

DATA SHEET

116 RLL

Aluminum electrolytic capacitors Radial Long Life

Product specification
Supersedes data of 5th November 2001
File under BCcomponents, BC01

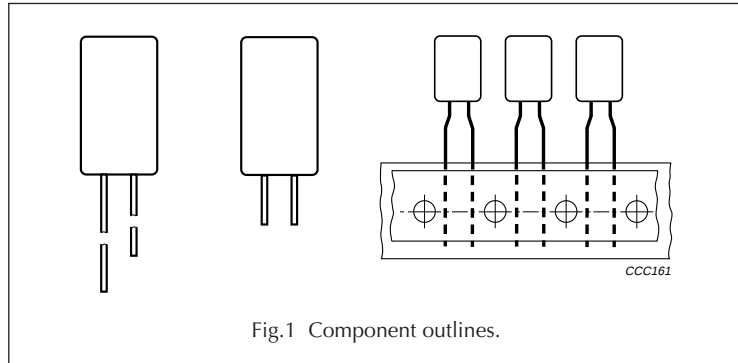
2003 May 19

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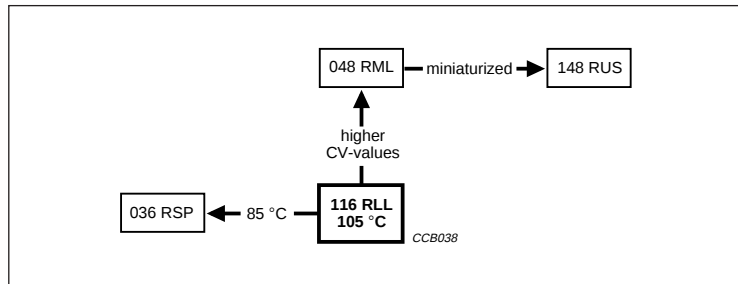
FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, all-insulated (light blue)
- Natural pitch 2.5 mm and 5 mm
- Charge and discharge proof
- Miniaturized, high CV-product per unit volume
- Long useful life: 2000 hours at 105 °C, high reliability.



APPLICATIONS

- Automotive, telecommunication, industrial and EDP
- Stand-by applications in audio and video equipment
- Coupling, decoupling, timing; smoothing, filtering and buffering in DC-DC converters
- Portable and mobile equipment (small size, low mass).



QUICK REFERENCE DATA

DESCRIPTION	VALUE
Case sizes ($\varnothing D_{nom} \times L_{nom}$ in mm)	5 × 11 and 8.2 × 11
Rated capacitance range, C_R	0.47 to 470 μF
Tolerance on C_R	±20%
Rated voltage range, U_R	6.3 to 100 V
Category temperature range	−55 to +105 °C
Endurance test at 105 °C	1 500 hours
Endurance test at 85 °C	5 000 hours
Useful life at 105 °C	2 000 hours
Useful life at 40 °C, $1.3 \times I_R$ applied	200 000 hours
Shelf life at 0 V, 105 °C	1 500 hours
Based on sectional specification	IEC 60384-4/EN130300
Climatic category IEC 60068	55/105/56

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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	35	40	50	63	100
0.47	–	–	–	–	–	–	5 × 11	–	–
1.0	–	–	–	–	–	–	5 × 11	–	–
1.5	–	–	–	–	–	–	5 × 11	–	–
2.2	–	–	–	–	–	–	5 × 11	–	8.2 × 11
3.3	–	–	–	–	–	–	5 × 11	–	–
4.7	–	–	–	–	–	–	5 × 11	–	8.2 × 11
6.8	–	–	–	–	–	–	5 × 11	–	–
10	–	–	–	–	–	–	5 × 11	8.2 × 11	8.2 × 11
	–	–	–	–	–	–	8.2 × 11	–	–
15	–	–	–	–	–	–	5 × 11	–	–
22	–	–	–	–	–	–	5 × 11	8.2 × 11	–
	–	–	–	–	–	–	8.2 × 11	–	–
33	–	–	–	–	5 × 11	5 × 11	8.2 × 11	–	–
47	–	–	–	5 × 11	–	–	8.2 × 11	–	–
68	–	–	5 × 11	–	–	–	8.2 × 11	–	–
100	–	5 × 11	–	–	8.2 × 11	8.2 × 11	–	–	–
150	5 × 11	–	–	8.2 × 11	–	–	–	–	–
220	–	–	8.2 × 11	–	–	–	–	–	–
330	–	8.2 × 11	–	–	–	–	–	–	–
470 ⁽¹⁾	8.2 × 11	–	–	–	–	–	–	–	–

