Aluminum Capacitors
Power Long Life Snap-in

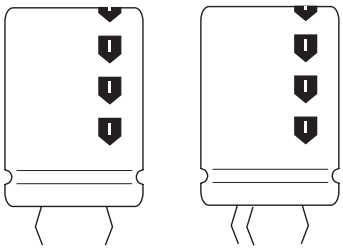
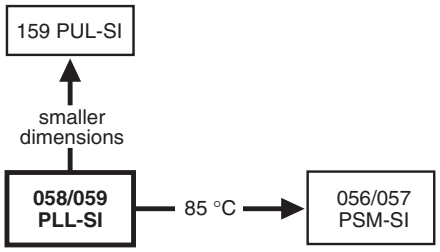


Fig.1 Component outlines.



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 10000 hours at 105 °C
- Extended temperature range: 105 °C
- Low ESR, high ripple current capability
- Keyed polarity version available
- Lead (Pb)-free versions are RoHS compliant.

Pb-free Available

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 (∅D × L in mm)	22 × 25 to 35 × 50	
Rated capacitance range (E6 series), C_R	33 to 47000 μF	
Tolerance on C_R	±20%	
Rated voltage range, U_R	10 to 100 V	200 to 400 V
Category temperature range	–40 to +105 °C	
Endurance test at 105 °C	≤ 50 V: 2000 hours; ≥ 63 V: 5000 hours	
Useful life at 105 °C	≤ 50 V: 5000 hours; ≥ 63 V: 10000 hours	
Useful life at 40 °C, 1.9 × I_R applied	≤ 50 V: 125000 hours; ≥ 63 V: 250000 hours	
Shelf life at 0 V, 105 °C	500 hours	
Based on sectional specification	IEC 60384-4/EN130300	
Climatic category IEC 60068	40/105/56	

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

C_R (∝F)	U_R (V)						
	10	16	25	40	50	63	100
330	–	–	–	–	–	–	22 × 25
470	–	–	–	–	–	–	22 × 30
680	–	–	–	–	–	22 × 25	25 × 30
	–	–	–	–	–	–	22 × 40
1000	–	–	–	–	22 × 25	22 × 30	30 × 30
	–	–	–	–	–	–	25 × 40
1500	–	–	–	22 × 25	22 × 30	25 × 30	30 × 40
	–	–	–	–	–	22 × 40	25 × 50

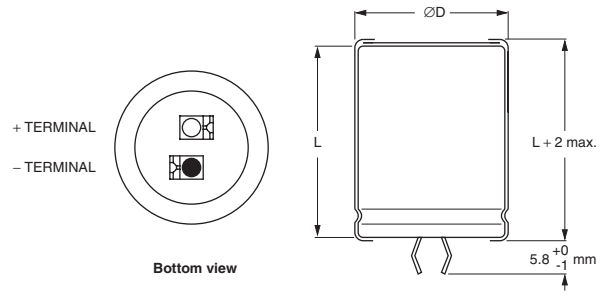
* Pb containing terminations are not RoHS compliant, exemptions may apply

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES FOR 058 SERIES (∅D × L in mm)							
C_R (∝F)	U_R (V)						
	10	16	25	40	50	63	100
2200	–	–	22 × 25	22 × 30	25 × 30	30 × 30	35 × 40
	–	–	–	–	22 × 40	25 × 40	30 × 50
3300	–	22 × 25	22 × 30	25 × 30	30 × 30	30 × 40	35 × 50
	–	–	–	22 × 40	25 × 40	25 × 50	–
4700	22 × 25	22 × 30	25 × 30	30 × 30	30 × 40	35 × 40	–
	–	–	22 × 40	25 × 40	25 × 50	30 × 50	–
6800	22 × 30	25 × 30	30 × 30	30 × 40	35 × 40	35 × 50	–
	–	22 × 40	25 × 40	25 × 50	30 × 50	–	–
10000	25 × 30	30 × 30	30 × 40	35 × 40	35 × 50	–	–
	22 × 40	25 × 40	25 × 50	30 × 50	–	–	–
15000	30 × 30	30 × 40	35 × 40	35 × 50	–	–	–
	25 × 40	25 × 50	30 × 50	–	–	–	–
22000	30 × 40	35 × 40	35 × 50	–	–	–	–
	25 × 50	30 × 50	–	–	–	–	–
33000	35 × 40	35 × 50	–	–	–	–	–
	30 × 50	–	–	–	–	–	–
47000	35 × 50	–	–	–	–	–	–

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

DIMENSIONS in millimeters AND AVAILABLE FORMS

TWO TERMINAL SNAP-IN



The minus terminal can be marked with a black dot or with an

Fig.2 Two terminal snap-in.

