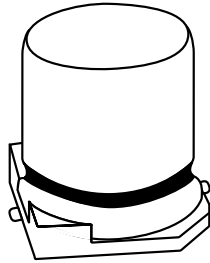


## Aluminum Capacitors



### FEATURES

- Polarized aluminum electrolytic capacitors
- SMD style
- Miniature dimension
- Extended temperature range: 105 °C
- Reflow soldering
- RoHS compliant


**RoHS**  
COMPLIANT

QUICK REFERENCE DATA		
DESCRIPTION	UNIT	VALUE
Nominal case size (Ø D x L)	mm	4 x 5.3 to 10 x 10
Rated capacitance range C <sub>R</sub>	µF	0.1 to 470
Capacitance tolerance	%	± 20
Rated voltage range	V	16 to 50
Category temperature range	°C	- 40 to + 105
Load life	h	1000
Based on sectional specification		IEC 60384-4/EN 130300
Climatic category IEC 60068		40/105/56

### APPLICATIONS

- Industrial electronics, automotive electronics, telecommunication systems
- Smoothing and filtering
- Miniature power supply units, dc-to-dc converters

### PACKAGING

- Supplied in blister tape

SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)				
C <sub>R</sub> (µF)	RATED VOLTAGE (V)			
	16	25	35	50
0.10	→	→	→	4 x 5.3
0.22	→	→	→	4 x 5.3
0.33	→	→	→	4 x 5.3
0.47	→	→	→	4 x 5.3
1.0	→	→	→	4 x 5.3
2.2	→	→	→	4 x 5.3
3.3	→	→	→	4 x 5.3
4.7	→	→	4 x 5.3	5 x 5.3
10	4 x 5.3	→	5 x 5.3	6.3 x 5.3
22	5 x 5.3	→	6.3 x 5.3	6.3 x 5.8
33	→	6.3 x 5.3	6.3 x 5.8	6.3 x 7.7
47	6.3 x 5.3	→	6.3 x 5.8	6.3 x 7.7
100	6.3 x 5.8	6.3 x 7.7	8 x 10	10 x 10
220	6.3 x 7.7	8 x 10	10 x 10	-
330	8 x 10	10 x 10	-	-
470	10 x 10	-	-	-

DIMENSIONS in millimeters									
CASE SIZE CODE	D ± α	L ± α	A ± α	B ± α	C ± α	E ± α	R	N	P
BB	4 ± 0.5	5.3 ± 0.2	1.9 ± 0.2	4.3 ± 0.2	4.3 ± 0.2	1.0 ± 0.2	0.5 ~ 0.8	0.3	0.5
BC	5 ± 0.5	5.3 ± 0.2	2.3 ± 0.2	5.3 ± 0.2	5.3 ± 0.2	1.4 ± 0.2	0.5 ~ 0.8	0.3	0.5
BD	6.3 ± 0.5	5.3 ± 0.3	2.4 ± 0.2	6.6 ± 0.2	6.6 ± 0.2	2.2 ± 0.2	0.5 ~ 0.8	0.3	0.5
AD	6.3 ± 0.5	5.8 ± 0.3	2.4 ± 0.2	6.6 ± 0.2	6.6 ± 0.2	2.2 ± 0.2	0.5 ~ 0.8	0.3	0.5
BM	6.3 ± 0.5	7.7 ± 0.4	2.4 ± 0.2	6.6 ± 0.2	6.6 ± 0.2	2.2 ± 0.2	0.5 ~ 0.8	0.3	0.5
AE	8 ± 0.5	6.2 ± 0.4	3.3 ± 0.2	8.3 ± 0.2	8.3 ± 0.2	2.3 ± 0.2	0.5 ~ 0.8	0.3	0.5
AF	8 ± 0.5	10 ± 0.5	2.9 ± 0.2	8.3 ± 0.2	8.3 ± 0.2	3.1 ± 0.2	0.8 ~ 1.1	0.3	0.5
AG	10 ± 0.5	10 ± 0.5	3.2 ± 0.2	10.3 ± 0.2	10.3 ± 0.2	4.5 ± 0.2	0.8 ~ 1.1	0.3	0.5

The technical drawings include:
 

- Top View:** Shows the octagonal case with dimensions D ± α (width), L ± α (length), and A ± α (height). It also indicates the positive (+) and negative (-) terminals, capacitance value, lot number, and voltage rating (e.g., 22 μF, 50 V).
- Side View:** Shows the overall height B ± α, the diameter of the case OD ± α, and the length L ± α.
- Cross-sectional View:** Shows the internal structure with dimensions C ± α (terminal width), E ± α (terminal height), R (radius), and N max. (height of the plastic platform).

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
U <sub>R</sub>	rated voltage
C <sub>R</sub>	rated capacitance at 120 Hz
tan δ	max. dissipation factor at 120 Hz
R <sub>ESR</sub>	max. equivalent series resistance at 120 Hz
I <sub>R</sub>	rated alternating current at 120 Hz and upper category temperature

**Note**

Unless otherwise specified, all electrical values apply at T<sub>amb</sub> = 20 °C, P = 80 to 120 kPa, RH = 45 to 75 %.

