Aluminum Capacitors
Power Ultra Long Life Snap-In



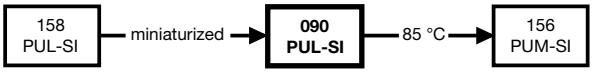


Fig. 1

FEATURES

- Long useful life: up to 5000 h at 105 °C
- Low ESR, high ripple current capability
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Keyed polarity version available
- 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/EN130300
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 25	22 x 30
1000	-	-	-	-	-	-	22 x 30	25 x 30
1200	-	-	-	-	-	-	25 x 30	-
1500	-	-	-	-	-	22 x 25	-	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 25	22 x 30	25 x 40	30 x 40	35 x 40
3900	-	-	-	22 x 30	25 x 30	25 x 40 30 x 30	-	-
4700	-	22 x 25	22 x 30	22 x 30	25 x 30 25 x 40	30 x 30 30 x 35	35 x 40	-
5600	-	-	-	25 x 30	25 x 40	30 x 35	-	-
6800	22 x 25	22 x 30	25 x 30	25 x 40	30 x 30	30 x 40	-	-

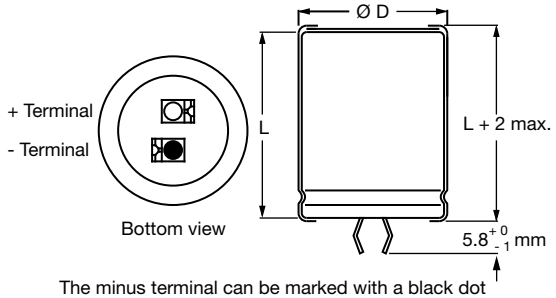
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SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)								
C_R (µF)	U_R (V)							
	16	25	35	40	50	63	80	100
8200	-	25 x 30	-	- 30 x 30	30 x 35	35 x 40	-	-
10 000	22 x 30	25 x 40	25 x 40 30 x 30	30 x 35 30 x 40	30 x 40	-	-	-
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	-	-	-	-
18 000	-	-	-	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	30 x 40 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

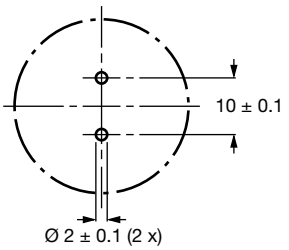
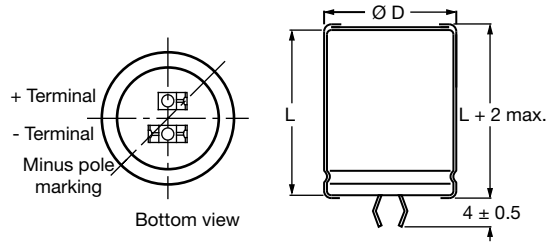