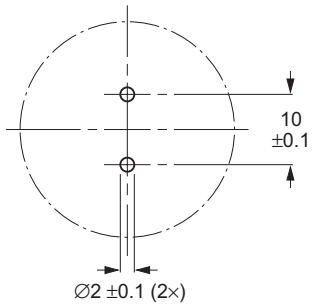
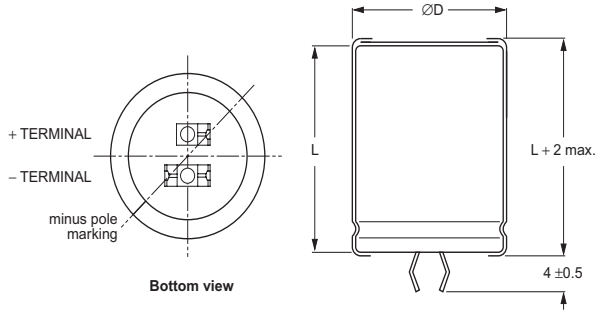


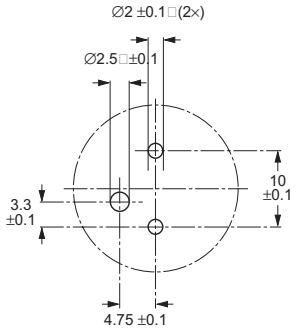
Fig.3 Mounting hole diagram.

THREE TERMINAL SNAP-IN



The negative terminal has **TWO** pins which are **BOTH**

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

Fig.5 Mounting hole diagram.

Table 1

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

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 minute at U_R
I_{L5}	max. leakage current after 5 minutes at U_R
ESR	max. equivalent series resistance at 100 Hz
Z	max. impedance at 10 kHz

Note

1. Unless otherwise specified, all electrical values in Tables 2 and 3 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75%.

ORDERING EXAMPLE*

Electrolytic capacitor 058 series

10000 μF/25 V; ±20%
Nominal case size: ∅30 × 40 mm

2-terminal snap-in:

Catalog number: 2222 058 56103.

3-terminal snap-in:

Catalog number: 2222 058 76103.

*Note: To ensure delivery of lead (Pb)-free parts during the transition period, please contact your Vishay sales agent.

