Aluminum Capacitors
Power Long Life Snap-In



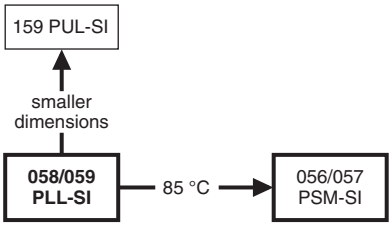


Fig. 1

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, minimized dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Very long useful life: up to 10 000 h at 105 °C
- Extended temperature range: 105 °C
- Low ESR, high ripple current capability
- Keyed polarity version available
- Compliant ot RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT

APPLICATIONS

- Computer, telecommunication and industrial systems
- Smoothing and filtering applications
- 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)
- 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	
	058	059
Nominal case sizes (Ø D x L in mm)	22 x 25 to 35 x 50	
Rated capacitance range (E6 series), C_R	33 µF to 47 000 µF	
Tolerance on C_R	± 20 %	
Rated voltage range, U_R	10 V to 100 V	200 V to 400 V
Category temperature range	- 40 °C to 105 °C	- 25 °C to 105 °C
Endurance test at 105 °C	≤ 50 V: 2000 h; ≥ 63 V: 5000 h	
Useful life at 105 °C	≤ 50 V: 5000 h; ≥ 63 V: 10 000 h	
Useful life at 40 °C, 1.9 x I_R applied	≤ 50 V: 125 000 h; ≥ 63 V: 250 000 h	
Shelf life at 0 V, 105 °C	500 h	
Based on sectional specification	IEC 60384-4/EN130300	
Climatic category IEC 60068	40/105/56	25/105/56

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 058 SERIES (Ø D x L in mm)

C_R (µF)	U_R (V)						
	10	16	25	40	50	63	100
330	-	-	-	-	-	-	22 x 25
470	-	-	-	-	-	-	22 x 30
680	-	-	-	-	-	22 x 25	25 x 30
	-	-	-	-	-	-	22 x 40
1000	-	-	-	-	22 x 25	22 x 30	30 x 30
	-	-	-	-	-	-	25 x 40
1500	-	-	-	22 x 25	22 x 30	25 x 30	30 x 40
	-	-	-	-	-	22 x 40	25 x 50

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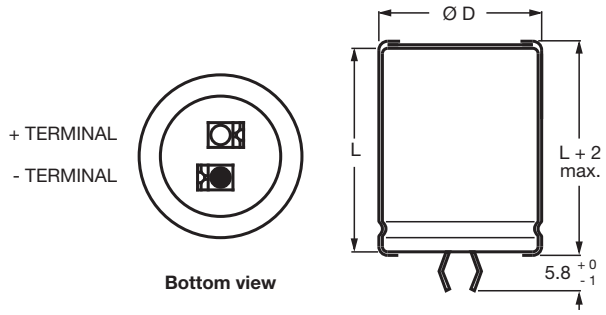
SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 058 SERIES (Ø D x L in mm)							
C_R (µF)	U_R (V)						
	10	16	25	40	50	63	100
2200	-	-	22 x 25	22 x 30	25 x 30	30 x 30	35 x 40
	-	-	-	-	22 x 40	25 x 40	30 x 50
3300	-	22 x 25	22 x 30	25 x 30	30 x 30	30 x 40	35 x 50
	-	-	-	22 x 40	25 x 40	25 x 50	-
4700	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	-
6800	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	-	-
10 000	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	-	-	-
15 000	30 x 30	30 x 40	35 x 40	35 x 50	-	-	-
	25 x 40	25 x 50	30 x 50	-	-	-	-
22 000	30 x 40	35 x 40	35 x 50	-	-	-	-
	25 x 50	30 x 50	-	-	-	-	-
33 000	35 x 40	35 x 50	-	-	-	-	-
	30 x 50	-	-	-	-	-	-
47 000	35 x 50	-	-	-	-	-	-

