Aluminum Electrolytic Capacitors
Power Ultra Long Life Snap-In

Fig. 1

FEATURES

- Useful life: 5000 h at +105 °C
- Miniaturized, very small dimensions
- High ripple current capability
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Keyed polarity version available
- High reliability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- General purpose, industrial, telecom and audio / video systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems

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 (YYMM)
- Name of manufacturer
- Code for factory of origin
- "-" sign to identify the negative terminal, visible from the top and side of the capacitor
- Code number
- Climatic category in accordance with IEC 60068

QUICK REFERENCE DATA	
DESCRIPTION	**VALUE**
Nominal case sizes (Ø D x L in mm)	22 x 25 to 35 x 40
Rated capacitance range (E6 / E12 series), C_R	560 µF to 47 000 µF
Tolerance on C_R	± 20 %
Rated voltage range, U_R	25 V to 100 V
Category temperature range	-40 °C to +105 °C
Endurance test at 105 °C	2000 h
Useful life at 105 °C	5000 h
Useful life at 40 °C, 1.9 x I_R applied	125 000 h
Shelf life at 0 V, 105 °C	500 h
Based on sectional specification	IEC 60384-4 / EN 130300
Climatic category IEC 60068	40 / 105 / 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)							
	16	**25**	**35**	**40**	**50**	**63**	**80**	**100**
560	-	-	-	-	-	-	-	22 x 25
680	-	-	-	-	-	-	-	22 x 30
820	-	-	-	-	-	-	22 x 25	-
1000	-	-	-	-	-	-	22 x 30	25 x 30
1500	-	-	-	-	-	22 x 25	25 x 30	25 x 40 30 x 30
1800	-	-	-	-	-	-	-	30 x 35
2200	-	-	-	-	22 x 25	22 x 30	25 x 40 30 x 30	30 x 40
2700	-	-	-	-	-	25 x 30	30 x 35	-
3300	-	-	-	-	22 x 30	25 x 40	30 x 40	35 x 40
3900	-	-	-	-	25 x 30	25 x 40 30 x 30	-	-
4700	-	22 x 25	22 x 30	-	25 x 30 25 x 40	30 x 30 30 x 35	35 x 40	-
5600	-	-	-	-	25 x 40	30 x 35	-	-

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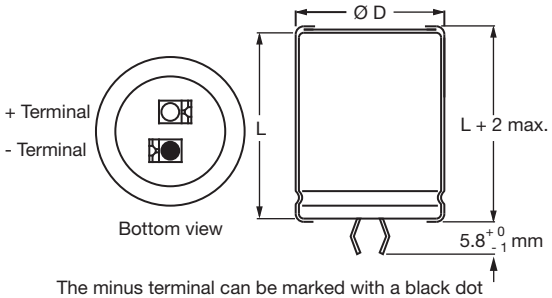
SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)								
C_R (µF)	U_R (V)							
	16	25	35	40	50	63	80	100
6800	22 x 25	22 x 30	-	25 x 40	30 x 30	30 x 40	-	-
8200	-	25 x 30	-	-	30 x 35	35 x 40	-	-
10 000	22 x 30	25 x 40	30 x 30	30 x 40	30 x 40	-	-	-
12 000	-	25 x 40 30 x 30	-	-	-	-	-	-
15 000	25 x 30	30 x 35 30 x 40	30 x 40	35 x 40	35 x 40	-	-	-
22 000	25 x 40 30 x 30	35 x 40	35 x 40	-	-	-	-	-
27 000	30 x 35	-	-	-	-	-	-	-
33 000	30 x 40	-	-	-	-	-	-	-
39 000	-	-	-	-	-	-	-	-
47 000	35 x 40	-	-	-	-	-	-	-

DIMENSIONS in millimeters AND AVAILABLE FORMS

TWO TERMINAL SNAP-IN



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

Fig. 2 - Two terminal snap-in

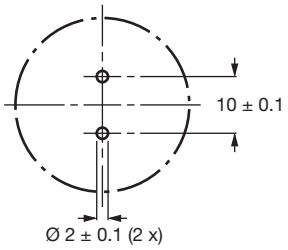
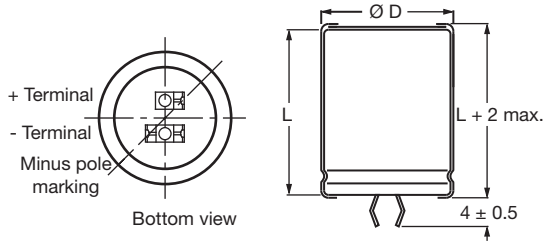


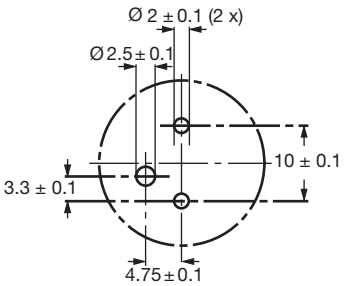
Fig. 3 - Mounting hole diagram

THREE TERMINAL SNAP-IN



The negative terminal has **TWO** pins which are **BOTH** electrically connected

Fig. 4 - Three terminal snap-in



The 10 mm spacing of the 2 pin snap-in is used as the base layout and a third hole is added. The third hole is closer to the negative primary hole so that polarization is always maintained, together with added mechanical stability.

