

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



LINKS TO ADDITIONAL RESOURCES



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 μ F to 560 μ F
Tolerance on C_R	$\pm 20\%$
Rated voltage, U_R	500 V 570 V
Rated temperature range	-40 °C to +60 °C
Endurance at U_R , 60 °C, no ripple applied	6000 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	- 1000 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

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



APPLICATIONS

- Solar PV inverters
- Industrial motor control
- Power supply

MARKING

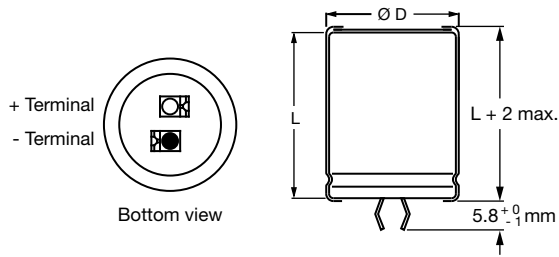
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in μ 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

SELECTION CHART FOR C_R , U_R , AND RELEVANT NOMINAL CASE SIZES (\varnothing D x L in mm)					
C_R (μ F)	U_R (V)				
	35 x 30	35 x 40	35 x 45	35 x 50	35 x 60
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

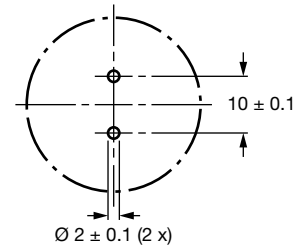
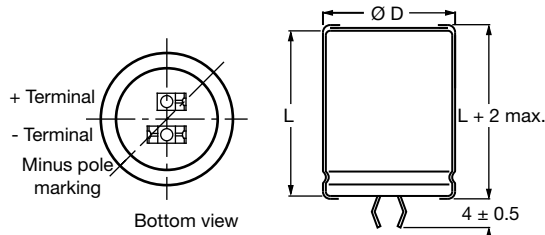


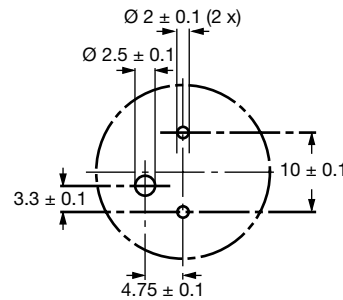
Fig. 3 - Mounting hole diagram

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_{L5}	Max. leakage current after 5 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 $T_{amb} = 20\text{ °C}$, $P = 86\text{ kPa}$ to 106 kPa , $RH = 45\%$ to 75%

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION									
U_R (V)	U_C (V)	C_R (μF)	CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 105 °C (A) ⁽¹⁾	I_L 5 min (mA)	ESR 100 Hz MAX. (m Ω)	Z 10 kHz MAX. (m Ω)	ORDERING CODE MAL2193.....	
								2-TERM.	3-TERM.
500	450	220	35 x 30	1.35	0.99	900	600	MAL219390101E3	MAL219390111E3
		330	35 x 40	1.74	1.49	600	400	MAL219390102E3	MAL219390112E3
		390	35 x 45	1.94	1.76	500	350	MAL219390103E3	MAL219390113E3
		470	35 x 50	2.18	2.12	450	300	MAL219390104E3	MAL219390114E3
		560	35 x 60	2.52	2.52	350	250	MAL219390105E3	MAL219390115E3
570	475	220	35 x 30	1.32	1.05	600	450	MAL219390121E3	MAL219390131E3
		330	35 x 40	1.70	1.57	400	300	MAL219390122E3	MAL219390132E3
		390	35 x 45	1.90	1.85	350	250	MAL219390123E3	MAL219390133E3
		470	35 x 50	2.14	2.23	300	200	MAL219390124E3	MAL219390134E3
		560	35 x 60	2.46	2.66	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		$U_{rev} \leq 1\text{ V}$
Current		
Leakage current	After 5 min at U_C	$I_{L5} \leq 0.01 C_R \times U_C$
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 , 60 °C, no I_R applied	6000 h
Useful life	U_C , 105 °C, I_R applied	

