

Aluminum Capacitors

Power General Purpose Snap-in

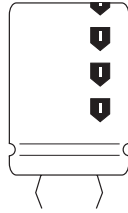
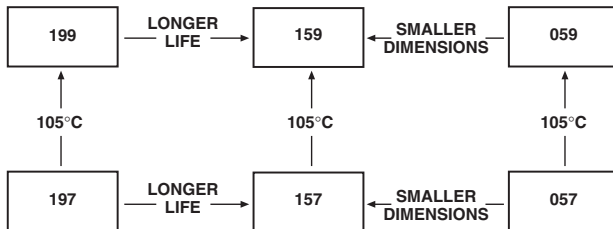


Fig.1 Component outline.



QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case size ($\varnothing D \times L$ in mm)	22 × 25 to 35 × 50
Rated capacitance range (E6/E12 series), C_R	56 to 2200 μF
Tolerance on C_R	±20%
Rated voltage range, U_R	160 V; 200 V; 250 V; 400 V; 450 V
Category temperature range	-25 to +85 °C
Useful life at 85 °C	3000 hours
Useful life at 40 °C and $1.4 \times I_R$ applied	90000 hours
Shelf life at 0 V, 85 °C	1000 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	
56	-	-	-	-	22 × 25	
68	-	-	-	22 × 25	22 × 25	
82	-	-	-	22 × 25	22 × 30	
100	-	-	-	-	25 × 25	
	-	-	-	22 × 30	22 × 35	
120	-	-	-	25 × 25	25 × 30	
	-	-	-	-	22 × 40	
	-	-	-	22 × 35	25 × 30	
150	-	-	-	25 × 35	30 × 25	
	22 × 25	22 × 25	22 × 25	22 × 35	-	
	-	-	-	25 × 30	25 × 35	
	-	-	-	30 × 25	30 × 30	
180	22 × 25	22 × 25	22 × 25	22 × 40	-	
	-	-	-	25 × 35	25 × 40	
	-	-	-	30 × 25	30 × 30	
	-	-	-	-	35 × 30	
220	22 × 25	22 × 25	22 × 30	-	-	
	-	-	25 × 25	25 × 40	30 × 35	
	-	-	-	30 × 30	35 × 30	
	-	-	-	-	-	
270	22 × 25	22 × 25	22 × 30	-	30 × 40	
	-	-	25 × 25	30 × 35	35 × 35	
	-	-	-	35 × 30	-	
	-	-	-	-	-	

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case insulated with a blue sleeve
- Useful life: 3000 hours at 85 °C.



RoHS COMPLIANT

APPLICATIONS

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

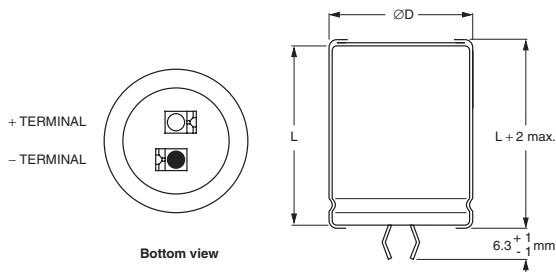
MARKING

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

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

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

DIMENSIONS in millimeters AND AVAILABLE FORMS



The minus terminal can be marked with an imprinted sign.

Fig.2 Two terminal snap-in.

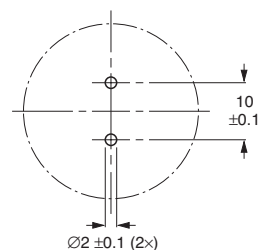


Fig.3 Mounting hole diagram.

Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE ∅D × L	∅D _{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



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
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, 85 °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 197 series
1000 µF/200 V; ±20%
Nominal case size: Ø30 × 40 mm
Catalog number: 2222 197 22102.

