

Aluminum Capacitors Power Economy Long Life Snap-in

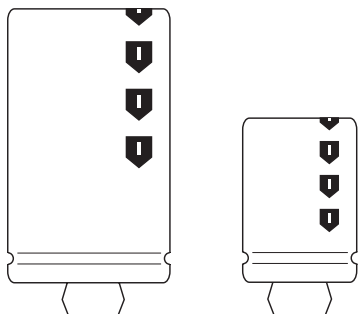
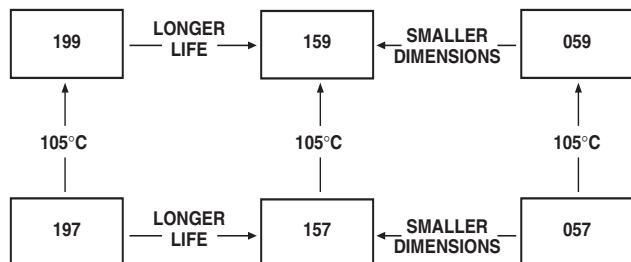


Fig.1 Component outlines.



FEATURES

- Polarized aluminum capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Useful life : 3000 hours at 105 °C



RoHS
COMPLIANT

APPLICATIONS

- Consumer electronics
- Whitegood motor control
- Electronic drives
- smps/ups

MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in μF).
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 (M for $\pm 20\%$).
- Rated voltage (in V).
- Name of manufacturer.
- Date code.
- '-' sign to identify the negative terminal, visible from the top and side of the capacitor.
- Code number (last 8 digits).
- Maximum operating temperature.

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case size ($\varnothing D \times L$ in mm)	22 × 25 to 35 × 50
Rated capacitance range, C_R	47 to 2200 μF
Tolerance on C_R	$\pm 20\%$
Rated voltage range, U_R	160 V; 200 V; 250 V; 400 V; 450 V
Category temperature range	-25 to +105 °C
Endurance test at 105 °C	2000 hours
Useful life at 105 °C	3000 hours
Useful life at 40 °C and $1.6 \times I_R$ applied	300000 hours
Shelf life at 0 V, 105 °C	500 hours
Based on sectional specification	IEC 60384-4/EN130300/W of JISC5141

SELECTION CHART FOR C_R , U_R AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm)					
C_R (μF)	U_R (V)				
	160	200	250	400	450
47	-	-	-	22 × 25	-
56	-	-	-	22 × 25	22 × 25
68	-	-	-	22 × 25	22 × 30
	-	-	-	-	22 × 25
82	-	-	-	22 × 30	22 × 35
	-	-	-	25 × 25	-
100	-	-	-	22 × 35	22 × 40
	-	-	-	25 × 30	25 × 30
	-	-	-	-	30 × 25
120	-	-	-	22 × 35	25 × 35
	-	-	-	25 × 30	-
	-	-	-	30 × 25	-

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES (ØD × L in mm)					
C _R (µF)	U _R (V)				
	160	200	250	400	450
150	-	-	-	22 × 40	-
	-	-	-	25 × 35	25 × 40
	-	-	-	30 × 30	30 × 30
	-	-	-	-	35 × 25
180	-	-	-	25 × 40	-
	-	-	-	30 × 30	30 × 35
	-	-	-	35 × 25	-
220	-	-	22 × 30	-	-
	-	-	25 × 25	-	30 × 40
	-	-	-	30 × 35	35 × 30
270	-	-	-	35 × 30	-
	-	-	22 × 35	25 × 50	30 × 45
	-	-	25 × 30	30 × 40	35 × 35
330	-	-	30 × 25	35 × 30	-
	22 × 25	22 × 35	22 × 40	-	30 × 50
	-	-	25 × 30	30 × 45	35 × 40
390	-	-	30 × 25	35 × 35	-
	22 × 30	22 × 35	-	30 × 50	-
	-	25 × 30	25 × 35	35 × 40	35 × 45
470	-	-	30 × 30	-	-
	22 × 35	-	-	-	35 × 50
	-	-	25 × 40	35 × 50	-
560	-	30 × 25	30 × 30	-	-
	-	-	35 × 25	35 × 45	-
	22 × 40	-	-	-	-
680	25 × 30	-	-	-	-
	-	30 × 30	30 × 35	35 × 50	-
	-	-	35 × 30	-	-
820	25 × 35	-	-	-	-
	-	30 × 30	30 × 40	-	-
	-	-	35 × 35	-	-
1000	-	35 × 25	-	-	-
	25 × 40	25 × 50	30 × 45	-	-
	30 × 30	30 × 35	35 × 35	-	-
1200	35 × 25	35 × 30	35 × 40	-	-
	30 × 35	30 × 45	-	-	-
	35 × 30	35 × 35	35 × 40	-	-
1500	-	-	35 × 40	-	-
	25 × 50	30 × 50	35 × 45	-	-
	30 × 40	-	35 × 50	-	-
1800	35 × 30	-	-	-	-
	30 × 45	35 × 45	-	-	-
	35 × 35	-	-	-	-
2200	30 × 50	-	-	-	-
	35 × 45	35 × 50	-	-	-
2200	35 × 50	-	-	-	-

