

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



### FEATURES

- Long useful life: 6000 h at +105 °C
- Specified for 500 V, 50 °C operation
- High ripple current capability
- High reliability
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

- Solar PV inverters
- Industrial motor control
- Power supply

### MARKING

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

- Rated capacitance (in  $\mu\text{F}$ )
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 ( $\pm 20\%$ )
- 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

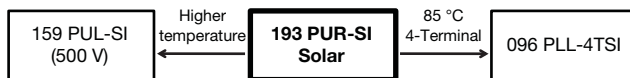


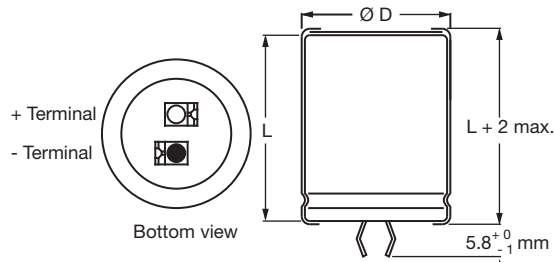
Fig. 1

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 $\mu\text{F}$ to 560 $\mu\text{F}$
Tolerance on $C_R$	$\pm 20\%$
Rated voltage, $U_R$	500 V
Rated temperature range	-40 °C to +50 °C
Category voltage, $U_C$	450 V
Category temperature range	-40 °C to +105 °C
Useful life at $U_C$ , 105 °C, $I_R$ applied	6000 h
Endurance at $U_R$ , 50 °C, no ripple applied	5000 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

SELECTION CHART FOR $C_R$ , $U_R$ , AND RELEVANT NOMINAL CASE SIZES ( $\varnothing$ D x L in mm)					
$C_R$ ( $\mu\text{F}$ )	$U_R$ (V)				
	500				
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

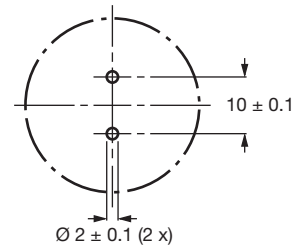


Fig. 3 - Mounting hole diagram

Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE	Ø D <sub>max.</sub>	L <sub>max.</sub>	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	390 x 198 x 74

#### Note

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

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C <sub>R</sub>	Rated capacitance at 100 Hz
I <sub>R</sub>	Rated RMS ripple current at 100 Hz and 105 °C
I <sub>L1</sub>	Max. leakage current after 1 min at U <sub>R</sub>
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<sub>amb</sub> = 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  
 Ordering code: MAL219390104E3

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION								
U <sub>R</sub> (V)	U <sub>C</sub> (V)	C <sub>R</sub> (µF)	CASE SIZE Ø D x L (mm)	I <sub>R</sub> 100 Hz 105 °C (A) <sup>(1)</sup>	I <sub>L</sub> 1 min (mA)	ESR 100 Hz MAX. (mΩ)	Z 10 kHz MAX. (mΩ)	ORDERING CODE
500	450	220	35 x 30	1.35	0.6	900	600	MAL219390101E3
		330	35 x 40	1.74	0.9	600	400	MAL219390102E3
		390	35 x 45	1.94	1.1	500	350	MAL219390103E3
		470	35 x 50	2.18	1.3	450	300	MAL219390104E3
		560	35 x 60	2.52	1.5	350	250	MAL219390105E3

