Aluminum Electrolytic Capacitors, Power High Ripple Current, Screw Terminals



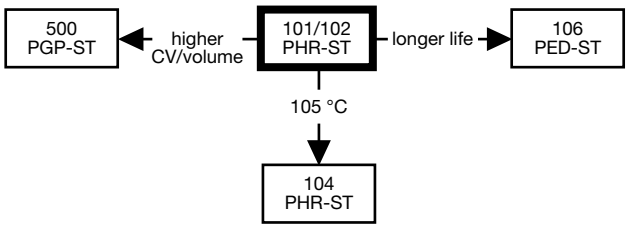


Fig. 1

FEATURES

- Long useful life: 10 000 h to 15 000 h at +85 °C
- Available in case sizes up to Ø 90 mm x 220 mm
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief in the sealing
- Low ESR
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT

APPLICATIONS

- Buffering and filtering
- Motor drives, inverters, UPS, and traction systems
- Pulsed power supplies

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 (YYMM or in 2 digits according to IEC 60062)
- 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

QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	101	102
Nominal case size (Ø D x L in mm)	35 x 60 to 90 x 220	
Rated capacitance range (E6 series), C_R	220 µF to 1 F	
Tolerance on C_R	± 20 %	
Rated voltage range, U_R	25 V to 100 V	200 V to 450 V
Category temperature range	-40 °C to +85 °C	
Endurance test at 85 °C	2000 h	
Useful life at 85 °C	10 000 h (D ≤ 50 mm) 15 000 h (D ≥ 65 mm)	10 000 h
Useful life at 40 °C, 1.4 x I_R applied	400 000 h (D ≤ 50 mm) 600 000 h (D ≥ 65 mm)	400 000 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 / 056	

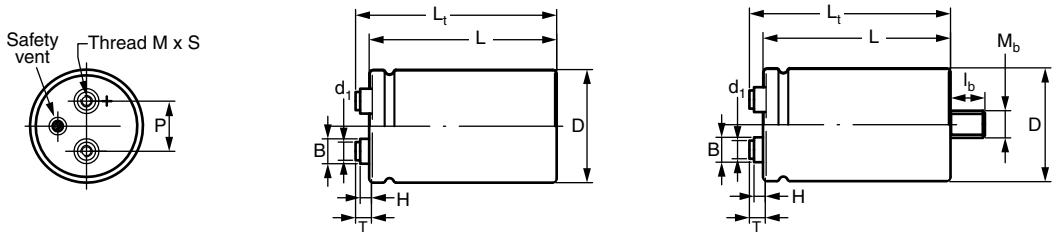
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SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)										
C_R (µF)	U_R (V)									
	25	40	63	100	200	250	350	385	400	450
220	-	-	-	-	-	-	-	35 x 60	35 x 60	35 x 60
330	-	-	-	-	-	-	35 x 60	-	35 x 60	-
	-	-	-	-	-	-	-	-	35 x 80	-
470	-	-	-	-	-	35 x 60	-	35 x 80	35 x 80	-
	-	-	-	-	-	-	35 x 80	-	35 x 105	35 x 105
680	-	-	-	-	35 x 60	35 x 80	-	-	35 x 105	-
	-	-	-	-	-	-	-	-	50 x 80	50 x 80
1000	-	-	-	-	35 x 80	35 x 80	-	50 x 80	50 x 80	50 x 80
	-	-	-	-	35 x 105	35 x 105	-	-	50 x 105	50 x 105
1500	-	-	-	-	35 x 105	35 x 105	-	-	-	50 x 105
	-	-	-	-	50 x 80	50 x 80	50 x 105	50 x 105	50 x 105	65 x 105
2200	-	-	-	35 x 60	50 x 80	50 x 80	50 x 105	-	-	65 x 105
	-	-	-	-	-	50 x 105	65 x 105	65 x 105	65 x 105	76 x 105
3300	-	-	-	35 x 60	50 x 80	50 x 105	-	-	65 x 105	76 x 105
	-	-	-	35 x 80	50 x 105	65 x 105	65 x 105	76 x 105	76 x 105	76 x 146
4700	-	-	35 x 60	35 x 80	-	65 x 105	76 x 105	76 x 105	76 x 105	76 x 146
	-	-	-	35 x 105	65 x 105	76 x 105	76 x 146	76 x 146	76 x 146	-
5600	-	-	-	-	-	-	-	-	-	-
6800	-	-	35 x 60	35 x 105	65 x 105	76 x 105	-	-	76 x 146	76 x 220
	-	-	35 x 80	50 x 80	76 x 105	76 x 146	76 x 146	76 x 146	-	90 x 146
10 000	-	35 x 60	35 x 80	50 x 80	76 x 105	76 x 105	76 x 220	-	-	-
	-	-	35 x 105	50 x 105	76 x 146	76 x 146	90 x 146	-	-	90 x 220
15 000	35 x 60	35 x 60	35 x 105	50 x 105	76 x 146	76 x 146	-	-	-	-
	-	35 x 80	50 x 80	-	-	-	90 x 220	-	-	-
22 000	35 x 60	35 x 80	50 x 80	65 x 105	76 x 220	76 x 220	-	-	-	-
	-	50 x 80	50 x 105	76 x 105	90 x 146	90 x 146	-	-	-	-
33 000	35 x 80	35 x 105	50 x 105	76 x 105	-	-	-	-	-	-
	50 x 80	50 x 80	65 x 105	76 x 146	90 x 220	90 x 220	-	-	-	-
47 000	35 x 105	50 x 80	65 x 105	-	-	-	-	-	-	-
	50 x 80	50 x 105	76 x 105	76 x 146	-	-	-	-	-	-
68 000	50 x 80	50 x 105	76 x 105	76 x 146	-	-	-	-	-	-
	50 x 105	65 x 105	76 x 146	-	-	-	-	-	-	-
100 000	50 x 105	65 x 105	-	76 x 220	-	-	-	-	-	-
	65 x 105	76 x 105	76 x 146	90 x 146	-	-	-	-	-	-
150 000	65 x 105	76 x 105	76 x 146	-	-	-	-	-	-	-
	76 x 105	76 x 146	-	90 x 220	-	-	-	-	-	-
220 000	65 x 105	-	76 x 220	-	-	-	-	-	-	-
	76 x 105	76 x 146	90 x 146	-	-	-	-	-	-	-
330 000	76 x 146	76 x 220	-	-	-	-	-	-	-	-
	-	90 x 146	90 x 220	-	-	-	-	-	-	-
470 000	76 x 220	-	-	-	-	-	-	-	-	-
	90 x 146	90 x 220	-	-	-	-	-	-	-	-
680 000	76 x 220	-	-	-	-	-	-	-	-	-
1 000 000	90 x 220	-	-	-	-	-	-	-	-	-

