

# Aluminum Capacitors



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 <sub>R</sub>	10 µF to 2200 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/EN130300
Climatic category IEC 60068	40/105/56

## FEATURES

- Load life: 2000 h at 105 °C
- Miniature dimension
- SMD style
- Reflow soldering
- Polarized aluminum electrolytic capacitors
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## 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)					
	6.3	10	16	25	35	50
10	→	→	4 x 5.3	→	5 x 5.3	6.3 x 5.8
22	→	→	→	6.3 x 5.8	6.3 x 5.8	8 x 6.2
33	→	→	6.3 x 5.8	6.3 x 5.8	8 x 6.2	8 x 10
47	5 x 5.3	→	6.3 x 5.8	8 x 6.2	8 x 10	10 x 10
100	→	6.3 x 5.8	→	8 x 10	→	10 x 10
220	→	8 x 10	10 x 10	→	10 x 10	12.5 x 13.5
330	8 x 10	→	10 x 10	10 x 10	12.5 x 13.5	-
470	→	10 x 10	10 x 10	10 x 10	12.5 x 13.5	-
680	→	→	→	12.5 x 13.5	-	-
1000	→	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 to 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 to 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 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

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

**Note**

- Unless otherwise specified, all electrical values apply at  $T_{amb} = 20\text{ }^\circ\text{C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $RH = 45\%$  to  $75\%$ .

**ORDERING EXAMPLE**

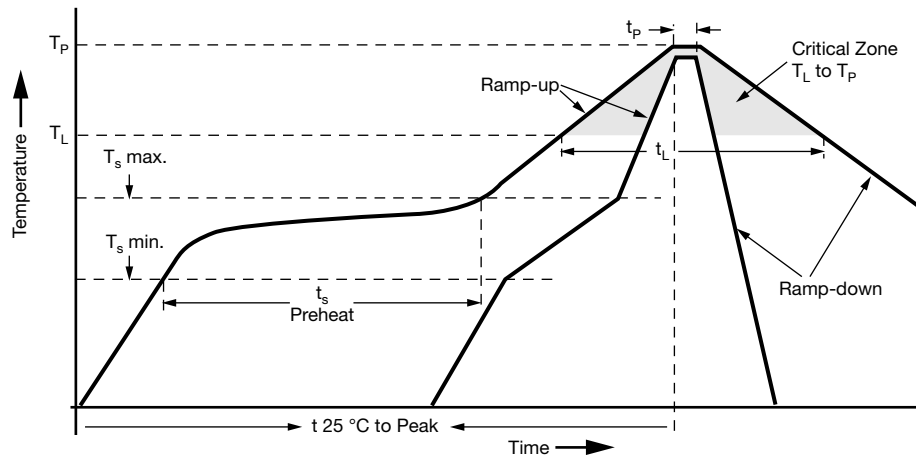
 ECV 220  $\mu\text{F}/35\text{ V}$ ,  $\pm 20\%$ , size 10 mm x 10 mm

Ordering code: MALSECV00AG322FARK

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 ( $\mu\text{F}$ )	DIMENSIONS D x L (mm)	$\tan \delta$ 120 Hz	$R_{ESR}$ 120 Hz/20 $^\circ\text{C}$ ( $\Omega$ )	$I_R$ 120 Hz/105 $^\circ\text{C}$ (mA)	WEIGHT (g)	CATALOG NUMBER
6.3	47	5 x 5.3	0.22	6.21	36	0.17	MALSECV00BC247BARK
	330	8 x 10	0.28	1.13	288	1.00	MALSECV00AF333BARK
	1500	10 x 10	0.28	0.25	560	1.21	MALSECV00AG415BARK
	2200	12.5 x 13.5	0.28	0.17	730	2.00	MALSECV00AH422BARK
10	100	6.3 x 5.8	0.19	2.52	60	0.30	MALSECV00AD310CARK
	220	8 x 10	0.24	1.45	173	1.00	MALSECV00AF322CARK
	470	10 x 10	0.24	0.68	351	1.21	MALSECV00AG347CARK
	1000	10 x 10	0.24	0.32	550	1.21	MALSECV00AG410CARK
	1500	12.5 x 13.5	0.24	0.21	650	2.00	MALSECV00AH415CARK
16	10	4 x 5.3	0.16	21.22	17	0.12	MALSECV00BB210DARK
	33	6.3 x 5.8	0.16	6.43	40	0.30	MALSECV00AD233DARK
	47	6.3 x 5.8	0.16	4.52	50	0.30	MALSECV00AD247DARK
	220	10 x 10	0.20	1.21	330	1.21	MALSECV00AG322DARK
	330	10 x 10	0.20	0.80	441	1.21	MALSECV00AG333DARK
	470	10 x 10	0.20	0.56	489	1.21	MALSECV00AG347DARK
	1000	12.5 x 13.5	0.20	0.27	600	2.00	MALSECV00AH410DARK