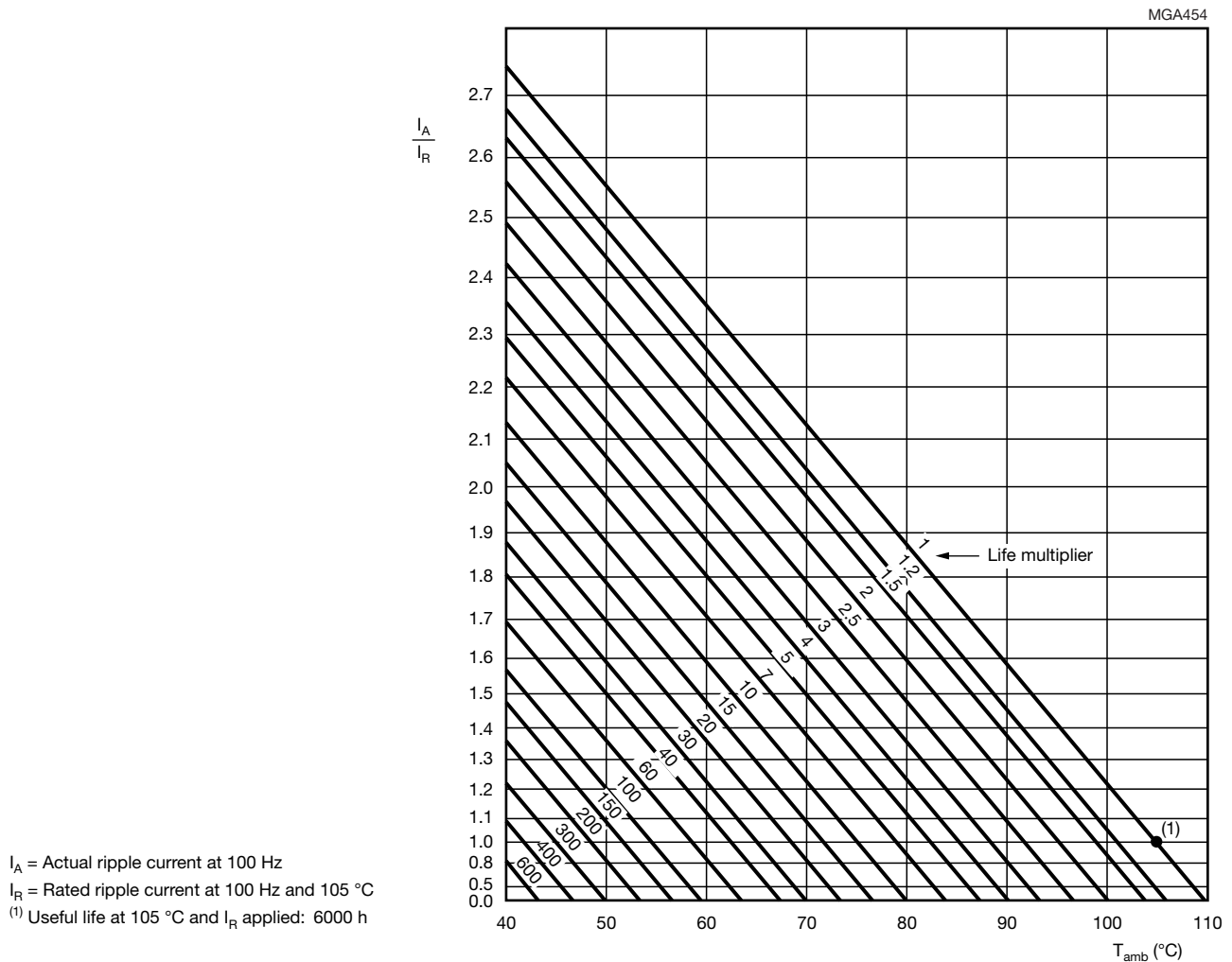


Fig. 6 - Multiplier of useful life as a function of ambient temperature and ripple current load

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	$T_{amb} = 60\text{ }^{\circ}\text{C}$; U_R applied; 6000 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	$T_{amb} = 105\text{ }^{\circ}\text{C}$; 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	$T_{amb} = 105\text{ }^{\circ}\text{C}$; 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.



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.