Aluminum Capacitors
Radial Low Profile, 7 mm

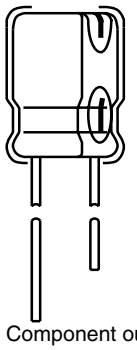


Fig.1 Component outline

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue vinyl sleeve
- Charge and discharge proof
- Low profile, 7 mm height
- Miniaturized, high CV-product per unit volume
- Lead (Pb)-free versions are RoHS compliant

Pb-free
RoHS COMPLIANT

APPLICATIONS

- General purpose; industrial, automotive and audio-video
- Low surface demand on printed-circuit board
- Coupling, decoupling, smoothing, filtering and timing
- Portable and mobile equipment (small size, low mass), low profile equipment

MARKING

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

- Rated capacitance (in µF)
- Rated voltage (in V)
- Negative terminal identification
- Code indicating factory of origin
- Name of manufacturer
- Date code, in accordance with IEC 60062
- Series number (097)

QUICK REFERENCE DATA	
DESCRIPTION	**VALUE**
Nominal case sizes (∅ D x L in mm)	4 x 7 to 6.3 x 7
Rated capacitance range, C_R	0.1 to 220 µF
Tolerance on C_R	± 20 %
Rated voltage, U_R	6.3 to 63 V
Category temperature range	- 40 to + 85 °C
Endurance test at 85 °C	1000 hours
Useful life at 85 °C	1500 hours
Useful life at 40 °C , 1.4 x I_R applied	40 000 hours
Shelf life at 0 V, 85 °C	500 hours
Based on sectional specification	IEC 60384-4/EN130300
Climatic category IEC 60068	40/085/56

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

C_R (µF)	U_R (V)						
	6.3	**10**	**16**	**25**	**35**	**50**	**63**
0.10	-	-	-	-	-	-	4 x 7
0.22	-	-	-	-	-	-	4 x 7
0.47	-	-	-	-	-	-	4 x 7
1.0	-	-	-	-	-	-	4 x 7
2.2	-	-	-	-	-	-	4 x 7
3.3	-	-	-	-	-	4 x 7	5 x 7
4.7	-	-	-	-	4 x 7	5 x 7	6.3 x 7
10	-	-	4 x 7	-	5 x 7	6.3 x 7	6.3 x 7
22	4 x 7	-	5 x 7	-	6.3 x 7	6.3 x 7	-
33	-	5 x 7	-	6.3 x 7	6.3 x 7	-	-
47	5 x 7	-	6.3 x 7	6.3 x 7	-	-	-
100	-	6.3 x 7	6.3 x 7	-	-	-	-
220	6.3 x 7	-	-	-	-	-	-