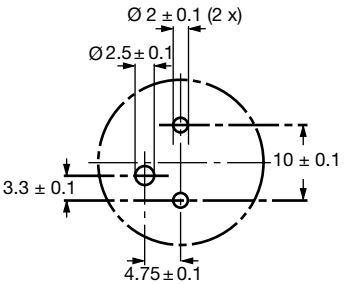
Fig. 3 - Mounting hole diagram

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	2.8	3.3	222	82	66	15682E3	55682E3
	10 000	22 x 30	3.4	4.0	324	59	48	15103E3	55103E3
	15 000	25 x 30	3.6	4.3	484	53	44	25153E3	65153E3
	22 000	25 x 40	4.5	5.5	708	38	33	25223E3	65223E3
	22 000	30 x 30	3.7	4.5	708	54	43	35223E3	75223E3
	27 000	30 x 35	4.2	5.1	868	45	36	35273E3	75273E3
	33 000	30 x 40	4.7	5.6	1060	39	32	35333E3	75333E3
	47 000	35 x 40	4.8	5.8	1508	43	32	45473E3	85473E3
25	4700	22 x 25	2.6	3.1	236	89	66	16472E3	56472E3
	6800	22 x 30	3.2	3.8	341	65	49	16682E3	56682E3
	8200	25 x 30	3.4	4.1	411	60	46	26822E3	66822E3
	10 000	25 x 40	4.3	5.1	501	46	35	26103E3	66103E3
	12 000	25 x 40	4.3	5.2	601	43	34	26123E3	66123E3
	12 000	30 x 30	3.7	4.5	601	56	44	36123E3	76123E3
	15 000	30 x 35	4.2	5.1	751	46	36	16153E3	56153E3
	15 000	30 x 40	4.8	5.7	751	40	33	36153E3	76153E3
	22 000	35 x 40	5.1	6.1	1101	40	31	46223E3	86223E3
35	4700	22 x 30	2.8	3.4	330	78	53	10472E3	50472E3
	6800	25 x 30	3.0	3.6	477	70	50	20682E3	60682E3
	10 000	25 x 40	3.9	4.7	701	49	36	20103E3	60103E3
	10 000	30 x 30	3.2	3.9	701	70	49	30103E3	70103E3
	15 000	30 x 40	4.1	4.9	1051	49	35	30153E3	70153E3
	22 000	35 x 40	4.2	5.0	1541	55	35	40223E3	80223E3

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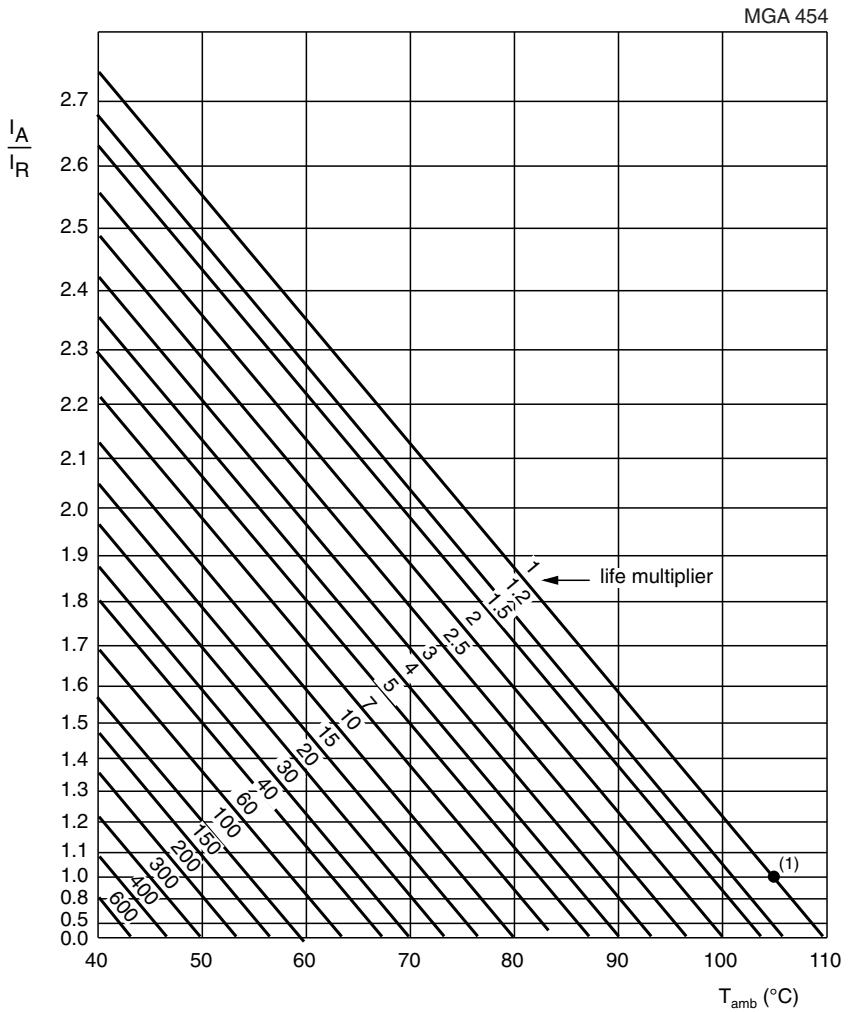
ELECTRICAL DATA AND ORDERING INFORMATION

