

Aluminum Electrolytic Capacitors

Series 2222-030-033

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 sizes 10 x 30 mm to 21 x 40 mm with pressure relief
- Taped version available for automatic insertion up to case size 15 x 30 mm
- Charge and discharge proof
- Useful life: 3000 to 8000 hours at 85 °C (case \varnothing 3.3 mm: 1500 hours)
- Standard dimensions.

- Coupling, decoupling, timing, smoothing, filtering, buffering in SMPS

- Boards with restricted mounting height, vibration and shock resistant.

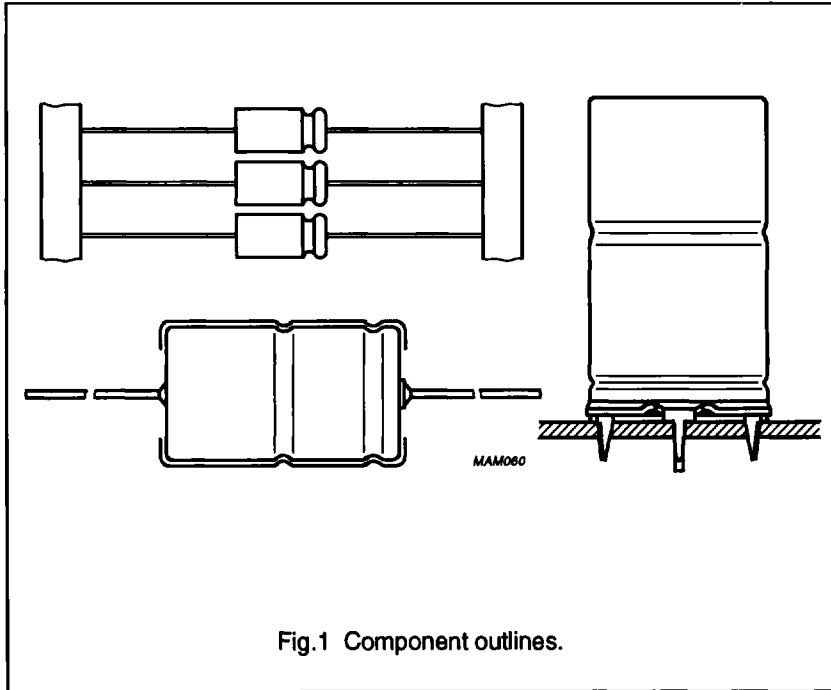


Fig.1 Component outlines.

APPLICATIONS

- General purpose and industrial, automotive, telecommunication, audio-video

QUICK REFERENCE DATA

Case sizes ($\varnothing D_{nom} \times L_{nom}$ in mm)	3.3 x 11	4.5 x 10 to 10 x 25	10 x 30 to 21 x 40
Rated capacitance range, C_R	0.33 to 15 000 μ F		
Tolerance on C_R	-10 to +50%		
Rated voltage range, U_R	6.3 to 100 V		
Category temperature range	-40 to +85 °C		
Endurance test at 85 °C	1000 hours	2000 hours	5000 hours
Useful life at 85 °C	1500 hours	3000 hours	8000 hours
Useful life at 40 °C, 1.4 I_R applied	40 000 hours	80 000 hours	200 000 hours
Shelf life at 0 V, 85 °C	500 hours		
Based on sectional specification	IEC 384-4/CECC 30 300		
	GP grade	LL grade	LL grade
Detail specification	similar to DIN 45910-T126 (without approval), former DIN 41316		
Climatic category IEC 68 DIN 40040	40/085/56 GPF		
Approvals	LNZ 44-04		

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Table 1 Selection chart for $C_R U_R$ and relevant nominal case sizes ($\varnothing D \times L$ in mm). Preferred types in **bold**.

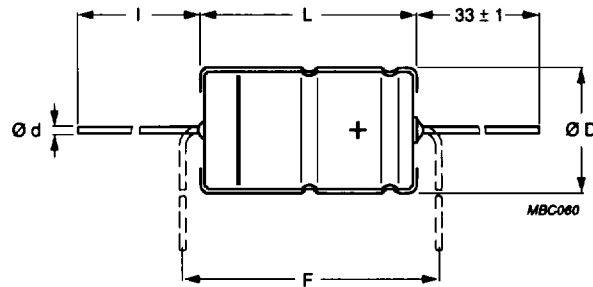
C_R (μF)	U_R (V)						
	6.3	10	16	25	40	63	100
0.33						4.5 x 10	
0.47						4.5 x 10 3.3 x 11	4.5 x 10
1.0						4.5 x 10 3.3 x 11	4.5 x 10
1.5						4.5 x 10	
2.2					3.3 x 11	4.5 x 10	4.5 x 10
3.3				3.3 x 11		4.5 x 10	4.5 x 10
4.7			3.3 x 11			4.5 x 10	6 x 10
6.8		3.3 x 11			4.5 x 10	4.5 x 10	6 x 10
10	3.3 x 11			4.5 x 10	4.5 x 10	6 x 10	8 x 11 6.5 x 18
15			4.5 x 10		4.5 x 10	6 x 10	
22		4.5 x 10		4.5 x 10	6 x 10	8 x 11 6.5 x 18	8 x 18
33	4.5 x 10		4.5 x 10		6 x 10		10 x 18
47		4.5 x 10		6 x 10	8 x 11 6.5 x 18	8 x 18	10 x 25
68	4.5 x 10		6 x 10			10 x 18	10 x 30
100		6 x 10		8 x 11 6.5 x 18	8 x 18	10 x 25	12.5 x 30
150	6 x 10		8 x 11 6.5 x 18	8 x 18	10 x 18	10 x 30	15 x 30
220		8 x 11 6.5 x 18	8 x 18	10 x 18	10 x 25 10 x 30	12.5 x 30	18 x 30
330		8 x 18	10 x 18	10 x 25	12.5 x 30	15 x 30	18 x 40
470	8 x 18	10 x 18	10 x 25	10 x 30	12.5 x 30	15 x 30	21 x 40
680	10 x 18	10 x 25	10 x 30	12.5 x 30	15 x 30	18 x 30	21 x 40
1000	10 x 25	10 x 30	12.5 x 30	15 x 30	18 x 30	21 x 40	
1500	10 x 30	12.5 x 30	15 x 30	18 x 30	18 x 40	21 x 40	
2200	12.5 x 30	15 x 30	18 x 30	18 x 40	21 x 40		
3300	15 x 30	18 x 30	18 x 40	21 x 40	21 x 40		
4700	18 x 30	18 x 40	21 x 40	21 x 40			
6800	18 x 40	21 x 40	21 x 40				
10 000	21 x 40	21 x 40					
15 000	21 x 40						

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MECHANICAL DATA, AVAILABLE FORMS and PACKING QUANTITIES

Dimensions in mm.



For case sizes 18 x 40 and 21 x 40 mm, the stated L_{max} may be exceeded by 0.7 mm.

Fig.2 Case sizes 10 x 30 mm to 21 x 40 mm Form AA: axial; for dimensions see Table 2.

Table 2 Axial, dimensions in mm; mass in g

CASE SIZE $\varnothing D_{nom} \times L_{nom}$	CASE CODE	AXIAL: Form AA, BA, and BR						APPROX. MASS	PACKING QUANTITIES		
		$\varnothing d$	l	A	$\varnothing D_{max}$	L_{max}	F_{min}		Form AA	Form BA	Form BR
3.3 x 11	1	0.6	-	63.5 ± 1.5	3.5	12	17.5	0.35	-	1000	4000
4.5 x 10	2	0.6	-	63.5 ± 1.5	5.0	10.5	15	0.5	-	1000	3000
6 x 10	3	0.6	-	63.5 ± 1.5	6.3	10.5	15	0.7	-	1000	1000
8 x 11	5a	0.6	-	63.5 ± 1.5	8.5	11.5	15	1.1	-	500	500
6.5 x 18	4	0.8	-	73 ± 1.6	6.9	18.5	25	1.3	-	1000	1000
8 x 18	5	0.8	-	73 ± 1.6	8.5	18.5	25	1.7	-	500	500
10 x 18	6	0.8	-	73 ± 1.6	10.5	18.5	25	2.5	-	500	500
10 x 25	7	0.8	-	73 ± 1.6	10.5	25.0	30	3.3	-	500	500
10 x 30	00	0.8	55 ± 1	73 ± 1.6	10.5	30.5	35	4.8	200	-	500
12.5 x 30	01	0.8	55 ± 1	73 ± 1.6	13.0	30.5	35	7.4	200	-	400
15 x 30	02	0.8	55 ± 1	73 ± 1.6	15.5	30.5	35	11.7	200	-	250
18 x 30	03	0.8	55 ± 1	-	18.5	30.5	35	12.9	200	-	-
18 x 40	04	0.8	34 ± 1	-	18.5	41.5	45	19.4	100	-	-
21 x 40	05	0.8	34 ± 1	-	21.5	41.5	45	24.7	100	-	-

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Tape dimensions are specified in chapter "PACKING".