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 059 SERIES (Ø D x L in mm)				
C_R (µF)	U_R (V)			
	200	250	385	400
33	-	-	22 x 25	-
47	-	-	22 x 30	22 x 30
68	-	22 x 25	22 x 35	22 x 35
	-	-	25 x 30	25 x 30
100	22 x 25	22 x 30	30 x 30	30 x 30
	-	-	25 x 40	25 x 40
150	22 x 30	22 x 35	25 x 50	30 x 35
	-	25 x 30	30 x 40	25 x 50
220	22 x 35	30 x 30	35 x 40	35 x 40
	25 x 30	25 x 35	30 x 50	30 x 50
330	30 x 30	30 x 35	35 x 50	35 x 50
	25 x 40	25 x 50	-	-
470	30 x 35	35 x 35	-	-
	25 x 50	30 x 45	-	-
680	35 x 35	35 x 45	-	-
	30 x 45	-	-	-
1000	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

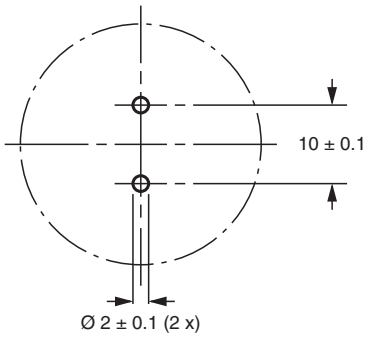
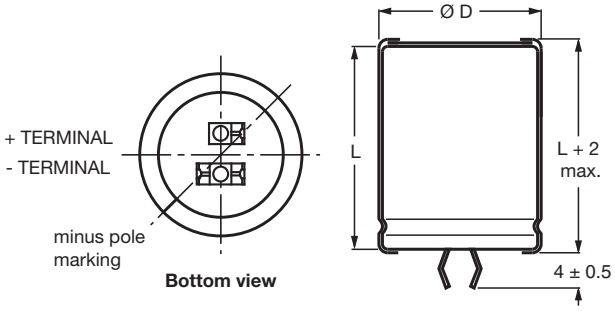


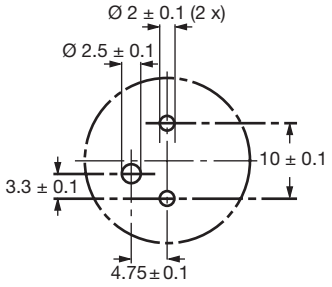
Fig. 3 - Mounting hole diagram

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**
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 105 °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 table 2 and 3 apply at T_{amb} = 20 °C, P = 86 kPa to 106 kPa, RH = 45 % to 75 %

ORDERING EXAMPLE

Electrolytic capacitor 058 series

10 000 µF/25 V; ± 20 %

Nominal case size: Ø 30 mm x 40 mm

2-terminal snap-in:

Ordering code: MAL2 058 56103 E3
Former 12NC: 2222 058 56103

3-terminal snap-in:

Ordering code: MAL2 058 76103 E3
Former 12NC: 2222 058 76103

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION FOR 058 SERIES (Ø D x L in mm)

