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

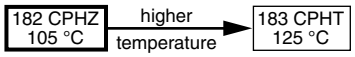

Fig. 1

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

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Automotive electronics
- 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

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 10.5
Rated capacitance range, C_R	10 µF to 330 µF
Tolerance on C_R	± 20 %
Rated voltage range, U_R	25 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

SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (L x W x H in mm)

C_R (µF)	U_R (V)				
	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	-	-
100	6.3 x 6.3 x 7.7	→	10.0 x 10.0 x 10.5	-	-
150	→	8.0 x 8.0 x 10.5	-	-	-
220	8.0 x 8.0 x 10.5	-	-	-	-
270	→	10.0 x 10.0 x 10.5	-	-	-
330	10.0 x 10.0 x 10.5	-	-	-	-

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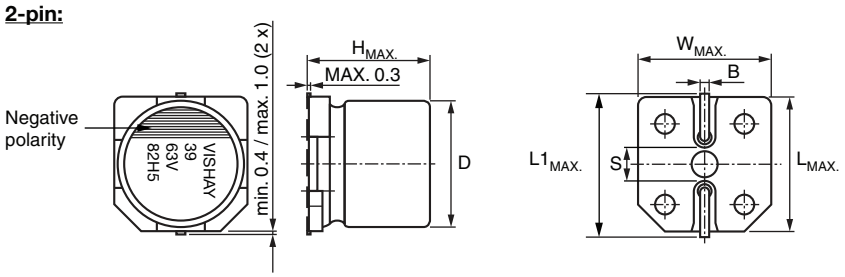

Fig. 2 - Dimensional outline

Table 1

DIMENSIONS in millimeters **AND MASS**									
NOMINAL CASE SIZE L x W x H	**CASE CODE**	**$L_{MAX.}$**	**$W_{MAX.}$**	**$H_{MAX.}$**	**Ø D**	**$B_{MAX.}$**	**S**	**$L1_{MAX.}$**	**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	6.7	6.7	6.1	6.3	0.8	2.2	7.4	0.3
6.3 x 6.3 x 7.7	0608	6.7	6.7	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

Table 2

TAPE AND REEL DIMENSIONS in millimeters, **PACKAGING QUANTITIES**						
NOMINAL CASE SIZE L x W x H	**CASE CODE**	**PITCH P_1**	**TAPE WIDTH W**	**TAPE THICKNESS T_2**	**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

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. 3 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. 4.

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.

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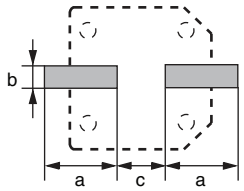

Fig. 3 - Recommended soldering pad dimensions

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

SOLDERING PROFILE FOR LEAD (Pb)-FREE REFLOW PROCESS

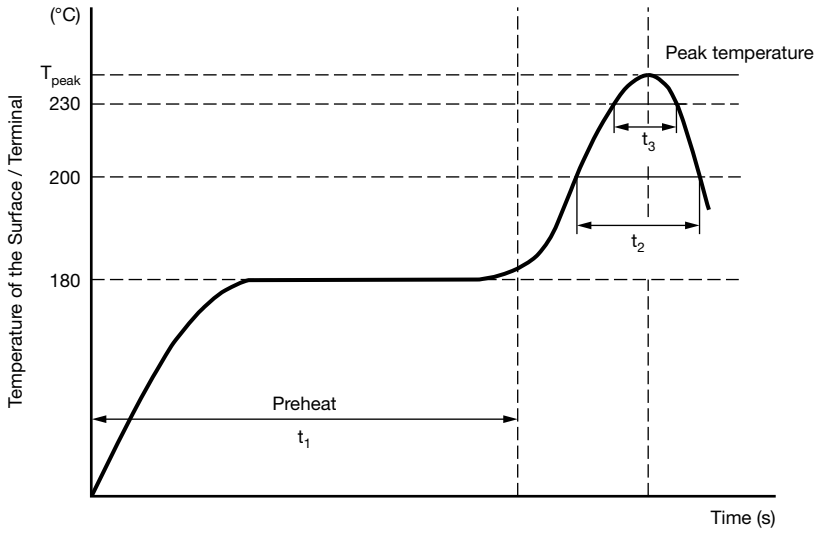

Fig. 4 - Maximum temperature load during reflow soldering

Table 4

REFLOW SOLDERING CONDITIONS for MAL2182xxxxxE3		
PROFILE FEATURES	**25 V**	**35 V TO 80 V**
Maximum time between 150 °C to 180 °C (t_1)	120 s	120 s
Maximum time above 200 °C (t_2)	80 s	70 s
Maximum time above 230 °C (t_3)	50 s	30 s
Peak temperature T_{Peak}	240 °C	240 °C
Maximum reflow cycles	2	1

Note

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

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ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	Rated capacitance at 120 Hz, tolerance ± 20 %
I_R 105 °C	Rated RMS ripple current at 100 kHz
I_{L2}	Max. leakage current after 2 min at U_R
tan δ	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 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %

ORDERING EXAMPLE

Hybrid conductive polymer 182 CPHZ series

100 µF / 25 V; ± 20 %

Nominal case size: 6.3 mm x 6.3 mm x 7.7 mm; taped on reel

Ordering code: MAL218297603E3

Table 5

ELECTRICAL DATA AND ORDERING INFORMATION							
U_R (V)	C_R (µF)	NOMINAL CASE SIZE L x W x H (mm)	I_R 105 °C 100 kHz (mA)	I_{L2} 2 min (µA)	tan δ 120 Hz	ESR 100 kHz 20 °C (mΩ)	ORDERING CODE MAL2182...
25	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
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
Voltage		
Surge voltage for short periods	IEC 60384-25, subclause 4.14	$U_s \leq 1.15 \times U_R$

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USEFUL LIFE AND ENDURANCE

Table 7

ENDURANCE TEST AND USEFUL LIFE							
SERIES	CASE CODE	USEFUL LIFE AT 105 °C (h) [1]	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 1010	10 000	10 000	20 000	40 000	80 000	160 000

Note

[1] Identical with endurance for this series

Endurance can be calculated by formula below:

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

L: estimated lifetime (h)

$L_{Tmax.}$: 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”	ΔC/C: ± 5 % tan δ ≤ spec. limit I_{L2} ≤ spec. limit
Endurance	IEC 60384-25 / CECC 32300, subclause 4.15	T_{amb} = 105 °C; U_R applied; for test duration see Table 7	ΔC/C: ± 30 % tan δ ≤ 2 x spec. limit I_{L2} ≤ spec. limit ESR ≤ 2 x spec. limit
Useful life	CECC 30301, subclause 1.8.1	T_{amb} = 105 °C; U_R and I_R applied; for test duration see Table 7	ΔC/C: ± 30 % tan δ ≤ 2 x spec. limit I_{L2} ≤ spec. limit ESR ≤ 2 x spec. limit
Shelf life (storage at high temperature)	IEC 60384-25 / CECC 32300, subclause 4.16	T_{amb} = 105 °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.

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