Aluminum Capacitors

FEATURES

- Load life: 2000 h at 85 °C
- Miniature dimension
- High CU-product
- SMD style
- Polarized aluminum electrolytic capacitors
- Reflow soldering
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- General use
- Consumer electronics
- Low-headroom, height restricted low mass units
- Filtering, smoothing, coupling

PACKAGING

Supplied in blister tape.

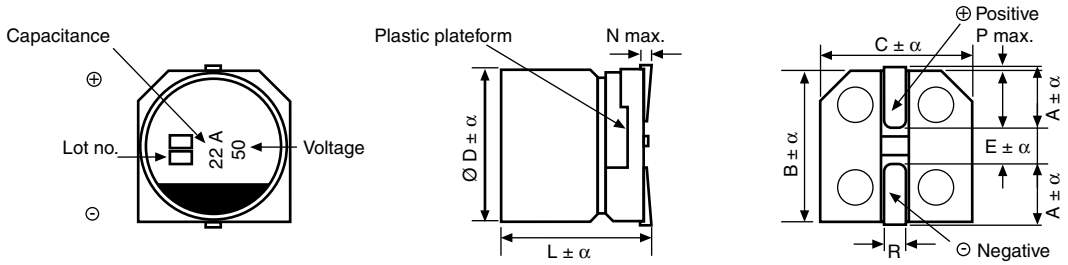
QUICK REFERENCE DATA	
DESCRIPTION	**VALUE**
Nominal case size (Ø D x L in mm)	4 x 5.3 to 12.5 x 13.5
Rated capacitance range, C_R	0.10 µF to 2200 µF
Capacitance tolerance	± 20 %
Rated voltage range	6.3 V to 100 V
Category temperature range	- 40 °C to + 85 °C
Load life	2000 h
Based on sectional specification	IEC 60384-4/EN 130300
Climatic category IEC 60068	40/105/56

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

C_R (µF)	RATED VOLTAGE (V)							
	6.3	**10**	**16**	**25**	**35**	**50**	**63**	**100**
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	→	5 x 5.3
3.3	→	→	→	→	→	4 x 5.3	→	6.3 x 5.8
4.7	→	→	→	→	→	5 x 5.3	→	6.3 x 5.8
10	→	→	→	→	4 x 5.3	5 x 5.3	6.3 x 5.8	8 x 10
22	→	→	→	5 x 5.3	→	6.3 x 5.3	8 x 6.2	8 x 10
33	→	→	→	5 x 5.3	6.3 x 5.3	6.3 x 7.7	8 x 10	10 x 10
47	→	→	5 x 5.3	6.3 x 5.3	8 x 6.2	8 x 10	→	10 x 10
68	→	→	→	→	→	→	→	12.5 x 13.5
100	5 x 5.3	→	6.3 x 5.3	8 x 6.2	8 x 10	10 x 10	→	12.5 x 13.5
220	→	8 x 6.2	6.3 x 7.7	8 x 10	→	10 x 10	12.5 x 13.5	-
330	6.3 x 7.7	→	8 x 10	→	10 x 10	12.5 x 13.5	-	-
470	→	8 x 10	→	10 x 10	12.5 x 13.5	-	-	-
1000	8 x 10	10 x 10	→	12.5 x 13.5	-	-	-	-
1500	10 x 10	→	12.5 x 13.5	-	-	-	-	-
2200	→	12.5 x 13.5	-	-	-	-	-	-

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
AH	12.5 ± 0.5	13.5 ± 0.5	4.6 ± 0.2	12.8 ± 0.2	12.8 ± 0.2	4.5 ± 0.2	1.1 ~ 1.4	0.3	0.5
AK	16 ± 0.5	16.5 ± 0.5	5.6 ± 0.2	16.8 ± 0.2	16.8 ± 0.2	6.5 ± 0.2	1.1 ~ 1.4	0.3	0.5



ELECTRICAL DATA

SYMBOL	DESCRIPTION
U_R	Rated voltage
C_R	Rated capacitance at 120 Hz
tan δ	Max. dissipation factor at 120 Hz
R_{ESR}	Max. equivalent series resistance at 120 Hz
I_R	Rated alternating current at 120 Hz and upper catagory temperature

Note

- Unless otherwise specified, all electrical values apply at T_{amb} = 20 °C, P = 80 kPa to 120 kPa, RH = 45 % to 75 %.