DIMENSIONS in millimeters, **AND AVAILABLE FORMS**

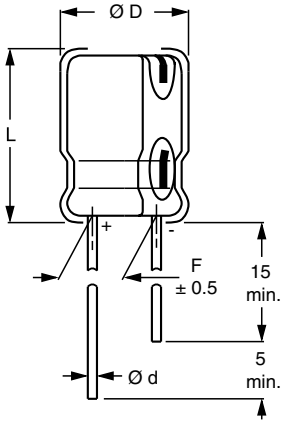


Fig.2 **Form CA**: Long leads

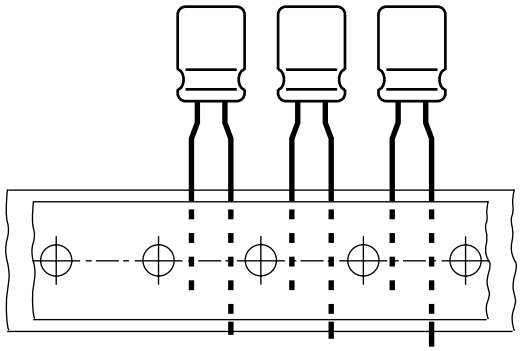


Fig.2 **Form TFA:**
Taped in box (ammopack), formed leads, pitch F = 5 mm

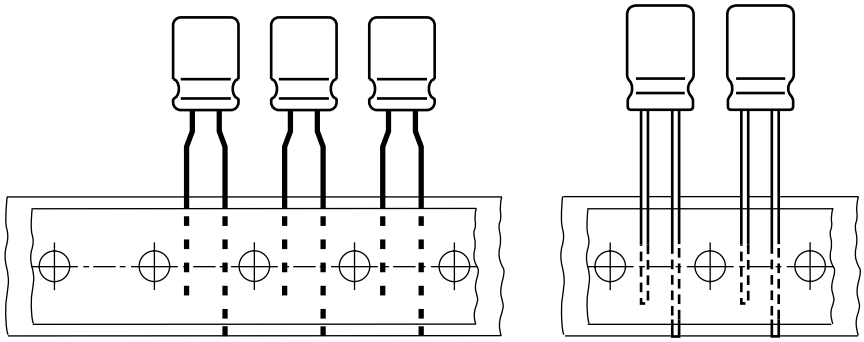


Fig.2 **Form TNA:** Taped in box (ammopack), pitch F = 2.5 mm

DIMENSIONS in millimeters **AND PACKAGING QUANTITIES**								
NOMINAL CASE SIZE Ø D x L	**CASE CODE**	**Ø d**	**Ø $D_{max.}$**	**$L_{max.}$**	**F**	**PACKAGING QUANTITIES**		
						FORM CA	**FORM TFA**	**FORM TNA**
4 x 7	71	0.45	4.5	8	1.5 ± 0.5	2000	2000	2000
5 x 7	72	0.45	5.5	8	2.0 ± 0.5	1000	2000	2000
6.3 x 7	73	0.45	6.8	8	2.5 ± 0.5	1000	2000	2000

Note
Detailed tape dimensions see section ‘PACKAGING’.

ELECTRICAL DATA

SYMBOL	DESCRIPTION
C_R	rated capacitance at 120 Hz, tolerance ± 20 %
I_R	rated RMS ripple current at 120 Hz, 85 °C
I_{L2}	max. leakage current after 2 minutes at U_R
tan δ	max. dissipation factor at 120 Hz
Z	max. impedance at 100 kHz

Note
Unless otherwise specified, all electrical values in Table 2 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75 %.

ORDERING EXAMPLE

Electrolytic capacitor 097 series

100 µF/16 V; ± 20 %

Nominal case size: Ø 6.3 x 7 mm; Form TFA

Ordering Code: MAL209735101E6
Former 12NC: 2222 097 35101

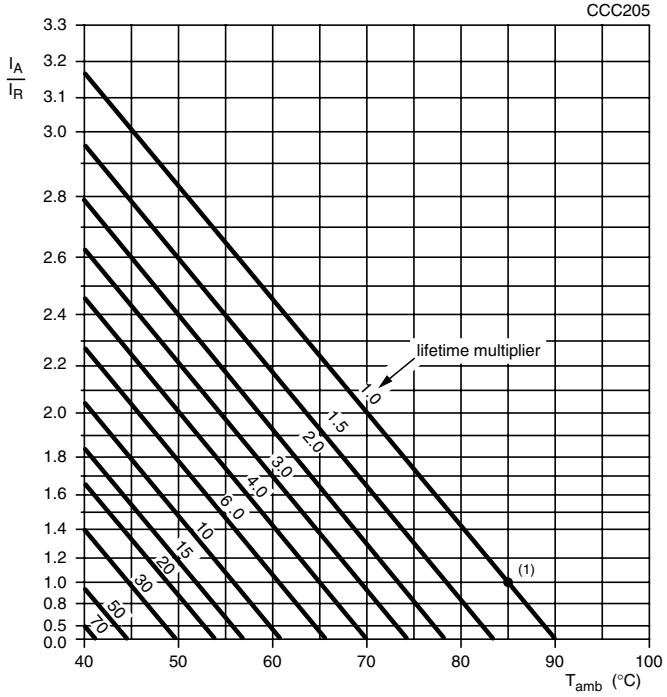
ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 120 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 120 Hz 85 °C (mA)	I_{L2} 2 min (µA)	tan δ 120 Hz	Z 100 kHz (Ω)	ORDERING CODE MAL2097.....					
							BULK LONG LEADS		TAPED AMMOPACK			
							FORM CA	F (mm)	FORM TFA	F (mm)	FORM TNA	F (mm)
6.3	22	4 x 7	31	3	0.24	8.4	53229E6	1.5	33229E6	5.0	73229E6	2.5
	47	5 x 7	47	3	0.24	4.6	53479E6	2.0	33479E6	5.0	73479E6	2.5
	220	6.3 x 7	90	14	0.24	1.8	53221E6	2.5	33221E6	5.0	73221E6	2.5
10	33	5 x 7	43	4	0.20	3.7	54339E6	2.0	34339E6	5.0	74339E6	2.5
	100	6.3 x 7	80	10	0.20	2.2	54101E6	2.5	34101E6	5.0	74101E6	2.5
16	10	4 x 7	25	3	0.16	10	55109E6	1.5	35109E6	5.0	75109E6	2.5
	22	5 x 7	39	4	0.16	5	55229E6	2.0	35229E6	5.0	75229E6	2.5
	47	6.3 x 7	59	8	0.16	3.5	55479E6	2.5	35479E6	5.0	75479E6	2.5
	100	6.3 x 7	90	16	0.16	2.5	55101E6	2.5	35101E6	5.0	75101E6	2.5
25	33	6.3 x 7	53	9	0.14	2.6	56339E6	2.5	36339E6	5.0	76339E6	2.5
	47	6.3 x 7	65	12	0.14	1.9	56479E6	2.5	36479E6	5.0	76479E6	2.5
35	4.7	4 x 7	20	3	0.12	10	50478E6	1.5	30478E6	5.0	70478E6	2.5
	10	5 x 7	30	4	0.12	5.6	50109E6	2.0	30109E6	5.0	70109E6	2.5
	22	6.3 x 7	47	8	0.12	3	50229E6	2.5	30229E6	5.0	70229E6	2.5
	33	6.3 x 7	60	12	0.12	2.6	50339E6	2.5	30339E6	5.0	70339E6	2.5
50	3.3	4 x 7	18	3	0.10	14	51338E6	1.5	31338E6	5.0	71338E6	2.5
	4.7	5 x 7	23	3	0.10	10	51478E6	2.0	31478E6	5.0	71478E6	2.5
	10	6.3 x 7	34	5	0.10	5.5	51109E6	2.5	31109E6	5.0	71109E6	2.5
	22	6.3 x 7	53	11	0.10	2.9	51229E6	2.5	31229E6	5.0	71229E6	2.5
63	0.10	4 x 7	1.3	3	0.08	170	58107E6	1.5	38107E6	5.0	78107E6	2.5
	0.22	4 x 7	2.9	3	0.08	110	58227E6	1.5	38227E6	5.0	78227E6	2.5
	0.47	4 x 7	7.9	3	0.08	66	58477E6	1.5	38477E6	5.0	78477E6	2.5
	1	4 x 7	11	3	0.08	36	58108E6	1.5	38108E6	5.0	78108E6	2.5
	2.2	4 x 7	17	3	0.08	19	58228E6	1.5	38228E6	5.0	78228E6	2.5
	3.3	5 x 7	21	3	0.08	14	58338E6	2.0	38338E6	5.0	78338E6	2.5
	4.7	6.3 x 7	26	3	0.08	10	58478E6	2.5	38478E6	5.0	78478E6	2.5
	10	6.3 x 7	40	7	0.08	5.5	58109E6	2.5	38109E6	5.0	78109E6	2.5

