

Non-solid Al - electrolytic capacitors Power Standard Miniature Snap-in

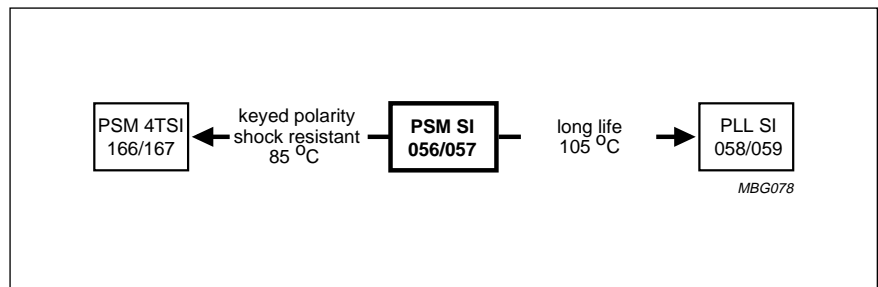
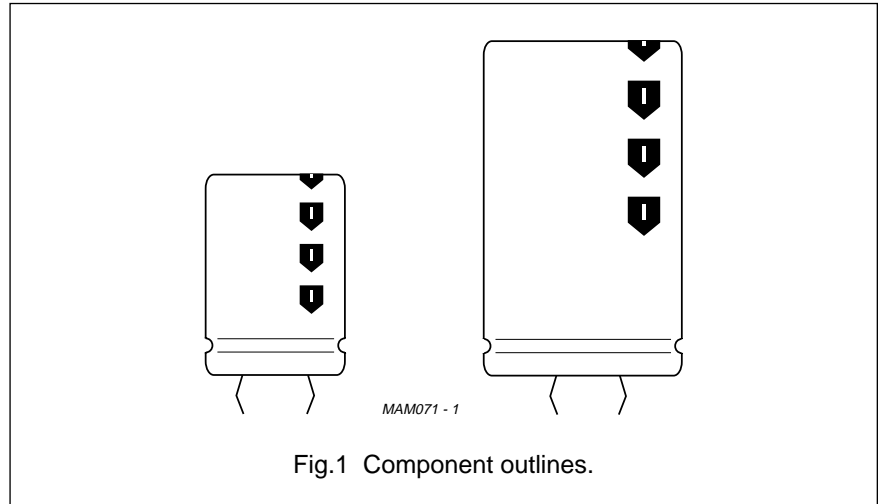
PSM-SI 056/057

FEATURES

- Polarized aluminium electrolytic capacitors, non-solid
- Large types, minimized dimensions, cylindrical aluminium case, insulated with a blue sleeve
- Pressure relief on the top of the aluminium case
- Charge and discharge proof
- Long useful life:
12000 hours at 85 °C
- High ripple current capability.

APPLICATIONS

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



QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	056	057
Case size ($\varnothing D_{nom} \times L_{nom}$ in mm)	22 × 25 to 35 × 50	
Rated capacitance range (E6 series), C_R	470 to 68000 μF	47 to 1500 μF
Tolerance on C_R	±20%	
Rated voltage range, U_R	10 to 100 V	200 to 450 V
Category temperature range	-40 to +85 °C	
Endurance test at 85 °C	5000 hours (450 V: 2000 hours)	
Useful life at 85 °C	12000 hours (450 V: 5000 hours)	
Useful life at 40 °C and $1.4 \times I_R$ applied	210000 hours (450 V: 90000 hours)	
Shelf life at 0 V, 85 °C	500 hours	
Based on sectional specification	IEC 384-4/CECC 30300, LL grade	
Detail specification	CECC 30301-806 (in preparation)	
Climatic category IEC 68 (DIN 40040)	40/085/56 (GPF)	

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Selection chart for C_R , U_R and relevant nominal case sizes ($\varnothing D \times L$ in mm) for 056 series

Preferred types in **bold**.

C_R (μF)	U_R (V)						
	10	16	25	40	50	63	100
470	–	–	–	–	–	–	22 × 25
680	–	–	–	–	–	–	22 × 30
1000	–	–	–	–	–	22 × 25	25 × 30
	–	–	–	–	–	–	22 × 40
1500	–	–	–	–	22 × 25	22 × 30	30 × 30
	–	–	–	–	–	–	25 × 40
2200	–	–	–	22 × 25	22 × 30	25 × 30	30 × 40
	–	–	–	–	–	22 × 40	25 × 50
3300	–	–	22 × 25	22 × 30	25 × 30	30 × 30	35 × 40
	–	–	–	–	22 × 40	25 × 40	30 × 50
4700	–	22 × 25	22 × 30	25 × 30	30 × 30	30 × 40	35 × 50
	–	–	–	22 × 40	25 × 40	25 × 50	–
6800	22 × 25	22 × 30	25 × 30	30 × 30	30 × 40	35 × 40	–
	–	–	22 × 40	25 × 40	25 × 50	30 × 50	–
10000	22 × 30	25 × 30	30 × 30	30 × 40	35 × 40	35 × 50	–
	–	22 × 40	25 × 40	25 × 50	30 × 50	–	–
15000	25 × 30	30 × 30	30 × 40	35 × 40	35 × 50	–	–
	22 × 40	25 × 40	25 × 50	30 × 50	–	–	–
22000	30 × 30	30 × 40	35 × 40	35 × 50	–	–	–
	25 × 40	25 × 50	30 × 50	–	–	–	–
33000	30 × 40	35 × 40	35 × 50	–	–	–	–
	25 × 50	30 × 50	–	–	–	–	–
47000	35 × 40	35 × 50	–	–	–	–	–
	30 × 50	–	–	–	–	–	–
68000	35 × 50	–	–	–	–	–	–

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Selection chart for C_R , U_R and relevant nominal case sizes ($\varnothing D \times L$ in mm) for 057 series

Preferred types in **bold**.

C_R (μF)	U_R (V)				
	200	250	385	400	450
47	–	–	22 × 25	22 × 25	22 × 30
68	–	–	22 × 30	22 × 30	22 × 30
100	–	22 × 25	25 × 30	25 × 30	30 × 30
	–	–	22 × 35	22 × 35	25 × 35
	–	–	22 × 40	–	–
150	22 × 25	22 × 30	30 × 30	30 × 30	25 × 50
	–	–	25 × 40	25 × 40	30 × 35
220	22 × 30	25 × 30	25 × 50	25 × 50	35 × 40
	–	22 × 40	30 × 35	30 × 35	30 × 45
	–	–	30 × 40	–	–
330	25 × 30	30 × 30	30 × 45	35 × 40	35 × 50
	22 × 40	25 × 40	35 × 35	30 × 50	35 × 45
470	30 × 30	30 × 40	35 × 50	35 × 50	–
	25 × 40	25 × 50	35 × 45	–	–
680	30 × 40	35 × 40	–	–	–
	25 × 50	30 × 50	–	–	–
1000	35 × 40	35 × 50	–	–	–
	30 × 50	–	–	–	–
1500	35 × 50	–	–	–	–

MARKING

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

- Rated capacitance (in μF)
- Tolerance code on rated capacitance (M for $\pm 20\%$)
- Rated voltage (in V)
- Climatic category in accordance with "IEC 68"
- Date code (year and week) in accordance with "IEC 62"
- Code for factory of origin
- Name of manufacturer
- '–' sign to indicate the negative terminal, visible from the top and side of the capacitor
- Code number (last 8 digits)
- Code for basic specification in accordance with "IEC 384-4-1" and "CECC 30301".