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION FOR 058 SERIES

U_R (V)	C_R 100 Hz (∝F)	NOMINAL CASE SIZE ∅D × 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 Hz (mΩ)	CATALOG NUMBER 2222 058	
									2-TERM.	3-TERM.
10	4700	22 × 25	1.95	2.30	286	98	82	57	54472	74472
	6800	22 × 30	2.44	2.88	412	140	61	44	54682	74682
	10000	25 × 30	2.81	3.32	604	204	54	42	54103	74103
	10000	22 × 40	3.29	3.88	604	204	43	32	44103	24103
	15000	30 × 30	3.53	4.17	904	304	42	34	54153	74153
	15000	25 × 40	3.78	4.46	904	304	38	30	44153	24153
	22000	30 × 40	4.62	5.45	1324	444	31	25	54223	74223
	22000	25 × 50	4.68	5.52	1324	444	31	24	44223	24223
	33000	35 × 40	5.15	6.08	1984	664	30	24	54333	74333
	33000	30 × 50	5.70	6.73	1984	664	24	21	44333	24333
	47000	35 × 50	6.23	7.35	2824	944	24	21	54473	74473
16	3300	22 × 25	1.90	2.24	321	110	86	57	55332	75332
	4700	22 × 30	2.36	2.78	455	154	65	44	55472	75472
	6800	25 × 30	2.75	3.25	657	222	56	42	55682	75682
	6800	22 × 40	3.18	3.75	657	222	46	32	45682	25682
	10000	30 × 30	3.44	4.06	964	324	44	34	55103	75103
	10000	25 × 40	3.66	4.32	964	324	40	30	45103	25103
	15000	30 × 40	4.55	5.37	1444	484	32	25	55153	75153
	15000	25 × 50	4.55	5.37	1444	484	32	24	45153	25153
	22000	35 × 40	5.07	5.98	2116	708	31	24	55223	75223
	22000	30 × 50	5.67	6.69	2116	708	25	21	45223	25223
	33000	35 × 50	6.23	7.35	3172	1060	25	21	55333	75333
25	2200	22 × 25	1.76	2.08	334	114	100	57	56222	76222
	3300	22 × 30	2.23	2.63	499	169	73	44	56332	76332
	4700	25 × 30	2.60	3.07	709	239	62	42	56472	76472
	4700	22 × 40	3.00	3.54	709	239	52	32	46472	26472
	6800	30 × 30	3.26	3.85	1024	344	49	34	56682	76682
	6800	25 × 40	3.49	4.12	1024	344	44	30	46682	26682
	10000	30 × 40	4.37	5.16	1504	504	35	25	56103	76103
	10000	25 × 50	4.37	5.16	1504	504	35	24	46103	26103
	15000	35 × 40	4.91	5.79	2254	754	33	24	56153	76153
	15000	30 × 50	5.43	6.41	2254	754	27	21	46153	26153
	22000	35 × 50	6.07	7.16	3304	1104	27	21	56223	76223
40	1500	22 × 25	1.65	2.01	364	124	114	65	57152	77152
	2200	22 × 30	2.04	2.49	532	180	87	50	57222	77222
	3300	25 × 30	2.43	2.99	796	268	71	45	57332	77332
	3300	22 × 40	2.78	3.39	796	268	60	37	47332	27332
	4700	30 × 30	2.96	3.61	1132	380	59	40	57472	77472
	4700	25 × 40	3.26	3.90	1132	380	51	32	47472	27472
	6800	30 × 40	3.94	4.81	1636	548	42	29	57682	77682
	6800	25 × 50	4.10	5.00	1636	548	39	26	47682	27682
	10000	35 × 40	4.18	5.10	2404	804	46	29	57103	77103
	10000	30 × 50	4.98	6.08	2404	804	36	24	47103	27103
	15000	35 × 50	5.21	6.36	3604	1204	36	24	57153	77153

ELECTRICAL DATA AND ORDERING INFORMATION FOR 058 SERIES

U_R (V)	C_R 100 Hz (∝F)	NOMINAL CASE SIZE ∅D × 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 Hz (mΩ)	CATALOG NUMBER 2222 058	
									2-TERM.	3-TERM.
50	1000	22 × 25	1.50	1.83	304	104	138	69	51102	71102
	1500	22 × 30	1.88	2.29	454	154	102	54	51152	71152
	2200	25 × 30	2.27	2.77	664	124	82	47	51222	71222
	2200	22 × 40	2.55	3.11	664	124	71	38	41222	21222
	3300	30 × 30	2.81	3.43	994	334	66	41	51332	71332
	3300	25 × 40	3.07	3.75	994	334	57	33	41332	21332
	4700	30 × 40	3.77	4.60	1414	474	47	30	51472	71472
	4700	25 × 50	3.85	4.70	1414	474	43	27	41472	21472
	6800	35 × 40	4.01	4.89	2044	684	49	30	51682	71682
	6800	30 × 50	4.74	5.78	2044	684	38	24	41682	21682
	10000	35 × 50	5.04	6.15	3004	1004	38	24	51103	71103
63	680	22 × 25	1.17	1.43	261	90	228	150	58681	78681
	1000	22 × 30	1.46	1.78	382	130	170	115	58102	78102
	1500	25 × 30	1.76	2.15	571	193	137	85	58152	78152
	1500	22 × 40	2.00	2.44	571	193	115	85	48152	28152
	2200	30 × 30	2.27	2.77	836	281	101	70	58222	78222
	2200	25 × 40	2.40	2.93	836	281	94	70	48222	28222
	3300	30 × 40	3.07	3.75	1251	420	70	50	58332	78332
	3300	25 × 50	3.07	3.75	1251	420	70	50	48332	28332
	4700	35 × 40	3.65	4.45	1781	596	60	45	58472	78472
	4700	30 × 50	3.88	4.73	1781	596	53	45	48472	28472
	6800	35 × 50	4.58	5.59	2574	861	46	35	58682	78682
100	330	22 × 25	0.92	1.12	202	70	370	250	59331	79331
	470	22 × 30	1.14	1.39	286	98	280	190	59471	79471
	680	25 × 30	1.35	1.65	412	140	232	140	59681	79681
	680	22 × 40	1.57	1.92	412	140	190	140	49681	29681
	1000	30 × 30	1.79	2.40	604	204	163	115	59102	79102
	1000	25 × 40	1.85	2.26	604	204	158	115	49102	29102
	1500	30 × 40	2.45	2.99	904	304	111	85	59152	79152
	1500	25 × 50	2.38	2.90	904	304	116	85	49152	29152
	2200	35 × 40	3.05	3.72	1324	444	86	65	59222	79222
	2200	30 × 50	3.13	3.82	1324	444	82	65	49222	29222
	3300	35 × 50	3.84	4.68	1984	664	64	50	59332	79332

