

Non-solid Al - electrolytic capacitors

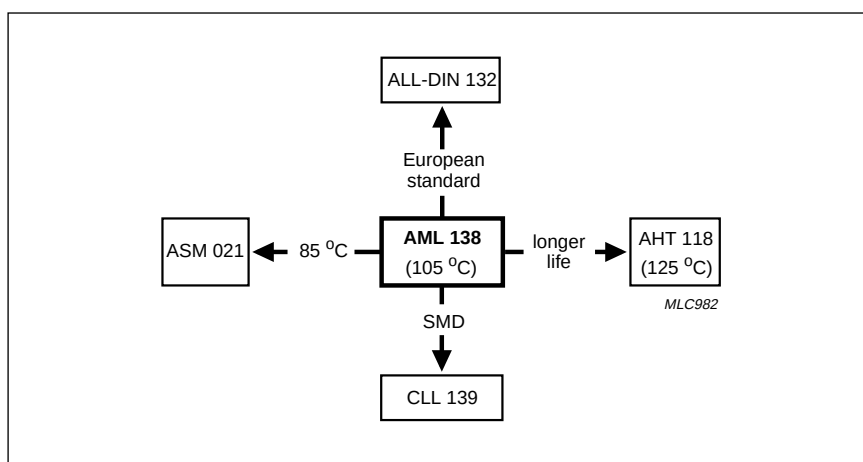
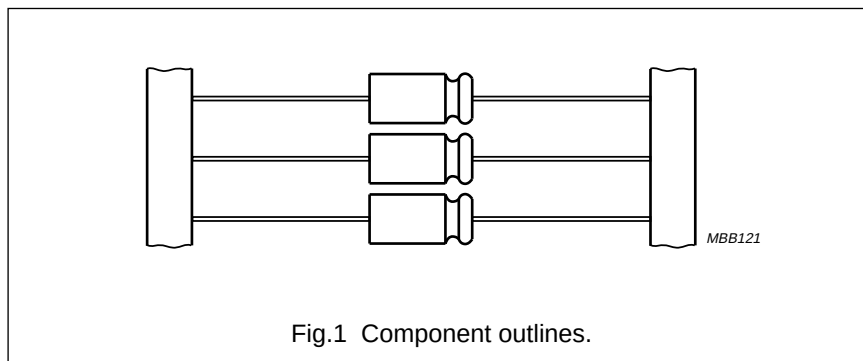
Axial Miniature Long-Life

AML 138**FEATURES**

- Polarized aluminium electrolytic capacitors, non-solid
- Axial leads, cylindrical aluminium case, insulated with a blue sleeve (case $\varnothing 6.3 \times 12.7$ and 7.7×12.7 mm are moulded with flame retardant plastic material)
- Mounting ring version (single ended) not insulated
- Case $\varnothing 10 \times 30$ to 21×40 mm with pressure relief
- Taped versions up to case $\varnothing 15 \times 30$ mm available for automatic insertion
- Charge and discharge proof
- Long useful life: 2000 to 5000 hours at 105 °C, high reliability
- High ripple current capability
- Miniaturized, high CV-product per unit volume.

APPLICATIONS

- Industrial, automotive, EDP and telecommunication
- Smoothing, filtering, buffering in SMPS; coupling, decoupling, timing



- Portable and mobile equipment (small size, low mass)
- Stand-by applications
- Low mounting height boards, vibration and shock resistant.

QUICK REFERENCE DATA

DESCRIPTION	VALUE	
Case sizes ($\varnothing D_{nom} \times L_{nom}$ in mm)	6.3×2.7 to 10×25	10×30 to 21×40
Rated capacitance range, C_R	1.0 to 15000 μF	
Tolerance on C_R	$\pm 20\%$	
Rated voltage range, U_R	6.3 to 100 V	
Category temperature range	-40 to +105 °C	
Endurance test at 105 °C	1000 hours	2 000 hours
Useful life at 105 °C	2000 hours	5000 hours
Useful life at 40 °C, I_R applied	$1.3 \times I_R$ applied: 200 000 hours	$1.7 \times I_R$ applied: 200 000 hours
Shelf life at 0 V, 105 °C	500 hours	500 hours
Based on sectional specification	IEC 384-4/CECC 30 300	
Climatic category IEC 68 (DIN 40040)	40/105/56 (GMF)	

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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	50	63	100
1.0	–	–	–	–	–	–	–	6.3 × 12.7
2.2	–	–	–	–	–	–	–	6.3 × 12.7
4.7	–	–	–	–	–	–	6.3 × 12.7	7.7 × 12.7
10	–	–	–	6.3 × 12.7	–	6.3 × 12.7	7.7 × 12.7	6.5 × 18
22	–	–	6.3 × 12.7	6.3 × 12.7	–	7.7 × 12.7	6.5 × 18	8 × 18
33	–	–	–	6.3 × 12.7	7.7 × 12.7	–	–	–
47	–	–	6.3 × 12.7	7.7 × 12.7	6.5 × 18	–	8 × 18	10 × 25
68	–	–	–	–	–	–	–	10 × 30
100	6.3 × 12.7	–	7.7 × 12.7	6.5 × 18	8 × 18	10 × 18	10 × 25	12.5 × 30
150	–	7.7 × 12.7	–	–	–	–	10 × 30	15 × 30
220	7.7 × 12.7	6.5 × 18	8 × 18	10 × 18	10 × 25	–	12.5 × 30	15 × 30
330	–	–	–	–	10 × 30	–	12.5 × 30	18 × 30
470	6.5 × 18	8 × 18	10 × 18	10 × 25	12.5 × 30	–	15 × 30	18 × 40
680	–	–	–	10 × 30	12.5 × 30	–	18 × 30	21 × 40
1000	10 × 18	10 × 25	10 × 30	12.5 × 30	15 × 30	–	18 × 40	–
1500	–	10 × 30	12.5 × 30	15 × 30	18 × 30	–	21 × 40	–
2200	10 × 25	12.5 × 30	15 × 30	18 × 30	18 × 40	–	–	–
3300	–	15 × 30	18 × 30	18 × 40	21 × 40	–	–	–
4700	–	18 × 30	18 × 30	18 × 40	–	–	–	–
6800	–	18 × 40	18 × 40	21 × 40	–	–	–	–
10000	–	18 × 40	21 × 40	–	–	–	–	–
15000	–	21 × 40	–	–	–	–	–	–

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MECHANICAL DATA, AVAILABLE FORMS AND PACKAGING QUANTITIES

Dimensions in mm.

Form BR: Taped on reel.

Form BA: Taped in box (ammopack).

Case $\varnothing D \times L = 6.3 \times 12.7$ and 7.7×12.7 mm.

For dimensions see Table 1.

Tape dimensions are specified in this handbook, section "Packaging".

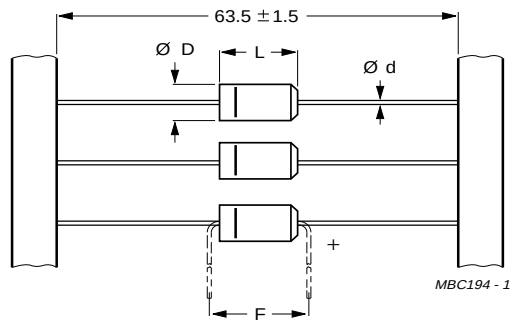


Fig.2 Dimensional outline; Forms BA and BR.

Dimensions in mm.

Form BR: Taped on reel,

case $\varnothing D \times L = 6.5 \times 18$ to 15×30 mm.

Form BA: Taped in box (ammopack),

case $\varnothing D \times L = 6.5 \times 18$ to 10×25 mm.

For dimensions see Table 1.

Tape dimensions are specified in this handbook, section "Packaging".

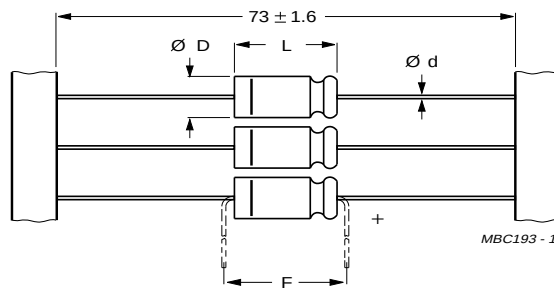


Fig.3 Dimensional outline; Forms BA and BR.

Dimensions in mm.

Form AA: Axial in box.

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

For dimensions see Table 1.

For case $\varnothing D \times L = 18 \times 40$ and 21×40 mm, the stated L may be exceeded by 0.7 mm.

