

DATA SHEET

140 RTM

Aluminium electrolytic capacitors
Radial High Temperature Miniature

Preliminary specification
Supersedes data of May 1998
File under BC Components, BC01

1999 Feb 17

Aluminium electrolytic capacitors Radial High Temperature Miniature

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FEATURES

- Polarized aluminium electrolytic capacitors, non-solid
- Radial leads, cylindrical aluminium case with pressure relief, insulated with a blue sleeve
- Charge and discharge proof
- Very long useful life: 2500 to 4000 hours at 125 °C, high stability, high reliability
- Extended temperature range up to 125 °C
- High ripple current capability.

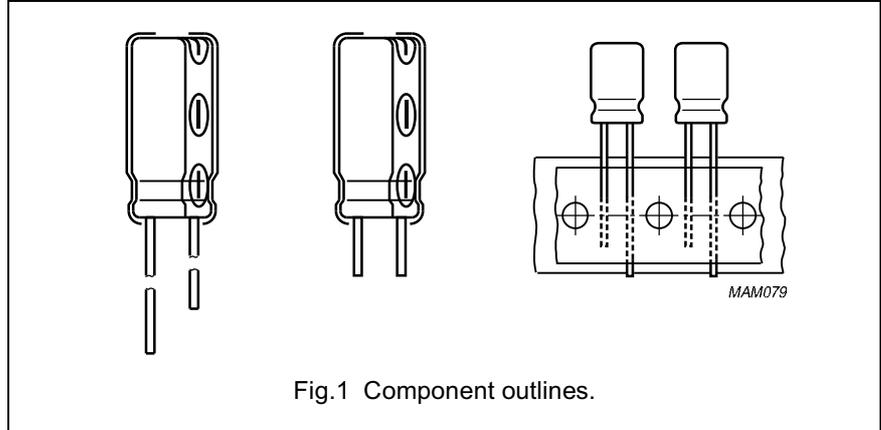
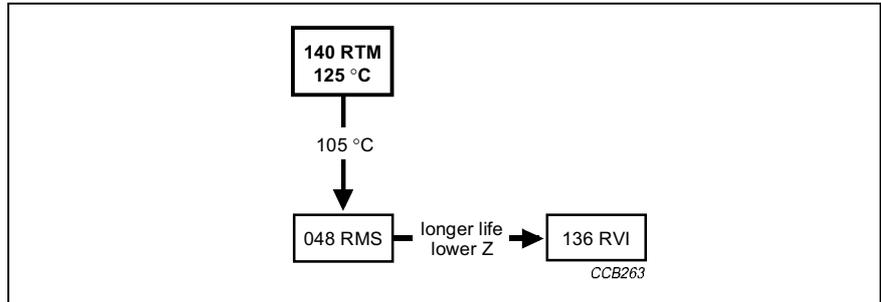


Fig.1 Component outlines.

APPLICATIONS

- EDP, telecommunication, industrial, automotive and military
- Smoothing, filtering, buffering in SMPS
- High ambient temperature environments.



QUICK REFERENCE DATA

DESCRIPTION	VALUE
Case sizes ($\varnothing D_{nom} \times L_{nom}$ in mm)	10 × 12 to 18 × 31
Rated capacitance range, C_R	22 to 4700 μ F
Tolerance on C_R	$\pm 20\%$
Rated voltage range, U_R	10 to 63 V
Category temperature range	-55 to +125 °C
Endurance test at 125 °C	2000 hours
Useful life at 125 °C	2500 to 4000 hours (dependent on case size)
Useful life at 40 °C, $1.6 \times I_R$ applied	300000 hours
Shelf life at 0 V, 125 °C	500 hours
Based on sectional specification	IEC 60384-4/CECC 30300
Climatic category IEC 60068	55/125/56

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Selection chart for C_R , U_R and relevant nominal case sizes ($\varnothing D \times L$ in mm)