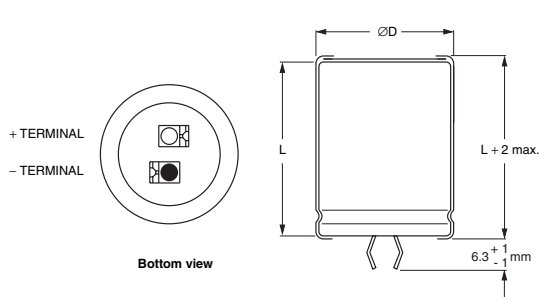
DIMENSIONS in millimeters AND AVAILABLE FORMS


Fig.2 Two terminal snap-in.

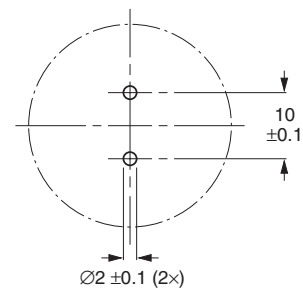


Fig.3 Mounting hole diagram.

The minus terminal can be marked with a black dot or with an imprinted sign.



Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE ØD × L	ØD _{max}	L _{max}	MASS (g)	PACKAGING QUANTITIES	CARDBOARD BOX DIMENSIONS L × W × H
22 × 25	22.5	25.5	≈12	216	280 × 240 × 140
22 × 30	22.5	30.5	≈16	216	280 × 240 × 140
22 × 35	22.5	35.5	≈20	216	280 × 240 × 140
22 × 40	22.5	40.5	≈23	144	280 × 240 × 105
22 × 45	22.5	45.5	≈26	144	280 × 240 × 140
22 × 50	22.5	50.5	≈29	144	280 × 240 × 140
25 × 25	25.5	25.5	≈20	216	280 × 240 × 140
25 × 30	25.5	32.0	≈22	216	280 × 240 × 140
25 × 35	25.5	35.5	≈24	216	280 × 240 × 140
25 × 40	25.5	40.5	≈27	144	280 × 240 × 105
25 × 45	25.5	45.5	≈32	144	280 × 240 × 140
25 × 50	25.5	50.5	≈38	144	280 × 240 × 140
30 × 25	30.5	27.5	≈25	168	280 × 240 × 140
30 × 30	30.5	32.5	≈30	168	280 × 240 × 140
30 × 35	30.5	37.5	≈35	168	280 × 240 × 140
30 × 40	30.5	41.5	≈40	112	280 × 240 × 105
30 × 45	30.5	46.5	≈45	112	280 × 240 × 140
30 × 50	30.5	51.5	≈50	112	280 × 240 × 140
35 × 25	35.5	25.5	≈33	126	280 × 240 × 140
35 × 30	35.5	32.5	≈40	126	280 × 240 × 140
35 × 35	35.5	35.5	≈48	126	280 × 240 × 140
35 × 40	35.5	41.5	≈55	84	280 × 240 × 105
35 × 45	35.5	46.5	≈63	84	280 × 240 × 140
35 × 50	35.5	51.5	≈72	84	280 × 240 × 140

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C _R	rated capacitance at 120 Hz
I _R	rated RMS ripple current at 120 Hz, 105 °C
I _{L5}	max. leakage current after 5 minutes at U _R
ESR	max. equivalent series resistance at 120 Hz; note 1

ORDERING EXAMPLE

Electrolytic capacitor 199 series

820 µF/160V; ±20%

Nominal case size: Ø25 × 40 mm

Catalog number: 2222 199 51821.

Note

- ESR at 100 Hz is approximately 1.05 × ESR 120 Hz.
- Unless otherwise specified, all electrical values in Table 2 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75%.