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MECHANICAL DATA AND PACKAGING QUANTITIES

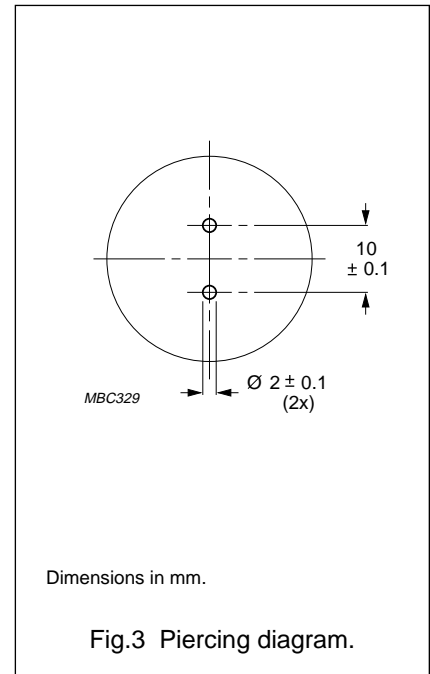
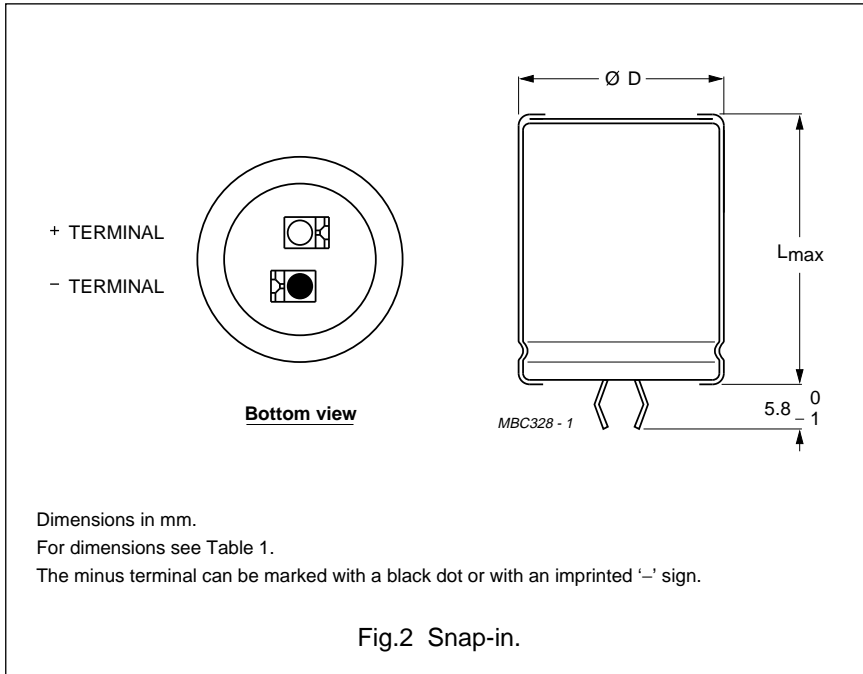


Table 1 Physical dimensions, mass and packaging information; see Fig.2

NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	ØD _{max} (mm)	L _{max} (mm)	MASS (g)	PACKAGING QUANTITIES (units per box)	BOX DIMENSIONS l × w × h (mm)
22 × 25	2225	23	27	≈12	100	260 × 250 × 39
22 × 30	2230	23	32	≈16	100	260 × 250 × 44
22 × 35	2235	23	37	≈20	100	260 × 250 × 49
22 × 40	2240	23	42	≈23	100	260 × 250 × 54
25 × 30	2530	26	32	≈22	100	290 × 280 × 44
25 × 35	2535	26	37	≈24	100	290 × 280 × 49
25 × 40	2540	26	42	≈27	100	290 × 280 × 54
25 × 50	2550	26	52	≈38	100	290 × 280 × 64
30 × 30	3030	31	32	≈30	100	340 × 330 × 44
30 × 35	3035	31	37	≈35	100	340 × 330 × 49
30 × 40	3040	31	42	≈40	100	340 × 330 × 54
30 × 45	3045	31	47	≈45	100	340 × 330 × 59
30 × 50	3050	31	52	≈50	100	340 × 330 × 64
35 × 35	3535	36	37	≈48	50	390 × 198 × 49
35 × 40	3540	36	42	≈55	50	390 × 198 × 54
35 × 45	3545	36	47	≈63	50	390 × 198 × 59
35 × 50	3550	36	52	≈72	50	390 × 198 × 64

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ELECTRICAL DATA AND ORDERING INFORMATION

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

SYMBOL	DESCRIPTION
C_R	rated capacitance at 100 Hz
I_R	rated RMS ripple current at 100 Hz or $\geq 10\text{ kHz}$ and 85 °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

Ordering example

Electrolytic capacitor
 PSM-SI 056

10000 $\mu\text{F}/25\text{ V}$; $\pm 20\%$

Nominal case size: $\varnothing 25 \times 40\text{ mm}$

Catalogue number: 2222 056 46103.

Table 2 Electrical data and ordering information for **056** series; preferred types in **bold**

U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	I_R 100 Hz 85 °C (A)	I_R $\geq 10\text{ kHz}$ 85 °C (A)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	ESR 100 Hz (m Ω)	Z 10 kHz (m Ω)	CATALOGUE NUMBER 2222
10	6800	22 × 25	2225	2.04	2.40	412	140	76	62	056 54682
	10000	22 × 30	2230	2.56	3.02	608	205	56	45	056 54103
	15000	25 × 30	2530	3.12	3.68	904	304	44	39	056 54153
	15000	22 × 40	2240	3.39	4.00	904	304	41	34	056 44153
	22000	30 × 30	3030	3.47	4.09	1324	444	44	37	056 54223
	22000	25 × 40	2540	4.12	4.86	1324	444	34	28	056 44223
	33000	30 × 40	3040	4.58	5.40	1984	664	32	28	056 54333
	33000	25 × 50	2550	4.70	5.55	1984	664	30	27	056 44333
	47000	35 × 40	3540	5.10	6.02	2824	944	31	26	056 54473
	47000	30 × 50	3050	5.39	6.36	2824	944	28	24	056 44473
	68000	35 × 50	3550	5.88	6.94	4084	1364	28	23	056 54683
16	4700	22 × 25	2225	2.01	2.37	455	154	79	62	056 55472
	6800	22 × 30	2230	2.54	3.00	657	222	57	45	056 55682
	10000	25 × 30	2530	3.02	3.56	964	324	47	39	056 55103
	10000	22 × 40	2240	3.28	3.87	964	324	44	34	056 45103
	15000	30 × 30	3030	3.36	3.96	1444	484	47	37	056 55153
	15000	25 × 40	2540	4.00	4.72	1444	484	34	28	056 45153
	22000	30 × 40	3040	4.51	5.32	2116	708	33	28	056 55223
	22000	25 × 50	2550	3.97	4.68	2116	708	42	41	056 45223
	33000	35 × 40	3540	5.02	5.92	3172	1060	32	28	056 55333
	33000	30 × 50	3050	4.75	5.61	3172	1060	36	34	056 45333
	47000	35 × 50	3550	5.34	6.30	4516	1508	34	32	056 55473

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U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	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 (m Ω)	Z 10 kHz (m Ω)	CATALOGUE NUMBER 2222
25	3300	22 × 25	2225	1.88	2.22	499	169	89	61	056 56332
	4700	22 × 30	2230	2.37	2.80	709	239	65	45	056 56472
	6800	25 × 30	2530	2.81	3.32	1024	344	54	41	056 56682
	6800	22 × 40	2240	3.16	3.73	1024	344	47	38	056 46682
	10000	30 × 30	3030	3.25	3.84	1504	504	50	38	056 56103
	10000	25 × 40	2540	3.73	4.40	1504	504	39	30	056 46103
	15000	30 × 40	3040	4.73	5.58	2254	754	30	28	056 56153
	15000	25 × 50	2550	3.92	4.63	2254	754	43	39	056 46153
	22000	35 × 40	3540	4.48	5.29	3304	1104	40	28	056 56223
	22000	30 × 50	3050	4.96	5.85	3304	1104	36	23	056 46223
33000	35 × 50	3550	4.98	5.88	4954	1654	39	33	056 56333	
40	2200	22 × 25	2225	1.85	2.26	532	180	92	61	056 57222
	3300	22 × 30	2230	2.09	2.55	796	260	67	45	056 57332
	4700	25 × 30	2530	2.28	2.78	1132	380	82	70	056 57472
	4700	22 × 40	2240	3.10	3.78	1132	380	49	38	056 47472
	6800	30 × 30	3030	3.16	3.85	1636	548	53	38	056 57682
	6800	25 × 40	2540	3.06	3.73	1636	548	58	50	056 47682
	10000	30 × 40	3040	4.20	5.12	2404	804	38	28	056 57103
	10000	25 × 50	2550	3.88	4.73	2404	804	44	39	056 47103
	15000	35 × 40	3540	4.05	4.94	3604	1204	49	41	056 57153
	15000	30 × 50	3050	4.45	5.43	3604	1204	41	34	056 47153
22000	35 × 50	3550	4.86	5.93	5284	1764	40	33	056 57223	
50	1500	22 × 25	2225	1.36	1.66	454	154	170	130	056 51152
	2200	22 × 30	2230	1.75	2.14	664	224	120	91	056 51222
	3300	25 × 30	2530	2.17	2.65	994	334	90	72	056 51332
	3300	22 × 40	2240	2.42	2.95	994	334	80	63	056 41332
	4700	30 × 30	3030	2.65	3.23	1414	474	75	63	056 51472
	4700	25 × 40	2540	2.89	3.53	1414	474	65	52	056 41472
	6800	30 × 40	3040	3.56	4.34	2044	684	53	45	056 51682
	6800	25 × 50	2550	3.75	4.58	2044	684	50	43	056 41682
	10000	35 × 40	3540	4.05	4.94	3004	1004	49	42	056 51103
	10000	30 × 50	3050	4.50	5.49	3004	1004	40	35	056 41103
15000	35 × 50	3550	4.98	6.08	4504	1504	39	33	056 51153	

