

Non-solid Al - electrolytic capacitors

Axial Standard Miniature

ASM 021

FEATURES

- Polarized aluminium electrolytic capacitors, non-solid
- Axial leads, cylindrical aluminium case, insulated with a blue sleeve
- Mounting ring version (single ended) not insulated
- Case $\varnothing 10 \times 30$ to 21×40 mm with pressure relief
- Charge and discharge proof
- Taped versions up to case $\varnothing 15 \times 30$ mm available for automatic insertion
- Miniaturized, high CV-product per unit volume.

APPLICATIONS

- General purpose, industrial, automotive, audio-video
- Coupling, decoupling, smoothing, filtering, buffering and timing
- Portable and mobile equipment (small size, low mass)
- Low mounting height boards, vibration and shock resistant.

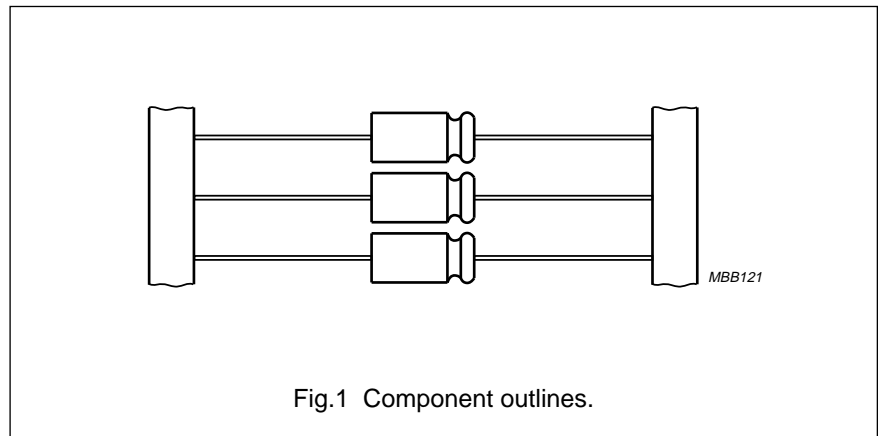
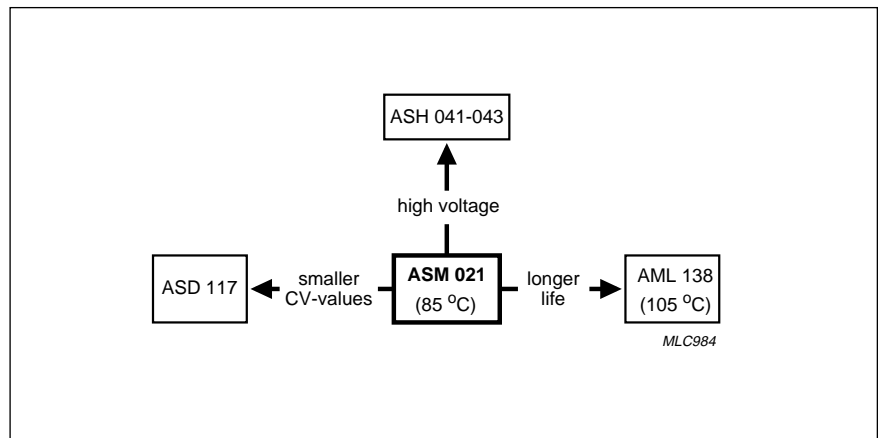


Fig.1 Component outlines.



QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	Case sizes ($\varnothing D_{nom} \times L_{nom}$ in mm)	4.5 × 10 to 10 × 25
Rated capacitance range, C_R	0.47 to 15000 μF	
Tolerance on C_R	±20%	
Rated voltage range, U_R	6.3 to 100 V	
Category temperature range	-40 to +85 °C	
Endurance test at 85 °C		
$U_R = 6.3$ to 25 V	1000 hours	5000 hours
$U_R = 40$ to 100 V	2000 hours	5000 hours
Useful life at 85 °C	2500 hours	8000 hours
Useful life at 40 °C, $1.4 \times I_R$ applied	70000 hours	200000 hours
Shelf life at 0 V, 85 °C	500 hours	500 hours
Based on sectional specification	IEC 384-4/CECC 30300	IEC 384-4/CECC 30300
$U_R = 6.3$ to 25 V	GP grade	LL grade
$U_R = 40$ to 100 V	LL grade	LL grade
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)

Preferred types in **bold**.

C_R (μF)	$U_R(V)$						
	6.3	10	16	25	40	63	100
0.47	–	–	–	–	–	4.5 × 10	–
1	–	–	–	–	–	4.5 × 10	4.5 × 10
2.2	–	–	–	–	–	4.5 × 10	4.5 × 10
3.3	–	–	–	–	–	4.5 × 10	–
4.7	–	–	–	–	–	4.5 × 10	4.5 × 10
10	–	–	–	–	–	4.5 × 10	6 × 10
15	–	–	–	–	–	4.5 × 10	8 × 11
	–	–	–	–	–	–	6.5 × 18
22	–	–	–	–	4.5 × 10	6 × 10	8 × 11
	–	–	–	–	–	–	6.5 × 18
33	–	–	–	–	–	6 × 10	6.5 × 18
47	–	–	–	4.5 × 10	6 × 10	8 × 11	8 × 18
	–	–	–	–	–	6.5 × 18	–
68	–	–	4.5 × 10	–	–	8 × 11	10 × 18
	–	–	–	–	–	6.5 × 18	–
100	–	4.5 × 10	–	6 × 10	8 × 11	8 × 18	10 × 25
	–	–	–	–	6.5 × 18	–	10 × 30
150	–	–	6 × 10	8 × 11	8 × 18	10 × 18	12.5 × 30
	–	–	–	6.5 × 18	–	–	–
220	–	6 × 10	8 × 11	6.5 × 18	10 × 18	10 × 25	12.5 × 30
	–	–	–	–	–	10 × 30	–
330	–	8 × 11	6.5 × 18	8 × 18	10 × 25	12.5 × 30	15 × 30
470	8 × 11	6.5 × 18	8 × 18	10 × 18	10 × 25	12.5 × 30	18 × 30
	–	–	–	–	10 × 30	–	–
680	–	8 × 18	10 × 18	10 × 25	12.5 × 30	15 × 30	18 × 40
	–	–	–	10 × 30	–	–	–
1000	8 × 18	10 × 18	10 × 25	12.5 × 30	12.5 × 30	18 × 30	21 × 40
	–	–	10 × 30	–	–	–	–
1500	–	10 × 25	12.5 × 30	12.5 × 30	15 × 30	18 × 40	–
	–	10 × 30	–	–	–	–	–
2200	10 × 25	12.5 × 30	12.5 × 30	15 × 30	18 × 30	21 × 40	–
3300	–	12.5 × 30	15 × 30	18 × 30	18 × 40	–	–
4700	–	15 × 30	18 × 30	18 × 40	21 × 40	–	–
6800	–	18 × 30	18 × 40	21 × 40	–	–	–
10000	–	18 × 40	21 × 40	–	–	–	–
15000	–	21 × 40	–	–	–	–	–

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MECHANICAL DATA, AVAILABLE FORMS AND PACKAGING QUANTITIES

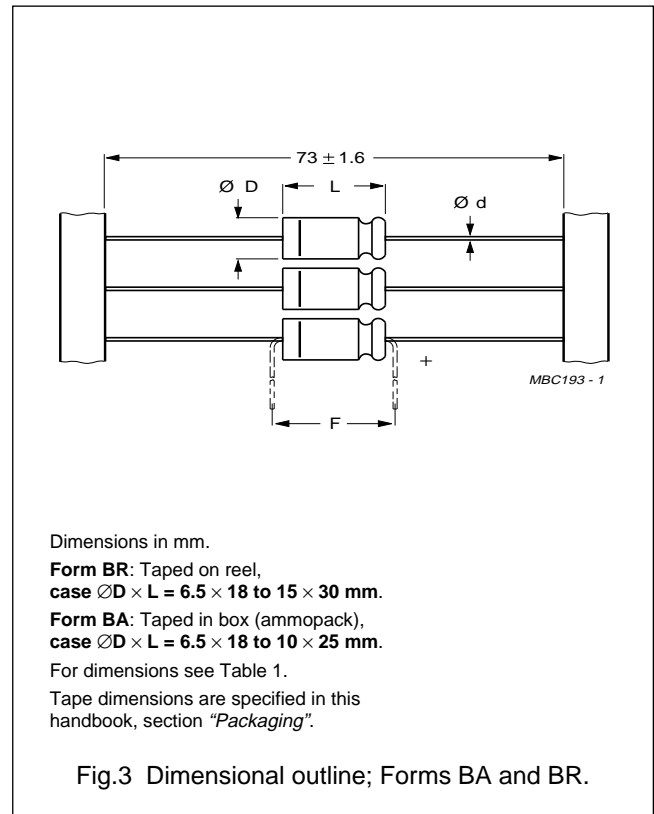
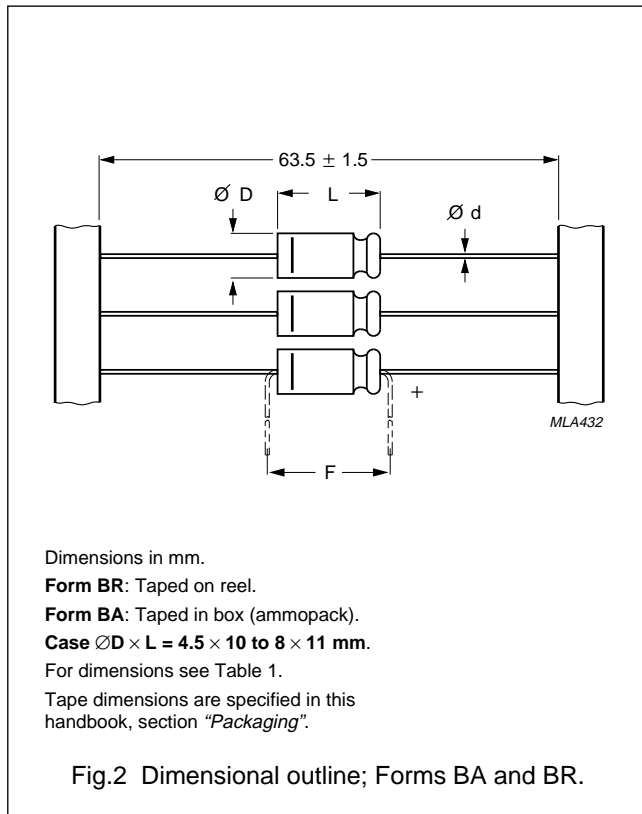


Table 1 Axial; physical dimensions, mass and packaging quantities; see Figs 2 and 3

NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	AXIAL: FORM AA, BA, and BR					MASS (g)	PACKAGING QUANTITIES		
		$\varnothing d$	l	$\varnothing D_{max}$ (mm)	L_{max} (mm)	F_{min} (mm)		FORM AA	FORM BA	FORM BR
4.5 × 10	2	0.6	–	5.0	10.5	15	≈0.50	–	1000	3000
6 × 10	3	0.6	–	6.3	10.5	15	≈0.70	–	1000	1000
8 × 11	5a	0.6	–	8.5	11.5	15	≈1.1	–	500	500
6.5 × 18	4	0.8	–	6.9	18.5	25	≈1.3	–	1000	1000
8 × 18	5	0.8	–	8.5	18.5	25	≈1.7	–	500	500
10 × 18	6	0.8	–	10.5	18.5	25	≈2.5	–	500	500
10 × 25	7	0.8	–	10.5	25.0	30	≈3.3	–	500	500
10 × 30	00	0.8	55 ±1	10.5	30.5	35	≈4.8	200	–	500
12.5 × 30	01	0.8	55 ±1	13.0	30.5	35	≈7.4	200	–	400
15 × 30	02	0.8	55 ±1	15.5	30.5	35	≈11.7	200	–	250
18 × 30	03	0.8	55 ±1	18.5	30.5	35	≈12.9	200	–	–
18 × 40	04	0.8	34 ±1	18.5	41.5	45	≈19.4	100	–	–
21 × 40	05	0.8	34 ±1	21.5	41.5	45	≈24.7	100	–	–

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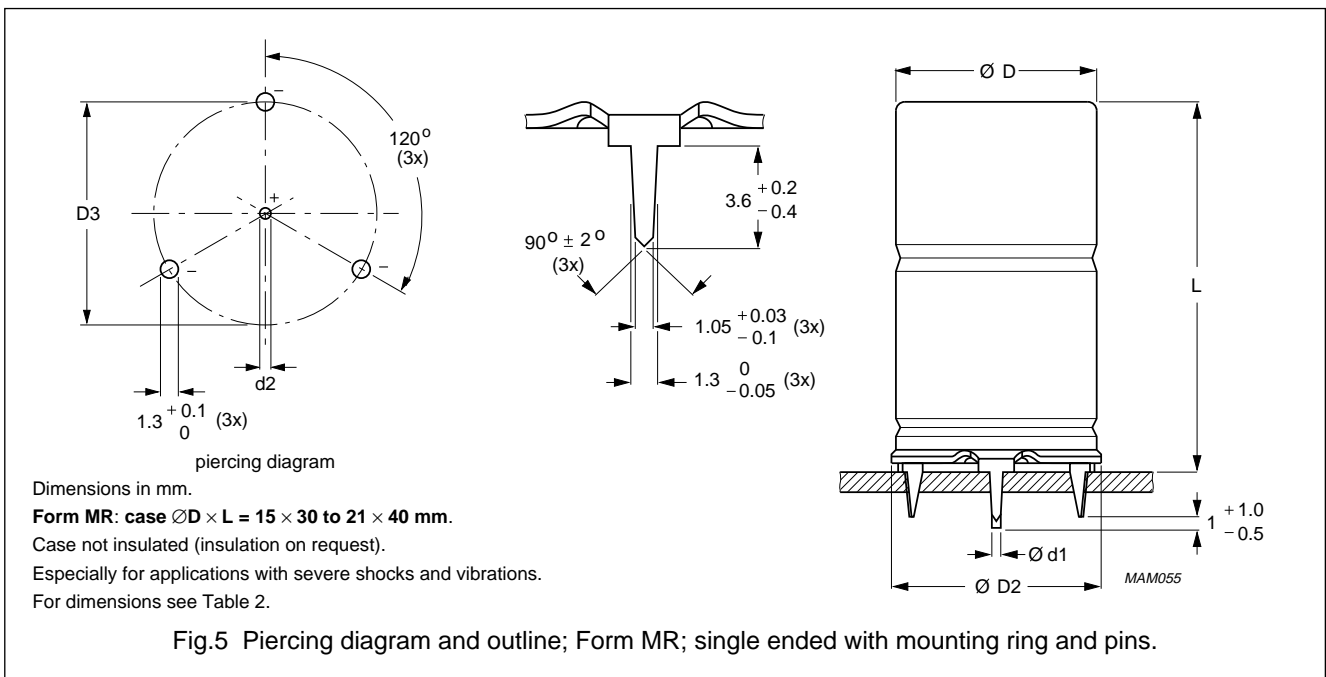
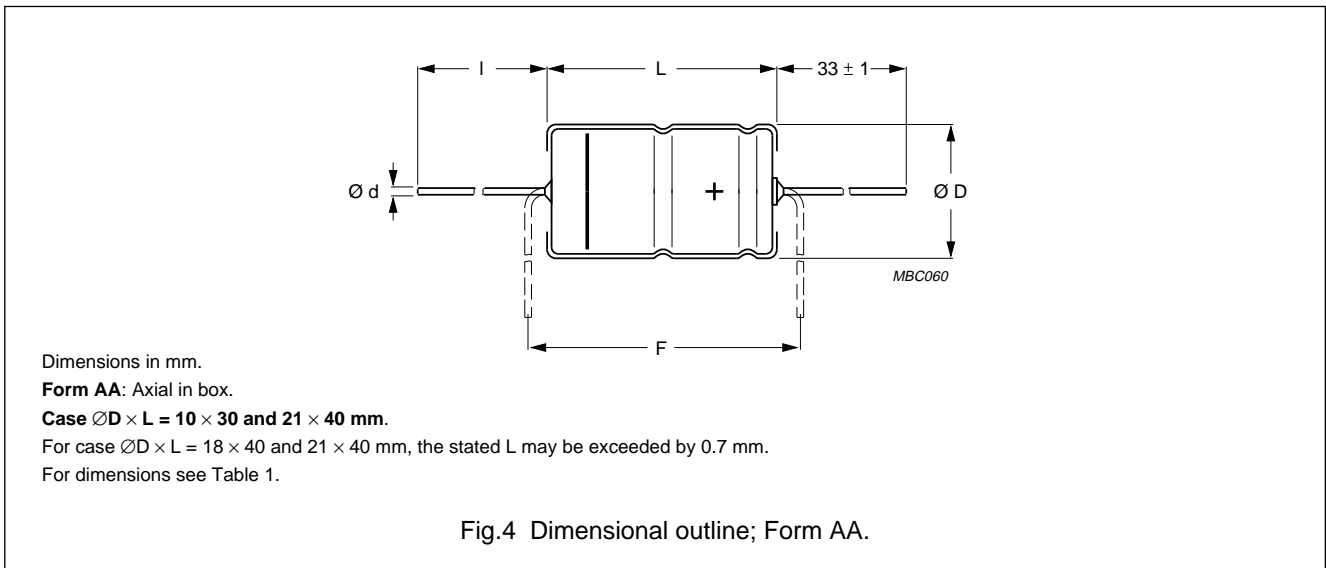


Table 2 Single ended; mass and packaging quantities; see Fig.5

NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	SINGLE ENDED WITH MOUNTING RING: FORM MR					MASS (g)	PACKAGING QUANTITIES
		$\varnothing d_1$ (mm)	$\varnothing d_2$ (mm)	$\varnothing D_{2max}$ (mm)	D3 (mm)	L_{max} (mm)		
15 × 30	02	0.8	1.0 +0.4	17.5	16.5 ±0.2	33	≈11.7	200
18 × 30	03	0.8	1.0 +0.4	19.5	18.5 ±0.2	33	≈12.9	200
18 × 40	04	0.8	1.0 +0.4	19.5	18.5 ±0.2	45	≈19.4	100
21 × 40	05	0.8	1.0 +0.4	22.5	21.5 ±0.2	45	≈24.7	100

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Ordering example

Electrolytic capacitor ASM 021

1000 $\mu\text{F}/16\text{ V}$; $\pm 20\%$ Nominal case size: $\varnothing 10 \times 25$; Form BA

Catalogue number: 2222 021 90518.

ELECTRICAL DATA AND ORDERING INFORMATION

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

SYMBOL	DESCRIPTION
C_R	rated capacitance at 100 Hz, tolerance $\pm 20\%$
I_R	rated RMS ripple current at 100 Hz, $85\text{ }^\circ\text{C}$
I_{L1}	max. leakage current after 1 minute at U_R
I_{L5}	max. leakage current after 5 minutes at U_R
$\text{Tan } \delta$	max. dissipation factor at 100 Hz
ESR	equivalent series resistance at 100 Hz (calculated from $\text{tan } \delta$ max. and C_R)
Z	max. impedance at 10 kHz

Table 3 Electrical data and ordering Information; 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 $85\text{ }^\circ\text{C}$ (mA)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	$\text{Tan } \delta$ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	CATALOGUE NUMBER 2222			
										AXIAL			SINGLE ENDED
										IN BOX FORM AA	TAPED ON REEL FORM BR	TAPED IN BOX FORM BA	MOUNTING RING FORM MR
6.3	470	8 × 11	5a	260	22	10	0.25	0.85	0.64	–	021 23471	021 33471	–
	1000	8 × 18	5	440	42	17	0.25	0.4	0.5	–	021 23102	021 33102	–
	2200	10 × 25	7	710	87	32	0.29	0.21	0.16	–	021 90588	021 90589	–
10	100	4.5 × 10	2	100	10	6	0.20	3.2	2.0	–	021 24101	021 34101	–
	220	6 × 10	3	160	17	8.4	0.20	1.5	0.91	–	021 24221	021 34221	–
	330	8 × 11	5a	230	24	11	0.20	1.0	0.61	–	021 24331	021 34331	–
	470	6.5 × 18	4	310	32	13	0.20	0.68	0.43	–	021 24471	021 34471	–
	680	8 × 18	5	400	45	18	0.20	0.47	0.29	–	021 24681	021 34681	–
	1000	10 × 18	6	550	64	24	0.20	0.32	0.20	–	021 24102	021 34102	–
	1500	10 × 25	7	690	94	34	0.23	0.25	0.18	–	021 90524	021 90525	–
	1500	10 × 30	00	740	94	34	0.23	0.245	0.18	021 14152	021 24152	–	–
	2200	12.5 × 30	01	800	136	48	0.25	0.177	0.095	021 14222	021 24222	–	–
	3300	12.5 × 30	01	1000	202	70	0.27	0.128	0.095	021 14332	021 24332	–	–
	4700	15 × 30	02	1180	286	98	0.29	0.100	0.07	021 14472	021 24472	–	021 44472
	6800	18 × 30	03	1480	412	140	0.34	0.079	0.065	021 14682	–	–	021 44682
	10000	18 × 40	04	1860	604	204	0.40	0.064	0.04	021 14103	–	–	021 44103
15000	21 × 40	05	2250	904	304	0.50	0.054	0.035	021 14153	–	–	021 44153	