Note

- For higher CV-values see data sheet "048 RML".

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MECHANICAL DATA, AVAILABLE FORMS AND PACKAGING QUANTITIES

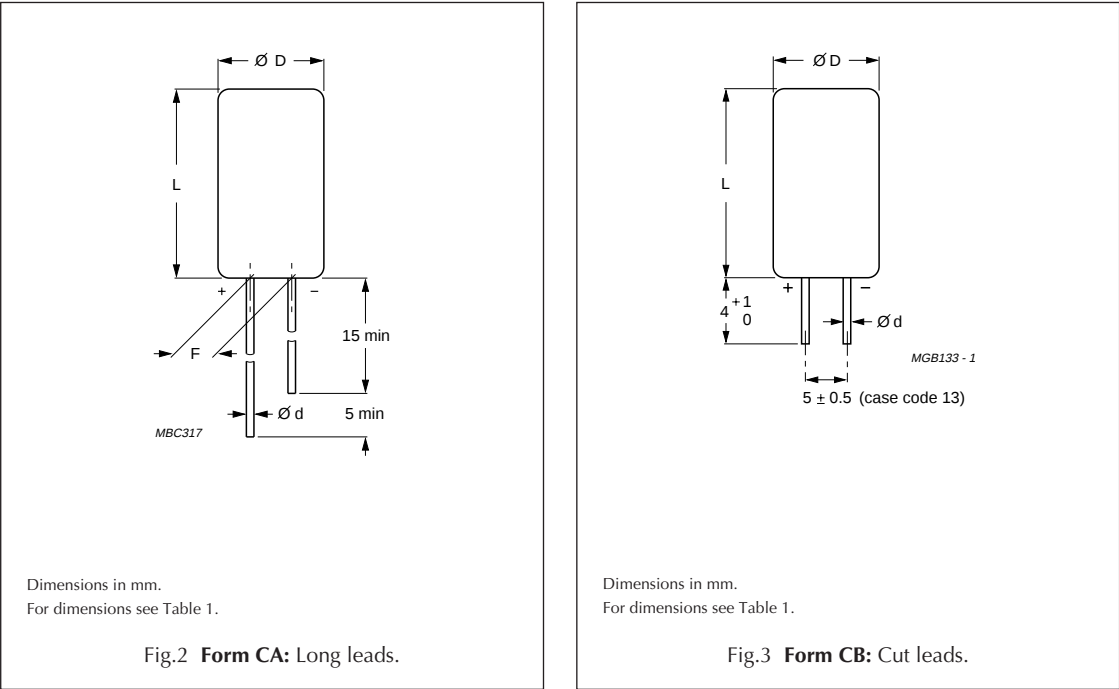


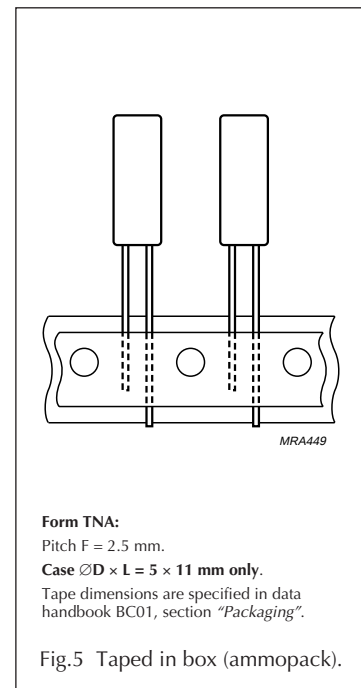
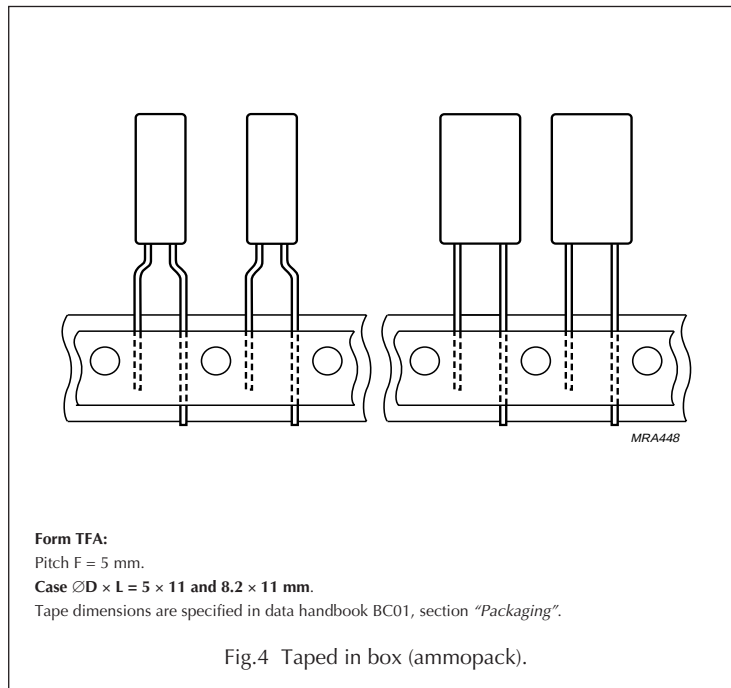
Table 1 Physical dimensions, mass and packaging quantities; see Figs 2 and 3

NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	Ød (mm)	ØD _{max} (mm)	L _{max} (mm)	F (mm)	MASS (g)	PACKAGING QUANTITIES		
							FORM CA, CB	FORM TR+,TN+	FORM TFA, TNA
5 × 11	11	0.5	5.5	12	2.5 ±0.5	≈0.4	1 000	1 000	2 000
8.2 × 11	13	0.6	8.7	12	5 ±0.5	≈1.1	1 000	500	1 000

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Taped products



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 60062"
- Rated voltage (in V)
- Group number (116)
- Name of manufacturer
- Date code in accordance with "IEC 60062"
- Code indicating factory of origin
- Minus-sign on top to identify the negative terminal.

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Ordering example
Electrolytic capacitor 116 series
220 µF/16 V; ±20%
Nominal case size: Ø8.2 × 11 mm; Form TFA
Catalogue number: 2222 116 35221.

ELECTRICAL DATA
Unless otherwise specified, all electrical values in Table 2 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75%.

SYMBOL	DESCRIPTION
C _R	rated capacitance at 100 Hz, tolerance ±20%
I _R	rated RMS ripple current at 100 kHz, 105 °C
I _{L1}	max. leakage current after 1 minute at U _R
Tan δ	max. dissipation factor at 100 Hz
Z ₁₀₀	max. impedance at 100 kHz and 20 °C