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U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	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 (m Ω)	Z 10 kHz (m Ω)	CATALOGUE NUMBER 2222
63	1000	22 × 25	2225	1.46	1.78	382	130	148	104	056 58102
	1500	22 × 30	2230	1.87	2.28	571	193	105	72	056 58152
	2200	25 × 30	2530	2.32	2.83	836	281	79	59	056 58222
	2200	22 × 40	2240	2.54	3.10	836	281	73	53	056 48222
	3300	30 × 30	3030	2.87	3.50	1251	420	64	50	056 58332
	3300	25 × 40	2540	3.14	3.83	1251	420	55	44	056 48332
	4700	30 × 40	3040	3.67	4.48	1780	596	50	38	056 58472
	4700	25 × 50	2550	3.71	4.53	1780	596	48	38	056 48472
	6800	35 × 40	3540	4.33	5.28	2574	861	43	38	056 58682
	6800	30 × 50	3050	4.75	5.80	2574	861	42	37	056 48682
	10000	35 × 50	3550	5.26	6.42	3784	1264	35	30	056 58103
100	470	22 × 25	2225	0.77	0.94	286	98	535	470	056 59471
	680	22 × 30	2230	0.99	1.21	412	160	375	328	056 59681
	1000	25 × 30	2530	1.27	1.55	604	204	265	235	056 59102
	1000	22 × 40	2240	1.35	1.65	604	204	260	225	056 49102
	1500	30 × 30	3030	1.67	2.04	904	304	190	170	056 59152
	1500	25 × 40	2540	1.75	2.14	904	304	180	160	056 49152
	2200	30 × 40	3040	2.27	2.77	1324	444	130	120	056 59222
	2200	25 × 50	2550	2.30	2.80	1324	444	125	110	056 49222
	3300	35 × 40	3540	2.84	3.46	1984	664	100	95	056 59332
	3300	30 × 50	3050	2.97	3.62	1984	664	92	85	056 49332
	4700	35 × 50	3550	3.59	4.38	2824	677	75	70	056 59472

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Table 3 Electrical data and ordering information for **057** series; preferred types in **bold**

U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	I_R 100 Hz 85 °C (A)	I_{L1} 1 min (μ A)	I_{L5} 5 min (μ A)	ESR 100 Hz (m Ω)	Z 10 kHz (m Ω)	CATALOGUE NUMBER 2222
200	150	22 × 25	2225	0.77	184	64	950	620	057 52151
	220	22 × 30	2230	1.00	268	92	650	435	057 52221
	330	25 × 30	2530	1.36	400	136	430	310	057 52331
	330	22 × 40	2240	1.36	400	136	430	310	057 42331
	470	30 × 30	3030	1.80	568	192	310	230	057 52471
	470	25 × 40	2540	1.80	568	192	310	230	057 42471
	680	30 × 40	3040	2.39	820	276	210	180	057 52681
	680	25 × 50	2550	2.39	820	276	210	180	057 42681
	1000	35 × 40	3540	2.85	1204	404	160	135	057 52102
	1000	30 × 50	3050	2.85	1204	404	160	135	057 42102
	1500	35 × 50	3550	3.66	1804	604	120	105	057 52152
250	100	22 × 25	2225	0.63	154	54	1440	770	057 53101
	150	22 × 30	2230	0.83	229	79	960	520	057 53151
	220	25 × 30	2530	1.10	334	114	660	365	057 53221
	220	22 × 40	2240	1.10	334	114	660	365	057 43221
	330	30 × 30	3030	1.49	499	169	440	265	057 53331
	330	25 × 40	2540	1.49	499	169	440	265	057 43331
	470	30 × 40	3040	1.98	709	239	310	185	057 53471
	470	25 × 50	2550	1.98	709	239	310	185	057 43471
	680	35 × 40	3540	2.60	1024	344	240	145	057 53681
	680	30 × 50	3050	2.60	1024	344	240	145	057 43681
	1000	35 × 50	3550	3.12	1504	504	160	105	057 53102
385	47	22 × 25	2225	0.50	112	40	3000	1400	057 58479
	68	22 × 30	2230	0.63	161	56	2100	1000	057 58689
	100	22 × 35	2235	0.84	235	81	1400	780	057 38101
	100	25 × 30	2530	0.86	235	81	1400	780	057 58101
	100	22 × 40	2240	0.86	235	81	1400	780	057 48101
	150	30 × 30	3030	1.16	350	119	950	520	057 58151
	150	25 × 40	2540	1.16	350	119	950	520	057 48151
	220	30 × 35	3035	1.50	512	173	650	400	057 38221
	220	25 × 50	2550	1.57	512	173	650	400	057 48221
	220	30 × 40	3040	1.57	512	173	650	400	057 58221
	330	30 × 45	3045	1.75	766	258	480	280	057 38331
	330	35 × 35	3535	1.73	766	258	480	280	057 68331
	470	35 × 45	3545	2.29	1089	366	340	220	057 48471
470	35 × 50	3550	2.40	1089	366	340	220	057 58471	

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U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	I_R 100 Hz 85 °C (A)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	ESR 100 Hz (m Ω)	Z 10 kHz (m Ω)	CATALOGUE NUMBER 2222
400	47	22 × 25	2225	0.50	117	42	3000	1400	057 56479
	68	22 × 30	2230	0.63	167	58	2100	1000	057 56689
	100	22 × 35	2235	0.84	240	84	1400	780	057 36101
	100	25 × 30	2530	0.86	244	84	1400	780	057 56101
	150	30 × 30	3030	1.16	364	124	950	520	057 56151
	150	25 × 40	2540	1.16	364	124	950	520	057 46151
	220	30 × 35	3035	1.50	532	180	650	400	057 36221
	220	25 × 50	2550	1.57	532	180	650	400	057 46221
	330	35 × 40	3540	1.85	796	268	480	280	057 56331
	330	30 × 50	3050	1.85	796	268	480	280	057 46331
	470	35 × 50	3550	2.40	1132	380	340	220	057 56471
450	47	22 × 30	2230	0.26	131	45	5600	4400	057 67479
	68	22 × 30	2230	0.33	188	65	3900	3100	057 57689
	100	25 × 35	2535	0.46	274	94	2600	2100	057 37101
	100	30 × 30	3030	0.48	274	94	2600	2100	057 57101
	150	25 × 50	2550	0.70	409	140	1600	1300	057 47151
	150	30 × 35	3035	0.66	409	140	1600	1300	057 37151
	220	30 × 45	3045	0.73	598	202	1100	900	057 37221
	220	35 × 40	3540	0.92	598	202	1100	900	057 57221
	330	35 × 45	3545	1.20	895	301	700	600	057 47331
	330	35 × 50	3550	1.26	895	301	700	600	057 57331