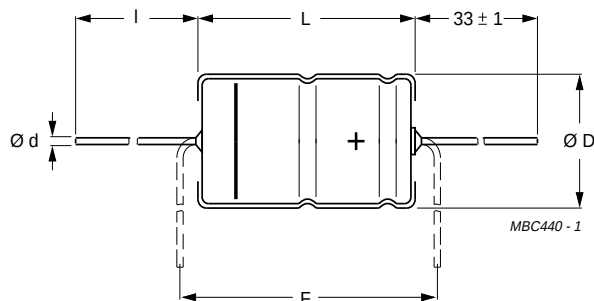


Fig.4 Dimensional outline; Form AA.

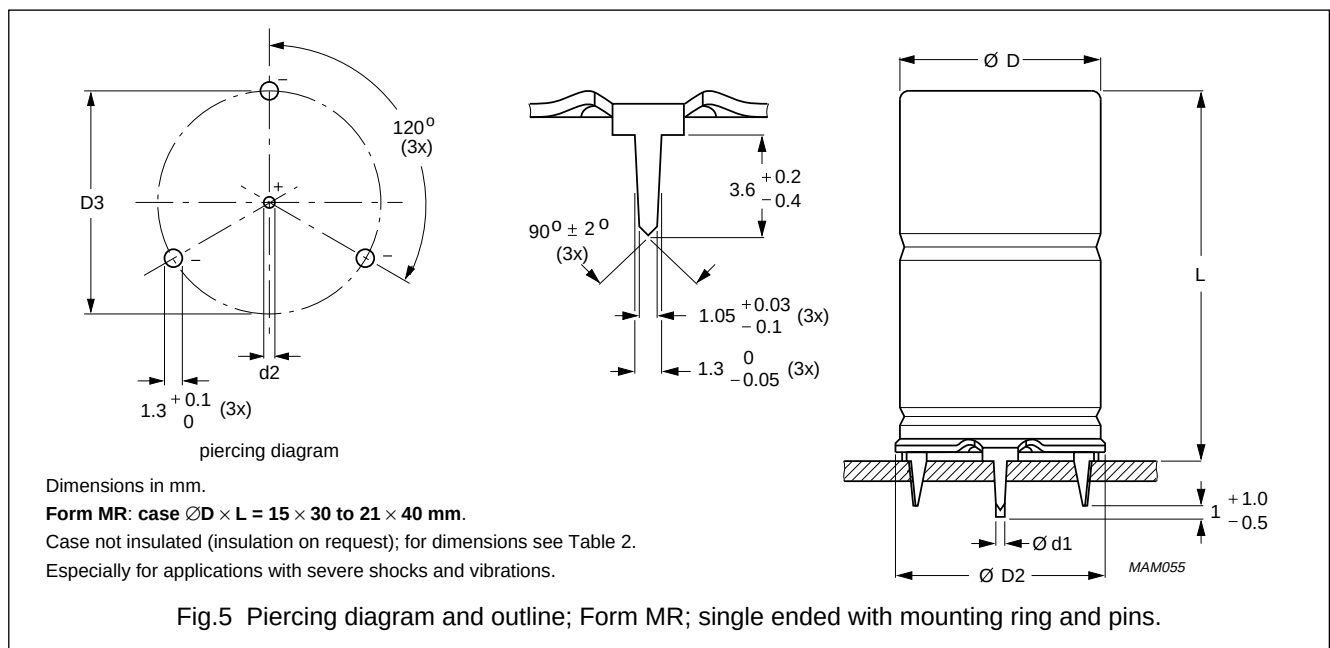
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Table 1 Axial; physical dimensions, mass and packaging quantities; see Figs 2, 3 and 4

NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	AXIAL: FORM AA, BA, and BR					MASS (g)	PACKAGING QUANTITIES		
		$\varnothing d$ (mm)	L (mm)	$\varnothing D_{\max}$ (mm)	$L_{\max}$ (mm)	$F_{\min}$ (mm)		FORM AA	FORM BA	FORM BR
6.3 × 12.7	(2)	0.6	—	6.5	12.9	17.5	≈1.1	—	1000	1000
7.7 × 12.7	(3)	0.6	—	7.9	12.9	17.5	≈1.3	—	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	—	—

**Table 2** Single ended; physical dimensions, 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)	$\varnothing D_{\max}$ (mm)	$\varnothing D2_{\max}$ (mm)	D3 (mm)	$L_{\max}$ (mm)		
15 × 30	02	0.8	1.0 +0.4	15.5	17.5	16.5 ±0.2	33	≈11.7	200
18 × 30	03	0.8	1.0 +0.4	18.5	19.5	18.5 ±0.2	33	≈12.9	200
18 × 40	04	0.8	1.0 +0.4	18.5	19.5	18.5 ±0.2	45	≈19.4	100
21 × 40	05	0.8	1.0 +0.4	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 Tables 3, 5, 7 and 9 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, tolerance $\pm 20\%$
I_R	rated RMS ripple current at 100 Hz, 105 °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 or 100 kHz

Table 3 Electrical data; preferred types in **bold**

U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 105 °C (mA)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	$\tan \delta$ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	Z 100 kHz (Ω)
6.3	100	6.3×12.7	99	16	5.3	0.24	3.8	3.0	1.8
	220	7.7×12.7	160	31	6.8	0.24	1.7	1.4	0.95
	470	6.5×18	250	22	9.9	0.24	0.81	0.64	0.5
	1000	10×18	430	42	17	0.24	0.38	0.30	0.24
	2200	10×25	640	87	32	0.29	0.21	0.18	0.15
10	150	7.7×12.7	140	33	7.0	0.2	2.1	1.3	0.95
	220	6.5×18	190	17	8.4	0.2	1.4	0.91	0.5
	470	8×18	300	32	13	0.2	0.68	0.43	0.35
	1000	10×25	520	64	24	0.2	0.32	0.20	0.16
	1500	10×30	560	94	34	0.26	0.27	0.18	0.15
	2200	12.5×30	750	140	48	0.27	0.14	0.13	0.12
	3300	15×30	990	200	70	0.28	0.10	0.1	0.094
	4700	18×30	1200	290	98	0.31	0.083	0.088	0.083
	6800	18×40	1700	410	140	0.32	0.056	0.049	0.069
	10000	18×40	1900	600	200	0.37	0.048	0.042	0.065
	15000	21×40	2200	900	300	0.51	0.044	0.038	0.063
16	22	6.3×12.7	58	10	4.7	0.12	8.7	7.3	2.7
	47	6.3×12.7	83	18	5.5	0.16	5.4	3.4	1.9
	100	7.7×12.7	130	35	7.2	0.16	2.5	1.6	1.0
	220	8×18	230	25	11	0.16	1.2	0.73	0.35
	470	10×18	360	49	19	0.16	0.54	0.34	0.25
	1000	10×30	530	100	36	0.19	0.29	0.20	0.18
	1500	12.5×30	730	150	52	0.19	0.20	0.14	0.13
	2200	15×30	950	210	74	0.21	0.15	0.105	0.103
	3300	18×30	1200	320	110	0.23	0.11	0.083	0.088

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ORDERING INFORMATION**Ordering example**

Electrolytic capacitor AML 138

470 μF /10 V; $\pm 20\%$ Nominal case size: $\varnothing 8 \times 18$; Form BA

Catalogue number: 2222 138 34471.

Table 4 Ordering information; preferred types in **bold**

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	100	6.3×12.7	(2)	—	138 23101	138 33101	—
	220	7.7×12.7	(3)	—	138 23221	138 33221	—
	470	6.5×18	4	—	138 23471	138 33471	—
	1000	10×18	6	—	138 23102	138 33102	—
	2200	10×25	7	—	138 23222	138 33222	—
10	150	7.7×12.7	(3)	—	138 24151	138 34151	—
	220	6.5×18	4	—	138 24221	138 34221	—
	470	8×18	5	—	138 24471	138 34471	—
	1000	10×25	7	—	138 24102	138 34102	—
	1500	10×30	00	138 14152	138 24152	—	—
	2200	12.5×30	01	138 14222	138 24222	—	—
	3300	15×30	02	138 14332	138 24332	—	138 44332
	4700	18×30	03	138 14472	—	—	138 44472
	6800	18×40	04	138 14682	—	—	138 44682
	10000	18×40	04	138 14103	—	—	138 44103
	15000	21×40	05	138 14153	—	—	138 44153
16	22	6.3×12.7	(2)	—	138 25229	138 35229	—
	47	6.3×12.7	(2)	—	138 25479	138 35479	—
	100	7.7×12.7	(3)	—	138 25101	138 35101	—
	220	8×18	5	—	138 25221	138 35221	—
	470	10×18	6	—	138 25471	138 35471	—
	1000	10×30	00	138 15102	138 25102	—	—
	1500	12.5×30	01	138 15152	138 25152	—	—
	2200	15×30	02	138 15222	138 25222	—	138 45222
	3300	18×30	03	138 15332	—	—	138 45332

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ELECTRICAL DATA (continued)**Table 5** Electrical data continued; preferred types in **bold**