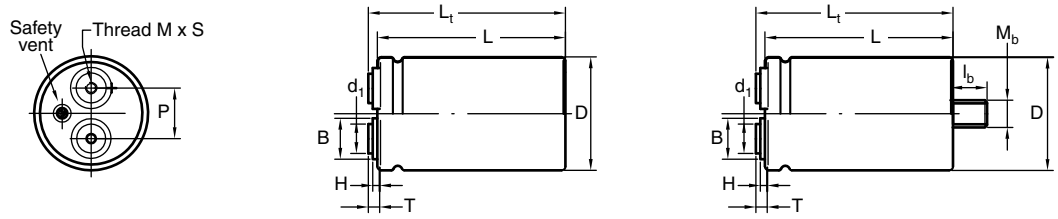
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DIMENSIONS in millimeters **AND AVAILABLE FORMS**



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

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)**
35 x 60	2A	63.3	68.7	35.3	12.8	7	4.6	11	7.9	M5	9.5	M8	12	75
35 x 80	2A	81.3	86.7	35.3	12.8	7	4.6	11	7.9	M5	9.5	M8	12	95
35 x 105	2A	103.3	108.7	35.3	12.8	7	4.6	11	7.9	M5	9.5	M8	12	130
50 x 80	2A	82.8	88.8	51	22.2	7.1	4.8	11	7.9	M5	9.5	M12	16	200
50 x 105	2A	104.8	110.8	51	22.2	7.1	4.8	11	7.9	M5	9.5	M12	16	300
65 x 105	2A	104.8	110.7	65	28.5	7	4.6	11.9	7.9	M5	9.5	M12	16	480
65 x 105 HC	2B	104.8	109.2	65	28.5	5.5	3.5	18	13	M6	8.5	M12	16	480
76 x 105	2A	105.8	111.7	76.4	31.8	7	4.6	11.7	7.9	M5	9.5	M12	16	700
76 x 105 HC	2B	105.8	110.2	76.4	31.8	5.5	3.5	18.3	13	M6	8.5	M12	16	700
76 x 146	2A	145.8	151.7	76.4	31.8	7	4.6	11.7	7.9	M5	9.5	M12	16	1000
76 x 146 HC	2B	145.8	150.2	76.4	31.8	5.5	3.5	18.3	13	M6	8.5	M12	16	1000
76 x 220	2A	219.8	225.7	76.4	31.8	7	4.6	11.7	7.9	M5	9.5	M12	16	1500
76 x 220 HC	2B	219.8	224.2	76.4	31.8	5.5	3.5	18.3	13	M6	8.5	M12	16	1500
90 x 146 HC	2B	150.1	155.4	89.4	31.8	7.9	0	13	13	M6	10	M12	16	1300
90 x 220 HC	2B	218.1	223.4	89.4	31.8	7.9	0	13	13	M6	10	M12	16	2000

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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	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 bolt version holds:
  H cardbox 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	Max. equivalent series resistance at 100 Hz
Z	Max. impedance at 20 kHz

