Aluminum Electrolytic Capacitors
Power Standard Miniature Snap-In



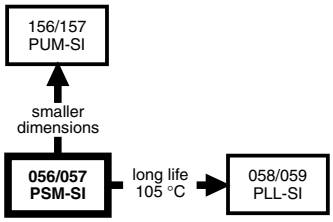


Fig. 1

FEATURES

- Long useful life: 12 000 h at 85 °C
- Low ESR
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, minimized dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief on the top of the aluminum case
- Charge and discharge proof
- High ripple current capability
- Keyed polarity version available
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- General purpose, industrial and audio / video systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems

MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance code 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	
	056	057
Nominal case size (Ø D x L in mm)	22 x 25 to 35 x 50	
Rated capacitance range (E6 series), C_R	470 µF to 68 000 µF	47 µF to 1500 µF
Tolerance on C_R	± 20 %	
Rated voltage range, U_R (1)	10 V to 100 V	200 V to 450 V
Category temperature range	-40 °C to +85 °C	-25 °C to +85 °C
Endurance test at 85 °C	5000 h (450 V: 2000 h)	
Useful life at 85 °C	12 000 h (450 V: 5000 h)	
Useful life at 40 °C and 1.4 x I_R applied	210 000 h (450 V: 90 000 h)	
Shelf life at 0 V, 85 °C	500 h	
Max. RMS value of ripple voltage	n/a	12 V
Based on sectional specification	IEC 60384-4 / EN130300	
Climatic category IEC 60068	40 / 085 / 056	25 / 085 / 56

Note

(1) A 420 V range is available on request

SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES FOR 056 SERIES (Ø D x L in mm)

C_R (µF)	U_R (V)						
	10	16	25	40	50	63	100
470	-	-	-	-	-	-	22 x 25
680	-	-	-	-	-	-	22 x 30
1000	-	-	-	-	-	22 x 25	25 x 30
	-	-	-	-	-	-	22 x 40
1500	-	-	-	-	22 x 25	22 x 30	30 x 30
	-	-	-	-	-	-	25 x 40

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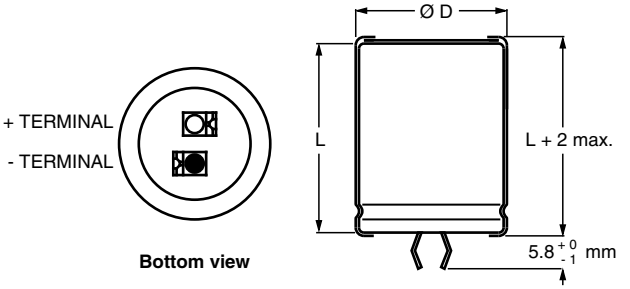
SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES FOR 056 SERIES (Ø D x L in mm)							
C_R (µF)	U_R (V)						
	10	16	25	40	50	63	100
2200	-	-	-	22 x 25	22 x 30	25 x 30	30 x 40
	-	-	-	-	-	22 x 40	25 x 50
3300	-	-	22 x 25	22 x 30	25 x 30	30 x 30	35 x 40
	-	-	-	-	22 x 40	25 x 40	30 x 50
4700	-	22 x 25	22 x 30	25 x 30	30 x 30	30 x 40	35 x 50
	-	-	-	22 x 40	25 x 40	25 x 50	-
6800	22 x 25	22 x 30	25 x 30	30 x 30	30 x 40	35 x 40	-
	-	-	22 x 40	25 x 40	25 x 50	30 x 50	-
10 000	22 x 30	25 x 30	30 x 30	30 x 40	35 x 40	35 x 50	-
	-	22 x 40	25 x 40	25 x 50	30 x 50	-	-
15 000	25 x 30	30 x 30	30 x 40	35 x 40	35 x 50	-	-
	22 x 40	25 x 40	25 x 50	30 x 50	-	-	-
22 000	30 x 30	30 x 40	35 x 40	35 x 50	-	-	-
	25 x 40	25 x 50	30 x 50	-	-	-	-
33 000	30 x 40	35 x 40	35 x 50	-	-	-	-
	25 x 50	30 x 50	-	-	-	-	-
47 000	35 x 40	35 x 50	-	-	-	-	-
	30 x 50	-	-	-	-	-	-
68 000	35 x 50	-	-	-	-	-	-

SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES FOR 057 SERIES (Ø D x L in mm)					
C_R (µF)	U_R (V)				
	200	250	385	400	450
47	-	-	22 x 25	22 x 25	22 x 30
68	-	-	22 x 30	22 x 30	22 x 30
100	-	22 x 25	25 x 30	25 x 30	30 x 30
	-	-	22 x 40	22 x 35	25 x 35
	-	-	22 x 35	-	-
150	22 x 25	22 x 30	30 x 30	30 x 30	25 x 50
	-	-	25 x 40	-	30 x 35
	-	-	-	25 x 40	-
220	22 x 30	25 x 30	30 x 45	30 x 35	35 x 40
	-	22 x 40	30 x 40	25 x 40	30 x 45
	-	-	30 x 35	-	-
	-	-	25 x 50	-	-
330	25 x 30	30 x 30	35 x 35	35 x 40	35 x 50
	22 x 40	25 x 40	-	35 x 50	35 x 45
470	30 x 30	30 x 40	35 x 50	35 x 50	-
	25 x 40	25 x 50	35 x 45	-	-
680	30 x 40	35 x 40	-	-	-
	25 x 50	30 x 50	-	-	-
1000	35 x 40	35 x 50	-	-	-
	30 x 50	-	-	-	-
1500	35 x 50	-	-	-	-

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DIMENSIONS in millimeters AND AVAILABLE FORMS

TWO TERMINAL SNAP-IN



The minus terminal can be marked with a black dot or with an imprinted "-" sign.

Fig. 2 - Two terminal snap-in

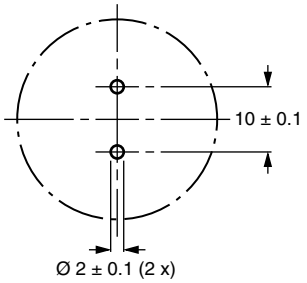
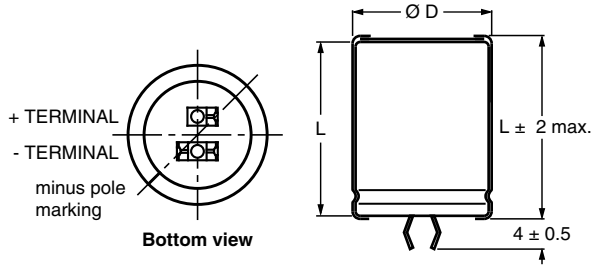


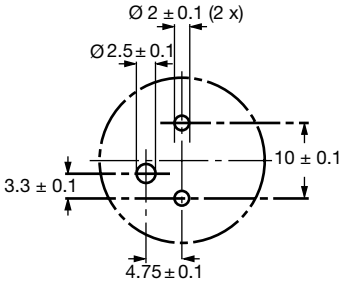
Fig. 3 - Mounting hole diagram

THREE TERMINAL SNAP-IN



The negative terminal has **TWO** pins which are **BOTH** electrically connected.

Fig. 4 - Three terminal snap-in



The 10 mm spacing of the 2 pin snap-in is used as the base layout and a third hole is added. The third hole is closer to the negative primary hole so that polarization is always maintained, together with added mechanical stability.

Fig. 5 - Mounting hole diagram

Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE Ø D x L	Ø $D_{max.}$	$L_{max.}$	MASS (g)	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS L x W x H (mm)
22 x 25	23	27	≈ 12	100	260 x 250 x 39
22 x 30	23	32	≈ 16	100	260 x 250 x 44
22 x 35	23	37	≈ 20	100	260 x 250 x 49
22 x 40	23	42	≈ 23	100	260 x 250 x 54
25 x 30	26	32	≈ 22	100	290 x 280 x 44
25 x 35	26	37	≈ 24	100	290 x 280 x 49
25 x 40	26	42	≈ 27	100	290 x 280 x 54
25 x 50	26	52	≈ 38	100	290 x 280 x 64
30 x 30	31	32	≈ 30	100	340 x 330 x 44
30 x 35	31	37	≈ 35	100	340 x 330 x 49
30 x 40	31	42	≈ 40	100	340 x 330 x 54
30 x 45	31	47	≈ 45	100	340 x 330 x 59
30 x 50	31	52	≈ 50	100	340 x 330 x 64
35 x 35	36	37	≈ 48	50	390 x 198 x 49
35 x 40	36	42	≈ 55	50	390 x 198 x 54
35 x 45	36	47	≈ 63	50	390 x 198 x 59
35 x 50	36	52	≈ 72	50	390 x 198 x 64

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ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	Rated capacitance at 100 Hz
I_R	Rated RMS ripple current at 100 Hz or ≥ 10 kHz and 85 °C
I_{L1}	Max. leakage current after 1 min at U_R
I_{L5}	Max. leakage current after 5 min at U_R
ESR	Max. equivalent series resistance at 100 Hz
Z	Max. impedance at 10 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 056 series

10 000 µF / 25 V; ± 20 %

Nominal case size: Ø 25 mm x 40 mm

2-terminal snap-in:

Ordering code: MAL2 05646103E3
Former 12NC: 2222 05646103

3-terminal snap-in:

Ordering code: MAL2 05626103E3
Former 12NC: 2222 05626103

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION FOR 056 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_R ≥ 10 kHz 85 °C (A)	I_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2056.....	
									2-TERM.	3-TERM.
10	6800	22 x 25	2.04	2.40	412	140	76	62	54682E3	74682E3
	10 000	22 x 30	2.56	3.02	608	205	56	45	54103E3	74103E3
	15 000	25 x 30	3.12	3.68	904	304	44	39	54153E3	74153E3
	15 000	22 x 40	3.39	4.00	904	304	41	34	44153E3	24153E3
	22 000	30 x 30	3.47	4.09	1324	444	44	37	54223E3	74223E3
	22 000	25 x 40	4.12	4.86	1324	444	34	28	44223E3	24223E3
	33 000	30 x 40	4.58	5.40	1984	664	32	28	54333E3	74333E3
	33 000	25 x 50	4.70	5.55	1984	664	30	27	44333E3	24333E3
	47 000	35 x 40	5.10	6.02	2824	944	31	26	54473E3	74473E3
	47 000	30 x 50	5.39	6.36	2824	944	28	24	44473E3	24473E3
	68 000	35 x 50	5.88	6.94	4084	1364	28	23	54683E3	74683E3
16	4700	22 x 25	2.01	2.37	455	154	79	62	55472E3	75472E3
	6800	22 x 30	2.54	3.00	657	222	57	45	55682E3	75682E3
	10 000	25 x 30	3.02	3.56	964	324	47	39	55103E3	75103E3
	10 000	22 x 40	3.28	3.87	964	324	44	34	45103E3	25103E3
	15 000	30 x 30	3.36	3.96	1444	484	47	37	55153E3	75153E3
	15 000	25 x 40	4.00	4.72	1444	484	34	28	45153E3	25153E3
	22 000	30 x 40	4.51	5.32	2116	708	33	28	55223E3	75223E3
	22 000	25 x 50	3.97	4.68	2116	708	42	41	45223E3	25223E3
	33 000	35 x 40	5.02	5.92	3172	1060	32	28	55333E3	75333E3
	33 000	30 x 50	4.75	5.61	3172	1060	36	34	45333E3	25333E3
	47 000	35 x 50	5.34	6.30	4516	1508	34	32	55473E3	75473E3
25	3300	22 x 25	1.88	2.22	499	169	89	61	56332E3	76332E3
	4700	22 x 30	2.37	2.80	709	239	65	45	56472E3	76472E3
	6800	25 x 30	2.81	3.32	1024	344	54	41	56682E3	76682E3
	6800	22 x 40	3.16	3.73	1024	344	47	38	46682E3	26682E3
	10 000	30 x 30	3.25	3.84	1504	504	50	38	56103E3	76103E3
	10 000	25 x 40	3.73	4.40	1504	504	39	30	46103E3	26103E3
	15 000	30 x 40	4.73	5.58	2254	754	30	28	56153E3	76153E3
	15 000	25 x 50	3.92	4.63	2254	754	43	39	46153E3	26153E3
	22 000	35 x 40	4.48	5.29	3304	1104	40	28	56223E3	76223E3
	22 000	30 x 50	4.96	5.85	3304	1104	36	23	46223E3	26223E3
	33 000	35 x 50	4.98	5.88	4954	1654	39	33	56333E3	76333E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 056 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_R ≥ 10 kHz 85 °C (A)	I_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2056.....	
									2-TERM.	3-TERM.
40	2200	22 x 25	1.85	2.26	532	180	92	61	57222E3	77222E3
	3300	22 x 30	2.09	2.55	796	260	67	45	57332E3	77332E3
	4700	25 x 30	2.28	2.78	1132	380	82	70	57472E3	77472E3
	4700	22 x 40	3.10	3.78	1132	380	49	38	47472E3	27472E3
	6800	30 x 30	3.16	3.85	1636	548	53	38	57682E3	77682E3
	6800	25 x 40	3.06	3.73	1636	548	58	50	47682E3	27682E3
	10 000	30 x 40	4.20	5.12	2404	804	38	28	57103E3	77103E3
	10 000	25 x 50	3.88	4.73	2404	804	44	39	47103E3	27103E3
	15 000	35 x 40	4.05	4.94	3604	1204	49	41	57153E3	77153E3
	15 000	30 x 50	4.45	5.43	3604	1204	41	34	47153E3	27153E3
	22 000	35 x 50	4.86	5.93	5284	1764	40	33	57223E3	77223E3
50	1500	22 x 25	1.36	1.66	454	154	170	130	51152E3	71152E3
	2200	22 x 30	1.75	2.14	664	224	120	91	51222E3	71222E3
	3300	25 x 30	2.17	2.65	994	334	90	72	51332E3	71332E3
	3300	22 x 40	2.42	2.95	994	334	80	63	41332E3	21332E3
	4700	30 x 30	2.65	3.23	1414	474	75	63	51472E3	71472E3
	4700	25 x 40	2.89	3.53	1414	474	65	52	41472E3	21472E3
	6800	30 x 40	3.56	4.34	2044	684	53	45	51682E3	71682E3
	6800	25 x 50	3.75	4.58	2044	684	50	43	41682E3	21682E3
	10 000	35 x 40	4.05	4.94	3004	1004	49	42	51103E3	71103E3
	10 000	30 x 50	4.50	5.49	3004	1004	40	35	41103E3	21103E3
	15 000	35 x 50	4.98	6.08	4504	1504	39	33	51153E3	71153E3
63	1000	22 x 25	1.46	1.78	382	130	148	104	58102E3	78102E3
	1500	22 x 30	1.87	2.28	571	193	105	72	58152E3	78152E3
	2200	25 x 30	2.32	2.83	836	281	79	59	58222E3	78222E3
	2200	22 x 40	2.54	3.10	836	281	73	53	48222E3	28222E3
	3300	30 x 30	2.87	3.50	1251	420	64	50	58332E3	78332E3
	3300	25 x 40	3.14	3.83	1251	420	55	44	48332E3	28332E3
	4700	30 x 40	3.67	4.48	1780	596	50	38	58472E3	78472E3
	4700	25 x 50	3.71	4.53	1780	596	48	38	48472E3	28472E3
	6800	35 x 40	4.33	5.28	2574	861	43	38	58682E3	78682E3
	6800	30 x 50	4.75	5.80	2574	861	42	37	48682E3	28682E3
	10 000	35 x 50	5.26	6.42	3784	1264	35	30	58103E3	78103E3
100	470	22 x 25	0.77	0.94	286	98	535	470	59471E3	79471E3
	680	22 x 30	0.99	1.21	412	160	375	328	59681E3	79681E3
	1000	25 x 30	1.27	1.55	604	204	265	235	59102E3	79102E3
	1000	22 x 40	1.35	1.65	604	204	260	225	49102E3	29102E3
	1500	30 x 30	1.67	2.04	904	304	190	170	59152E3	79152E3
	1500	25 x 40	1.75	2.14	904	304	180	160	49152E3	29152E3
	2200	30 x 40	2.27	2.77	1324	444	130	120	59222E3	79222E3
	2200	25 x 50	2.30	2.80	1324	444	125	110	49222E3	29222E3
	3300	35 x 40	2.84	3.46	1984	664	100	95	59332E3	79332E3
	3300	30 x 50	2.97	3.62	1984	664	92	85	49332E3	29332E3
	4700	35 x 50	3.59	4.38	2824	677	75	70	59472E3	79472E3