Table 3

ELECTRICAL DATA AND ORDERING INFORMATION FOR 059 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE ∅D × L (mm)	I_R 100 Hz 105 °C (A)	I_{L1} 1 min (∝A)	I_{L5} 5 min (µA)	ESR 100 kHz (mΩ)	Z 10 kHz (mΩ)	CATALOG NUMBER 2222 059	
								2-TERM.	3-TERM.
200	100	22 × 25	0.53	124	44	1280	730	52101	72101
	150	22 × 30	0.67	184	64	850	540	52151	72151
	220	22 × 35	0.86	268	92	610	430	32221	12221
	220	25 × 30	0.87	268	92	610	430	52221	72221
	330	30 × 30	1.12	400	136	435	300	52331	72331
	330	25 × 40	1.12	400	136	435	300	42331	22331
	470	30 × 35	1.46	568	192	335	225	32471	12471
	470	25 × 50	1.25	568	192	335	225	42471	22471
	680	30 × 45	1.87	820	276	235	155	32681	12681
	680	35 × 35	1.85	820	276	235	155	62681	82681
	1000	35 × 50	2.45	1204	404	160	125	52102	72102
250	68	22 × 25	0.49	106	38	1640	760	53689	73689
	100	22 × 30	0.62	154	54	1110	570	53101	73101
	150	22 × 35	0.82	229	79	795	440	33151	13151
	150	25 × 30	0.82	229	79	795	440	53151	73151
	220	25 × 35	1.03	334	114	540	300	33221	13221
	220	30 × 30	1.06	334	114	540	300	53221	73221
	330	30 × 35	1.43	499	169	385	225	33331	13331
	330	25 × 50	1.40	499	169	385	225	43331	23331
	470	30 × 45	1.79	709	239	270	155	33471	13471
	470	35 × 35	1.79	709	239	270	155	63471	83471
	680	35 × 45	2.25	1024	344	190	125	43681	23681

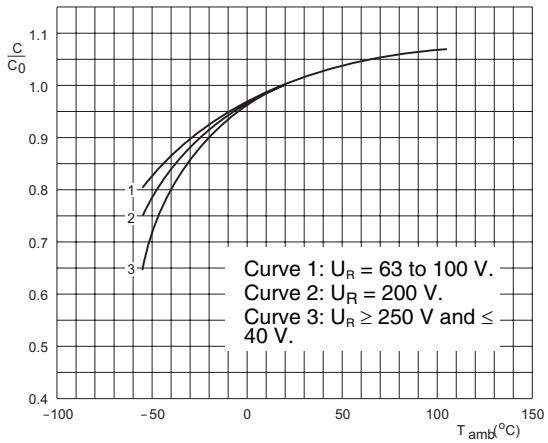
ELECTRICAL DATA AND ORDERING INFORMATION FOR 059 SERIES

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE ∅D × L (mm)	I_R 100 Hz 105 °C (A)	I_{L1} 1 min (∝A)	I_{L5} 5 min (µA)	ESR 100 kHz (mΩ)	Z 10 kHz (mΩ)	CATALOG NUMBER 2222 059	
								2-TERM.	3-TERM.
385	33	22 × 25	0.32	80	29	3860	3000	58339	78339
	47	22 × 30	0.41	113	40	2710	2100	58479	78479
	68	22 × 35	0.53	161	56	1870	1460	38689	18689
	68	25 × 30	0.52	161	56	1870	1460	58689	78689
	100	30 × 30	0.72	235	81	1270	1010	58101	78101
	100	25 × 40	0.72	235	81	1270	1010	48101	28101
	150	30 × 40	0.99	351	119	850	675	58151	78151
	150	25 × 50	0.99	351	119	850	675	48151	28151
	220	35 × 40	1.31	512	173	580	465	58221	78221
	220	30 × 50	1.31	512	173	580	465	48221	28221
	330	35 × 50	1.75	766	258	390	320	58331	78331
400	47	22 × 30	0.30	117	42	4260	3490	56479	76479
	68	22 × 35	0.38	167	58	2950	2420	36689	16689
	68	25 × 30	0.41	167	58	2950	2420	56689	76689
	100	30 × 30	0.55	244	84	2020	1660	56101	76101
	100	25 × 40	0.55	244	84	2020	1660	46101	26101
	150	30 × 35	0.68	364	124	1350	1110	36151	16151
	150	25 × 50	0.78	364	124	1350	1110	46151	26151
	220	35 × 40	0.94	532	180	930	760	56221	76221
	220	30 × 50	0.94	532	180	930	760	46221	26221
	330	35 × 50	1.25	796	260	620	510	56331	76331