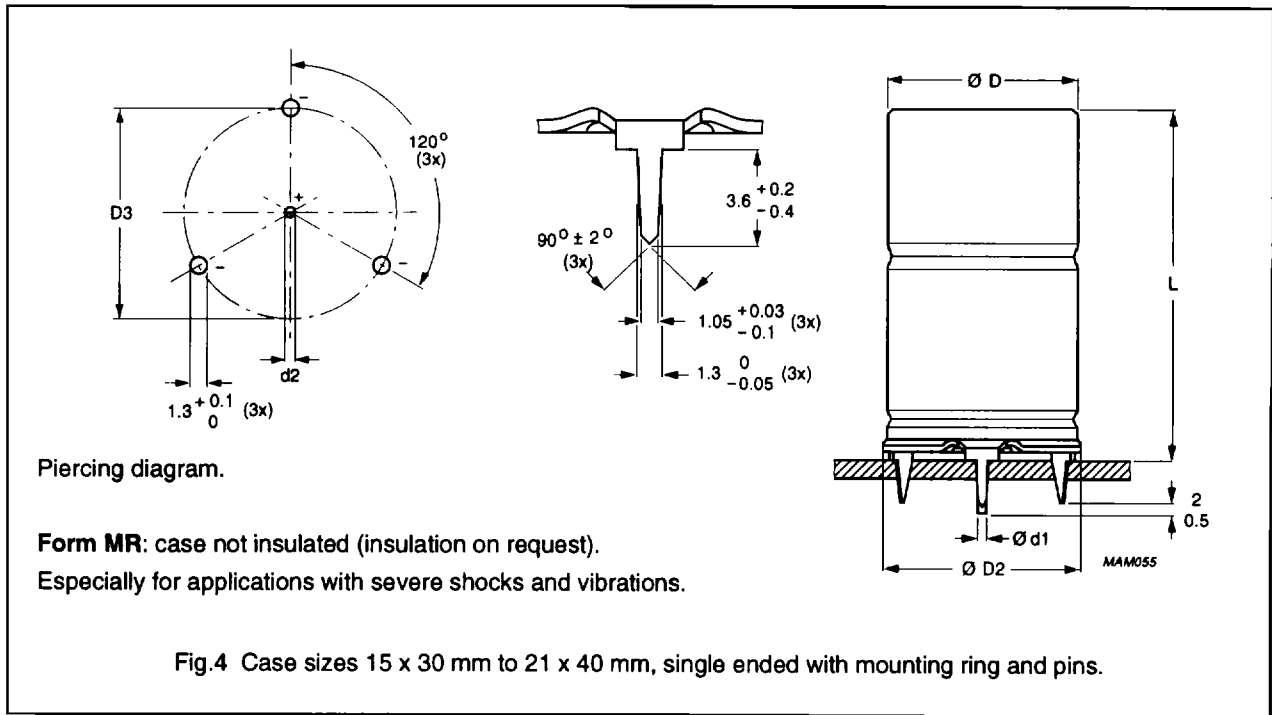
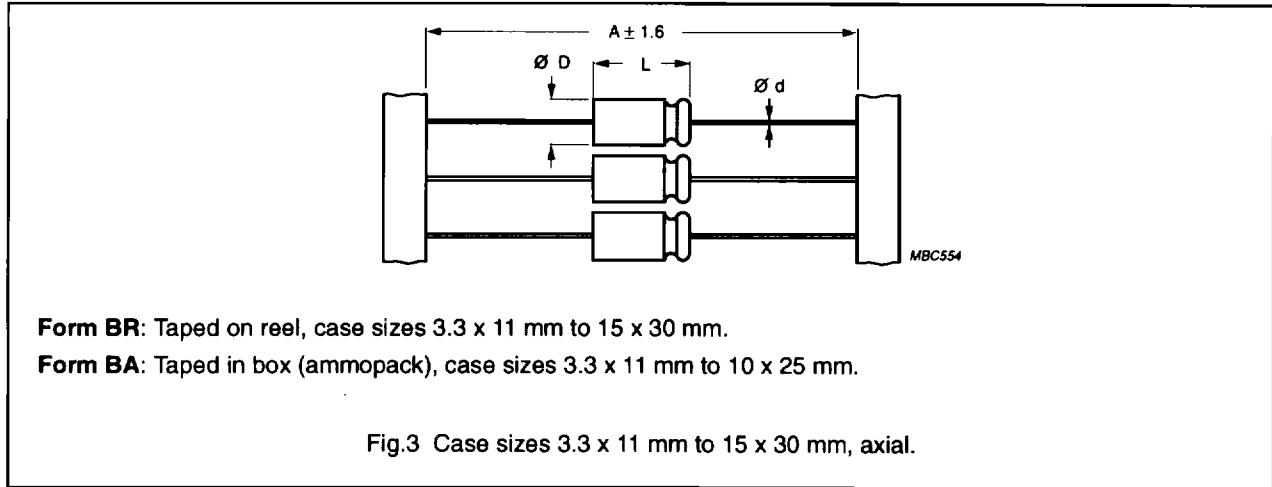


Table 3 Single ended, dimensions in mm; mass in g

CASE SIZE Ø D _{nom} x L _{nom}	CASE CODE	SINGLE ENDED WITH MOUNTING RING: Form MR						APPROX. MASS	PACKING QUANTITIES
		Ø d ₁	Ø d ₂	Ø D _{max}	Ø D _{2max}	D3	L _{max}		
15 x 30	02	0.8	1.0 +0.1	15.5	17.5	16.5 ± 0.2	33	11.7	200
18 x 30	03	0.8	1.0 +0.1	18.5	19.5	18.5 ± 0.2	33	12.9	200
18 x 40	04	1.0	1.3 +0.1	18.5	19.5	18.5 ± 0.2	45	19.4	100
21 x 40	05	1.0	1.3 +0.1	21.5	22.5	21.5 ± 0.2	45	24.7	100

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ELECTRICAL DATA

Unless otherwise specified, all electrical values in Table 4 apply at $T_{amb} = 20\text{ °C}$, $P = 86$ to 106 kPa , $RH = 45$ to 75% .

- C_R = rated capacitance at 100 Hz, tolerance -10 to +50%
 I_R = RMS ripple current at 100 Hz, 85 °C
 I_{L1} = max. leakage current after 1 minute at U_R
 I_{L5} = max. leakage current after 5 minutes at U_R
 $\tan \delta$ = max. dissipation factor at 100 Hz
 ESR = equivalent series resistance at 100 Hz (calculated from $\tan \delta_{max}$ and C_R)
 Z = max. impedance at 1 kHz or 10 kHz.

Table 4 Electrical data

U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 85 °C (mA)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	$\tan \delta$ 100 Hz	ESR 100 Hz (Ω)	Z 1 kHz (Ω)	Z 10 kHz (Ω)
6.3	10	3.3 x 11	15	5	5	0.30	47.8		20
	33	4.5 x 10	50	11	5.4	0.25	12.1		6.1
	68	4.5 x 10	75	22	5.9	0.25	5.86		2.9
	150	6 x 10	120	10	6.9	0.25	2.66		1.3
	470	8 x 18	330	22	11	0.25	0.85		0.43
	680	10 x 18	430	30	14	0.25	0.59		0.29
	1000	10 x 25	560	42	18	0.25	0.40		0.20
	1500	10 x 30	450	61	24	0.28	0.30	0.23	
	2200	12.5 x 30	610	88	33	0.29	0.21	0.16	
	3300	15 x 30	790	129	47	0.32	0.15	0.11	
	4700	18 x 30	1000	182	64	0.34	0.12	0.07	
	6800	18 x 40	1280	261	91	0.39	0.09	0.05	
	10 000	21 x 40	1570	382	131	0.45	0.07	0.05	
15 000	21 x 40	1600	571	194	0.67	0.07	0.05		

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ORDERING INFORMATION

Ordering Example

Electrolytic Capacitors AS 030-033

1000 $\mu\text{F}/10\text{ V}$; $-10/+50\%$

Case size 10 x 30; Form BR

Catalogue number: 2222 032 24102.

Table 5 Ordering information

U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	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	10	3.3 x 11	1	–	030 23109	030 33109	–
	33	4.5 x 10	2	–	030 23339	030 33339	–
	68	4.5 x 10	2	–	030 23689	030 33689	–
	150	6 x 10	3	–	030 23151	030 33151	–
	470	8 x 18	5	–	031 23471	031 33471	–
	680	10 x 18	6	–	031 23681	031 33681	–
	1000	10 x 25	7	–	031 23102	031 33102	–
	1500	10 x 30	00	032 13152	032 23152	–	–
	2200	12.5 x 30	01	032 13222	032 23222	–	–
	3300	15 x 30	02	032 13332	032 23332	–	032 43332
	4700	18 x 30	03	032 13472	–	–	032 43472
	6800	18 x 40	04	033 13682	–	–	033 43682
	10 000	21 x 40	05	033 13103	–	–	033 43103
	15 000	21 x 40	05	033 13153	–	–	033 43153

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U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE \varnothing D x L (mm)	I_R 100 Hz 85 °C (mA)	I_{L1} 1 min (μ A)	I_{L5} 5 min (μ A)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 1 kHz (Ω)	Z 10 kHz (Ω)
10	6.8	3.3 x 11	15	5	5	0.25	58.6		24
	22	4.5 x 10	45	11	5.4	0.20	14.5		7.3
	47	4.5 x 10	70	24	5.9	0.20	6.78		3.4
	100	6 x 10	110	110	7	0.20	3.19		1.6
	220	8 x 11	210	18	9.4	0.20	1.45		0.73
	220	6.5 x 18	210	18	9.4	0.20	1.45		0.73
	330	8 x 18	310	24	12	0.20	0.97		0.48
	470	10 x 18	410	33	14	0.20	0.68		0.34
	680	10 x 25	510	45	19	0.20	0.47		0.24
	1000	10 x 30	430	64	25	0.20	0.32		0.20
	1500	12.5 x 30	570	94	35	0.23	0.25	0.20	
	2200	15 x 30	740	136	49	0.24	0.18	0.14	
	3300	18 x 30	950	202	71	0.27	0.13	0.09	
	4700	18 x 40	1220	286	99	0.29	0.10	0.06	
6800	21 x 40	1500	412	141	0.34	0.08	0.06		
10 000	21 x 40	1520	604	205	0.49	0.08	0.05		
16	4.7	3.3 x 11	15	5	5	0.20	67.8		26
	15	4.5 x 10	55	12	5.5	0.16	17.0		8
	33	4.5 x 10	65	27	6.1	0.16	7.72		3.6
	68	6 x 10	110	11	7.2	0.16	3.75		1.8
	150	8 x 11	200	19	9.8	0.16	1.70		0.80
	150	6.5 x 18	200	19	9.8	0.16	1.70		0.80
	220	8 x 18	270	26	12	0.16	1.16		0.55
	330	10 x 18	410	36	16	0.16	0.78		0.36
	470	10 x 25	480	49	20	0.16	0.55		0.26
	680	10 x 30	400	70	27	0.16	0.38		0.18
	1000	12.5 x 30	550	100	37	0.16	0.26		0.12
	1500	15 x 30	680	148	53	0.19	0.21	0.17	
	2200	18 x 30	880	216	75	0.20	0.15	0.13	
	3300	18 x 40	1160	321	111	0.23	0.11	0.08	
4700	21 x 40	1430	455	155	0.25	0.09	0.06		
6800	21 x 40	1460	657	223	0.36	0.08	0.06		

