

# Hybrid Conductive Polymer Aluminum Capacitors SMD (Chip), Low Impedance

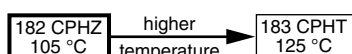


Fig. 1

## QUICK REFERENCE DATA

DESCRIPTION	VALUE
Nominal case sizes (L x W x H in mm)	5.0 x 5.0 x 5.8 to 10.0 x 10.0 x 16.5
Rated capacitance range, C <sub>R</sub>	10 µF to 1500 µF
Tolerance on C <sub>R</sub>	± 20 %
Rated voltage range, U <sub>R</sub>	16 V to 80 V
Category temperature range	-55 °C to +105 °C
Endurance test at 105 °C	10 000 h
Useful life at 105 °C	10 000 h
Shelf life at 0 V, 105 °C	1000 h
Based on sectional specification	IEC 60384-25 / CECC 32300
Climatic category IEC 60068	55 / 105 / 56

## FEATURES

- Long useful life: up to 10 000 h at 105 °C
- Very low ESR and high ripple current
- High voltages up to 80 V
- SMD-version with base plate, lead (Pb)-free reflow solderable
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## APPLICATIONS

- Industrial and professional applications
- Telecommunications and IT
- Portable and mobile equipment

## MARKING

- Rated capacitance (in µF)
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Black mark or “-” sign indicating the cathode (the anode is identified by beveled edges)
- Code indicating group number (82)

## PACKAGING

Supplied in blister tape on reel

## SELECTION CHART FOR C<sub>R</sub>, U<sub>R</sub>, AND RELEVANT NOMINAL CASE SIZES (L x W x H in mm)

C <sub>R</sub> (µF)	U <sub>R</sub> (V)					
	16	25	35	50	63	80
10	→	→	→	5.0 x 5.0 x 5.8	6.3 x 6.3 x 5.8	-
22	→	→	5.0 x 5.0 x 5.8	6.3 x 6.3 x 5.8	6.3 x 6.3 x 7.7	8.0 x 8.0 x 10.5
27	→	→	6.3 x 6.3 x 5.8	-	-	-
33	→	5.0 x 5.0 x 5.8	→	6.3 x 6.3 x 7.7	8.0 x 8.0 x 10.5	10.0 x 10.0 x 10.5
47	→	→	6.3 x 6.3 x 5.8	-	-	-
56	→	6.3 x 6.3 x 5.8	→	→	10.0 x 10.0 x 10.5	-
68	→	→	6.3 x 6.3 x 7.7	8.0 x 8.0 x 10.5	10.0 x 10.0 x 10.5	-
82	→	→	→	→	10.0 x 10.0 x 12.4	-
100	6.3 x 6.3 x 5.8	6.3 x 6.3 x 7.7	→	10.0 x 10.0 x 10.5	-	-
150	6.3 x 6.3 x 5.8	→	8.0 x 8.0 x 10.5	-	10.0 x 10.0 x 16.5	-
220	6.3 x 6.3 x 7.7	8.0 x 8.0 x 10.5	-	-	-	-
270	6.3 x 6.3 x 7.7	→	10.0 x 10.0 x 10.5	-	-	-
330	10.0 x 10.0 x 10.5	10.0 x 10.0 x 10.5	-	-	-	-
470	8.0 x 8.0 x 10.5	-	-	-	-	-
560	10.0 x 10.0 x 10.5	-	-	-	-	-
820	10.0 x 10.0 x 12.4	-	-	-	-	-
1500	10.0 x 10.0 x 16.5	-	-	-	-	-