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R ≥ 10 kHz 105 °C (A)	I_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2058.....	
									2-TERM.	3-TERM.
10	4700	22 x 25	1.95	2.30	286	98	82	57	54472E3	74472E3
	6800	22 x 30	2.44	2.88	412	140	61	44	54682E3	74682E3
	10 000	25 x 30	2.81	3.32	604	204	54	42	54103E3	74103E3
	10 000	22 x 40	3.29	3.88	604	204	43	32	44103E3	24103E3
	15 000	30 x 30	3.53	4.17	904	304	42	34	54153E3	74153E3
	15 000	25 x 40	3.78	4.46	904	304	38	30	44153E3	24153E3
	22 000	30 x 40	4.62	5.45	1324	444	31	25	54223E3	74223E3
	22 000	25 x 50	4.68	5.52	1324	444	31	24	44223E3	24223E3
	33 000	35 x 40	5.15	6.08	1984	664	30	24	54333E3	74333E3
	33 000	30 x 50	5.70	6.73	1984	664	24	21	44333E3	24333E3
	47 000	35 x 50	6.23	7.35	2824	944	24	21	54473E3	74473E3
16	3300	22 x 25	1.90	2.24	321	110	86	57	55332E3	75332E3
	4700	22 x 30	2.36	2.78	455	154	65	44	55472E3	75472E3
	6800	25 x 30	2.75	3.25	657	222	56	42	55682E3	75682E3
	6800	22 x 40	3.18	3.75	657	222	46	32	45682E3	25682E3
	10 000	30 x 30	3.44	4.06	964	324	44	34	55103E3	75103E3
	10 000	25 x 40	3.66	4.32	964	324	40	30	45103E3	25103E3
	15 000	30 x 40	4.55	5.37	1444	484	32	25	55153E3	75153E3
	15 000	25 x 50	4.55	5.37	1444	484	32	24	45153E3	25153E3
	22 000	35 x 40	5.07	5.98	2116	708	31	24	55223E3	75223E3
	22 000	30 x 50	5.67	6.69	2116	708	25	21	45223E3	25223E3
	33 000	35 x 50	6.23	7.35	3172	1060	25	21	55333E3	75333E3
25	2200	22 x 25	1.76	2.08	334	114	100	57	56222E3	76222E3
	3300	22 x 30	2.23	2.63	499	169	73	44	56332E3	76332E3
	4700	25 x 30	2.60	3.07	709	239	62	42	56472E3	76472E3
	4700	22 x 40	3.00	3.54	709	239	52	32	46472E3	26472E3
	6800	30 x 30	3.26	3.85	1024	344	49	34	56682E3	76682E3
	6800	25 x 40	3.49	4.12	1024	344	44	30	46682E3	26682E3
	10 000	30 x 40	4.37	5.16	1504	504	35	25	56103E3	76103E3
	10 000	25 x 50	4.37	5.16	1504	504	35	24	46103E3	26103E3
	15 000	35 x 40	4.91	5.79	2254	754	33	24	56153E3	76153E3
	15 000	30 x 50	5.43	6.41	2254	754	27	21	46153E3	26153E3
	22 000	35 x 50	6.07	7.16	3304	1104	27	21	56223E3	76223E3
40	1500	22 x 25	1.65	2.01	364	124	114	65	57152E3	77152E3
	2200	22 x 30	2.04	2.49	532	180	87	50	57222E3	77222E3
	3300	25 x 30	2.43	2.99	796	268	71	45	57332E3	77332E3
	3300	22 x 40	2.78	3.39	796	268	60	37	47332E3	27332E3
	4700	30 x 30	2.96	3.61	1132	380	59	40	57472E3	77472E3
	4700	25 x 40	3.26	3.90	1132	380	51	32	47472E3	27472E3
	6800	30 x 40	3.94	4.81	1636	548	42	29	57682E3	77682E3
	6800	25 x 50	4.10	5.00	1636	548	39	26	47682E3	27682E3
	10 000	35 x 40	4.18	5.10	2404	804	46	29	57103E3	77103E3
	10 000	30 x 50	4.98	6.08	2404	804	36	24	47103E3	27103E3
	15 000	35 x 50	5.21	6.36	3604	1204	36	24	57153E3	77153E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 058 SERIES (Ø D x L in mm)										
U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R ≥ 10 kHz 105 °C (A)	I_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2058.....	
									2-TERM.	3-TERM.
50	1000	22 x 25	1.50	1.83	304	104	138	69	51102E3	71102E3
	1500	22 x 30	1.88	2.29	454	154	102	54	51152E3	71152E3
	2200	25 x 30	2.27	2.77	664	124	82	47	51222E3	71222E3
	2200	22 x 40	2.55	3.11	664	124	71	38	41222E3	21222E3
	3300	30 x 30	2.81	3.43	994	334	66	41	51332E3	71332E3
	3300	25 x 40	3.07	3.75	994	334	57	33	41332E3	21332E3
	4700	30 x 40	3.77	4.60	1414	474	47	30	51472E3	71472E3
	4700	25 x 50	3.85	4.70	1414	474	43	27	41472E3	21472E3
	6800	35 x 40	4.01	4.89	2044	684	49	30	51682E3	71682E3
	6800	30 x 50	4.74	5.78	2044	684	38	24	41682E3	21682E3
	10 000	35 x 50	5.04	6.15	3004	1004	38	24	51103E3	71103E3
63	680	22 x 25	1.17	1.43	261	90	228	150	58681E3	78681E3
	1000	22 x 30	1.46	1.78	382	130	170	115	58102E3	78102E3
	1500	25 x 30	1.76	2.15	571	193	137	85	58152E3	78152E3
	1500	22 x 40	2.00	2.44	571	193	115	85	48152E3	28152E3
	2200	30 x 30	2.27	2.77	836	281	101	70	58222E3	78222E3
	2200	25 x 40	2.40	2.93	836	281	94	70	48222E3	28222E3
	3300	30 x 40	3.07	3.75	1251	420	70	50	58332E3	78332E3
	3300	25 x 50	3.07	3.75	1251	420	70	50	48332E3	28332E3
	4700	35 x 40	3.65	4.45	1781	596	60	45	58472E3	78472E3
	4700	30 x 50	3.88	4.73	1781	596	53	45	48472E3	28472E3
	6800	35 x 50	4.58	5.59	2574	861	46	35	58682E3	78682E3
100	330	22 x 25	0.92	1.12	202	70	370	250	59331E3	79331E3
	470	22 x 30	1.14	1.39	286	98	280	190	59471E3	79471E3
	680	25 x 30	1.35	1.65	412	140	232	140	59681E3	79681E3
	680	22 x 40	1.57	1.92	412	140	190	140	49681E3	29681E3
	1000	30 x 30	1.79	2.40	604	204	163	115	59102E3	79102E3
	1000	25 x 40	1.85	2.26	604	204	158	115	49102E3	29102E3
	1500	30 x 40	2.45	2.99	904	304	111	85	59152E3	79152E3
	1500	25 x 50	2.38	2.90	904	304	116	85	49152E3	29152E3
	2200	35 x 40	3.05	3.72	1324	444	86	65	59222E3	79222E3
	2200	30 x 50	3.13	3.82	1324	444	82	65	49222E3	29222E3
	3300	35 x 50	3.84	4.68	1984	664	64	50	59332E3	79332E3

