Conductive Polymer Aluminum Capacitors
SMD (Chip), Low Impedance

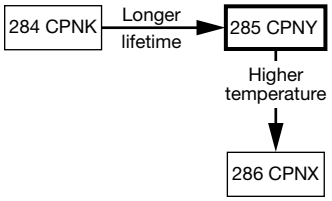

Fig. 1

FEATURES

- Extended useful life: up to 5000 h at 105 °C
- Very low ESR and high ripple current
- Voltages up to 50 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

- 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 (85)

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 5.7 to 10.0 x 10.0 x 12
Rated capacitance range, C_R	10 µF to 1000 µF
Tolerance on C_R	± 20 %
Rated voltage range, U_R	6.3 V to 50 V
Category temperature range	-55 °C to +105 °C
Endurance test at 105 °C	5000 h
Useful life at 105 °C	5000 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)						
	6.3	**10**	**16**	**20**	**25**	**35**	**50**
10	→	→	→	→	→	6.3 x 6.3 x 5.7	6.3 x 6.3 x 5.7
22	→	→	→	→	6.3 x 6.3 x 4.3	→	6.3 x 6.3 x 7.7
27	→	→	→	→	→	6.3 x 6.3 x 5.7	8 x 8 x 11.2
33	→	→	→	→	→	→	10 x 10 x 10
39	→	→	→	→	→	8 x 8 x 6.7	-
47	→	→	5 x 5 x 5.7	→	6.3 x 6.3 x 5.7	-	-
56	→	6.3 x 6.3 x 5.7	→	→	→	6.3 x 6.3 x 9	-
68	→	→	→	→	→	→	8 x 8 x 9.7
82	→	→	→	→	6.3 x 6.3 x 5.7	-	-
100	6.3 x 6.3 x 5.7	→	→	→	6.3 x 6.3 x 7.7	10 x 10 x 8	10 x 10 x 8
120	→	→	8 x 8 x 6.7	6.3 x 6.3 x 5.7	8 x 8 x 9.7	-	-

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)						
	6.3	10	16	20	25	35	50
150	→	→	6.3 x 6.3 x 5.7	→	→	10 x 10 x 12	-
180	→	→	8 x 8 x 6.7	8 x 8 x 6.7	8 x 8 x 11.2	-	-
220	6.3 x 6.3 x 5.7	→	6.3 x 6.3 x 9	→	8 x 8 x 9.7	-	-
270	→	8 x 8 x 6.7	-	-	-	-	-
330	→	8 x 8 x 9.7	10 x 10 x 10	-	-	-	-
470	8 x 8 x 7.7	-	-	-	-	-	-
560	→	10 x 10 x 12	-	-	-	-	-
680	→	→	10 x 10 x 10	-	-	-	-
820	10 x 10 x 8	-	-	-	-	-	-
1000	8 x 8 x 9.7	8 x 8 x 12.7	-	-	-	-	-

2-pin:

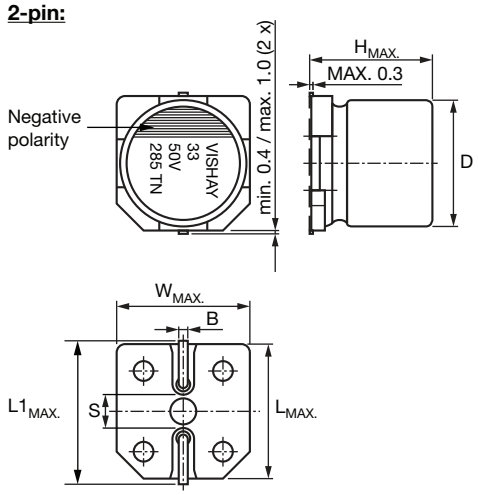

Fig. 2 - Dimensional outline

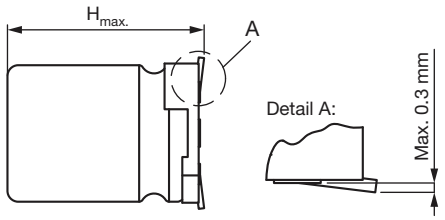

Fig. 3 - Coplanarity of pins

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 5.7	0506	5.5	5.5	6.0	5.3	0.8	1.4	6.1	0.2
6.3 x 6.3 x 4.3	0604	6.8	6.8	4.7	6.3	0.8	2.1	7.5	0.2
6.3 x 6.3 x 5.7	0606	6.8	6.8	6.0	6.3	0.8	2.1	7.5	0.3
6.3 x 6.3 x 7.7	0608	6.8	6.8	8.0	6.3	0.8	2.1	7.5	0.4
6.3 x 6.3 x 9.0	0609	6.8	6.8	10.0	6.3	1.1	2.1	7.5	0.4
8.0 x 8.0 x 6.7	0807	8.5	8.5	7.0	8.0	0.8	3.2	9.2	0.5
8.0 x 8.0 x 7.7	0808	8.5	8.5	8.0	8.0	1.1	3.2	9.2	0.6
8.0 x 8.0 x 9.7	0810	8.5	8.5	10.2	8.0	1.1	3.2	9.2	0.7
8.0 x 8.0 x 11.2	0811	8.5	8.5	11.7	8.0	1.1	3.2	9.2	0.8
8.0 x 8.0 x 12.7	0813	8.5	8.5	13.2	8.0	1.1	3.2	9.2	0.9
10.0 x 10.0 x 8	1009	10.5	10.5	9.0	10.0	1.1	4.6	11.2	0.9
10.0 x 10.0 x 10.0	1010	10.5	10.5	10.5	10.0	1.1	4.6	11.2	1.1
10.0 x 10.0 x 12.0	1012	10.5	10.5	12.5	10.0	1.1	4.6	11.2	1.3

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 5.7	0506	12.0	16.0	6.6	380	1200
6.3 x 6.3 x 4.3	0604	12.0	16.0	5.2	380	1500
6.3 x 6.3 x 5.7	0606	12.0	16.0	6.7	380	1200
6.3 x 6.3 x 7.7	0608	12.0	16.0	8.6	380	900
6.3 x 6.3 x 9.0	0609	12.0	16.0	10.4	380	700
8.0 x 8.0 x 6.7	0807	12.0	24.0	7.6	380	1000
8.0 x 8.0 x 7.7	0808	12.0	24.0	8.5	380	900
8.0 x 8.0 x 9.7	0810	16.0	24.0	10.3	380	600
8.0 x 8.0 x 11.2	0811	16.0	24.0	12.0	380	500
8.0 x 8.0 x 12.7	0813	16.0	24.0	13.3	380	400
10.0 x 10.0 x 8.0	1009	16.0	24.0	9.0	380	500
10.0 x 10.0 x 10.0	1010	16.0	24.0	10.9	380	500
10.0 x 10.0 x 12.0	1012	16.0	24.0	12.6	380	400

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.

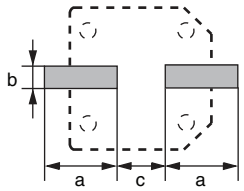

Fig. 4 - Recommended soldering pad dimensions

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 5.7	0506	3.0	1.6	1.4
6.3 x 6.3 x 4.3	0604	3.5	1.6	2.1
6.3 x 6.3 x 5.7	0606	3.5	1.6	2.1
6.3 x 6.3 x 7.7	0608	3.5	1.6	2.1
6.3 x 6.3 x 9.0	0609	3.5	1.6	2.1
8.0 x 8.0 x 6.7	0807	4.2	1.9	2.8
8.0 x 8.0 x 7.7	0808	4.2	1.9	2.8
8.0 x 8.0 x 9.7	0810	4.2	1.9	2.8
8.0 x 8.0 x 11.2	0811	4.2	1.9	2.8
8.0 x 8.0 x 12.7	0813	4.2	1.9	2.8
10.0 x 10.0 x 8.0	1009	4.4	1.9	4.3
10.0 x 10.0 x 10.0	1010	4.4	1.9	4.3
10.0 x 10.0 x 12.0	1012	4.4	1.9	4.3

SOLDERING PROFILE FOR LEAD (Pb)-FREE REFLOW PROCESS

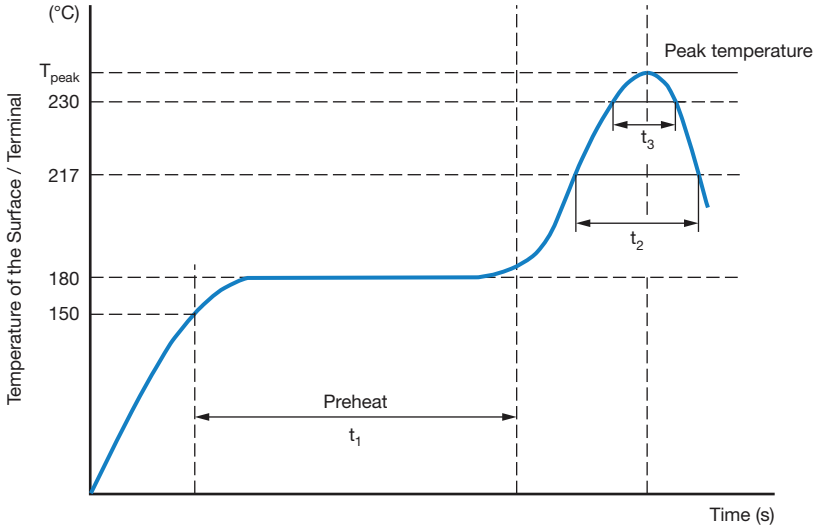

Fig. 5 - Maximum temperature load during reflow soldering

Table 4

REFLOW SOLDERING CONDITIONS for MAL2285xxxxxE3		
PROFILE FEATURES		
Maximum time between 150 °C to 180 °C (t_1)	120 s	
Ramp up rate from 217 °C to T_{peak}	0.5 K/s to 3 K/s	
Maximum time above 217 °C (t_2)	50 s	
Maximum time above 230 °C (t_3)	40 s	
Peak temperature T_{Peak}	250 °C	260 °C
Maximum reflow cycles	2	1
Ramp down rate T_{peak} to 217 °C	6 K/s max.	
Time 25 °C to T_{Peak}	8 min max.	