U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 105 °C (mA)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	$\tan \delta$ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	Z 100 kHz (Ω)
16	4700	18 × 30	1400	450	150	0.28	0.093	0.073	0.082
	6800	18 × 40	1800	660	220	0.28	0.062	0.048	0.065
	10000	21 × 40	2100	960	320	0.35	0.055	0.044	0.063
25	10	6.3 × 12.7	46	8	4.5	0.09	14	12	2.8
	22	6.3 × 12.7	61	14	5.1	0.14	10	5.5	2.5
	33	6.3 × 12.7	74	20	5.7	0.14	6.8	3.6	1.9
	47	7.7 × 12.7	96	27	6.4	0.14	4.7	2.6	1.0
	100	6.5 × 18	160	19	9.0	0.13	2.1	1.2	0.55
	220	10 × 18	270	37	15	0.13	0.94	0.55	0.27
	470	10 × 25	440	75	28	0.13	0.44	0.26	0.17
	680	10 × 30	500	110	38	0.14	0.32	0.20	0.18
	1000	12.5 × 30	670	150	54	0.14	0.22	0.14	0.13
	1500	15 × 30	890	230	79	0.15	0.16	0.105	0.105
	2200	18 × 30	1200	330	110	0.16	0.12	0.083	0.088
	3300	18 × 40	1600	500	170	0.17	0.08	0.055	0.069
	4700	18 × 40	1800	710	240	0.20	0.067	0.049	0.065
	6800	21 × 40	2100	1000	340	0.26	0.059	0.045	0.064
40	33	7.7 × 12.7	91	29	6.6	0.11	5.3	2.7	1.0
	47	6.5 × 18	120	15	7.8	0.10	3.4	1.9	0.65
	100	8 × 18	180	28	12	0.10	1.6	0.9	0.40
	220	10 × 25	350	57	22	0.10	0.72	0.41	0.20
	330	10 × 30	410	83	30	0.10	0.45	0.25	0.21
	470	12.5 × 30	550	120	42	0.10	0.33	0.18	0.16
	680	12.5 × 30	650	170	58	0.11	0.25	0.145	0.13
	1000	15 × 30	840	240	84	0.11	0.17	0.105	0.097
	1500	18 × 30	1100	360	120	0.12	0.13	0.085	0.087
	2200	18 × 40	1500	530	180	0.13	0.09	0.055	0.070
	3300	21 × 40	1700	800	270	0.15	0.075	0.052	0.069
50	10	6.3 × 12.7	51	13	5.0	0.09	14	7	2.7
	22	7.7 × 12.7	82	25	6.2	0.09	6.5	3.2	1.1
	100	10 × 18	230	34	14	0.08	1.3	0.7	0.30

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ORDERING INFORMATION (continued)**Table 6** Ordering information continued; preferred types in **bold**

U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ØD × 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	4700	18 × 30	03	138 15472	—	—	138 45472
	6800	18 × 40	04	138 15682	—	—	138 45682
	10000	21 × 40	05	138 15103	—	—	138 45103
25	10	6.3 × 12.7	(2)	—	138 26109	138 36109	—
	22	6.3 × 12.7	(2)	—	138 26229	138 36229	—
	33	6.3 × 12.7	(2)	—	138 26339	138 36339	—
	47	7.7 × 12.7	(3)	—	138 26479	138 36479	—
	100	6.5 × 18	4	—	138 26101	138 36101	—
	220	10 × 18	6	—	138 26221	138 36221	—
	470	10 × 25	7	—	138 26471	138 36471	—
	680	10 × 30	00	138 16681	138 26681	—	—
	1000	12.5 × 30	01	138 16102	138 26102	—	—
	1500	15 × 30	02	138 16152	138 26152	—	138 46152
	2200	18 × 30	02	138 16222	—	—	138 46222
	3300	18 × 40	04	138 16332	—	—	138 46332
	4700	18 × 40	04	138 16472	—	—	138 46472
	6800	21 × 40	05	138 16682	—	—	138 46682
40	33	7.7 × 12.7	(3)	—	138 27339	138 37339	—
	47	6.5 × 18	4	—	138 27479	138 37479	—
	100	8 × 18	5	—	138 27101	138 37101	—
	220	10 × 25	7	—	138 27221	138 37221	—
	330	10 × 30	00	138 17331	138 27331	—	—
	470	12.5 × 30	01	138 17471	138 27471	—	—
	680	12.5 × 30	01	138 17681	138 27681	—	—
	1000	15 × 30	02	138 17102	138 27102	—	138 47102
	1500	18 × 30	03	138 17152	—	—	138 47152
	2200	18 × 40	04	138 17222	—	—	138 47222
	3300	21 × 40	05	138 17332	—	—	138 47332
50	10	6.3 × 12.7	(2)	—	138 21109	138 31109	—
	22	7.7 × 12.7	(3)	—	138 21229	138 31229	—
	100	10 × 18	6	—	138 21101	138 31101	—

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ELECTRICAL DATA (continued)

Table 7 Electrical data continued; preferred types in **bold**

U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 105 °C (mA)	I_{L1} 1 min (μA)	I_{L5} 5 min (μA)	$\tan \delta$ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz (Ω)	Z 100 kHz (Ω)
63	4.7	6.3 × 12.7	35	9	4.6	0.09	30	17	5
	10	7.7 × 12.7	59	16	5.3	0.08	13	8	1.8
	22	6.5 × 18	100	12	6.8	0.07	5.1	3.6	0.85
	47	8 × 18	150	22	9.9	0.07	2.4	1.7	0.50
	100	10 × 25	280	42	17	0.07	1.1	0.8	0.27
	150	10 × 30	340	61	23	0.11	0.73	0.41	0.31
	220	12.5 × 30	470	88	32	0.11	0.50	0.28	0.22
	330	12.5 × 30	570	130	46	0.12	0.37	0.22	0.18
	470	15 × 30	730	180	63	0.12	0.26	0.15	0.14
	680	18 × 30	930	260	90	0.12	0.19	0.12	0.11
	1000	18 × 40	1300	380	130	0.12	0.13	0.08	0.09
	1500	21 × 40	1600	570	190	0.13	0.10	0.07	0.08
100	1.0	6.3 × 12.7	16	5	4.2	0.09	140	55	10
	2.2	6.3 × 12.7	24	7	4.4	0.09	65	25	8
	4.7	7.7 × 12.7	40	12	4.9	0.08	27	17	5
	10	6.5 × 18	67	10	6.0	0.07	11	8	2.4
	22	8 × 18	100	17	8.4	0.07	5.1	3.6	1.4
	47	10 × 25	190	32	13	0.07	2.4	1.7	0.67
	68	10 × 30	220	45	18	0.07	1.7	1.1	0.97
	100	12.5 × 30	290	64	24	0.07	1.1	0.77	0.67
	150	15 × 30	390	94	34	0.07	0.78	0.52	0.46
	220	15 × 30	470	140	48	0.07	0.54	0.37	0.33
	330	18 × 30	620	200	70	0.08	0.38	0.27	0.24
	470	18 × 40	840	290	98	0.08	0.27	0.19	0.17
	680	21 × 40	1100	410	140	0.09	0.21	0.14	0.14

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ORDERING INFORMATION (continued)**Table 8** Ordering information continued; preferred types in **bold**

U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ØD × 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	4.7	6.3 × 12.7	(2)	—	138 28478	138 38478	—
	10	7.7 × 12.7	(3)	—	138 28109	138 38109	—
	22	6.5 × 18	4	—	138 28229	138 38229	—
	47	8 × 18	5	—	138 28479	138 38479	—
	100	10 × 25	7	—	138 28101	138 38101	—
	150	10 × 30	00	138 18151	138 28151	—	—
	220	12.5 × 30	01	138 18221	138 28221	—	—
	330	12.5 × 30	01	138 18331	138 28331	—	—
	470	15 × 30	02	138 18471	138 28471	—	138 48471
	680	18 × 30	03	138 18681	—	—	138 48681
	1000	18 × 40	04	138 18102	—	—	138 48102
	1500	21 × 40	05	138 18152	—	—	138 48152
100	1.0	6.3 × 12.7	(2)	—	138 29108	138 39108	—
	2.2	6.3 × 12.7	(2)	—	138 29228	138 39228	—
	4.7	7.7 × 12.7	(3)	—	138 29478	138 39478	—
	10	6.5 × 18	4	—	138 29109	138 39109	—
	22	8 × 18	5	—	138 29229	138 39229	—
	47	10 × 25	7	—	138 29479	138 39479	—
	68	10 × 30	00	138 19689	138 29689	—	—
	100	12.5 × 30	01	138 19101	138 29101	—	—
	150	15 × 30	02	138 19151	138 29151	—	138 49151
	220	15 × 30	02	138 19221	138 29221	—	138 49221
	330	18 × 30	03	138 19331	—	—	138 49331
	470	18 × 40	04	138 19471	—	—	138 49471
	680	21 × 40	05	138 19681	—	—	138 49681