Table 2 Electrical data; preferred types in bold

U _R (V)	C _R 100 Hz (µF)	NOMINAL CASE SIZE ØD × L (mm)	I _R 100 kHz 105 °C (mA)	I _{L1} 1 min (µA)	Tan δ 100 Hz	Z ₁₀₀ 100 kHz 20 °C (Ω)	CATALOGUE NUMBER 2222 116					
							BULK PACKAGING			TAPED AMMOPACK		
							LONG LEADS		CUT LEADS		F (mm)	FORM TNA
							FORM CA	F (mm)	FORM CB	F (mm)		
6.3	150 470	5 × 11 8.2 × 11	130 300	8.7 21	0.25 0.25	1.3 0.45	53151 53471	2.5 5.0	– 63471	– 5.0	33151 33471	73151 –
10	100 330	5 × 11 8.2 × 11	130 280	9 23	0.2 0.2	1.4 0.45	54101 54331	2.5 5.0	– 64331	– 5.0	34101 34331	74101 –
16	68 220	5 × 11 8.2 × 11	130 280	9.5 24	0.16 0.16	1.5 0.5	55689 55221	2.5 5.0	– 65221	– 5.0	35689 35221	75689 –
25	47 150	5 × 11 8.2 × 11	120 260	10 26	0.14 0.14	1.6 0.5	56479 56151	2.5 5.0	– 66151	– 5.0	36479 36151	76479 –
35	33 100	5 × 11 8.2 × 11	110 240	9.9 24	0.12 0.12	1.7 0.55	50339 50101	2.5 5.0	– 60101	– 5.0	30339 30101	70339 –
40	33 100	5 × 11 8.2 × 11	110 240	10.9 27	0.12 0.12	1.7 0.55	57339 57101	2.5 5.0	– 67101	– 5.0	37339 37101	77339 –

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CATALOGUE NUMBER 2222 116														
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I _R 100 kHz 105 °C (mA)	I _{L1} 1 min (μA)	Tan δ 100 Hz	Z ₁₀₀ 100 kHz 20 °C (Ω)	BULK PACKAGING				TAPED AMMOPACK			
							LONG LEADS		CUT LEADS					
							FORM CA	F (mm)	FORM CB	F (mm)	FORM TFA	F (mm)	FORM TNA	F (mm)
50	0.47	5 × 11	30	3.1	0.09	10	51477	2.5	—	5.0	31477	5.0	71477	2.5
	1.0	5 × 11	40	3.3	0.09	6	51108	2.5	—	5.0	31108	5.0	71108	2.5
	1.5	5 × 11	50	3.5	0.09	4	51158	2.5	—	5.0	31158	5.0	71158	2.5
	2.2	5 × 11	60	3.7	0.09	3.5	51228	2.5	—	5.0	31228	5.0	71228	2.5
	3.3	5 × 11	65	4	0.09	3.1	51338	2.5	—	5.0	31338	5.0	71338	2.5
	4.7	5 × 11	70	4.4	0.09	2.8	51478	2.5	—	5.0	31478	5.0	71478	2.5
	6.8	5 × 11	75	5	0.09	2.5	51688	2.5	—	5.0	31688	5.0	71688	2.5
	10	5 × 11	80	6	0.09	2.2	51109	2.5	—	5.0	31109	5.0	71109	2.5
	10	8.2 × 11	160	6	0.05	1.0	90084	5.0	90085	5.0	90036	5.0	—	—
	15	5 × 11	90	7.5	0.09	2.0	51159	2.5	—	5.0	31159	5.0	71159	2.5
	22	5 × 11	110	9.6	0.09	1.9	51229	2.5	—	5.0	31229	5.0	71229	2.5
	22	8.2 × 11	190	9.6	0.06	0.9	90025	5.0	90086	5.0	90039	5.0	—	—
	33	8.2 × 11	190	13	0.09	0.77	51339	5.0	61339	5.0	31339	5.0	—	—
	47	8.2 × 11	210	17	0.09	0.65	51479	5.0	61479	5.0	31479	5.0	—	—
	68	8.2 × 11	240	23	0.09	0.55	51689	5.0	61689	5.0	31689	5.0	—	—
63	10	8.2 × 11	160	7	0.06	1.3	58109	5.0	68109	5.0	38109	5.0	—	—
	22	8.2 × 11	190	11	0.06	0.9	58229	5.0	68229	5.0	38229	5.0	—	—
100	2.2	8.2 × 11	60	4.3	0.06	4	59228	5.0	69228	5.0	39228	5.0	—	—
	4.7	8.2 × 11	75	5.8	0.07	3.5	59478	5.0	69478	5.0	39478	5.0	—	—
	10	8.2 × 11	100	9	0.08	3	59109	5.0	69109	5.0	39109	5.0	—	—