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U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	CASE CODE	I _R 100 Hz 85 °C (mA)	I _{L1} 1 min (μA)	I _{L5} 5 min (μA)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	CATALOGUE NUMBER 2222			
										AXIAL			SINGLE ENDED
										IN BOX FORM AA	TAPED ON REEL FORM BR	TAPED IN BOX FORM BA	MOUNTING RING FORM MR
16	68	4.5 × 10	2	90	11	6.2	0.16	3.8	2.4	–	021 25689	021 35689	–
	150	6 × 10	3	140	18	8.8	0.16	1.7	1.1	–	021 25151	021 35151	–
	220	8 × 11	5a	210	25	11	0.16	1.2	0.73	–	021 25221	021 35221	–
	330	6.5 × 18	4	290	36	15	0.16	0.77	0.48	–	021 25331	021 35331	–
	470	8 × 18	5	380	49	19	0.16	0.55	0.34	–	021 25471	021 35471	–
	680	10 × 18	6	500	69	26	0.16	0.38	0.24	–	021 25681	021 35681	–
	1000	10 × 25	7	660	100	36	0.16	0.26	0.18	–	021 90517	021 90518	–
	1000	10 × 30	00	700	100	36	0.16	0.260	0.175	021 15102	021 25102	–	–
	1500	12.5 × 30	01	740	148	52	0.19	0.205	0.095	021 15152	021 25152	–	–
	2200	12.5 × 30	01	890	216	74	0.21	0.150	0.095	021 15222	021 25222	–	–
	3300	15 × 30	02	1130	321	110	0.23	0.111	0.07	021 15332	021 25332	–	021 45332
	4700	18 × 30	03	1410	455	154	0.25	0.087	0.065	021 15472	–	–	021 45472
	6800	18 × 40	04	1780	656	222	0.30	0.070	0.04	021 15682	–	–	021 45682
	10000	21 × 40	05	2170	964	324	0.36	0.058	0.035	021 15103	–	–	021 45103
25	47	4.5 × 10	2	80	11	6.4	0.14	4.8	2.6	–	021 26479	021 36479	–
	100	6 × 10	3	150	19	9	0.14	2.3	1.2	–	021 26101	021 36101	–
	150	8 × 11	5a	190	27	12	0.14	1.5	0.80	–	021 90534	021 90535	–
	150	6.5 × 18	4	210	27	12	0.14	1.5	0.80	–	021 26151	021 36151	–
	220	6.5 × 18	4	250	37	15	0.14	1.0	0.55	–	021 26221	021 36221	–
	330	8 × 18	5	340	54	21	0.14	0.68	0.36	–	021 26331	021 36331	–
	470	10 × 18	6	450	75	28	0.14	0.48	0.26	–	021 26471	021 36471	–
	680	10 × 25	7	560	106	38	0.14	0.33	0.18	–	021 90527	021 90528	–
	680	10 × 30	00	640	106	38	0.14	0.323	0.175	021 16681	021 26681	–	–
	1000	12.5 × 30	01	720	154	54	0.14	0.220	0.095	021 16102	021 26102	–	–
	1500	12.5 × 30	01	790	229	79	0.17	0.179	0.095	021 16152	021 26152	–	–
	2200	15 × 30	02	1030	334	114	0.19	0.132	0.07	021 16222	021 26222	–	021 46222
	3300	18 × 30	03	1310	499	169	0.21	0.099	0.065	021 16332	–	–	021 46332
	4700	18 × 40	04	1680	709	239	0.23	0.079	0.04	021 16472	–	–	021 46472
6800	21 × 40	05	2070	1024	344	0.28	0.064	0.035	021 16682	–	–	021 46682	

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U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	CASE CODE	I _R 100 Hz 85 °C (mA)	I _{L1} 1 min (μA)	I _{L5} 5 min (μA)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	CATALOGUE NUMBER 2222			
										AXIAL			SINGLE ENDED
										IN BOX FORM AA	TAPED ON REEL FORM BR	TAPED IN BOX FORM BA	MOUNTING RING FORM MR
40	22	4.5 × 10	2	60	9	5.8	0.11	8.0	3.2	–	021 27229	021 37229	–
	47	6 × 10	3	110	15	7.8	0.11	3.8	1.5	–	021 27479	021 37479	–
	100	8 × 11	5a	170	28	12	0.11	1.8	0.70	–	021 90537	021 90538	–
	100	6.5 × 18	4	190	28	12	0.11	1.8	0.70	–	021 27101	021 37101	–
	150	8 × 18	5	250	40	16	0.11	1.1	0.47	–	021 27151	021 37151	–
	220	10 × 18	6	330	57	22	0.11	0.8	0.32	–	021 27221	021 37221	–
	330	10 × 25	7	430	83	30	0.11	0.53	0.21	–	021 27331	021 37331	–
	470	10 × 25	7	520	117	42	0.11	0.37	0.18	–	021 90514	021 90515	–
	470	10 × 30	00	570	117	42	0.12	0.404	0.175	021 17471	021 27471	–	–
	680	12.5 × 30	01	620	167	58	0.12	0.297	0.095	021 17681	021 27681	–	–
	1000	12.5 × 30	01	770	244	84	0.12	0.190	0.095	021 17102	021 27102	–	–
	1500	15 × 30	02	930	364	124	0.15	0.159	0.07	021 17152	021 27152	–	021 47152
	2200	18 × 30	03	1200	532	180	0.17	0.118	0.065	021 17222	–	–	021 47222
	3300	18 × 40	04	1550	796	268	0.19	0.090	0.04	021 17332	–	–	021 47332
	4700	21 × 40	05	1880	1132	380	0.21	0.072	0.035	021 17472	–	–	021 47472
63	0.47	4.5 × 10	2	8	4.2	4.1	0.09	310	120	–	021 28477	021 38477	–
	1	4.5 × 10	2	12	4.4	4.1	0.09	150	55	–	021 28108	021 38108	–
	2.2	4.5 × 10	2	21	4.8	4.3	0.09	65	25	–	021 28228	021 38228	–
	3.3	4.5 × 10	2	25	5.2	4.4	0.09	44	17	–	021 28338	021 38338	–
	4.7	4.5 × 10	2	31	5.8	4.6	0.09	31	12	–	021 28478	021 38478	–
	10	4.5 × 10	2	50	7.8	5.3	0.08	13	5.5	–	021 28109	021 38109	–
	15	4.5 × 10	2	55	9.5	5.9	0.08	8.5	3.7	–	021 28159	021 38159	–
	22	6 × 10	3	90	12	6.8	0.08	5.8	2.5	–	021 28229	021 38229	–
	33	6 × 10	3	100	16	8.2	0.08	3.9	1.7	–	021 28339	021 38339	–
	47	8 × 11	5a	140	22	10	0.08	2.7	1.2	–	021 90541	021 90542	–
	47	6.5 × 18	4	150	22	10	0.08	2.7	1.2	–	021 28479	021 38479	–
	68	8 × 11	5a	160	30	13	0.08	1.9	0.81	–	021 90544	021 90545	–
	68	6.5 × 18	4	170	30	13	0.08	1.9	0.81	–	021 28689	021 38689	–
	100	8 × 18	5	250	42	17	0.08	1.3	0.55	–	021 28101	021 38101	–

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										AXIAL			SINGLE ENDED
										IN BOX FORM AA	TAPED ON REEL FORM BR	TAPED IN BOX FORM BA	MOUNTING RING FORM MR
63	150	10 × 18	6	320	61	23	0.08	0.85	0.37	–	021 28151	021 38151	–
	220	10 × 25	7	430	88	32	0.08	0.60	0.25	–	021 90511	021 90512	–
	220	10 × 30	00	480	88	32	0.08	0.614	0.20	021 18221	021 28221	–	–
	330	12.5 × 30	01	530	129	46	0.08	0.409	0.14	021 18331	021 28331	–	–
	470	12.5 × 30	01	630	182	63	0.08	0.287	0.10	021 18471	021 28471	–	–
	680	15 × 30	02	830	261	90	0.08	0.199	0.080	021 18681	021 28681	–	021 48681
	1000	18 × 30	03	1120	382	130	0.08	0.135	0.065	021 18102	–	–	021 48102
	1500	18 × 40	04	1350	571	193	0.11	0.122	0.04	021 18152	–	–	021 48152
	2200	21 × 40	05	1780	836	281	0.13	0.099	0.035	021 18222	–	–	021 48222
100	1	4.5 × 10	2	14	4.6	4.6	0.08	130	90	–	021 29108	021 39108	–
	2.2	4.5 × 10	2	20	5.3	5.3	0.08	58	41	–	021 29228	021 39228	–
	4.7	4.5 × 10	2	30	7	7	0.08	27	19	–	021 29478	021 39478	–
	10	6 × 10	3	65	10	10	0.08	13	9	–	021 29109	021 39109	–
	15	8 × 11	5a	77	13	13	0.08	8.5	6	–	021 90547	021 90548	–
	15	6.5 × 18	4	85	13	13	0.08	8.5	6	–	021 29159	021 39159	–
	22	8 × 11	5a	95	17	17	0.08	5.8	4.1	–	021 90551	021 90552	–
	22	6.5 × 18	4	100	17	17	0.08	5.8	4.1	–	021 29229	021 39229	–
	33	6.5 × 18	4	120	24	24	0.08	3.9	2.7	–	021 29339	021 39339	–
	47	8 × 18	5	160	32	32	0.08	2.7	1.9	–	021 29479	021 39479	–
	68	10 × 18	6	220	45	45	0.08	1.9	1.3	–	021 29689	021 39689	–
	100	10 × 25	7	300	64	64	0.08	1.3	0.9	–	021 90531	021 90532	–
	100	10 × 30	00	360	64	64	0.07	1.150	1.0	021 19101	021 29101	–	–
	150	12.5 × 30	01	420	94	94	0.07	0.645	0.61	021 19151	021 29151	–	–
	220	12.5 × 30	01	460	136	136	0.08	0.610	0.56	021 19221	021 29221	–	–
	330	15 × 30	02	580	202	202	0.09	0.420	0.40	021 19331	021 29331	–	021 49331
	470	18 × 30	03	740	286	286	0.09	0.310	0.29	021 19471	–	–	021 49471
	680	18 × 40	04	1050	412	412	0.09	0.195	0.18	021 19681	–	–	021 49681
	1000	21 × 40	05	1260	604	604	0.10	0.160	0.15	021 19102	–	–	021 49102