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ELECTRICAL DATA (continued)**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 :		
	case $\varnothing D \times L = 6.3 \times 12.7$ and $7.7 \times 12.7 \text{ mm}$	$I_{L1} \leq 0.02C_R \times U_R + 3 \mu\text{A}$	
	case $\varnothing D \times L = 6.5 \times 18$ to $21 \times 40 \text{ mm}$	$I_{L1} \leq 0.006C_R \times U_R + 4 \mu\text{A}$	
	after 5 minutes at U_R :	$I_{L5} \leq 0.002C_R \times U_R + 4 \mu\text{A}$	
Inductance			
Equivalent series inductance (ESL)	case $\varnothing D \times L \text{ mm}$:		
	6.3 × 12.7	typ. 20 nH	—
	7.7 × 12.7	typ. 30 nH	—
	6.5 × 18	typ. 15 nH	—
	8 × 18	typ. 35 nH	—
	10 × 18	typ. 69 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	

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"
- Rated voltage (in V)
- Upper category temperature (105 °C)
- Group number (138)
- Name of manufacturer (PHILIPS)
- Date code, in accordance with "IEC 62"
- Code indicating factory of origin
- Band to indicate the negative terminal
- "+" sign to identify the positive terminal (not for case sizes $L < 18$ mm).

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ELECTRICAL DATA (continued)

Capacitance (C)

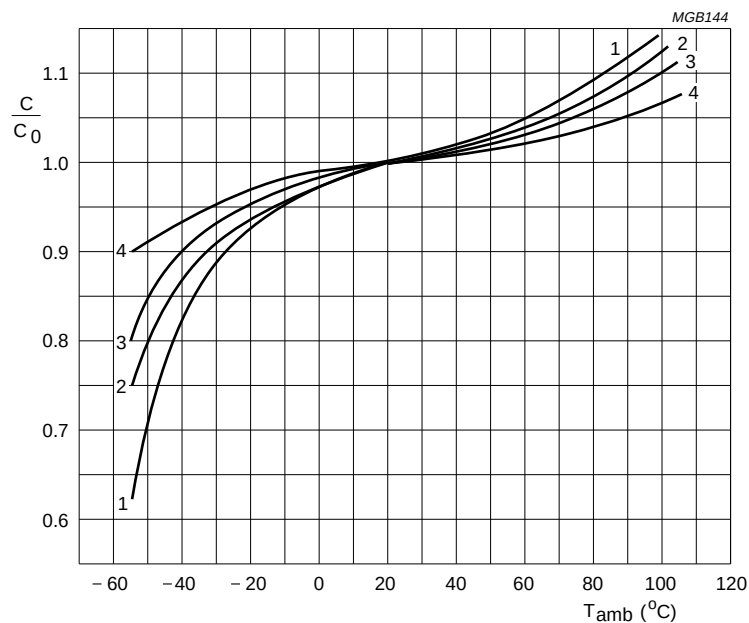


Fig.6 Typical multiplier of capacitance as a function of ambient temperature.

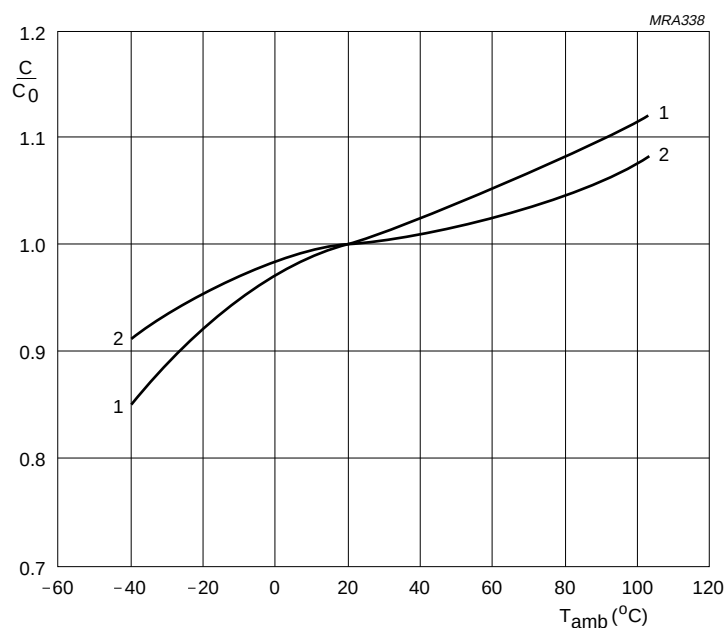


Fig.7 Multiplier of capacitance as a function of ambient temperature.

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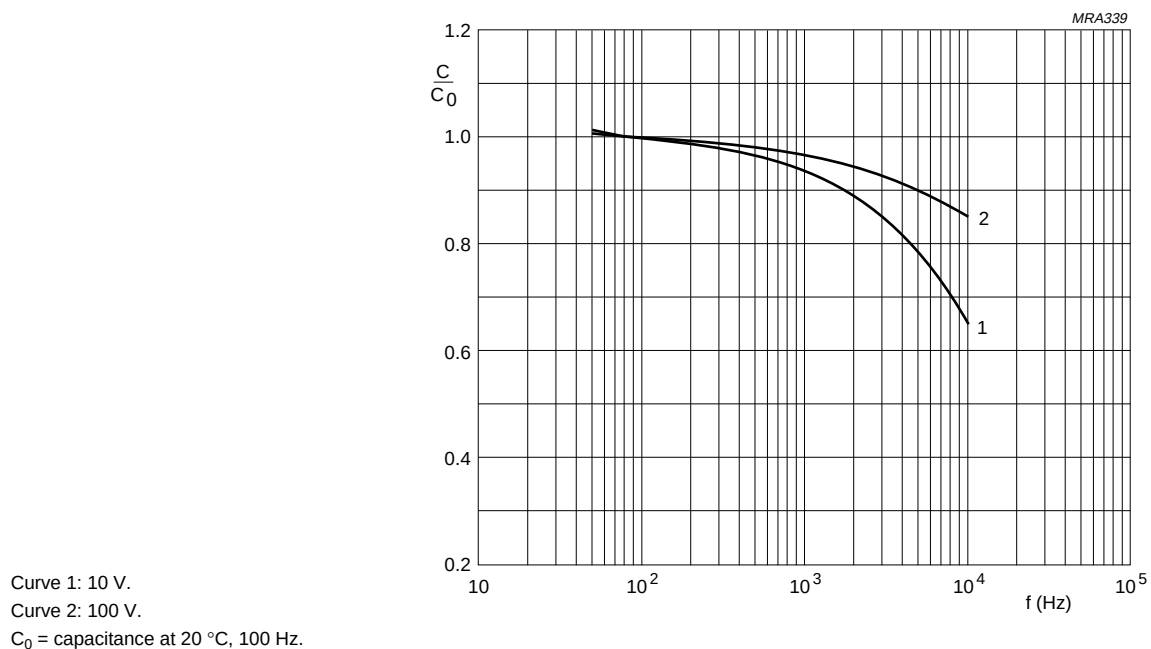