ADDITIONAL ELECTRICAL DATA

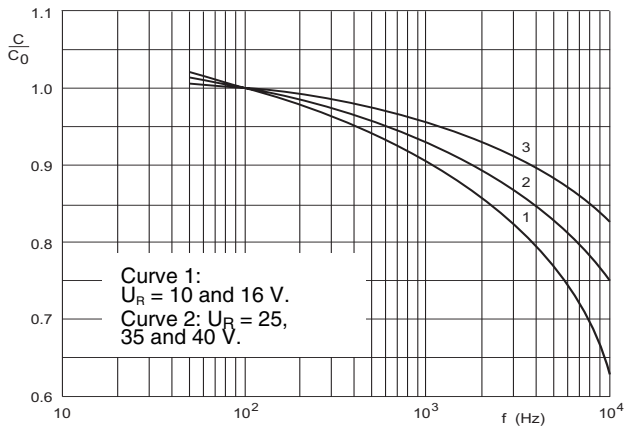
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≤ 250 V versions	$U_s = 1.15 \times U_R$
	≥ 385 V versions	$U_s = 1.1 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	after 1 minute at U_R	$I_{L1} \leq 0.006\ C_R \times U_R + 4$ µA
	after 5 minutes at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4$ µA
Inductance		
Equivalent series inductance (ESL)	all case sizes	typ. 19 nH
		max. 25 nH

CAPACITANCE (C)



C_0 = capacitance at 20 °C and 100 Hz.

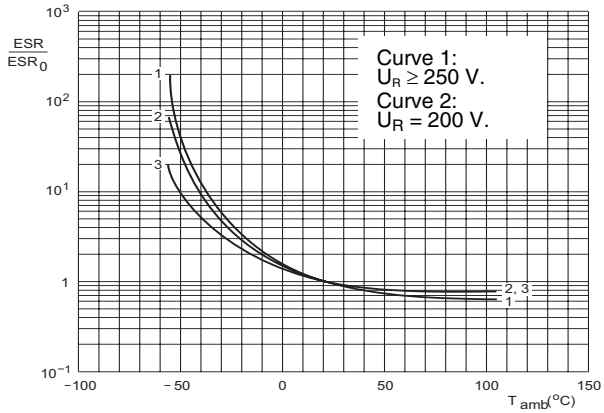
Fig.6 Typical multiplier of capacitance as a function of ambient temperature.



C_0 = capacitance at 20 °C and 100 Hz.

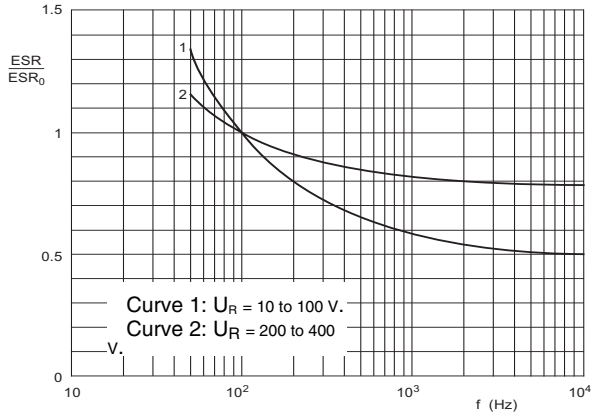
Fig.7 Typical multiplier of capacitance as a function of frequency.

EQUIVALENT SERIES RESISTANCE (ESR)



ESR_0 = typical at 20 °C and 100 Hz.