**ORDERING EXAMPLE**

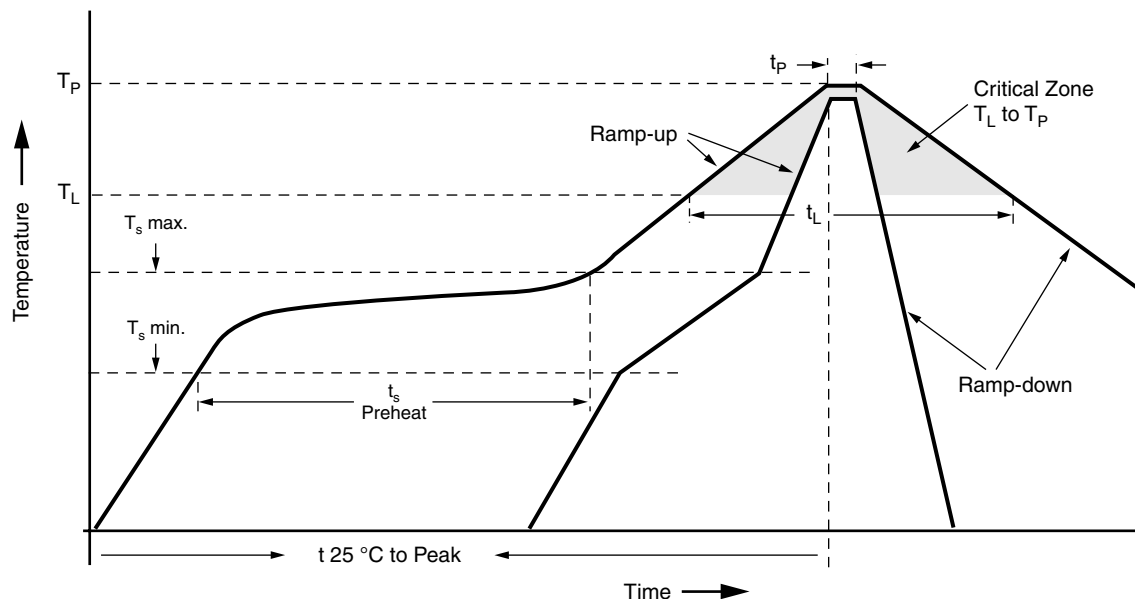
ECB 10 μF/35 V, ± 20 %, size 5 x 5.3 mm

Ordering code: MALSECB00BC210FARK

For Standard Packaging Quantity (SPQ) and Minimum Order Quantity (MOQ) please refer to our price list or contact customer service.

ELECTRICAL DATA AND ORDERING INFORMATION							
U <sub>R</sub> (V)	C <sub>R</sub> 120 Hz (μF)	DIMENSIONS D x L (mm)	tan δ 120 Hz	R <sub>ESR</sub> 120 Hz (Ω)	I <sub>R</sub> 120 Hz/105 °C (mA)	WEIGHT (g)	CATALOG NUMBER
16	10	4 x 5.3	0.19	25.20	17	0.12	MALSECB00BB210DARK
	22	5 x 5.3	0.19	11.45	30	0.17	MALSECB00BC222DARK
	47	6.3 x 5.3	0.19	5.36	51	0.30	MALSECB00BD247DARK
	100	6.3 x 5.8	0.19	2.52	64	0.30	MALSECB00AD310DARK
	220	6.3 x 7.7	0.19	1.15	105	0.37	MALSECB00BM322DARK
	330	8 x 10	0.19	0.76	425	1.00	MALSECB00AF333DARK
	470	10 x 10	0.19	0.54	470	1.21	MALSECB00AG347DARK

