Aluminum Electrolytic Capacitors, Power Eurodin, Screw Terminals

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 (YYMM)
- 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 / EN130300
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
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	-	-	-

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DIMENSIONS in millimeters **AND AVAILABLE FORMS**

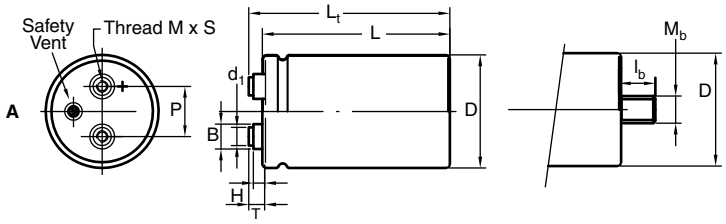

Fig. 2 **A**: standard M5 disc: Screw Terminal (ST) and Screw Terminal Bolt nut (STB)

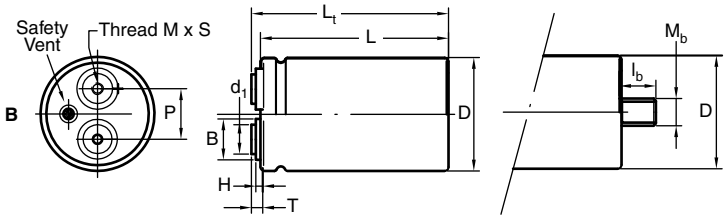

Fig. 2 **B**: high current M6 disc: Screw Terminal (ST) and Screw Terminal Bolt nut (STB)

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

Note

- For bolt version holds:
  L = L standard - 0.5 mm
  L_t = L_t standard - 0.5 mm

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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	18	520 x 270 x 280
76 x 220 HC	18	520 x 270 x 280
90 x 146 HC	8	377 x 375 x 168
90 x 220 HC	10	520 x 270 x 280

Note

- For bolt 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: MAL2 10616103E3
Former 12NC: 2222 10616103

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Table 2

ELECTRICAL DATA AND ORDERING INFORMATION										
							STANDARD HIGH POST M5 DISC		HIGH CURRENT M6 DISC	
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)	ST ORDERING CODE MAL2106.....	ST BOLT NUT ORDERING CODE MAL2106.....	ST ORDERING CODE MAL2106.....	ST BOLT NUT 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
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	-	-
	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	-	-
	15 000	50 x 105	14.5	1.89	16	11	18153E3	58153E3	-	-
	10 000	50 x 80	17.0	1.26	12	9	18103E3	58103E3	-	-
	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

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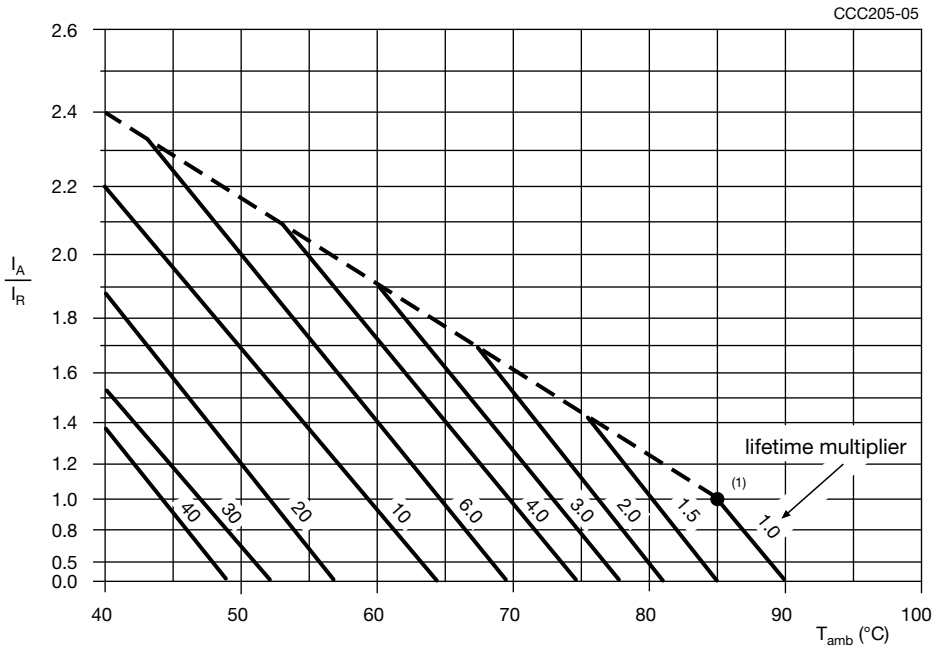
ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage		$U_s = 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 min at U_R	$I_{L1} \leq 0.006\ C_R \times U_R + 4$ µF
	After 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4$ µF
Inductance		
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



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

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Table 3

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	**I_R MULTIPLIER**
50	0.83
100	1.00
200	1.10
400	1.15
1000	1.19
≥ 2000	1.20

Table 4

TEST PROCEDURES AND REQUIREMENTS			
TEST		**PROCEDURE (quick reference)**	**REQUIREMENTS**
NAME OF TEST	**REFERENCE**		
Endurance	IEC 60384-4 / EN130300 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 / EN130300 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

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