

Aluminum Electrolytic Capacitors

Series 2222-021

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 sizes 10 x 30 mm to 21 x 40 mm with pressure relief
- Charge and discharge proof
- Taped versions up to case size 15 x 30 mm available for automatic insertion
- Miniaturized, high CU-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.

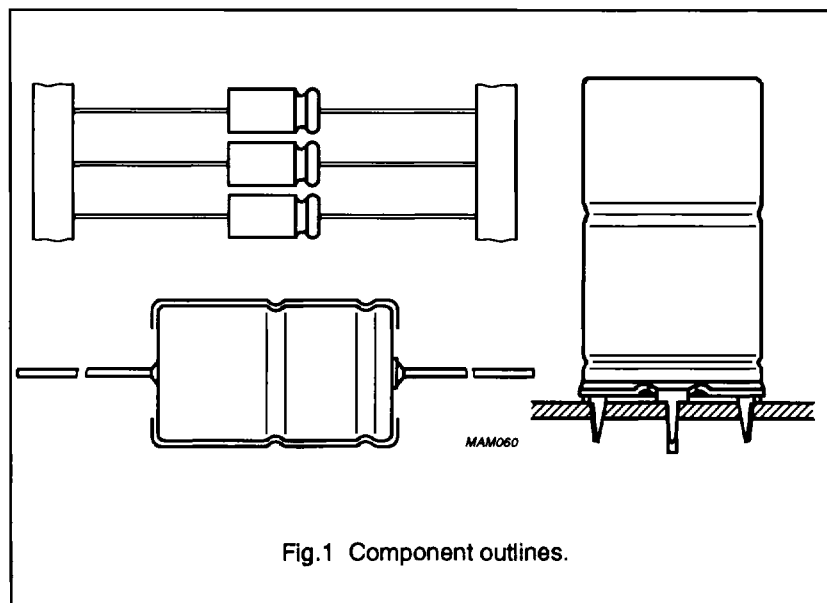


Fig.1 Component outlines.

QUICK REFERENCE DATA

Case sizes ($\varnothing D_{nom} \times L_{nom}$ in mm)	4.5 x 10 to 10 x 25	10 x 30 to 21 x 40
Rated capacitance range, C_R	0.22 to 15 000 μF	
Tolerance on C_R	$\pm 20\%$	
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 x I_R applied	70 000 hours	200 000 hours
Shelf life at 0 V, 85 °C	500 hours	500 hours
Based on sectional specification	IEC 384-4/CECC 30 300	IEC 384-4/CECC 30 300
$U_R = 6.3$ to 25 V	GP grade	LL grade
$U_R = 40$ to 100 V	LL grade	LL grade
Detail specification	similar to DIN 45910-T126 (without approval), former DIN 41316 - with reduced dimensions	
Climatic category IEC 68 DIN 40040	40/085/56 GPF	

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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
0.22						4.5 x 10	
0.47						4.5 x 10	
1						4.5 x 10	4.5 x 10
1.5						4.5 x 10	
2.2						4.5 x 10	4.5 x 10
3.3						4.5 x 10	
4.7						4.5 x 10	4.5 x 10
6.8						4.5 x 10	4.5 x 10
10						4.5 x 10	6 x 10
15						4.5 x 10	8 x 11 6.5 x 18
22					4.5 x 10	6 x 10	8 x 11 6.5 x 18
33						6 x 10	6.5 x 18
47				4.5 x 10	6 x 10	8 x 11 6.5 x 18	8 x 18 6.5 x 25
68			4.5 x 10			8 x 11 6.5 x 18	10 x 18
100		4.5 x 10		6 x 10	8 x 11 6.5 x 18	8 x 18 6.5 x 25	10 x 25 10 x 30
150			6 x 10	8 x 11 6.5 x 18	8 x 18 6.5 x 25	10 x 18	12.5 x 30
220		6 x 10	8 x 11	6.5 x 18	10 x 18	10 x 25 10 x 30	12.5 x 30
330		8 x 11	6.5 x 18	8 x 18 6.5 x 25	10 x 25	12.5 x 30	15 x 30
470	8 x 11	6.5 x 18	8 x 18 6.5 x 25	10 x 18	10 x 25 10 x 30	12.5 x 30	18 x 30
680		8 x 18 6.5 x 25	10 x 18	10 x 25 10 x 30	12.5 x 30	15 x 30	18 x 40
1000	8 x 18 6.5 x 25	10 x 18	10 x 25 10 x 30	12.5 x 30	12.5 x 30	18 x 30	21 x 40
1500		10 x 25 10 x 30	12.5 x 30	12.5 x 30	15 x 30	18 x 40	
2200	10 x 25	12.5 x 30	12.5 x 30	15 x 30	18 x 30	21 x 40	
3300		12.5 x 30	15 x 30	18 x 30	18 x 40		
4700		15 x 30	18 x 30	18 x 40	21 x 40		
6800		18 x 30	18 x 40	21 x 40			
10 000		18 x 40	21 x 40				
15 000		21 x 40					

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MECHANICAL DATA, AVAILABLE FORMS and PACKING QUANTITIES

Dimensions in mm.

Tape dimensions are specified in chapter "PACKING".

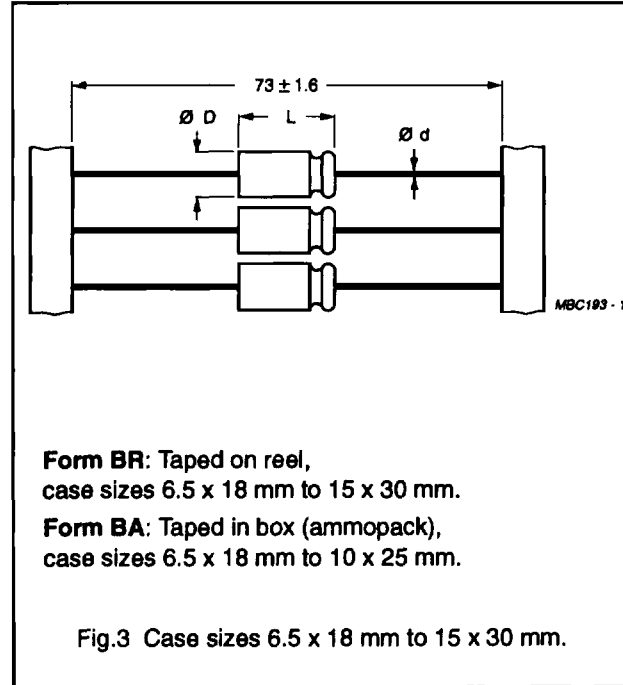
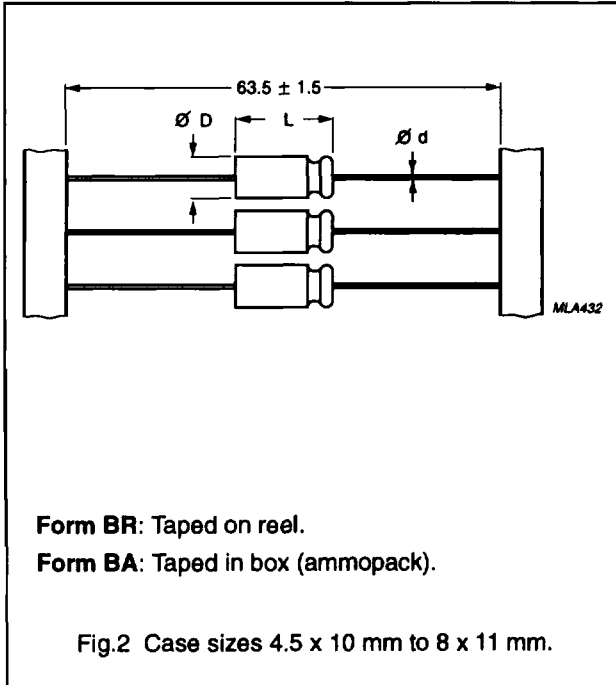