Fig. 5 - Mounting hole diagram

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Table 1

DIMENSIONS in millimeters, MASS, AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE Ø D x L	Ø $D_{max.}$	$L_{max.}$	MASS (g)	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS L x W x H (mm)
22 x 25	23	27	12	100	260 x 250 x 39
22 x 30	23	32	16	100	260 x 250 x 44
25 x 30	26	32	22	100	290 x 280 x 44
25 x 40	26	42	27	100	290 x 280 x 54
30 x 30	31	32	30	100	340 x 330 x 44
30 x 35	31	37	35	100	340 x 330 x 49
30 x 40	31	42	40	100	340 x 330 x 54
35 x 40	36	42	55	50	390 x 198 x 54

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	Rated capacitance at 100 Hz
I_R	Rated RMS ripple current at 100 Hz or 10 kHz, 105 °C
I_{L5}	Max. leakage current after 5 minutes at U_R
ESR	Max. equivalent series resistance at 100 Hz (1)
Z	Max. impedance at 10 kHz

Notes

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

(1) ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

ORDERING EXAMPLE

Electrolytic capacitor 090 series

3300 µF / 80 V; ± 20 %

Nominal case size: Ø 30 mm x 40 mm

2-terminal snap-in:

Ordering code: MAL209032332E3
Former 12NC: 2222 09032332

3-terminal snap-in:

Ordering code: MAL209072332E3
Former 12NC: 2222 09072332

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION									
U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R 10 kHz 105 °C (A)	I_{L5} 5 min (µA)	MAX. ESR 100 Hz (1) (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2090.....	
								2-TERM. SI	3-TERM. SI
16	6800	22 x 25	2.5	3.0	222	82	66	15682E3	55682E3
	10 000	22 x 30	3.1	3.6	324	59	48	15103E3	55103E3
	15 000	25 x 30	3.2	3.9	484	53	44	25153E3	65153E3
	22 000	25 x 40	4.1	5.0	708	38	33	25223E3	65223E3
	22 000	30 x 30	3.3	4.1	708	54	43	35223E3	75223E3
	27 000	30 x 35	3.8	4.6	868	45	36	35273E3	75273E3
	33 000	30 x 40	4.2	5.0	1060	39	32	35333E3	75333E3
	47 000	35 x 40	4.3	5.2	1508	43	32	45473E3	85473E3
25	4700	22 x 25	2.3	2.8	236	89	66	16472E3	56472E3
	6800	22 x 30	2.9	3.4	341	65	49	16682E3	56682E3
	8200	25 x 30	3.1	3.7	411	60	46	26822E3	66822E3
	10 000	25 x 40	3.9	4.6	501	46	35	26103E3	66103E3
	12 000	25 x 40	3.9	4.7	601	43	34	26123E3	66123E3
	12 000	30 x 30	3.3	4.1	601	56	44	36123E3	76123E3
	15 000	30 x 35	3.8	4.6	751	46	36	16153E3	56153E3
	15 000	30 x 40	4.3	5.1	751	40	33	36153E3	76153E3
	22 000	35 x 40	4.6	5.5	1101	40	31	46223E3	86223E3
35	4700	22 x 30	2.5	3.1	330	78	53	10472E3	50472E3
	10 000	30 x 30	2.9	3.5	701	70	49	30103E3	70103E3
	15 000	30 x 40	3.7	4.4	1051	49	35	30153E3	70153E3
	22 000	35 x 40	3.8	4.5	1541	55	35	40223E3	80223E3