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Additional electrical data

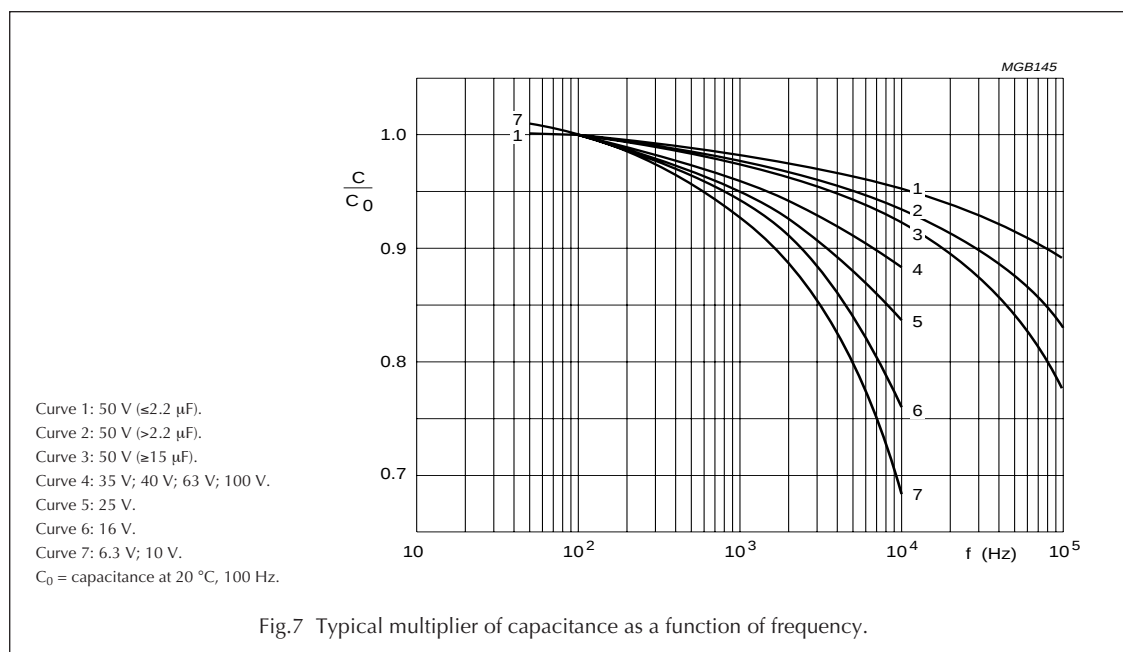
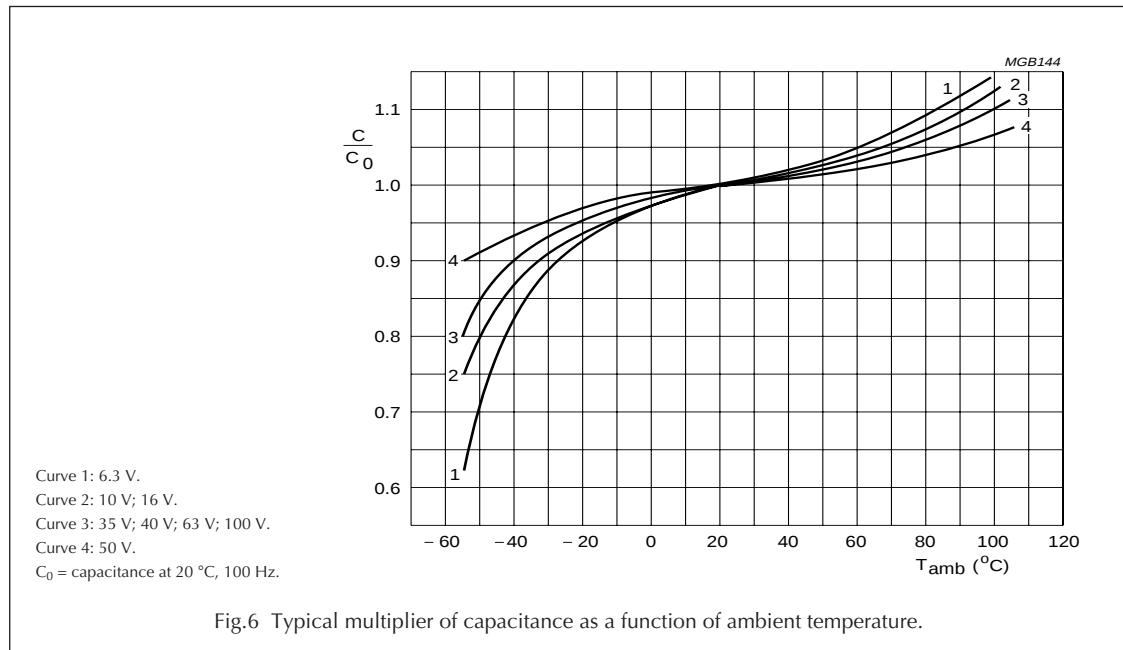
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage		$U_s \leq 1.3 U_R$
Reverse voltage		$U_{rev} \leq 1 V$
Current		
Leakage current	after 1 minute at U_R	$I_{L1} \leq 0.006 C_R \times U_R + 3 \mu A$
	after 5 minutes at U_R	$I_{L5} \leq 0.001 C_R \times U_R + 3 \mu A$
Inductance		
Equivalent series inductance (ESL)	case $\varnothing D \times L = 5 \times 11 \text{ mm}$	typ. 13 nH
	case $\varnothing D \times L = 8.2 \times 11 \text{ mm}$	typ. 16 nH
Resistance		
Equivalent series resistance (ESR)	calculated from $\tan \delta_{max}$ and C_R (see Table 2)	$ESR = \tan \delta / 2\pi f C_R$