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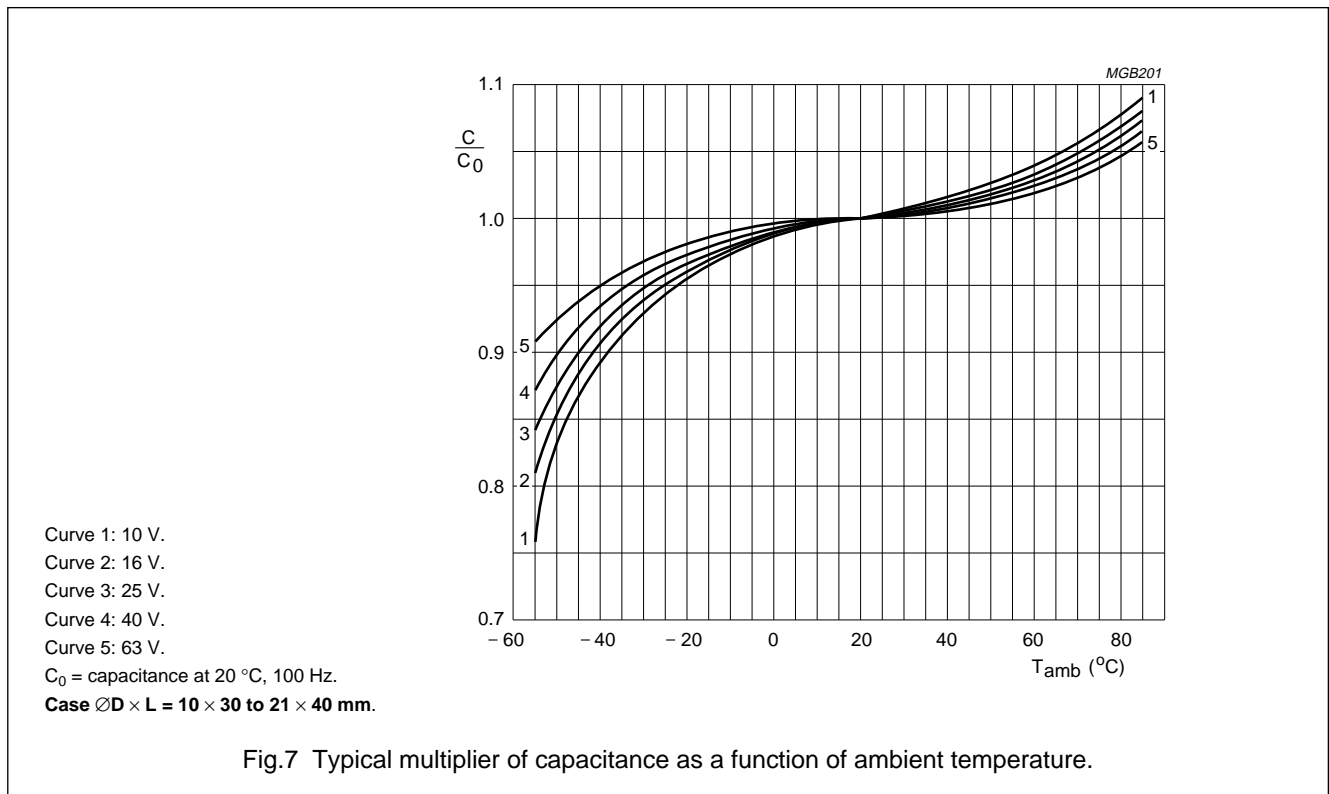
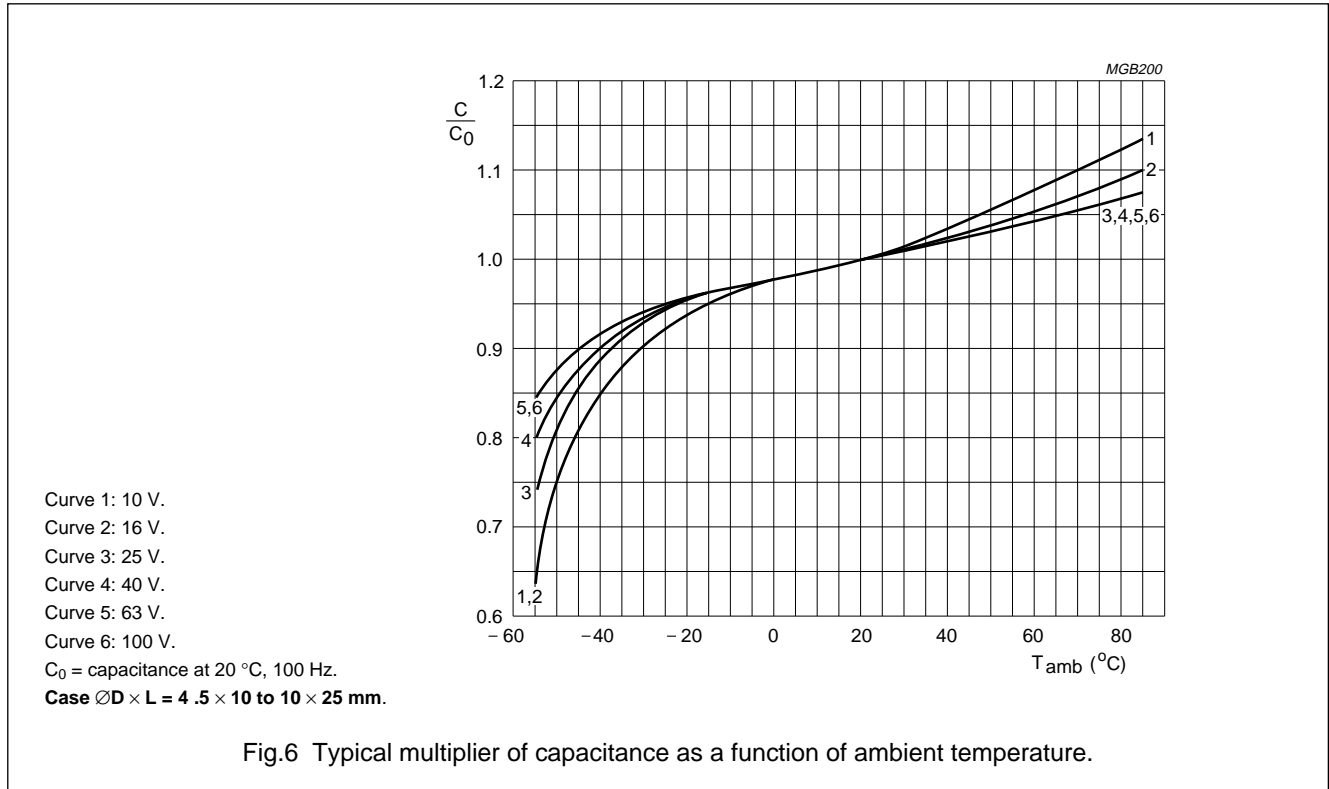
Additional electrical data

PARAMETER	CONDITIONS	VALUE	
		AXIAL	SINGLE ENDED
Voltage			
Surge voltage for short periods		$U_s \leq 1.15 \times U_R$	
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 : $U_R = 6.3 \text{ V to } 63 \text{ V}$ $U_R = 100 \text{ V}$	$I_{L5} \leq 0.002C_R \times U_R + 4 \mu\text{A}$ $I_{L5} \leq 0.006C_R \times U_R + 4 \mu\text{A}$	
Inductance			
Equivalent series inductance (ESL)	case $\varnothing D \times L$ mm:		
	4.5 × 10	typ. 10 nH	–
	6 × 10	typ. 22 nH	–
	8 × 11	typ. 85 nH	–
	6.5 × 18	typ. 25 nH	–
	8 × 18	typ. 40 nH	–
	10 × 18	typ. 61 nH	–
	10 × 25	typ. 38 nH	–
	10 × 30	typ. 38 nH	–
	12.5 × 30	typ. 46 nH	–
	15 × 30	typ. 48 nH	typ. 39 nH
	18 × 30	typ. 50 nH	typ. 39 nH
18 × 40	typ. 54 nH	typ. 39 nH	
21 × 40	typ. 59 nH	typ. 39 nH	

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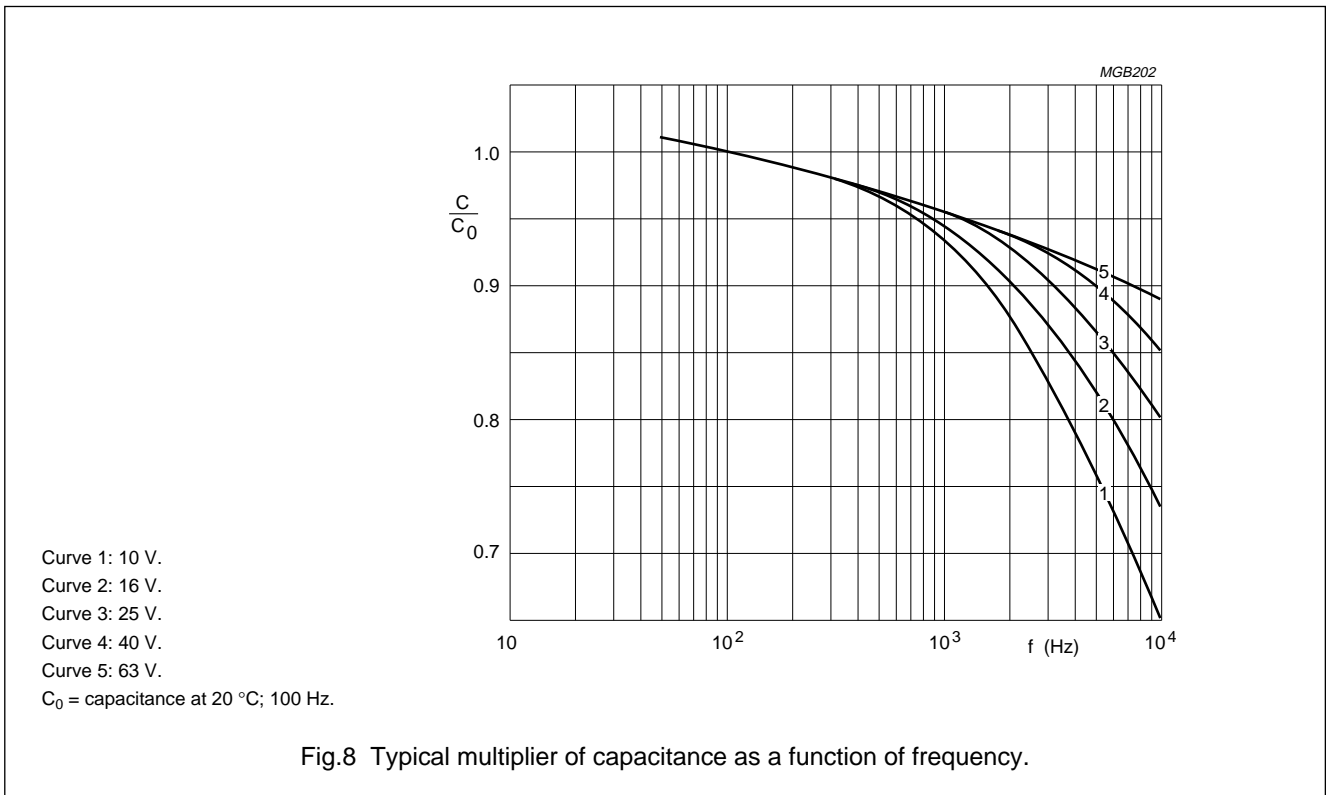
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Capacitance (C)