Table 2 Axial, dimensions in mm; mass in g

CASE SIZE Ø D _{nom} x L _{nom}	CASE CODE	AXIAL: Form AA, BA, and BR					APPROX. MASS	PACKING QUANTITIES		
		Ø d	l	Ø D _{max}	L _{max}	F _{min}		Form AA	Form BA	Form BR
4.5 x 10	2	0.6	-	5.0	10.5	15	0.50	-	1000	3000
6 x 10	3	0.6	-	6.3	10.5	15	0.70	-	1000	1000
8 x 11	5a	0.6	-	8.5	11.5	15	1.1	-	500	500
6.5 x 18	4	0.8	-	6.9	18.5	25	1.3	-	1000	1000
8 x 18	5	0.8	-	8.5	18.5	25	1.7	-	500	500
6.5 x 25	4L	0.8	-	6.9	25.0	30	1.9	-	1000	1000
10 x 18	6	0.8	-	10.5	18.5	25	2.5	-	500	500
10 x 25	7	0.8	-	10.5	25.0	30	3.3	-	500	500
10 x 30	00	0.8	55 ± 1	10.5	30.5	35	4.8	200	-	500
12.5 x 30	01	0.8	55 ± 1	13.0	30.5	35	7.4	200	-	400
15 x 30	02	0.8	55 ± 1	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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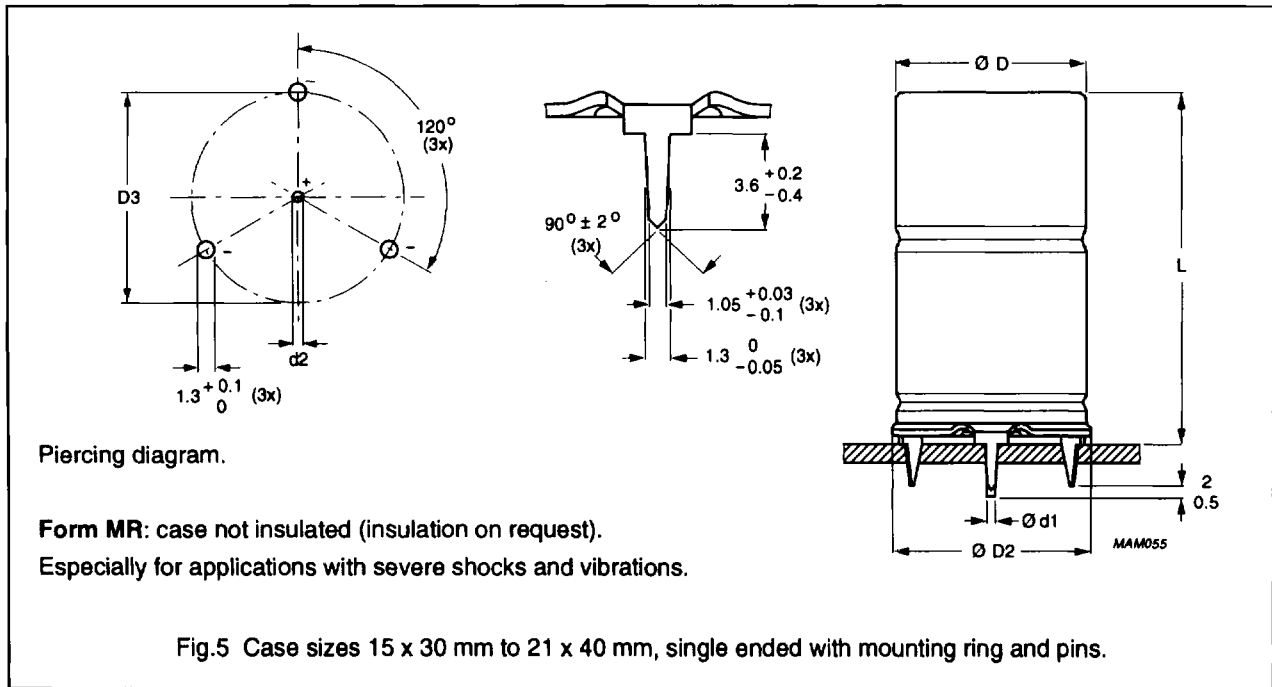
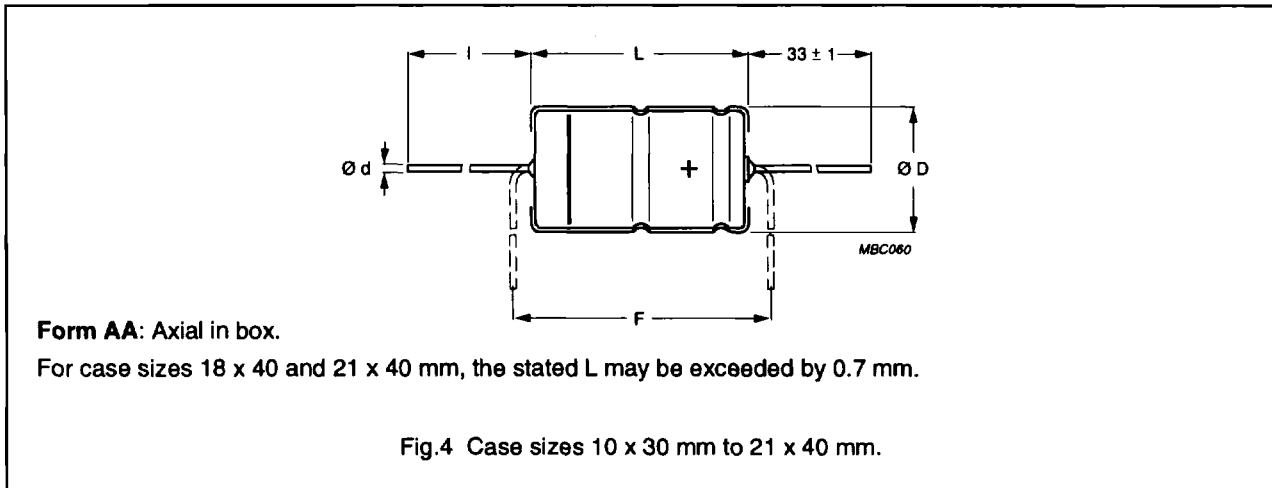


Table 3 Single ended, dimensions in mm; mass in g

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 D2 _{max}	D3	L _{max}		
15 x 30	02	0.8	1.0 +0.1	17.5	16.5 ±0.2	33	11.7	200
18 x 30	03	0.8	1.0 +0.1	19.5	18.5 ±0.2	33	12.9	200
18 x 40	04	1.0	1.3 +0.1	19.5	18.5 ±0.2	45	19.4	100
21 x 40	05	1.0	1.3 +0.1	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 $T_{amb} = 20\text{ °C}$, $P = 86\text{ to }106\text{ kPa}$, $RH = 45\text{ to }75\%$.

- C_R = rated capacitance at 100 Hz, tolerance $\pm 20\%$
 I_R = rated 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 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 10 kHz (Ω)
6.3	470	8 x 11	260	22	10	0.25	0.85	0.64
	1000	8 x 18	440	42	17	0.25	0.4	0.5
	1000	6.5 x 25	420	42	17	0.30	0.48	0.5
	2200	10 x 25	710	87	32	0.29	0.21	0.16
10	100	4.5 x 10	100	10	6	0.20	3.2	2.0
	220	6 x 10	160	17	8.4	0.20	1.5	0.91
	330	8 x 11	230	24	11	0.20	1.0	0.61
	470	6.5 x 18	310	32	13	0.20	0.68	0.43
	680	8 x 18	400	45	18	0.20	0.47	0.29
	680	6.5 x 25	420	45	18	0.20	0.47	0.29
	1000	10 x 18	550	64	24	0.20	0.32	0.20
	1500	10 x 25	690	94	34	0.23	0.25	0.18
	1500	10 x 30	740	94	34	0.23	0.245	0.18
	2200	12.5 x 30	800	136	48	0.25	0.177	0.095
	3300	12.5 x 30	1000	202	70	0.27	0.128	0.095
	4700	15 x 30	1180	286	98	0.29	0.100	0.07
	6800	18 x 30	1480	412	140	0.34	0.079	0.065
	10 000	18 x 40	1860	604	204	0.40	0.064	0.04
15 000	21 x 40	2250	904	304	0.50	0.054	0.035	

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ORDERING INFORMATION

Ordering Example

Electrolytic Capacitor ASM 021
 1000 µF/16 V; ±20%
 Case size 10 x 25; Form BR
 Catalogue number: 2222 021 90517

Table 5

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
6.3	470	8 x 11	5a	-	021 23471	021 33471	-
	1000	8 x 18	5	-	021 23102	021 33102	-
	1000	6.5 x 25	4L	-	021 90592	021 90593	-
	2200	10 x 25	7	-	021 90588	021 90589	-
10	100	4.5 x 10	2	-	021 24101	021 34101	-
	220	6 x 10	3	-	021 24221	021 34221	-
	330	8 x 11	5a	-	021 24331	021 34331	-
	470	6.5 x 18	4	-	021 24471	021 34471	-
	680	8 x 18	5	-	021 24681	021 34681	-
	680	6.5 x 25	4L	-	021 90594	021 90595	-
	1000	10 x 18	6	-	021 24102	021 34102	-
	1500	10 x 25	7	-	021 90524	021 90525	-
	1500	10 x 30	00	021 14152	021 24152	-	-
	2200	12.5 x 30	01	021 14222	021 24222	-	-
	3300	12.5 x 30	01	021 14332	021 24332	-	-
	4700	15 x 30	02	021 14472	021 24472	-	021 44472
	6800	18 x 30	03	021 14682	-	-	021 44682
	10 000	18 x 40	04	021 14103	-	-	021 44103
15 000	21 x 40	05	021 14153	-	-	021 44153	

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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)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)
16	68	4.5 x 10	90	11	6.2	0.16	3.8	2.4
	150	6 x 10	140	18	8.8	0.16	1.7	1.1
	220	8 x 11	210	25	11	0.16	1.2	0.73
	330	6.5 x 18	290	36	15	0.16	0.77	0.48
	470	8 x 18	380	49	19	0.16	0.55	0.34
	470	6.5 x 25	400	49	19	0.16	0.55	0.34
	680	10 x 18	500	69	26	0.16	0.38	0.24
	1000	10 x 25	660	100	36	0.16	0.26	0.18
	1000	10 x 30	700	100	36	0.16	0.260	0.175
	1500	12.5 x 30	740	148	52	0.19	0.205	0.095
	2200	12.5 x 30	890	216	74	0.21	0.150	0.095
	3300	15 x 30	1130	321	110	0.23	0.111	0.07
	4700	18 x 30	1410	455	154	0.25	0.087	0.065
	6800	18 x 40	1780	656	222	0.30	0.070	0.04
10 000	21 x 40	2170	964	324	0.36	0.058	0.035	
25	47	4.5 x 10	80	11	6.4	0.14	4.8	2.6
	100	6 x 10	150	19	9	0.14	2.3	1.2
	150	8 x 11	190	27	12	0.14	1.5	0.80
	150	6.5 x 18	210	27	12	0.14	1.5	0.80
	220	6.5 x 18	250	37	15	0.14	1.0	0.55
	330	8 x 18	340	54	21	0.14	0.68	0.36
	330	6.5 x 25	350	54	21	0.14	0.68	0.36
	470	10 x 18	450	75	28	0.14	0.48	0.26
	680	10 x 25	560	106	38	0.14	0.33	0.18
	680	10 x 30	640	106	38	0.14	0.323	0.175
	1000	12.5 x 30	720	154	54	0.14	0.220	0.095
	1500	12.5 x 30	790	229	79	0.17	0.179	0.095
	2200	15 x 30	1030	334	114	0.19	0.132	0.07
	3300	18 x 30	1310	499	169	0.21	0.099	0.065
	4700	18 x 40	1680	709	239	0.23	0.079	0.04
	6800	21 x 40	2070	1024	344	0.28	0.064	0.035