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U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅ D x L (mm)	CASE CODE	CATALOGUE NUMBER 2222			
				AXIAL			SINGLE ENDED
				IN BOX Form AA	TAPED ON REEL Form BR	TAPED IN BOX Form BA	MOUNTING RING Form MR
10	6.8	3.3 x 11	1	-	030 24688	030 34688	-
	22	4.5 x 10	2	-	030 24229	030 34229	-
	47	4.5 x 10	2	-	030 24479	030 34479	-
	100	6 x 10	3	-	030 24101	030 34101	-
	220	8 x 11	5a	-	030 24221	030 34221	-
	220	6.5 x 18	4	-	031 24221	031 34221	-
	330	8 x 18	5	-	031 24331	031 34331	-
	470	10 x 18	6	-	031 24471	031 34471	-
	680	10 x 25	7	-	031 24681	031 34681	-
	1000	10 x 30	00	032 14102	032 24102	-	-
	1500	12.5 x 30	01	032 14152	032 24152	-	-
	2200	15 x 30	02	032 14222	032 24222	-	032 44222
	3300	18 x 30	03	032 14332	-	-	032 44332
	4700	18 x 40	04	033 14472	-	-	033 44472
	6800	21 x 40	05	033 14682	-	-	033 44682
	10 000	21 x 40	05	033 14103	-	-	033 44103
16	4.7	3.3 x 11	1	-	030 25478	030 35478	-
	15	4.5 x 10	2	-	030 25159	030 35159	-
	33	4.5 x 10	2	-	030 25339	030 35339	-
	68	6 x 10	3	-	030 25689	030 35689	-
	150	8 x 11	5a	-	030 25151	030 35151	-
	150	6.5 x 18	4	-	031 25151	031 35151	-
	220	8 x 18	5	-	031 25221	031 35221	-
	330	10 x 18	6	-	031 25331	031 35331	-
	470	10 x 25	7	-	031 25471	031 35471	-
	680	10 x 30	00	032 15681	032 25681	-	-
	1000	12.5 x 30	01	032 15102	032 25102	-	-
	1500	15 x 30	02	032 15152	032 25152	-	032 45152
	2200	18 x 30	03	032 15222	-	-	032 45222
	3300	18 x 40	04	033 15332	-	-	033 45332
	4700	21 x 40	05	033 15472	-	-	033 45472
	6800	21 x 40	05	033 15682	-	-	033 45682

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U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE \varnothing D x L (mm)	I_R 100 Hz 85 °C (mA)	I_{L1} 1 min (μ A)	I_{L5} 5 min (μ A)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 1 kHz (Ω)	Z 10 kHz (Ω)
25	3.3	3.3 x 11	15	5	5	0.18	86.9		27
	10	4.5 x 10	50	13	5.5	0.14	22.3		9
	22	4.5 x 10	60	28	6.1	0.14	10.2		4.1
	47	6 x 10	100	12	7.4	0.14	4.8		1.9
	100	8 x 11	160	19	10	0.14	2.23		0.90
	100	6.5 x 18	160	19	10	0.14	2.23		0.90
	150	8 x 18	240	27	13	0.14	1.49		0.60
	220	10 x 18	350	37	16	0.14	1.02		0.41
	330	10 x 25	460	54	22	0.14	0.68		0.27
	470	10 x 30	360	75	29	0.14	0.47		0.19
	680	12.5 x 30	500	106	39	0.14	0.32		0.13
	1000	15 x 30	660	154	55	0.14	0.22		0.09
	1500	18 x 30	810	229	80	0.17	0.18	0.15	
	2200	18 x 40	1060	334	115	0.18	0.13	0.10	
	3300	21 x 40	1340	499	170	0.21	0.10	0.07	
4700	21 x 40	1370	709	240	0.28	0.10	0.06		
40	2.2	3.3 x 11	15	5	5	0.15	109		32
	6.8	4.5 x 10	45	14	5.5	0.11	25.8		10
	10	4.5 x 10	50	20	5.8	0.11	17.6		7
	15	4.5 x 10	55	30	6.2	0.11	11.7		4.7
	22	6 x 10	75	9	6.8	0.11	8.0		3.2
	33	6 x 10	95	12	7.7	0.11	5.31		2.1
	47	8 x 11	150	16	8.8	0.11	3.73		1.5
	47	6.5 x 18	150	16	8.8	0.11	3.73		1.5
	100	8 x 18	220	28	13	0.11	1.75		0.70
	150	10 x 18	300	40	17	0.11	1.17		0.47
	220	10 x 25	430	57	23	0.11	0.80		0.32
	220	10 x 30	260	57	23	0.12	0.86		0.32
	330	12.5 x 30	370	84	31	0.12	0.58		0.21
	470	12.5 x 30	440	117	43	0.12	0.40		0.15
	680	15 x 30	580	167	59	0.12	0.28		0.10
	1000	18 x 30	780	244	85	0.12	0.19		0.07
	1500	18 x 40	970	364	125	0.15	0.16	0.13	
	2200	21 x 40	1220	532	181	0.16	0.12	0.09	
3300	21 x 40	1284	796	269	0.24	0.11	0.07		

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U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅ D x L (mm)	CASE CODE	CATALOGUE NUMBER 2222			
				AXIAL			SINGLE ENDED
				IN BOX Form AA	TAPED ON REEL Form BR	TAPED IN BOX Form BA	MOUNTING RING Form MR
25	3.3	3.3 x 11	1	-	030 26338	030 36338	-
	10	4.5 x 10	2	-	030 26109	030 36109	-
	22	4.5 x 10	2	-	030 26229	030 36229	-
	47	6 x 10	3	-	030 26479	030 36479	-
	100	8 x 11	5a	-	030 26101	030 36101	-
	100	6.5 x 18	4	-	031 26101	031 36101	-
	150	8 x 18	5	-	031 26151	031 36151	-
	220	10 x 18	6	-	031 26221	031 36221	-
	330	10 x 25	7	-	031 26331	031 36331	-
	470	10 x 30	00	032 16471	032 26471	-	-
	680	12.5 x 30	01	032 16681	032 26681	-	-
	1000	15 x 30	02	032 16102	032 26102	-	032 46102
	1500	18 x 30	03	032 16152	-	-	032 46152
	2200	18 x 40	04	033 16222	-	-	033 46222
	3300	21 x 40	05	033 16332	-	-	033 46332
	4700	21 x 40	05	033 16472	-	-	033 46472
40	2.2	3.3 x 11	1	-	030 27228	030 37228	-
	6.8	4.5 x 10	2	-	030 27688	030 37688	-
	10	4.5 x 10	2	-	030 27109	030 37109	-
	15	4.5 x 10	2	-	030 27159	030 37159	-
	22	6 x 10	3	-	030 27229	030 37229	-
	33	6 x 10	3	-	030 27339	030 37339	-
	47	8 x 11	5a	-	030 27479	030 37479	-
	47	6.5 x 18	4	-	031 27479	031 37479	-
	100	8 x 18	5	-	031 27101	031 37101	-
	150	10 x 18	6	-	031 27151	031 37151	-
	220	10 x 25	7	-	031 27221	031 37221	-
	220	10 x 30	00	032 17221	032 27221	-	-
	330	12.5 x 30	01	032 17331	032 27331	-	-
	470	12.5 x 30	01	032 17471	032 27471	-	-
	680	15 x 30	02	032 17681	032 27681	-	032 47681
	1000	18 x 30	03	032 17102	-	-	032 47102
	1500	18 x 40	04	033 17152	-	-	033 47152
	2200	21 x 40	05	033 17222	-	-	033 47222
3300	21 x 40	05	033 17332	-	-	033 47332	

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U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE \varnothing D x L (mm)	I_R 100 Hz 85 °C (mA)	I_{L1} 1 min (μ A)	I_{L5} 5 min (μ A)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 1 kHz (Ω)	Z 10 kHz (Ω)
63	0.33	4.5 x 10	4	5	5	0.09	435		167
	0.47	3.3 x 11	6	5	5	0.10	339		117
	0.47	4.5 x 10	6	5	5	0.09	305		117
	1.0	3.3 x 11	10	5	5	0.12	191		55
	1.0	4.5 x 10	13	5	5	0.09	143		55
	1.5	4.5 x 10	17	5	5	0.09	95.6		37
	2.2	4.5 x 10	25	7	5.3	0.09	65.2		25
	3.3	4.5 x 10	35	11	5.4	0.09	46.5		17
	4.7	4.5 x 10	40	15	5.6	0.09	30.5		12
	6.8	4.5 x 10	46	22	5.9	0.09	21.1		8.1
	10	6 x 10	70	7	6.3	0.08	12.8		5.5
	15	6 x 10	79	10	6.9	0.08	8.5		3.7
	22	8 x 11	110	13	7.8	0.08	5.79		2.5
	22	6.5 x 18	110	13	7.8	0.08	5.79		2.5
	47	8 x 18	190	22	11	0.08	2.71		1.2
	68	10 x 18	250	30	14	0.08	1.88		0.81
	100	10 x 25	300	42	18	0.08	1.28		0.55
	150	10 x 30	260	61	24	0.08	0.90		0.37
	220	12.5 x 30	350	88	33	0.08	0.61		0.25
	330	15 x 30	480	129	47	0.08	0.41		0.17
	470	15 x 30	570	182	64	0.08	0.29		0.15
	680	18 x 30	770	261	91	0.08	0.20		0.08
	1000	21 x 40	1140	382	131	0.08	0.14		0.06
	1500	21 x 40	1110	571	194	0.12	0.15	0.15	

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U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE \varnothing D x L (mm)	CASE CODE	CATALOGUE NUMBER 2222			
				AXIAL			SINGLE ENDED
				IN BOX Form AA	TAPED ON REEL Form BR	TAPED IN BOX Form BA	MOUNTING RING Form MR
63	0.33	4.5 x 10	2	-	030 28337	030 38337	-
	0.47	3.3 x 11	1	-	030 90065	030 90098	-
	0.47	4.5 x 10	2	-	030 28477	030 38477	-
	1.0	3.3 x 11	1	-	030 90067	030 90068	-
	1.0	4.5 x 10	2	-	030 28108	030 38108	-
	1.5	4.5 x 10	2	-	030 28158	030 38158	-
	2.2	4.5 x 10	2	-	030 28228	030 38228	-
	3.3	4.5 x 10	2	-	030 28338	030 38338	-
	4.7	4.5 x 10	2	-	030 28478	030 38478	-
	6.8	4.5 x 10	2	-	030 28688	030 38688	-
	10	6 x 10	3	-	030 28109	030 38109	-
	15	6 x 10	3	-	030 28159	030 38159	-
	22	8 x 11	5a	-	030 28229	030 38229	-
	22	6.5 x 18	4	-	031 28229	031 38229	-
	47	8 x 18	5	-	031 28479	031 38479	-
	68	10 x 18	6	-	031 28689	031 38689	-
	100	10 x 25	7	-	031 28101	031 38101	-
	150	10 x 30	00	032 18151	032 28151	-	-
	220	12.5 x 30	01	032 18221	032 28221	-	-
	330	15 x 30	02	032 18331	032 28331	-	032 48331
470	15 x 30	02	032 18471	032 28471	-	032 48471	
680	18 x 30	03	032 18681	-	-	032 48681	
1000	21 x 40	05	033 18102	-	-	033 48102	
1500	21 x 40	05	033 18152	-	-	033 48152	