Table 3

ELECTRICAL DATA AND ORDERING INFORMATION FOR 059 SERIES									
U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2059.....	
								2-TERM.	3-TERM.
200	100	22 x 25	0.53	124	44	1280	730	52101E3	72101E3
	150	22 x 30	0.67	184	64	850	540	52151E3	72151E3
	220	22 x 35	0.86	268	92	610	430	32221E3	12221E3
	220	25 x 30	0.87	268	92	610	430	52221E3	72221E3
	330	30 x 30	1.12	400	136	435	300	52331E3	72331E3
	330	25 x 40	1.12	400	136	435	300	42331E3	22331E3
	470	30 x 35	1.46	568	192	335	225	32471E3	12471E3
	470	25 x 50	1.25	568	192	335	225	42471E3	22471E3
	680	30 x 45	1.87	820	276	235	155	32681E3	12681E3
	680	35 x 35	1.85	820	276	235	155	62681E3	82681E3
	1000	35 x 50	2.45	1204	404	160	125	52102E3	72102E3
250	68	22 x 25	0.49	106	38	1640	760	53689E3	73689E3
	100	22 x 30	0.62	154	54	1110	570	53101E3	73101E3
	150	22 x 35	0.82	229	79	795	440	33151E3	13151E3
	150	25 x 30	0.82	229	79	795	440	53151E3	73151E3
	220	25 x 35	1.03	334	114	540	300	33221E3	13221E3
	220	30 x 30	1.06	334	114	540	300	53221E3	73221E3
	330	30 x 35	1.43	499	169	385	225	33331E3	13331E3
	330	25 x 50	1.40	499	169	385	225	43331E3	23331E3
	470	30 x 45	1.79	709	239	270	155	33471E3	13471E3
	470	35 x 35	1.79	709	239	270	155	63471E3	83471E3
	680	35 x 45	2.25	1024	344	190	125	43681E3	23681E3