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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
16	68	4.5 x 10	2	-	021 25689	021 35689	-
	150	6 x 10	3	-	021 25151	021 35151	-
	220	8 x 11	5a	-	021 25221	021 35221	-
	330	6.5 x 18	4	-	021 25331	021 35331	-
	470	8 x 18	5	-	021 25471	021 35471	-
	470	6.5 x 25	4L	-	021 90596	021 90597	-
	680	10 x 18	6	-	021 25681	021 35681	-
	1000	10 x 25	7	-	021 90517	021 90518	-
	1000	10 x 30	00	021 15102	021 25102	-	-
	1500	12.5 x 30	01	021 15152	021 25152	-	-
	2200	12.5 x 30	01	021 15222	021 25222	-	-
	3300	15 x 30	02	021 15332	021 25332	-	021 45332
	4700	18 x 30	03	021 15472	-	-	021 45472
	6800	18 x 40	04	021 15682	-	-	021 45682
	10 000	21 x 40	05	021 15103	-	-	021 45103
25	47	4.5 x 10	2	-	021 26479	021 36479	-
	100	6 x 10	3	-	021 26101	021 36101	-
	150	8 x 11	5a	-	021 90534	021 90535	-
	150	6.5 x 18	4	-	021 26151	021 36151	-
	220	6.5 x 18	4	-	021 26221	021 36221	-
	330	8 x 18	5	-	021 26331	021 36331	-
	330	6.5 x 25	4L	-	021 90598	021 90599	-
	470	10 x 18	6	-	021 26471	021 36471	-
	680	10 x 25	7	-	021 90527	021 90528	-
	680	10 x 30	00	021 16681	021 26681	-	-
	1000	12.5 x 30	01	021 16102	021 26102	-	-
	1500	12.5 x 30	01	021 16152	021 26152	-	-
	2200	15 x 30	02	021 16222	021 26222	-	021 46222
	3300	18 x 30	03	021 16332	-	-	021 46332
	4700	18 x 40	04	021 16472	-	-	021 46472
6800	21 x 40	05	021 16682	-	-	021 46682	

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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 10 kHz (Ω)
40	22	4.5 x 10	60	9	5.8	0.11	8.0	3.2
	47	6 x 10	110	15	7.8	0.11	3.8	1.5
	100	8 x 11	170	28	12	0.11	1.8	0.70
	100	6.5 x 18	190	28	12	0.11	1.8	0.70
	150	8 x 18	250	40	16	0.11	1.1	0.47
	150	6.5 x 25	260	40	16	0.11	1.1	0.47
	220	10 x 18	330	57	22	0.11	0.8	0.32
	330	10 x 25	430	83	30	0.11	0.53	0.21
	470	10 x 25	520	117	42	0.11	0.37	0.18
	470	10 x 30	570	117	42	0.12	0.404	0.175
	680	12.5 x 30	620	167	58	0.12	0.297	0.095
	1000	12.5 x 30	770	244	84	0.12	0.190	0.095
	1500	15 x 30	930	364	124	0.15	0.159	0.07
	2200	18 x 30	1200	532	180	0.17	0.118	0.065
	3300	18 x 40	1550	796	268	0.19	0.090	0.04
	4700	21 x 40	1880	1132	380	0.21	0.072	0.035

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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
40	22	4.5 x 10	2	-	021 27229	021 37229	-
	47	6 x 10	3	-	021 27479	021 37479	-
	100	8 x 11	5a	-	021 90537	021 90538	-
	100	6.5 x 18	4	-	021 27101	021 37101	-
	150	8 x 18	5	-	021 27151	021 37151	-
	150	6.5 x 25	4L	-	021 90601	021 90602	-
	220	10 x 18	6	-	021 27221	021 37221	-
	330	10 x 25	7	-	021 27331	021 37331	-
	470	10 x 25	7	-	021 90514	021 90515	-
	470	10 x 30	00	021 17471	021 27471	-	-
	680	12.5 x 30	01	021 17681	021 27681	-	-
	1000	12.5 x 30	01	021 17102	021 27102	-	-
	1500	15 x 30	02	021 17152	021 27152	-	021 47152
	2200	18 x 30	03	021 17222	-	-	021 47222
	3300	18 x 40	04	021 17332	-	-	021 47332
	4700	21 x 40	05	021 17472	-	-	021 47472

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U_R (V)	C_R 100 Hz (μ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (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 10 kHz (Ω)
63	0.22	4.5 x 10	5	4.1	4	0.09	650	250
	0.47	4.5 x 10	8	4.2	4.1	0.09	310	120
	1	4.5 x 10	12	4.4	4.1	0.09	150	55
	1.5	4.5 x 10	12	4.6	4.2	0.09	100	37
	2.2	4.5 x 10	21	4.8	4.3	0.09	65	25
	3.3	4.5 x 10	25	5.2	4.4	0.09	44	17
	4.7	4.5 x 10	31	5.8	4.6	0.09	31	12
	6.8	4.5 x 10	31	6.6	4.9	0.09	21	8.1
	10	4.5 x 10	50	7.8	5.3	0.08	13	5.5
	15	4.5 x 10	55	9.5	5.9	0.08	8.5	3.7
	22	6 x 10	90	12	6.8	0.08	5.8	2.5
	33	6 x 10	100	16	8.2	0.08	3.9	1.7
	47	8 x 11	140	22	10	0.08	2.7	1.2
	47	6.5 x 18	150	22	10	0.08	2.7	1.2
	68	8 x 11	160	30	13	0.08	1.9	0.81
	68	6.5 x 18	170	30	13	0.08	1.9	0.81
	100	8 x 18	250	42	17	0.08	1.3	0.55
	100	6.5 x 25	260	42	17	0.08	1.3	0.55
	150	10 x 18	320	61	23	0.08	0.85	0.37
	220	10 x 25	430	88	32	0.08	0.60	0.25
	220	10 x 30	480	88	32	0.08	0.614	0.20
	330	12.5 x 30	530	129	46	0.08	0.409	0.14
	470	12.5 x 30	630	182	63	0.08	0.287	0.10
	680	15 x 30	830	261	90	0.08	0.199	0.080
	1000	18 x 30	1120	382	130	0.08	0.135	0.065
	1500	18 x 40	1350	571	193	0.11	0.122	0.04
	2200	21 x 40	1780	836	281	0.13	0.099	0.035

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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
63	0.22	4.5 x 10	2	-	021 28227	021 38227	-
	0.47	4.5 x 10	2	-	021 28477	021 38477	-
	1	4.5 x 10	2	-	021 28108	021 38108	-
	1.5	4.5 x 10	2	-	021 28158	021 38158	-
	2.2	4.5 x 10	2	-	021 28228	021 38228	-
	3.3	4.5 x 10	2	-	021 28338	021 38338	-
	4.7	4.5 x 10	2	-	021 28478	021 38478	-
	6.8	4.5 x 10	2	-	021 28688	021 38688	-
	10	4.5 x 10	2	-	021 28109	021 38109	-
	15	4.5 x 10	2	-	021 28159	021 38159	-
	22	6 x 10	3	-	021 28229	021 38229	-
	33	6 x 10	3	-	021 28339	021 38339	-
	47	8 x 11	5a	-	021 90541	021 90542	-
	47	6.5 x 18	4	-	021 28479	021 38479	-
	68	8 x 11	5a	-	021 90544	021 90545	-
	68	6.5 x 18	4	-	021 28689	021 38689	-
	100	8 x 18	5	-	021 28101	021 38101	-
	100	6.5 x 25	4L	-	021 90603	021 90604	-
	150	10 x 18	6	-	021 28151	021 38151	-
	220	10 x 25	7	-	021 90511	021 90512	-
	220	10 x 30	00	021 18221	021 28221	-	-
	330	12.5 x 30	01	021 18331	021 28331	-	-
	470	12.5 x 30	01	021 18471	021 28471	-	-
	680	15 x 30	02	021 18681	021 28681	-	021 48681
	1000	18 x 30	03	021 18102	-	-	021 48102
	1500	18 x 40	04	021 18152	-	-	021 48152
	2200	21 x 40	05	021 18222	-	-	021 48222

Aluminum Electrolytic Capacitors

Series 2222-021

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 δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)
100	1	4.5 x 10	14	4.6	4.6	0.08	130	90
	2.2	4.5 x 10	20	5.3	5.3	0.08	58	41
	4.7	4.5 x 10	30	7	7	0.08	27	19
	6.8	4.5 x 10	35	8	8	0.08	19	13
	10	6 x 10	65	10	10	0.08	13	9
	15	8 x 11	77	13	13	0.08	8.5	6
	15	6.5 x 18	85	13	13	0.08	8.5	6
	22	8 x 11	95	17	17	0.08	5.8	4.1
	22	6.5 x 18	100	17	17	0.08	5.8	4.1
	33	6.5 x 18	120	24	24	0.08	3.9	2.7
	47	8 x 18	160	32	32	0.08	2.7	1.9
	47	6.5 x 25	170	32	32	0.08	2.7	1.9
	68	10 x 18	220	45	45	0.08	1.9	1.3
	100	10 x 25	300	64	64	0.08	1.3	0.9
	100	10 x 30	360	64	64	0.07	1.150	1.0
	150	12.5 x 30	420	94	94	0.07	0.645	0.61
	220	12.5 x 30	460	136	136	0.08	0.610	0.56
	330	15 x 30	580	202	202	0.09	0.420	0.40
	470	18 x 30	740	286	286	0.09	0.310	0.29
	680	18 x 40	1050	412	412	0.09	0.195	0.18
1000	21 x 40	1260	604	604	0.10	0.160	0.15	