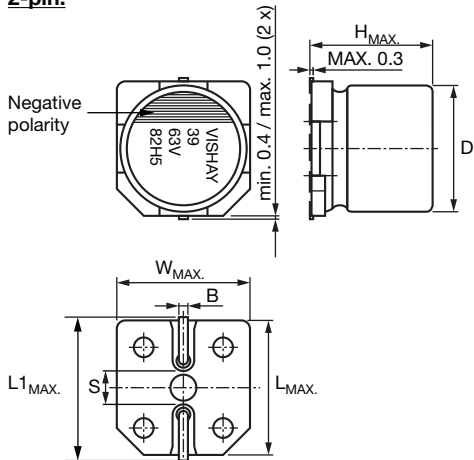
**2-pin:**


Fig. 2 - Dimensional outline

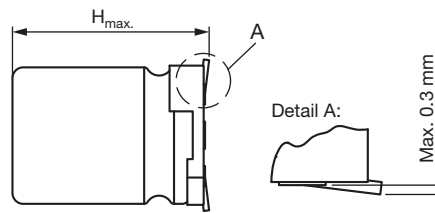


Fig. 3 - Coplanarity of pins

Table 1

<b>DIMENSIONS in millimeters AND MASS</b>									
NOMINAL CASE SIZE L x W x H	CASE CODE	L <sub>MAX.</sub>	W <sub>MAX.</sub>	H <sub>MAX.</sub>	Ø D	B <sub>MAX.</sub>	S	L1 <sub>MAX.</sub>	MASS (g)
5.0 x 5.0 x 5.8	0506	5.5	5.5	6.1	5.0	0.8	1.4	6.1	0.2
6.3 x 6.3 x 5.8	0606	6.8	6.8	6.1	6.3	0.8	2.2	7.4	0.3
6.3 x 6.3 x 7.7	0608	6.8	6.8	8.0	6.3	0.8	2.2	7.4	0.4
8.0 x 8.0 x 10.5	0810	8.5	8.5	10.8	8.0	1.1	3.1	9.2	0.9
10.0 x 10.0 x 10.5	1010	10.5	10.5	10.8	10.0	1.1	4.5	11.2	1.2
10.0 x 10.0 x 12.4	1012	10.5	10.5	12.7	10.0	1.4	4.5	11.2	1.5
10.0 x 10.0 x 16.5	1016	10.5	10.5	16.8	10.0	1.4	4.5	11.2	1.8

Table 2

<b>TAPE AND REEL DIMENSIONS in millimeters, PACKAGING QUANTITIES</b>						
NOMINAL CASE SIZE L x W x H	CASE CODE	PITCH P <sub>1</sub>	TAPE WIDTH W	TAPE THICKNESS T <sub>2</sub>	REEL DIAMETER	PACKAGING QUANTITY PER REEL
5.0 x 5.0 x 5.8	0506	12	12	6.1	380	1000
6.3 x 6.3 x 5.8	0606	12	16	5.7	380	1000
6.3 x 6.3 x 7.7	0608	12	16	8.0	380	900
8.0 x 8.0 x 10.5	0810	16	24	11.0	380	500
10.0 x 10.0 x 10.5	1010	16	24	11.0	380	500
10.0 x 10.0 x 12.4	1012	16	24	12.9	380	400
10.0 x 10.0 x 16.5	1016	16	24	17.5	380	250

**MOUNTING**

The capacitors are designed for automatic placement on to printed-circuit boards.

Optimum dimensions of soldering pads depend amongst others on soldering method, mounting accuracy, print layout and / or adjacent components.

For recommended soldering pad dimensions, refer to Fig. 4 and Table 3.

**SOLDERING**

Soldering conditions are defined by the curve, temperature versus time, where the temperature is that measured on the component during processing.

For maximum conditions refer to Fig. 5.

Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

As a general principle, temperature and duration shall be the **minimum** necessary required to ensure good soldering connections. However, the specified maximum curves should never be exceeded.

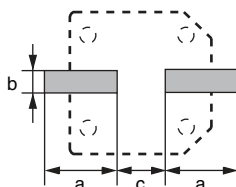


Fig. 4 - Recommended soldering pad dimensions

Table 3

RECOMMENDED SOLDERING PAD DIMENSIONS in millimeters				
NOMINAL CASE SIZE L x W x H	CASE CODE	a	b	c
5.0 x 5.0 x 5.8	0506	3.0	1.6	1.4
6.3 x 6.3 x 5.8	0606	3.5	1.6	2.1
6.3 x 6.3 x 7.7	0608	3.5	1.6	2.1
8.0 x 8.0 x 10.5	0810	4.2	1.9	2.8
10.0 x 10.0 x 10.5	1010	4.4	1.9	4.3
10.0 x 10.0 x 12.4	1012	4.4	1.9	4.3
10.0 x 10.0 x 16.5	1016	4.4	1.9	4.3

