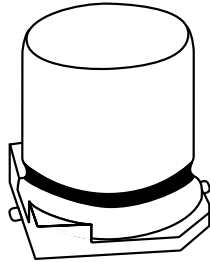


## Aluminum Capacitors



### FEATURES

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


**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

### QUICK REFERENCE DATA

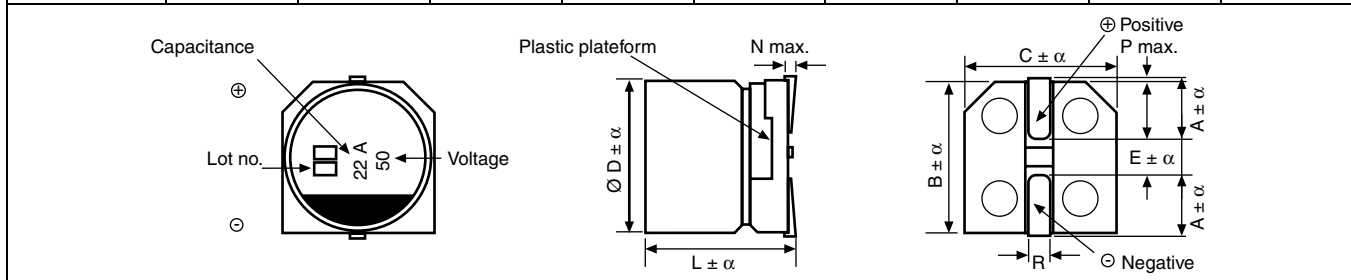
DESCRIPTION	UNIT	VALUE
Nominal case size (Ø D x L)	mm	4 x 5.3 to 12.5 x 13.5
Rated capacitance range C <sub>R</sub>	µF	10 to 2200
Capacitance tolerance	%	± 20
Rated voltage range	V	6.3 to 50
Category temperature range	°C	- 40 to 105
Load life	h	2000
Based on sectional specification		IEC 60384-4/ EN130300
Climatic category IEC 60068		40/105/56

### 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 ~ 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
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



**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  $T_{amb} = 20^\circ\text{C}$ ,  $P = 86$  to  $106$  kPa,  $RH = 45$  to  $75\%$ .

**ORDERING EXAMPLE**

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

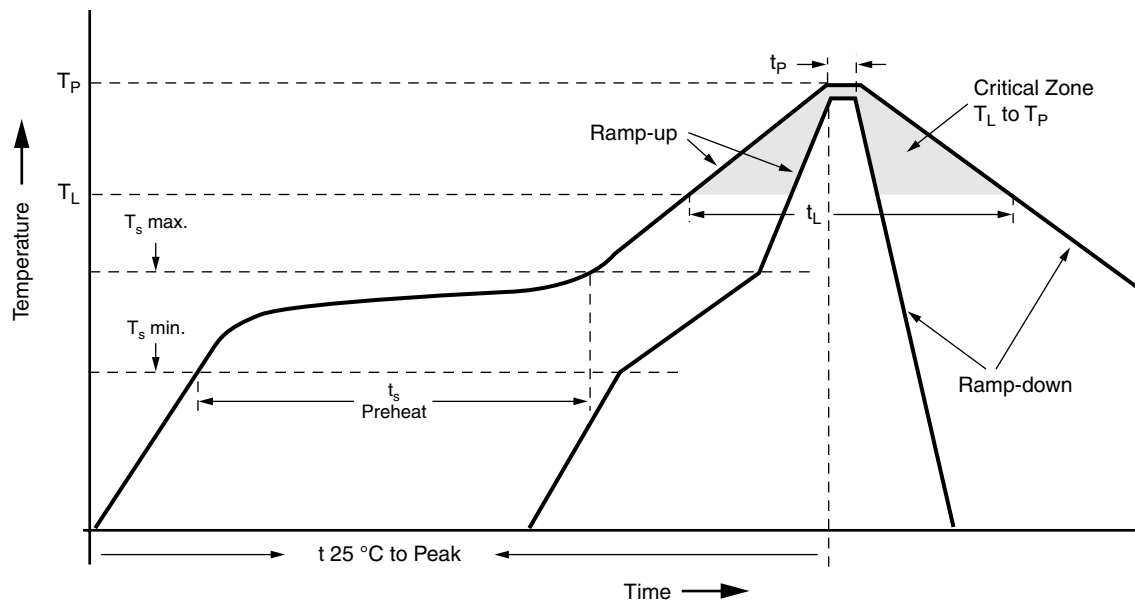
Ordering code: MALSECV00AG322FARK

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

<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/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**


<b>PROFILE FEATURE</b>	<b>SOLDERING CONDITION</b>		
	$\varnothing 4 \sim \varnothing 10$	$\varnothing 12.5$	$\varnothing 16$
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 ~ 150 s	40 ~ 120 s	40 ~ 100 s
$T_s$ max. to $T_L$			
Ramp-up rate	3 °C/s max.	3 °C/s max.	



PROFILE FEATURE		
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)					
	6.3	10	16	25	35	50
T2/T1						
- 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 <sub>R</sub> , 20 °C)	After 2 minutes at U <sub>R</sub>	$I_{L2} \leq 0.01 \times C_R \times U_R$ 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> .	$ESR = \tan \delta / 2 \pi f C_R$

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 2000 h	ΔC/C: ± 20 % 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: ± 20 % of initial value I <sub>L</sub> ≤ spec. limit tan δ ≤ 2 x spec. limit



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