Aluminum Electrolytic Capacitors

Series 2222-021

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	1	4.5 x 10	2	-	021 29108	021 39108	-
	2.2	4.5 x 10	2	-	021 29228	021 39228	-
	4.7	4.5 x 10	2	-	021 29478	021 39478	-
	6.8	4.5 x 10	2	-	021 29688	021 39688	-
	10	6 x 10	3	-	021 29109	021 39109	-
	15	8 x 11	5a	-	021 90547	021 90548	-
	15	6.5 x 18	4	-	021 29159	021 39159	-
	22	8 x 11	5a	-	021 90551	021 90552	-
	22	6.5 x 18	4	-	021 29229	021 39229	-
	33	6.5 x 18	4	-	021 29339	021 39339	-
	47	8 x 18	5	-	021 29479	021 39479	-
	47	6.5 x 25	4L	-	021 90605	021 90606	-
	68	10 x 18	6	-	021 29689	021 39689	-
	100	10 x 25	7	-	021 90531	021 90532	-
	100	10 x 30	00	021 19101	021 29101	-	-
	150	12.5 x 30	01	021 19151	021 29151	-	-
	220	12.5 x 30	01	021 19221	021 29221	-	-
	330	15 x 30	02	021 19331	021 29331	-	021 49331
	470	18 x 30	03	021 19471	-	-	021 49471
	680	18 x 40	04	021 19681	-	-	021 49681
1000	21 x 40	05	021 19102	-	-	021 49102	

Aluminum Electrolytic Capacitors

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Voltage

Surge voltage for short periods

$$U_s \leq 1.15 \times U_R$$

Reverse voltage

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

Leakage current

After 1 minute at U_R

$$I_{L1} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$$

After 5 minutes at:

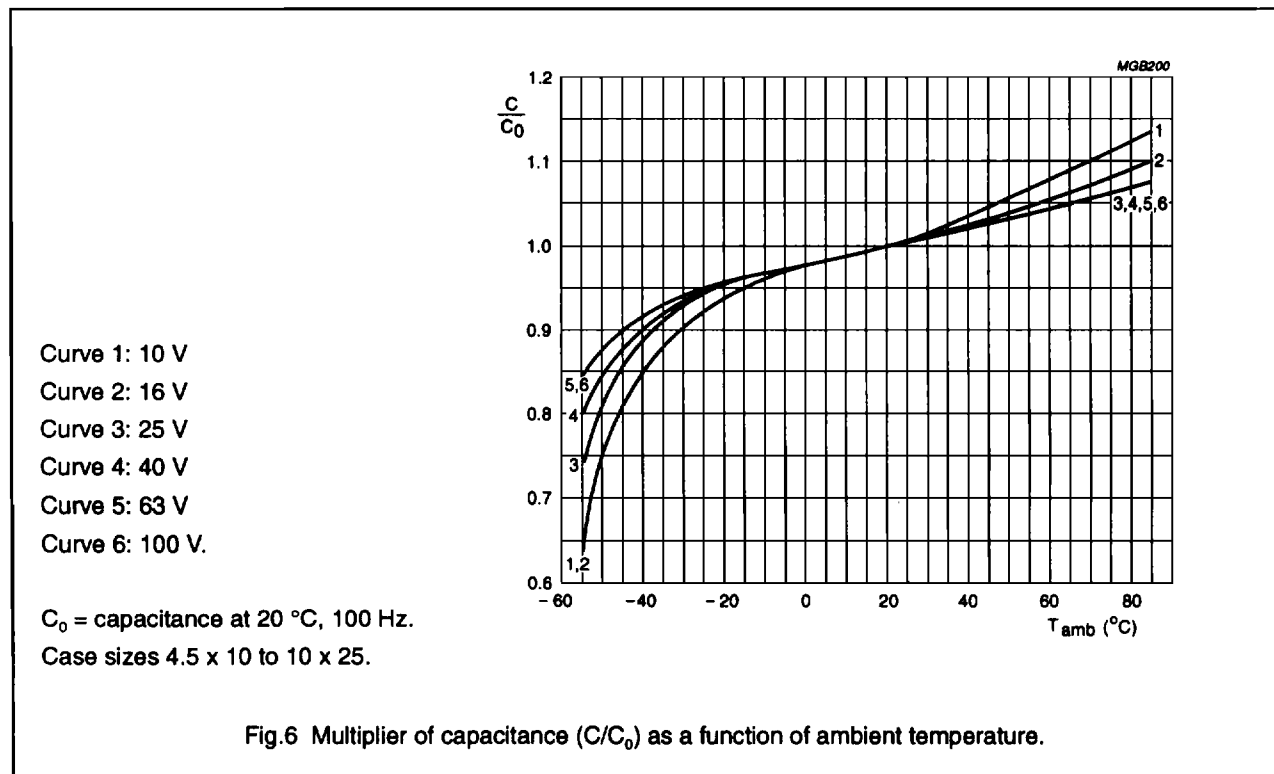
U_R (6.3 V to 63 V)

$$I_{L5} \leq 0.002 C_R \times U_R + 4 \mu\text{A}$$

U_R (100 V)

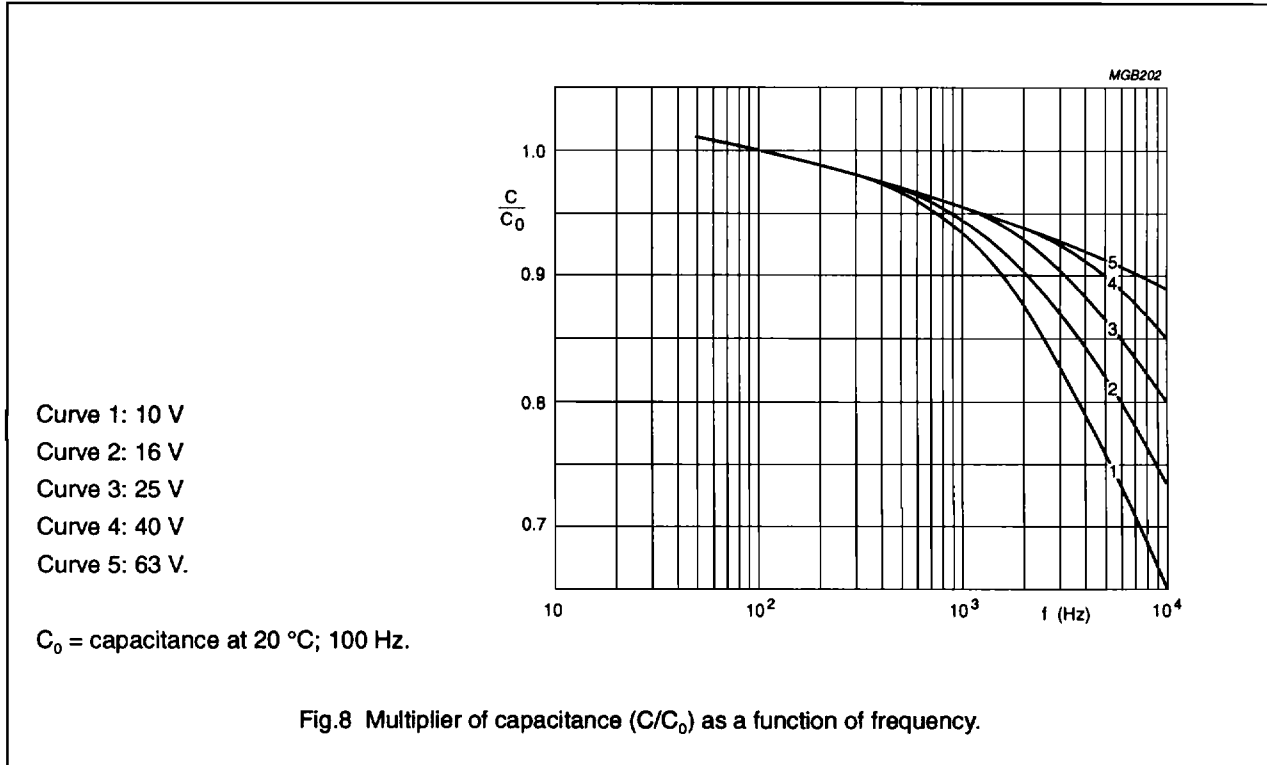
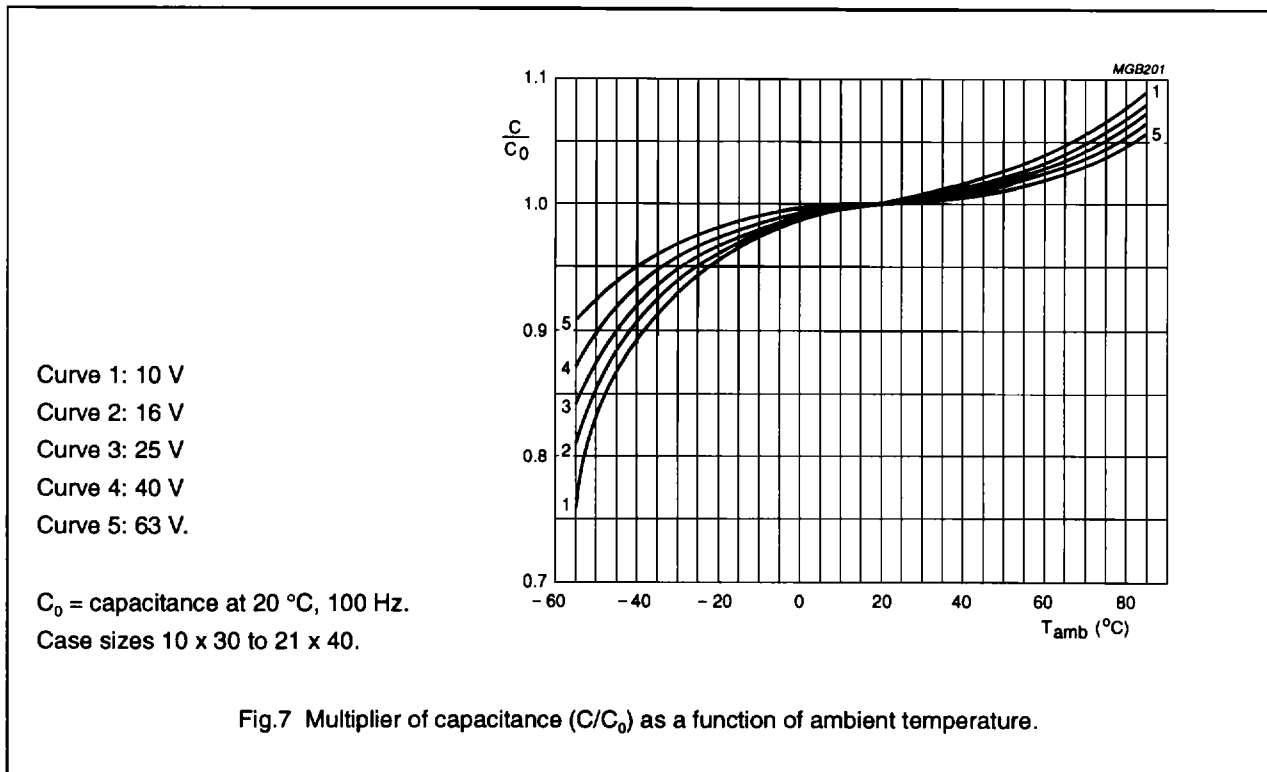
$$I_{L5} \leq 0.006 C_R \times U_R + 4 \mu\text{A}$$