### SOLDERING PROFILE FOR LEAD (Pb)-FREE REFLOW PROCESS

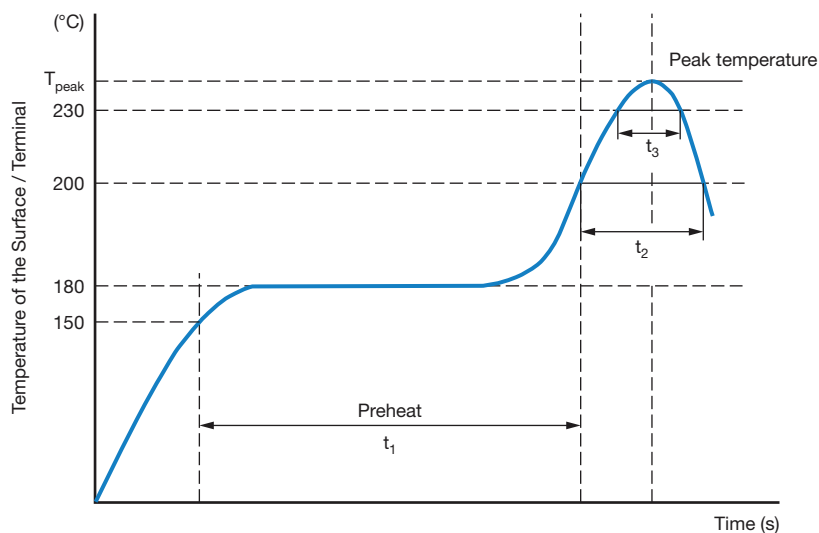


Fig. 5 - Maximum temperature load during reflow soldering

Table 4

REFLOW SOLDERING CONDITIONS for MAL2182xxxxxE3				
PROFILE FEATURES	Ø ≤ 6.3 mm		Ø ≥ 8 mm	
Maximum time between 150 °C to 200 °C (t <sub>1</sub> )	120 s		120 s	
Ramp up rate from 217 °C to T <sub>peak</sub>	0.5 K/s to 3 K/s			
Maximum time above 200 °C (t <sub>2</sub> )	70 s		70 s	
Maximum time above 230 °C (t <sub>3</sub> )	30 s		30 s	
Peak temperature T <sub>Peak</sub>	260 °C		260 °C	245 °C
Maximum reflow cycles	2		1	2
Ramp down rate T <sub>peak</sub> to 217 °C	6 K/s max.			
Time 25 °C to T <sub>Peak</sub>	8 min max.			

#### Note

- Temperature measuring point on top of the case and on terminals

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	Rated capacitance at 120 Hz, tolerance $\pm 20\%$
$I_R$ 105 °C	Rated RMS ripple current at 100 kHz
$I_{L2}$	Max. leakage current after 2 min at $U_R$
$\tan \delta$	Max. dissipation factor at 120 Hz
ESR	Max. ESR at 100 kHz

**Note**

- Unless otherwise specified, all electrical values in Table 5 apply at  $T_{amb} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to  $106\text{ kPa}$ ,  $RH = 45\%$  to  $75\%$