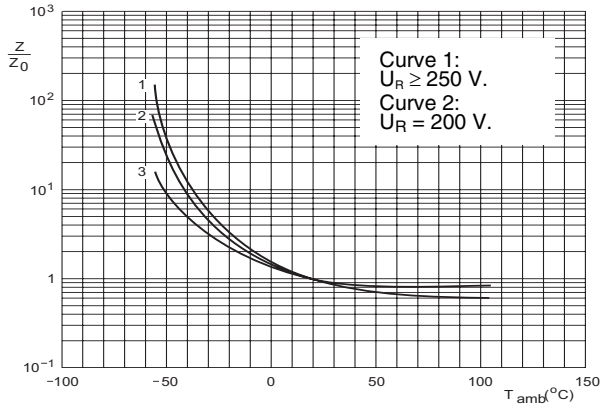
Fig.8 Typical multiplier of ESR as a function of ambient temperature.



ESR_0 = typical at 20 °C and 100 Hz.

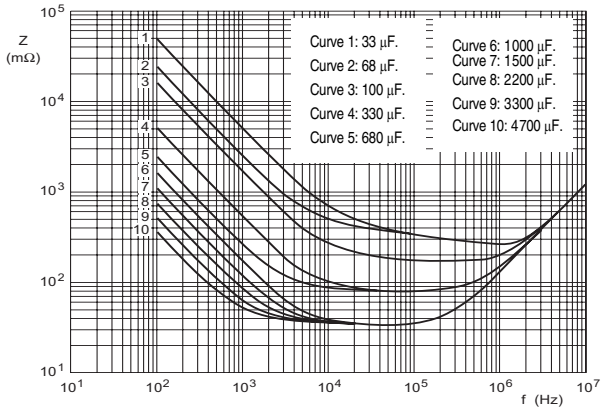
Fig.9 Typical multiplier of ESR as a function of frequency.

IMPEDANCE (Z)



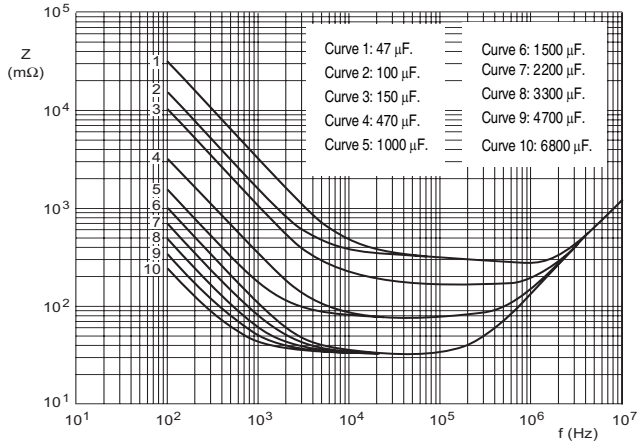
Z_0 = typical impedance at 20 °C and 10 kHz.

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



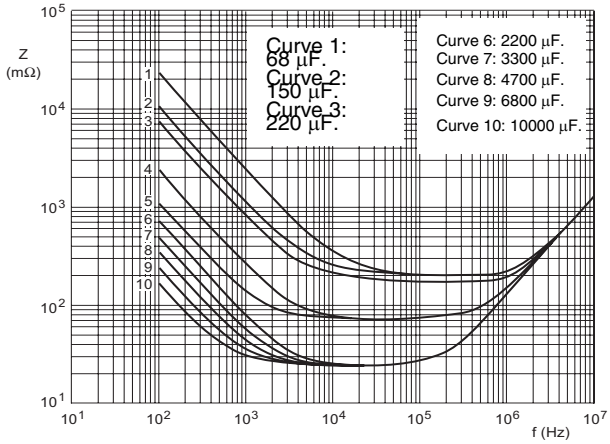
Case ∅D × L = 22 × 25 mm. T_{amb} = 20 °C.

Fig.11 Typical impedance as a function of frequency.



Case ∅D × L = 22 × 30 mm. T_{amb} = 20 °C.

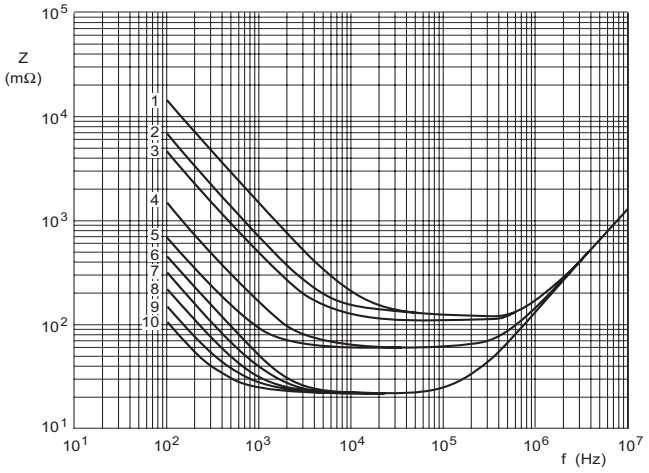
Fig.12 Typical impedance as a function of frequency.