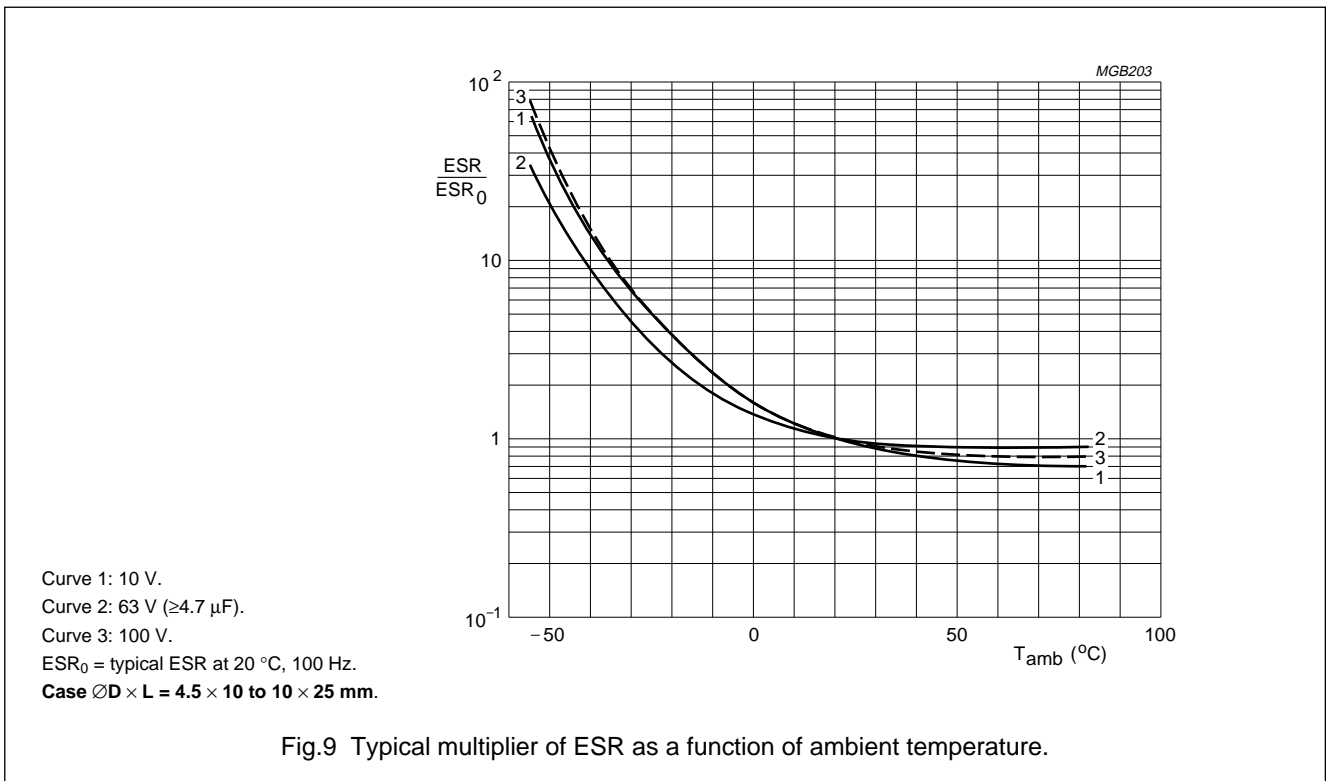


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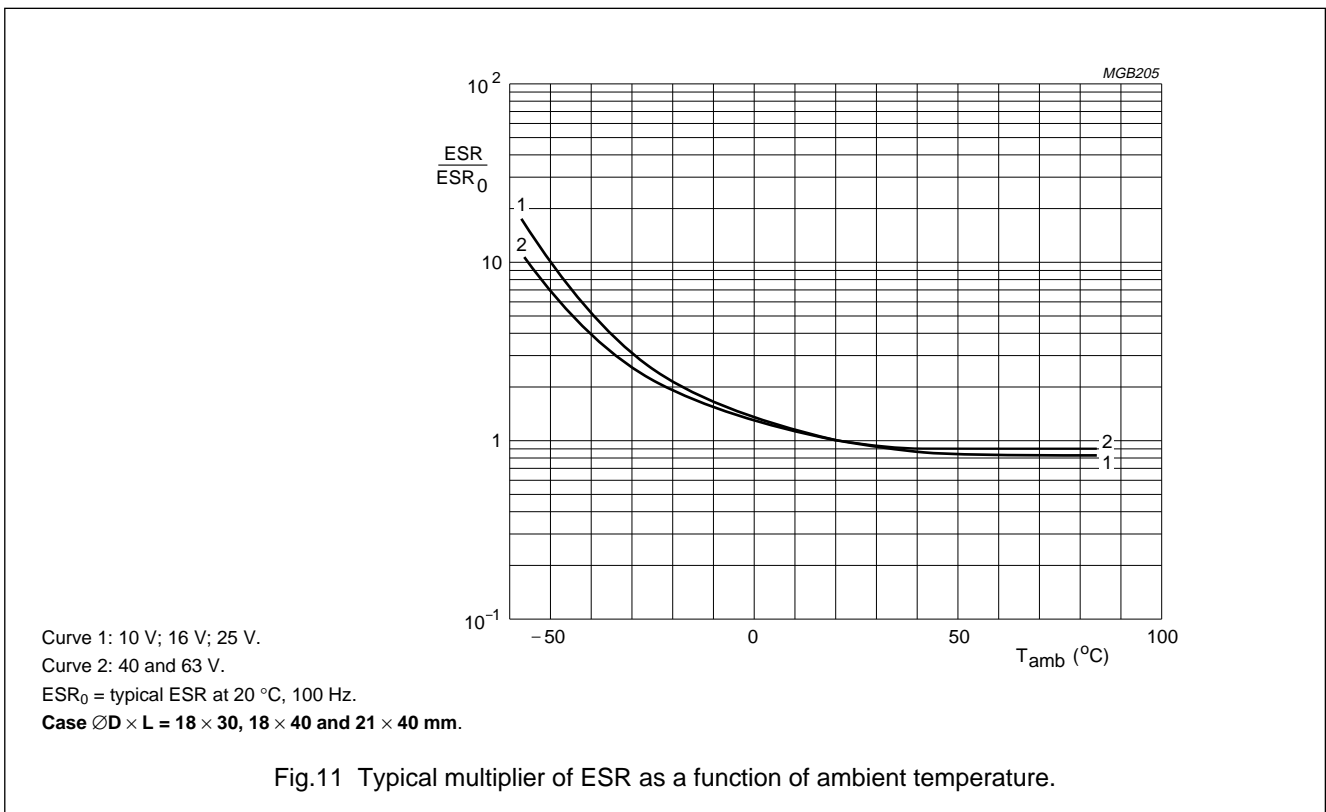
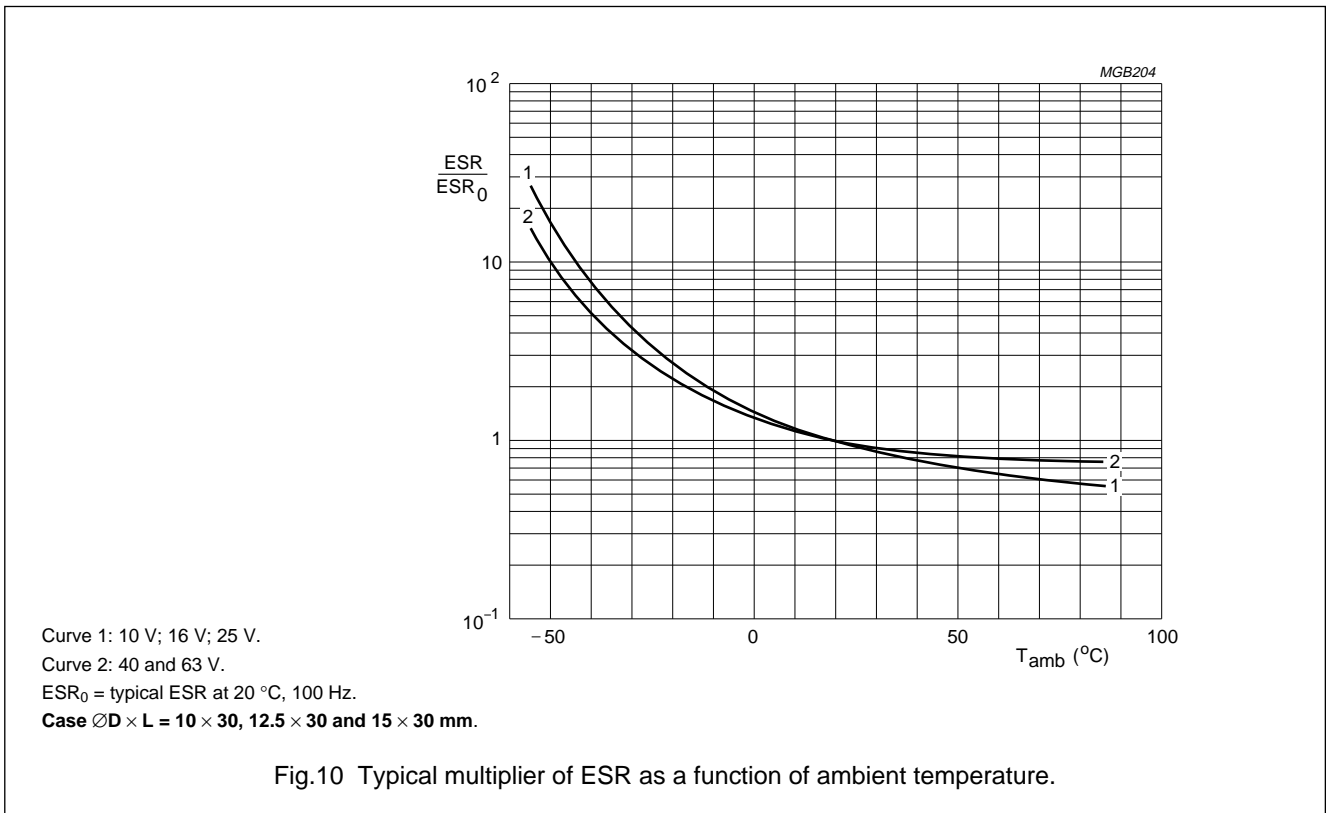


Equivalent series resistance (ESR)