**Table 5**

ELECTRICAL DATA AND ORDERING INFORMATION							
$U_R$ (V)	$C_R$ ( $\mu\text{F}$ )	NOMINAL CASE SIZE L x W x H (mm)	$I_R$ 105 °C 100 kHz (mA)	$I_{L2}$ 2 min ( $\mu\text{A}$ )	$\tan \delta$ 120 Hz	ESR 100 kHz 20 °C (m $\Omega$ )	ORDERING CODE MAL2182...
16	100	6.3 x 6.3 x 5.8	1300	16	0.16	50	97501E3
	150	6.3 x 6.3 x 5.8	1300	24	0.16	50	97502E3
	220	6.3 x 6.3 x 7.7	2000	35.2	0.16	30	97503E3
	270	6.3 x 6.3 x 7.7	2000	43.2	0.16	30	97504E3
	330	10.0 x 10.0 x 10.5	2500	52.8	0.16	20	97505E3
	470	8.0 x 8.0 x 10.5	2300	75.2	0.16	27	97506E3
	560	10.0 x 10.0 x 10.5	2500	89.6	0.16	20	97507E3
	820	10.0 x 10.0 x 12.4	2800	131.2	0.16	16	97508E3
25	1500	10.0 x 10.0 x 16.5	5000	240	0.16	11	97509E3
	33	5.0 x 5.0 x 5.8	900	8.3	0.14	80	97601E3
	56	6.3 x 6.3 x 5.8	1300	14	0.14	50	97602E3
	100	6.3 x 6.3 x 7.7	2000	25	0.14	30	97603E3
	220	8.0 x 8.0 x 10.5	2300	55	0.14	27	97604E3
	330	10.0 x 10.0 x 10.5	2500	82.5	0.14	20	97605E3
35	22	5.0 x 5.0 x 5.8	900	7.7	0.12	100	97001E3
	27	6.3 x 6.3 x 5.8	1300	9.5	0.12	60	97002E3
	47	6.3 x 6.3 x 5.8	1300	16.5	0.12	60	97003E3
	68	6.3 x 6.3 x 7.7	2000	23.8	0.12	35	97004E3
	150	8.0 x 8.0 x 10.5	2300	52.5	0.12	27	97005E3
	270	10.0 x 10.0 x 10.5	2500	94.5	0.12	20	97006E3
50	10	5.0 x 5.0 x 5.8	750	5	0.1	120	97101E3
	22	6.3 x 6.3 x 5.8	1100	11	0.1	80	97102E3
	33	6.3 x 6.3 x 7.7	1600	16.5	0.1	40	97103E3
	68	8.0 x 8.0 x 10.5	1800	34	0.1	30	97104E3
	100	10.0 x 10.0 x 10.5	2000	50	0.1	28	97105E3
63	10	6.3 x 6.3 x 5.8	1000	6.3	0.08	120	97801E3
	22	6.3 x 6.3 x 7.7	1500	13.9	0.08	80	97802E3
	33	8.0 x 8.0 x 10.5	1700	20.8	0.08	40	97803E3
	56	10.0 x 10.0 x 10.5	1800	35.3	0.08	30	97804E3
	68	10.0 x 10.0 x 10.5	1800	42.8	0.08	30	97805E3
	82	10.0 x 10.0 x 12.4	2100	51.7	0.08	22	97806E3
	150	10.0 x 10.0 x 16.5	4350	94.5	0.08	15	97807E3
80	22	8.0 x 8.0 x 10.5	1550	17.6	0.08	45	97701E3
	33	10.0 x 10.0 x 10.5	1700	26.4	0.08	36	97702E3

**Table 6**

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage for short periods	IEC 60384-25, subclause 4.14	$U_S \leq 1.15 \times U_R$

## USEFUL LIFE AND ENDURANCE

Table 7

ENDURANCE TEST AND USEFUL LIFE							
SERIES	CASE CODE	USEFUL LIFE AT 105 °C (h) <sup>(1)</sup>	ENDURANCE AT 105 °C (h)	ENDURANCE AT 95 °C (h)	ENDURANCE AT 85 °C (h)	ENDURANCE AT 75 °C (h)	ENDURANCE AT 65 °C (h)
182 CPHZ	0506 to 1016	10 000	10 000	20 000	40 000	80 000	160 000

### Note

<sup>(1)</sup> Identical with endurance for this series

Endurance can be calculated by formula below:

$$L = L_{T_{max.}} \times 2^{\frac{T_{max.} - T_a}{10}}$$

L: estimated lifetime (h)

$L_{T_{max.}}$ : base lifetime specified at maximum operating temperature with applied DC voltage (h)

$T_{max.}$ : rated maximum operating temperature (°C)

$T_a$ : actual ambient temperature (°C)

Table 8

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY			
FREQUENCY (Hz)			
120	1000	10 000	≥ 100 000
$I_R$ MULTIPLIER			
0.1	0.3	0.6	1

Table 9

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Mounting	IEC 60384-25, subclause 4.3	Shall be performed prior to tests mentioned below; reflow soldering; for maximum temperature load refer to chapter "Mounting"	$\Delta C/C: \pm 5 \%$ $\tan \delta \leq \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$
Endurance	IEC 60384-25 / CECC 32300, subclause 4.15	$T_{amb} = 105 \text{ °C}$ ; $U_R$ applied; for test duration see Table 7	$\Delta C/C: \pm 30 \%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$ $ESR \leq 2 \times \text{spec. limit}$
Useful life	CECC 30301, subclause 1.8.1	$T_{amb} = 105 \text{ °C}$ ; $U_R$ and $I_R$ applied; for test duration see Table 7	$\Delta C/C: \pm 30 \%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$ $ESR \leq 2 \times \text{spec. limit}$
Shelf life (storage at high temperature)	IEC 60384-25 / CECC 32300, subclause 4.16	$T_{amb} = 105 \text{ °C}$ ; no voltage applied; 1000 h after test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement	For requirements see "Endurance test" above

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.