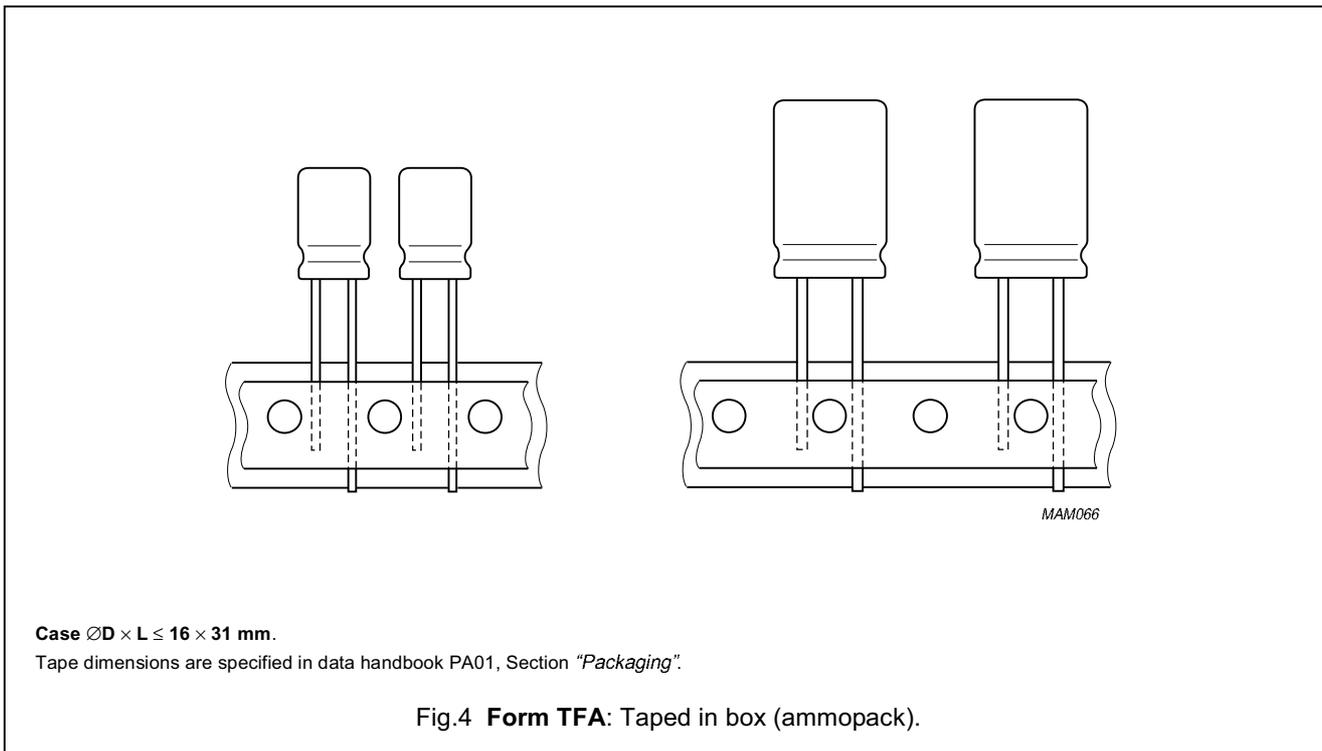
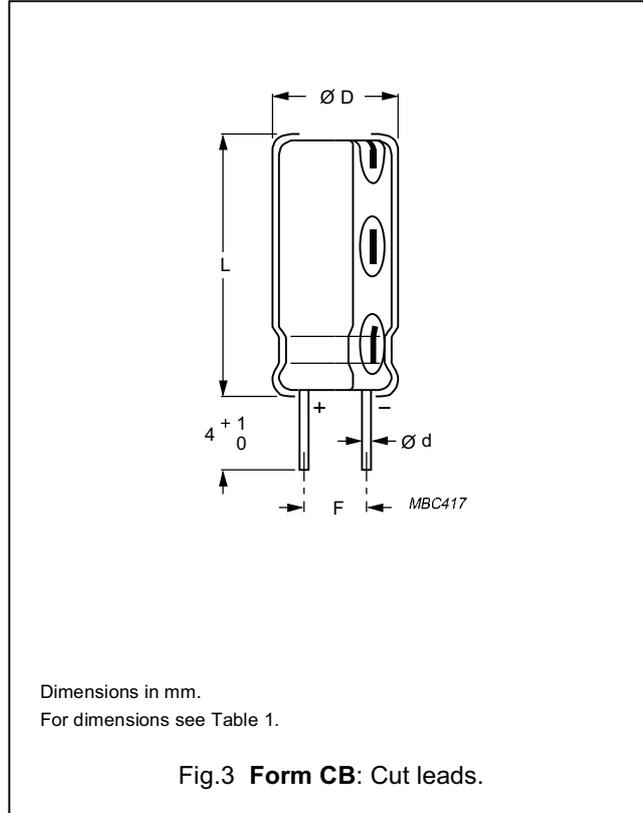
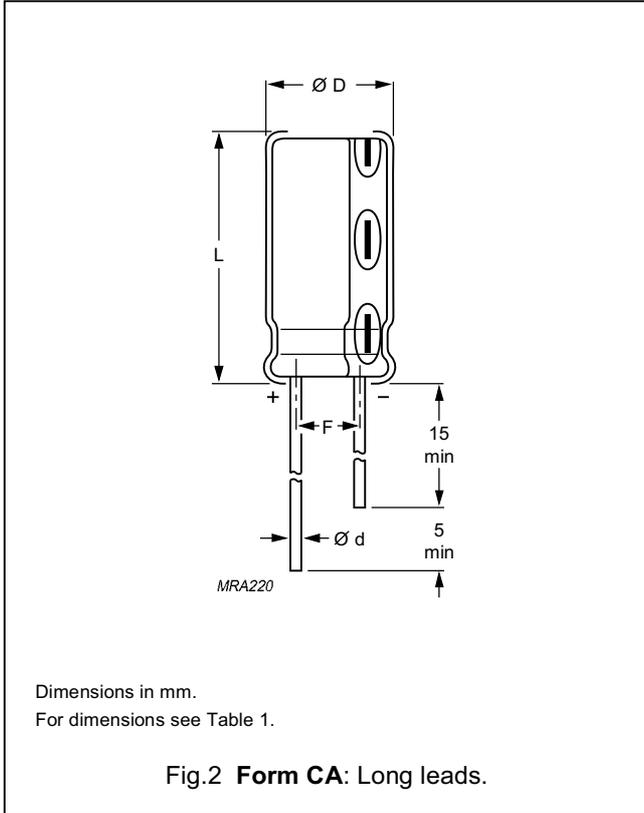
Preferred types in **bold**.