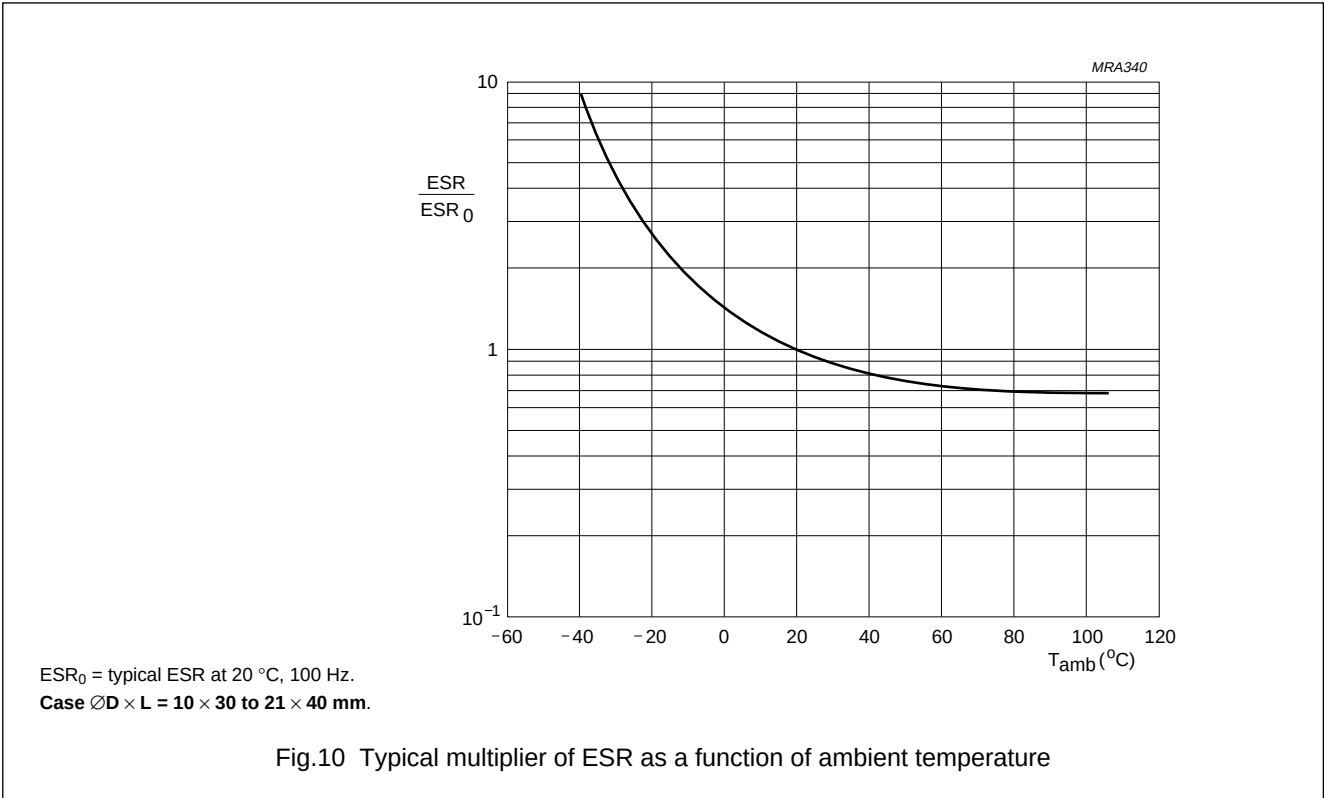
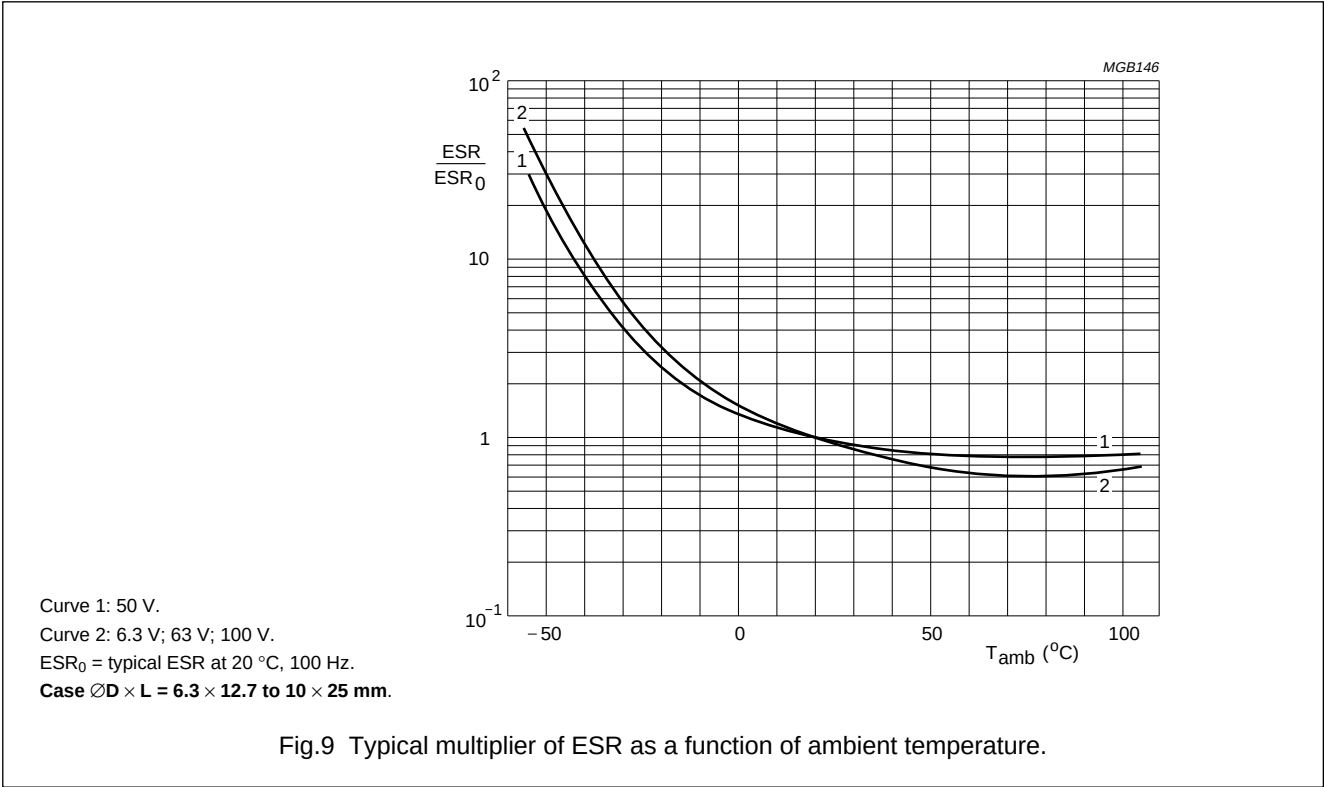
Fig.8 Typical multiplier of capacitance as a function of frequency.

