



**THE DATASHEET OF
MAL210617473E3**



Aluminum Electrolytic Capacitors, Power Eurodin, Screw Terminals



LINKS TO ADDITIONAL RESOURCES



Fig. 1

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

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


**RoHS
COMPLIANT**

APPLICATIONS

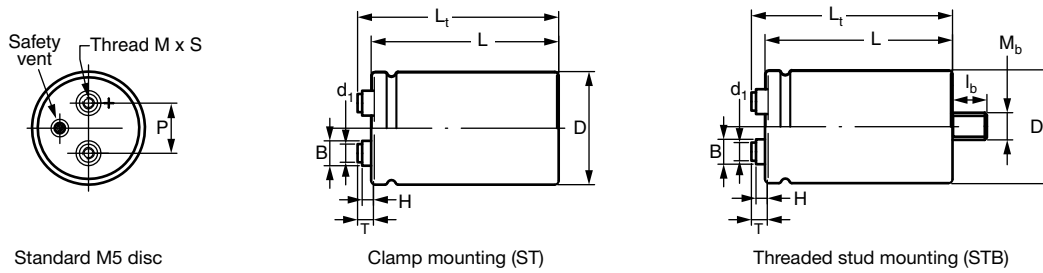
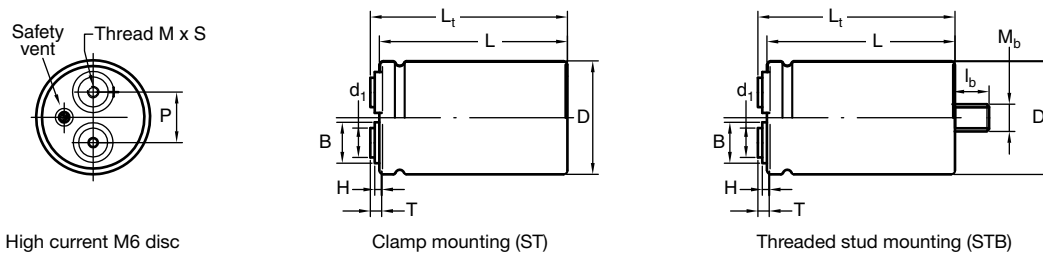
- Computer, telecommunications, and industrial systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems

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

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	-	-	-

DIMENSIONS in millimeters AND AVAILABLE FORMS

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

 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	$L \pm 1$	$L_t \pm 1$	$D \pm 1$	$P \pm 0.3$	$T \pm 0.2$	$H \pm 0.3$	$B \pm 0.3$	$d_1 \pm 0.1$	M	S - 0	M_b	$l_b \pm 0.1$	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

ORDERING EXAMPLE

Electrolytic capacitor 106 PED-ST series
 10 000 μ F / 25 V; -10 % / +30 %
 Nominal case size: \varnothing 35 mm x 80 mm, ST version
 Ordering code: MAL210616103E3

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 %

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION										
U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE \varnothing D x L (mm)	I_R 100 Hz 85 °C (A)	I_{L5} 5 MIN. (mA)	ESR MAX. 100 Hz (m Ω)	Z MAX. 20 kHz (m Ω)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
							ST ORDERING CODE	STB ORDERING CODE	ST ORDERING CODE	STB ORDERING CODE
							MAL2106.....	MAL2106.....	MAL2106.....	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	$I_{L1} \leq 0.006 C_R \times U_R + 4 \mu F$
	After 5 min at U_R	$I_{L5} \leq 0.002 C_R \times U_R + 4 \mu F$
Inductance		
Equivalent series inductance (ESL)	Case $\varnothing D = 35 \text{ mm}$	Typ. 13 nH
	Case $\varnothing D = 50 \text{ mm}$	Typ. 16 nH
	Case $\varnothing D = 65 \text{ mm}$	Typ. 19 nH ⁽¹⁾
	Case $\varnothing D = 76 \text{ mm}$	Typ. 20 nH ⁽¹⁾
	Case $\varnothing D = 90 \text{ mm}$	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

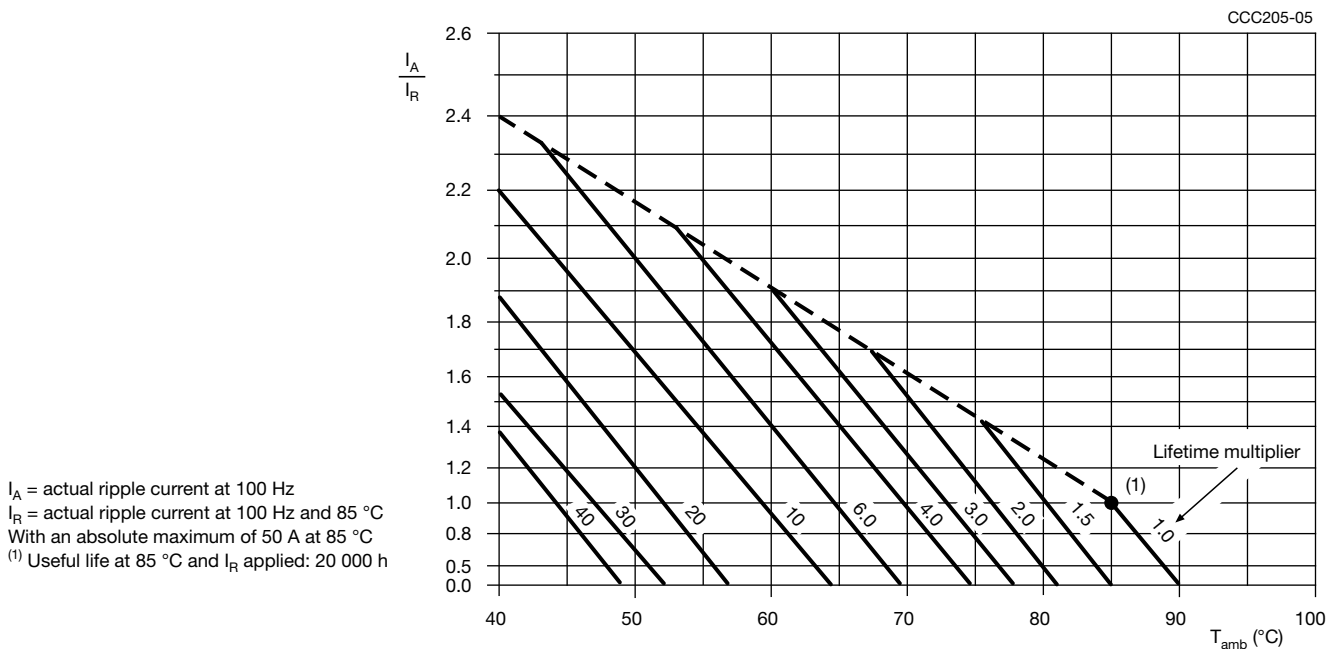


Fig. 3 - Multiplier of useful life as a function of ambient temperature and ripple current load



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	$T_{amb} = 85\text{ }^\circ\text{C}$; U_R applied; 8000 h	$\Delta C/C: \pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ }^\circ\text{C}$; U_R and I_R applied; 20 000 h	$\Delta C/C: \pm 45\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage $\leq 1\%$
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300 subclause 4.17	$T_{amb} = 85\text{ }^\circ\text{C}$; no voltage applied; 500 h after test: U_R to be applied for 30 min, 24 h to 48 h before measurement	$\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$

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