C_R (μF)	U_R (V)					
	10	16	25	35	50	63
22	–	–	–	–	–	10 × 12
47	–	–	–	–	10 × 12	10 × 12
100	–	–	–	10 × 12	10 × 16	10 × 20
220	–	10 × 12	10 × 16	10 × 16	12.5 × 20	16 × 20
330	10 × 12	10 × 16	10 × 20	–	12.5 × 20	16 × 20
470	10 × 16	10 × 16	10 × 20	12.5 × 20	16 × 20	16 × 25
1000	10 × 20	12.5 × 20	16 × 20	16 × 25	16 × 31	18 × 31
2200	16 × 20	16 × 25	16 × 31	18 × 31	–	–
3300	16 × 25	16 × 31	18 × 31	–	–	–
4700	16 × 31	18 × 31	–	–	–	–

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MECHANICAL DATA, AVAILABLE FORMS AND PACKAGING QUANTITIES



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

NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	$\varnothing d$ (mm)	$\varnothing D_{max}$ (mm)	L_{max} (mm)	F (mm)	MASS (g)	PACKAGING QUANTITIES PER BOX		
							FORM CA	FORM CB	FORM TFA
10 × 12	14	0.6	10.5	13.5	5.0 ±0.5	≈1.6	1 000	500	800
10 × 16	15	0.6	10.5	17.5	5.0 ±0.5	≈1.9	500	500	800
10 × 20	16	0.6	10.5	22.0	5.0 ±0.5	≈2.2	500	500	800
12.5 × 20	17	0.6	13.0	22.0	5.0 ±0.5	≈4.0	500	500	500
16 × 20	19a	0.8	16.5	22.0	7.5 ±0.5	≈6.0	250	250	250
16 × 25	19	0.8	16.5	27.0	7.5 ±0.5	≈8.0	250	250	250
16 × 31	20	0.8	16.5	33.5	7.5 ±0.5	≈9.0	100	100	250
18 × 31	1831	0.8	18.5	33.5	7.5 ±0.5	≈12.5	100	100	–

MARKING

The capacitors are marked with the following information:

- Rated capacitance value (in μF)
- Tolerance on rated capacitance, code letter in accordance with "IEC 60062" (M for $\pm 20\%$)
- Rated voltage (in V)
- Upper category temperature (125 °C)
- Group number (140)
- Code indicating factory of origin
- Name of manufacturer, PHILIPS
- Date code, in accordance with "IEC 60062"
- Negative terminal identification.

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Ordering example

Electrolytic capacitor 140 series
220 µF/25 V; ±20%
Nominal case size: Ø10 × 16 mm; Form TFA
Catalogue number: 2222 140 36221.