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 85 °C (A)	I _{L5} 5 min (mA)	MAX. ESR 120 ⁽¹⁾ (Ω)	CATALOG NUMBER 2222
160	150	22 × 25	0.92	0.48	1.11	197 11151
	180	22 × 25	0.99	0.58	0.92	197 11181
	220	22 × 25	1.08	0.70	0.75	197 11221
	270	22 × 25	1.16	0.86	0.61	197 11271
	330	22 × 25	1.24	1.06	0.50	197 11331
	390	22 × 30	1.45	1.25	0.43	197 11391
	470	22 × 30	1.53	1.50	0.35	197 11471
	470	25 × 25	1.45	1.50	0.35	197 21471
	560	30 × 25	1.67	1.50	0.30	197 31561
	680	25 × 30	1.82	1.50	0.24	197 21681
	680	30 × 25	1.70	1.50	0.24	197 31681
	820	25 × 35	2.04	1.50	0.20	197 21821
	1000	30 × 30	2.07	1.50	0.17	197 31102
	1000	35 × 30	2.24	1.50	0.17	197 41102
	1200	30 × 35	2.28	1.50	0.17	197 21122
	1200	35 × 30	2.22	1.50	0.17	197 31122
	1500	35 × 35	2.42	1.50	0.15	197 21152
	1500	35 × 40	2.72	1.50	0.13	197 31152
	1800	30 × 50	3.08	1.50	0.11	197 11182
	1800	35 × 40	2.66	1.50	0.13	197 21182
2200	35 × 50	3.25	1.50	0.10	197 41222	
200	150	22 × 25	1.06	0.60	1.11	197 12151
	180	22 × 25	1.15	0.72	0.92	197 12181
	220	22 × 25	1.24	0.88	0.75	197 12221
	270	22 × 25	1.34	1.08	0.61	197 12271
	330	22 × 30	1.58	1.32	0.50	197 12331
	330	25 × 25	1.53	1.32	0.50	197 22331
	390	25 × 25	1.59	1.50	0.45	197 22391
	470	22 × 35	1.92	1.50	0.35	197 12471
	470	25 × 30	1.92	1.50	0.35	197 22471
	470	30 × 25	1.86	1.50	0.38	197 32471
	560	25 × 35	2.16	1.50	0.30	197 22561
	560	30 × 25	1.90	1.50	0.34	197 32561
	680	25 × 40	2.44	1.50	0.24	197 22681
	680	30 × 30	2.28	1.50	0.27	197 32681
	820	30 × 35	2.55	1.50	0.24	197 32821
	820	35 × 30	2.52	1.50	0.26	197 42821
	1000	30 × 40	2.84	1.50	0.20	197 22102
	1000	35 × 35	2.79	1.50	0.22	197 32102
	1200	30 × 45	3.16	1.50	0.17	197 12122
	1200	35 × 35	2.77	1.50	0.21	197 22122
1500	35 × 50	3.72	1.50	0.15	197 22152	
2200	35 × 50	3.70	1.50	0.11	197 12222	



ELECTRICAL DATA AND ORDERING INFORMATION						
U_R (V)	C_R 120 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I_R 120 Hz 85 °C (A)	I_{L5} 5 min (mA)	MAX. ESR 120⁽¹⁾ (Ω)	CATALOG NUMBER 2222
250	150	22 × 25	1.07	0.75	1.11	197 13151
	180	22 × 25	1.16	0.90	0.92	197 13181
	220	22 × 30	1.36	1.10	0.75	197 13221
	220	25 × 25	1.34	1.10	0.75	197 23221
	270	22 × 30	1.47	1.35	0.61	197 13271
	270	25 × 25	1.42	1.35	0.61	197 23271
	330	22 × 35	1.70	1.50	0.50	197 13331
	330	25 × 30	1.71	1.50	0.50	197 23331
	330	30 × 25	1.68	1.50	0.50	197 33331
	390	22 × 40	1.92	1.50	0.43	197 13391
	390	25 × 35	1.92	1.50	0.43	197 23391
	390	30 × 25	1.74	1.50	0.43	197 33391
	470	25 × 40	2.17	1.50	0.35	197 23471
	470	30 × 30	2.07	1.50	0.35	197 33471
	560	25 × 40	2.28	1.50	0.27	197 53561
	560	30 × 35	2.32	1.50	0.30	197 33561
	680	25 × 50	2.73	1.50	0.24	197 13681
	680	30 × 40	2.60	1.50	0.24	197 23681
	680	35 × 30	2.36	1.50	0.27	197 33681
	820	30 × 45	2.90	1.50	0.20	197 13821
	820	35 × 35	2.61	1.50	0.24	197 23821
	1000	30 × 50	3.21	1.50	0.17	197 13102
	1000	35 × 40	2.89	1.50	0.21	197 23102
	1200	35 × 50	3.49	1.50	0.19	197 13122
400	68	22 × 25	0.57	0.55	3.66	197 16689
	82	22 × 25	0.62	0.66	3.03	197 16829
	100	22 × 30	0.73	0.80	2.49	197 16101
	100	25 × 25	0.73	0.80	2.49	197 26101
	120	22 × 35	0.84	0.96	2.07	197 16121
	120	25 × 35	0.89	0.96	2.07	197 26121
	150	22 × 35	0.93	1.20	1.66	197 16151
	150	25 × 30	0.94	1.20	1.66	197 26151
	150	30 × 25	0.96	1.20	1.66	197 36151
	180	25 × 35	1.07	1.44	1.38	197 26181
	180	30 × 25	1.03	1.44	1.38	197 36181
	220	25 × 40	1.23	1.50	1.13	197 26221
	220	30 × 30	1.21	1.50	1.13	197 36221
	270	30 × 35	1.38	1.50	0.92	197 26271
	270	35 × 30	1.41	1.50	0.92	197 36271
	330	30 × 40	1.57	1.50	0.75	197 26331
	330	35 × 30	1.49	1.50	0.78	197 36331
	390	30 × 45	1.75	1.50	0.64	197 16391
	390	35 × 35	1.67	1.50	0.66	197 26391
	470	30 × 50	1.96	1.50	0.53	197 16471
	470	35 × 40	1.87	1.50	0.56	197 26471
	560	35 × 45	2.08	1.50	0.47	197 16561
	680	35 × 50	2.31	1.50	0.39	197 16681
	450	56	22 × 25	0.53	0.28	4.44
68		22 × 25	0.58	0.34	3.66	197 17689
82		22 × 30	0.68	0.41	3.03	197 17829
82		25 × 25	0.68	0.41	3.03	197 27829
100		22 × 35	0.78	0.50	2.49	197 17101
100		25 × 30	0.80	0.50	2.49	197 27101
120		22 × 40	0.89	0.60	2.07	197 17121
120		25 × 30	0.86	0.60	2.07	197 27121
120		30 × 25	0.89	0.60	2.07	197 37121
150		25 × 35	1.00	0.75	1.66	197 27151
150		30 × 30	1.05	0.75	1.66	197 37151
180		25 × 40	1.14	0.90	1.38	197 27181
180		30 × 30	1.13	0.90	1.38	197 37181
180		35 × 30	1.22	0.90	1.38	197 47181
220		30 × 35	1.29	1.10	1.13	197 27221
220		35 × 30	1.32	1.10	1.13	197 37221
270		30 × 40	1.47	1.35	0.92	197 17271
330		30 × 50	1.74	1.50	0.75	197 17331
330		35 × 40	1.69	1.50	0.75	197 27331
390		35 × 50	1.97	1.50	0.64	197 27391
470		35 × 50	2.10	1.50	0.53	197 17471