ORDERING EXAMPLE

ECA 33 µF/25 V, ± 20 %, size 5 x 5.3 mm

Ordering code: MALSECA00BC233EARK

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

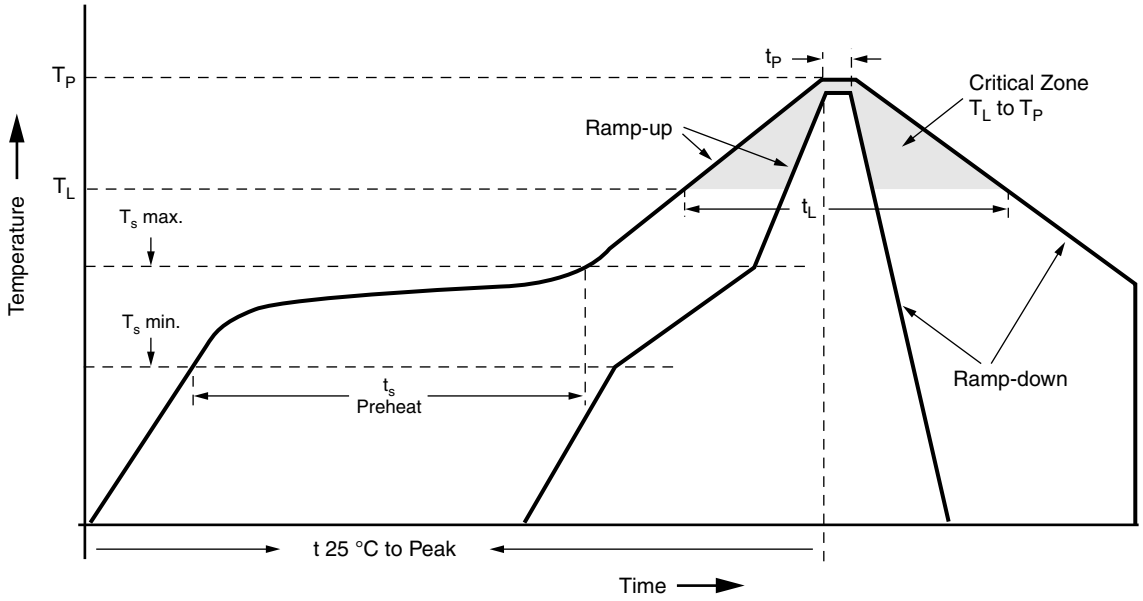
ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 120 Hz (µF)	DIMENSIONS D x L (mm)	tan δ 120 Hz	R_{ESR} 120 Hz (Ω)	I_R 120 Hz/85 °C (mA)	WEIGHT (g)	CATALOG NUMBER
6.3	100	5 x 5.3	0.28	3.71	60	0.17	MALSECA00BC310BARK
	330	6.3 x 7.7	0.35	1.41	188	0.40	MALSECA00BM333BARK
	1000	8 x 10	0.35	0.46	370	1.00	MALSECA00AF410BARK
	1500	10 x 10	0.35	0.31	480	1.25	MALSECA00AG415BARK
10	220	8 x 6.2	0.24	1.45	175	0.55	MALSECA00AE322CARK
	470	8 x 10	0.24	0.68	290	1.00	MALSECA00AF347CARK
	1000	10 x 10	0.24	0.32	454	1.25	MALSECA00AG410CARK
	2200	12.5 x 13.5	0.24	0.14	960	2.50	MALSECA00AH422CARK