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	3300	22 x 25	2.4	2.9	265	99	70	17332E3	57332E3
	3900	22 x 30	2.9	3.4	313	76	54	17392E3	57392E3
	4700	22 x 30	2.9	3.5	377	71	51	17472E3	57472E3
	5600	25 x 30	3.1	3.7	449	69	50	27562E3	67562E3
	6800	25 x 40	3.9	4.7	545	51	38	27682E3	67682E3
	8200	30 x 30	3.3	3.9	657	69	49	37822E3	77822E3
	10 000	30 x 35	3.8	4.5	801	56	41	17103E3	57103E3
	10 000	30 x 40	4.3	5.1	801	48	36	37103E3	77103E3
	15 000	35 x 40	4.5	5.4	1201	50	35	47153E3	87153E3
	18 000	35 x 40	4.3	5.1	1441	54	35	47183E3	87183E3
50	2200	22 x 25	2.1	2.6	221	145	106	11222E3	51222E3
	3300	22 x 30	2.6	3.2	331	101	76	11332E3	51332E3
	3900	25 x 30	2.8	3.4	391	93	71	21392E3	61392E3
	4700	25 x 30	2.9	3.5	471	85	70	31472E3	71472E3
	4700	25 x 40	3.6	4.3	471	71	55	21472E3	61472E3
	5600	25 x 40	3.6	4.4	561	66	51	21562E3	61562E3
	6800	30 x 30	3.1	3.7	681	83	65	31682E3	71682E3
	8200	30 x 35	3.5	4.2	821	68	54	31822E3	71822E3
	10 000	30 x 40	4.0	4.7	1001	58	46	31103E3	71103E3
	15 000	35 x 40	4.0	4.9	1501	63	45	41153E3	81153E3
63	1500	22 x 25	2.1	2.5	190	161	126	18152E3	58152E3
	2200	22 x 30	2.6	3.1	279	114	90	18222E3	58222E3
	2700	25 x 30	2.8	3.4	342	101	81	28272E3	68272E3
	3300	25 x 40	3.5	4.2	417	79	63	28332E3	68332E3
	3900	25 x 40	3.6	4.3	493	71	58	28392E3	68392E3
	3900	30 x 30	3.1	3.8	493	89	74	38392E3	78392E3
	4700	30 x 30	3.1	3.7	594	88	71	18472E3	58472E3
	4700	30 x 35	3.6	4.3	594	74	61	38472E3	78472E3
	5600	30 x 35	3.5	4.2	707	71	59	38562E3	78562E3
	6800	30 x 40	4.0	4.7	858	61	51	38682E3	78682E3
	8200	35 x 40	4.3	5.1	1035	61	50	48822E3	88822E3
80	820	22 x 25	1.5	1.8	133	244	184	12821E3	52821E3
	1000	22 x 30	1.8	2.1	161	196	146	12102E3	52102E3
	1500	25 x 30	2.1	2.6	241	145	113	22152E3	62152E3
	2200	25 x 40	2.8	3.3	353	101	79	22222E3	62222E3
	2200	30 x 30	2.5	3.0	353	119	96	32222E3	72222E3
	2700	30 x 35	2.8	3.4	433	98	79	32272E3	72272E3
	3300	30 x 40	3.2	3.8	529	81	66	32332E3	72332E3
	4700	35 x 40	3.4	4.1	753	75	63	42472E3	82472E3
100	560	22 x 25	1.4	1.6	113	269	184	19561E3	59561E3
	680	22 x 30	1.6	1.9	137	216	146	19681E3	59681E3
	1000	25 x 30	1.9	2.3	201	163	114	29102E3	69102E3
	1500	25 x 40	2.5	3.1	301	111	79	29152E3	69152E3
	1500	30 x 30	2.3	2.7	301	130	98	39152E3	79152E3
	1800	30 x 35	2.6	3.2	361	108	80	39182E3	79182E3
	2200	30 x 40	3.0	3.6	441	90	68	39222E3	79222E3
	3300	35 x 40	3.2	3.8	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



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 3

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	I_R MULTIPLIER
	U_R = 25 V TO 100 V
50	0.91
100	1.00
200	1.05
400	1.09
1000	1.13
2000	1.15
4000	1.18
≥ 10 000	1.22

Table 4

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN130300 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/ EN130300 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

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