ELECTRICAL DATA AND ORDERING INFORMATION							
$U_R$ (V)	$C_R$ 120 Hz ( $\mu$ F)	DIMENSIONS D x L (mm)	$\tan \delta$ 120 Hz	$R_{ESR}$ 120 Hz/20 °C ( $\Omega$ )	$I_R$ 120 Hz/105 °C (mA)	WEIGHT (g)	CATALOG NUMBER
25	22	6.3 x 5.8	0.14	8.44	38	0.30	MALSECV00AD222EARK
	33	6.3 x 5.8	0.14	5.63	48	0.30	MALSECV00AD233EARK
	47	8 x 6.2	0.16	4.52	79	0.55	MALSECV00AE247EARK
	100	8 x 10	0.16	2.12	181	1.00	MALSECV00AF310EARK
	330	10 x 10	0.16	0.64	372	1.21	MALSECV00AG333EARK
	470	10 x 10	0.16	0.45	450	1.21	MALSECV00AG347EARK
	680	12.5 x 13.5	0.16	0.31	500	2.00	MALSECV00AH368EARK
35	10	5 x 5.3	0.12	15.92	24	0.17	MALSECV00BC210FARK
	22	6.3 x 5.8	0.12	7.23	42	0.30	MALSECV00AD222FARK
	33	8 x 6.2	0.13	5.22	76	0.55	MALSECV00AE233FARK
	47	8 x 10	0.13	3.67	124	1.00	MALSECV00AF247FARK
	220	10 x 10	0.13	0.78	450	1.21	MALSECV00AG322FARK
	330	12.5 x 13.5	0.13	0.52	500	2.00	MALSECV00AH333FARK
	470	12.5 x 13.5	0.13	0.37	600	2.00	MALSECV00AH347FARK
50	10	6.3 x 5.8	0.10	13.26	30	0.30	MALSECV00AD210HARK
	22	8 x 6.2	0.12	7.23	67	0.55	MALSECV00AE222HARK
	33	8 x 10	0.12	4.82	133	1.00	MALSECV00AF233HARK
	47	10 x 10	0.12	3.39	180	1.21	MALSECV00AG247HARK
	100	10 x 10	0.12	1.59	310	1.21	MALSECV00AG310HARK
	220	12.5 x 13.5	0.12	0.72	480	2.00	MALSECV00AH322HARK

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


PROFILE FEATURE	SOLDERING CONDITION		
	$\varnothing 4$ TO $\varnothing 10$	$\varnothing 12.5$	$\varnothing 16$
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
- 25 °C/+ 20 °C	3	3	2	2	2	2
- 40 °C/+ 20 °C	8	5	4	3	3	3

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 $\tan \delta_{max}$ .	$ESR = \tan \delta / 2 \pi f C_R$

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
$\geq 10\ 000$	1.50

TEST PROCEDURES AND REQUIREMENTS		
TEST	PROCEDURE (quick reference)	REQUIREMENTS
Load life	$T_{amb} = 105\ ^\circ C$ $U_R$ and $I_R$ applied After 2000 h	$\Delta C/C: \pm 20\%$ 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 h to 48 h before measurement	$\Delta C/C: \pm 20\%$ of initial value $I_L \leq$ spec. limit $\tan \delta \leq 2 \times$ spec. limit



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