Case ∅D × L = 25 × 30 and 22 × 40 mm. T_{amb} = 20 °C.

Fig.13 Typical impedance as a function of frequency.

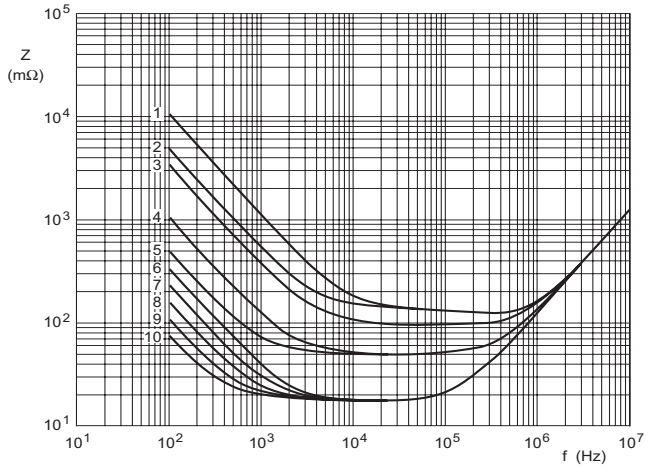
IMPEDANCE (Z)



Curve 1: 100 µF.
Curve 2: 220 µF.
Curve 6: 3300 µF.
Curve 7: 4700 µF.
Curve 8: 6800 µF.
Curve 9: 10000 µF.
Curve 10: 15000 µF.

Case ∅D × L = 30 × 30 and 25 × 40 mm. T_{amb} = 20 °C.

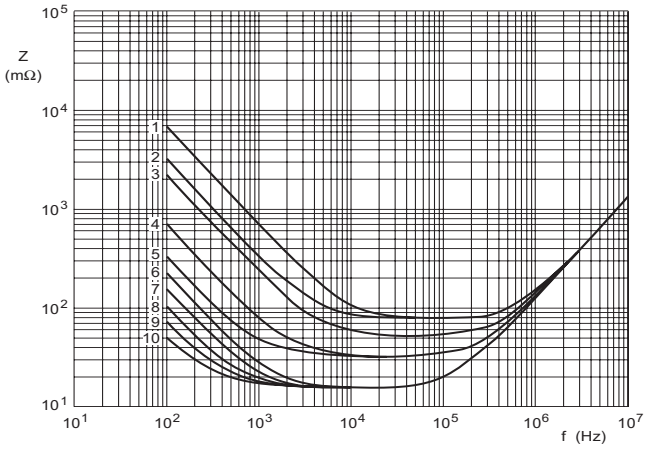
Fig.14 Typical impedance as a function of frequency.



Curve 1: 150 µF.
Curve 2: 330 µF.
Curve 6: 4700 µF.
Curve 7: 6800 µF.
Curve 8: 10000 µF.
Curve 9: 15000 µF.
Curve 10: 22000 µF.

Case ∅D × L = 30 × 40 and 25 × 50 mm. T_{amb} = 20 °C.

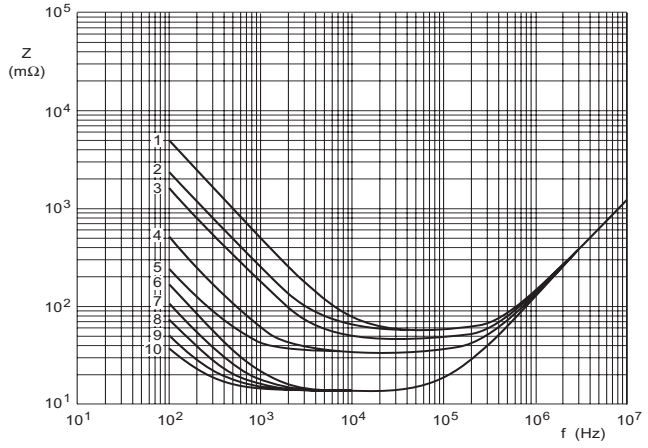
Fig.15 Typical impedance as a function of frequency.