Aluminum Electrolytic
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U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 85 °C (mA)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	$\text{Tan } \delta$ 100 Hz	ESR 100 Hz (Ω)	Z 1 kHz (Ω)	Z 10 kHz (Ω)
100	0.47	4.5 x 10	9	5	5	0.08	271		96
	1.0	4.5 x 10	20	5	5	0.08	128		45
	2.2	4.5 x 10	30	11	11	0.08	57.9		21
	3.3	4.5 x 10	40	17	17	0.08	38.6		14
	4.7	6 x 10	50	22	22	0.07	23.7		9.6
	6.8	6 x 10	70	34	34	0.07	16.4		6.6
	10	8 x 11	90	50	50	0.07	11.2		4.5
	10	6.5 x 18	90	50	50	0.07	11.2		4.5
	22	8 x 18	120	80	80	0.07	5.07		2.1
	33	10 x 18	200	119	119	0.07	3.38		1.4
	47	10 x 25	260	33	33	0.07	2.37		0.96
	68	10 x 30	130	45	45	0.15	3.53		2.0
	100	12.5 x 30	190	64	64	0.15	2.40		1.2
	150	15 x 30	250	94	94	0.15	1.60		0.85
	220	18 x 30	330	136	136	0.15	1.09		0.60
	330	18 x 40	460	202	202	0.15	0.73		0.50
	470	21 x 40	600	286	286	0.15	0.51		0.35
	680	21 x 40	650	412	412	0.15	0.42		0.35

Voltage

Surge voltage for short periods

$$U_s \leq 1.15 \times U_R$$

Reverse voltage

$$U_{rev} \leq 1 \text{ V}$$

Leakage currentAfter 1 minute at U_R

case sizes 3.3 x 11 and 4.5 x 10 mm

case sizes 6 x 10 mm to 21 x 40 mm

$$I_{L1} \leq 0.05 C_R \times U_R \text{ or } 5 \mu\text{A, whichever is greater}$$

$$I_{L1} \text{ for } CU \leq 1000 \mu\text{C: } \leq 0.01 C_R \times U_R \text{ or } 1 \mu\text{A,}$$

whichever is greater

$$I_{L1} \text{ for } CU > 1000 \mu\text{C: } \leq 0.006 C_R \times U_R + 4 \mu\text{A}$$

After 5 minutes at U_R

6.3 to 63 V

100 V

$$I_{L5} \leq 0.002 C_R \times U_R + 5 \mu\text{A}$$

$$I_{L5} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$$

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Series 2222-030-033

U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅ D x L (mm)	CASE CODE	CATALOGUE NUMBER 2222			
				AXIAL			SINGLE ENDED
				IN BOX Form AA	TAPED ON REEL Form BR	TAPED IN BOX Form BA	MOUNTING RING Form MR
100	0.47	4.5 x 10	2	-	030 29477	030 39477	-
	1.0	4.5 x 10	2	-	030 29108	030 39108	-
	2.2	4.5 x 10	2	-	030 29228	030 39228	-
	3.3	4.5 x 10	2	-	030 29338	030 39338	-
	4.7	6 x 10	3	-	030 29478	030 39478	-
	6.8	6 x 10	3	-	030 29688	030 39688	-
	10	8 x 11	5a	-	030 29109	030 39109	-
	10	6.5 x 18	4	-	031 29109	031 39109	-
	22	8 x 18	5	-	031 29229	031 39229	-
	33	10 x 18	6	-	031 29339	031 39339	-
	47	10 x 25	7	-	031 29479	031 39479	-
	68	10 x 30	00	032 19689	032 29689	-	-
	100	12.5 x 30	01	032 19101	032 29101	-	-
	150	15 x 30	02	032 19151	032 29151	-	032 49151
	220	18 x 30	03	032 19221	-	-	032 49221
	330	18 x 40	04	033 19331	-	-	033 49331
	470	21 x 40	05	033 19471	-	-	033 49471
680	21 x 40	05	033 19681	-	-	033 49681	

MARKING

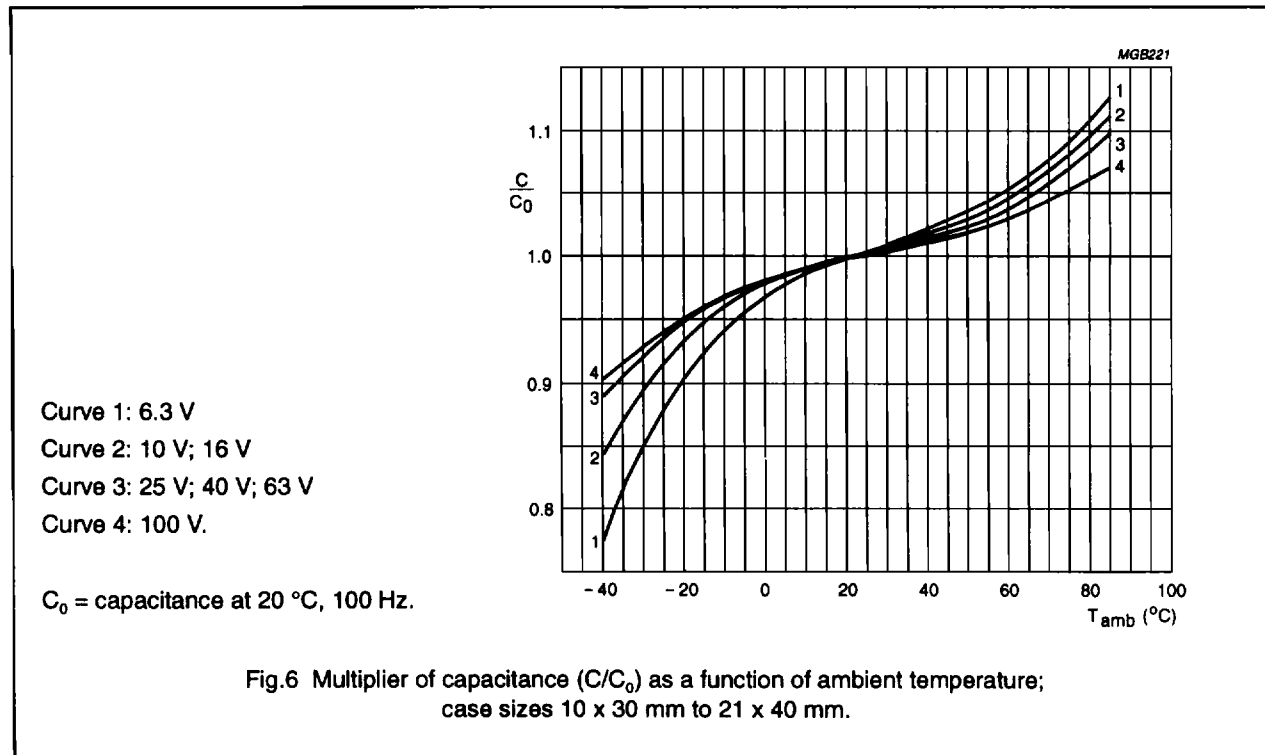
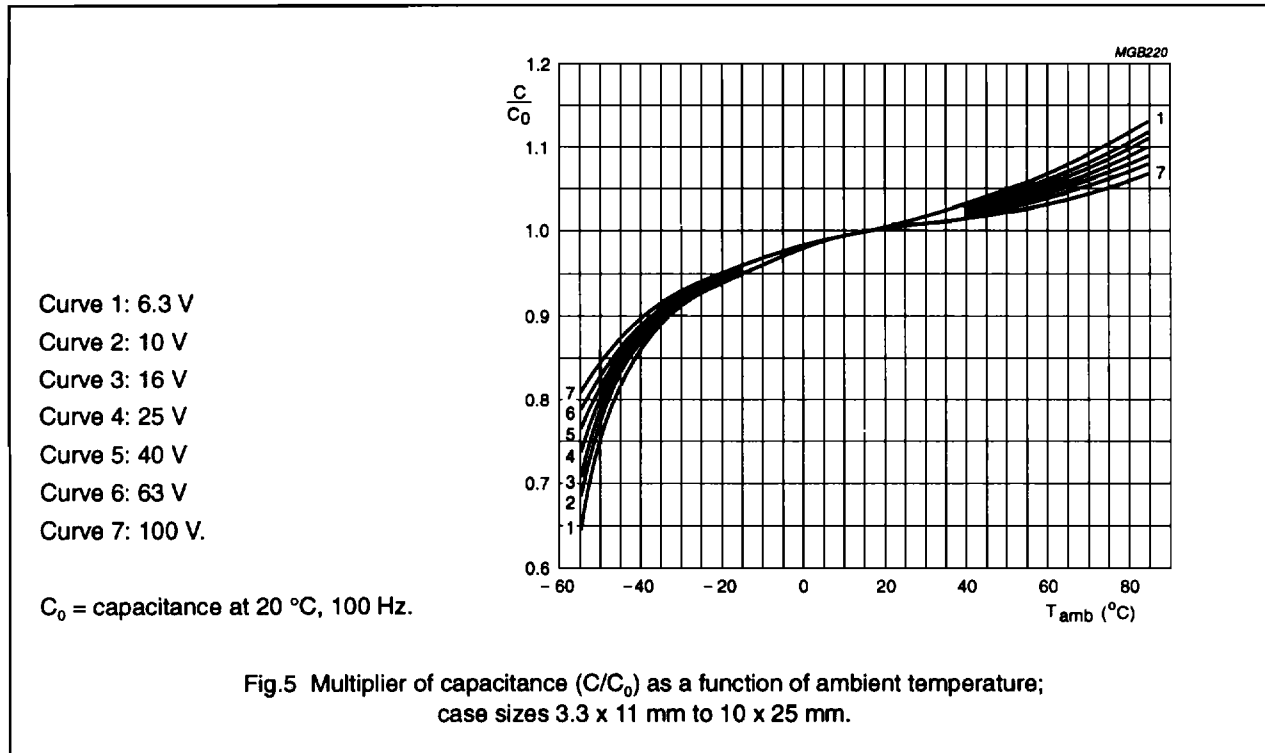
The capacitors are marked (where possible) with the following information:

- Rated capacitance in μF
- Tolerance on rated capacitance, code letter in accordance with IEC 62 (not for case size 1)
- Rated voltage in V
- Group number (030, 031, 032 or 033)
- Code indicating factory of origin
- Name of manufacturer (PHILIPS)
- Date code, in accordance with IEC 62
- Band to identify the negative terminal
- "+" - signs to identify the positive terminal (not for case sizes L < 18 mm).