Capacitance (C)



Aluminum Electrolytic Capacitors

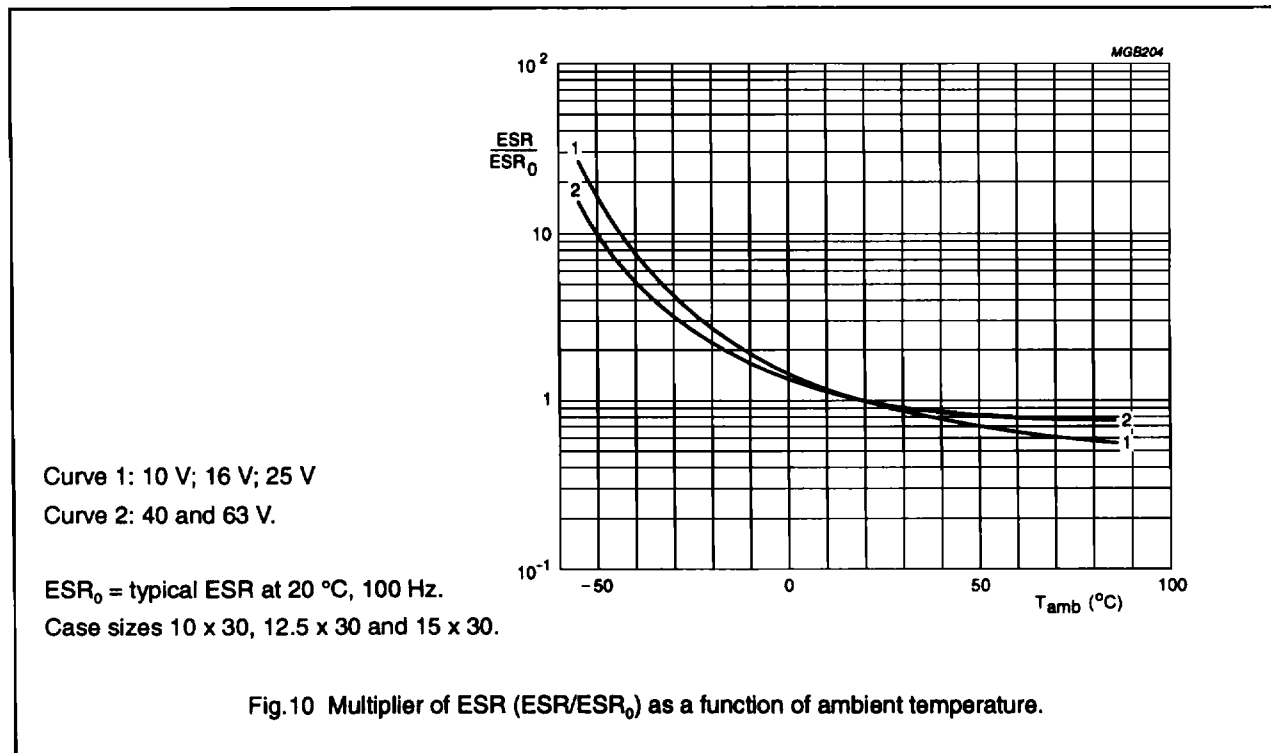
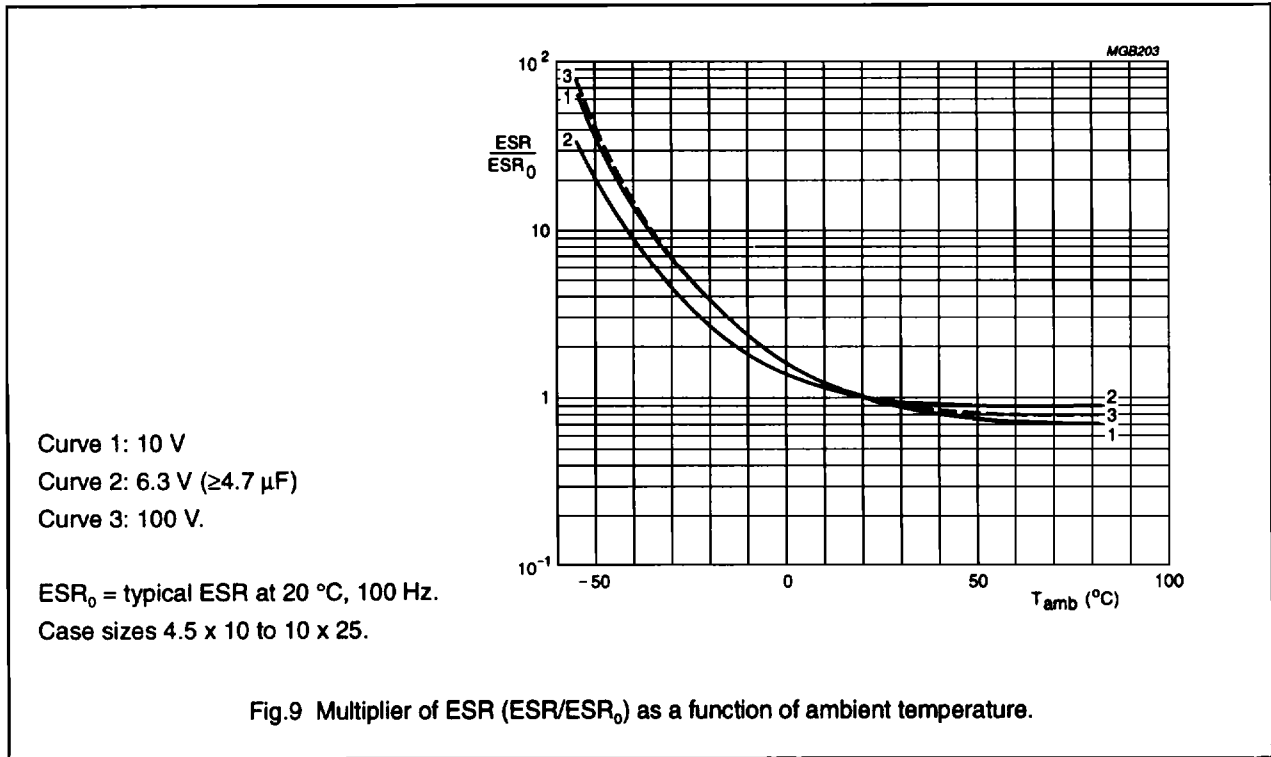
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Aluminum Electrolytic Capacitors