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 %

ORDERING EXAMPLE

Electrolytic capacitor 101 series

10 000 µF / 40 V; ± 20 %

Nominal case size: Ø 35 mm x 60 mm;
ST version, standard M5 disc

Ordering code: MAL2 10117103E3
Former 12NC: 2222 10117103

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES											
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)	LIFE CODE (1)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2101.....	STB ORDERING CODE MAL2101.....	ST ORDERING CODE MAL2101.....	STB ORDERING CODE MAL2101.....
	15 000	35 x 60	7.7	0.75	29	22	L1	16153E3	56153E3	-	-
	22 000	35 x 60	8.3	1.10	27	22	L1	16223E3	56223E3	-	-
	33 000	35 x 80	9.0	1.65	19	17	L1	16333E3	56333E3	-	-
	33 000	50 x 80	10.0	1.65	17	14	L1	26333E3	66333E3	-	-
	47 000	35 x 105	12.1	2.35	15	13	L1	16473E3	56473E3	-	-
	47 000	50 x 80	14.8	2.35	12	10	L1	26473E3	66473E3	-	-
	68 000	50 x 80	12.8	3.40	15	13	L1	16683E3	56683E3	-	-
	68 000	50 x 105	17.1	3.40	9	8	L1	26683E3	66683E3	-	-
	100 000	50 x 105	14.7	5.00	12	11	L1	16104E3	56104E3	-	-
25	100 000	65 x 105	19.6	5.00	7	6	L2	26104E3	66104E3	46104E3	86104E3
	150 000	65 x 105	17.6	7.50	8	7	L2	16154E3	56154E3	36154E3	76154E3
	150 000	76 x 105	21.4	7.50	6	5	L2	26154E3	66154E3	46154E3	86154E3
	220 000	65 x 105	20.2	11.0	6	5	L2	16224E3	56224E3	36224E3	76224E3
	220 000	76 x 105	22.5	11.0	6	5	L2	26224E3	66224E3	46224E3	86224E3
	330 000	76 x 146	25.8	16.5	4	4	L2	26334E3	66334E3	46334E3	86334E3
	470 000	76 x 220	29.9	23.5	5	5	L2	16474E3	56474E3	36474E3	76474E3
	470 000	90 x 146	38.2	23.5	5	5	L2	-	-	46474E3	86474E3
	680 000	76 x 220	29.0	34.0	5	5	L2	16684E3	56684E3	36684E3	76684E3
	1 000 000	90 x 220	46.6	50.0	5	5	L2	-	-	46105E3	86105E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES

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)	LIFE CODE (1)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2101.....	STB ORDERING CODE MAL2101.....	ST ORDERING CODE MAL2101.....	STB ORDERING CODE MAL2101.....
40	10 000	35 x 60	7.1	0.80	31	23	L1	17103E3	57103E3	-	-
	15 000	35 x 60	7.8	1.20	28	22	L1	17153E3	57153E3	-	-
	15 000	35 x 80	8.7	1.20	22	17	L1	27153E3	67153E3	-	-
	22 000	35 x 80	9.4	1.76	20	17	L1	17223E3	57223E3	-	-
	22 000	50 x 80	11.2	1.76	19	15	L1	27223E3	67223E3	-	-
	33 000	35 x 105	11.0	2.64	15	13	L1	17333E3	57333E3	-	-
	33 000	50 x 80	13.7	2.64	13	10	L1	27333E3	67333E3	-	-
	47 000	50 x 80	14.6	3.76	12	10	L1	17473E3	57473E3	-	-
	47 000	50 x 105	15.9	3.76	10	8	L1	27473E3	67473E3	-	-
	68 000	50 x 105	16.9	5.44	9	8	L1	17683E3	57683E3	-	-
	68 000	65 x 105	18.1	5.44	7	6	L2	27683E3	67683E3	47683E3	87683E3
	100 000	65 x 105	19.2	8.0	7	6	L2	17104E3	57104E3	37104E3	77104E3
	100 000	76 x 105	21.3	8.0	7	6	L2	27104E3	67104E3	47104E3	87104E3
	150 000	76 x 105	20.5	12.0	7	6	L2	17154E3	57154E3	37154E3	77154E3
	150 000	76 x 146	24.0	12.0	5	5	L2	27154E3	67154E3	47154E3	87154E3
	220 000	76 x 146	24.5	17.6	5	5	L2	27224E3	67224E3	47224E3	87224E3
	330 000	76 x 220	28.2	26.4	5	5	L2	17334E3	57334E3	37334E3	77334E3
	330 000	90 x 146	38.6	26.4	5	5	L2	-	-	47334E3	87334E3
	470 000	90 x 220	41.5	37.6	5	5	L2	-	-	47474E3	87474E3
63	4700	35 x 60	5.9	0.59	42	25	L1	18472E3	58472E3	-	-
	6800	35 x 60	6.6	0.86	38	25	L1	18682E3	58682E3	-	-
	6800	35 x 80	7.3	0.86	30	19	L1	28682E3	68682E3	-	-
	10 000	35 x 80	8.1	1.26	27	19	L1	18103E3	58103E3	-	-
	10 000	35 x 105	8.8	1.26	22	14	L1	28103E3	68103E3	-	-
	15 000	35 x 105	9.7	1.89	19	14	L1	18153E3	58153E3	-	-
	15 000	50 x 80	12.1	1.89	16	11	L1	28153E3	68153E3	-	-
	22 000	50 x 80	11.1	2.77	19	15	L1	18223E3	58223E3	-	-
	22 000	50 x 105	14.3	2.77	12	9	L1	28223E3	68223E3	-	-
	33 000	50 x 105	12.9	4.16	14	12	L1	18333E3	58333E3	-	-
	33 000	65 x 105	16.5	4.16	9	6	L2	28333E3	68333E3	48333E3	88333E3
	47 000	65 x 105	15.6	5.92	10	8	L2	18473E3	58473E3	38473E3	78473E3
	47 000	76 x 105	18.6	5.92	8	6	L2	28473E3	68473E3	48473E3	88473E3
	68 000	76 x 105	20.0	8.57	7	6	L2	18683E3	58683E3	38683E3	78683E3
	68 000	76 x 146	21.9	8.57	6	5	L2	28683E3	68683E3	48683E3	88683E3
	100 000	76 x 146	23.4	12.6	5	5	L2	28104E3	68104E3	48104E3	88104E3
	150 000	76 x 146	22.2	18.9	6	5	L2	18154E3	58154E3	38154E3	78154E3
	220 000	76 x 220	27.0	27.7	5	5	L2	18224E3	58224E3	38224E3	78224E3
	220 000	90 x 146	36.5	27.7	5	5	L2	-	-	48224E3	88224E3
	330 000	90 x 220	42.9	41.6	5	5	L2	-	-	48334E3	88334E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES											
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)	LIFE CODE (1)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2101.....	STB ORDERING CODE MAL2101.....	ST ORDERING CODE MAL2101.....	STB ORDERING CODE MAL2101.....
100	2200	35 x 60	5.2	0.44	50	29	L1	19222E3	59222E3	-	-
	3300	35 x 60	6.0	0.66	42	27	L1	19332E3	59332E3	-	-
	3300	35 x 80	6.6	0.66	35	21	L1	29332E3	69332E3	-	-
	4700	35 x 80	7.3	0.94	31	20	L1	19472E3	59472E3	-	-
	4700	35 x 105	7.9	0.94	26	16	L1	29472E3	69472E3	-	-
	6800	35 x 105	8.8	1.36	23	15	L1	19682E3	59682E3	-	-
	6800	50 x 80	10.9	1.36	19	12	L1	29682E3	69682E3	-	-
	10 000	50 x 80	10.5	2.00	21	15	L1	19103E3	59103E3	-	-
	10 000	50 x 105	13.1	2.00	14	9	L1	29103E3	69103E3	-	-
	15 000	50 x 105	12.3	3.00	16	12	L1	19153E3	59153E3	-	-
	22 000	65 x 105	14.8	4.40	11	8	L2	19223E3	59223E3	39223E3	79223E3
	22 000	76 x 105	17.4	4.40	9	6	L2	29223E3	69223E3	49223E3	89223E3
	33 000	76 x 105	19.0	6.60	8	6	L2	19333E3	59333E3	39333E3	79333E3
	33 000	76 x 146	20.7	6.60	7	5	L2	29333E3	69333E3	49333E3	89333E3
	47 000	76 x 146	22.4	9.40	6	5	L2	29473E3	69473E3	49473E3	89473E3
	68 000	76 x 146	25.6	13.6	6	5	L2	19683E3	59683E3	39683E3	79683E3
	100 000	76 x 220	31.2	20.0	5	5	L2	19104E3	59104E3	39104E3	79104E3
	100 000	90 x 146	41.5	20.0	5	5	L2	-	-	49104E3	89104E3
	150 000	90 x 220	49.1	30.0	5	5	L2	-	-	49154E3	89154E3

Note

(1) Determines the applicable row in the table “Endurance Test Duration and Useful Life”