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ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R 10 kHz 105 °C (A)	I_{L5} 5 min (µA)	MAX. ESR 100 Hz [1] (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2090.....	
								2-TERM. SI	3-TERM. SI
40	6800	25 x 40	3.5	4.2	545	51	38	27682E3	67682E3
	10 000	30 x 40	3.9	4.6	801	48	36	37103E3	77103E3
	15 000	35 x 40	4.1	4.9	1201	50	35	47153E3	87153E3
50	2200	22 x 25	1.9	2.3	221	145	106	11222E3	51222E3
	3300	22 x 30	2.3	2.9	331	101	76	11332E3	51332E3
	3900	25 x 30	2.5	3.1	391	93	71	21392E3	61392E3
	4700	25 x 30	2.6	3.2	471	85	70	31472E3	71472E3
	4700	25 x 40	3.2	3.9	471	71	55	21472E3	61472E3
	5600	25 x 40	3.2	4.0	561	66	51	21562E3	61562E3
	6800	30 x 30	2.8	3.3	681	83	65	31682E3	71682E3
	8200	30 x 35	3.2	3.8	821	68	54	31822E3	71822E3
	10 000	30 x 40	3.6	4.2	1001	58	46	31103E3	71103E3
	15 000	35 x 40	3.6	4.4	1501	63	45	41153E3	81153E3
63	1500	22 x 25	1.9	2.3	190	161	126	18152E3	58152E3
	2200	22 x 30	2.3	2.8	279	114	90	18222E3	58222E3
	2700	25 x 30	2.5	3.1	342	101	81	28272E3	68272E3
	3300	25 x 40	3.2	3.8	417	79	63	28332E3	68332E3
	3900	25 x 40	3.2	3.9	493	71	58	28392E3	68392E3
	3900	30 x 30	2.8	3.4	493	89	74	38392E3	78392E3
	4700	30 x 30	2.8	3.3	594	88	71	18472E3	58472E3
	4700	30 x 35	3.2	3.9	594	74	61	38472E3	78472E3
	5600	30 x 35	3.2	3.8	707	71	59	38562E3	78562E3
	6800	30 x 40	3.6	4.2	858	61	51	38682E3	78682E3
	8200	35 x 40	3.9	4.6	1035	61	50	48822E3	88822E3
80	820	22 x 25	1.4	1.6	133	244	184	12821E3	52821E3
	1000	22 x 30	1.6	1.9	161	196	146	12102E3	52102E3
	1500	25 x 30	1.9	2.3	241	145	113	22152E3	62152E3
	2200	25 x 40	2.5	3.0	353	101	79	22222E3	62222E3
	2200	30 x 30	2.3	2.7	353	119	96	32222E3	72222E3
	2700	30 x 35	2.5	3.1	433	98	79	32272E3	72272E3
	3300	30 x 40	2.9	3.4	529	81	66	32332E3	72332E3
	4700	35 x 40	3.1	3.7	753	75	63	42472E3	82472E3
100	560	22 x 25	1.3	1.4	113	269	184	19561E3	59561E3
	680	22 x 30	1.4	1.7	137	216	146	19681E3	59681E3
	1000	25 x 30	1.7	2.1	201	163	114	29102E3	69102E3
	1500	25 x 40	2.3	2.8	301	111	79	29152E3	69152E3
	1500	30 x 30	2.1	2.4	301	130	98	39152E3	79152E3
	1800	30 x 35	2.3	2.9	361	108	80	39182E3	79182E3
	2200	30 x 40	2.7	3.2	441	90	68	39222E3	79222E3
	3300	35 x 40	2.9	3.4	661	81	64	49332E3	89332E3

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ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage		$U_s = 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 min at U_R	$I_{L1} \leq 0.006\ C_R \times U_R + 4$ µA
	After 5 min at U_R	$IL_5 \leq 0.002\ C_R \times U_R + 4$ µA
Inductance		
Equivalent series inductance (ESL)	All case sizes	Typ. 19 nH
		Max. 25 nH