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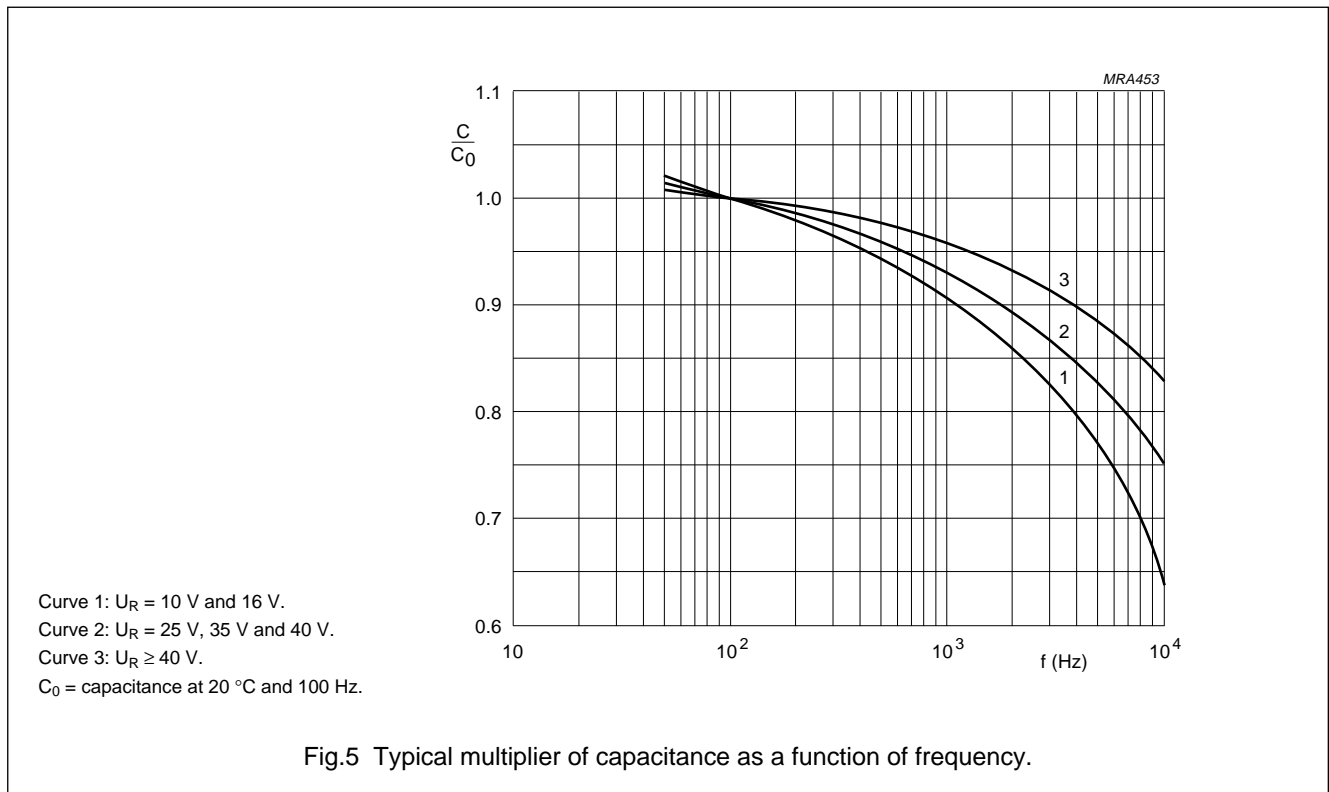
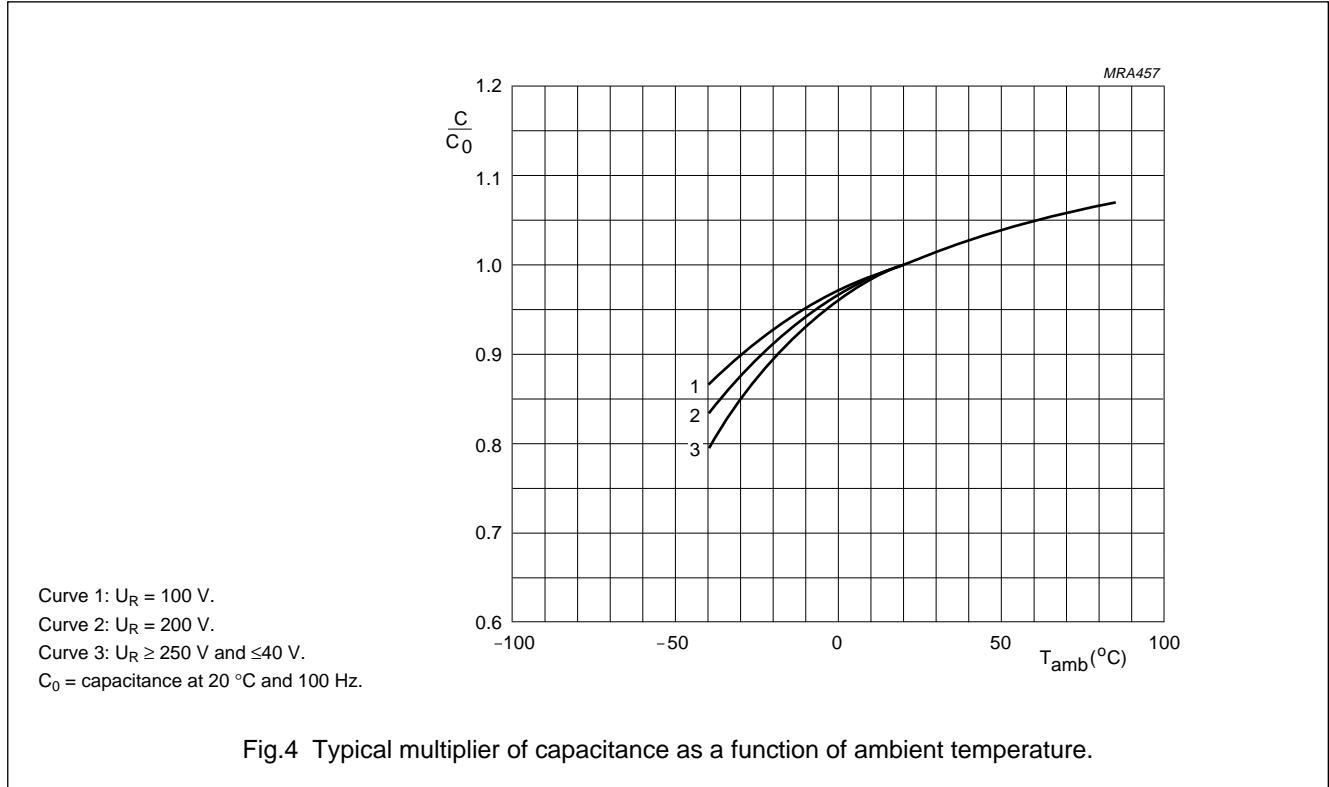
Additional electrical data

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

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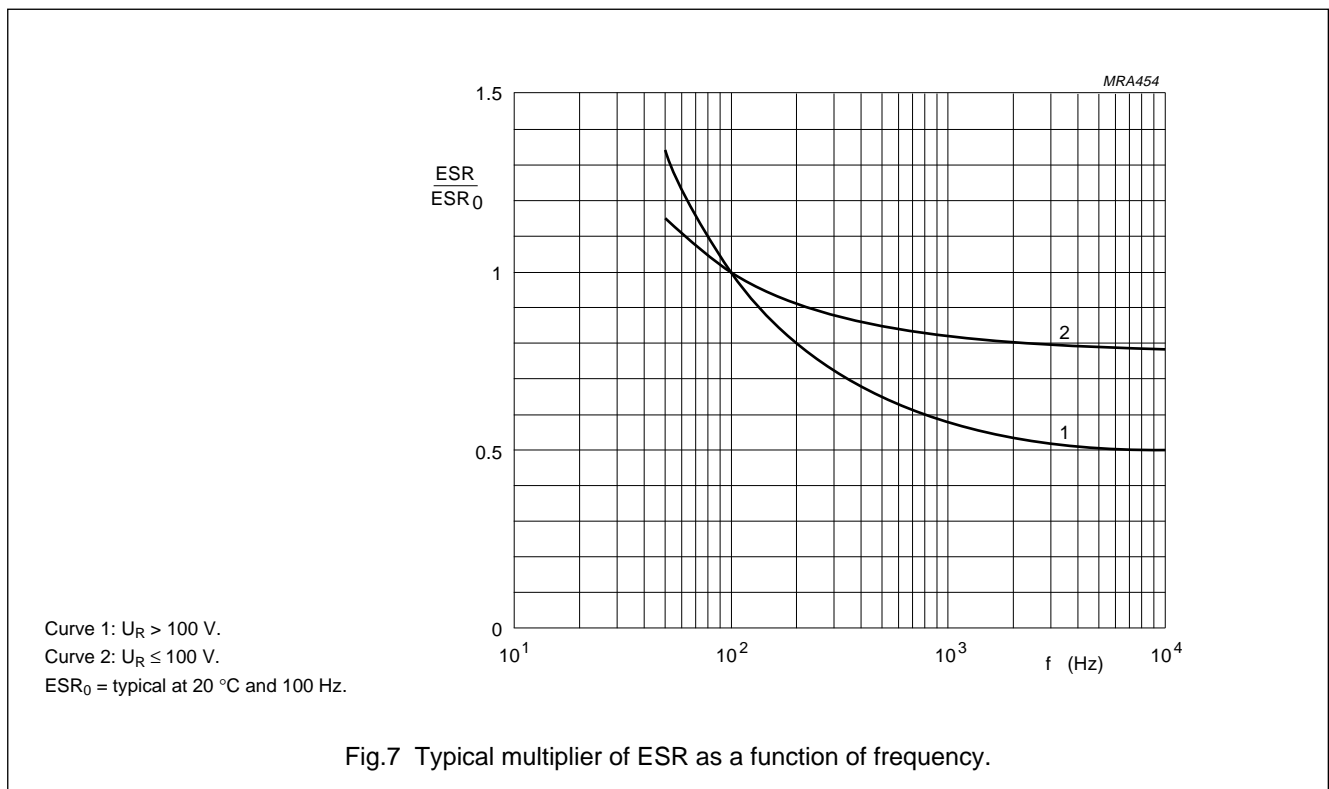
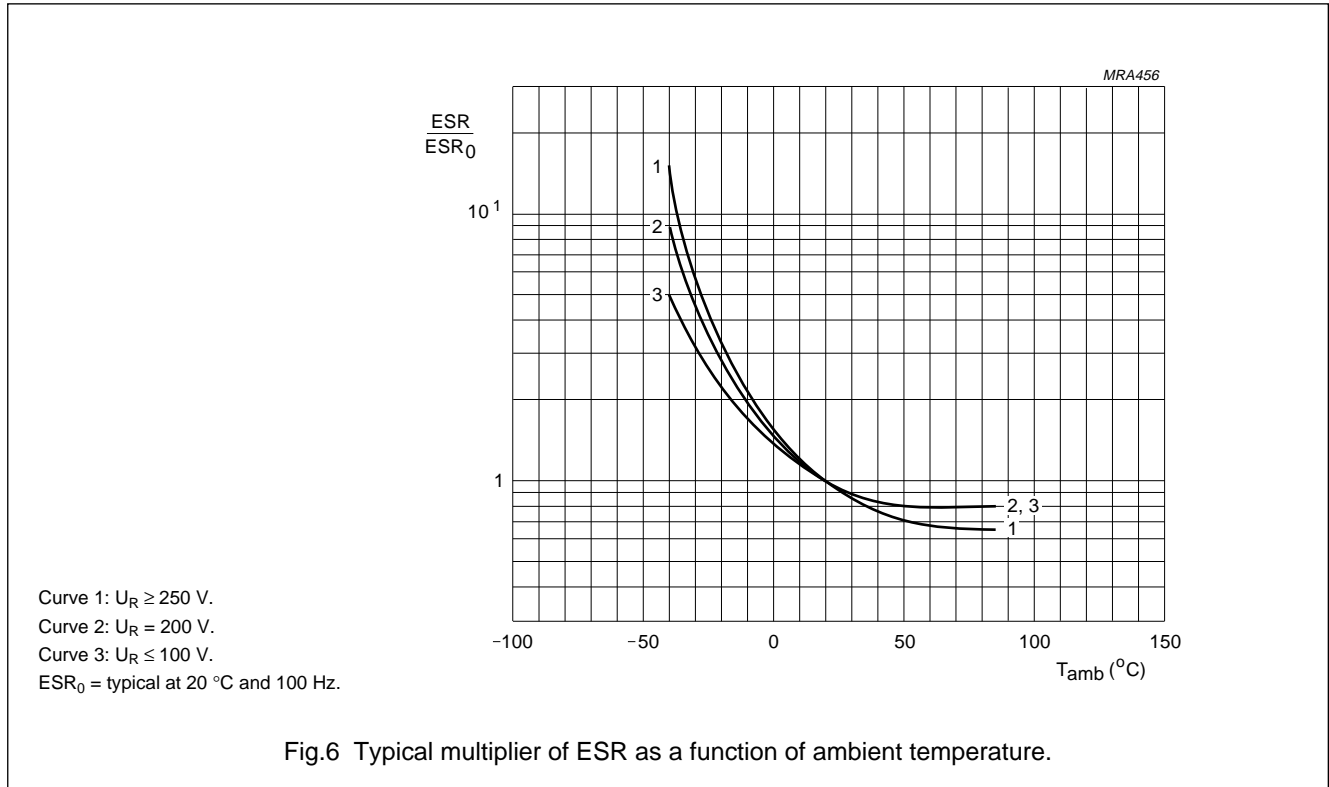
Capacitance (C)