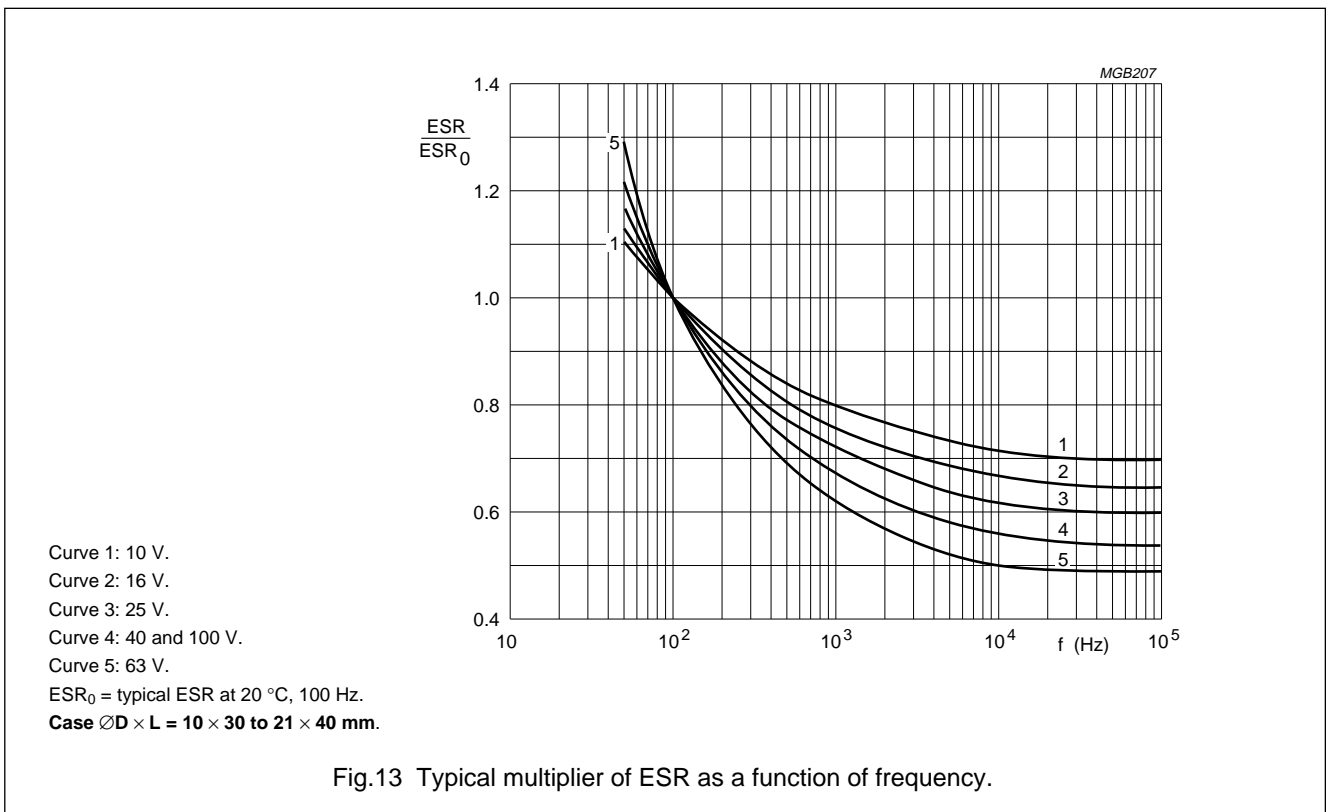
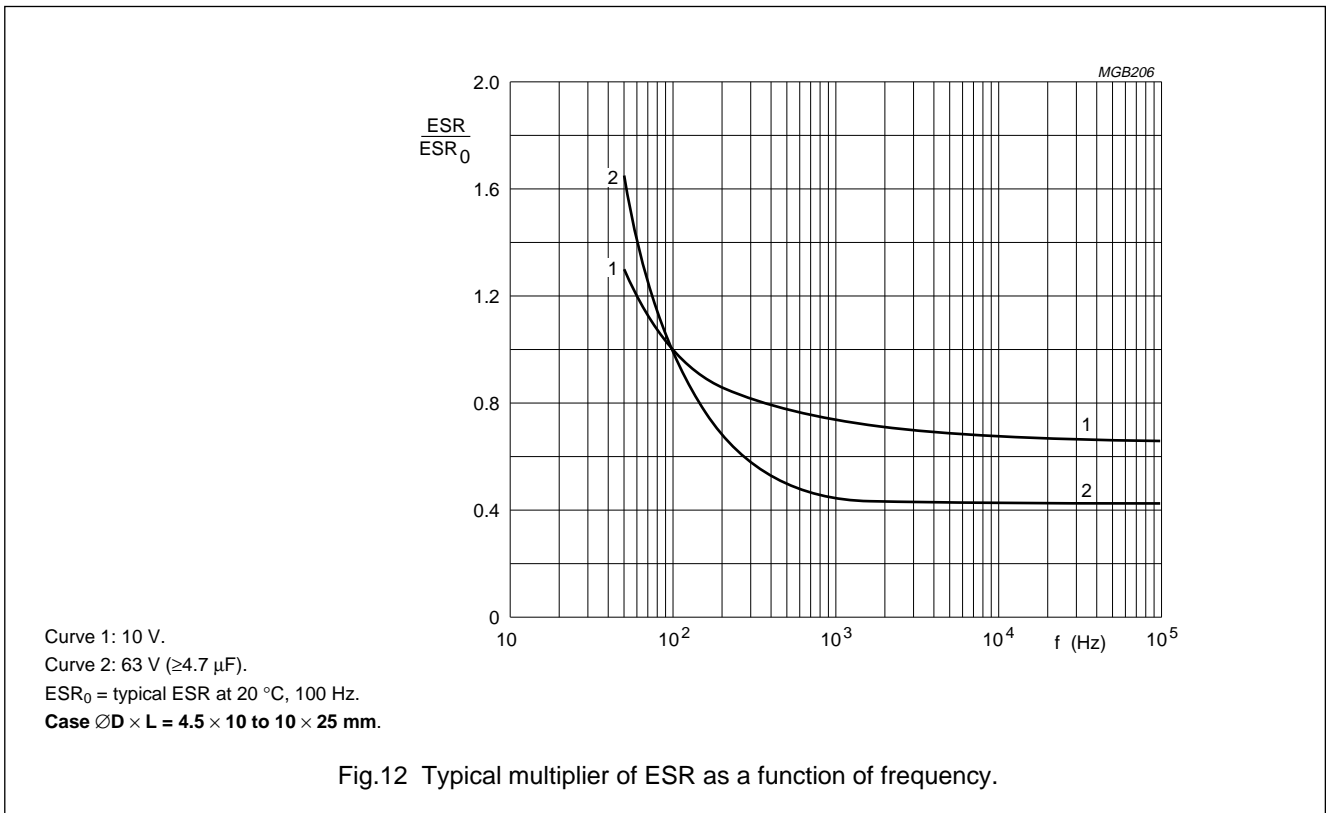
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Impedance (Z)

Table 4 Impedance × capacitance values (case ØD × L = 4.5 × 10 to 10 × 25 mm)

T _{amb}	Z = Z × C _R (Ω · µF) at 10 kHz						
	6.3 V	10 V	16 V	25 V	40 V	63 V	100 V
+20 °C	≤300	≤200	≤160	≤120	≤70	≤55	≤90
-25 °C	≤2000	≤1200	≤750	≤560	≤300	≤180	≤600
-40 °C	≤5500	≤3200	≤2000	≤1500	≤900	≤500	≤1600