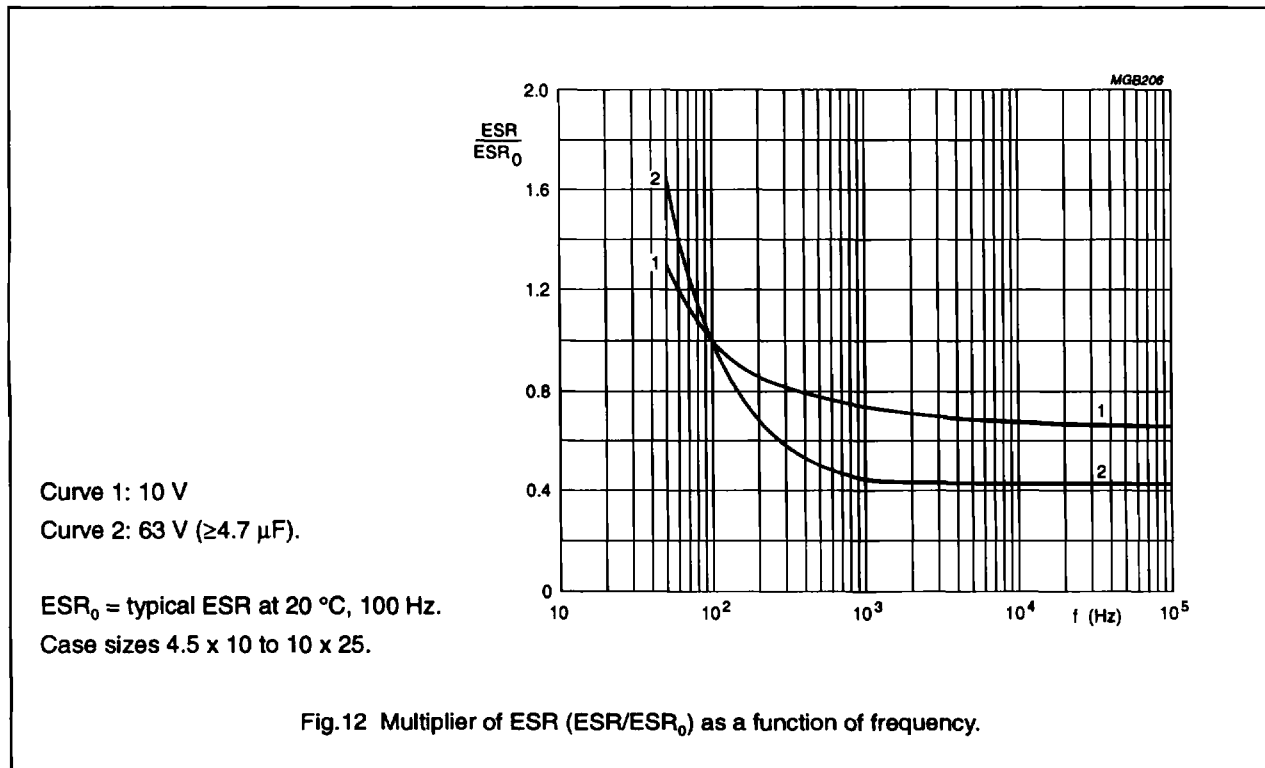
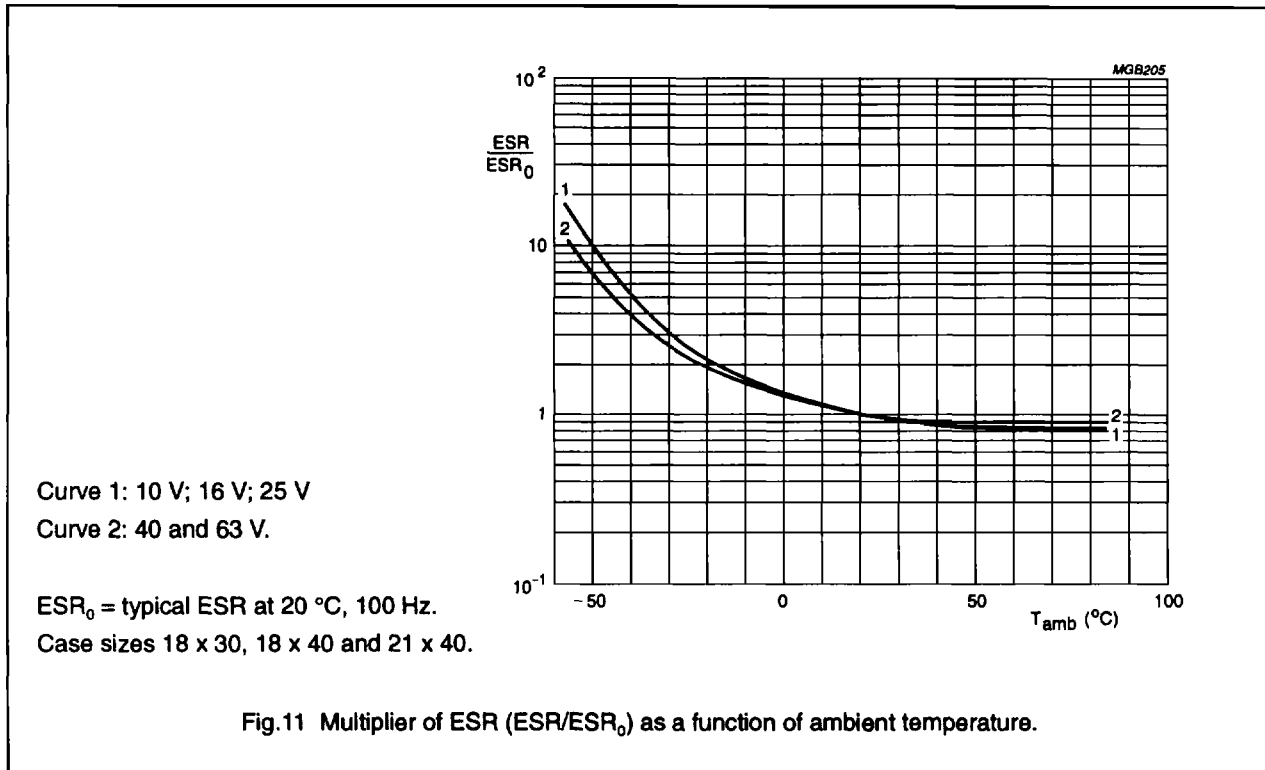
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Equivalent series resistance (ESR)



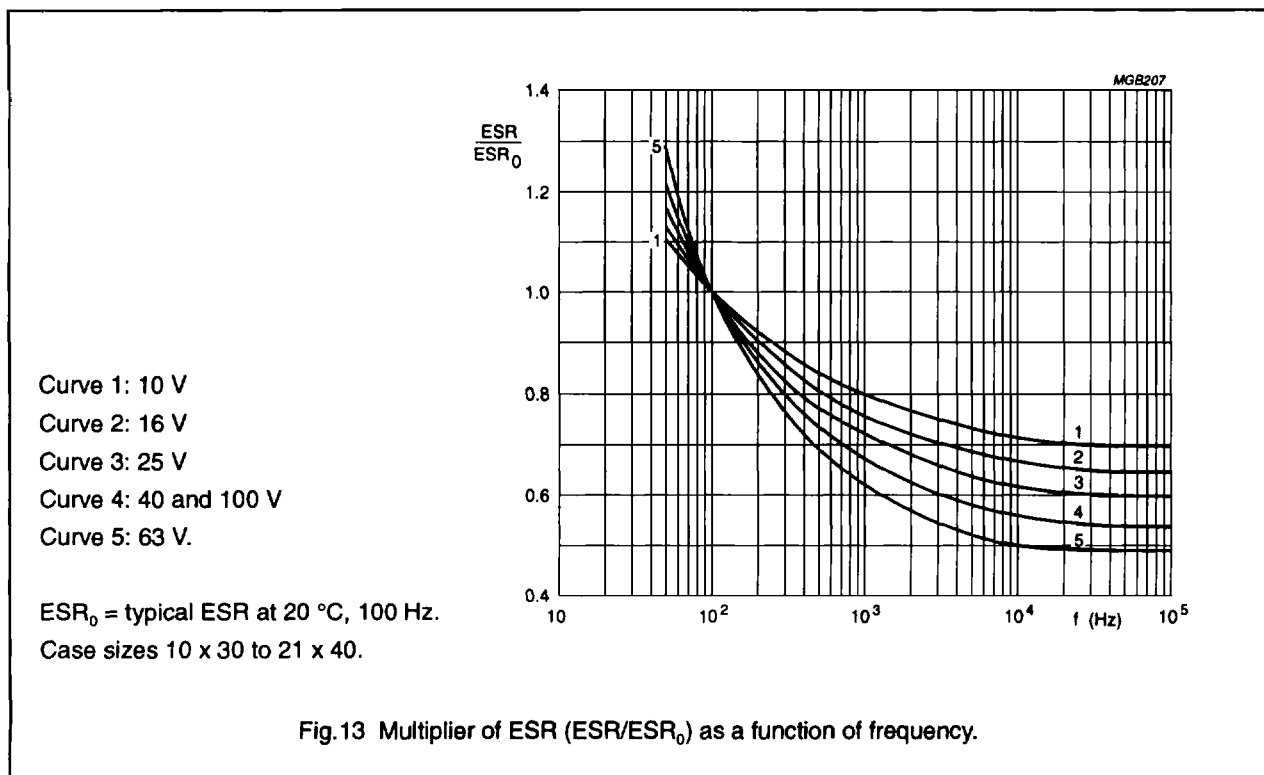
Aluminum Electrolytic Capacitors

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Equivalent series inductance (ESL)

Table 6 Equivalent series inductance, typical values

CASE SIZE (∅D x L in mm)	AXIAL (nH)	MOUNTING RING (nH)
4.5 x 10	10	—
6 x 10	22	—
8 x 11	85	—
6.5 x 18	25	—
8 x 18	40	—
6.5 x 25	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

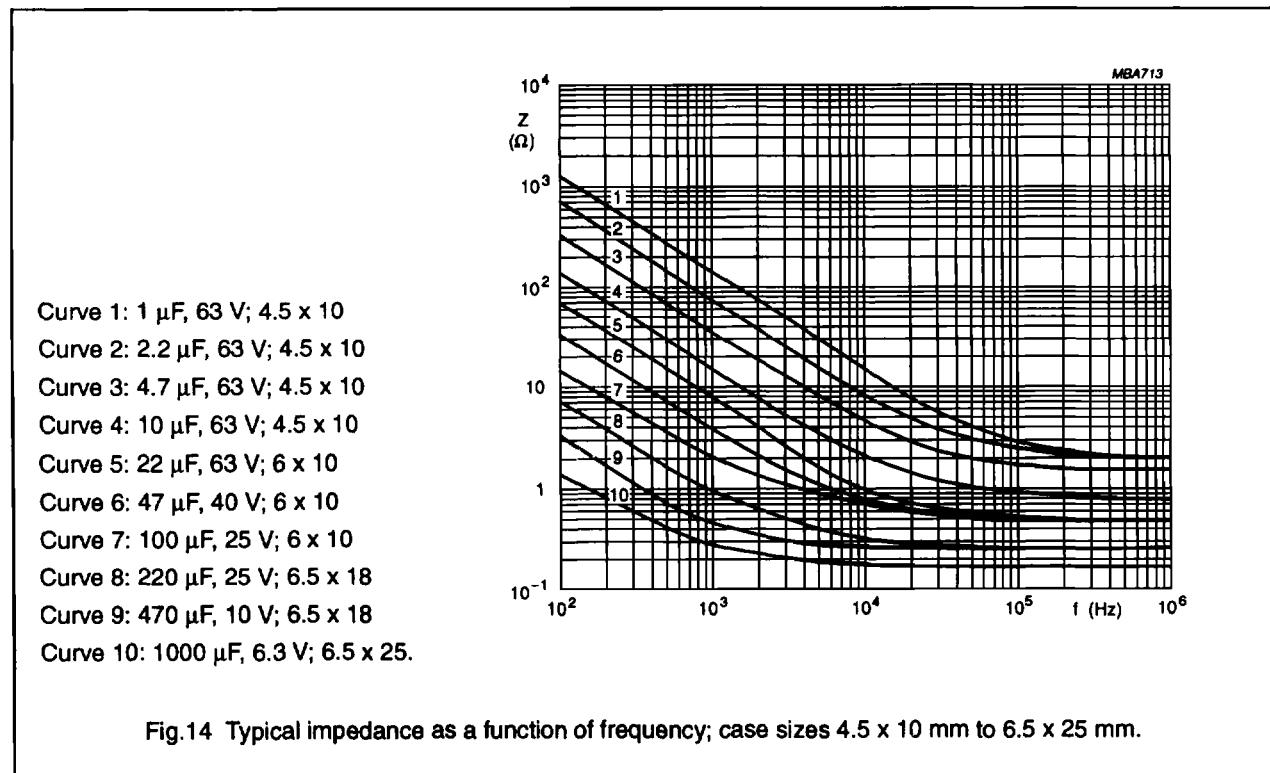
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Impedance (Z)