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

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

- Impedance ratio shall not exceed the given values.

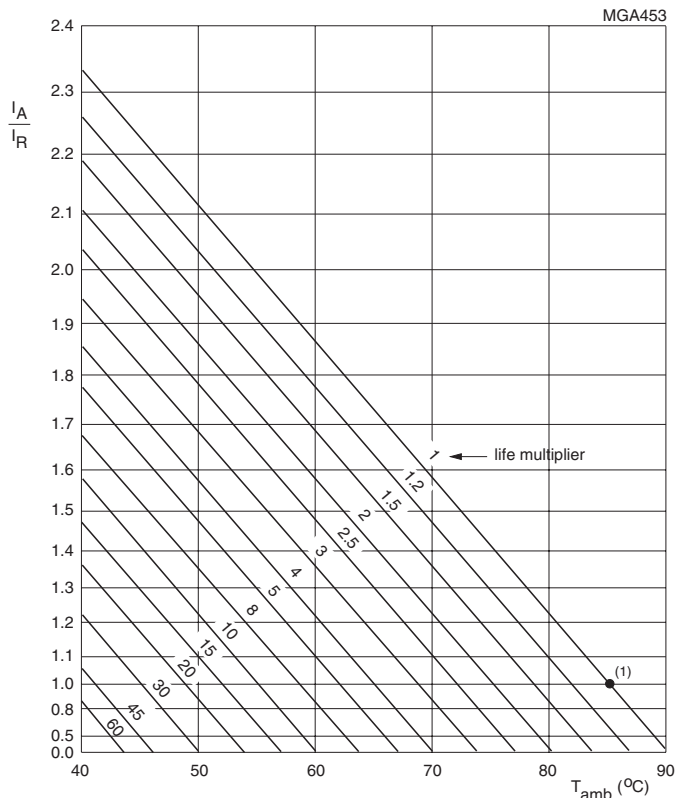
Table 4

DISSIPATION FACTOR (tan δ at 120 Hz, 20 °C)						
DESCRIPTION		U_R (V)				
		160	200	250	400	450
Tan δ (max.)		0.10 ⁽¹⁾	0.10 ⁽¹⁾	0.10 ⁽¹⁾	0.15	0.15

Note

- 0.15 for $\varnothing D = 35$ mm.

RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 120 Hz.

I_R = rated ripple current at 120 Hz and 85 °C.

(1) Useful life at 85 °C and I_R applied: 3000 hours.

Fig.4 Multiplier of useful life as a function of ambient temperature and ripple current load.

Table 5

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY		
FREQUENCY (Hz)	I_R MULTIPLIER	
	160 to 250 V	400 and 450 V
60	0.81	0.90
100	0.97	0.95
120	1.00	1.00
500	1.32	1.20
1000	1.45	1.30
≥ 10000	1.50	1.40

Table 6

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ }^\circ\text{C}$; U_R and I_R applied; 3000 hours	$\Delta C/C: \pm 30\%$ ESR $\leq 3 \times$ spec. limit $I_{L5} \leq$ 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	$T_{amb} = 85\text{ }^\circ\text{C}$; no voltage applied; 1000 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 20\%$ ESR $\leq 2 \times$ spec. limit $I_{L5} \leq 1 \times$ spec. limit