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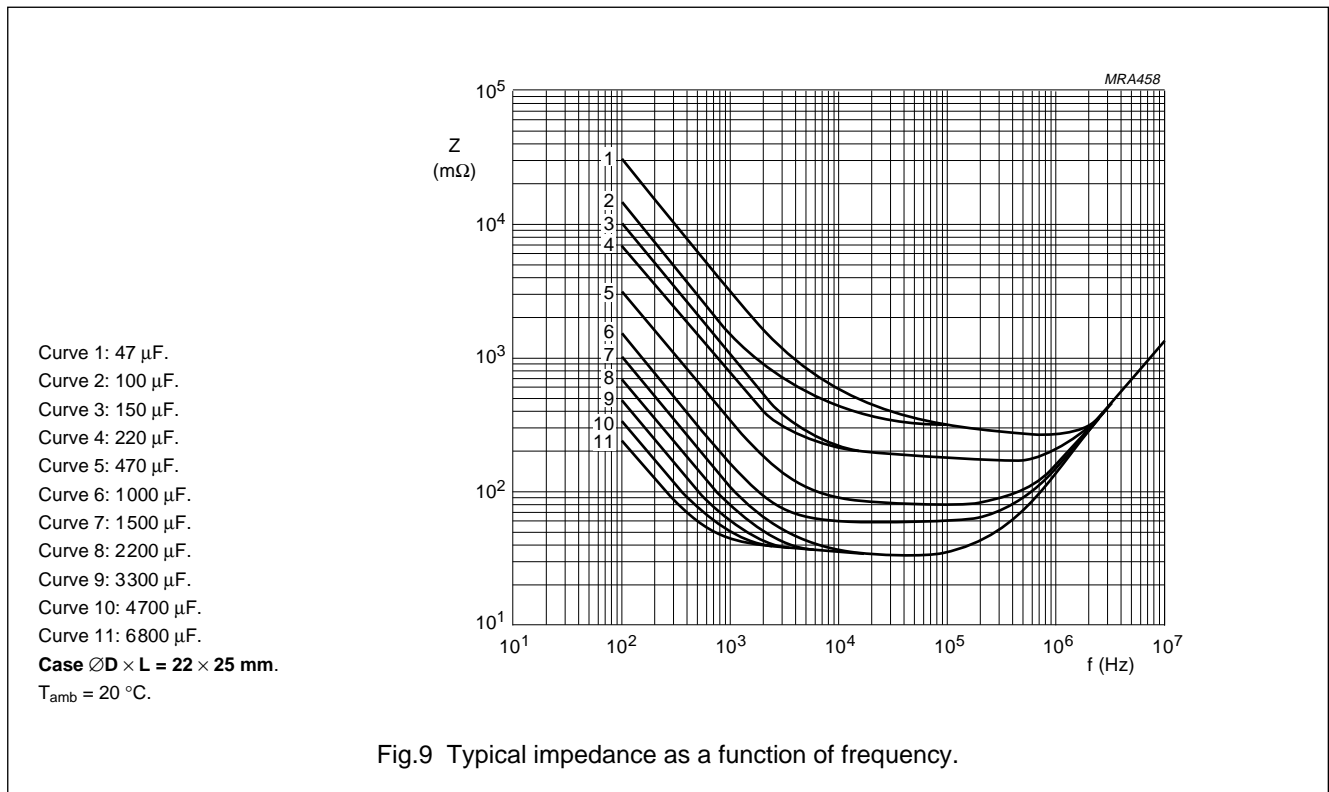
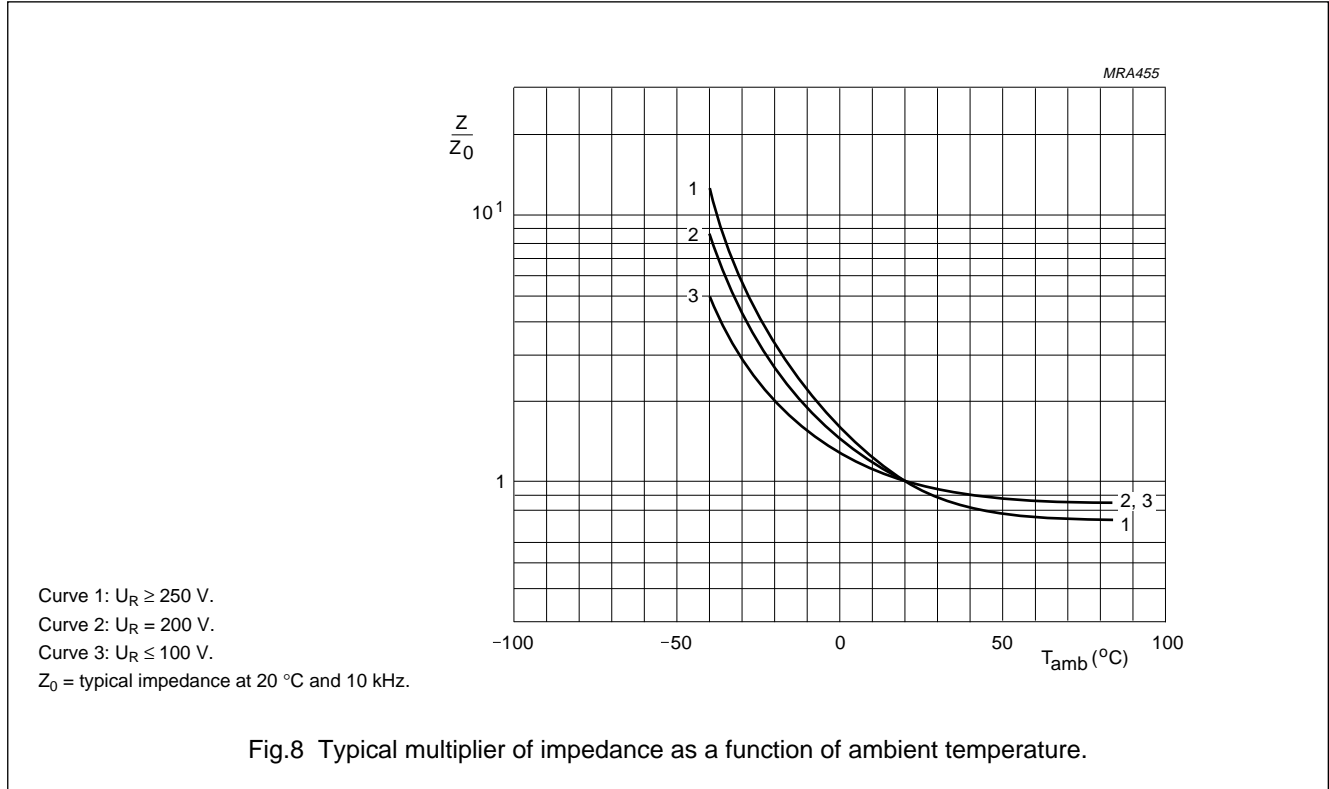
Equivalent series resistance (ESR)