Table 3

ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES											
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)	LIFE CODE (1)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2102.....	STB ORDERING CODE MAL2102.....	ST ORDERING CODE MAL2102.....	STB ORDERING CODE MAL2102.....
200	680	35 x 60	3.5	0.27	207	136	L1	12681E3	52681E3	-	-
	1000	35 x 80	4.4	0.40	144	95	L1	12102E3	52102E3	-	-
	1000	35 x 105	4.7	0.40	140	91	L1	22102E3	62102E3	-	-
	1500	35 x 105	5.5	0.60	100	67	L1	12152E3	52152E3	-	-
	1500	50 x 80	6.2	0.60	106	74	L1	22152E3	62152E3	-	-
	2200	50 x 80	8.0	0.88	67	44	L1	12222E3	52222E3	-	-
	3300	50 x 80	8.9	1.32	50	35	L1	12332E3	52332E3	-	-
	3300	50 x 105	9.9	1.32	46	32	L1	22332E3	62332E3	-	-
	4700	65 x 105	12.5	1.88	37	26	L1	22472E3	62472E3	42472E3	82472E3
	6800	65 x 105	15.2	2.72	25	18	L1	12682E3	52682E3	32682E3	72682E3
	6800	76 x 105	16.9	2.72	25	18	L1	22682E3	62682E3	42682E3	82682E3
	10 000	76 x 105	19.9	4.00	18	13	L1	12103E3	52103E3	32103E3	72103E3
	10 000	76 x 146	20.4	4.00	18	13	L1	22103E3	62103E3	42103E3	82103E3
	15 000	76 x 146	24.1	6.00	12	9	L1	12153E3	52153E3	32153E3	72153E3
	22 000	76 x 220	29.5	8.8	9	7	L1	12223E3	52223E3	32223E3	72223E3
	22 000	90 x 146	34.1	8.8	8	6	L1	-	-	42223E3	82223E3
	33 000	90 x 220	41.7	13.2	6	5	L1	-	-	42333E3	82333E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES

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)	LIFE CODE (1)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2102.....	STB ORDERING CODE MAL2102.....	ST ORDERING CODE MAL2102.....	STB ORDERING CODE MAL2102.....
250	470	35 x 60	3.1	0.24	250	152	L1	13471E3	53471E3	-	-
	680	35 x 80	3.8	0.34	175	107	L1	13681E3	53681E3	-	-
	1000	35 x 80	4.4	0.50	128	82	L1	13102E3	53102E3	-	-
	1000	35 x 105	4.8	0.50	122	76	L1	23102E3	63102E3	-	-
	1500	35 x 105	5.4	0.75	90	58	L1	13152E3	53152E3	-	-
	1500	50 x 80	7.0	0.75	81	50	L1	23152E3	63152E3	-	-
	2200	50 x 80	8.0	1.10	60	39	L1	13222E3	53222E3	-	-
	2200	50 x 105	8.7	1.10	57	35	L1	23222E3	63222E3	-	-
	3300	50 x 105	9.8	1.65	42	28	L1	13332E3	53332E3	-	-
	3300	65 x 105	11.4	1.65	42	28	L1	23332E3	63332E3	43332E3	83332E3
	4700	65 x 105	13.8	2.35	29	19	L1	13472E3	53472E3	33472E3	73472E3
	4700	76 x 105	15.3	2.35	29	19	L1	23472E3	63472E3	43472E3	83472E3
	6800	76 x 105	18.1	3.40	21	14	L1	13682E3	53682E3	33682E3	73682E3
	6800	76 x 146	18.6	3.40	21	14	L1	23682E3	63682E3	43682E3	83682E3
	10 000	76 x 105	19.3	5.00	17	12	L1	13103E3	53103E3	33103E3	73103E3
	10 000	76 x 146	22.0	5.00	15	10	L1	23103E3	63103E3	43103E3	83103E3
	15 000	76 x 146	23.3	7.5	12	10	L1	13153E3	53153E3	33153E3	73153E3
	22 000	76 x 220	29.1	11.0	9	7	L1	13223E3	53223E3	33223E3	73223E3
	22 000	90 x 146	35.3	11.0	7	5	L1	-	-	43223E3	83223E3
	33 000	90 x 220	43.2	16.5	5	5	L1	-	-	43333E3	83333E3
350	330	35 x 60	2.5	0.23	435	305	L1	15331E3	55331E3	-	-
	470	35 x 80	3.1	0.33	308	216	L1	25471E3	65471E3	-	-
	680	35 x 105	3.8	0.48	216	152	L1	25681E3	65681E3	-	-
	1000	50 x 80	5.6	0.70	145	102	L1	25102E3	65102E3	-	-
	1500	50 x 80	6.5	1.05	102	74	L1	15152E3	55152E3	-	-
	1500	50 x 105	7.0	1.05	99	70	L1	25152E3	65152E3	-	-
	2200	50 x 105	8.0	1.54	72	52	L1	15222E3	55222E3	-	-
	2200	65 x 105	9.3	1.54	72	52	L1	25222E3	65222E3	45222E3	85222E3
	3300	65 x 105	11.4	2.31	48	35	L1	25332E3	65332E3	45332E3	85332E3
	4700	76 x 105	15.0	3.29	34	25	L1	15472E3	55472E3	35472E3	75472E3
	4700	76 x 146	15.4	3.29	34	25	L1	25472E3	65472E3	45472E3	85472E3
	6800	76 x 146	18.3	4.76	24	18	L1	25682E3	65682E3	45682E3	85682E3
	10 000	76 x 220	23.2	7.0	15	12	L1	15103E3	55103E3	35103E3	75103E3
	10 000	90 x 146	25.1	7.0	15	12	L1	-	-	45103E3	85103E3
	15 000	90 x 220	31.2	10.5	10	8	L1	-	-	45153E3	85153E3
385	220	35 x 60	2.1	0.17	575	380	L1	18221E3	58221E3	-	-
	330	35 x 80	2.7	0.26	386	257	L1	18331E3	58331E3	-	-
	470	35 x 80	3.1	0.37	279	188	L1	18471E3	58471E3	-	-
	680	35 x 105	3.9	0.53	196	133	L1	18681E3	58681E3	-	-
	1000	50 x 80	5.6	0.77	132	89	L1	18102E3	58102E3	-	-
	1500	50 x 105	7.1	1.16	90	61	L1	18152E3	58152E3	-	-
	2200	65 x 105	10.0	1.70	61	42	L1	18222E3	58222E3	38222E3	78222E3
	3300	76 x 105	13.4	2.55	42	29	L1	18332E3	58332E3	38332E3	78332E3
	4700	76 x 105	15.0	3.62	31	22	L1	18472E3	58472E3	38472E3	78472E3
	4700	76 x 146	16.3	3.62	29	20	L1	28472E3	68472E3	48472E3	88472E3
	6800	76 x 146	18.3	5.24	22	16	L1	18682E3	58682E3	38682E3	78682E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES