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION							
U _R (V)	C _R 120 Hz (µF)	NOMINAL CASE SIZE ØD × L (mm)	I _R 120 Hz (A)	I _{L5} (mA)	MAX. ESR 120Hz ⁽¹⁾ (Ω)	MAX. Z 10KHz (mΩ)	CATALOG NUMBER 2222
160	330	22 × 25	1.00	1.06	0.50	316	199 51331
	390	22 × 30	1.17	1.25	0.43	260	199 51391
	470	22 × 35	1.35	1.50	0.35	216	199 51471
	560	22 × 40	1.53	1.50	0.30	183	199 51561
	560	25 × 30	1.42	1.50	0.30	199	199 41561
	680	25 × 35	1.60	1.50	0.24	170	199 51681
	820	25 × 40	1.80	1.50	0.20	144	199 51821
	820	30 × 30	1.67	1.50	0.20	166	199 41821
	820	35 × 25	1.44	1.50	0.30	219	199 31821
	1000	30 × 35	1.86	1.50	0.17	144	199 41102



ELECTRICAL DATA AND ORDERING INFORMATION							
U _R (V)	C _R 120 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I _R 120 Hz (A)	I _{L5} (mA)	MAX. ESR 120Hz ⁽¹⁾ (Ω)	MAX. Z 10KHz (mΩ)	CATALOG NUMBER 2222
160	1000	35 × 30	1.82	1.50	0.25	157	199 31102
	1200	25 × 50	2.24	1.50	0.14	105	199 51122
	1200	30 × 40	2.06	1.50	0.21	124	199 41122
	1200	35 × 30	1.81	1.50	0.21	152	199 31122
	1500	30 × 45	2.30	1.50	0.11	106	199 51152
	1500	35 × 35	1.97	1.50	0.17	134	199 41152
	1800	30 × 50	2.51	1.50	0.09	92	199 51182
	1800	35 × 45	2.45	1.50	0.14	102	199 41182
	2200	35 × 50	2.66	1.50	0.11	90	199 51222
200	330	22 × 35	1.19	1.32	0.50	241	199 42331
	390	22 × 35	1.27	1.50	0.43	212	199 42391
	390	25 × 30	1.27	1.50	0.43	219	199 52391
	470	30 × 25	1.28	1.50	0.35	231	199 52471
	560	30 × 30	1.53	1.50	0.30	180	199 52561
	680	30 × 30	1.57	1.50	0.24	167	199 52681
	680	35 × 25	1.36	1.50	0.37	225	199 62681
	820	25 × 50	2.04	1.50	0.20	115	199 32821
	820	30 × 35	1.75	1.50	0.20	146	199 42821
	820	35 × 30	1.72	1.50	0.30	160	199 52821
	1000	30 × 45	2.14	1.50	0.17	113	199 42102
	1000	35 × 35	1.90	1.50	0.25	140	199 52102
	1200	30 × 50	2.36	1.50	0.14	98	199 42122
	1500	35 × 45	2.31	1.50	0.17	104	199 52152
	1800	35 × 50	2.52	1.50	0.14	92	199 52182
250	220	22 × 30	1.14	1.10	0.75	294	199 43221
	220	25 × 25	0.94	1.10	0.75	317	199 53221
	270	22 × 35	1.11	1.35	0.61	240	199 43271
	270	25 × 30	1.12	1.35	0.61	247	199 53271
	270	30 × 25	1.11	1.35	0.61	274	199 63271
	330	22 × 40	1.27	1.50	0.50	199	199 33331
	330	25 × 30	1.20	1.50	0.50	216	199 43331
	330	30 × 25	1.17	1.50	0.50	250	199 53331
	390	25 × 35	1.35	1.50	0.43	186	199 43391
	390	30 × 30	1.38	1.50	0.43	196	199 53391
	470	25 × 40	1.52	1.50	0.35	158	199 33471
	470	30 × 30	1.43	1.50	0.35	181	199 43471
	470	35 × 25	1.28	1.50	0.53	240	199 53471
	560	30 × 35	1.60	1.50	0.30	158	199 53561
	560	35 × 30	1.59	1.50	0.44	172	199 63561
	680	30 × 40	1.79	1.50	0.24	135	199 43681
	680	35 × 35	1.76	1.50	0.37	150	199 53682
	820	30 × 45	2.00	1.50	0.20	116	199 43821
	820	35 × 35	1.77	1.50	0.30	147	199 53821
	820	35 × 40	1.96	1.50	0.30	130	199 63821
	1000	35 × 40	1.96	1.50	0.25	127	199 53102
	1000	35 × 45	2.17	1.50	0.25	111	199 63102
	1200	35 × 45	2.16	1.50	0.21	110	199 43122
	1200	35 × 50	2.38	1.50	0.21	98	199 53122