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Capacitance (C)

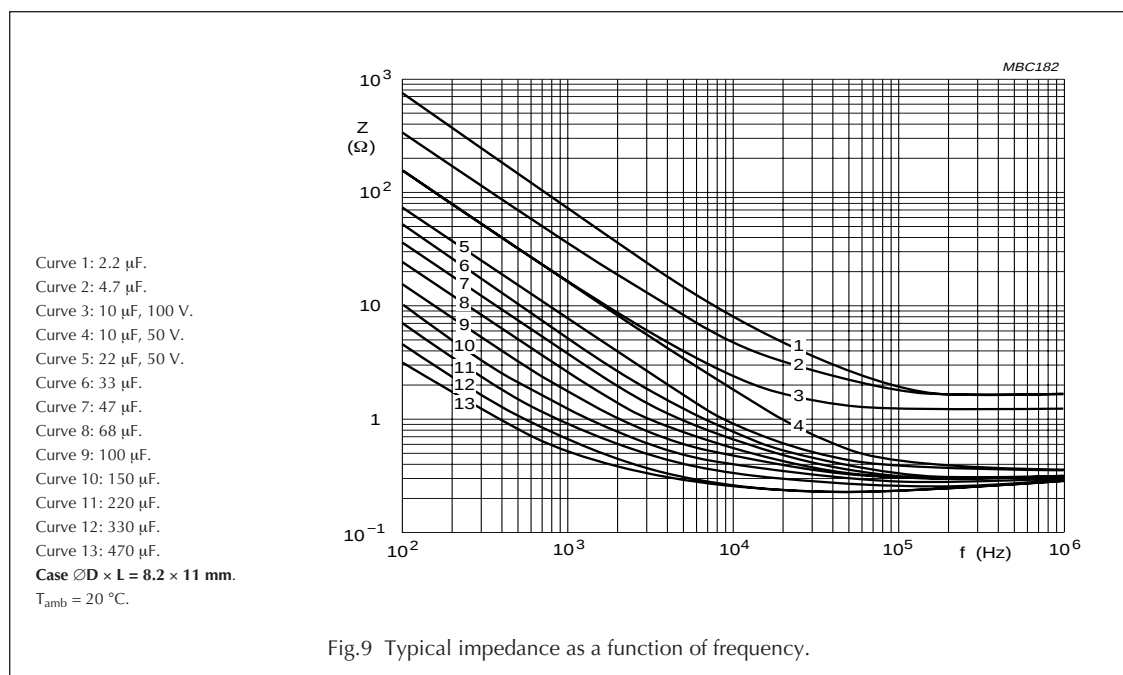
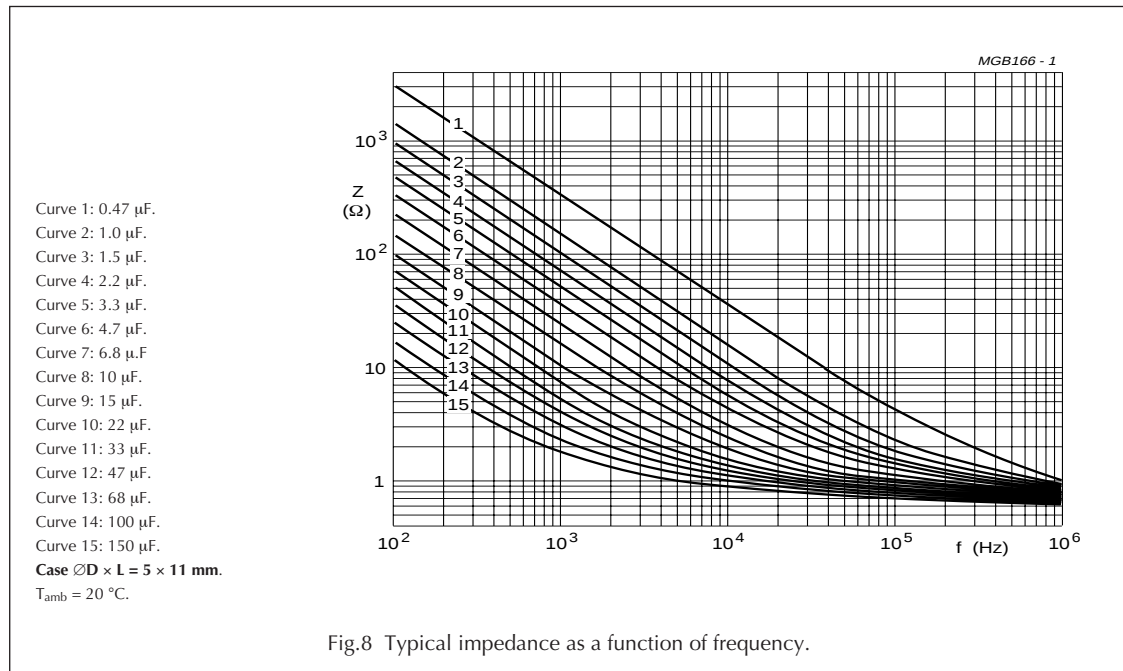


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Impedance (Z)