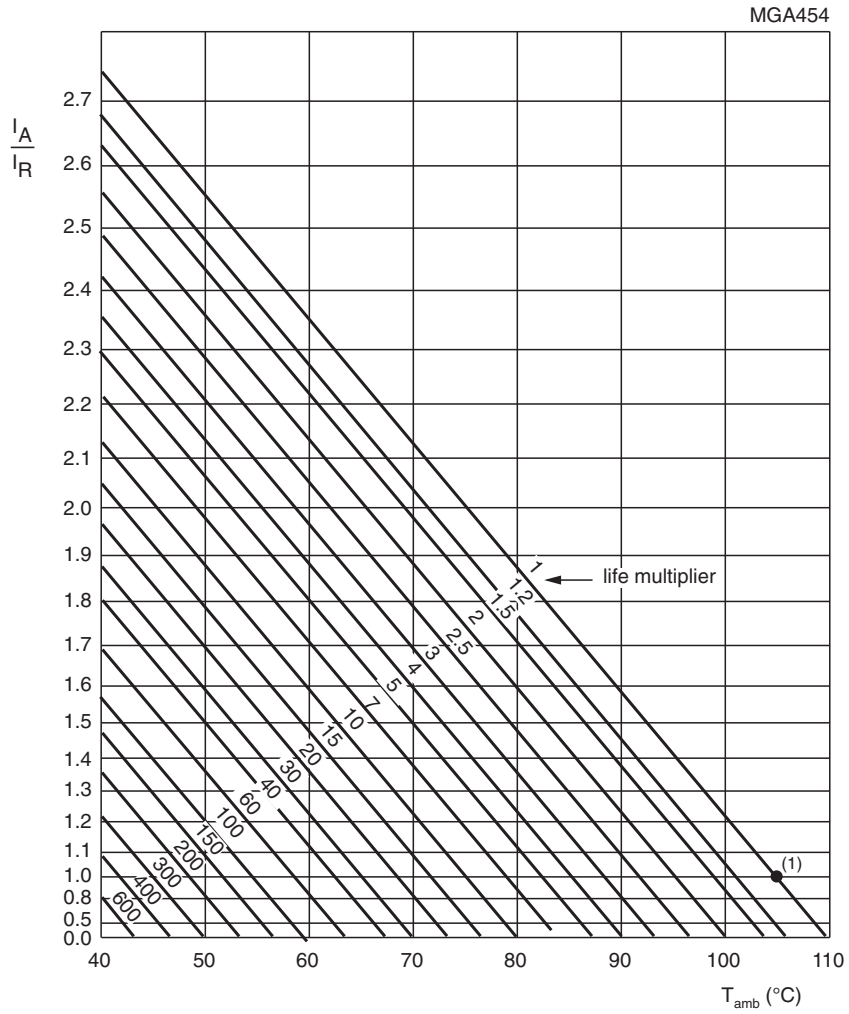
RIPPLE CURRENT AND USEFUL LIFE

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 105 °C (h)	**USEFUL LIFE AT 105 °C (h)**
2000	5000

Note

- Multiplier of useful life code: MGA454



I_A = Actual ripple current at 100 Hz

I_R = Rated ripple current at 100 Hz and 105 °C

(1) Useful life at 105 °C and I_R applied: 5000 h

Fig. 6 - Multiplier of useful life as a function of ambient temperature and ripple current load

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Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY							
FREQUENCY (Hz)							
50	100	200	400	1000	2000	4000	≥ 10 000
I_R MULTIPLIER							
0.91	1.00	1.05	1.09	1.13	1.15	1.18	1.22

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN 130300 subclause 4.13	T_{amb} = 105 °C; U_R applied; 2000 h	ΔC/C: ± 15 % ESR ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I_{L5} ≤ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_{amb} = 105 °C; U_R and I_R applied; 5000 h	ΔC/C: ± 20 % ESR ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_{L5} ≤ spec. limit no short or open circuit, no visible damage total failure percentage: U_R: ≤ 1 %
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300 subclause 4.17	T_{amb} = 105 °C; no voltage applied; 500 h After test: U_R to be applied for 30 min, 24 h to 48 h before measurement	ΔC/C: ± 15 % ESR ≤ 1.5 x spec. limit I_{L5} ≤ 2 x spec. limit

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.

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MAL209018152E3	MAL209082472E3	MAL209039222E3	MAL209026822E3	MAL209078562E3	MAL209048822E3
MAL209072332E3	MAL209049332E3	MAL209026123E3	MAL209030153E3	MAL209037103E3	MAL209081153E3
MAL209072222E3	MAL209019561E3	MAL209036123E3	MAL209071103E3	MAL209078472E3	MAL209012821E3
MAL209062222E3	MAL209019681E3	MAL209079152E3	MAL209016153E3	MAL209052102E3	MAL209035223E3
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MAL209015103E3	MAL209055103E3	MAL209021392E3	MAL209058222E3	MAL209089332E3	MAL209065223E3
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MAL209016472E3	MAL209066123E3	MAL209031103E3	MAL209041153E3	MAL209055682E3	MAL209030103E3
MAL209021562E3	MAL209028272E3	MAL209035333E3	MAL209076153E3	MAL209069102E3	MAL209069152E3
MAL209075273E3	MAL209075333E3	MAL209036153E3	MAL209047153E3	MAL209071682E3	MAL209066103E3
MAL209032222E3	MAL209032272E3	MAL209059561E3	MAL209056472E3	MAL209050472E3	MAL209051222E3
MAL209021472E3	MAL209028332E3	MAL209012102E3	MAL209046223E3	MAL209070103E3	MAL209011222E3
MAL209088822E3	MAL209039182E3	MAL209016682E3	MAL209068272E3	MAL209068332E3	MAL209059681E3
MAL209077103E3	MAL209087153E3	MAL209031682E3	MAL209068392E3	MAL209078392E3	MAL209022152E3
MAL209022222E3	MAL209056682E3	MAL209026103E3	MAL209027682E3	MAL209067682E3	MAL209051332E3
MAL209038682E3	MAL209072272E3	MAL209042472E3	MAL209015682E3		