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)	LIFE CODE (1)	STANDARD M5 DISC		HIGH CURRENT M6 DISC	
								ST ORDERING CODE MAL2102.....	STB ORDERING CODE MAL2102.....	ST ORDERING CODE MAL2102.....	STB ORDERING CODE MAL2102.....
	220	35 x 60	2.1	0.18	557	363	L1	16221E3	56221E3	-	-
	330	35 x 60	2.5	0.26	383	254	L1	16331E3	56331E3	-	-
	330	35 x 80	2.7	0.26	374	245	L1	26331E3	66331E3	-	-
	470	35 x 80	3.1	0.38	271	180	L1	16471E3	56471E3	-	-
	470	35 x 105	3.3	0.38	265	175	L1	26471E3	66471E3	-	-
	680	35 x 105	3.9	0.55	191	128	L1	16681E3	56681E3	-	-
	680	50 x 80	4.5	0.54	199	136	L1	26681E3	66681E3	-	-
	1000	50 x 80	5.7	0.80	128	86	L1	16102E3	56102E3	-	-
400	1000	50 x 105	6.0	0.80	125	83	L1	26102E3	66102E3	-	-
	1500	50 x 105	7.1	1.20	88	59	L1	26152E3	66152E3	-	-
	2200	65 x 105	10.0	1.76	60	40	L1	26222E3	66222E3	46222E3	86222E3
	3300	65 x 105	12.1	2.64	40	27	L1	16332E3	56332E3	36332E3	76332E3
	3300	76 x 105	13.4	2.64	40	27	L1	26332E3	66332E3	46332E3	86332E3
	4700	76 x 105	15.0	3.76	31	21	L1	16472E3	56472E3	36472E3	76472E3
	4700	76 x 146	16.4	3.76	28	19	L1	26472E3	66472E3	46472E3	86472E3
	6800	76 x 146	18.3	5.44	22	15	L1	26682E3	66682E3	46682E3	86682E3
	10000	76 x 220	22.1	8.0	14	11	L1	16103E3	56103E3	36103E3	76103E3
	220	35 x 60	2.1	0.20	503	313	L1	17221E3	57221E3	-	-
	330	35 x 80	2.7	0.30	339	212	L1	27331E3	67331E3	-	-
	470	35 x 105	3.4	0.42	241	151	L1	27471E3	67471E3	-	-
	680	50 x 80	4.9	0.61	159	98	L1	27681E3	67681E3	-	-
	1000	50 x 80	5.7	0.90	118	75	L1	17102E3	57102E3	-	-
	1000	50 x 105	6.1	0.90	114	72	L1	27102E3	67102E3	-	-
	1500	50 x 105	7.1	1.35	81	52	L1	17152E3	57152E3	-	-
	1500	65 x 105	8.3	1.35	81	52	L1	27152E3	67152E3	47152E3	87152E3
450	2200	65 x 105	10.1	1.98	55	35	L1	17222E3	57222E3	37222E3	77222E3
	2200	76 x 105	11.2	1.98	55	35	L1	27222E3	67222E3	47222E3	87222E3
	3300	76 x 105	13.5	2.97	37	24	L1	17332E3	57332E3	37332E3	77332E3
	3300	76 x 146	13.9	2.97	37	24	L1	27332E3	67332E3	47332E3	87332E3
	4700	76 x 146	16.4	4.23	26	17	L1	17472E3	57472E3	37472E3	77472E3
	5600	76 x 146	17.3	5.04	23	15	L1	17562E3	57562E3	37562E3	77562E3
	6800	76 x 220	19.8	6.1	25	20	L1	17682E3	57682E3	37682E3	77682E3
	6800	90 x 146	21.3	6.1	24	19	L1	-	-	47682E3	87682E3
	10 000	90 x 220	26.5	9.0	17	14	L1	-	-	47103E3	87103E3