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ELECTRICAL DATA AND ORDERING INFORMATION FOR 059 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_{L1} 1 min (µA)	I_{L5} 5 min (µA)	ESR 100 Hz (mΩ)	Z 10 kHz (mΩ)	ORDERING CODE MAL2059.....	
								2-TERM.	3-TERM.
385	33	22 x 25	0.32	80	29	3860	3000	58339E3	78339E3
	47	22 x 30	0.41	113	40	2710	2100	58479E3	78479E3
	68	22 x 35	0.53	161	56	1870	1460	38689E3	18689E3
	68	25 x 30	0.52	161	56	1870	1460	58689E3	78689E3
	100	30 x 30	0.72	235	81	1270	1010	58101E3	78101E3
	100	25 x 40	0.72	235	81	1270	1010	48101E3	28101E3
	150	30 x 40	0.99	351	119	850	675	58151E3	78151E3
	150	25 x 50	0.99	351	119	850	675	48151E3	28151E3
	220	35 x 40	1.31	512	173	580	465	58221E3	78221E3
	220	30 x 50	1.31	512	173	580	465	48221E3	28221E3
	330	35 x 50	1.75	766	258	390	320	58331E3	78331E3
400	47	22 x 30	0.30	117	42	4260	3490	56479E3	76479E3
	68	22 x 35	0.38	167	58	2950	2420	36689E3	16689E3
	68	25 x 30	0.41	167	58	2950	2420	56689E3	76689E3
	100	30 x 30	0.55	244	84	2020	1660	56101E3	76101E3
	100	25 x 40	0.55	244	84	2020	1660	46101E3	26101E3
	150	30 x 35	0.68	364	124	1350	1110	36151E3	16151E3
	150	25 x 50	0.78	364	124	1350	1110	46151E3	26151E3
	220	35 x 40	0.94	532	180	930	760	56221E3	76221E3
	220	30 x 50	0.94	532	180	930	760	46221E3	26221E3
	330	35 x 50	1.25	796	260	620	510	56331E3	76331E3

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	$I_{L1} \leq 0.006\ C_R \times U_R + 4$ µA
	After 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4$ µA
Inductance		
Equivalent series inductance (ESL)	All case sizes	typ. 19 nH
		max. 25 nH

CAPACITANCE (C)

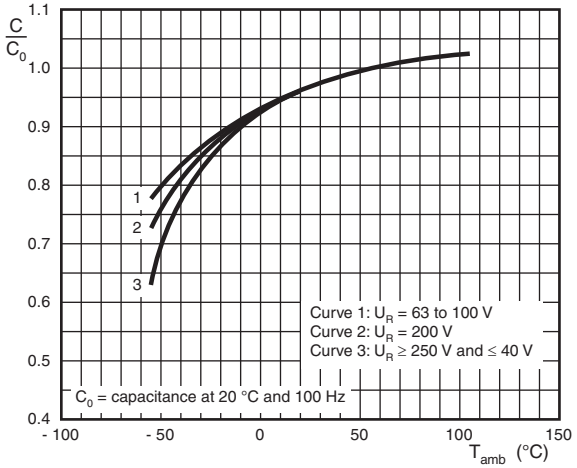


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

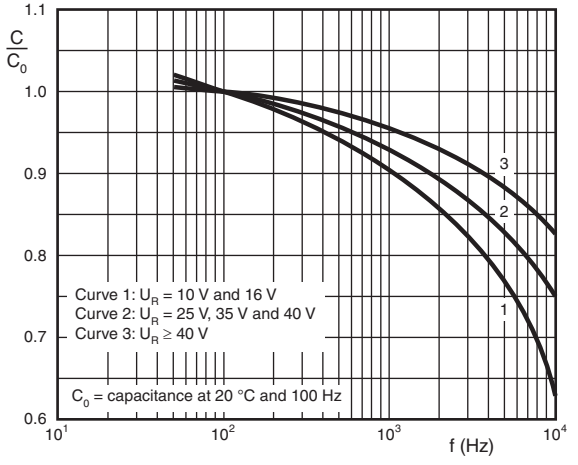


Fig. 7 - Typical multiplier of capacitance as a function of frequency

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EQUIVALENT SERIES RESISTANCE (ESR)