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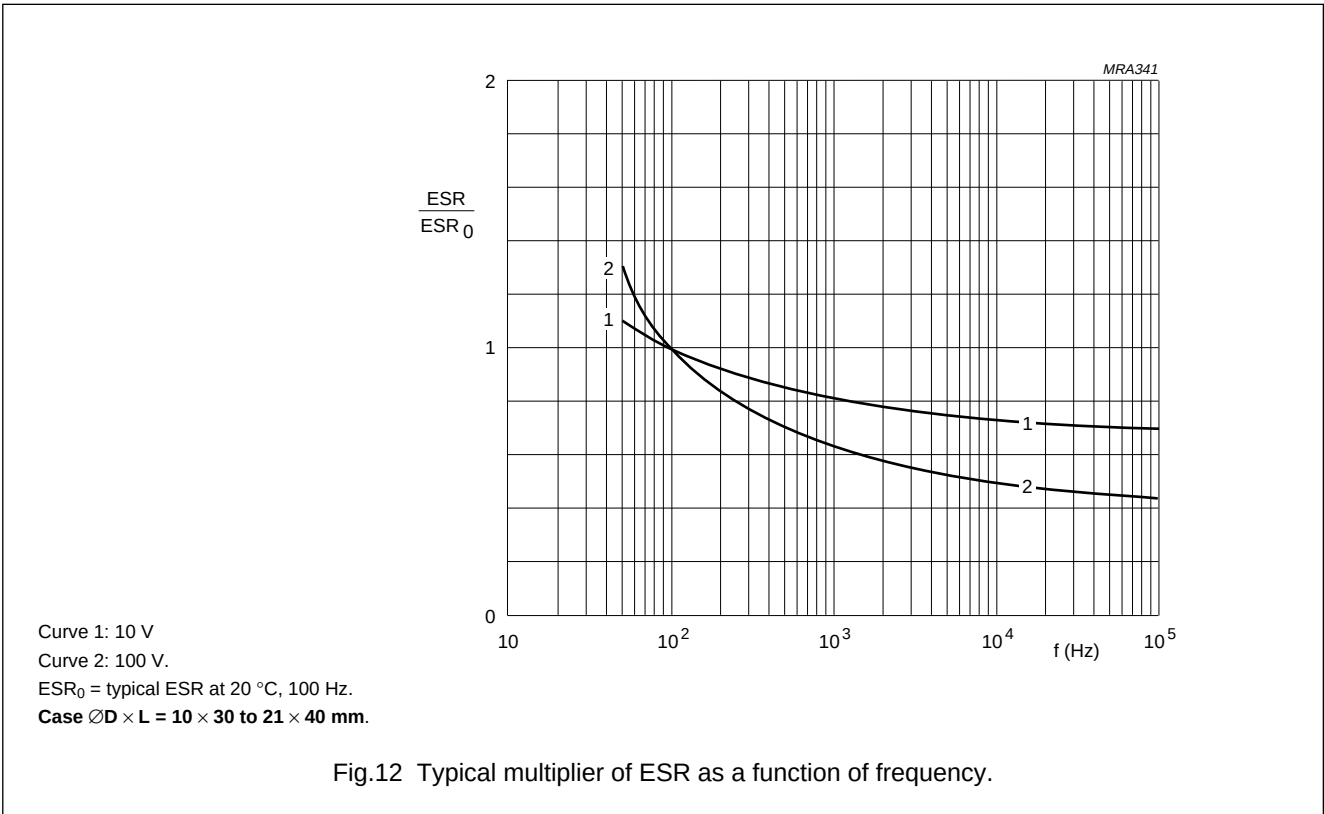
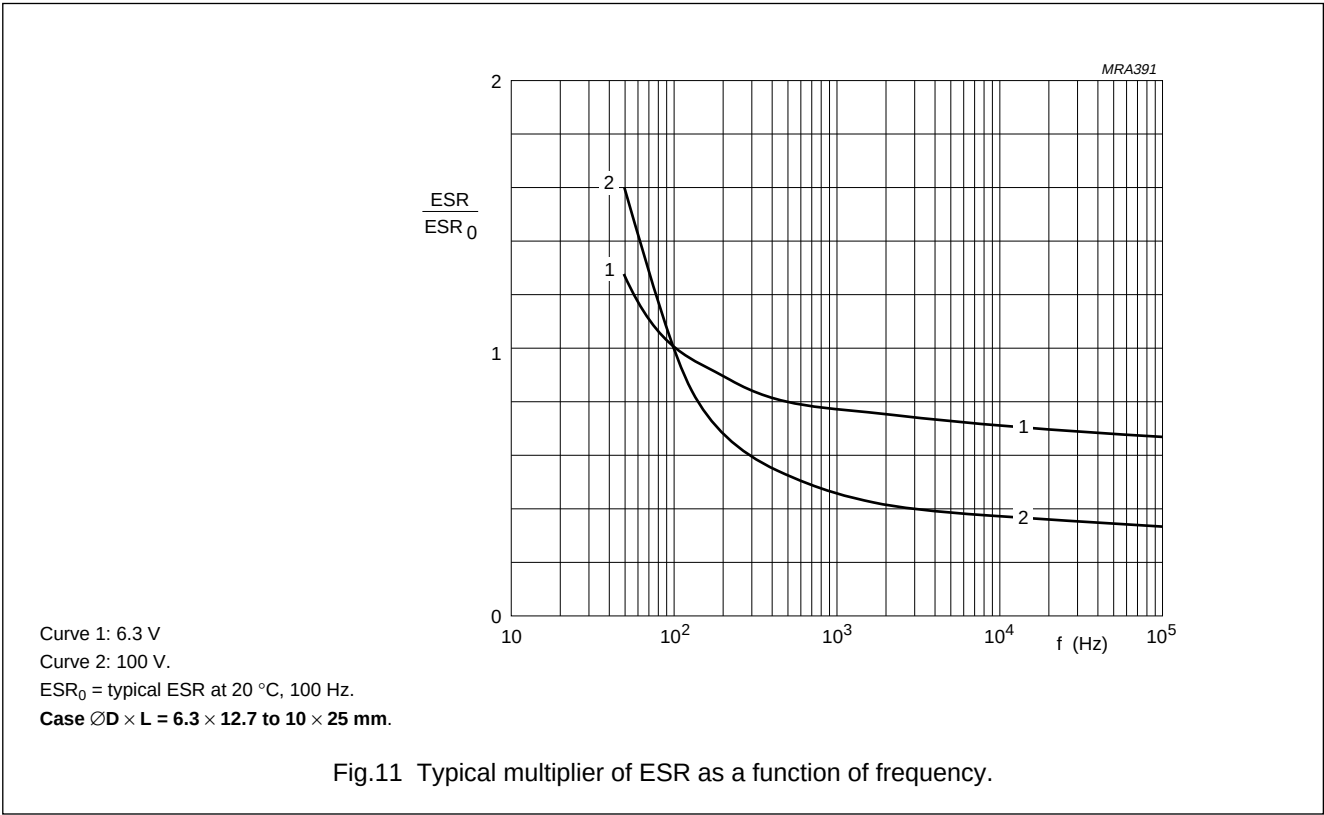
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Equivalent series resistance (ESR)



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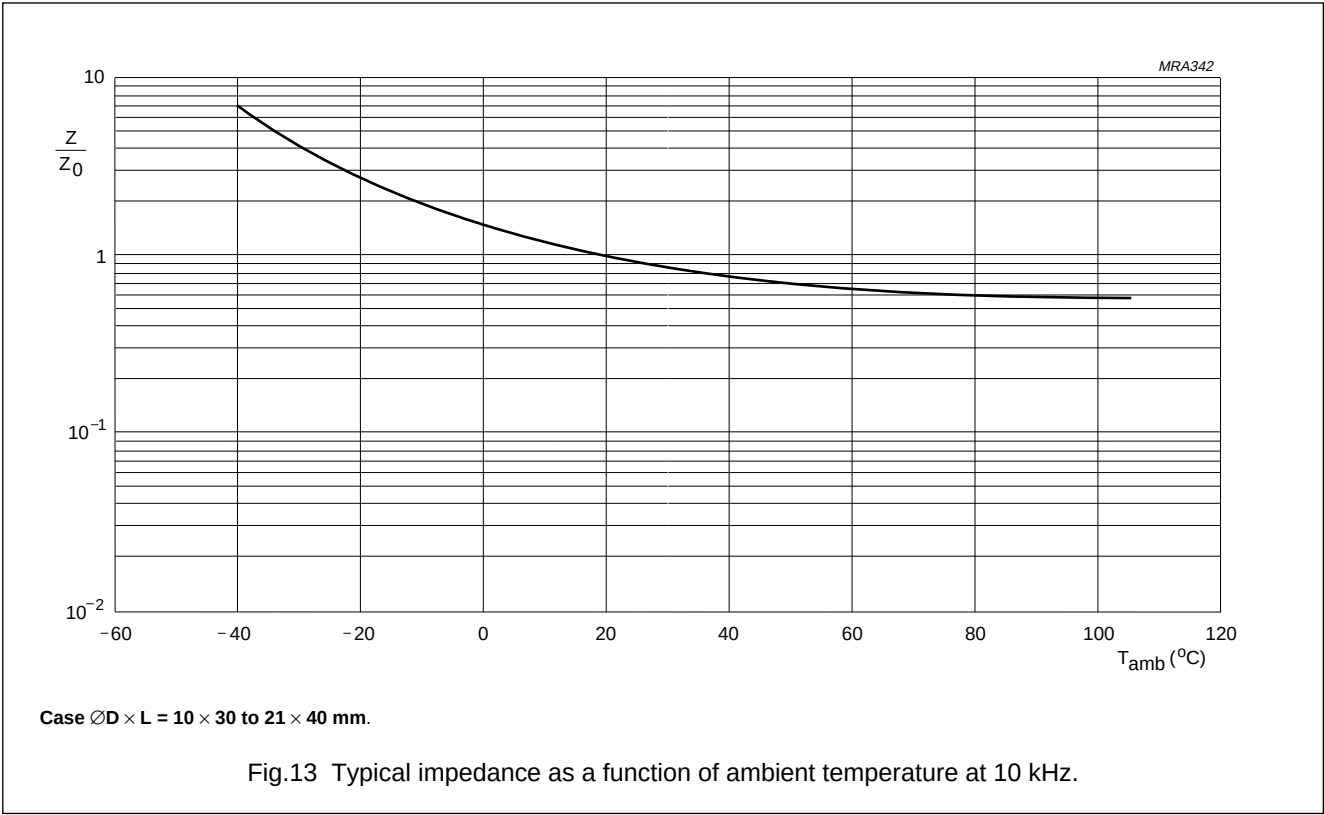
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Impedance (Z)

Table 9 Impedance × capacitance values (case ØD × L = 6.3 × 12.7 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	50 V	63 V	100 V
+20 °C	≤300	≤200	≤160	≤120	≤90	≤70	≤80	≤80
−25 °C	≤2000	≤1200	≤750	≤560	≤450	≤300	≤550	≤550
−40 °C	≤5500	≤3200	≤2000	≤1500	≤1200	≤900	≤1500	≤1500