Note

(1) Determines the applicable row in the table “Endurance Test Duration and Useful Life”

ADDITIONAL ELECTRICAL DATA

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≤ 250 V versions	$U_S = 1.15 \times U_R$
	≥ 350 V versions	$U_S = 1.1 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 min at U_R	$I_{L1} \leq 0.006\ C_R \times U_R$
	After 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_R$
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

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RIPPLE CURRENT AND USEFUL LIFE

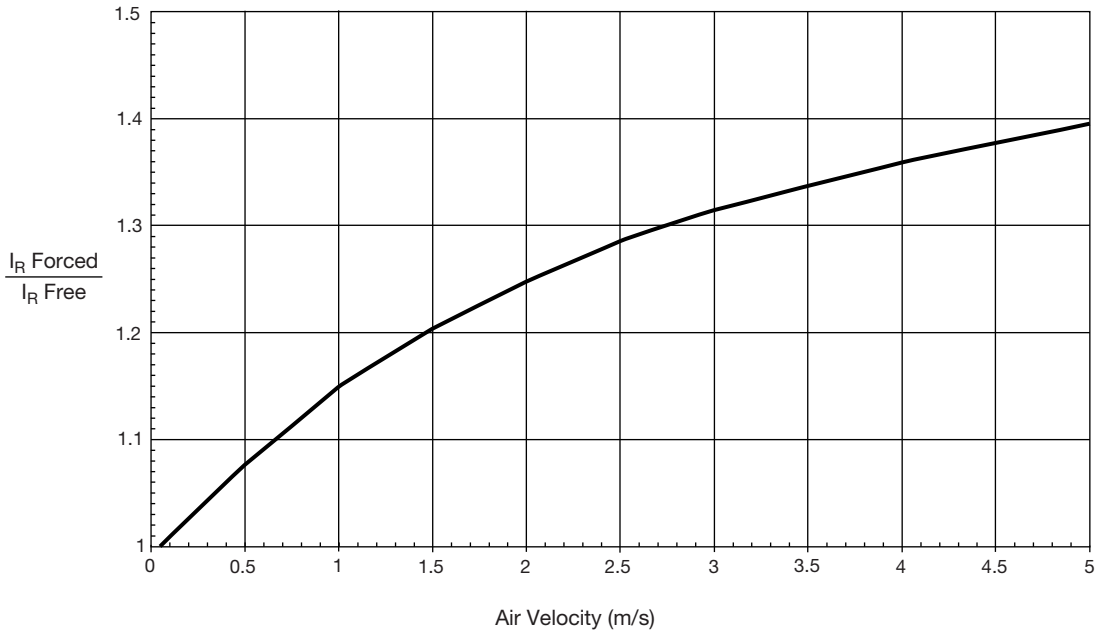


Fig. 3 - Multiplier of ripple current (I_R) as a function of air flow

MAXIMUM RIPPLE CURRENT			
PARAMETER	**CONDITION**	**MAXIMUM RIPPLE CURRENT MULTIPLIER**	**VALUE**
Ambient temperature (T_{amb})	70 °C	From nomogram; see Fig. 4	1.6
Operating frequency (f)	400 Hz	From frequency; see Table 4	1.3
Air flow	2 m/s	From air flow; see Fig. 3	1.25

Note

- Calculation example for 102 series. maximum ripple current multiplier = 1.6 x 1.3 x 1.25 = 2.6