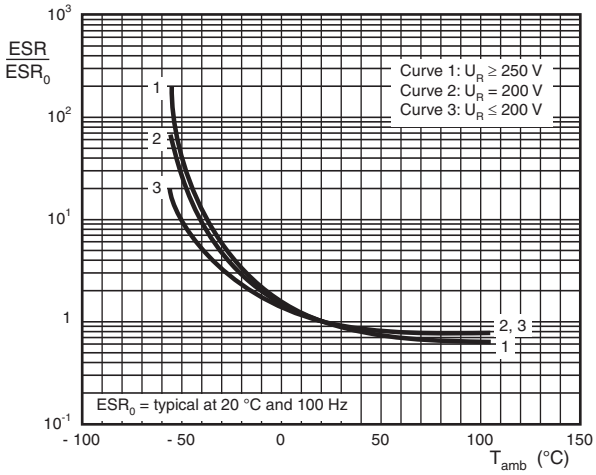


Fig. 8 - Typical multiplier of ESR as a function of ambient temperature

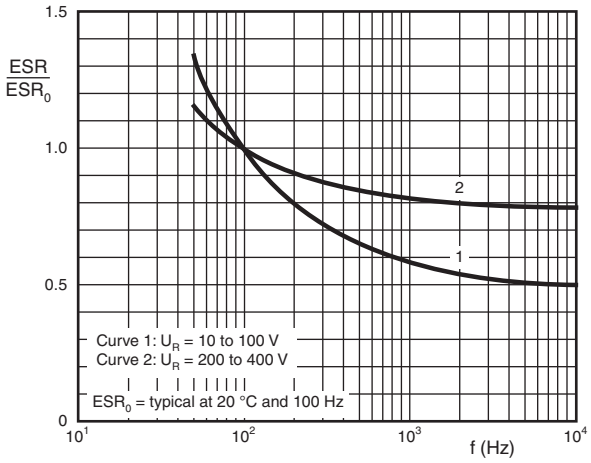


Fig. 9 - Typical multiplier of ESR as a function of frequency

IMPEDANCE (Z)