Aluminum Electrolytic Capacitors

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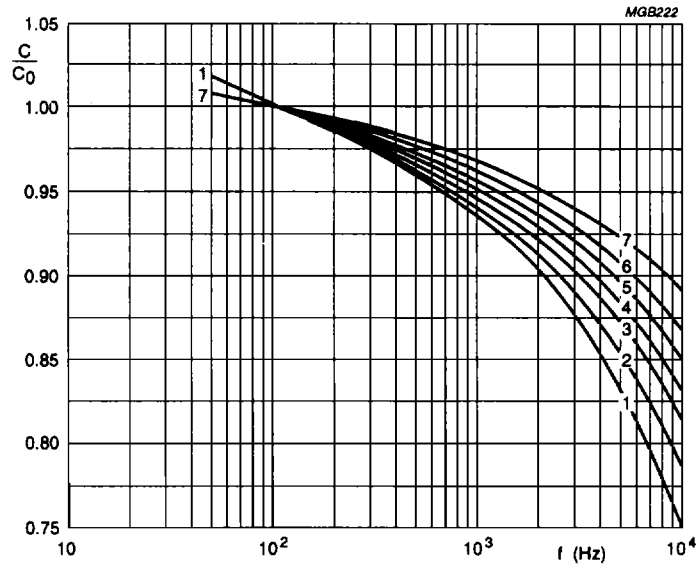
Capacitance (C)



Aluminum Electrolytic Capacitors

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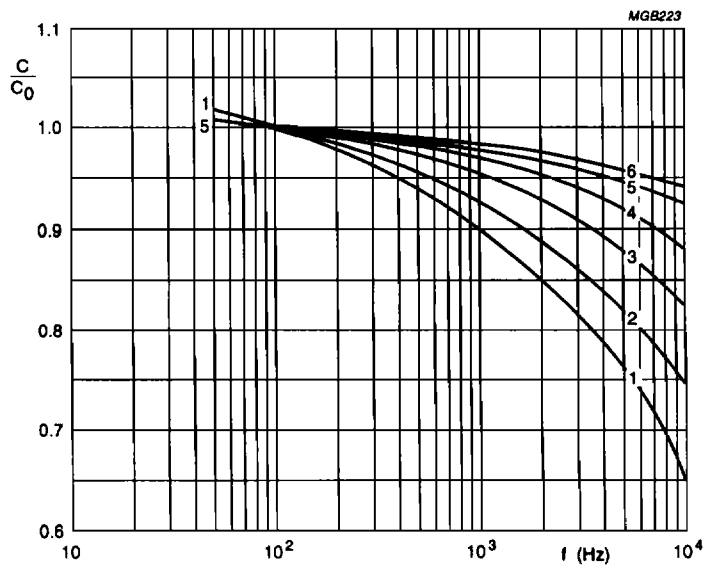
- Curve 1: 6.3 V
- Curve 2: 10 V
- Curve 3: 16 V
- Curve 4: 25 V
- Curve 5: 40 V
- Curve 6: 63 V
- Curve 7: 100 V.



C_0 = capacitance at 20 °C, 100 Hz.

Fig.7 Multiplier of capacitance (C/C_0) as a function of frequency; case sizes 3.3 x 11 mm to 10 x 25 mm.

- Curve 1: 6.3 V
- Curve 2: 10 V
- Curve 3: 16 V
- Curve 4: 25 V; 100 V
- Curve 5: 40 V
- Curve 6: 63 V.



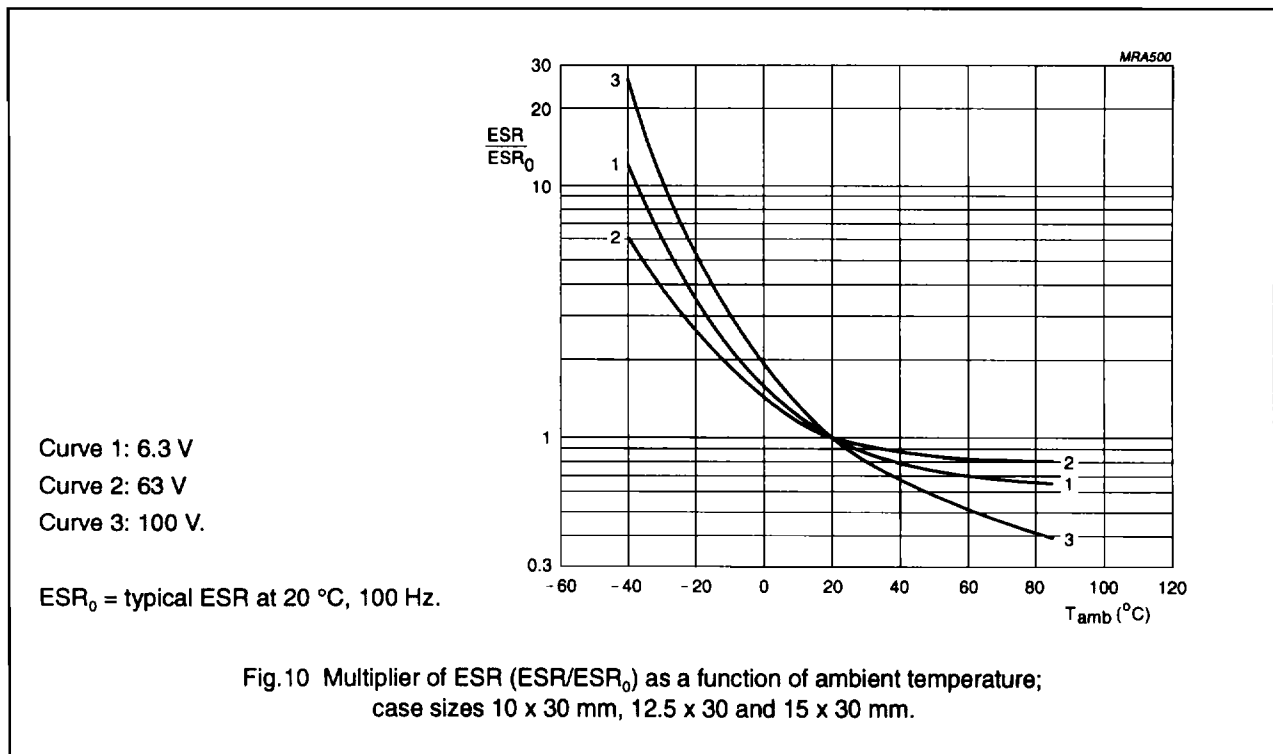
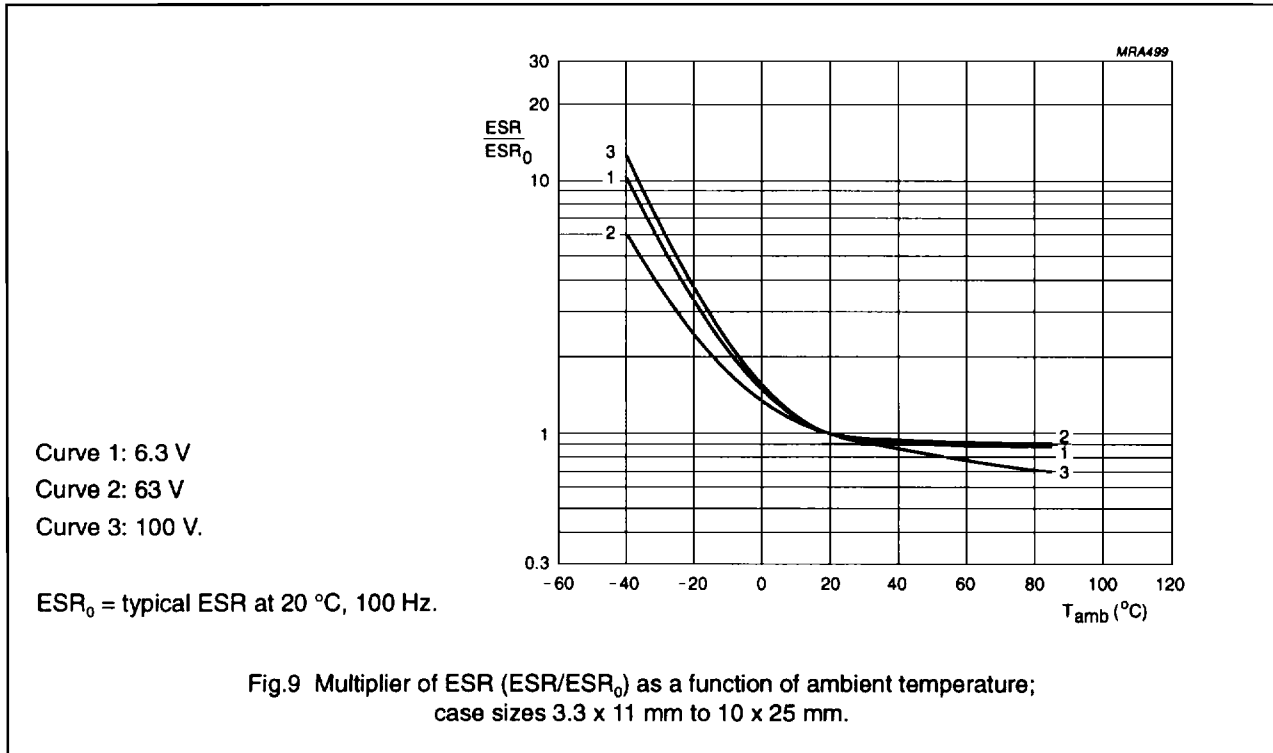
C_0 = capacitance at 20 °C, 100 Hz.

Fig.8 Multiplier of capacitance (C/C_0) as a function of frequency; case sizes 10 x 30 mm to 21 x 40 mm.