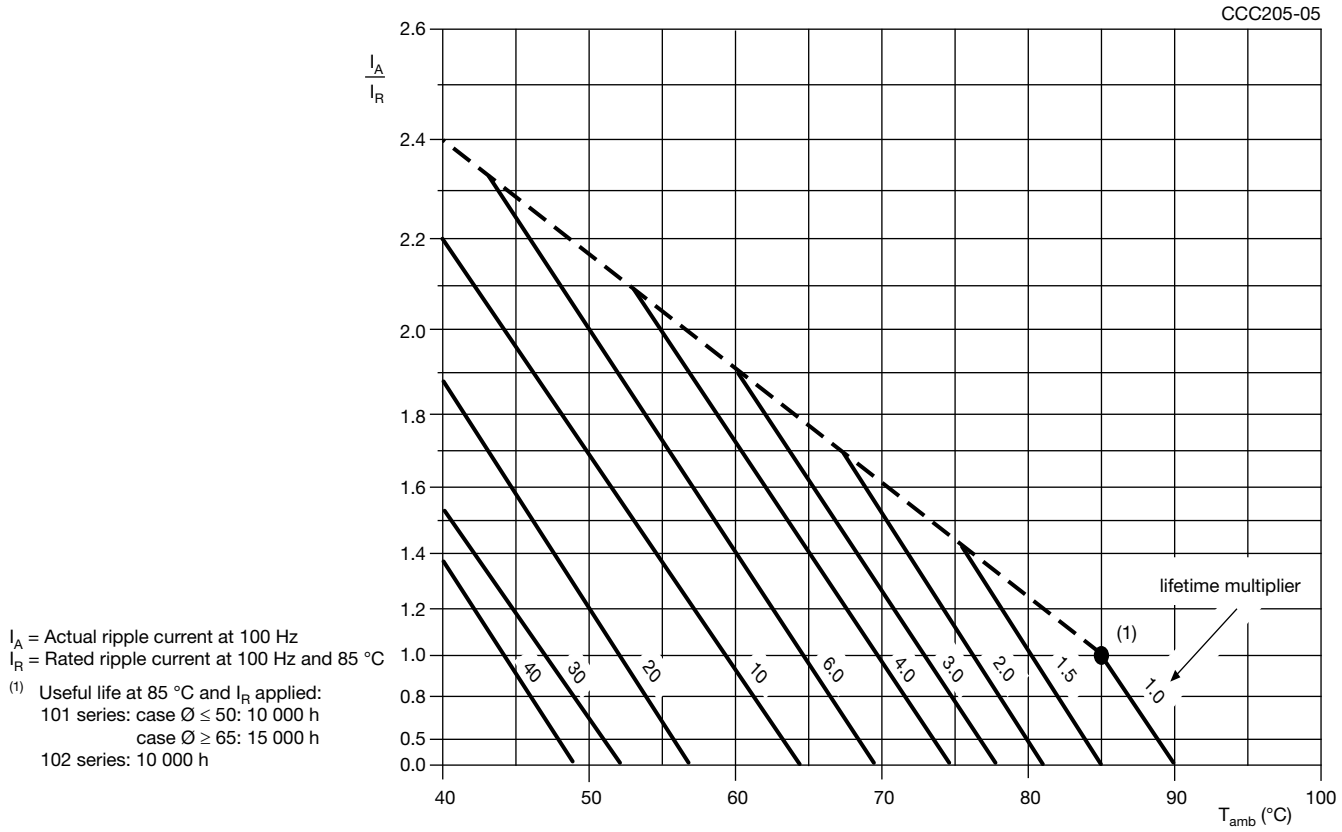
Table 4

ENDURANCE TEST DURATION AND USEFUL LIFE		
LIFE CODE	**ENDURANCE AT 85 °C (h)**	**USEFUL LIFE AT 85 °C (h)**
L1	2000	10 000
L2	2000	15 000

Note

- Multiplier of useful life code: CCC205-05

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I_A = Actual ripple current at 100 Hz
I_R = Rated ripple current at 100 Hz and 85 °C

(1) Useful life at 85 °C and I_R applied:
101 series: case Ø ≤ 50: 10 000 h
case Ø ≥ 65: 15 000 h
102 series: 10 000 h

Fig. 4 - Multiplier of useful life as a function of ambient temperature and ripple current load

Table 5

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY						
U_R (V)	FREQUENCY (Hz)					
	50	100	200	400	1000	10 000
	I_R MULTIPLIER					
25	0.85	1.00	1.10	1.15	1.20	1.30
40	0.85	1.00	1.10	1.15	1.20	1.30
63	0.85	1.00	1.10	1.15	1.20	1.30
100	0.85	1.00	1.10	1.15	1.20	1.30
200	0.90	1.00	1.20	1.30	1.40	1.50
250	0.90	1.00	1.20	1.30	1.40	1.50
350	0.90	1.00	1.20	1.30	1.40	1.50
385	0.90	1.00	1.20	1.30	1.40	1.50
400	0.90	1.00	1.20	1.30	1.40	1.50
450	0.90	1.00	1.20	1.30	1.40	1.50

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Table 6

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; 2000 h	$U_R \leq 100$ V; $\Delta C/C$: ± 15 % $U_R > 100$ V; $\Delta C/C$: ± 10 % tan $\delta \leq 1.3$ x spec. limit $Z \leq 2$ x spec. limit $I_{L5} \leq$ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_{amb} = 85 °C; U_R and I_R applied 101 series: case Ø D ≤ 50: 10 000 h case Ø D ≥ 65: 15 000 h 102 series: 10 000 h	$U_R \leq 100$ V; $\Delta C/C$: ± 45 % $U_R > 100$ V; $\Delta C/C$: ± 30 % tan $\delta \leq 3$ x spec. limit $Z \leq 3$ x spec. limit $I_{L5} \leq$ spec. limit no short or open circuit, no visible damage Total failure percentage: $U_R \leq 100$ V; ≤ 1 % $U_R > 100$ V; ≤ 3 %
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	$\Delta C/C$: ± 10 % tan $\delta \leq 1.2$ x spec. limit $I_{L5} \leq 2$ 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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