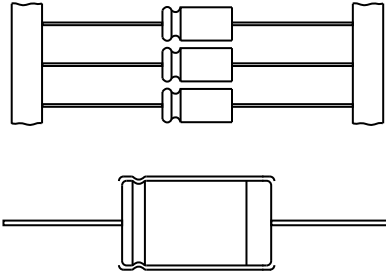


Aluminum Capacitors Axial Capacitors Style



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



RoHS
COMPLIANT

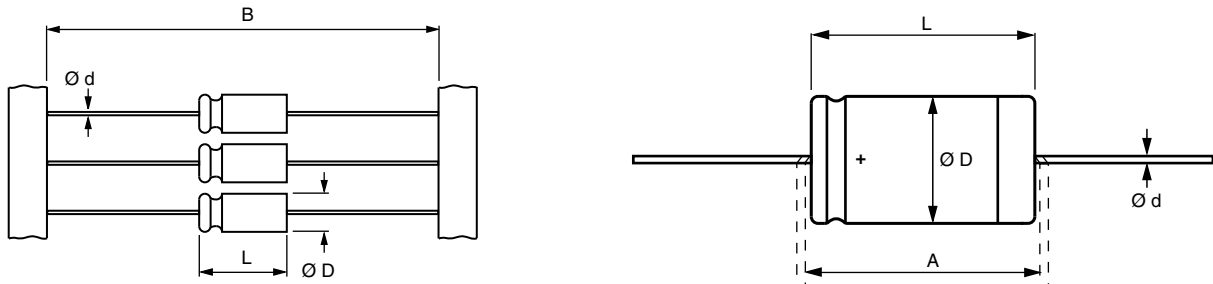
APPLICATIONS

- 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	-	-	-	-	-	-	-

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 δ _{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 (μ F)	NOMINAL CASE SIZE \varnothing D x L (mm)	$\tan \delta$ 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:

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

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 ≤ 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													

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	$T_a = \text{Upper cat. temp.}; U_R \text{ applied}$ $6.3 \text{ V} \leq U_R \leq 100 \text{ V}; 1000 \text{ h}$ $T_a = 85 \text{ }^\circ\text{C}; U_R \text{ applied}$	$U_R = 6.3 \text{ V}: - 40 \% \leq \Delta C/C \leq 25 \%$ $U_R > 6.3 \text{ V}: - 30 \% \leq \Delta C/C \leq 30 \%$ $\tan \delta \leq 1.5 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_L (300 \text{ s}) \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_a = 105 \text{ }^\circ\text{C}; U_R \text{ and } I_R \text{ applied};$ $6.3 \text{ V} \leq U_R \leq 100 \text{ V}$ Cases 4.5 x 11: 500 h Cases 6 x 10 to 10 x 25: 750 h $T_a = 85 \text{ }^\circ\text{C}; U_R \text{ and } I_R \text{ applied}$	$U_R = 6.3 \text{ V}: - 50 \% \leq \Delta C/C \leq 45 \%$ $U_R > 6.3 \text{ V}: - 45 \% \leq \Delta C/C \leq 45 \%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_L (300 \text{ s}) \leq \text{spec. limit}$ No short circuit, no open circuit Total failure percentage: $\leq 1 \%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN 130300 subclause 4.17	$T_a = \text{Upper cat. temp.}; \text{no voltage applied}$ $6.3 \text{ V} \leq U_R \leq 100 \text{ V}$ 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	$U_R = 6.3 \text{ V}: - 40 \% \leq \Delta C/C \leq 25 \%$ $U_R > 6.3 \text{ V}: - 30 \% \leq \Delta C/C \leq 30 \%$ $\tan \delta \leq 1.5 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_L (300 \text{ s}) \leq 2 \times \text{spec. limit}$



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