

Aluminum Capacitors, Power General Purpose Miniaturized Screw Terminal

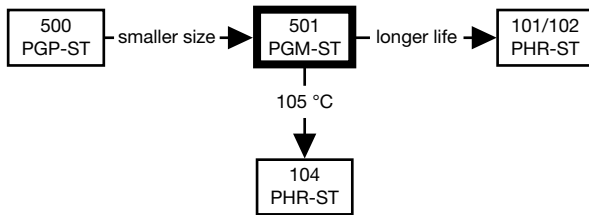


Fig. 1

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case size (Ø D x L in mm)	50 x 80 to 90 x 195
Rated capacitance range, C _R	1000 µF to 18 000 µF
Tolerance on C _R	± 20 %
Rated voltage range, U _R	400 V to 450 V
Category temperature range	-40 °C to +85 °C
Endurance test at 85 °C	2000 h
Useful life at 85 °C	5000 h
Shelf life at 0 V, 85 °C	1000 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)		
	400	450	500
1000	-	50 x 80	50 x 80
1200	-	50 x 80	50 x 80
1500	50 x 80	-	50 x 105
1800	-	50 x 105	-
2200	50 x 105	65 x 105	65 x 105
2700	-	65 x 105	65 x 105
3300	65 x 105	65 x 105	76 x 105
3900	65 x 105	-	76 x 105
4700	76 x 105	76 x 105	76 x 114
5600	76 x 105	76 x 114	76 x 146
6800	76 x 114	76 x 146	76 x 220
8200	76 x 146	-	76 x 220
10 000	90 x 146	76 x 220	90 x 195
12 000	90 x 146	76 x 220	90 x 195
15 000	76 x 220	90 x 195	-
18 000	90 x 195	-	-

FEATURES

- Useful life: 5000 h at +85 °C
- Efficient design
- Available in case sizes up to Ø 90 mm x 195 mm
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief in the sealing disc
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

APPLICATIONS

- UPS
- Energy storage in medical or industrial pulse systems
- Solar inverters

MARKING

The capacitors are marked with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code
- Name of manufacturer
- Code for factory of origin
- (Relevant part of) Ordering code

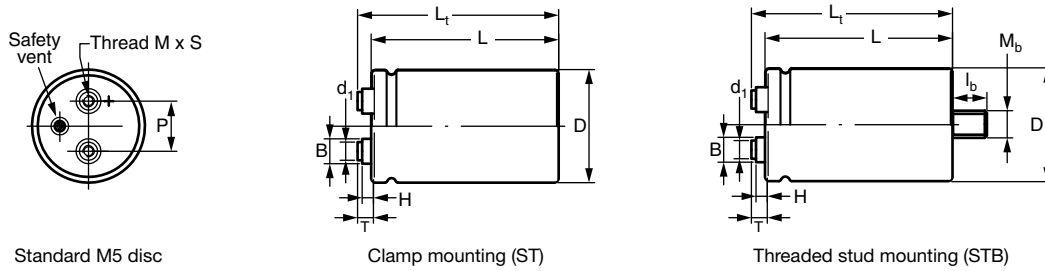
DIMENSIONS in millimeters AND AVAILABLE FORMS


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

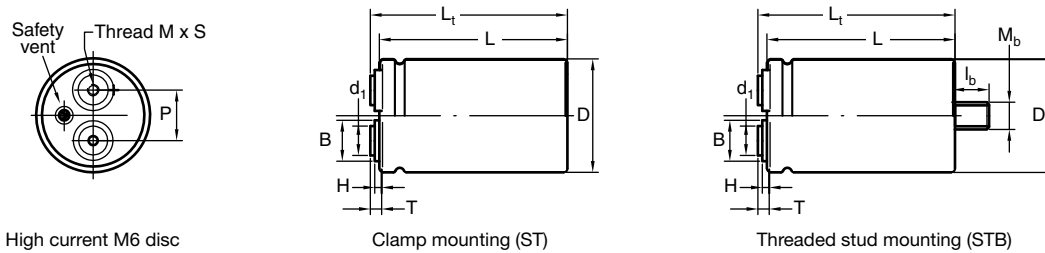


Fig. 2B - Mechanical drawings for high current M6 disc versions.
For details refer to Table 1

Notes

- 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
- High current disc with 1/4 28 UNF (US) thread is available on request

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)
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 114	2A	115.8	121.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	800
76 x 114 HC	2B	115.8	120.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	800
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 195 HC	2B	192.1	197.4	89.4	31.8	7.9	0.0	13.0	13.0	M6	10.0	M12	16.0	1800



