THE DATASHEET OF

MAL210618103E3

Aluminum Electrolytic Capacitors, Power Eurodin, Screw Terminals

LINKS TO ADDITIONAL RESOURCES

3D Models

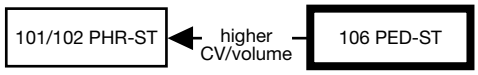


Fig. 1

FEATURES

- Very long useful life: 20 000 h at 85 °C
- Extremely low ESR and ESL allowing very high ripple current load
- High resistance to shock and vibration
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Also available in bolt version (106 PED-STB)
- Pressure relief in the sealing
- Charge and discharge proof
- High reliability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Computer, telecommunications, and industrial systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems

MARKING

The capacitors are marked with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (Q for -10 % / +30 %)
- Rated voltage (in V)
- Date code
- 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

QUICK REFERENCE DATA

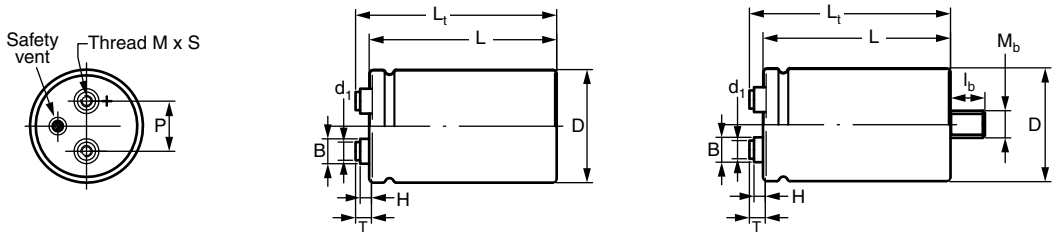
DESCRIPTION	VALUE
Nominal case size (Ø D x L in mm)	35 x 60 to 90 x 220
Rated capacitance range (E6 series), C_R	1000 µF to 330 000 µF
Tolerance on C_R	-10 % to +30 %
Rated voltage range, U_R	25 V to 100 V
Category temperature range	-40 °C to +85 °C
Endurance test at 85 °C	8000 h
Useful life at 85 °C	20 000 h
Shelf life at 0 V, 85 °C	500 h
Based on sectional specification	IEC 60384-4 / EN 130300
Climatic category IEC 60068	40 / 085 / 56

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

C_R (µF)	U_R (V)			
	25	40	63	100
1000	-	-	-	35 x 60
1500	-	-	-	35 x 60
2200	-	-	35 x 60	35 x 80
2700	-	-	35 x 60	-
3300	-	35 x 60	35 x 60	35 x 105
4700	35 x 60	35 x 60	35 x 80	50 x 80
6800	35 x 60	35 x 80	35 x 105	50 x 105
10 000	35 x 80	35 x 105	50 x 80	65 x 105
15 000	35 x 105	50 x 80	50 x 105	65 x 105
22 000	50 x 80	50 x 105	65 x 105	76 x 105
33 000	50 x 105	65 x 105	65 x 105	76 x 146
47 000	65 x 105	65 x 105	76 x 105	76 x 220
68 000	65 x 105	76 x 105	76 x 146	90 x 220
100 000	76 x 105	76 x 146	76 x 220	-
150 000	76 x 146	76 x 220	-	-
	-	90 x 146	90 x 220	-
220 000	76 x 220	-	-	-
	90 x 146	90 x 220	-	-
330 000	90 x 220	-	-	-

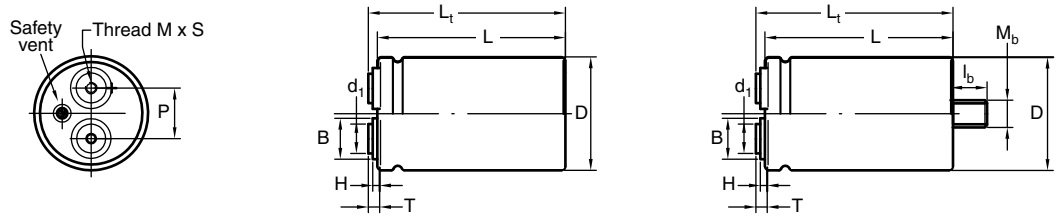
For technical questions, contact: aluminumcaps2@vishay.com

DIMENSIONS in millimeters **AND AVAILABLE FORMS**



Standard M5 disc | Clamp mounting (ST) | Threaded stud mounting (STB)

Fig. 2A - Mechanical drawings for standard M5 disc versions.
For details refer to Table 1