<b>ELECTRICAL DATA AND ORDERING INFORMATION</b>							
$U_R$ (V)	$C_R$ 120 Hz ( $\mu$ F)	DIMENSIONS D x L (mm)	$\tan \delta$ 120 Hz	$R_{ESR}$ 120 Hz ( $\Omega$ )	$I_R$ 120 Hz/105 °C (mA)	WEIGHT (g)	CATALOG NUMBER
25	33	6.3 x 5.3	0.15	6.03	48	0.30	MALSECB00BD233EARK
	100	6.3 x 7.7	0.15	1.99	91	0.37	MALSECB00BM310EARK
	220	8 x 10	0.15	0.90	340	1.00	MALSECB00AF322EARK
	330	10 x 10	0.15	0.60	360	1.21	MALSECB00AG333EARK
35	4.7	4 x 5.3	0.13	36.69	14	0.12	MALSECB00BB147FARK
	10	5 x 5.3	0.13	17.24	24	0.17	MALSECB00BC210FARK
	22	6.3 x 5.3	0.13	7.84	42	0.30	MALSECB00BD222FARK
	33	6.3 x 5.8	0.13	5.22	52	0.30	MALSECB00AD233FARK
	47	6.3 x 5.8	0.13	3.67	63	0.30	MALSECB00AD247FARK
	100	8 x 10	0.13	1.72	296	1.00	MALSECB00AF310FARK
	220	10 x 10	0.13	0.78	435	1.21	MALSECB00AG322FARK
50	0.10	4 x 5.3	0.11	1459	2.3	0.12	MALSECB00BB010HARK
	0.22	4 x 5.3	0.11	663.2	3.4	0.12	MALSECB00BB022HARK
	0.33	4 x 5.3	0.11	442.1	4.1	0.12	MALSECB00BB033HARK
	0.47	4 x 5.3	0.11	310.4	4.9	0.12	MALSECB00BB047HARK
	1.0	4 x 5.3	0.11	145.9	7.2	0.12	MALSECB00BB110HARK
	2.2	4 x 5.3	0.11	66.32	10.7	0.12	MALSECB00BB122HARK
	3.3	4 x 5.3	0.11	44.21	13.1	0.12	MALSECB00BB133HARK
	4.7	5 x 5.3	0.11	31.04	18.1	0.17	MALSECB00BC147HARK
	10	6.3 x 5.3	0.11	14.59	30.8	0.30	MALSECB00BD210HARK
	22	6.3 x 5.8	0.11	6.63	45	0.30	MALSECB00AD222HARK
	33	6.3 x 7.7	0.11	4.42	60	0.37	MALSECB00BM233HARK
	47	6.3 x 7.7	0.11	3.10	63	0.37	MALSECB00BM247HARK
	100	10 x 10	0.11	1.46	295	1.21	MALSECB00AG310HARK

**REFLOW SOLDERING CONDITIONS FOR SMD ALUMINUM ELECTROLYTIC CAPACITORS**




PROFILE FEATURE			
	SOLDERING CONDITION		
	Ø 4 ~ Ø 10	Ø 12.5	Ø 16
Average ramp-up rate (T <sub>L</sub> to T <sub>P</sub> )	3 °C/s max.	3 °C/s max.	
Preheat			
Temperature min. (T <sub>s</sub> min.)	150 °C	150 °C	
Temperature max. (T <sub>s</sub> max.)	200 °C	200 °C	
Time (T <sub>s</sub> min. to T <sub>s</sub> max.)	60 ~ 150 s	40 ~ 120 s	40 ~ 100 s
T <sub>s</sub> max. to T <sub>L</sub>			
Ramp-up rate	3 °C/s max.	3 °C/s max.	
Time maintained above			
Temperature (T <sub>L</sub> )	217 °C	217 °C	
Time (t <sub>L</sub> )	60 ~ 90 s	40 ~ 60 s	
Peak/classification temperature (T <sub>P</sub> )	250 °C	240 °C	230 °C
Time within 5 °C of actual peak temperature (T <sub>P</sub> )	10 s max.	10 s max.	
Ramp-down rate	3 °C/s max.	3 °C/s max.	
Time 25 °C to peak temperature	8 min max.	8 min max.	

RESISTANCE TO SOLDERING HEAT	
Leakage current	Less than specified value
Capacitance value	Within ± 10 % of initial value
Tan δ	Less than specified value

LOW TEMPERATURE BEHAVIOR (at 120 Hz)				
IMPEDANCE RATIO (Z) T2/(Z) T1	RATED VOLTAGE (V)			
	16	25	35	50
- 25 °C/+ 20 °C	2	2	2	2
- 40 °C/+ 20 °C	4	3	3	3

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Current</b>		
Leakage current (Test conditions: U <sub>R</sub> , 20 °C)	after 2 min at U <sub>R</sub>	I <sub>L2</sub> ≤ 0.01 x C <sub>R</sub> x U <sub>R</sub> or 3 µA for U <sub>R</sub> ≤ 100 V (whichever is greater)
<b>Resistance</b>		
Equivalent series resistance (ESR)	calculated from tan δ <sub>max</sub> .	ESR = tan δ/2πf C <sub>R</sub>

MULTIPLIER OF RIPPLE CURRENT (I <sub>R</sub> ) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	I <sub>R</sub> MULTIPLIER FOR U <sub>R</sub> ≤ 100 V
50	0.70
120	1.00
300	1.17
1000	1.36
≥ 10 000	1.50

TEST PROCEDURES AND REQUIREMENTS		
TEST	PROCEDURE (QUICK REFERENCE)	REQUIREMENTS
Load life	T <sub>amb</sub> = 105 °C U <sub>R</sub> and I <sub>R</sub> applied After 1000 h	ΔC/C: ± 25 % of initial value I <sub>L</sub> ≤ spec. limit tan δ ≤ 2 x spec. limit
Shelf life	No voltage applied After 1000 h After test: U <sub>R</sub> to be applied for 30 min 24 to 48 h before measurement	ΔC/C: ± 25 % of initial value I <sub>L</sub> ≤ spec. limit tan δ ≤ 2 x spec. limit



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