Aluminum Electrolytic Capacitors
Power Ultra High Ripple Current Snap-In for Solar

LINKS TO ADDITIONAL RESOURCES

3D Models

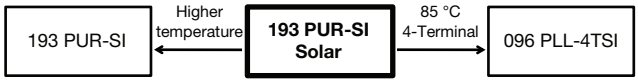


Fig. 1

QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
Nominal case size (D x L in mm)	35 x 30 to 35 x 60	
Rated capacitance range, C_R	220 µF to 560 µF	
Tolerance on C_R	± 20 %	
Rated voltage, U_R	500 V	570 V
Rated temperature range	-40 °C to +50 °C	-40 °C to +60 °C
Endurance at U_R, 50 °C, no ripple applied	5000 h	-
Endurance at U_R, 60 °C, no ripple applied	-	5000 h
Category voltage, U_C	450 V	475 V
Category temperature range	-40 °C to +105 °C	
Useful life at U_C, 105 °C, I_R applied	6000 h	
Operation up to 600 V, 60 °C, no ripple applied (1)	-	> 200 h
Shelf life at 0 V, 105 °C	1000 h	
Based on sectional specification	IEC 60384-4 / EN130300	
Climatic category IEC 60068	40 / 105 / 56	

Note

(1) Single operation max. 5 min, 600 V, 60 °C, no ripple current; afterwards min. 1 hour within specified U_R or U_C conditions

FEATURES

- **Tailored design for solar PV inverters**
- Specified for higher voltage, up to 600 V at specific operation conditions
- Long useful life: 6000 h at +105 °C
- > 25 years 24/7 application life at 60 °C
- High ripple current capability
- High reliability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Solar PV inverters
- Industrial motor control
- Power supply

MARKING

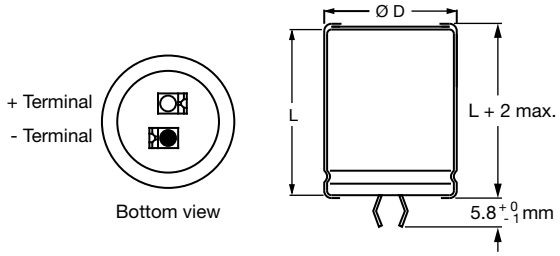
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 (± 20 %)
- Rated voltage (in V)
- Two digit date code, in accordance with IEC 60062
- 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
- "LL" for long life grade

SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)					
C_R (µF)	U_R (V)				
220	35 x 30	-	-	-	-
330	-	35 x 40	-	-	-
390	-	-	35 x 45	-	-
470	-	-	-	35 x 50	-
560	-	-	-	-	35 x 60

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

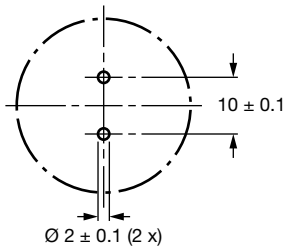
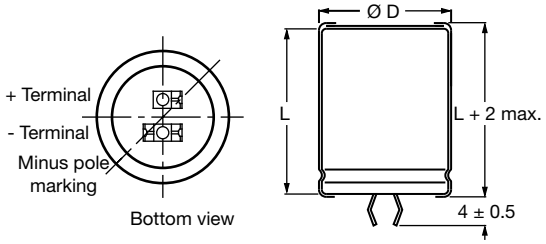


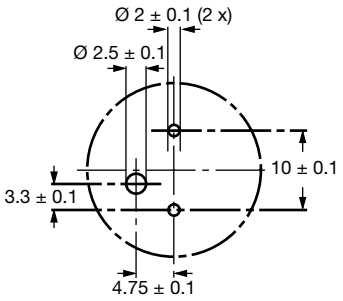
Fig. 3 - Mounting hole diagram

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

Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE	Ø $D_{max.}$	$L_{max.}$	MASS (g)	PACKAGING QUANTITIES (unit per box)	CARDBOARD BOX DIMENSIONS L x W x H
35 x 30	36	32	40	50	390 x 198 x 44
35 x 40	36	42	56	50	390 x 198 x 54
35 x 45	36	47	64	50	390 x 198 x 59
35 x 50	36	52	72	50	390 x 198 x 64
35 x 60	36	62	88	50	377 x 375 x 88

ELECTRICAL DATA	
SYMBOL	**DESCRIPTION**
C_R	Rated capacitance at 100 Hz
I_R	Rated RMS ripple current at 100 Hz and 105 °C
I_{L1}	Max. leakage current after 1 min at U_R
ESR	Max. equivalent series resistance at 100 Hz
Z	Max. impedance at 10 kHz

Note

- 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 %

ORDERING EXAMPLE

Electrolytic capacitors 470 µF / 500 V

Nominal case size: Ø 35 mm x 50 mm

2-terminal snap-in:

Ordering code: MAL219390104E3

3-terminal snap-in:

Ordering code: MAL219390114E3

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION									
U_R (V)	U_C (V)	C_R (µF)	CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A) (1)	I_L 1 min (mA)	ESR 100 Hz MAX. (mΩ)	Z 10 kHz MAX. (mΩ)	ORDERING CODE MAL2193.....	
								2-TERM.	3-TERM.
500	450	220	35 x 30	1.35	0.6	900	600	MAL219390101E3	MAL219390111E3
		330	35 x 40	1.74	0.9	600	400	MAL219390102E3	MAL219390112E3
		390	35 x 45	1.94	1.1	500	350	MAL219390103E3	MAL219390113E3
		470	35 x 50	2.18	1.3	450	300	MAL219390104E3	MAL219390114E3
		560	35 x 60	2.52	1.5	350	250	MAL219390105E3	MAL219390115E3
570	475	220	35 x 30	1.32	0.7	600	450	MAL219390121E3	MAL219390131E3
		330	35 x 40	1.70	1.0	400	300	MAL219390122E3	MAL219390132E3
		390	35 x 45	1.90	1.2	350	250	MAL219390123E3	MAL219390133E3
		470	35 x 50	2.14	1.4	300	200	MAL219390124E3	MAL219390134E3
		560	35 x 60	2.46	1.6	250	150	MAL219390125E3	MAL219390135E3

Notes

- Other case sizes, terminations and capacitance values available on request

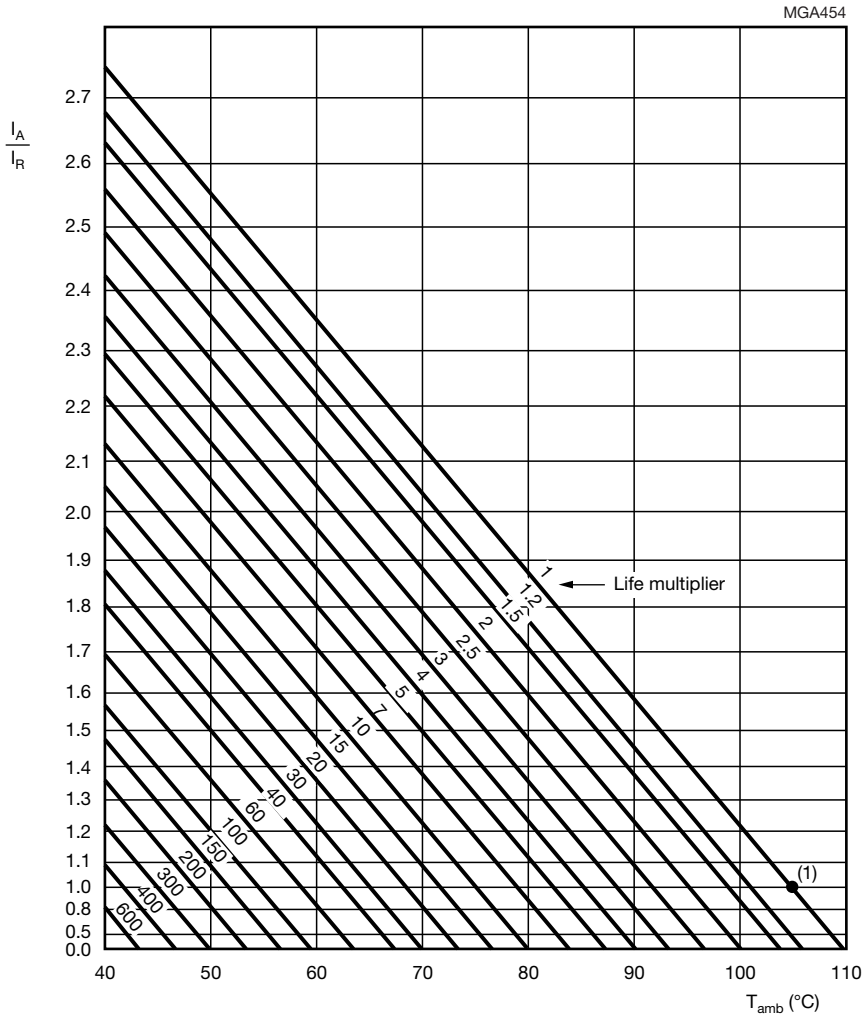
(1) At $U_{max.} \leq U_C$

ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage		$U_s = 1.1 \times U_C$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 min at U_R	$I_{L1} \leq 0.006\ C_R \times U_C$
	After 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_C$
Inductance		
Equivalent series inductance (ESL)	All case sizes	ca. 20 nH

RIPPLE CURRENT AND USEFUL LIFE

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE		
PARAMETER	**CONDITIONS**	**VALUE**
Endurance	U_R = 500 V, 50 °C, no ripple applied	5000 h
	U_R = 570 V, 60 °C, no ripple applied	
Useful life	U_C = 450 V; 105 °C, I_R applied	6000 h
	U_C = 475 V; 105 °C, I_R applied	



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: 6000 h

Fig. 6 - 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)					
50	**100**	**120**	**200**	**1000**	**≥ 10 000**
I_R MULTIPLIER					
0.90	1.00	1.05	1.15	1.30	1.40

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		**PROCEDURE (quick reference)**	**REQUIREMENTS**
NAME OF TEST	**REFERENCE**		
Endurance	IEC 60384-4 / EN130301 subclause 4.13	T_{amb} = 50 °C; U_R = 500 V applied; T_{amb} = 60 °C; U_R = 570 V applied; 5000 h	ΔC/C: ± 15 % ESR ≤ 1.5 x spec. limit Z ≤ 2 x spec. limit I_{L5} ≤ spec. limit
Useful life	EN130301 subclause 1.8.1	T_{amb} = 105 °C; U_C and I_R applied; 6000 h	ΔC/C: ± 30 % 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 ≤ 1 %
Shelf life (storage at high temperature)	IEC 60384-4 / EN130300 subclause 4.17	T_{amb} = 105 °C; no voltage applied; 1000 h After test: U_C 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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