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Table 3

ELECTRICAL DATA AND ORDERING INFORMATION FOR 057 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_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2057.....	
								2-TERM.	3-TERM.
200	150	22 x 25	0.77	184	64	950	620	52151E3	72151E3
	220	22 x 30	1.00	268	92	650	435	52221E3	72221E3
	330	25 x 30	1.36	400	136	430	310	52331E3	72331E3
	330	22 x 40	1.36	400	136	430	310	42331E3	22331E3
	470	30 x 30	1.80	568	192	310	230	52471E3	72471E3
	470	25 x 40	1.80	568	192	310	230	42471E3	22471E3
	680	30 x 40	2.39	820	276	210	180	52681E3	72681E3
	680	25 x 50	2.39	820	276	210	180	42681E3	22681E3
	1000	35 x 40	2.85	1204	404	160	135	52102E3	72102E3
	1000	30 x 50	2.85	1204	404	160	135	42102E3	22102E3
	1500	35 x 50	3.66	1804	604	120	105	52152E3	72152E3
250	100	22 x 25	0.63	154	54	1440	770	53101E3	73101E3
	150	22 x 30	0.83	229	79	960	520	53151E3	73151E3
	220	25 x 30	1.10	334	114	660	365	53221E3	73221E3
	220	22 x 40	1.10	334	114	660	365	43221E3	23221E3
	330	30 x 30	1.49	499	169	440	265	53331E3	73331E3
	330	25 x 40	1.49	499	169	440	265	43331E3	23331E3
	470	30 x 40	1.98	709	239	310	185	53471E3	73471E3
	470	25 x 50	1.98	709	239	310	185	43471E3	23471E3
	680	35 x 40	2.60	1024	344	240	145	53681E3	73681E3
	680	30 x 50	2.60	1024	344	240	145	43681E3	23681E3
	1000	35 x 50	3.12	1504	504	160	105	53102E3	73102E3
385	47	22 x 25	0.50	112	40	3000	1400	58479E3	78479E3
	68	22 x 30	0.63	161	56	2100	1000	58689E3	68689E3
	100	25 x 30	0.86	235	81	1400	780	58101E3	78101E3
	100	22 x 40	0.86	235	81	1400	780	48101E3	68101E3
	100	22 x 35	0.84	235	81	1400	780	38101E3	88101E3
	150	30 x 30	1.16	350	119	950	520	58151E3	78151E3
	150	25 x 40	1.16	350	119	950	520	48151E3	68151E3
	220	30 x 40	1.57	512	173	650	400	58221E3	78221E3
	220	30 x 35	1.50	512	173	650	400	38221E3	90051E3
	220	25 x 50	1.57	512	173	650	400	48221E3	68221E3
	330	35 x 35	1.73	766	258	480	280	68331E3	88331E3
	330	30 x 45	1.75	766	258	480	280	38331E3	78331E3
	470	35 x 50	2.40	1089	366	340	220	58471E3	78471E3
	470	35 x 45	2.29	1089	366	340	220	48471E3	28471E3
400	47	22 x 25	0.50	117	42	3000	1400	56479E3	76479E3
	68	22 x 30	0.63	167	58	2100	1000	56689E3	76689E3
	100	25 x 30	0.86	244	84	1400	780	56101E3	76101E3
	100	22 x 35	0.84	240	84	1400	780	36101E3	66101E3
	150	30 x 30	1.16	364	124	950	520	56151E3	90054E3
	150	25 x 40	1.16	364	124	950	520	46151E3	86151E3
	220	30 x 35	1.50	532	180	650	400	36221E3	90055E3
	220	25 x 50	1.57	532	180	650	400	46221E3	86221E3
	330	35 x 40	1.85	796	268	480	280	56331E3	76331E3
	330	30 x 50	1.85	796	268	480	280	46331E3	26331E3
	470	35 x 50	2.40	1132	380	340	220	56471E3	76471E3
450	47	22 x 30	0.26	131	45	5600	4400	67479E3	87479E3
	68	22 x 30	0.33	188	65	3900	3100	57689E3	77689E3
	100	30 x 30	0.48	274	94	2600	2100	57101E3	77101E3
	100	25 x 35	0.46	274	94	2600	2100	37101E3	17101E3
	150	30 x 35	0.66	409	140	1600	1300	37151E3	17151E3
	150	25 x 50	0.70	409	140	1600	1300	47151E3	27151E3
	220	35 x 40	0.92	598	202	1100	900	57221E3	77221E3
	220	30 x 45	0.73	598	202	1100	900	37221E3	17221E3
	330	35 x 50	1.26	895	301	700	600	57331E3	77331E3
	330	35 x 45	1.20	895	301	700	600	47331E3	27331E3

