

# Aluminum Capacitors



## FEATURES

- Load life: 2000 h at 105 °C
- Extra low impedance, high ripple current
- Polarized SMD aluminum electrolytic capacitors, non solid electrolyte
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case size (Ø D x L in mm)	6 x 5.8 to 12.5 x 13.5
Rated capacitance range C <sub>R</sub>	10 µF to 1500 µF
Capacitance tolerance	± 20 %
Rated voltage range	6.3 V to 50 V
Category temperature range	-40 °C to 105 °C
Load life	2000 h
Based on sectional specification	IEC 60384-4 / EN 130300
Climatic category IEC 60068	40 / 105 / 56

## APPLICATIONS

- SMD technology, for high mounting density
- Industrial and professional applications
- General industrial, consumer
- Smoothing, filtering, buffering

## 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)					
	6.3	10	16	25	35	50
10	→	→	→	→	→	6.3 x 5.8
22	→	→	→	→	→	6.3 x 5.8
33	→	→	→	→	6.3 x 5.8	8 x 6.2
47	→	→	→	→	6.3 x 5.8	8 x 6.2
68	→	→	→	6.3 x 5.8	8 x 6.2	8 x 10
100	→	→	6.3 x 5.8	8 x 6.2	8 x 10	10 x 10
220	6.3 x 5.8	6.3 x 7.7	8 x 6.2	8 x 10	10 x 10	-
330	8 x 6.2	→	8 x 10	-	-	-
470	→	8 x 10	10 x 10	-	-	-
680	→	10 x 10	-	-	-	-
1000	10 x 10	-	-	-	-	-
1500	10 x 10	-	-	-	-	-

DIMENSIONS in millimeters									
CASE SIZE CODE	D ± α	L ± α	A ± α	B ± α	C ± α	E ± α	R	N	P
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 to 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 to 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 to 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 to 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 to 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 to 1.4	0.3	0.5

Technical drawings showing the capacitor's dimensions and features:

- Top View:** Shows the circular case with diameter  $D \pm \alpha$ , length  $L \pm \alpha$ , and terminal spacing  $A \pm \alpha$ . It also indicates the capacitance value (e.g., 22 μF), voltage rating (e.g., 50 V), and lot number.
- Side View:** Shows the case height  $B \pm \alpha$ , length  $L \pm \alpha$ , and the plastic platform height  $N \text{ max.}$ .
- Cross-sectional View:** Shows the internal structure with terminal spacing  $A \pm \alpha$ , case diameter  $D \pm \alpha$ , and terminal length  $R$ . It also indicates the positive and negative terminals and the maximum plate thickness  $P \text{ max.}$ .

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$U_R$	Rated voltage
$C_R$	Rated capacitance at 120 Hz
$\tan \delta$	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 category temperature
$Z$	Max. impedance at 100 kHz

**Note**

- Unless otherwise specified, all electrical values apply at  $T_{amb} = 20^\circ\text{C}$ ,  $P = 86$  to  $100$  kPa,  $RH = 45$  to  $75\%$ .

**ORDERING EXAMPLE**

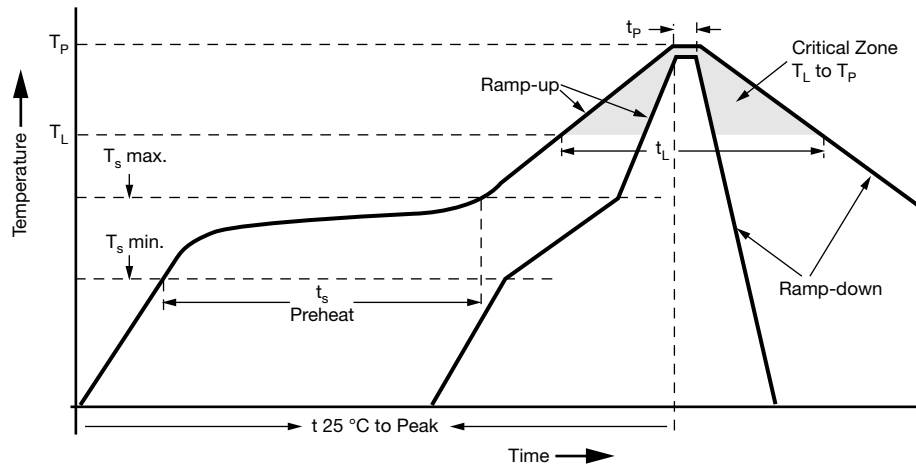
ECL 22 μF / 50 V, ± 20 %, size 6.3 x 5.8 mm