ELECTRICAL DATA AND ORDERING INFORMATION							
U _R (V)	C _R 120 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I _R 120 Hz (A)	I _{L5} (mA)	MAX. ESR 120Hz ⁽¹⁾ (Ω)	MAX. Z 10KHz (mΩ)	CATALOG NUMBER 2222
400	47	22 × 25	0.41	0.38	5.29	3127	199 56479
	56	22 × 25	0.45	0.45	4.44	2635	199 56569
	68	22 × 25	0.49	0.54	3.66	2161	199 56689
	82	22 × 30	0.57	0.66	3.03	1788	199 46829
	82	25 × 25	0.58	0.66	3.03	1808	199 56829
	100	22 × 35	0.66	0.80	2.49	1467	199 46101
	100	25 × 30	0.67	0.80	2.49	1472	199 56101
	120	22 × 35	0.72	0.96	2.07	1231	199 46121
	120	25 × 30	0.73	0.96	2.07	1238	199 56121
	120	30 × 25	0.75	0.96	2.07	1266	199 66121
	150	22 × 40	0.84	1.20	1.66	990	199 36151
	150	25 × 35	0.85	1.20	1.66	997	199 46151
	150	30 × 30	0.89	1.20	1.66	1006	199 56151
	180	25 × 40	0.97	1.44	1.38	835	199 36181
	180	30 × 30	0.96	1.44	1.38	854	199 46181
	180	35 × 25	0.94	1.44	1.38	907	199 56181
	220	30 × 35	1.09	1.50	1.13	707	199 56221
	220	35 × 30	1.12	1.50	1.13	719	199 66221
	270	25 × 50	1.25	1.50	0.92	564	199 46271
	270	30 × 40	1.24	1.50	0.92	582	199 56271
	270	35 × 30	1.19	1.50	0.92	611	199 66271
	330	30 × 45	1.41	1.50	0.75	480	199 56331
	330	35 × 35	1.34	1.50	0.75	510	199 66331
	390	30 × 50	1.56	1.50	0.64	410	199 46391
390	35 × 40	1.50	1.50	0.64	435	199 56391	
470	35 × 45	1.68	1.50	0.53	365	199 56471	
470	35 × 50	1.68	1.50	0.53	365	199 66471	
560	35 × 50	1.85	1.50	0.44	311	199 56561	
450	56	22 × 25	0.46	0.50	4.44	2161	199 57569
	68	22 × 30	0.53	0.61	3.66	1776	199 47689
	68	25 × 25	0.54	0.61	3.66	1797	199 57689
	82	22 × 35	0.62	0.74	3.03	1473	199 57829
	100	22 × 40	0.71	0.90	2.49	1211	199 37101
	100	25 × 30	0.69	0.90	2.49	1225	199 47101
	100	30 × 25	0.71	0.90	2.49	1254	199 57101
	120	25 × 35	0.78	1.08	2.07	1025	199 57121
	150	25 × 40	0.91	1.35	1.66	826	199 47151
	150	30 × 30	0.90	1.35	1.66	847	199 57151
	150	35 × 25	0.89	1.35	1.66	902	199 67151
	180	30 × 35	1.02	1.50	1.38	712	199 57181
	220	30 × 40	1.16	1.50	1.13	588	199 47221
	220	35 × 30	1.12	1.50	1.13	618	199 57221
	270	30 × 45	1.31	1.50	0.92	484	199 47271
	270	35 × 35	1.26	1.50	0.75	515	199 57271
	330	30 × 50	1.48	1.50	0.75	402	199 47331
	330	35 × 40	1.42	1.50	1.13	429	199 57331
	390	35 × 45	1.58	1.50	0.64	365	199 57391
	470	35 × 50	1.76	1.50	0.53	309	199 57471

Note

1. ESR at 100 Hz is approximately 1.05 × ESR 120 Hz.



ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≥ 400 V versions	$U_s = 1.1 \times U_R$
	≤ 250 V versions	$U_s = 1.15 \times U_R$
Reverse voltage	≤ 1 V	–
Current		
Leakage current	after 5 minutes at U_R	$I_{L5} \leq 0.02 C_R \times U_R$ or 1.5 mA, whichever is smaller
Inductance		
Equivalent series inductance (ESL)	all case sizes	19nH typical / 25nH max.