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ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage	≤ 250 V versions	$U_s = 1.15 \times U_R$
	≥ 385 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	$I_{L1} \leq 0.006\ C_R \times U_R + 4\ \mu A$
	after 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4\ \mu A$
Inductance		
Equivalent series inductance (ESL)	all case sizes	typ. 19 nH
		max. 25 nH

CAPACITANCE (C)

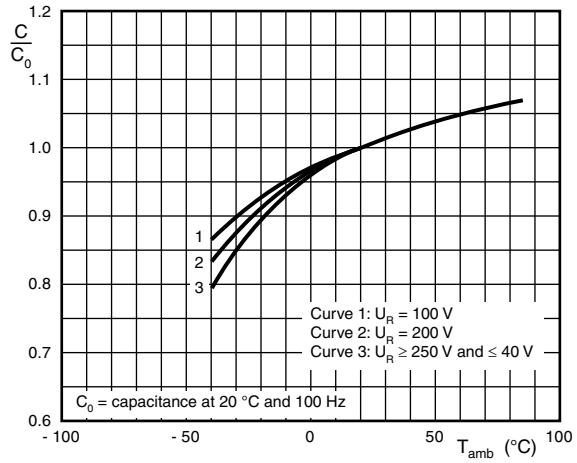


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

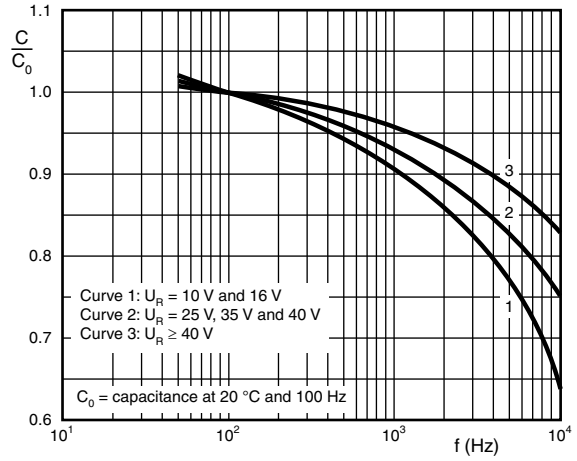


Fig. 7 - Typical multiplier of capacitance as a function of frequency

EQUIVALENT SERIES RESISTANCE (ESR)