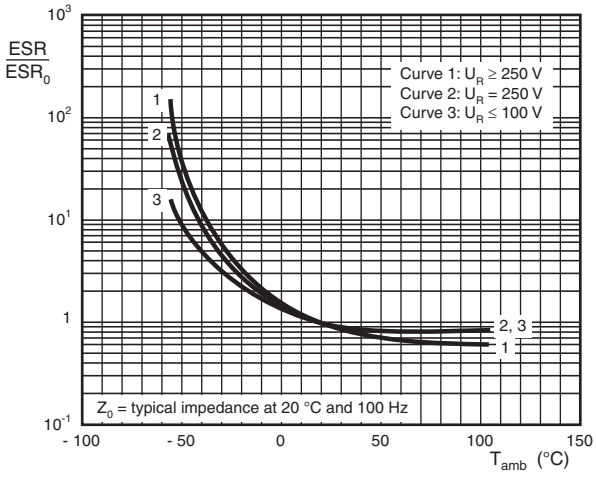


Fig. 10 - Typical multiplier of impedance as a function of ambient temperature

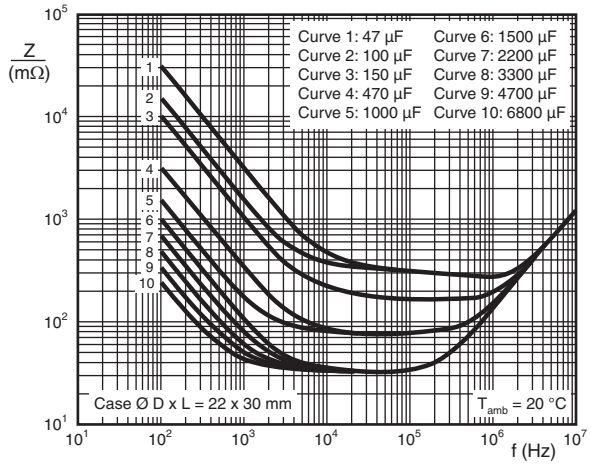


Fig. 12 - Typical impedance as a function of frequency

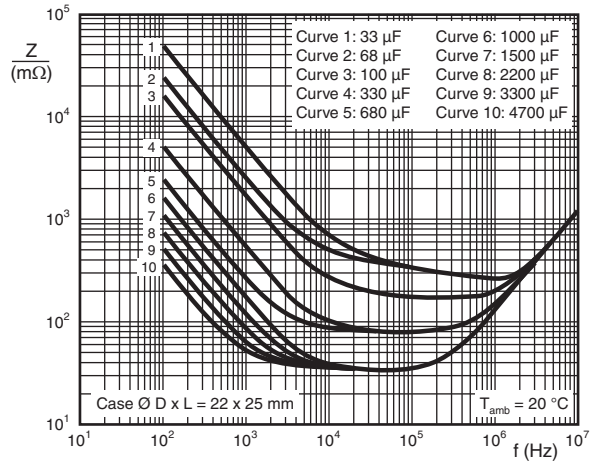


Fig. 11 - Typical impedance as a function of frequency

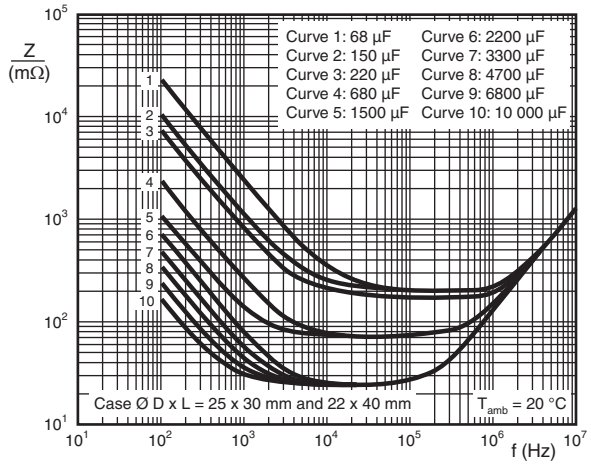


Fig. 13 - Typical impedance as a function of frequency

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IMPEDANCE (Z)