Aluminum Electrolytic Capacitors

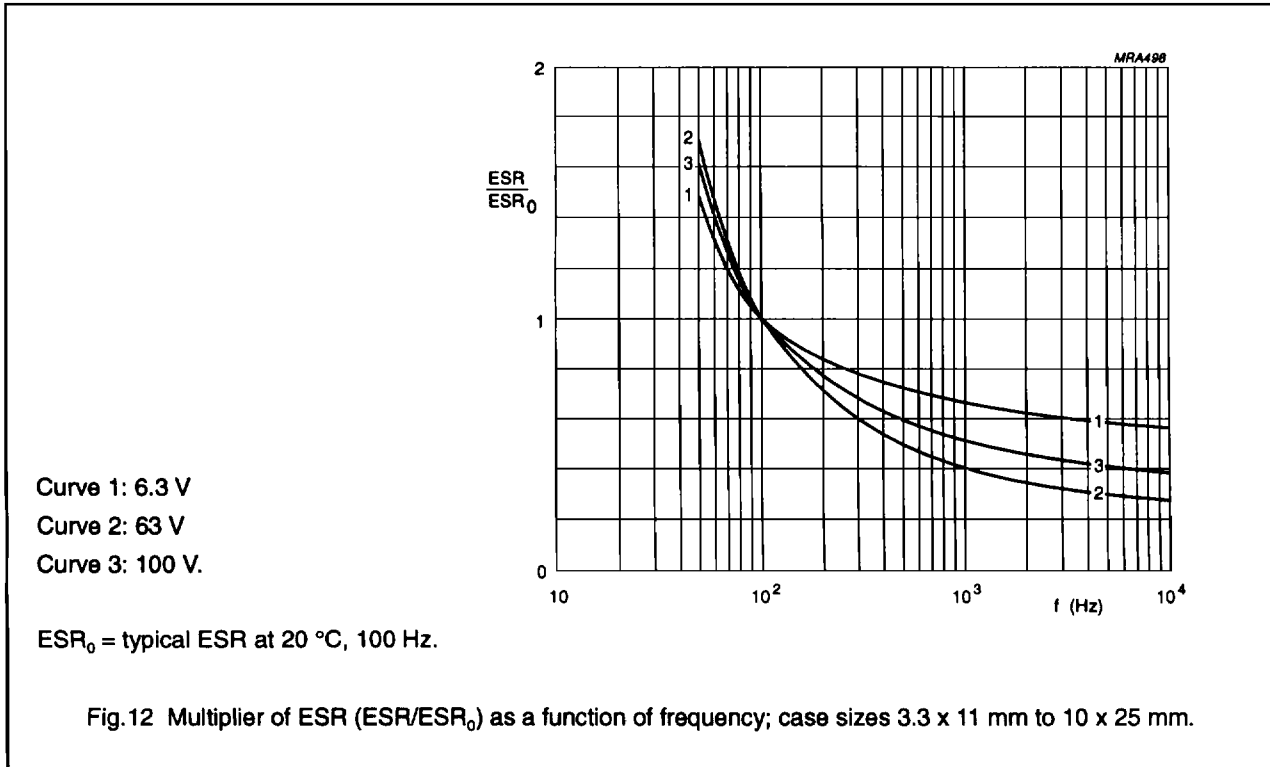
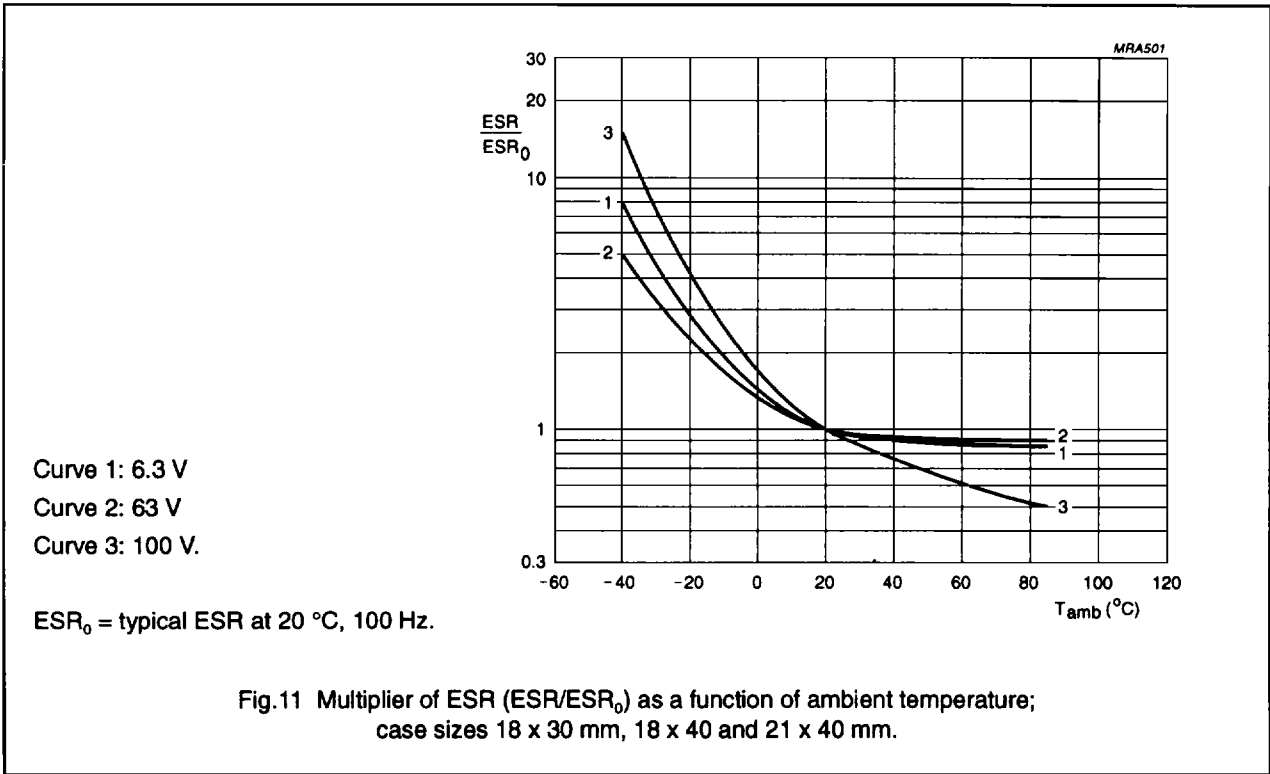
Series 2222-030-033

Equivalent series resistance (ESR)



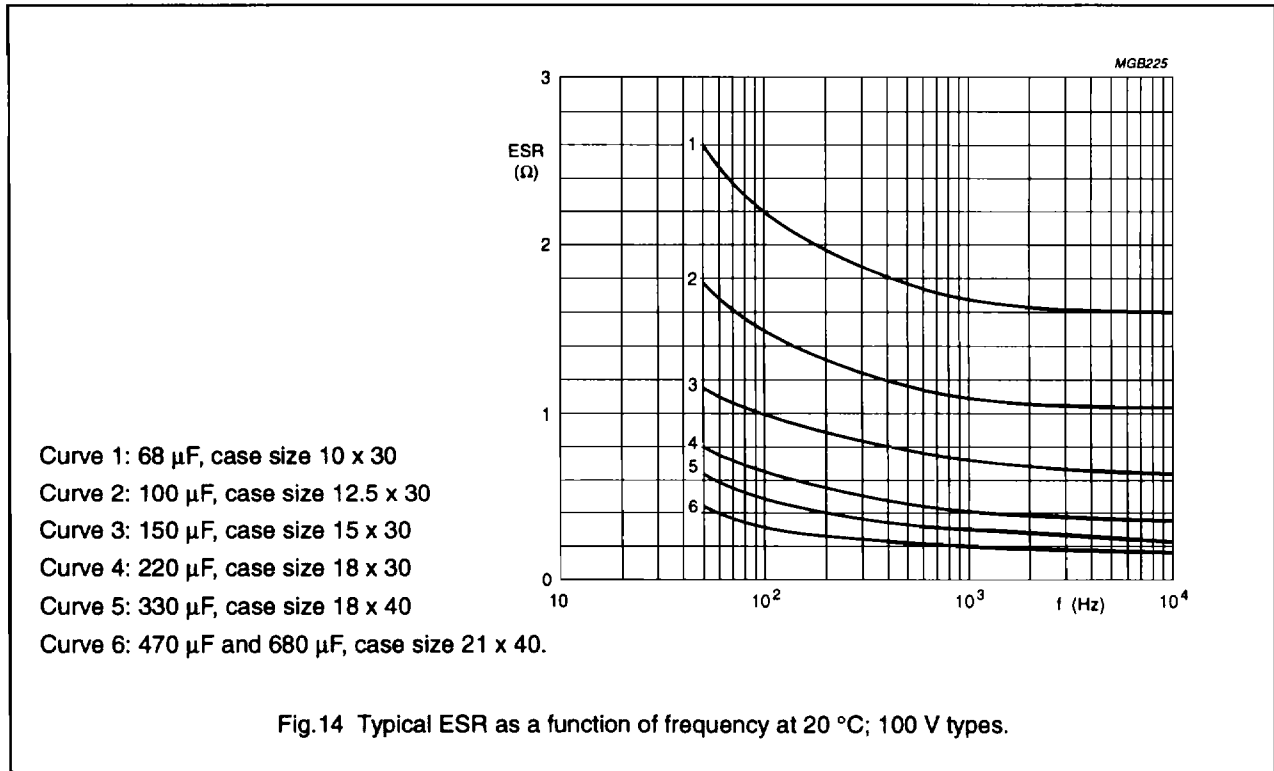
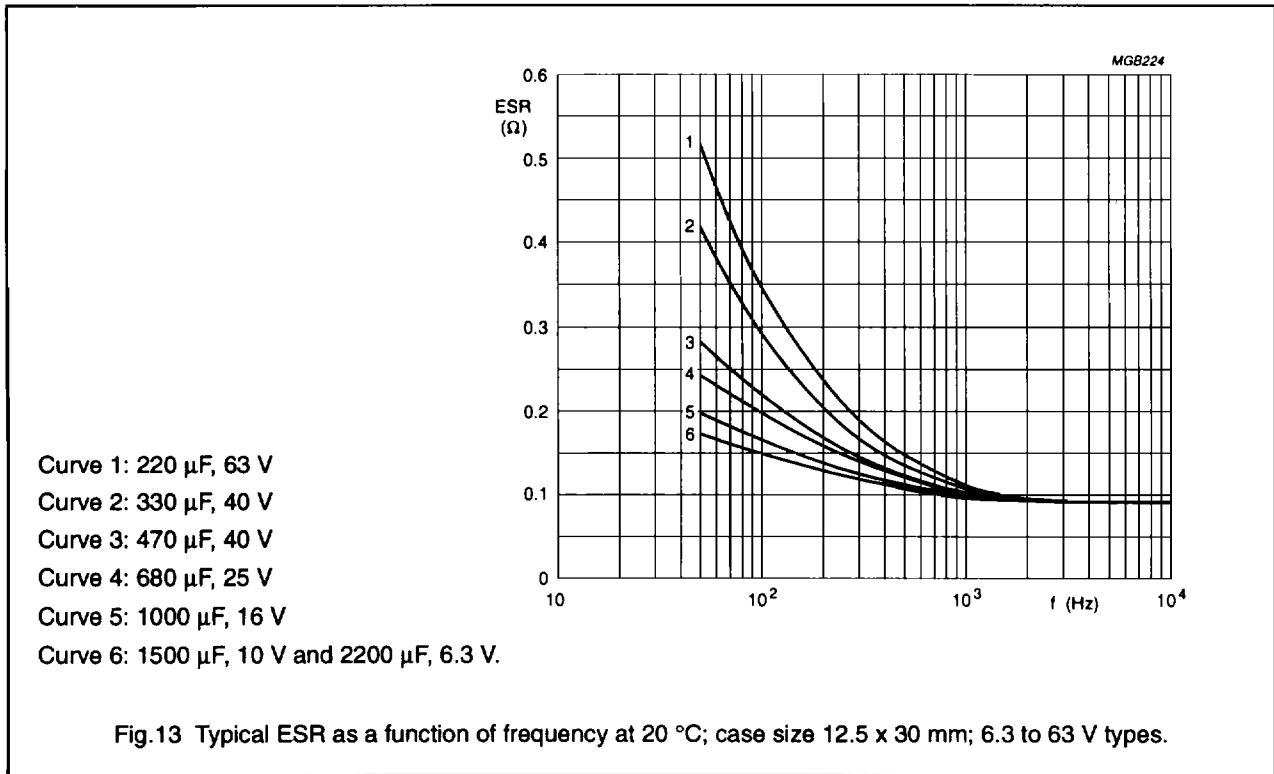
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Equivalent series inductance (ESL)
Table 6 Equivalent series inductance, typical values