High current M6 disc | Clamp mounting (ST) | Threaded stud mounting (STB)

Fig. 2B - Mechanical drawings for high current M6 disc versions.
For details refer to Table 1

Note

- Maximum permissible torque which may be applied to the termination screws: 2 Nm for M5; 2.5 Nm for M6
  For accessories refer to document “Mounting Accessories”, see www.vishay.com/doc?28348
  The capacitors are delivered with screws and washers

Table 1

DIMENSIONS in millimeters **AND MASS**														
DESIGN	**DRAWING**	**L ± 1**	**L_t ± 1**	**D ± 1**	**P ± 0.3**	**T ± 0.2**	**H ± 0.3**	**B ± 0.3**	**d_1 ± 0.1**	**M**	**S - 0**	**M_b**	**l_b ± 0.1**	**MASS (g)**
35 x 60	2A	63.3	68.7	35.3	12.8	7.0	4.6	11.0	7.9	M5	9.5	M8	12.0	75
35 x 80	2A	81.3	86.7	35.3	12.8	7.0	4.6	11.0	7.9	M5	9.5	M8	12.0	95
35 x 105	2A	103.3	108.7	35.3	12.8	7.0	4.6	11.0	7.9	M5	9.5	M8	12.0	130
50 x 80	2A	82.8	88.8	51.0	22.2	7.1	4.8	11.0	7.9	M5	9.5	M12	16.0	200
50 x 105	2A	104.8	110.8	51.0	22.2	7.1	4.8	11.0	7.9	M5	9.5	M12	16.0	300
65 x 105	2A	104.8	110.7	65.0	28.5	7.0	4.6	11.9	7.9	M5	9.5	M12	16.0	480
65 x 105 HC	2B	104.8	109.2	65.0	28.5	5.5	3.5	18.0	13.0	M6	8.5	M12	16.0	480
76 x 105	2A	105.8	111.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	700
76 x 105 HC	2B	105.8	110.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	700
76 x 146	2A	145.8	151.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	1000
76 x 146 HC	2B	145.8	150.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	1000
76 x 220	2A	219.8	225.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	1500
76 x 220 HC	2B	219.8	224.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	1500
90 x 146 HC	2B	150.1	155.4	89.4	31.8	7.9	0.0	13.0	13.0	M6	10.0	M12	16.0	1300
90 x 220 HC	2B	218.1	223.4	89.4	31.8	7.9	0.0	13.0	13.0	M6	10.0	M12	16.0	2000

PACKAGING QUANTITIES AND DIMENSIONS in millimeters		
DESIGN	PACKAGING QUANTITIES (units per box)	CARDBOX DIMENSIONS L x W x H
35 x 60	50	377 x 375 x 88
35 x 80	50	377 x 375 x 123
35 x 105	50	377 x 375 x 129
50 x 80	25	377 x 375 x 123
50 x 105	25	377 x 375 x 129
65 x 105	16	377 x 375 x 129
65 x 105 HC	16	377 x 375 x 129
76 x 105	12	377 x 375 x 129
76 x 105 HC	12	377 x 375 x 129
76 x 146	12	377 x 375 x 168
76 x 146 HC	12	377 x 375 x 168
76 x 220	12	377 x 375 x 242
76 x 220 HC	12	377 x 375 x 242
90 x 146 HC	8	377 x 375 x 168
90 x 220 HC	8	377 x 375 x 242

Note

- For STB version holds:
  H cardbox box: + 10 mm

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	Rated capacitance at 100 Hz, tolerance -10 % to +30 %
I_R	Rated RMS ripple current at 100 Hz, 85 °C
I_{L5}	Max. leakage current after 5 min at U_R
ESR	Max. equivalent series resistance at 100 Hz
Z	Max. impedance at 20 kHz

Note

- Unless otherwise specified, all electrical values in Tables 2 and 3 apply at T_{amb} = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %

ORDERING EXAMPLE

Electrolytic capacitor 106 PED-ST series

10 000 µF / 25 V; -10 % / +30 %

Nominal case size: Ø 35 mm x 80 mm, ST version

Ordering code: MAL210616103E3

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION										
U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 85 °C (A)	I_{L5} 5 MIN. (mA)	ESR MAX. 100 Hz (mΩ)	Z MAX. 20 kHz (mΩ)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
							ST ORDERING CODE MAL2106.....	STB ORDERING CODE MAL2106.....	ST ORDERING CODE MAL2106.....	STB ORDERING CODE MAL2106.....
25	4700	35 x 60	5.8	0.24	70	50	16472E3	56472E3	-	-
	6800	35 x 60	6.3	0.34	55	42	16682E3	56682E3	-	-
	10 000	35 x 80	7.7	0.50	40	31	16103E3	56103E3	-	-
	15 000	35 x 105	9.0	0.75	30	24	16153E3	56153E3	-	-
	22 000	50 x 80	13.5	1.10	19	15	16223E3	56223E3	-	-
	33 000	50 x 105	16.0	1.65	14	12	16333E3	56333E3	-	-
	47 000	65 x 105	22.5	3.35	10	10	16473E3	56473E3	36473E3	76473E3
	68 000	65 x 105	23.0	3.40	10	10	16683E3	56683E3	36683E3	76683E3
	100 000	76 x 105	29.5	5.00	9	8	16104E3	56104E3	36104E3	76104E3
	150 000	76 x 146	34.0	7.5	8	8	16154E3	56154E3	36154E3	76154E3
	220 000	76 x 220	40.0	11.0	8	8	16224E3	56224E3	36224E3	76224E3
	220 000	90 x 146	50.0	11.0	8	8	-	-	46224E3	86224E3
	330 000	90 x 220	50.0	16.5	8	8	-	-	46334E3	86334E3

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 85 °C (A)	I_{L5} 5 MIN. (mA)	ESR MAX. 100 Hz (mΩ)	Z MAX. 20 kHz (mΩ)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
							ST ORDERING CODE MAL2106.....	STB ORDERING CODE MAL2106.....	ST ORDERING CODE MAL2106.....	STB ORDERING CODE MAL2106.....
40	3300	35 x 60	5.5	0.27	71	49	17332E3	57332E3	-	-
	4700	35 x 60	5.8	0.38	59	44	17472E3	57472E3	-	-
	6800	35 x 80	7.1	0.55	42	32	17682E3	57682E3	-	-
	10 000	35 x 105	10.6	0.80	23	16	17103E3	57103E3	-	-
	15 000	50 x 80	12.5	1.20	20	16	17153E3	57153E3	-	-
	22 000	50 x 105	14.5	1.76	16	12	17223E3	57223E3	-	-
	33 000	65 x 105	21.0	2.64	11	8	17333E3	57333E3	37333E3	77333E3
	47 000	65 x 105	24.5	3.76	8	8	17473E3	57473E3	37473E3	77473E3
	68 000	76 x 105	27.0	5.44	8	8	17683E3	57683E3	37683E3	77683E3
	100 000	76 x 146	31.5	8.0	8	8	17104E3	57104E3	37104E3	77104E3
	150 000	76 x 220	38.0	12.0	8	8	17154E3	57154E3	37154E3	77154E3
	150 000	90 x 146	50.0	12.0	8	8	-	-	47154E3	87154E3
	220 000	90 x 220	50.0	17.6	8	8	-	-	47224E3	87224E3
63	2200	35 x 60	5.4	0.28	68	47	18222E3	58222E3	-	-
	2700	35 x 60	5.6	0.34	63	43	18272E3	58272E3	-	-
	3300	35 x 60	7.2	0.42	40	27	18332E3	58332E3	-	-
	4700	35 x 80	8.8	0.60	29	19	18472E3	58472E3	-	-
	6800	35 x 105	10.6	0.86	22	15	18682E3	58682E3	-	-
	10 000	50 x 80	14.5	1.26	16	11	18103E3	58103E3	-	-
	15 000	50 x 105	17.0	1.89	12	9	18153E3	58153E3	-	-
	22 000	65 x 105	23.5	2.78	9	8	18223E3	58223E3	38223E3	78223E3
	33 000	65 x 105	23.5	4.16	8	8	18333E3	58333E3	38333E3	78333E3
	47 000	76 x 105	25.0	5.93	8	8	18473E3	58473E3	38473E3	78473E3
	68 000	76 x 146	29.5	8.6	8	8	18683E3	58683E3	38683E3	78683E3
	100 000	76 x 220	36.5	12.6	8	8	18104E3	58104E3	38104E3	78104E3
	150 000	90 x 220	50.0	18.9	8	8	-	-	48154E3	88154E3
100	1000	35 x 60	3.7	0.20	96	48	19102E3	59102E3	-	-
	1500	35 x 60	4.8	0.30	59	27	19152E3	59152E3	-	-
	2200	35 x 80	5.9	0.44	42	20	19222E3	59222E3	-	-
	3300	35 x 105	7.3	0.66	29	15	19332E3	59332E3	-	-
	4700	50 x 80	10.1	0.94	22	12	19472E3	59472E3	-	-
	6800	50 x 105	12.1	1.36	16	9	19682E3	59682E3	-	-
	10 000	65 x 105	16.7	2.00	11	7	19103E3	59103E3	39103E3	79103E3
	15 000	65 x 105	17.6	3.00	10	6	19153E3	59153E3	39153E3	79153E3
	22 000	76 x 105	19.5	4.40	9	6	19223E3	59223E3	39223E3	79223E3
	33 000	76 x 146	23.0	6.6	8	6	19333E3	59333E3	39333E3	79333E3
	47 000	76 x 220	28.6	9.4	5	5	19473E3	59473E3	39473E3	79473E3
	68 000	90 x 220	50.0	13.6	5	5	-	-	49683E3	89683E3

ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage		$U_s = 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 min at U_R	$I_{L1} \leq 0.006\ C_R \times U_R + 4$ µF
	After 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4$ µF
Inductance		
Equivalent series inductance (ESL)	Case Ø D = 35 mm	Typ. 13 nH
	Case Ø D = 50 mm	Typ. 16 nH
	Case Ø D = 65 mm	Typ. 19 nH (1)
	Case Ø D = 76 mm	Typ. 20 nH (1)
	Case Ø D = 90 mm	Typ. 21 nH (1)

Note

(1) Low ESL designs available on request

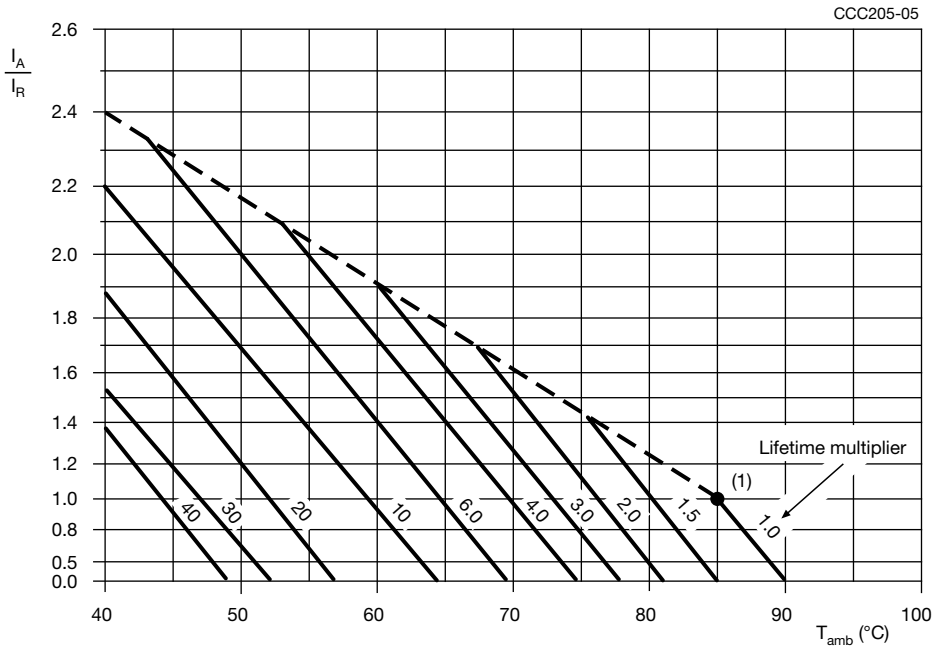
RIPPLE CURRENT AND USEFUL LIFE

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 85 °C (h)	**USEFUL LIFE AT 85 °C (h)**
8000	20 000

Note

- Multiplier of useful life code: CCC205-05



I_A = actual ripple current at 100 Hz
I_R = actual ripple current at 100 Hz and 85 °C
With an absolute maximum of 50 A at 85 °C
(1) Useful life at 85 °C and I_R applied: 20 000 h

Fig. 3 - 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	200	400	1000	≥ 2000
I_R MULTIPLIER					
0.83	1.00	1.10	1.15	1.19	1.20

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN 130300 subclause 4.13	T_{amb} = 85 °C; U_R applied; 8000 h	ΔC/C: ± 15 % tan δ ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I_{L5} ≤ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_{amb} = 85 °C; U_R and I_R applied; 20 000 h	ΔC/C: ± 45 % tan δ ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_{L5} ≤ spec. limit no short or open circuit, no visible damage total failure percentage ≤ 1 %
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300 subclause 4.17	T_{amb} = 85 °C; no voltage applied; 500 h after test: U_R to be applied for 30 min, 24 h to 48 h before measurement	ΔC/C: ± 10 % tan δ ≤ 1.2 x spec. limit I_{L5} ≤ 2 x 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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