Curve 1: 220 µF.
Curve 2: 470 µF.
Curve 6: 6800 µF.
Curve 7: 10000 µF.
Curve 8: 15000 µF.
Curve 9: 22000 µF.
Curve 10: 33000 µF.

Case ∅D × L = 35 × 40 and 30 × 50 mm. T_{amb} = 20 °C.

Fig.16 Typical impedance as a function of frequency.

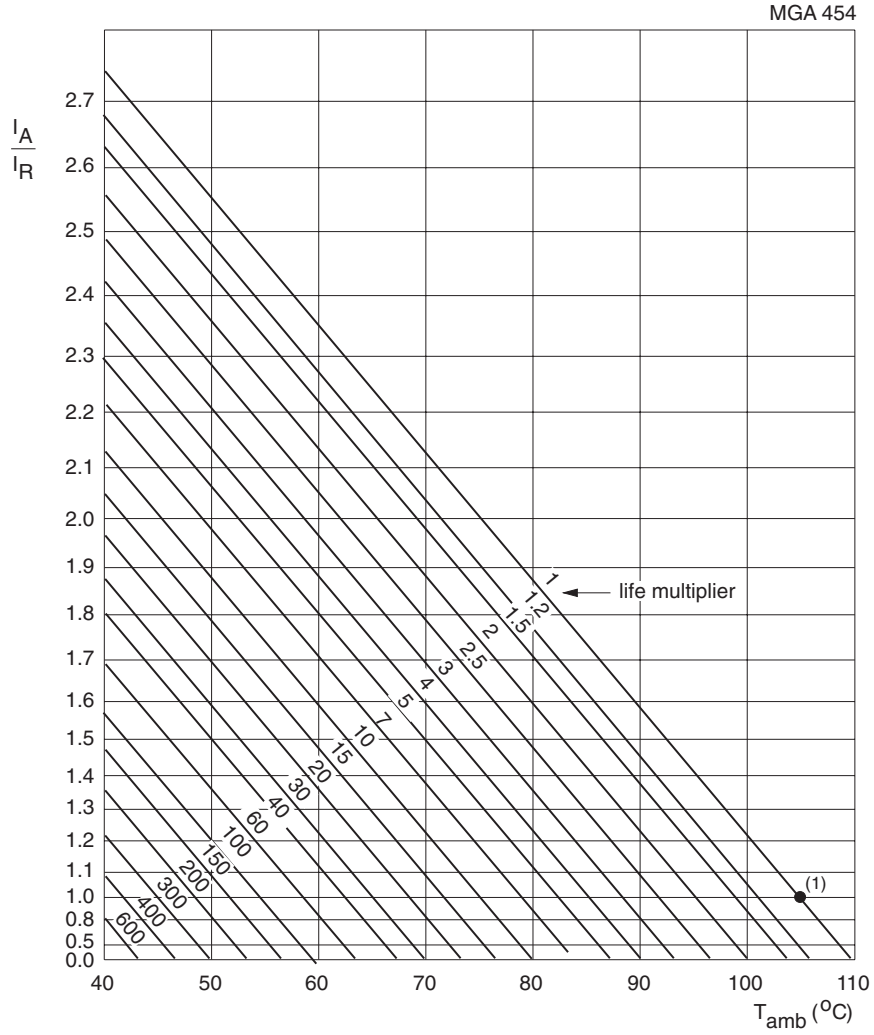


Curve 1: 330 µF.
Curve 2: 680 µF.
Curve 6: 10000 µF.
Curve 7: 15000 µF.
Curve 8: 22000 µF.
Curve 9: 33000 µF.
Curve 10: 47000 µF.

Case ∅D × L = 35 × 50 mm. T_{amb} = 20 °C.

Fig.17 Typical impedance as a function of frequency.

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 hours 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 to 25 V	U_R = 40 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
≥10000	1.18	1.22	1.40

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 hours; ≥ 63 V types: 5000 hours	$U_R \leq 100$ V; ΔC/C: ±15% $U_R > 100$ V; ΔC/C: ±10% ESR ≤ 1.3 × spec. limit Z ≤ 2 × 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 hours; ≥ 63 V types: 10000 hours	$U_R \leq 100$ V; ΔC/C: ±45% $U_R > 100$ V; ΔC/C: ±30% ESR ≤ 3 × spec. limit Z ≤ 3 × 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} = 105 °C; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	ΔC/C: ±10% ESR ≤ 1.2 × spec. limit I_{L5} ≤ 2 × spec. limit

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