CASE SIZE (\varnothing x L) (mm)	AXIAL (nH)	SINGLE ENDED (nH)
3.3 x 11	11	
4.5 x 10	10	
6 x 10	22	
8 x 11	85	
6.5 x 18	25	
8 x 18	40	
10 x 18	61	
10 x 25	38	
10 x 30	38	
12.5 x 30	46	
15 x 30	48	39
18 x 30	50	39
18 x 40	54	39
21 x 40	59	39

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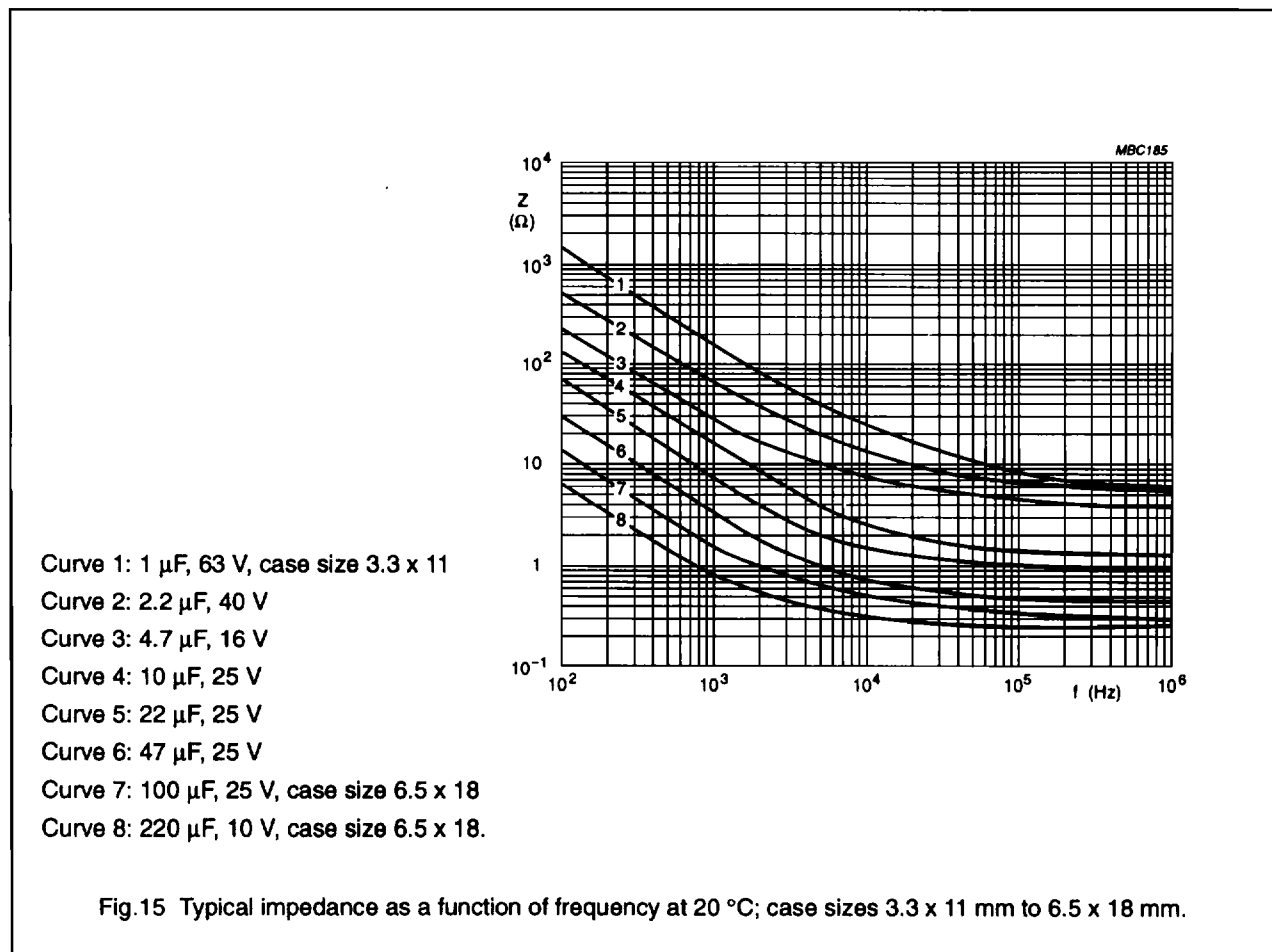
Impedance (Z)

Table 7 Impedance x capacitance values at 10 kHz

T _{amb}	z = Z x C _R (Ω μF) at 10 kHz						
	6.3 V	10 V	16 V	25 V	40 V	63 V	100 V
+20 °C	≤ 200	≤ 160	≤ 120	≤ 90	≤ 70	≤ 55	≤ 45
-25 °C	≤1200	≤ 750	≤ 560	≤ 400	≤ 300	≤ 180	≤ 130
-40 °C	≤3200	≤2000	≤1500	≤1100	≤ 900	≤ 500	≤ 350