PACKAGING QUANTITIES AND DIMENSIONS in millimeters		
DESIGN	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS L x W x H
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 114	12	377 x 375 x 140
76 x 114 HC	12	377 x 375 x 140
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 195 HC	10	520 x 270 x 255

Note

- For STB version < 90 mm diameter holds:
H of cardboard box: + 10 mm

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C _R	Rated capacitance at 100 Hz, tolerance ± 20 %
I _R	Rated RMS ripple current at 100 Hz, 85 °C
I _{L5}	Max. leakage current after 5 min at U _R
ESR	Equivalent series resistance at 100 Hz
Z	Max. impedance at 10 kHz

ORDERING EXAMPLE

Electrolytic capacitor 500 series

4700 µF / 400 V; ± 20 %

Nominal case size: Ø 76 mm x 105 mm;

STB version; standard M5 disc

Ordering code: MAL250156472E3

Note

- Unless otherwise specified, all electrical values in Table 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 (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I _R 100 Hz 85 °C (A)	I _{L5} 5 min (mA)	ESR TYP. 100 Hz (mΩ)	ESR MAX. 100 Hz (mΩ)	Z 10 kHz (mΩ)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE	STB ORDERING CODE	ST ORDERING CODE	STB ORDERING CODE
								MAL2501.....	MAL2501.....	MAL2501.....	MAL2501.....
400	1500	50 x 80	6.32	1.20	89	125	92	16152	56152	-	-
	2200	50 x 105	7.81	1.76	62	87	65	16222	56222	-	-
	3300	65 x 105	11.1	2.64	42	59	44	16332	56332	36332	76332
	3900	65 x 105	11.7	3.12	37	52	38	16392	56392	36392	76392
	4700	76 x 105	14.6	3.76	30	43	31	16472	56472	36472	76472
	5600	76 x 105	15.3	4.48	26	37	29	16562	56562	36562	76562
	6800	76 x 114	16.7	5.44	22	31	24	16682	56682	36682	76682
	8200	76 x 146	18.8	6.56	18	26	20	16822	56822	36822	76822
	10 000	90 x 146	23.8	8.00	14	20	16	-	-	36103	76103
	12 000	90 x 146	25.0	9.60	12	17	15	-	-	36123	76123
	15 000	76 x 220	26.1	12.00	10	15	12	16153	56153	36153	76153
	18 000	90 x 195	30.2	14.40	9	13	10	-	-	36183	76183



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 TYP. 100 Hz (mΩ)	ESR MAX. 100 Hz (mΩ)	Z 10 kHz (mΩ)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2501.....	STB ORDERING CODE MAL2501.....	ST ORDERING CODE MAL2501.....	STB ORDERING CODE MAL2501.....
450	1000	50 x 80	5.49	0.90	115	162	111	17102	57102	-	-
	1200	50 x 80	5.89	1.08	99	139	97	17122	57122	-	-
	1800	50 x 105	7.36	1.62	67	94	68	17182	57182	-	-
	2200	65 x 105	9.74	1.98	53	75	52	17222	57222	37222	77222
	2700	65 x 105	10.5	2.43	45	64	45	17272	57272	37272	77272
	3300	65 x 105	11.2	2.97	39	55	40	17332	57332	37332	77332
	4700	76 x 105	14.6	4.23	28	40	29	17472	57472	37472	77472
	5600	76 x 114	15.9	5.04	24	34	24	17562	57562	37562	77562
	6800	76 x 146	17.9	6.12	19	27	20	17682	57682	37682	77682
	10 000	76 x 220	23.3	9.00	13	19	13	17103	57103	37103	77103
	12 000	76 x 220	24.7	10.80	11	16	12	17123	57123	37123	77123
	15 000	90 x 195	28.9	13.50	9	13	10	-	-	37153	77153
500	1000	50 x 80	5.30	1.00	167	234	188	19102	59102	-	-
	1200	50 x 80	5.67	1.20	142	199	162	19122	59122	-	-
	1500	50 x 105	6.65	1.50	113	159	128	19152	59152	39152	79152
	2200	65 x 105	9.40	2.20	77	108	87	19222	59222	39222	79222
	2700	65 x 105	10.1	2.70	64	90	73	19272	59272	39272	79272
	3300	76 x 105	12.6	3.30	52	73	59	19332	59332	39332	79332
	3900	76 x 105	13.3	3.90	45	64	52	19392	59392	39392	79392
	4700	76 x 114	14.5	4.70	38	54	44	19472	59472	39472	79472
	5600	76 x 146	16.3	5.60	32	45	37	19562	59562	39562	79562
	6800	76 x 220	19.6	6.80	25	36	29	19682	59682	39682	79682
	8200	76 x 220	21.1	8.20	21	30	24	19822	59822	39822	79822
	10 000	90 x 195	25.0	10.00	18	26	22	-	-	39103	79103
12 000	90 x 195	26.4	12.00	15	22	19	-	-	39123	79123	