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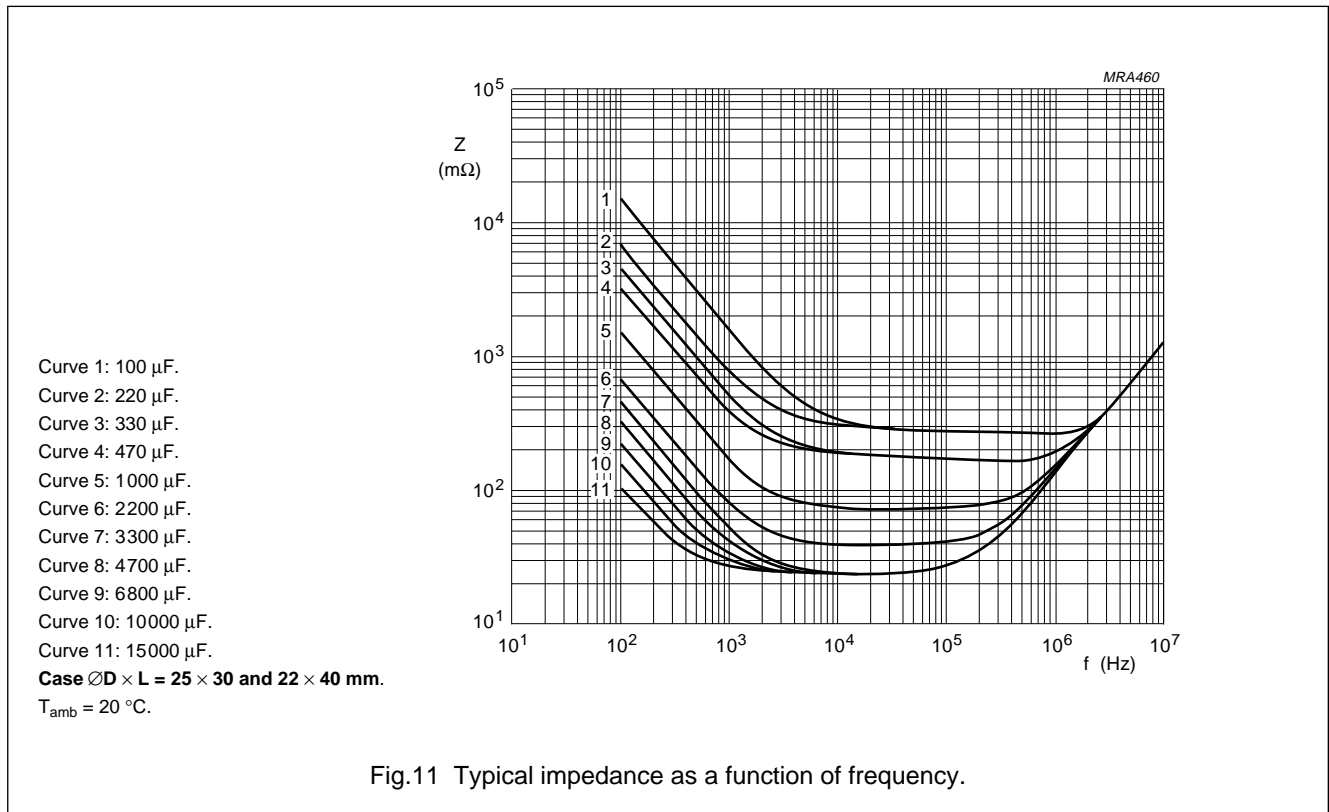
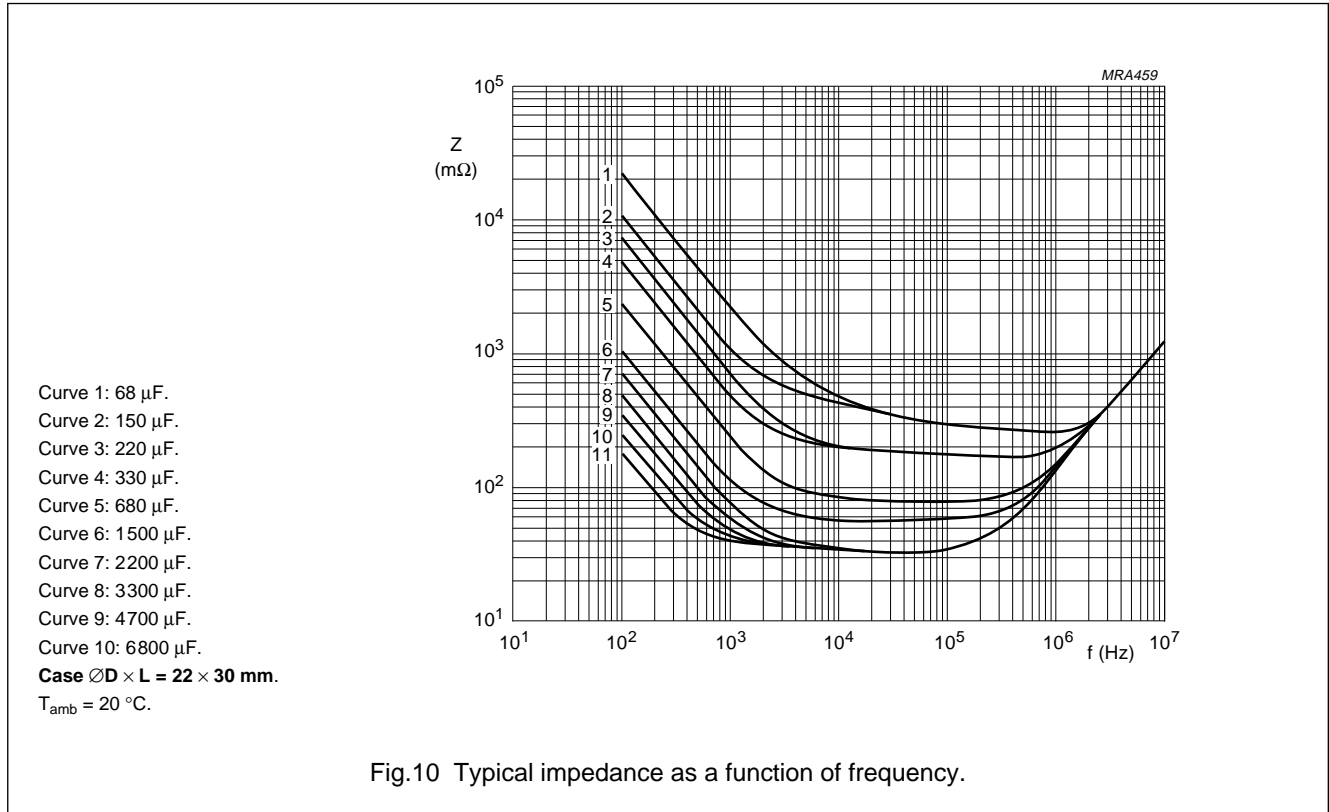
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Impedance (Z)