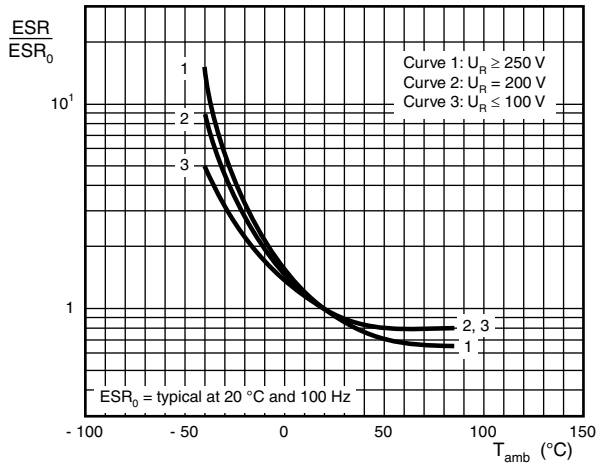


Fig. 8 - Typical multiplier of ESR as a function of ambient temperature

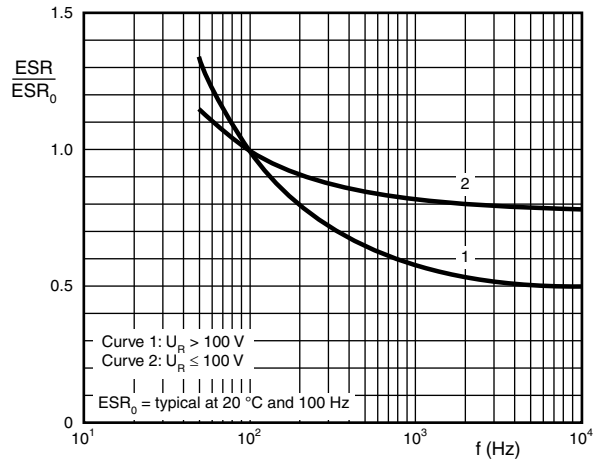


Fig. 9 - Typical multiplier of ESR as a function of frequency

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IMPEDANCE (Z)