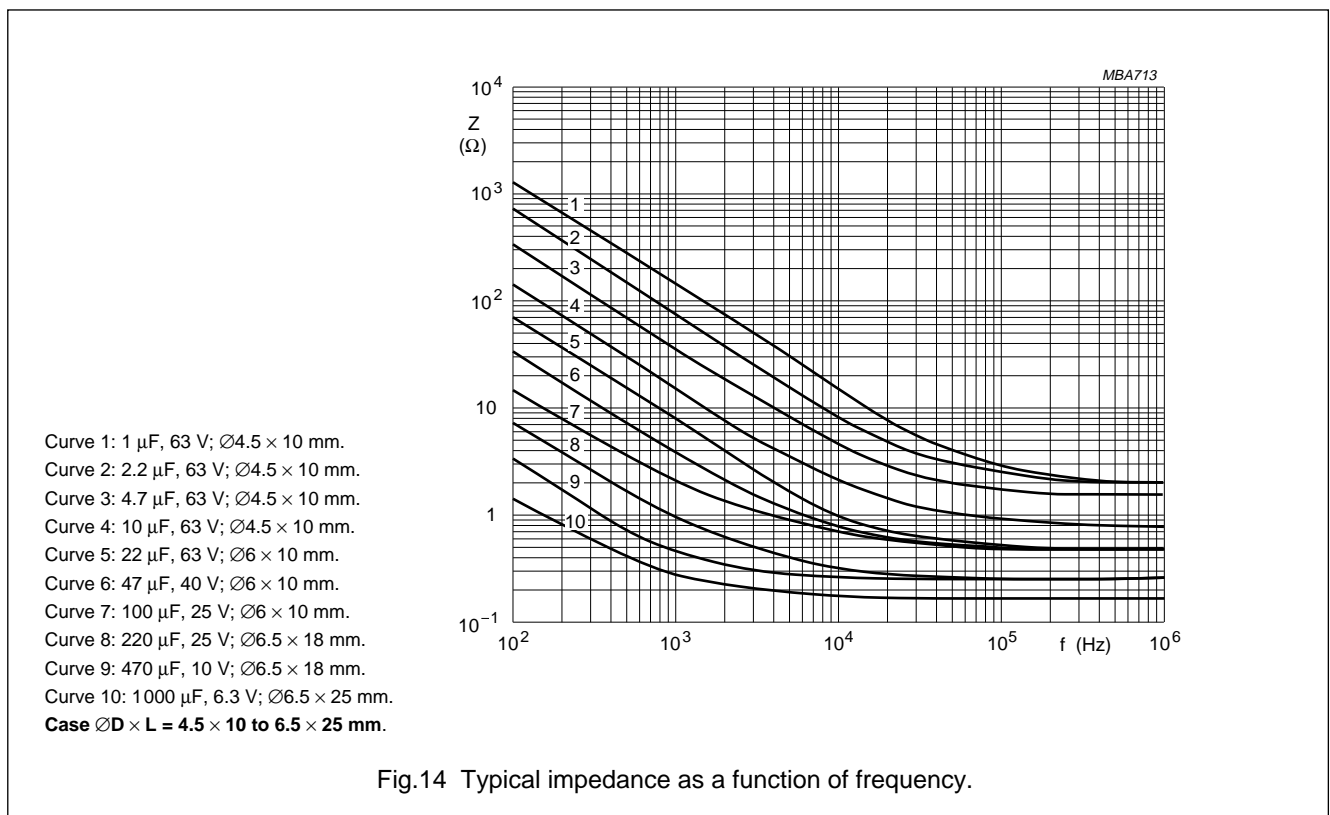
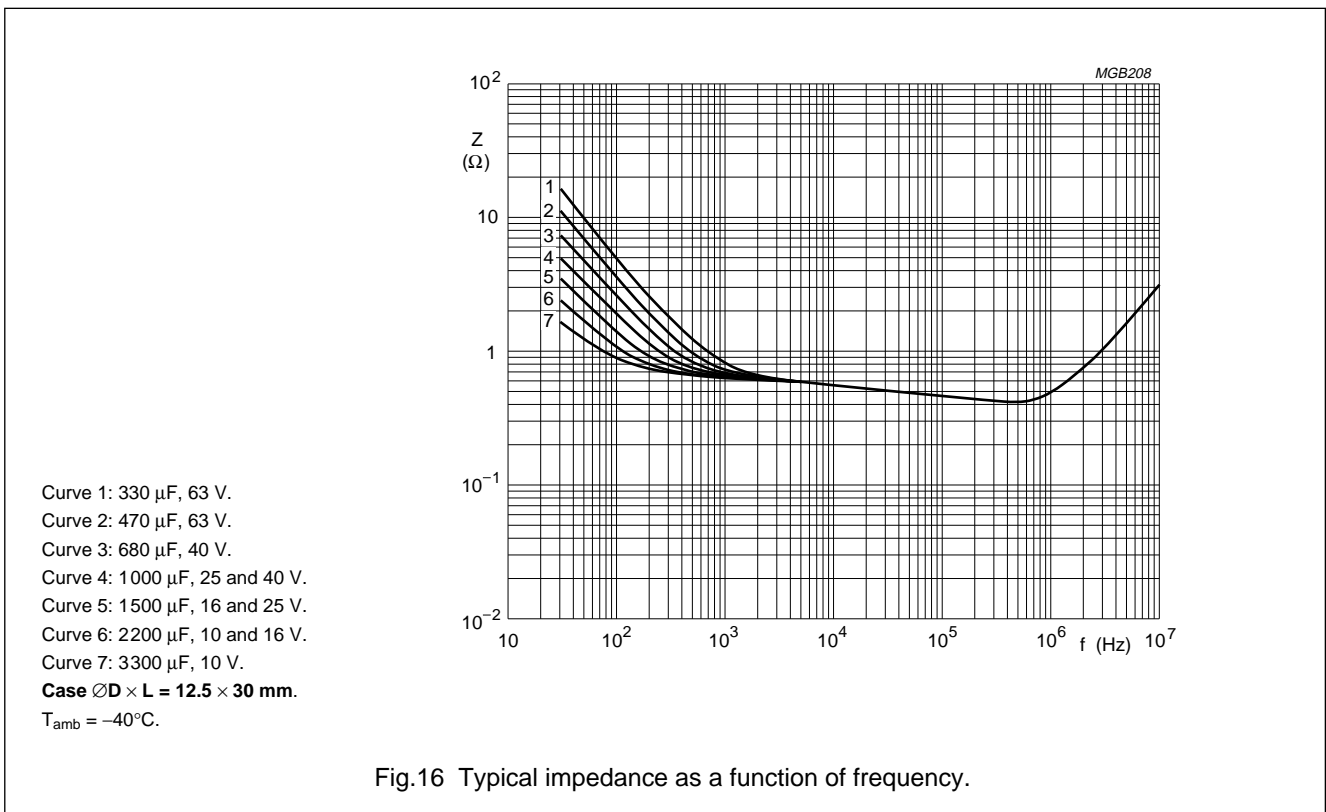
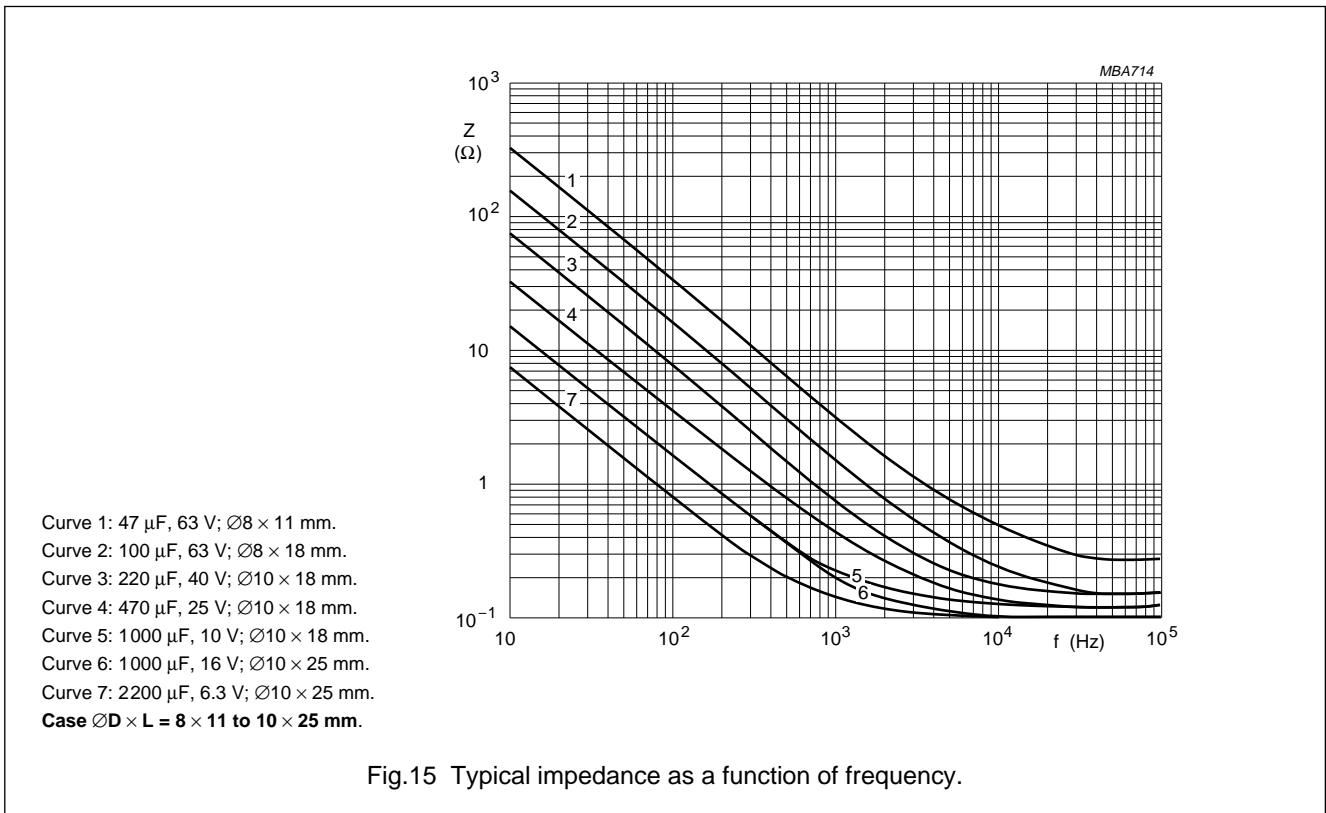


Fig.14 Typical impedance as a function of frequency.