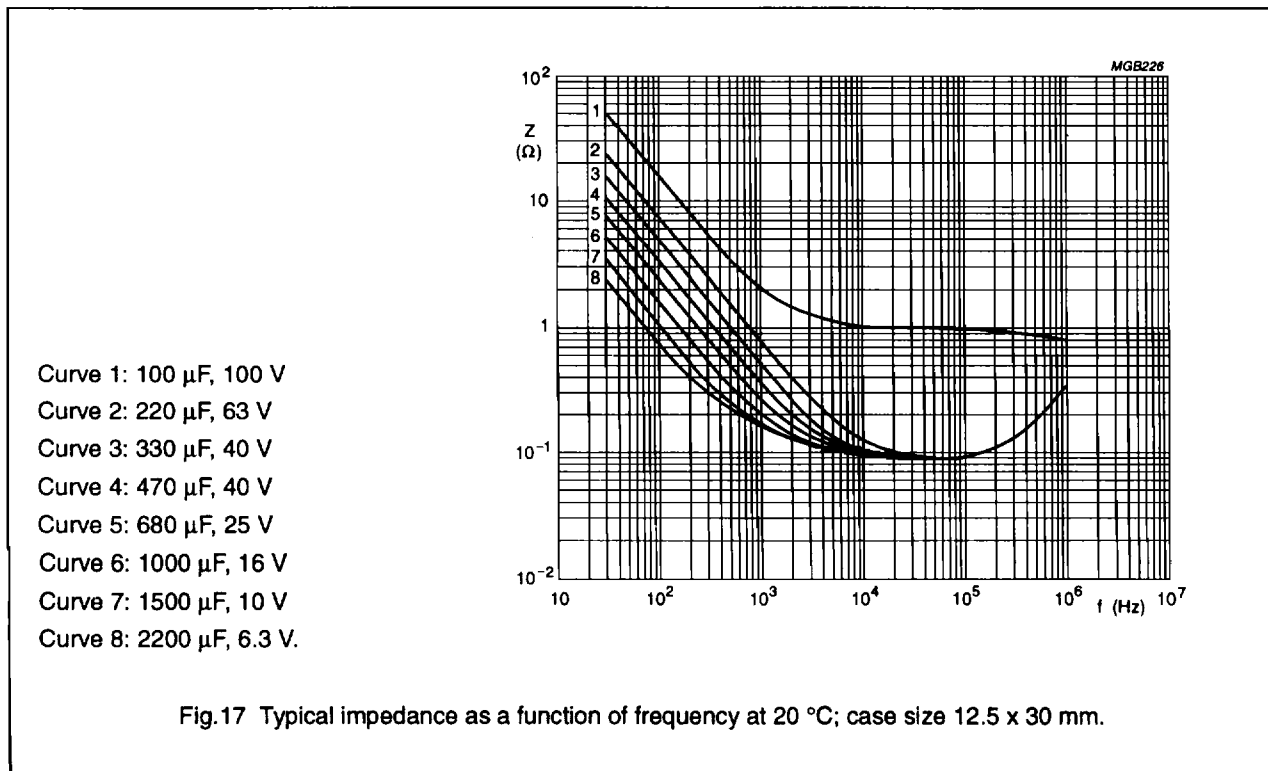
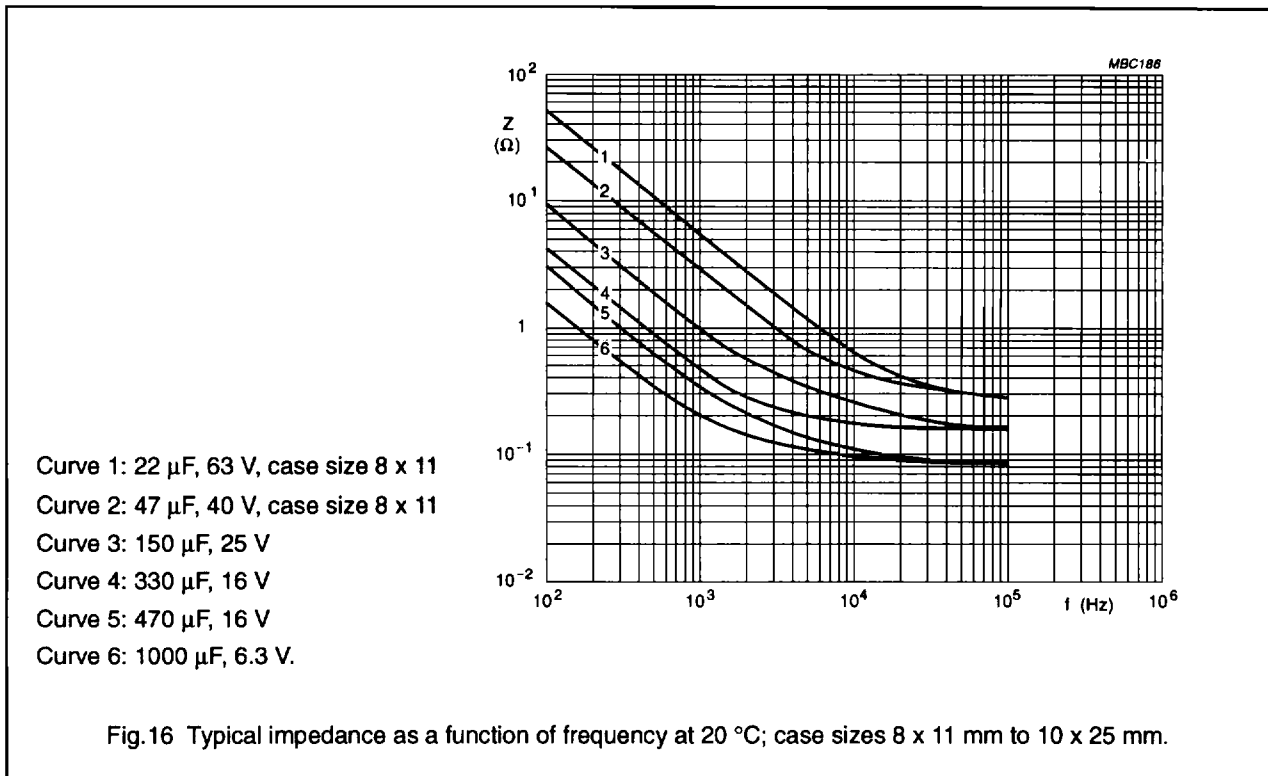
Table 8 Impedance x capacitance values at 1 kHz

T _{amb}	z = Z x C _R (Ω μF) at 1 kHz						
	6.3 V	10 V	16 V	25 V	40 V	63 V	100 V
+20 °C	≤ 350	≤ 300	≤ 250	≤ 220	≤ 200	≤ 180	≤ 175
-25 °C	≤1700	≤1100	≤ 800	≤ 570	≤ 430	≤ 330	≤ 300
-40 °C	≤4500	≤2800	≤2000	≤1400	≤1100	≤ 800	—



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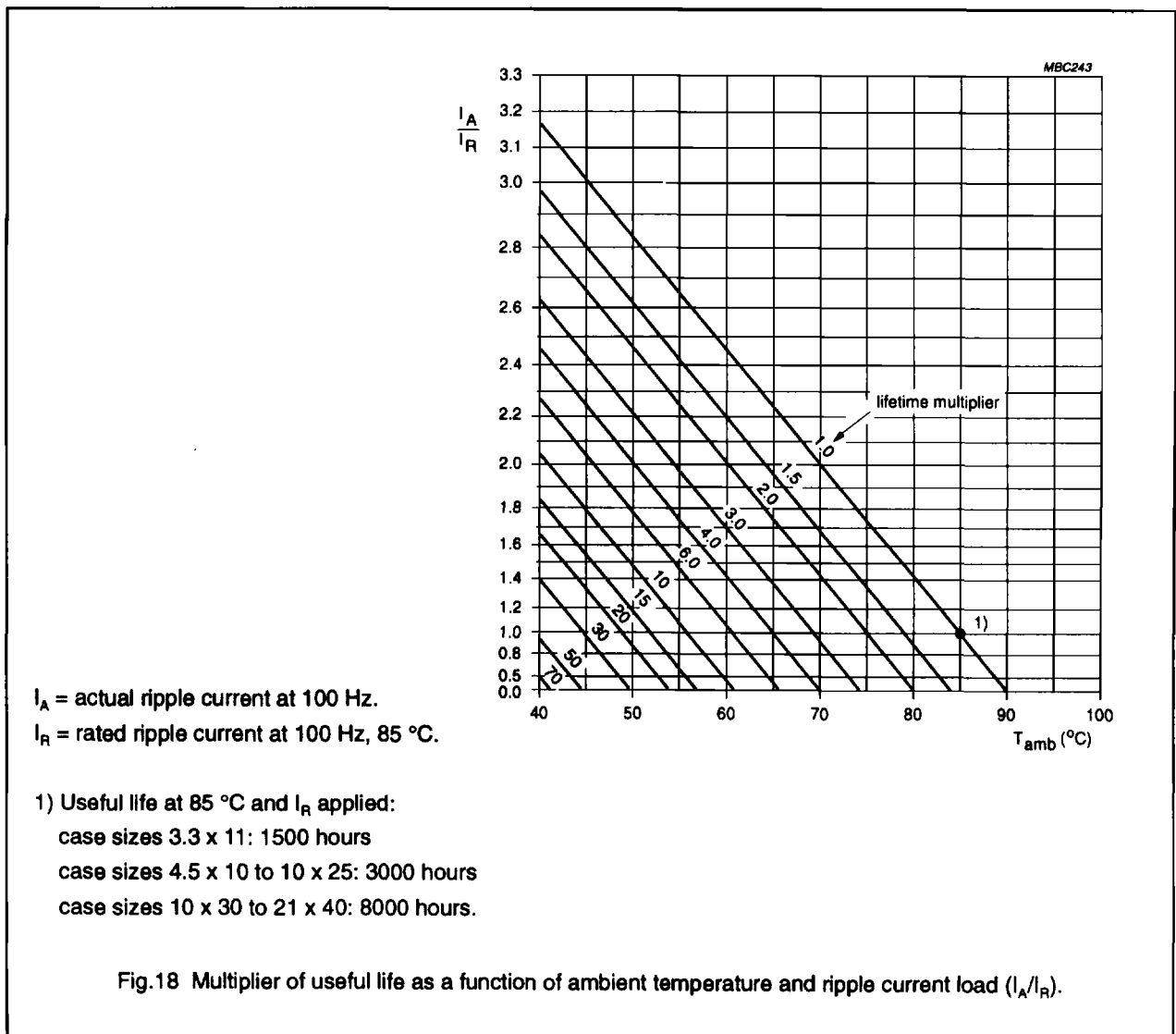
Aluminum Electrolytic Capacitors

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RIPPLE CURRENT and USEFUL LIFE

Table 9 Multiplier of ripple current (I_R/I_{RO}) as a function of frequency; I_{RO} = ripple current at 85 °C, 100 Hz.

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 6.3 \text{ V to } 10 \text{ V}$	$U_R = 16 \text{ V to } 25 \text{ V}$	$U_R = 40 \text{ V to } 100 \text{ V}$
50	0.95	0.9	0.85
100	1.0	1.0	1.0
300	1.07	1.12	1.2
1000	1.12	1.2	1.3
3000	1.15	1.25	1.35
$\geq 10\ 000$	1.2	1.3	1.4



Aluminum Electrolytic Capacitors

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SPECIFIC TESTS and REQUIREMENTS

General tests and requirements are specified in chapter "Tests and Requirements".

Table 10 Case size 3.3 x 11 mm

TEST		PROCEDURE (quick reference)	REQUIREMENTS
Name of test	Reference		
Endurance	IEC 384-4-1/ CECC 30 301 group C3, 4.13	$T_{amb} = 85\text{ °C}$; U_R applied; 1000 hours	$\Delta C/C \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30 301 amendment 2640 sub clause 1.8.1	$T_{amb} = 85\text{ °C}$; U_R and I_R applied; 1500 hours	$\Delta C/C \pm 50\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 3\%$
Shelf life (storage at high temp.)	IEC 384-4-1/ CECC 30 301, group C 5a, 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 $I_{L5} \leq 2 \times \text{spec. limit}$

Table 11 Case sizes 4.5 x 10 mm to 21 x 40 mm

TEST		PROCEDURE (quick reference)	REQUIREMENTS
Name of test	Reference		
Endurance	IEC 384-4-1/ CECC 30 301 group C3, 4.13	$T_{amb} = 85\text{ °C}$; U_R applied; case sizes: 4.5 x 10 to 10 x 25: 2000 hours 10 x 30 to 21 x 40: 5000 hours	$U_R \leq 6.3\text{ V}$: $\Delta C/C +15/-30\%$ $U_R > 6.3\text{ V}$: $\Delta C/C \pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30 301 amendment 2640 sub clause 1.8.1	$T_{amb} = 85\text{ °C}$; U_R and I_R applied; case sizes: 4.5 x 10 to 10 x 25: 3000 hours 10 x 30 to 21 x 40: 8000 hours	$U_R \leq 6.3\text{ V}$: $\Delta C/C +45/-50\%$ $U_R > 6.3\text{ V}$: $\Delta C/C \pm 45\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$
Shelf life (storage at high temp.)	IEC 384-4-1/ CECC 30 301, group C 5a, 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 $I_{L5} \leq 2 \times \text{spec. limit}$