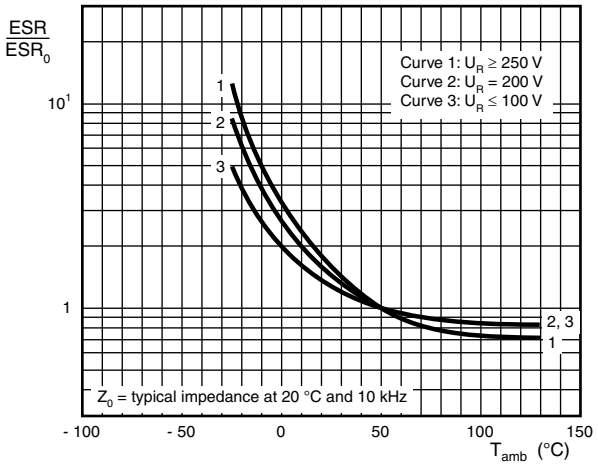


Fig. 10 - Typical multiplier of impedance as a function of ambient temperature

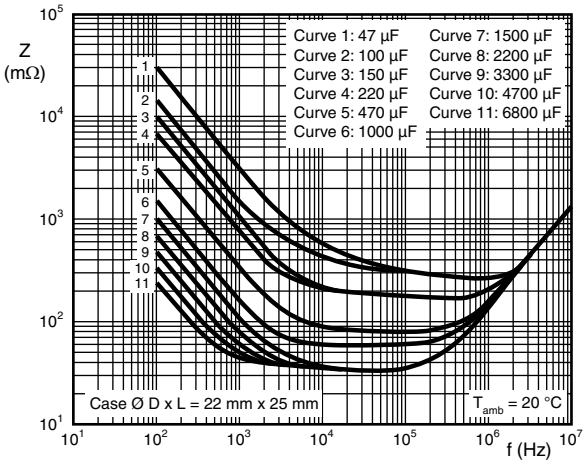


Fig. 13 - Typical impedance as a function of frequency

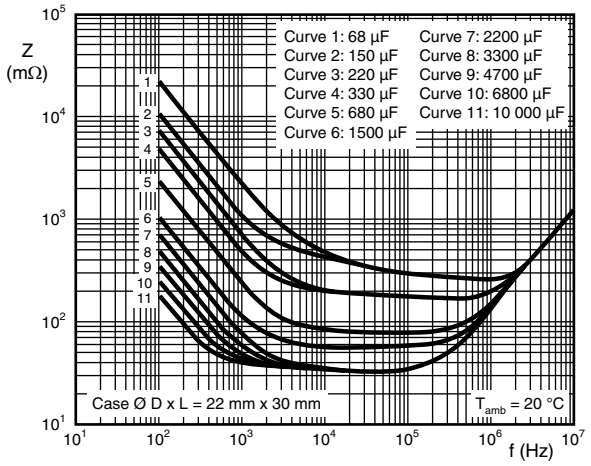


Fig. 11 - Typical impedance as a function of frequency

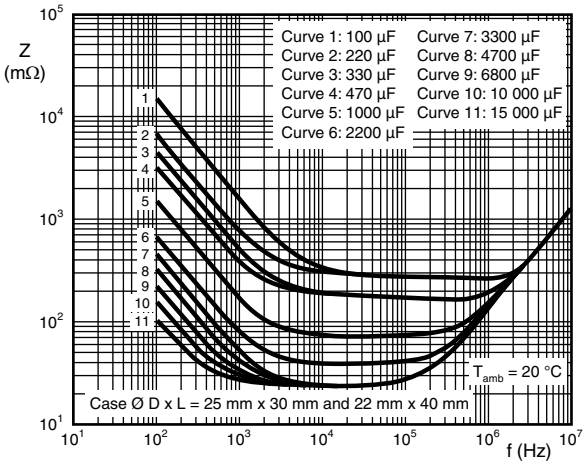


Fig. 14 - Typical impedance as a function of frequency

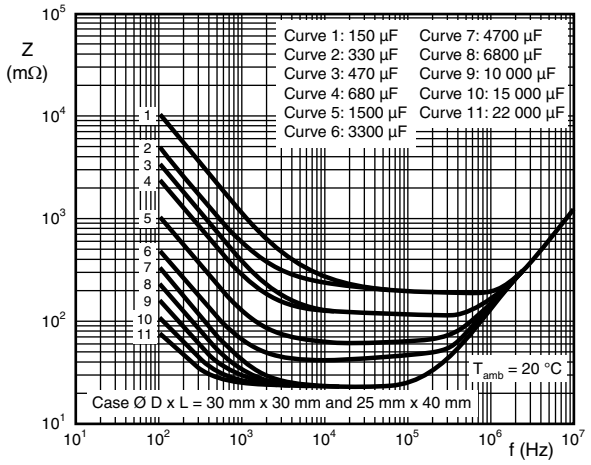


Fig. 12 - Typical impedance as a function of frequency

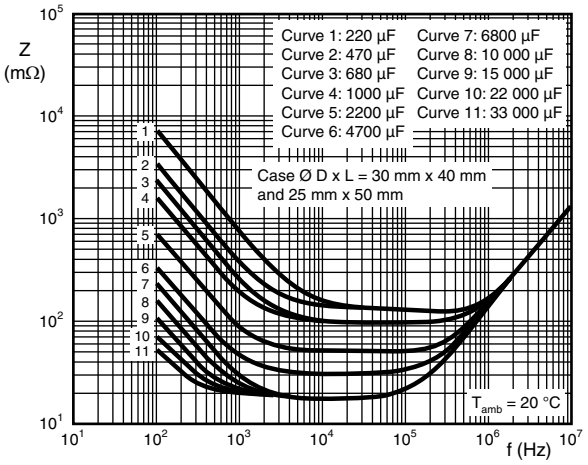


Fig. 15 - Typical impedance as a function of frequency

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IMPEDANCE (Z)