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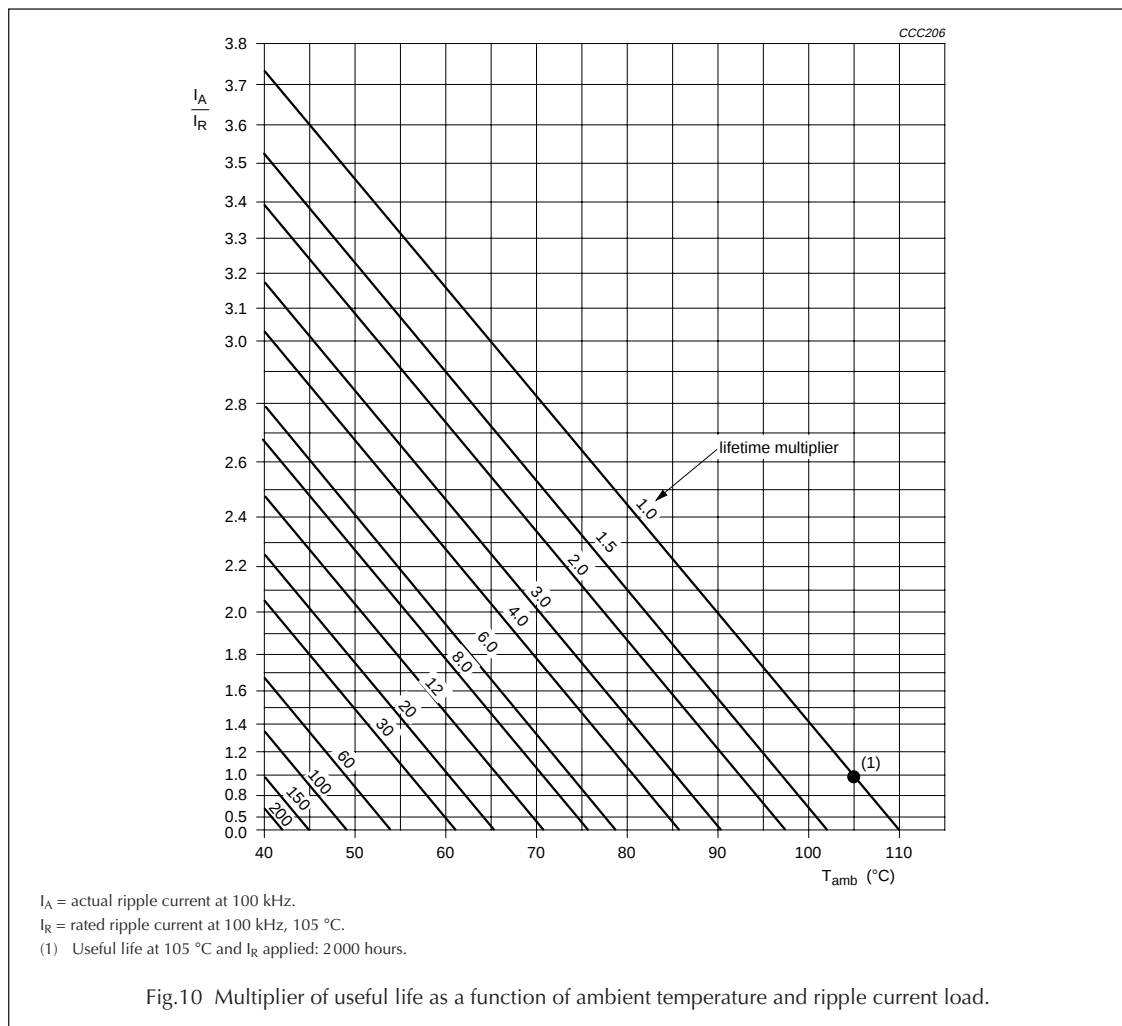
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RIPPLE CURRENT AND USEFUL LIFE

Table 3 Multiplier of ripple current (I_R) as a function of frequency

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 6.3$ to 10 V	$U_R = 16$ to 35 V	$U_R = 40$ to 100 V ($C_R \geq 10 \mu\text{F}$)
50	0.7	0.6	0.5
100	0.77	0.71	0.63
300	0.86	0.85	0.78
1 000	0.92	0.93	0.88
3 000	0.96	0.96	0.94
10 to 100 k	1.0	1.0	1.0



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SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in data handbook BC01, section “Tests and Requirements”.

Table 4 Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 105\text{ °C}$; U_R applied; 1500 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; 2000 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 60384-4/ EN130300 subclause 4.17	$T_{amb} = 105\text{ °C}$; no voltage applied; 1500 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 $I_{L5} \leq 2 \times \text{spec. limit}$