Notes

- Temperature measuring point on top of the case and on terminals
- MSL level 3 according to IPC/JEDEC® J-STD-20 MSL classifications

ELECTRICAL DATA	
SYMBOL	**DESCRIPTION**
C_R	Rated capacitance at 120 Hz, tolerance ± 20 %
I_R 105 °C	Max. allowed 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

Conductive polymer 285 CPNY 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: MAL228597604E3

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 MAL2285...
6.3	100	6.3 x 6.3 x 5.7	2400	315	0.10	27	97301E3
	220	6.3 x 6.3 x 5.7	3160	300	0.10	15	97302E3
	470	8 x 8 x 7.7	3950	592.2	0.10	12	97303E3
	820	10 x 10 x 8	4300	1033	0.10	12	97304E3
	1000	8 x 8 x 9.7	4770	1260	0.10	12	97305E3
10	56	6.3 x 6.3 x 5.7	2300	300	0.10	27	97401E3
	270	8 x 8 x 6.7	3220	540	0.10	22	97402E3
	330	8 x 8 x 9.7	3950	660	0.10	18	97403E3
	560	10 x 10 x 12	5300	1120	0.10	15	97404E3
	1000	8 x 8 x 12.7	5800	2000	0.10	12	97405E3
16	47	5 x 5 x 5.7	1300	300	0.10	40	97501E3
	120	8 x 8 x 6.7	2900	384	0.10	27	97502E3
	150	6.3 x 6.3 x 5.7	3300	480	0.10	22	97503E3
	180	8 x 8 x 6.7	3890	576	0.10	22	97504E3
	220	6.3 x 6.3 x 9	3300	704	0.10	22	97505E3
	330	10 x 10 x 10	4350	1050	0.10	16	97506E3
	680	10 x 10 x 10	4350	2176	0.10	18	97507E3
20	120	6.3 x 6.3 x 5.7	3200	480	0.10	25	97551E3
	180	8 x 8 x 6.7	3200	720	0.10	25	97552E3
25	22	6.3 x 6.3 x 4.3	2350	300	0.10	45	97601E3
	47	6.3 x 6.3 x 5.7	2500	588	0.10	30	97602E3
	82	6.3 x 6.3 x 5.7	1900	500	0.10	50	97603E3
	100	6.3 x 6.3 x 7.7	2000	500	0.10	30	97604E3
	120	8 x 8 x 9.7	3500	600	0.10	22	97605E3
	180	8 x 8 x 11.2	4650	900	0.10	16	97606E3
	220	8 x 8 x 9.7	4100	1100	0.10	22	97607E3
35	10	6.3 x 6.3 x 5.7	800	300	0.10	85	97001E3
	27	6.3 x 6.3 x 5.7	1500	189	0.10	50	97002E3
	39	8 x 8 x 6.7	2800	273	0.10	30	97003E3
	56	6.3 x 6.3 x 9	2600	392	0.10	35	97004E3
	100	10 x 10 x 8	2800	700	0.10	35	97005E3
	150	10 x 10 x 12	2600	1050	0.10	28	97006E3
50	10	6.3 x 6.3 x 5.7	2500	300	0.10	40	97101E3
	22	6.3 x 6.3 x 7.7	2000	220	0.10	60	97102E3
	27	8 x 8 x 11.2	2400	270	0.12	40	97103E3
	33	10 x 10 x 10	2200	330	0.12	42	97104E3
	68	8 x 8 x 9.7	2900	680	0.12	35	97105E3
	100	10 x 10 x 8	2300	1000	0.12	50	97106E3

Table 6

ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage for short periods	IEC 60384-25, subclause 4.14	$U_s \leq 1.15 \times U_R$

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)
285 CPNY	0506 to 1012	5000	5000	15 000	50 000	150 000	500 000

Note

[1] Identical with endurance for this series

Endurance can be calculated by formula below:

$$L = L_{Tmax.} \times 10^{\frac{T_{max.} - T_a}{20}}$$

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			
0.05	0.3	0.7	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: ± 20 % tan δ ≤ 1.5 x spec. limit I_{L2} ≤ spec. limit ESR ≤ 1.5 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: ± 20 % tan δ ≤ 1.5 x spec. limit I_{L2} ≤ spec. limit ESR ≤ 1.5 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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