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≥ 400 V versions	U _s = 1.1 x U _R
Reverse voltage		U _{rev} ≤ 1 V
Current		
Leakage current	After 1 min at U _R	I _{L1} ≤ 0.006 C _R x U _R + 4 µA
	After 5 min at U _R	I _{L5} ≤ 0.002 C _R x U _R + 4 µA
Inductance		
Equivalent series inductance (ESL)	Case Ø D = 50 mm	Typ. 16 nH
	Case Ø D = 65 mm	Typ. 19 nH
	Case Ø D = 76 mm	Typ. 20 nH
	Case Ø D = 90 mm	Typ. 20 nH

RIPPLE CURRENT AND USEFUL LIFE

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 85 °C (h)	USEFUL LIFE AT 85 °C (h)
2000	5000

Note

- Multiplier of useful life code: CCC205-05

CCC205-05

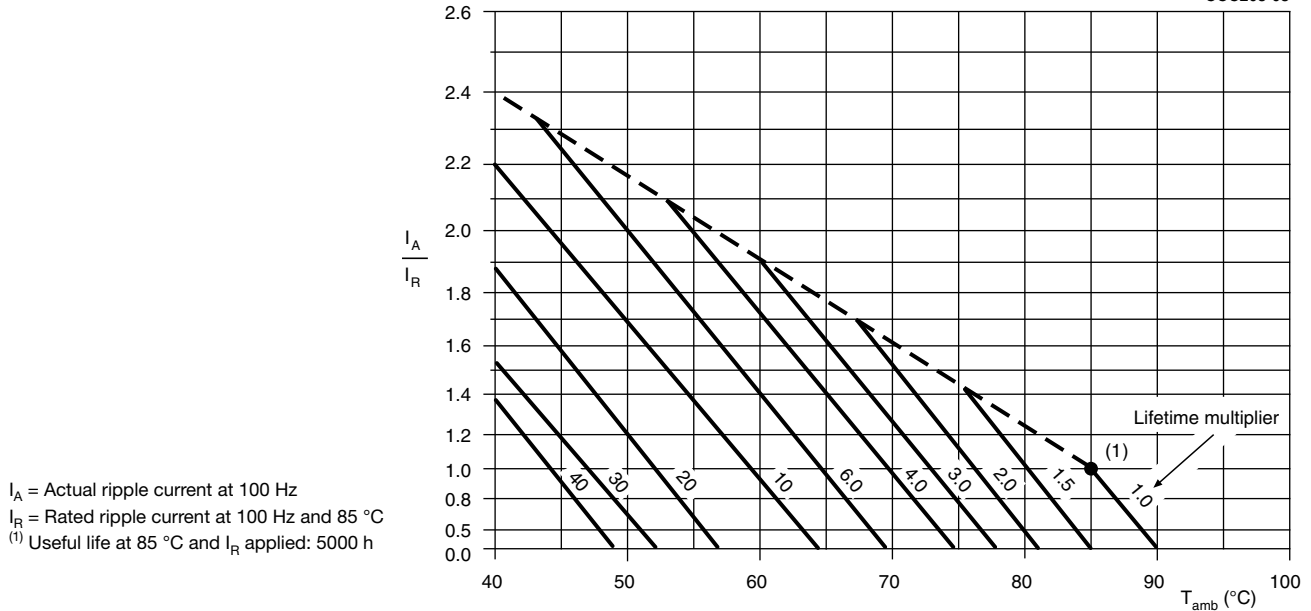


Fig. 3 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY					
FREQUENCY (Hz)					
50	100	120	500	1000	≥ 10 000
I_R MULTIPLIER					
0.80	1.00	1.05	1.30	1.40	1.50

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN 130300 subclause 4.13	$T_{amb} = 85\text{ °C}$; U_R applied; 2000 h	$\Delta C/C: \pm 10\%$ $ESR \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ °C}$; U_R and I_R applied; 5000 h	$\Delta C/C: \pm 30\%$ $ESR \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300 subclause 4.17	$T_{amb} = 85\text{ °C}$; no voltage applied; 1000 h after test: U_R to be applied for 30 min, 24 h to 48 h before measurement	$\Delta C/C: \pm 10\%$ $ESR \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$

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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