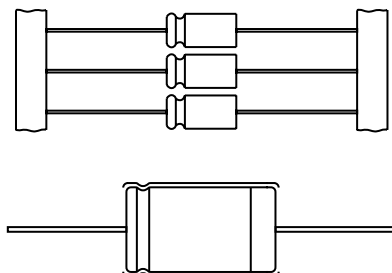


Aluminum Capacitors Axial Capacitor Style



Component outlines

FEATURES

- Polarized aluminum electrolytic capacitors
- High CU product
- Miniature size
- Charge/discharge proof
- High ripple current capability



RoHS
COMPLIANT

APPLICATIONS

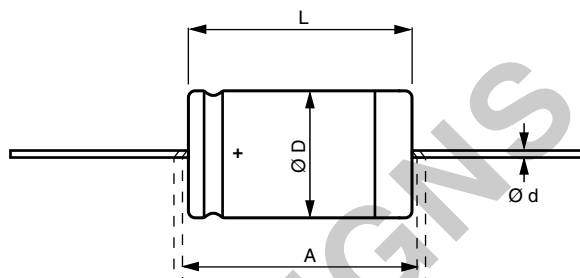
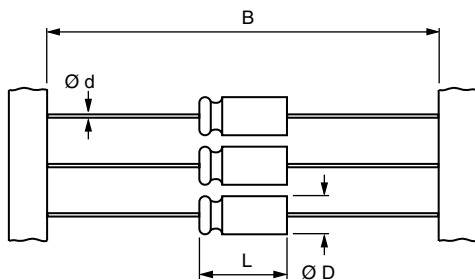
- General purpose, industrial electronics, audio/video systems
- Coupling, smoothing, filtering, buffering and timing
- Portable and mobile units
- Vibration and shock resistant

QUICK REFERENCE DATA

DESCRIPTION	UNIT	LOW VOLTAGE	
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****AXIAL STYLE: 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

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 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 table "Axial Styles" for available versions.

**ELECTRICAL DATA AND ORDERING INFORMATION**

U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (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	EBM00FL410BA0W
	1500	10 x 18	0.25	0.270	0.320	0.56	EBM00GL415BA0W
	2200	10 x 25	0.29	0.210	0.160	0.71	EBM00GD422BA0W
10	100	4.5 x 11	0.20	3.200	2.000	0.10	ELM00BA310CA0W
	220	6 x 10	0.20	1.500	0.910	0.16	EBM00CK322CA0W
	470	6.5 x 18	0.20	0.680	0.430	0.31	EBM00DL347CA0W
	680	8 x 18	0.20	0.470	0.290	0.40	EBM00FL368CA0W
	1000	10 x 18	0.20	0.320	0.200	0.55	EBM00GL410CA0W
	1500	10 x 25	0.23	0.250	0.180	0.69	EBM00GD415CA0W
16	470	8 x 18	0.16	0.550	0.340	0.38	EBM00FL347DA0W
	680	10 x 18	0.16	0.380	0.240	0.50	EBM00GL368DA0W
	1000	10 x 25	0.16	0.260	0.180	0.66	EBM00GD410DA0W
25	33	4.5 x 11	0.14	6.700	3.500	0.07	ELM00BA233EA0W
	47	4.5 x 11	0.14	4.800	2.600	0.08	ELM00BA247EA0W
	100	6 x 10	0.14	2.300	1.200	0.15	EBM00CK310EA0W
	220	6.5 x 18	0.14	1.000	0.550	0.25	EBM00DL322EA0W
	470	10 x 18	0.14	0.480	0.260	0.45	EBM00GL347EA0W
	680	10 x 25	0.14	0.330	0.180	0.56	EBM00GD368EA0W
40	22	4.5 x 11	0.11	8.000	3.200	0.06	ELM00BA222GA0W
	47	6 x 10	0.11	3.800	1.500	0.11	EBM00CK247GA0W
	100	6.5 x 18	0.11	1.800	0.700	0.19	EBM00DL310GA0W
	220	10 x 18	0.11	0.800	0.320	0.33	EBM00GL322GA0W
	470	10 x 25	0.11	0.370	0.160	0.52	EBM00GD347GA0W
63	10	4.5 x 11	0.08	13.000	5.500	0.05	ELM00BA210JA0W
	22	6 x 10	0.08	5.800	2.500	0.09	EBM00CK222JA0W
	47	6.5 x 18	0.08	2.700	1.200	0.15	EBM00DL247JA0W
	100	8 x 18	0.08	1.300	0.550	0.25	EBM00FL310JA0W
	220	10 x 25	0.08	0.600	0.250	0.43	EBM00GD322JA0W
100	1.0	4.5 x 11	0.08	130.000	90.000	0.01	ELM00BA110LA0W
	2.2	4.5 x 11	0.08	58.000	41.000	0.02	ELM00BA122LA0W
	4.7	4.5 x 11	0.08	27.000	19.000	0.03	ELM00BA147LA0W
	10	6 x 10	0.08	13.000	9.000	0.07	EBM00CK210LA0W
	22	6.5 x 18	0.08	5.800	4.100	0.10	EBM00DL222LA0W
	47	8 x 18	0.08	2.700	1.900	0.16	EBM00FL247LA0W
	100	10 x 25	0.08	1.300	0.900	0.30	EBM00GD310LA0W

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								combination not permitted
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													

I_R 100 Hz alternating current [A] at upper category temperature T_{UC} taken from data sheet

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 $6.3\text{ V} \leq U_R \leq 100\text{ V}$: 1000 h $T_A = 85\text{ }^\circ\text{C}$; U_R 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 and I_R 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 and I_R 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/ EN130300 subclause 4.17	T_A = upper cat. temp.; 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 minutes 24 to 48 hours 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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