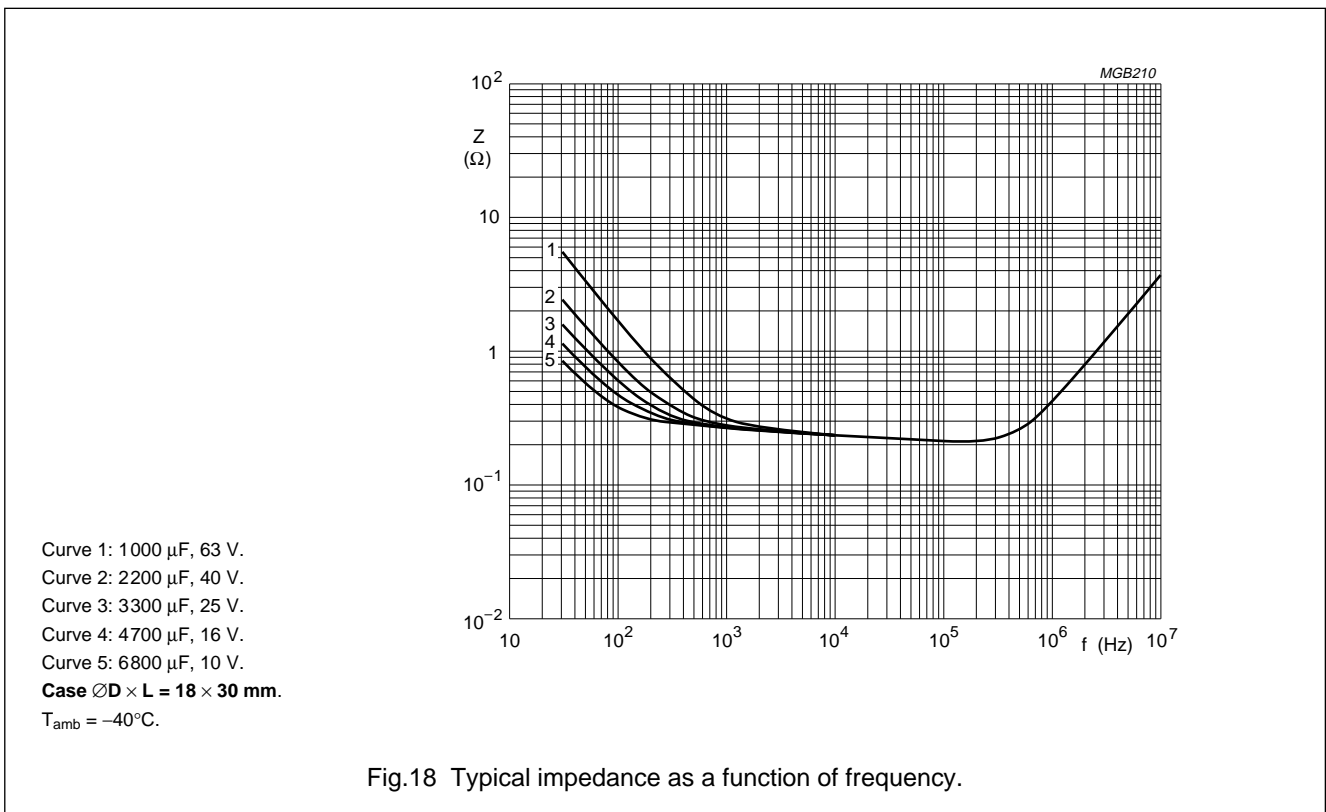
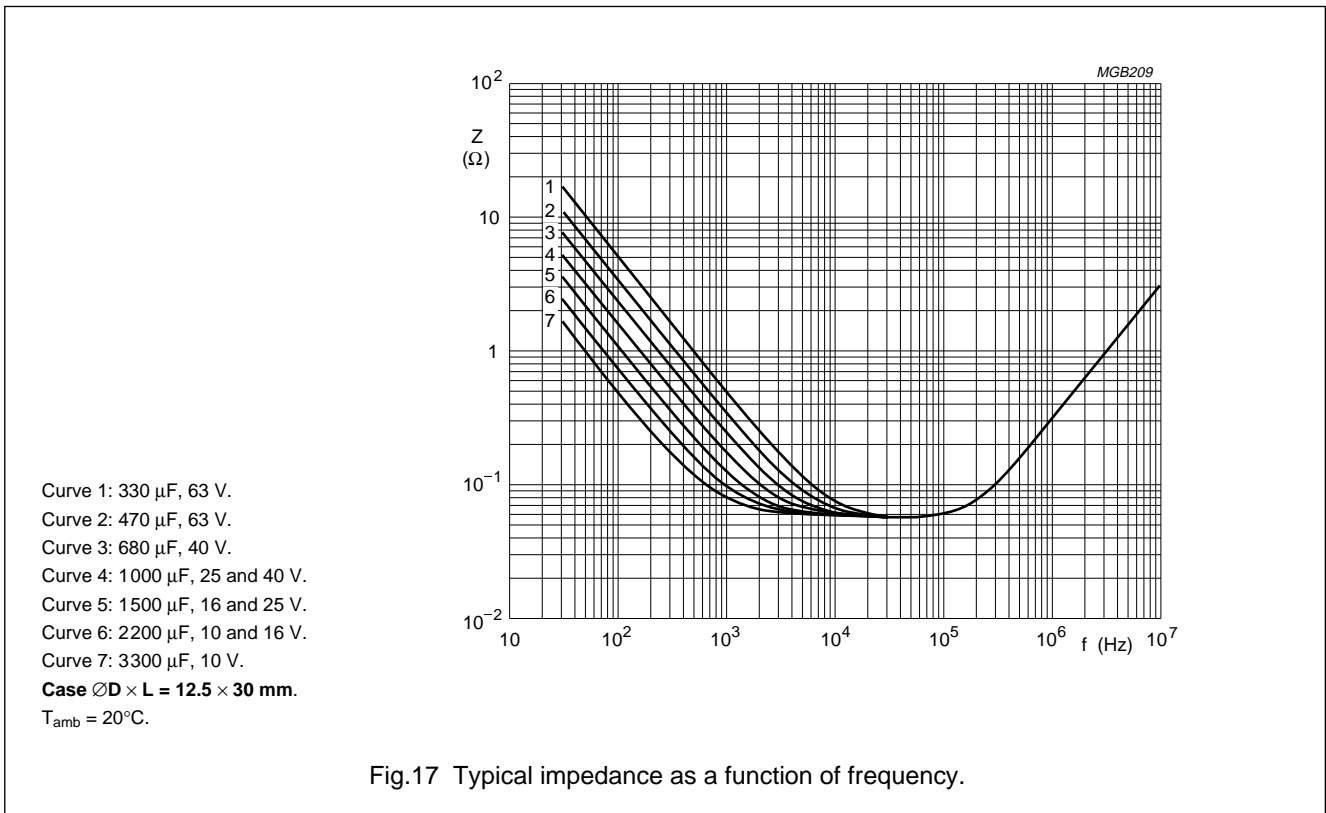
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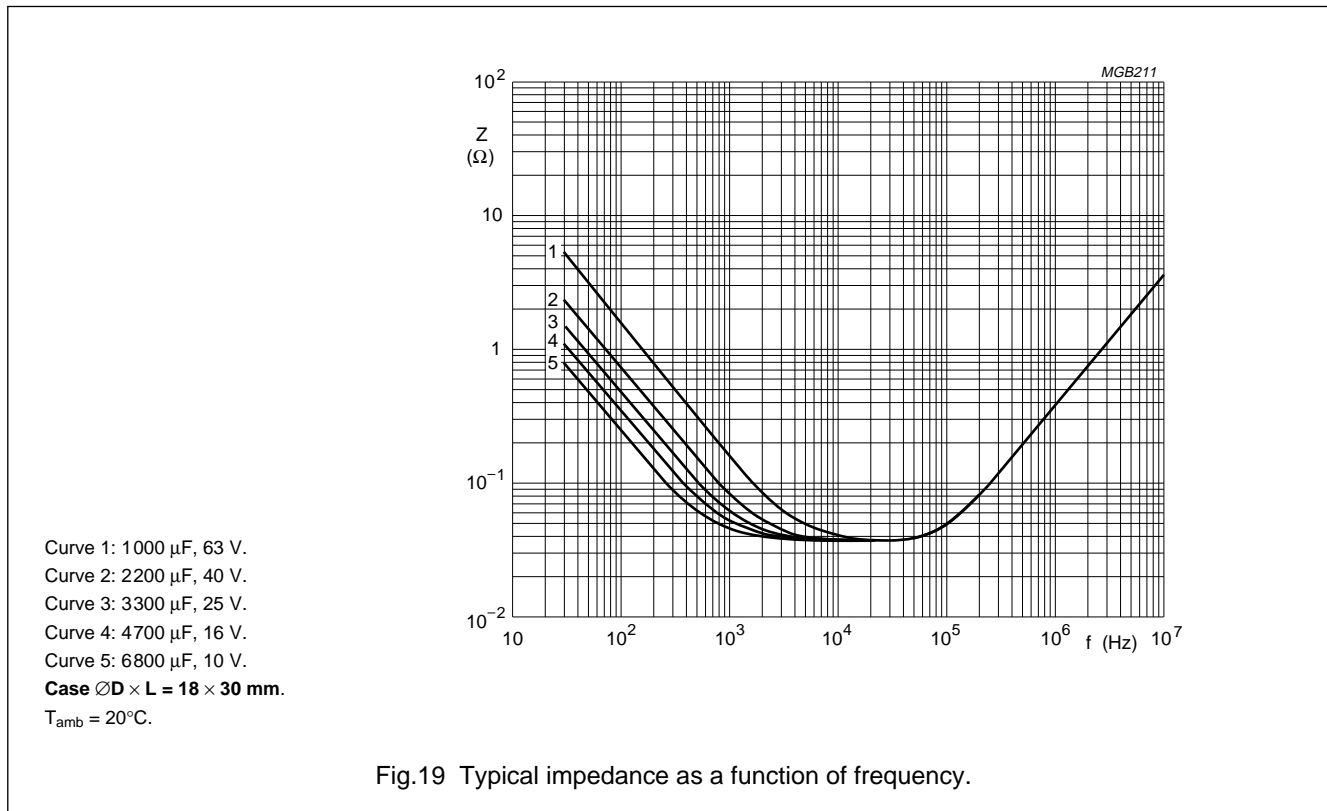
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MARKING

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

- Rated capacitance (in μF)
- Tolerance on nominal capacitance (in accordance with "IEC 62")
- Rated voltage (in V)
- Group number (021)
- Name of manufacturer (PHILIPS)
- Date code in accordance with "IEC 62"
- Code for factory of origin
- Band to indicate the negative terminal
- "+" sign to identify the positive terminal (not for case sizes $L < 18 \text{ mm}$).

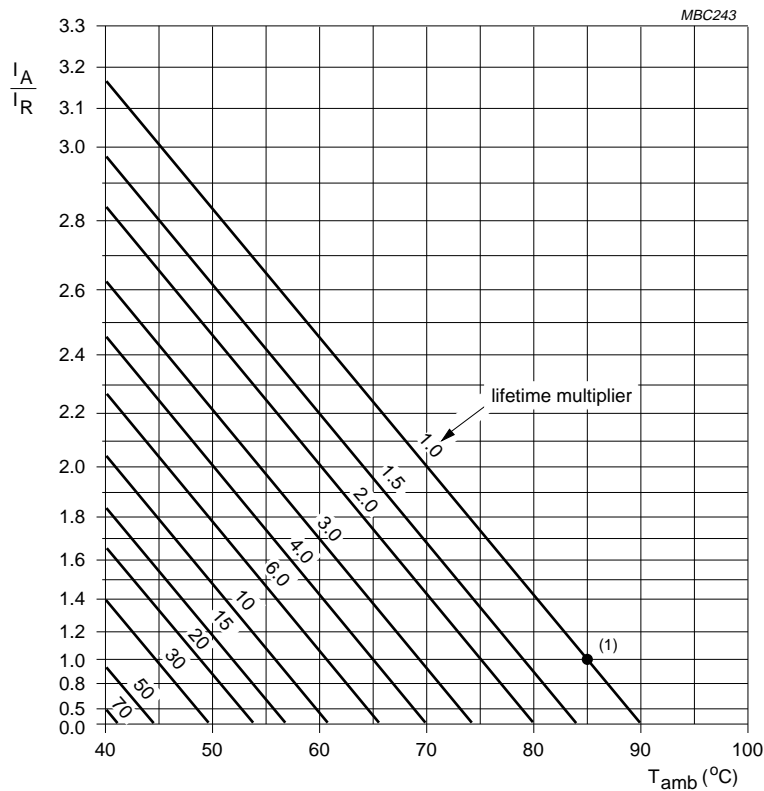
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RIPPLE CURRENT AND USEFUL LIFE

Multiplier of ripple current (I_R/I_{R0}) as a function of frequency (I_{R0} = rated ripple current at 100 Hz and 85 °C)

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 6.3$ to 16 V	$U_R = 25$ to 40 V	$U_R = 63$ to 100 V
50	0.95	0.9	0.85
100	1	1	1
300	1.07	1.12	1.2
1000	1.12	1.2	1.3
3000	1.15	1.25	1.35
≥ 10000	1.2	1.3	1.4



I_A = actual ripple current at 100 Hz.

I_R = rated ripple current at 100 Hz, 85 °C.

(1) Useful life at 85 °C and I_R applied:

Case $\varnothing D \times L = 4.5 \times 10$ to 10×25 mm: 2500 hours

Case $\varnothing D \times L = 10 \times 30$ to 21×40 mm: 8000 hours.

Fig.20 Multiplier of useful life as a function of ambient temperature and ripple current load.

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SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in this handbook, 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; case $\varnothing D \times L = 4.5 \times 10$ to 10×25 mm, $U_R = 6.3$ to 25 V: 1000 hours $U_R = 40$ to 100 V: 2000 hours; case $\varnothing D \times L = 10 \times 30$ to 21×40 mm, $U_R = 6.3$ to 100 V: 5000 hours	$U_R \leq 6.3$ V; $\Delta C/C$: +15/-30% $U_R > 6.3$ V; $\Delta C/C$: $\pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ °C}$; U_R and I_R applied; case $\varnothing D \times L = 4.5 \times 10$ to 10×25 mm: 2500 hours; case $\varnothing D \times L = 10 \times 30$ to 21×40 mm: 8000 hours	$U_R \leq 6.3$ V; $\Delta C/C$: +45/-50% $U_R > 6.3$ V; $\Delta C/C$: $\pm 45\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$
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	$\Delta C/C$, $\tan \delta$, Z : for requirements see 'Endurance test' above $I_{L5} \leq 2 \times \text{spec. limit}$