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 120 Hz (µF)	DIMENSIONS D x L (mm)	tan δ 120 Hz	R_{ESR} 120 Hz (Ω)	I_R 120 Hz/85 °C (mA)	WEIGHT (g)	CATALOG NUMBER
16	47	5 x 5.3	0.20	5.64	52	0.17	MALSECA00BC247DARK
	100	6.3 x 5.3	0.20	2.65	88	0.27	MALSECA00BD310DARK
	220	6.3 x 7.7	0.24	1.45	162	0.40	MALSECA00BM322DARK
	330	8 x 10	0.24	0.96	270	1.00	MALSECA00AF333DARK
	1500	12.5 x 13.5	0.24	0.21	870	2.50	MALSECA00AH415DARK
25	22	5 x 5.3	0.13	7.84	41	0.17	MALSECA00BC222EARK
	33	5 x 5.3	0.13	5.22	50	0.17	MALSECA00BC233EARK
	47	6.3 x 5.3	0.13	3.67	70	0.27	MALSECA00BD247EARK
	100	8 x 6.2	0.16	2.12	145	0.55	MALSECA00AE310EARK
	220	8 x 10	0.16	0.96	232	1.00	MALSECA00AF322EARK
	470	10 x 10	0.16	0.45	400	1.25	MALSECA00AG347EARK
	1000	12.5 x 13.5	0.16	0.21	820	2.50	MALSECA00AH410EARK
35	10	4 x 5.3	0.15	19.9	27	0.12	MALSECA00BB210FARK
	33	6.3 x 5.3	0.15	6.03	65	0.27	MALSECA00BD233FARK
	47	8 x 6.2	0.15	4.23	105	0.55	MALSECA00AE247FARK
	100	8 x 10	0.15	1.99	175	1.00	MALSECA00AF310FARK
	330	10 x 10	0.15	0.60	360	1.25	MALSECA00AG333FARK
	470	12.5 x 13.5	0.15	0.42	600	2.50	MALSECA00AH347FARK
50	0.10	4 x 5.3	0.10	1326	3.2	0.12	MALSECA00BB010HARK
	0.22	4 x 5.3	0.10	602.9	4.7	0.12	MALSECA00BB022HARK
	0.33	4 x 5.3	0.10	401.9	5.7	0.12	MALSECA00BB033HARK
	0.47	4 x 5.3	0.10	282.2	6.8	0.12	MALSECA00BB047HARK
	1.0	4 x 5.3	0.10	132.6	10	0.12	MALSECA00BB110HARK
	2.2	4 x 5.3	0.10	60.3	15	0.12	MALSECA00BB122HARK
	3.3	4 x 5.3	0.10	40.2	18	0.12	MALSECA00BB133HARK
	4.7	5 x 5.3	0.10	28.2	25	0.17	MALSECA00BC147HARK
	10	5 x 5.3	0.10	13.2	41	0.17	MALSECA00BC210HARK
	22	6.3 x 5.3	0.10	6.03	71	0.27	MALSECA00BD222HARK
	33	6.3 x 7.7	0.12	4.82	94	0.40	MALSECA00BM233HARK
	47	8 x 10	0.12	3.39	140	1.00	MALSECA00AF247HARK
	100	10 x 10	0.12	1.59	195	1.25	MALSECA00AG310HARK
	220	10 x 10	0.12	0.72	320	1.25	MALSECA00AG322HARK
	330	12.5 x 13.5	0.12	0.48	600	2.50	MALSECA00AH333HARK
63	10	6.3 x 5.8	0.12	15.9	46	0.30	MALSECA00AD210JARK
	22	8 x 6.2	0.12	7.23	96	0.55	MALSECA00AE222JARK
	33	8 x 10	0.12	4.82	117	1.00	MALSECA00AF233JARK
	220	12.5 x 13.5	0.12	0.72	550	2.50	MALSECA00AH322JARK
100	2.2	5 x 5.3	0.12	72.35	20	0.17	MALSECA00BC122LARK
	3.3	6.3 x 5.8	0.12	48.2	29	0.30	MALSECA00AD133LARK
	4.7	6.3 x 5.8	0.12	33.9	35	0.30	MALSECA00AD147LARK
	10	8 x 10	0.12	15.9	77	1.00	MALSECA00AF210LARK
	22	8 x 10	0.12	7.23	100	1.00	MALSECA00AF222LARK
	33	10 x 10	0.12	4.82	130	1.25	MALSECA00AG233LARK
	47	10 x 10	0.12	3.39	155	1.25	MALSECA00AG247LARK
	68	12.5 x 13.5	0.12	2.34	350	2.50	MALSECA00AH268LARK
	100	12.5 x 13.5	0.12	1.59	420	2.50	MALSECA00AH310LARK

REFLOW SOLDERING CONDITIONS FOR SMD ALUMINUM ELECTROLYTIC CAPACITORS



PROFILE FEATURE			
	SOLDERING CONDITION		
	Ø 4 TO Ø 10	Ø 12.5	Ø 16
Average ramp-up rate (T_L to T_P)	3 °C/s max.	3 °C/s max.	
Preheat			
Temperature min. (T_s min.)	150 °C	150 °C	
Temperature max. (T_s max.)	200 °C	200 °C	
Time (T_s min. to T_s max.)	60 s to 150 s	40 s to 120 s	40 s to 100 s
T_s max. to T_L			
Ramp-up rate	3 °C/s max.	3 °C/s max.	
Time maintained above			
Temperature (T_L)	217 °C	217 °C	
Time (t_L)	60 s to 90 s	40 s to 60 s	
Peak/classification temperature (T_P)	250 °C	240 °C	230 °C
Time within 5 °C of actual peak temperature (T_P)	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)							
T2/T1	6.3	10	16	25	35	50	63	100
- 25 °C/+ 20 °C	5	4	3	2	2	2	2	2
- 40 °C/+ 20 °C	10	8	6	4	3	3	3	3

ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Current		
Leakage current (Test conditions: U_R, 20 °C)	After 2 min at U_R	$I_{L2} \leq 0.01 \times C_R \times U_R$ or 3 µA for $U_R \leq 100$ V (whichever is greater)
Resistance		
Equivalent series resistance (ESR)	Calculated from tan $\delta_{max.}$	ESR = tan $\delta/2\ \pi\ f\ C_R$

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	**I_R MULTIPLIER FOR $U_R \leq 100$ 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_{amb} = 85 °C U_R and I_R applied After 2000 h	ΔC/C: ± 20 % of initial value $I_L \leq$ spec. limit tan $\delta \leq 2 \times$ spec. limit
Shelf life	No voltage applied After 1000 h After test: U_R to be applied for 30 min 24 to 48 h before measurement	ΔC/C: ± 20 % of initial value $I_L \leq$ spec. limit tan $\delta \leq 2 \times$ spec. limit

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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. 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.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.