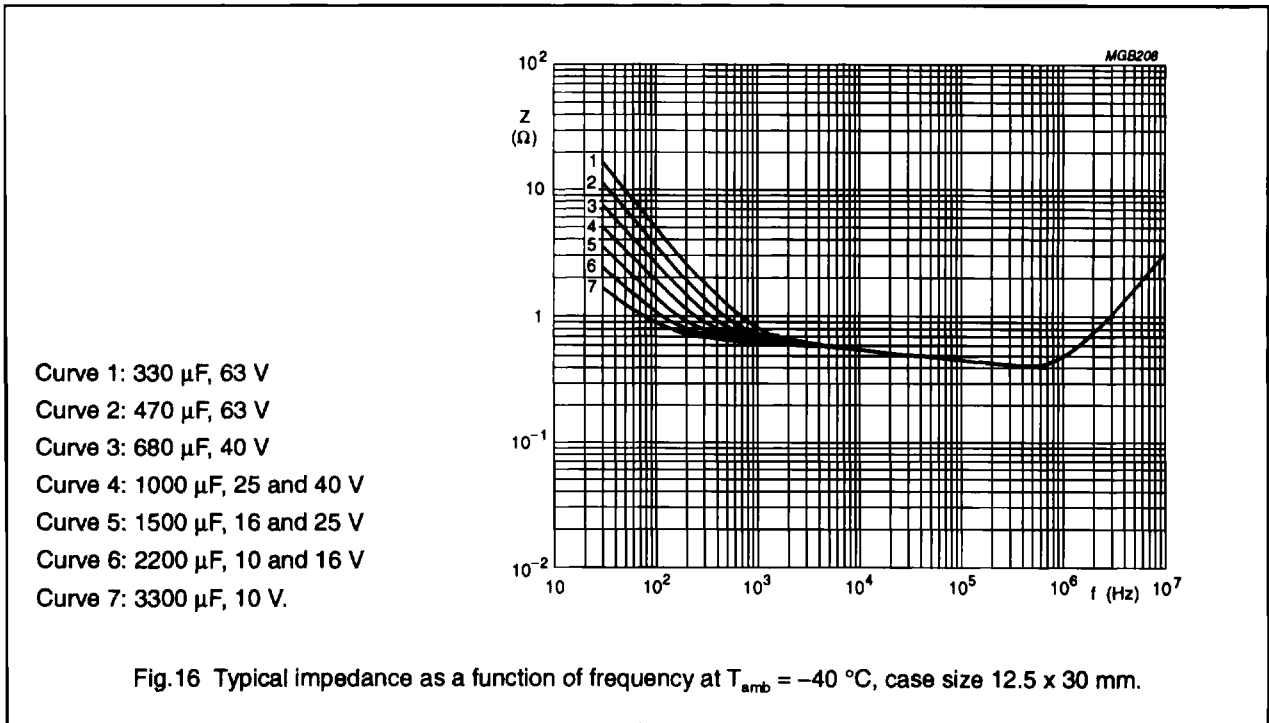
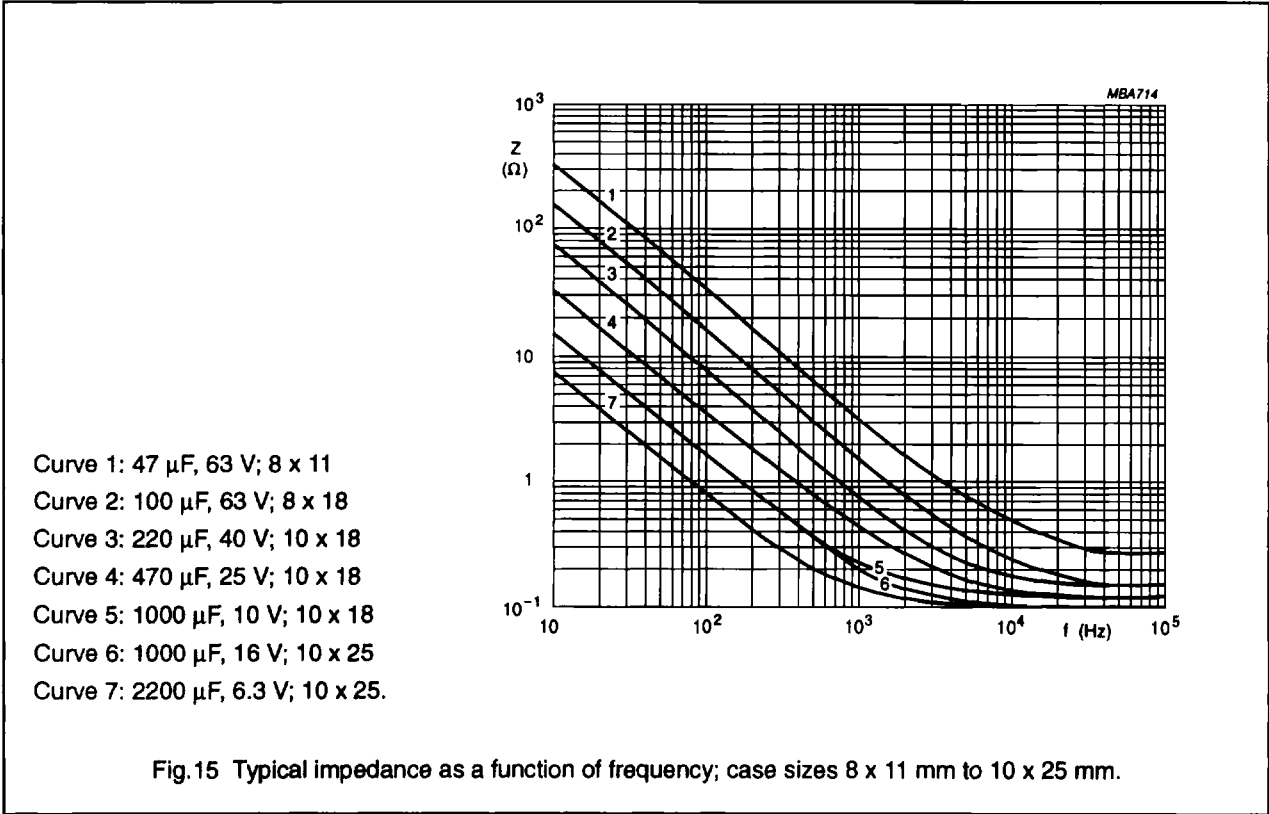
Table 7 Impedance x capacitance values (case sizes 4.5 x 10 mm to 10 x 25 mm)

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	≤ 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