#### Note

- <sup>(1)</sup> At U<sub>max.</sub> ≤ U<sub>C</sub>



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

**RIPPLE CURRENT AND USEFUL LIFE**

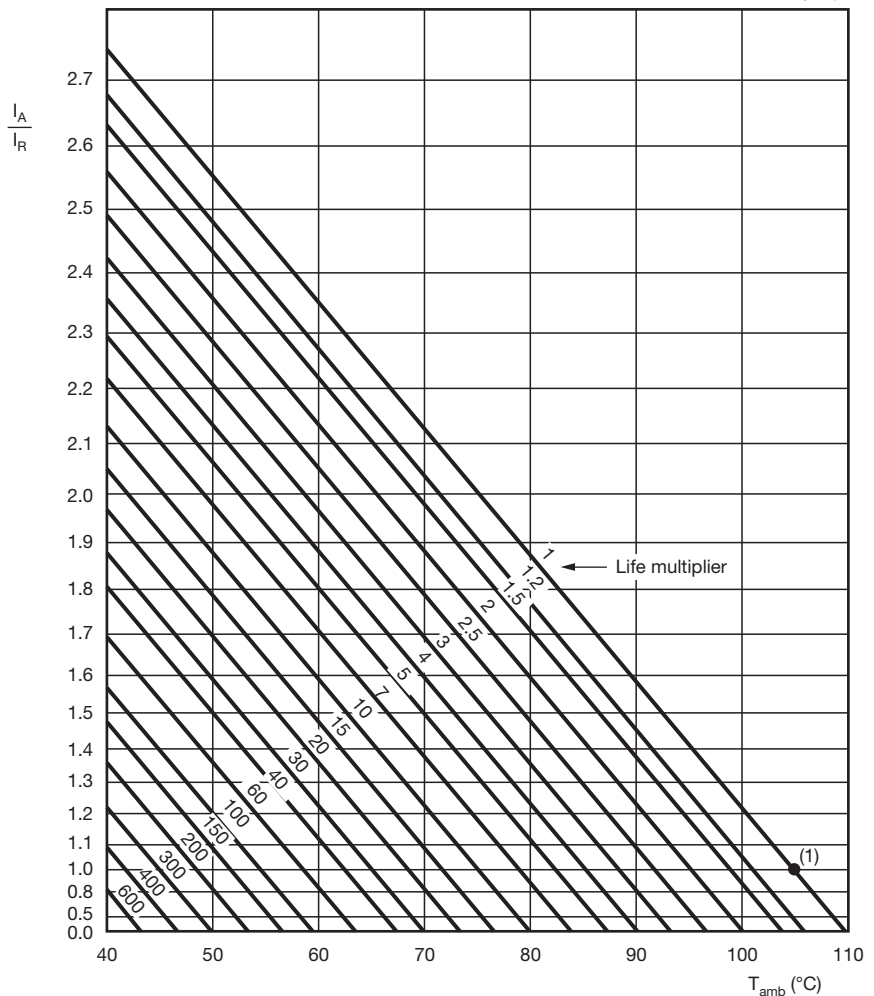
Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 50 °C, 500 V (h)	USEFUL LIFE AT 105 °C, 450 V (h)
5000	6000

**Note**

- Multiplier of useful life code: MGA454

MGA454



$I_A$  = Actual ripple current at 120 Hz  
 $I_R$  = Rated ripple current at 120 Hz and 105 °C  
 (1) Useful life at 105 °C and  $I_R$  applied: 6000 h

Fig. 4 - 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	$\geq 10\ 000$
$I_R$ MULTIPLIER					
0.90	0.95	1.00	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	$T_{amb} = 50\ ^\circ\text{C}$ ; $U_R = 500\ \text{V}$ applied; 5000 h	$\Delta C/C: \pm 15\ \%$ $ESR \leq 1.5 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	EN130301 subclause 1.8.1	$T_{amb} = 105\ ^\circ\text{C}$ ; $U_C$ and $I_R$ applied; 6000 h	$\Delta C/C: \pm 30\ \%$ $ESR \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage $\leq 1\ \%$
Shelf life (storage at high temperature)	IEC 60384-4 / EN130300 subclause 4.17	$T_{amb} = 105\ ^\circ\text{C}$ ; no voltage applied; 1000 h after test: $U_C$ to be applied for 30 min, 24 h to 48 h before measurement	$\Delta C/C: \pm 15\ \%$ $ESR \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$

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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