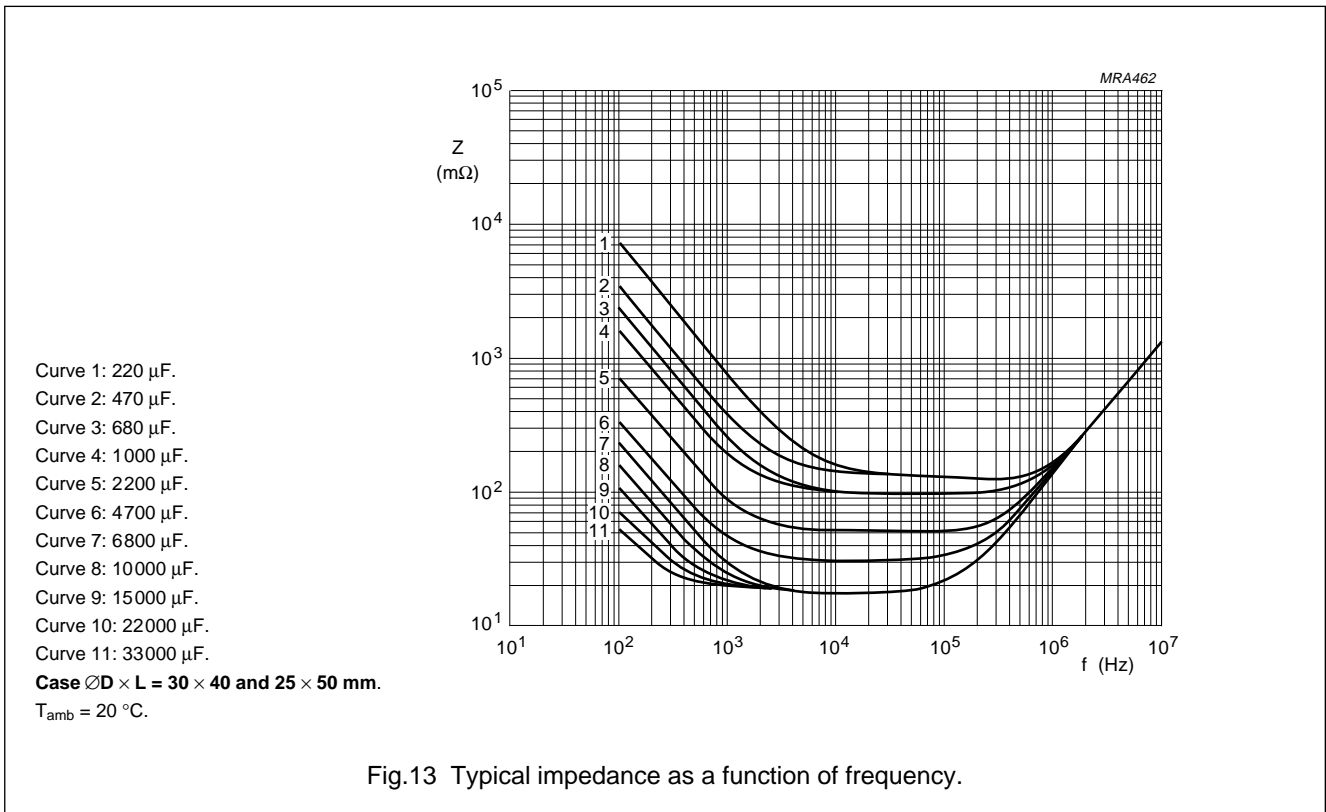
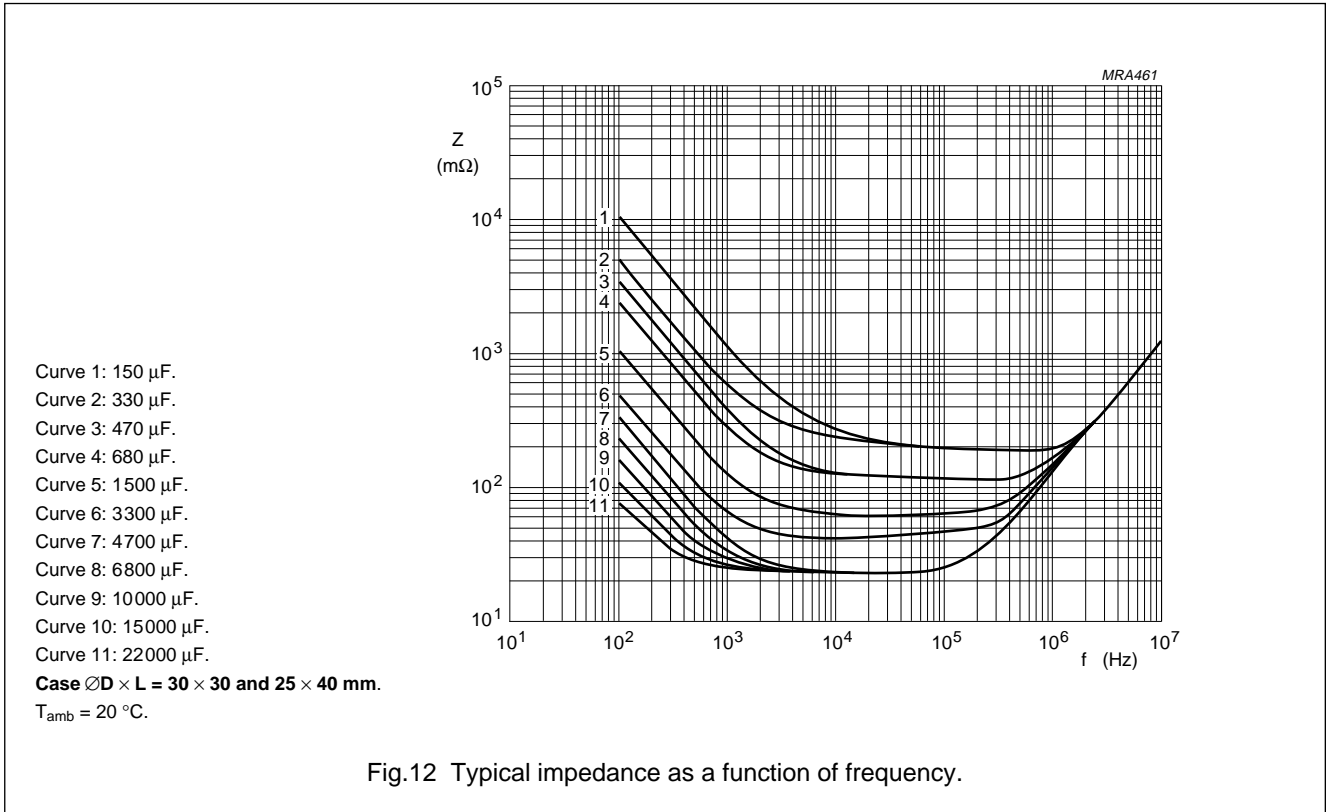
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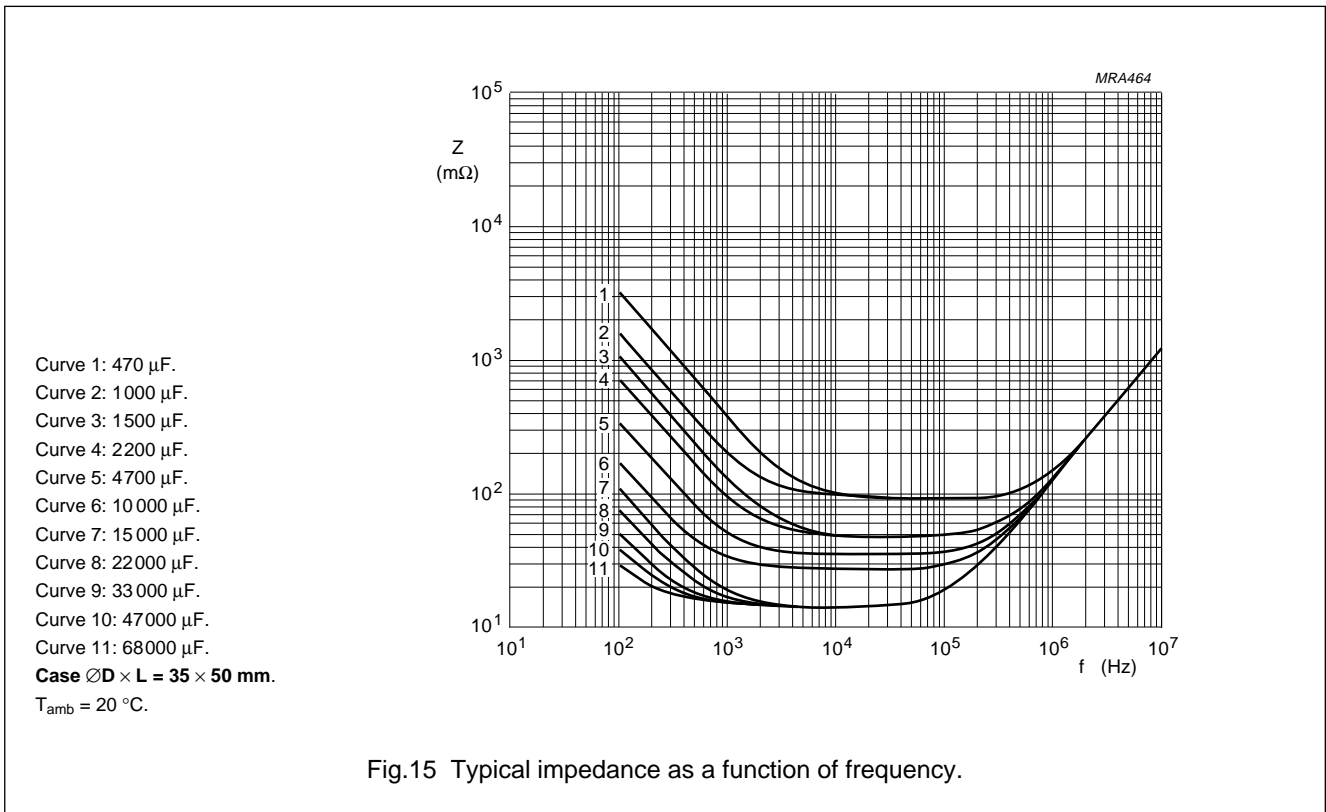
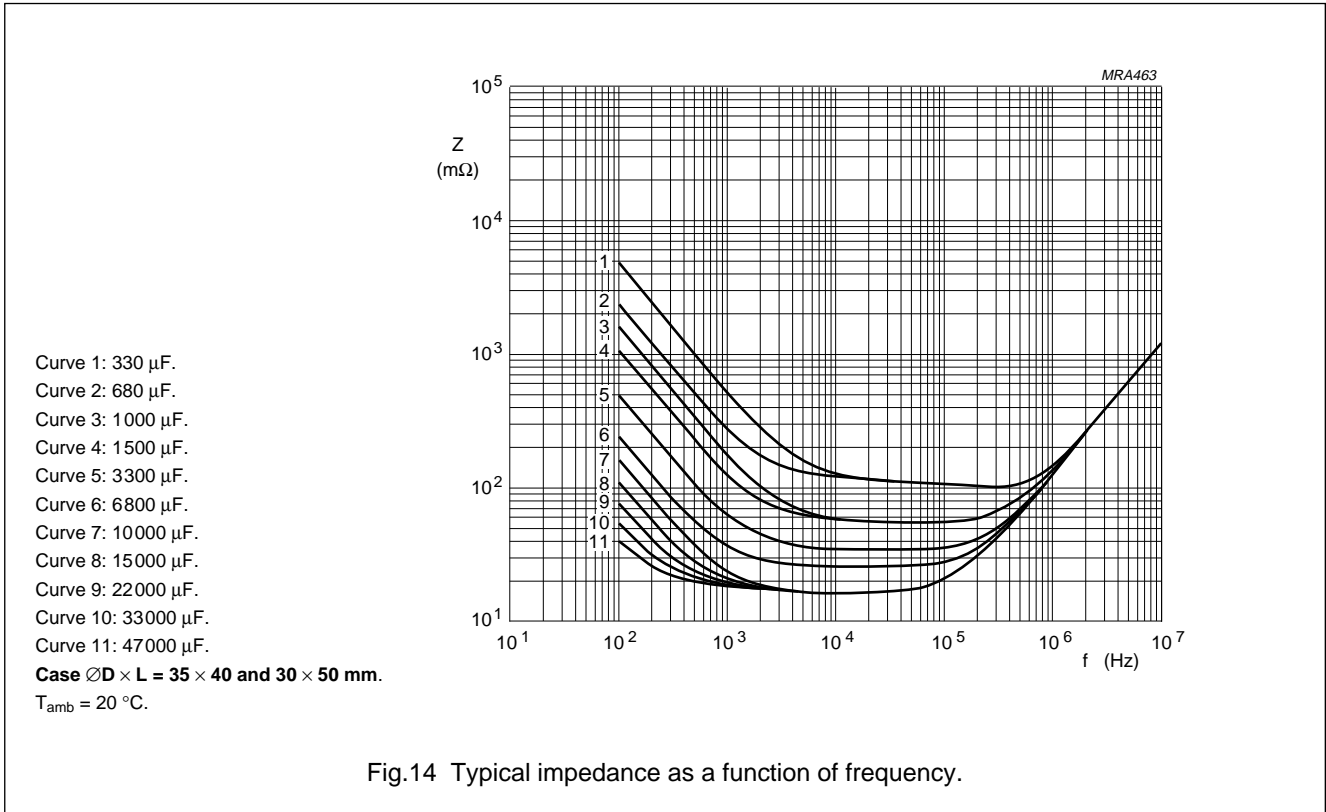
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RIPPLE CURRENT AND USEFUL LIFE