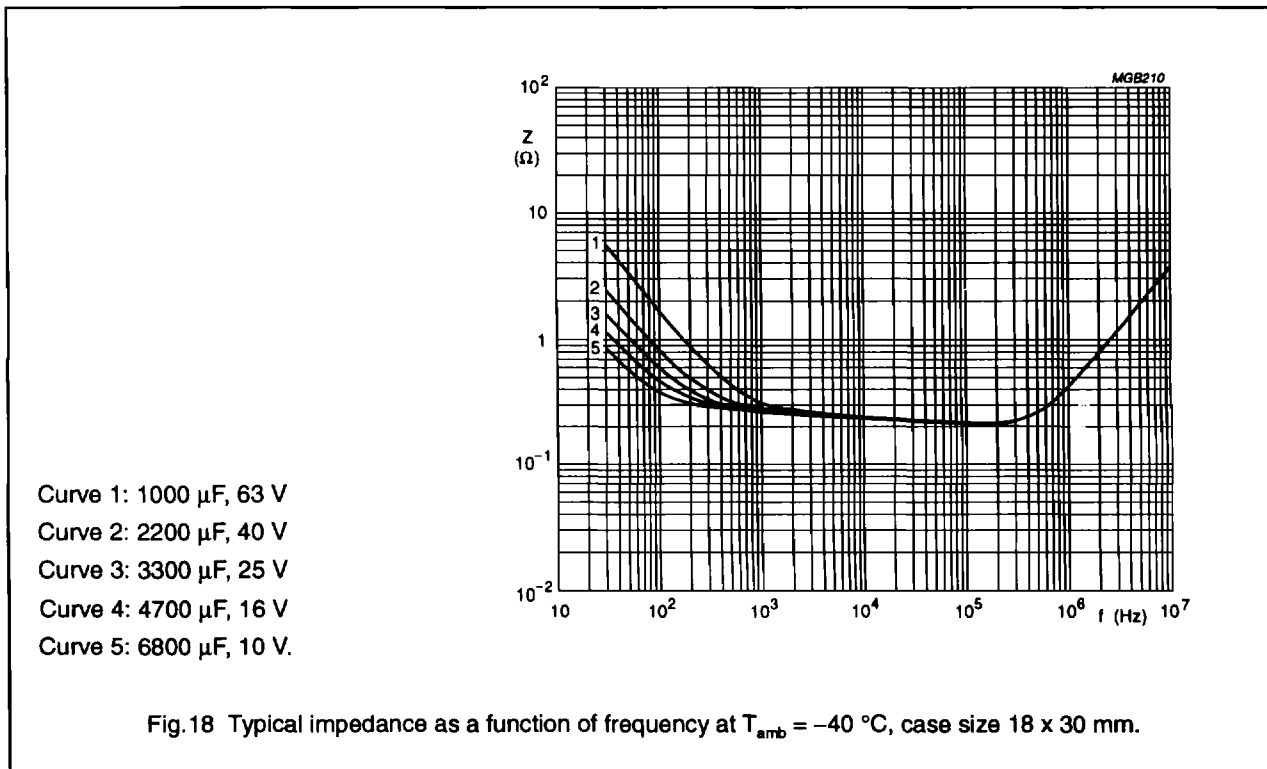
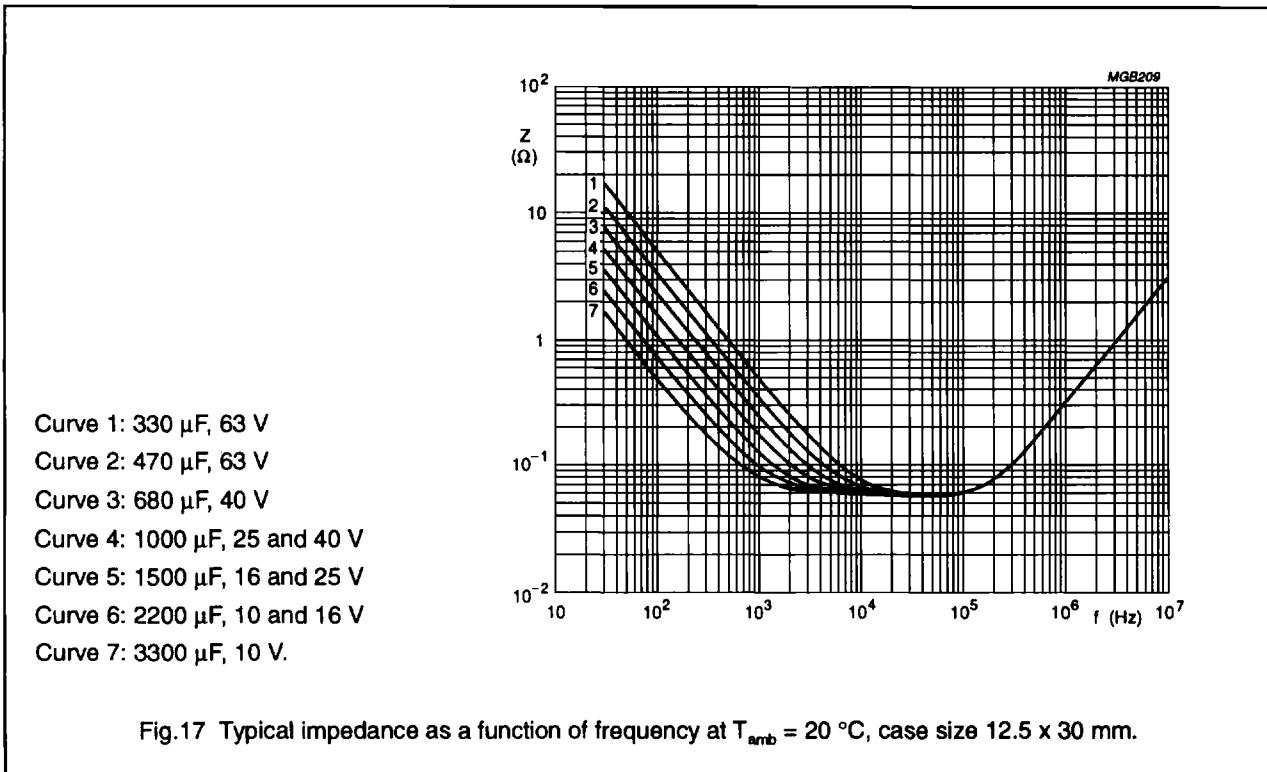
Aluminum Electrolytic Capacitors

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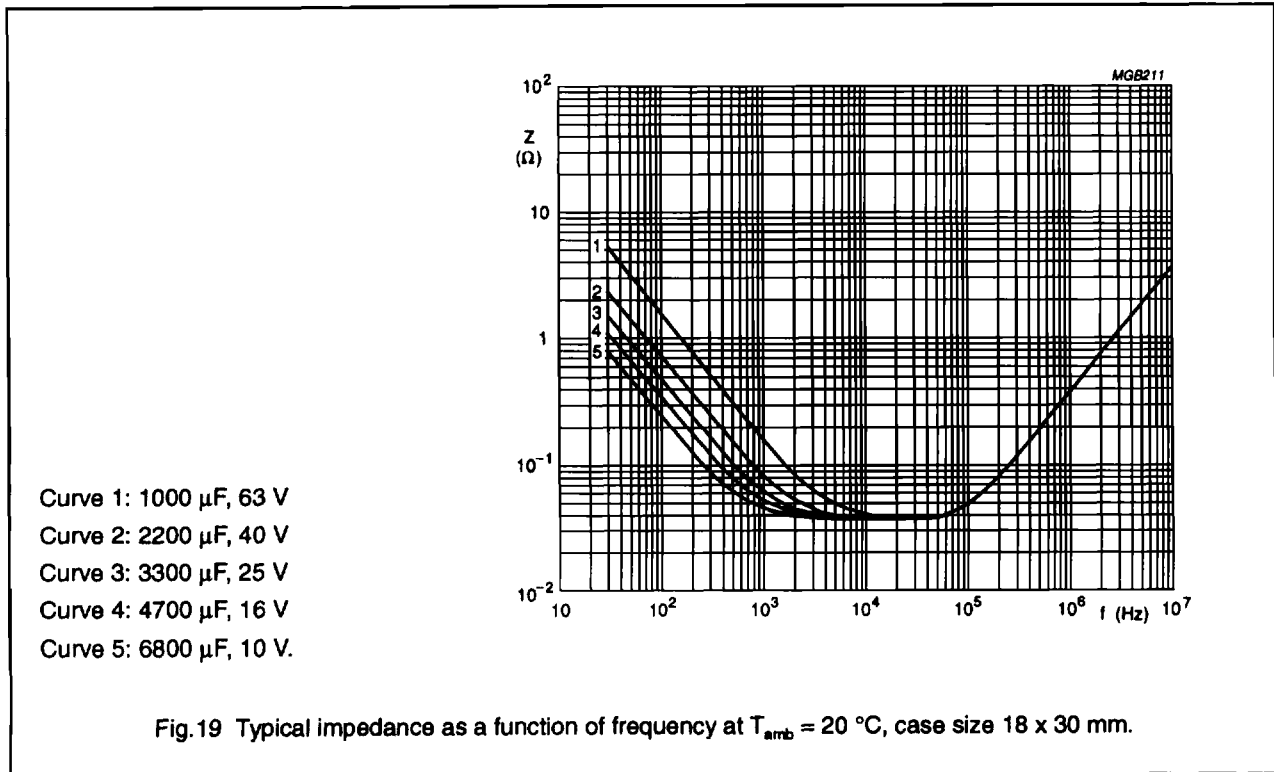
Aluminum Electrolytic Capacitors

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Aluminum Electrolytic Capacitors

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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 identify the negative terminal
- "+" - signs to identify the positive terminal (not for case sizes $L < 18\text{ mm}$).

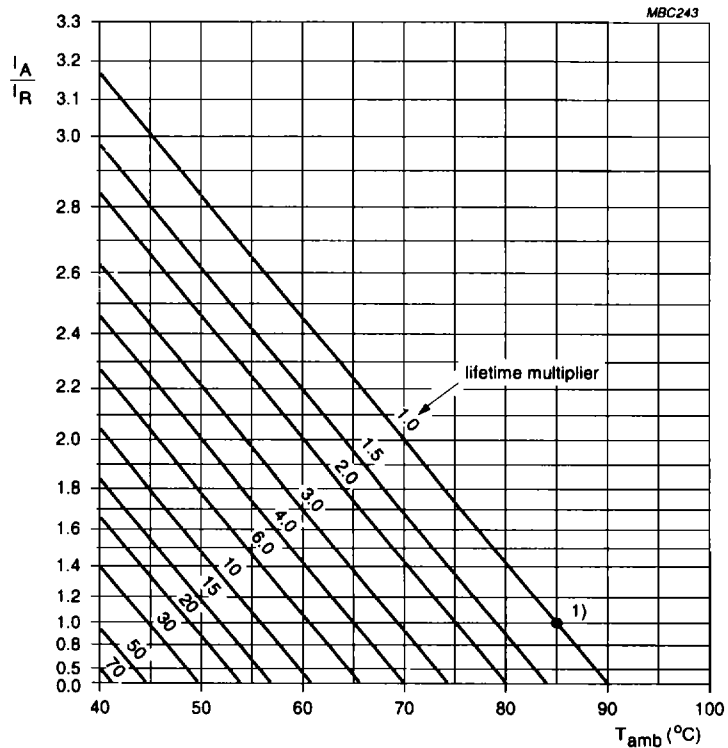
Aluminum Electrolytic Capacitors

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RIPPLE CURRENT and USEFUL LIFE

Table 8 Multiplier of ripple current (I_R/I_{RO}) as a function of frequency (I_{RO} = rated ripple current at 100 Hz and 85 °C)

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 6.3 \text{ V to } 16 \text{ V}$	$U_R = 25 \text{ V to } 40 \text{ V}$	$U_R = 63 \text{ V to } 100 \text{ V}$
50	0.95	0.9	0.85
100	1	1	1
300	1.07	1.12	1.2
1 000	1.12	1.2	1.3
3 000	1.15	1.25	1.35
$\geq 10\ 000$	1.2	1.3	1.4



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

Useful life at 85 °C and I_R applied:
 case sizes 4.5 x 10 mm to 10 x 25 mm: 2500 hours
 case sizes 10 x 30 mm to 21 x 40 mm: 8000 hours.

Fig.20 Multiplier of useful life as a function of ambient temperature and ripple current load (I_A/I_R).