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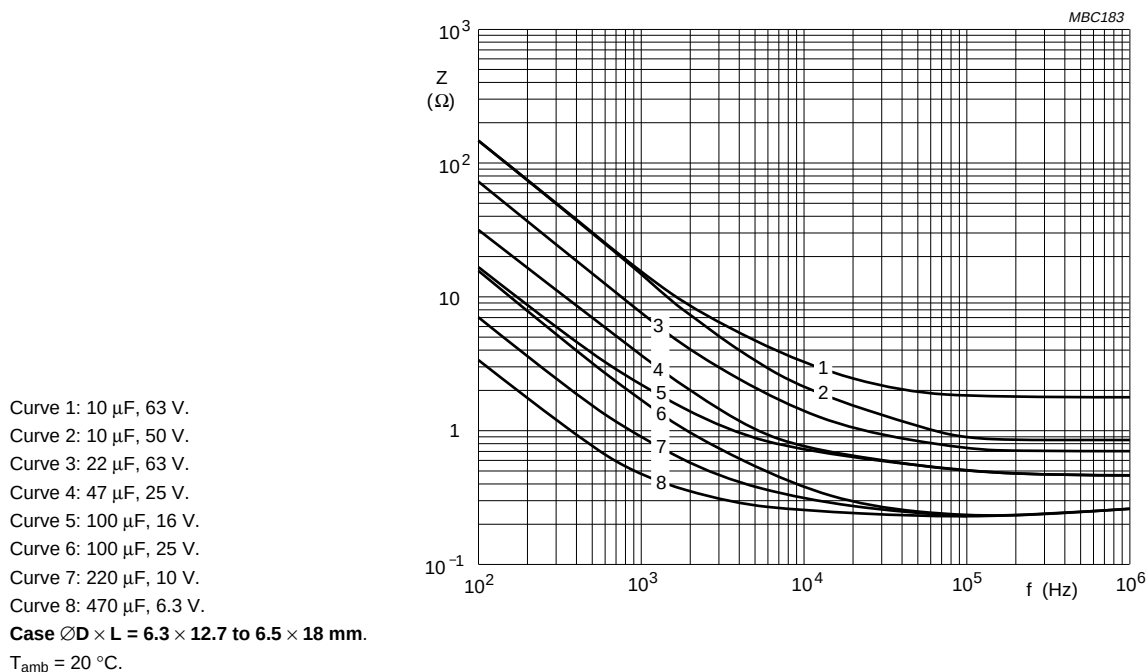


Fig.14 Typical impedance as a function of frequency.

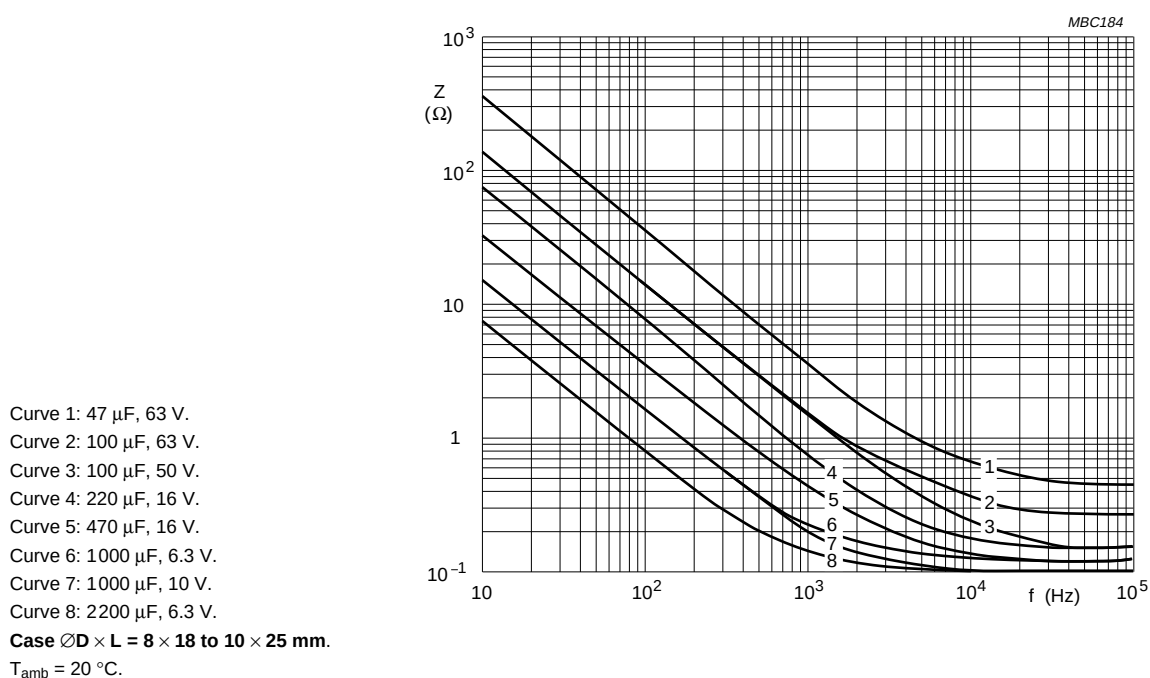


Fig.15 Typical impedance as a function of frequency.

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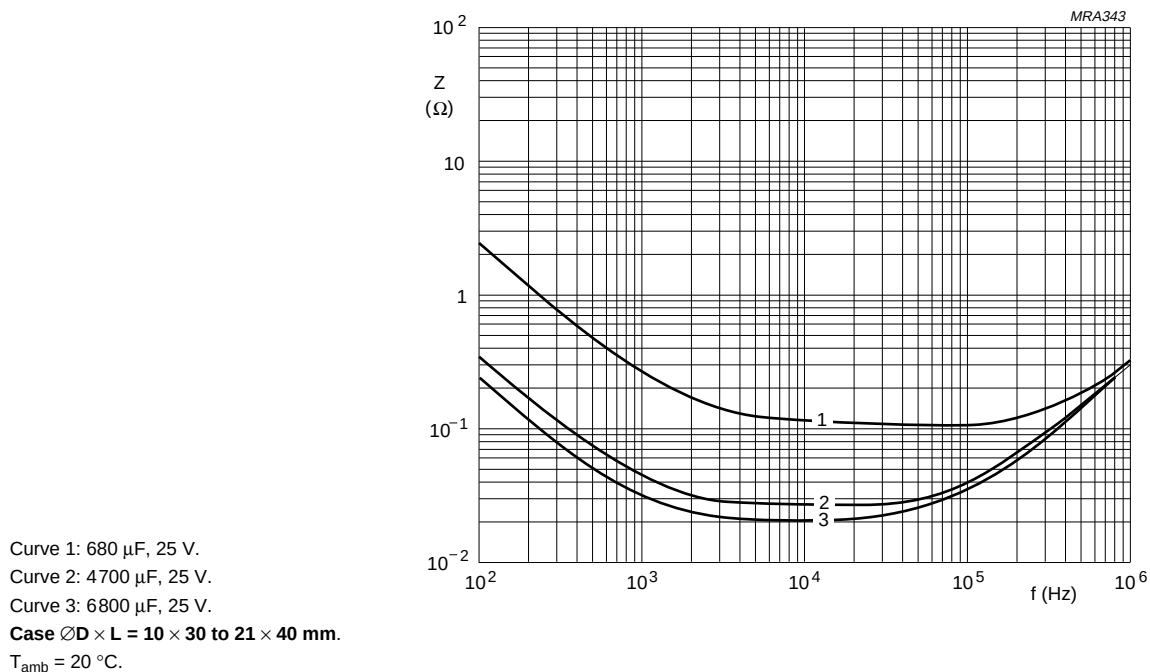


Fig.16 Typical impedance as a function of frequency.