ADDITIONAL ELECTRICAL DATA

DESCRIPTION	CONDITIONS	VALUE
Voltage		
Surge voltage		$U_s \leq 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 2 minutes at U_R	$I_{L2} \leq 0.01\ C_R \times U_R$ or 3 µA (whichever is greater)
Resistance		
Equivalent series resistance (ESR)	Calculated from tan $\delta_{max.}$ and C_R (see Table 2)	ESR = tan $\delta / 2\ \pi\ f\ C_R$

RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 120Hz
I_R = rated ripple current at 120 Hz, 85 °C
(1) useful life at 85 °C and I_R applied: 1500 h

Fig.5 Multiplier of useful life as a function of ambient temperature and ripple current load

Table 1

MULTIPLIER OF RIPPLE CURRENT (I_R) (AS A FUNCTION OF FREQUENCY)	
FREQUENCY (Hz)	**I_R MULTIPLIER**
50	0.60
120	1.00
400	1.20
800	1.30
≥ 2000	1.40

Table 2

TEST PROCEDURES AND REQUIREMENTS			
TEST		**PROCEDURE (quick reference)**	**REQUIREMENTS**
NAME OF TEST	**REFERENCE**		
Endurance	IEC 60384-4/ EN130300, subclause 4.13	T_{amb} = 85 °C, U_R applied; 1000 h	ΔC/C: ± 20 % tan δ ≤ 2 x spec. limit I_{L2} ≤ spec. limit
Useful life	CECC 30301, subclause 1.8.1	T_{amb} = 85 °C, U_R and I_R applied; 1500 h	ΔC/C: ± 50 % tan δ ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_{L2} ≤ spec. limit no short or open circuit total failure percentage: ≤ 3 %
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300, subclause 4.17	T_{amb} = 85 °C; no voltage applied; 500 h after test: U_R to be applied for 30 min, 24 to 48 h before measurement	ΔC/C, tan δ, Z: for requirements see 'Endurance test' above I_{L2} ≤ spec. limit

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