Ordering code: MALSECL00AD222HARK

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)	$\tan \delta$ 120 Hz	Z 100 kHz / 20 °C (Ω)	$I_R$ 100 kHz / 105 °C (mA)	WEIGHT (g)	CATALOG NUMBER
6.3	220	6.3 x 5.8	0.24	0.44	230	0.30	MALSECL00AD322BARK
	330	8 x 6.2	0.24	0.26	300	0.55	MALSECL00AE333BARK
	1000	10 x 10	0.24	0.09	670	1.21	MALSECL00AG410BARK
	1500	10 x 10	0.24	0.09	670	1.21	MALSECL00AG415BARK
10	220	6.3 x 7.7	0.19	0.34	280	0.40	MALSECL00BM322CARK
	470	8 x 10	0.19	0.17	450	1.00	MALSECL00AF347CARK
	680	10 x 10	0.19	0.09	670	1.21	MALSECL00AG368CARK
16	100	6.3 x 5.8	0.16	0.44	230	0.30	MALSECL00AD310DARK
	220	8 x 6.2	0.16	0.26	300	0.55	MALSECL00AE322DARK
	330	8 x 10	0.16	0.17	450	1.00	MALSECL00AF333DARK
	470	10 x 10	0.16	0.09	670	1.21	MALSECL00AG347DARK

ELECTRICAL DATA AND ORDERING INFORMATION							
$U_R$ (V)	$C_R$ 120 Hz ( $\mu$ F)	DIMENSIONS D x L (mm)	$\tan \delta$ 120 Hz	Z 100 kHz / 20 °C ( $\Omega$ )	$I_R$ 100 kHz / 105 °C (mA)	WEIGHT (g)	CATALOG NUMBER
25	68	6.3 x 5.8	0.14	0.44	230	0.30	MALSECL00AD268EARK
	100	8 x 6.2	0.14	0.26	300	0.55	MALSECL00AE310EARK
	220	8 x 10	0.14	0.17	450	1.00	MALSECL00AF322EARK
35	33	6.3 x 5.8	0.12	0.44	230	0.30	MALSECL00AD233FARK
	47	6.3 x 5.8	0.12	0.44	230	0.30	MALSECL00AD247FARK
	68	8 x 6.2	0.12	0.26	300	0.55	MALSECL00AE268FARK
	100	8 x 10	0.12	0.17	450	1.00	MALSECL00AF310FARK
	220	10 x 10	0.12	0.09	670	1.21	MALSECL00AG322FARK
50	10	6.3 x 5.8	0.12	0.88	165	0.30	MALSECL00AD210HARK
	22	6.3 x 5.8	0.12	0.88	165	0.30	MALSECL00AD222HARK
	33	8 x 6.2	0.12	0.63	300	0.55	MALSECL00AE233HARK
	47	8 x 6.2	0.12	0.63	300	0.55	MALSECL00AE247HARK
	68	8 x 10	0.12	0.34	450	1.00	MALSECL00AF268HARK
	100	10 x 10	0.12	0.18	670	1.21	MALSECL00AG310HARK

**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 $\pm 10\%$ of initial value
$\tan \delta$	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	2	2	2	2	2	2	3	3
-40 °C / +20 °C	3	3	3	3	3	3	4	4

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	$I_R$ MULTIPLIER
50	0.41
120	0.59
300	0.69
1000	0.80
10 000	0.88
100 000	1.00

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Current</b>		
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 $\mu$ A for $U_R \leq 100$ V (whichever is greater)
<b>Resistance</b>		
Equivalent series resistance (ESR)	Calculated from $\tan \delta_{max}$ .	$ESR = \tan \delta / 2 \pi f C_R$

TEST PROCEDURES AND REQUIREMENTS		
TEST	PROCEDURE (quick reference)	REQUIREMENTS
Load life	$T_{amb} = 105$ °C $U_R$ and $I_R$ applied After 2000 h	$\Delta C/C: \pm 25\%$ 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 h to 48 h before measurement	$\Delta C/C: \pm 25\%$ of initial value $I_L \leq$ spec. limit $\tan \delta \leq 2 \times$ spec. limit

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.



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