC} taken from datasheet
I User current [A]
T_a Ambient temperature of capacitor [°C]
L Lifetime multiplier
Regard L as a function of ambient temperature (x-axis) and of current (y-axis); use the current-axis according to the frequency

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN 130300 subclause 4.13	T_A = Upper cat. temp.; U_R applied 6.3 V ≤ U_R ≤ 100 V: 1000 h T_A = 85 °C; U_R applied	U_R = 6.3 V: -40 % ≤ ΔC/C ≤ 25 % U_R > 6.3 V: -30 % ≤ ΔC/C ≤ 30 % tan δ ≤ 1.5 x spec. limit Z ≤ 3 x spec. limit I_L (300 s) ≤ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_a = 105 °C; U_R and I_R applied; 6.3 V ≤ U_R ≤ 100 V Cases 4.5 x 11: 500 h Cases 6 x 10 to 10 x 25: 750 h T_a = 85 °C; U_R and I_R applied	U_R = 6.3 V: -50 % ≤ ΔC/C ≤ 45 % U_R > 6.3 V: -45 % ≤ ΔC/C ≤ 45 % tan δ ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_L (300 s) ≤ spec. limit No short circuit, no open circuit Total failure percentage: ≤ 1 %
Shelf life (storage at high temperature)	IEC 60384-4/ EN 130300 subclause 4.17	T_a = Upper cat. temp.; no voltage applied 6.3 V ≤ U_R ≤ 100 V Cases 4.5 x 11 to 10 x 25: 500 h After test: U_R to be applied for 30 min 24 h to 48 h before measurement	U_R = 6.3 V: -40 % ≤ ΔC/C ≤ 25 % U_R > 6.3 V: -30 % ≤ ΔC/C ≤ 30 % tan δ ≤ 1.5 x spec. limit Z ≤ 3 x spec. limit I_L (300 s) ≤ 2 x spec. limit

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