Table 4 Multiplier of ripple current (I_R) as a function of frequency

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 10 \text{ to } 25 \text{ V}$	$U_R = 40 \text{ to } 100 \text{ V}$	$U_R > 100 \text{ V}$
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

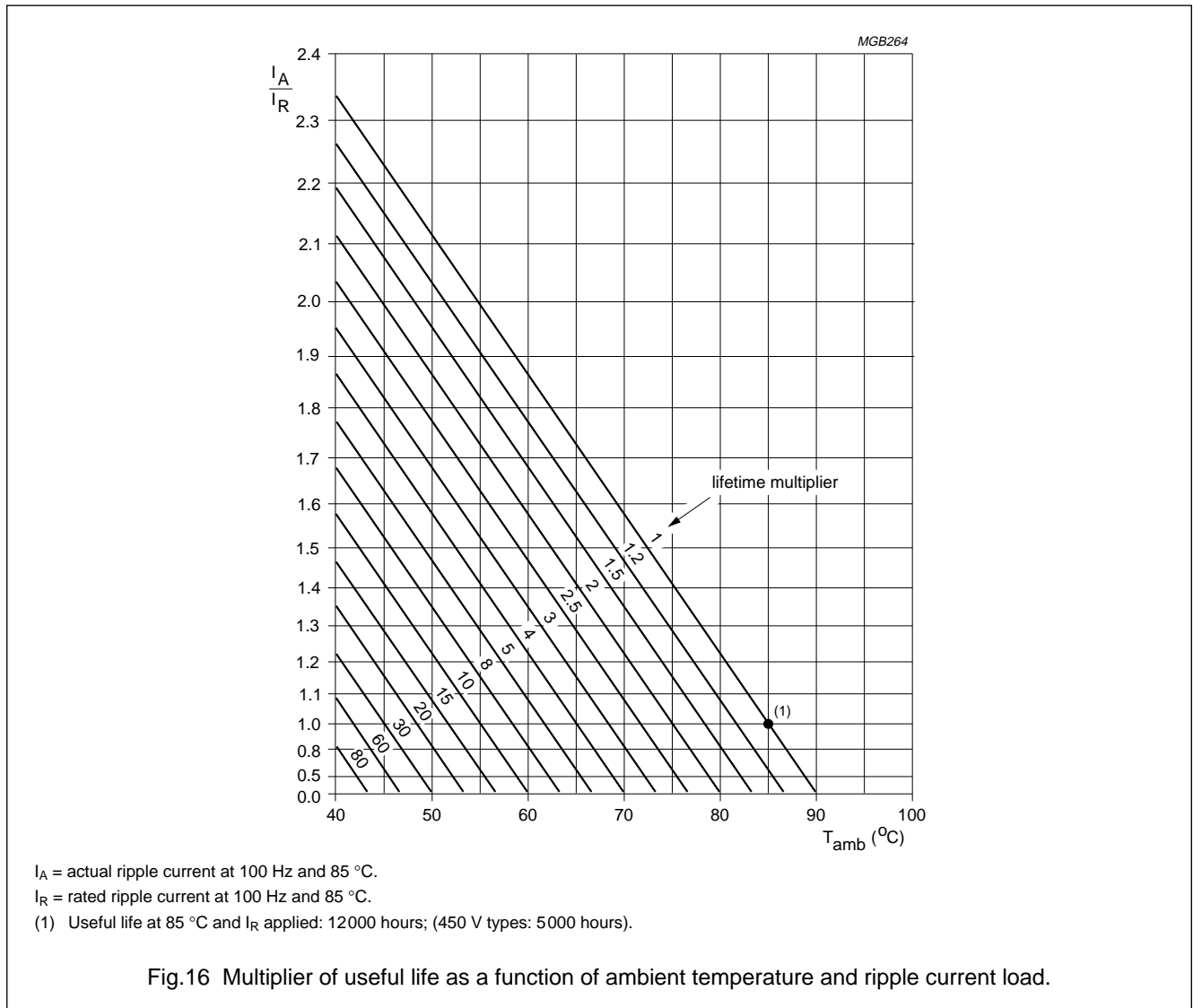


Fig.16 Multiplier of useful life as a function of ambient temperature and ripple current load.

Non-solid Al - electrolytic capacitors Power Standard Miniature Snap-in

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SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in data handbook PA01, Section "Tests and Requirements".

Table 5 Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 384-4/ CECC 30300 subclause 4.13	$T_{amb} = 85\text{ °C}$; U_R applied; 5000 hours (450 V types: 2000 hours)	$U_R \leq 100\text{ V}$; $\Delta C/C: \pm 15\%$ $U_R > 100\text{ V}$; $\Delta C/C: \pm 10\%$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ °C}$; U_R and I_R applied; 12000 hours (450 V types: 5000 hours)	$U_R \leq 100\text{ V}$; $\Delta C/C: \pm 45\%$ $U_R > 100\text{ V}$; $\Delta C/C: \pm 30\%$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $U_R \leq 100\text{ V}$: $\leq 1\%$; $U_R > 100\text{ V}$: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 384-4/ CECC 30300 subclause 4.17	$T_{amb} = 85\text{ °C}$; no voltage applied; 500 hours; after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 10\%$ $I_{L5} \leq 2 \times \text{spec. limit}$