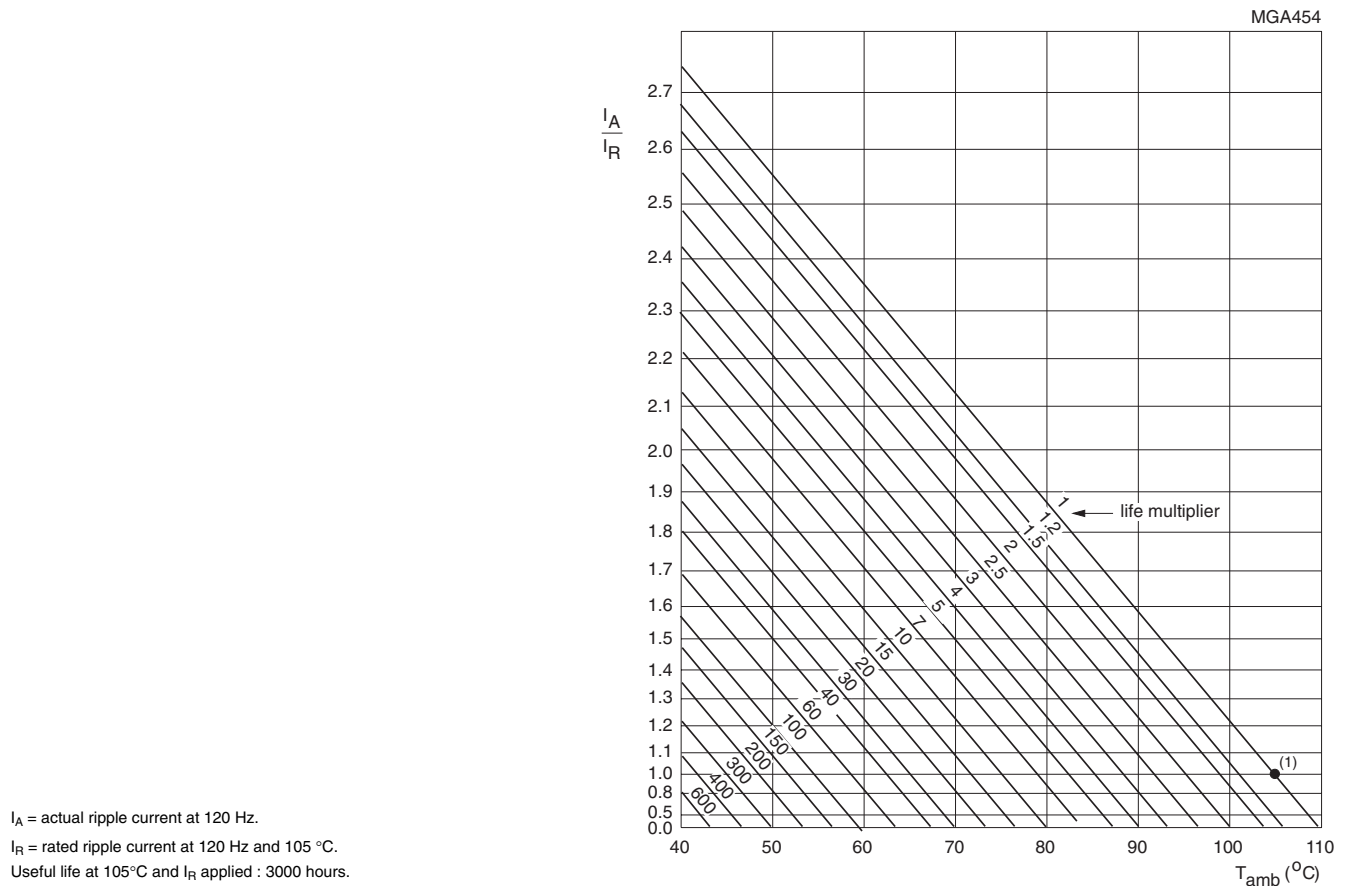
Table 3

LOW TEMPERATURE CHARACTERISTIC (AT 120 HZ)						
DESCRIPTION		U_R (V) ⁽¹⁾				
		160	200	250	400	450
Impedance ratio	$Z(-25\text{ °C})/Z(+20\text{ °C})$	4	4	4	4	4

Note

1. Impedance ratio shall not exceed the given values.

RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 120 Hz.
 I_R = rated ripple current at 120 Hz and 105 °C.
 Useful life at 105°C and I_R applied : 3000 hours.

Fig.3 Multiplier of useful life as a function of ambient temperature and ripple current load.

Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	I_R MULTIPLIER
50	0.90
100	0.95
120	1.00
500	1.20
1000	1.30
≥ 10000	1.40

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 105\text{ }^\circ\text{C}$; U_R applied: 2000 hours	$\Delta C/C: \pm 15\%$ $ESR \leq 1.3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105\text{ }^\circ\text{C}$; U_R and I_R applied: 3000 hours	$\Delta C/C: \pm 30\%$ $ESR \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 105\text{ }^\circ\text{C}$; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 20\%$ $ESR \leq 2 \times \text{spec. limit}$ $I_{L5} \leq 1 \times \text{spec. limit}$



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