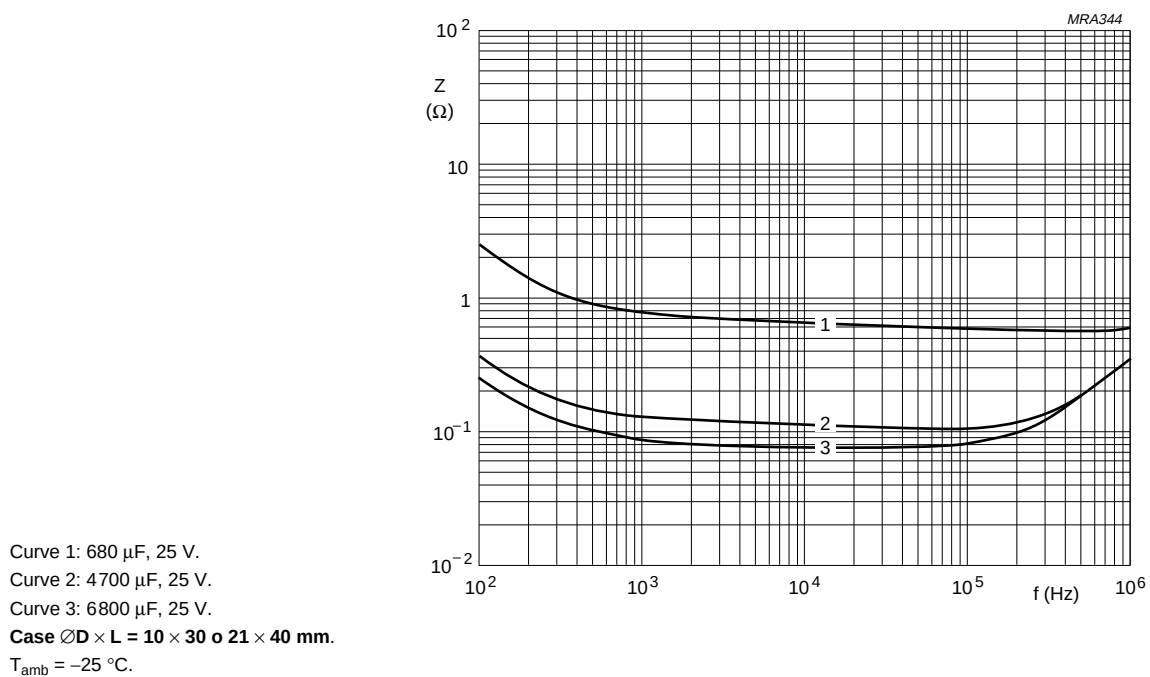
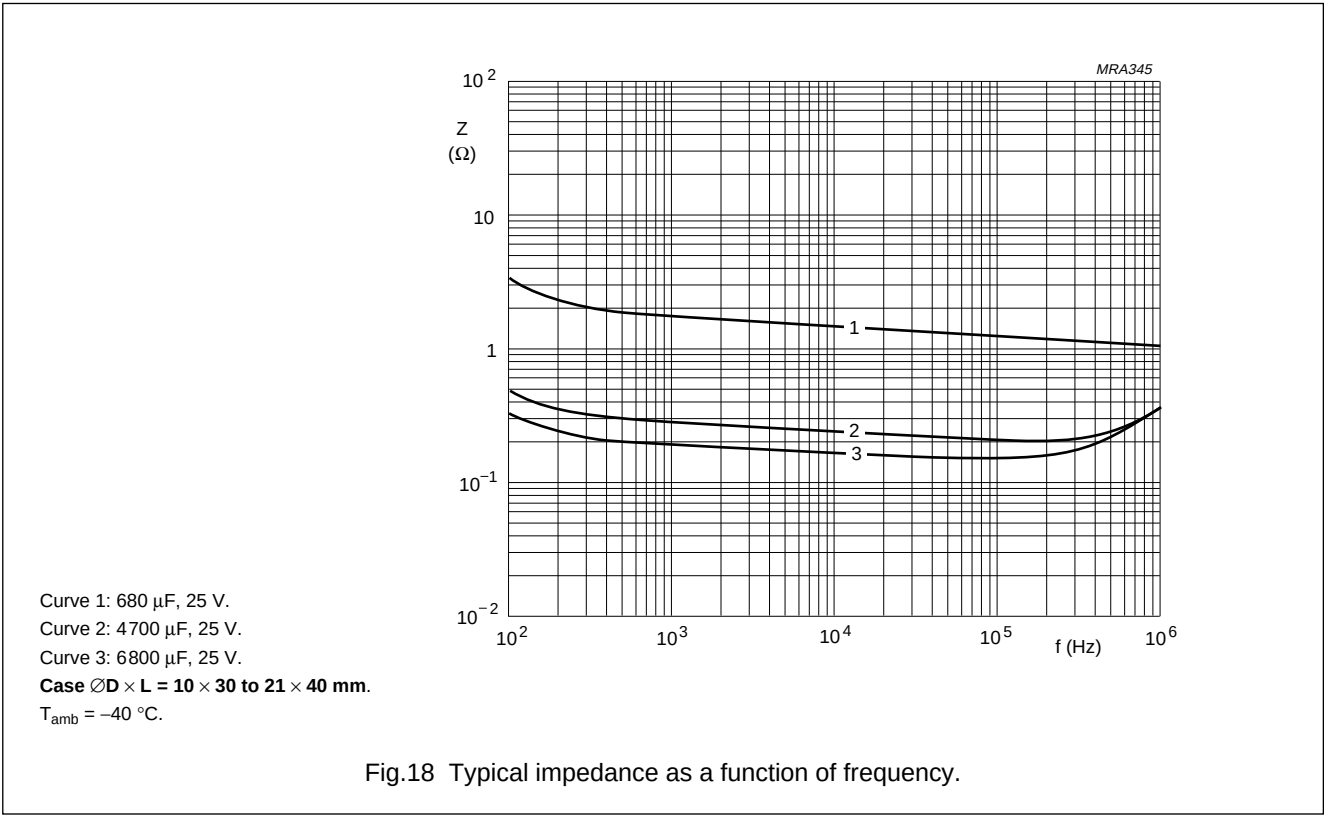


Fig.17 Typical impedance as a function of frequency.

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RIPPLE CURRENT AND USEFUL LIFE

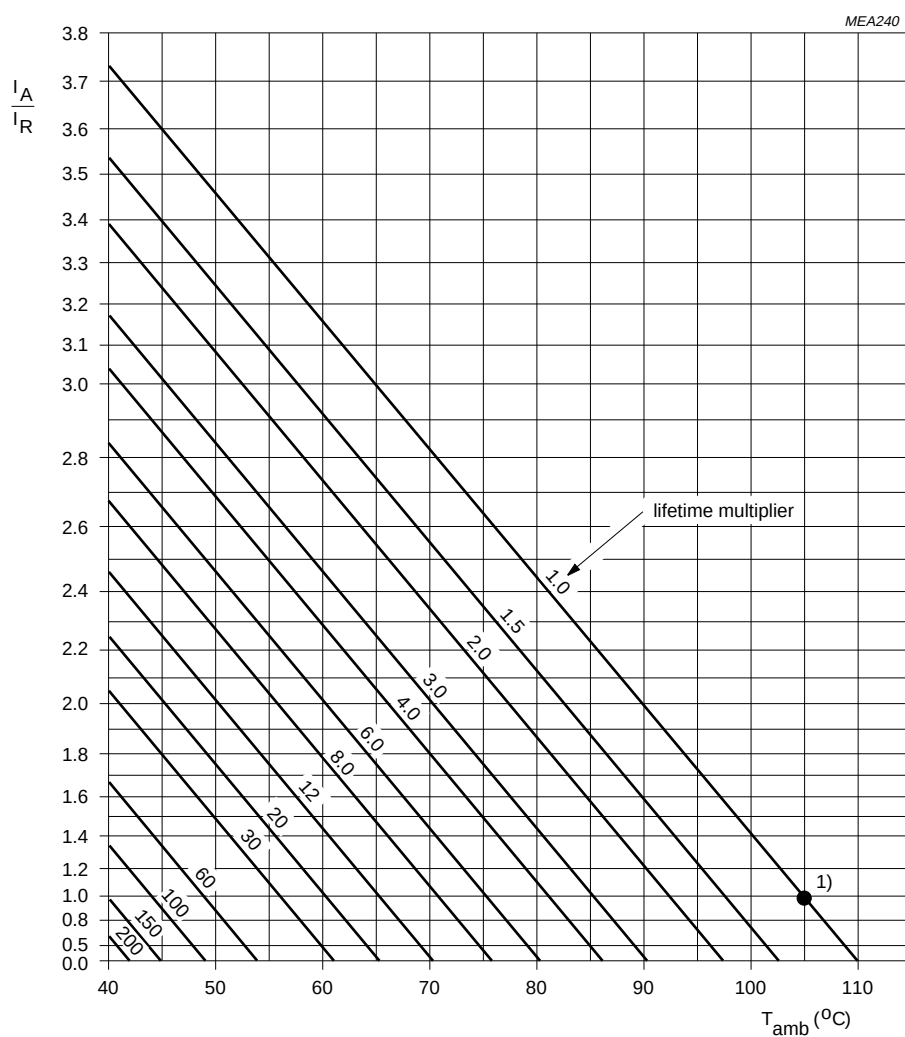
Table 10 Multiplier of ripple current (I_R/I_{RO}) as a function of frequency; I_R = ripple current at 105 °C, 100 Hz; see Fig.19

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 6.3$ to 10 V	$U_R = 16$ to 25 V	$U_R = 40$ to 100 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
≥ 10000	1.2	1.3	1.4

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I_A = actual ripple current at 100 Hz.

I_R = rated ripple current at 100 Hz, 105 °C.

(1) Useful life at 105 °C and I_R applied:

case $\varnothing D \times L = 6.3 \times 12.7$ to 10×25 mm: 2000 hours

case $\varnothing D \times L = 10 \times 30$ to 21×40 mm: 5000 hours.

Fig.19 Multiplier of useful life as a function of ambient temperature and ripple current load; see Table 10.

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SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in this handbook, section “Tests and Requirements”.

Table 11 Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 384-4/ CECC 30300 subclause 4.13	$T_{amb} = 105\text{ °C}$; U_R applied; case $\varnothing D \times L$: 6.3×12.7 to 10×25 mm: 1000 hours 10×30 to 21×40 mm: 2000 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 30301 subclause 1.8.1	$T_{amb} = 105\text{ °C}$; U_R and I_R applied; case $\varnothing D \times L$: 6.3×12.7 to 10×25 mm: 2000 hours 10×30 to 21×40 mm: 5000 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 temperature)	IEC 384-4/ CECC 30300, subclause 4.17	$T_{amb} = 105\text{ °C}$; 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 $I_{L5} \leq 2 \times \text{spec. limit}$

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NOTES