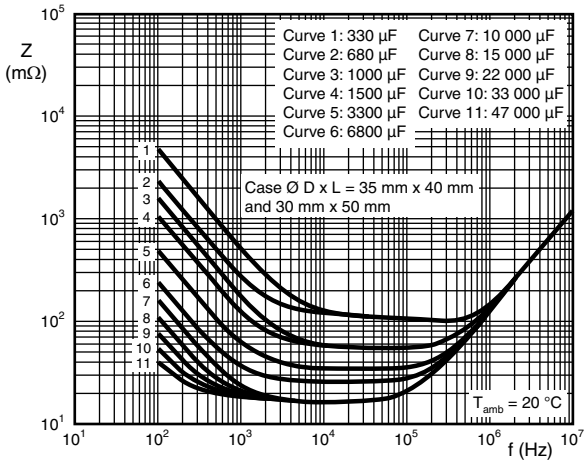


Fig. 16 - Typical impedance as a function of frequency

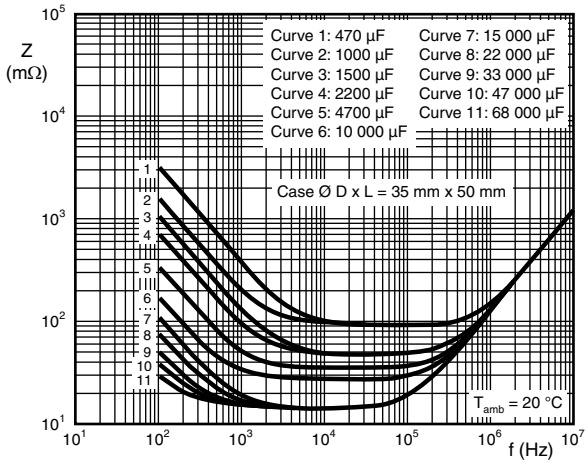
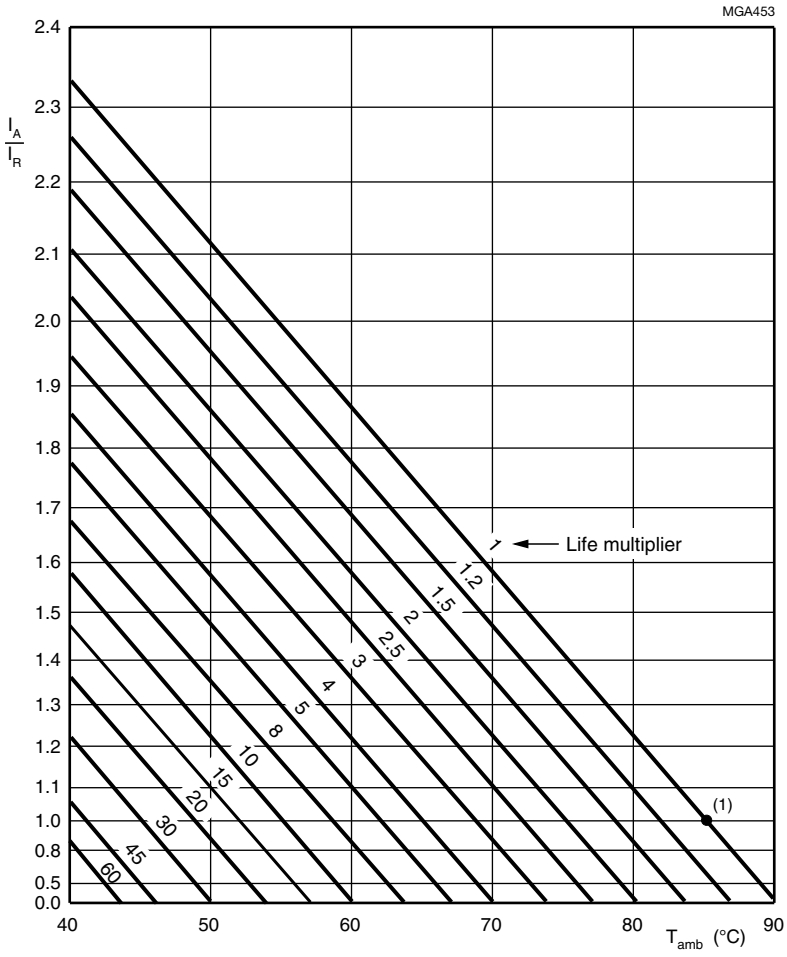


Fig. 17 - Typical impedance as a function of frequency

RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 100 Hz and 85 °C

I_R = rated ripple current at 100 Hz and 85 °C

(1) Useful life at 85 °C and I_R applied:
12 000 h (450 V types: 5000 h)

Fig. 18 - Multiplier of useful life as a function of ambient temperature and ripple current load

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Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY								
U_R (V)	FREQUENCY (Hz)							
	50	100	200	400	1000	2000	4000	≥ 10 000
	I_R MULTIPLIER							
10	0.93	1.00	1.04	1.07	1.11	1.13	1.15	1.18
16	0.93	1.00	1.04	1.07	1.11	1.13	1.15	1.18
25	0.93	1.00	1.04	1.07	1.11	1.13	1.15	1.18
40	0.91	1.00	1.05	1.09	1.13	1.15	1.18	1.22
63	0.91	1.00	1.05	1.09	1.13	1.15	1.18	1.22
100	0.91	1.00	1.05	1.09	1.13	1.15	1.18	1.22
200	0.86	1.00	1.13	1.21	1.29	1.32	1.35	1.40
250	0.86	1.00	1.13	1.21	1.29	1.32	1.35	1.40
385	0.86	1.00	1.13	1.21	1.29	1.32	1.35	1.40
400	0.86	1.00	1.13	1.21	1.29	1.32	1.35	1.40
450	0.86	1.00	1.13	1.21	1.29	1.32	1.35	1.40

Table 5

ENDURANCE TEST DURATION AND USEFUL LIFE		
U_R (V)	ENDURANCE AT 85 °C (h)	USEFUL LIFE AT 85 °C (h)
10	5000	12 000
16	5000	12 000
25	5000	12 000
40	5000	12 000
63	5000	12 000
100	5000	12 000
200	5000	12 000
250	5000	12 000
385	5000	12 000
400	5000	12 000
450	2000	5000

Note

- Multiplier of useful life code: MGA453

Table 6

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; 5000 h (450 V types: 2000 h)	$U_R \leq 100$ V; ΔC/C: ± 15 % $U_R > 100$ V; ΔC/C: ± 10 % ESR ≤ 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; 12 000 h (450 V types: 5000 h)	$U_R \leq 100$ V; ΔC/C: ± 45 % $U_R > 100$ V; ΔC/C: ± 30 % ESR ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_{L5} ≤ 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 / 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 % ESR ≤ 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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