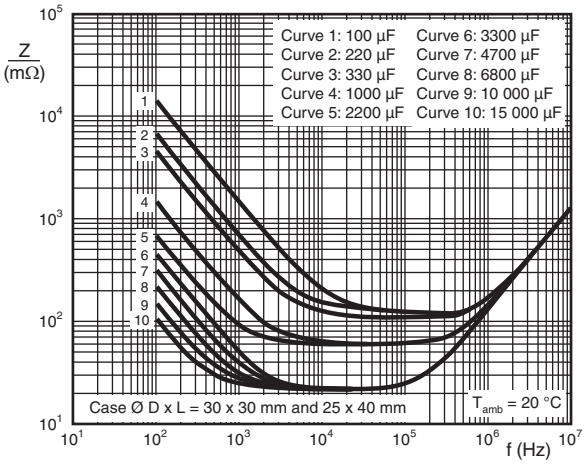


Fig. 14 - Typical impedance as a function of frequency

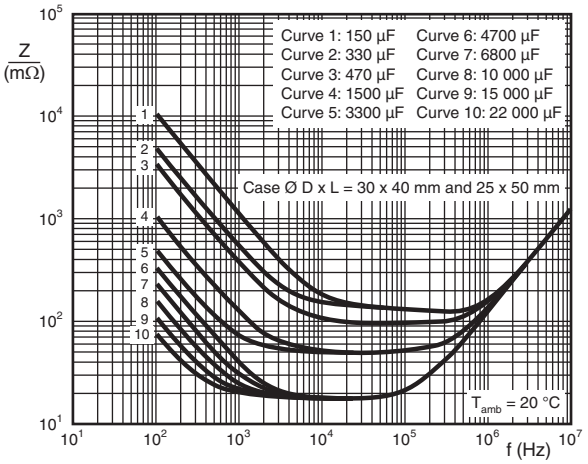


Fig. 15 - Typical impedance as a function of frequency

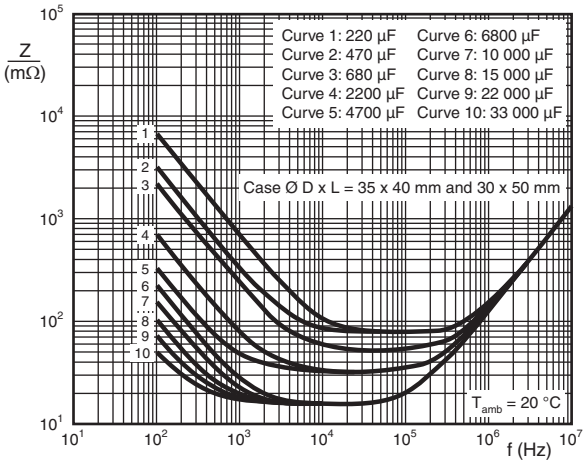


Fig. 16 - Typical impedance as a function of frequency

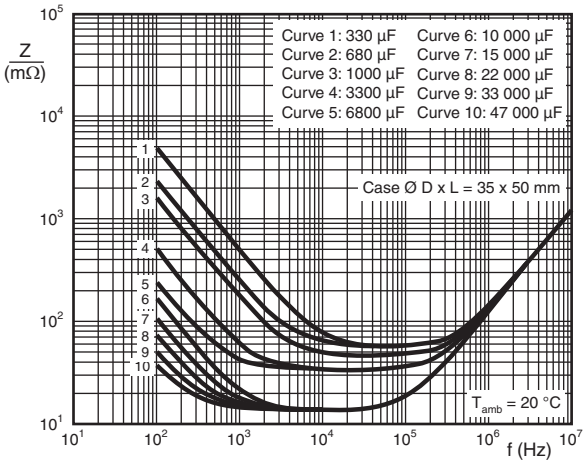
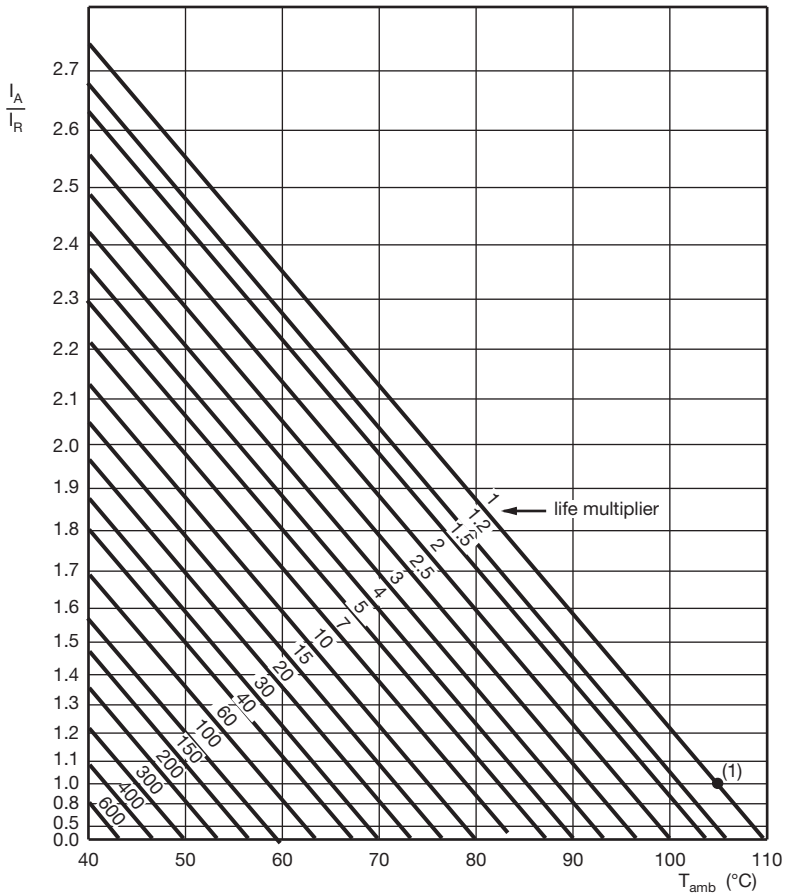


Fig. 17 - Typical impedance as a function of frequency

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RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 100 Hz
I_R = rated ripple current at 100 Hz and 105 °C
(1) Useful life at 105 °C and I_R applied:
5000 h for ≤ 50 V types

Fig. 18 - 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)	I_R MULTIPLIER		
	U_R = 10 V TO 25 V	U_R = 40 V TO 100 V	U_R > 100 V
50	0.93	0.91	0.86
100	1.00	1.00	1.00
200	1.04	1.05	1.13
400	1.07	1.09	1.21
1000	1.11	1.13	1.29
2000	1.13	1.15	1.32
4000	1.15	1.18	1.35
≥ 10 000	1.18	1.22	1.40

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Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		**PROCEDURE (quick reference)**	**REQUIREMENTS**
NAME OF TEST	**REFERENCE**		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	T_{amb} = 105 °C; U_R applied; ≤ 50 V types: 2000 h; ≥ 63 V types: 5000 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} = 105 °C; U_R and I_R applied; ≤ 50 V types: 5000 h; ≥ 63 V types: 10 000 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; $U_R > 100$ V: ≤ 3 %
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	T_{amb} = 105 °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

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