ELECTRICAL DATA AND ORDERING INFORMATION

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, 125 °C
I _{L1}	max. leakage current after 1 minute at U _R
I _{L5}	max. leakage current after 5 minutes at U _R
Tan δ	max. dissipation factor at 100 Hz
ESR	equivalent series resistance at 100 Hz (calculated from tan δ _{max} and C _R)
Z	max. impedance at 100 kHz

Table 2 Electrical data and ordering information; preferred types in bold

U _R (V)	C _R 100 Hz (µF)	NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	I _R 100 kHz 125 °C (mA)	I _{L1} 1 min (µA)	I _{L5} 5 min (µA)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 100 kHz +20 °C (Ω)	Z 100 kHz -40 °C (Ω)	CATALOGUE NUMBER			
											2222			
											BULK PACKAGING FORM CA	FORM CB	TAPED FORM TFA	
10	330	10 × 12	14	320	36	10	0.20	0.96	0.350	2.40	140 54331	140 64331	140 34331	
	470	10 × 16	15	420	50	12	0.20	0.68	0.290	2.00	140 54471	140 64471	140 34471	
	1000	10 × 20	16	520	103	23	0.20	0.32	0.200	1.40	140 54102	140 64102	140 34102	
	2200	16 × 20	19a	950	223	47	0.24	0.17	0.100	0.80	140 54222	140 64222	140 34222	
	3300	16 × 25	19	1200	333	69	0.24	0.12	0.065	0.45	140 54332	140 64332	140 34332	
	4700	16 × 31	20	1600	473	97	0.24	0.08	0.040	0.35	140 54472	140 64472	140 34472	
	16	220	10 × 12	14	320	38	10	0.16	1.16	0.350	2.40	140 55221	140 65221	140 35221
		330	10 × 16	15	420	56	14	0.16	0.77	0.290	2.00	140 55331	140 65331	140 35331
		470	10 × 16	15	420	78	18	0.16	0.54	0.290	2.00	140 55471	140 65471	140 35471
		1000	12.5 × 20	17	750	163	35	0.16	0.25	0.120	0.90	140 55102	140 65102	140 35102
2200		16 × 25	19	1200	355	73	0.18	0.13	0.065	0.45	140 55222	140 65222	140 35222	
3300	16 × 31	20	1600	531	109	0.18	0.09	0.040	0.35	140 55332	140 65332	140 35332		
4700	18 × 31	1831	1850	755	153	0.18	0.06	0.040	0.35	140 55472	140 65472	–		

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UR (V)	CR 100 Hz (µF)	NOMINAL CASE SIZE ∅D × L (mm)	CASE CODE	IR 100 kHz 125 °C (mA)	IL1 1 min (µA)	IL5 5 min (µA)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 100 kHz +20 °C (Ω)	Z 100 kHz -40 °C (Ω)	CATALOGUE NUMBER 2222		
											BULK PACKAGING		TAPED
											FORM CA	FORM CB	
25	220	10 × 16	15	420	58	14	0.14	1.01	0.290	2.00	140 56221	140 66221	140 36221
	330	10 × 20	16	520	86	20	0.14	0.68	0.200	1.40	140 56331	140 66331	140 36331
	470	10 × 20	16	520	121	27	0.14	0.47	0.200	1.40	140 56471	140 66471	140 36471
	1000	16 × 20	19a	950	253	53	0.14	0.22	0.100	0.80	140 56102	140 66102	140 36102
	2200	16 × 31	20	1600	553	113	0.16	0.12	0.040	0.35	140 56222	140 66222	140 36222
	3300	18 × 31	1831	1850	828	168	0.16	0.08	0.040	0.35	140 56332	140 66332	-
35	100	10 × 12	14	320	38	10	0.12	1.91	0.350	2.40	140 50101	140 60101	140 30101
	220	10 × 16	15	420	80	18	0.12	0.87	0.290	2.00	140 50221	140 60221	140 30221
	470	12.5 × 20	17	750	168	36	0.12	0.41	0.120	0.90	140 50471	140 60471	140 30471
	1000	16 × 25	19	1200	353	73	0.12	0.19	0.065	0.45	140 50102	140 60102	140 30102
	2200	18 × 31	1831	1850	773	157	0.14	0.10	0.040	0.35	140 50222	140 60222	-
	47	10 × 12	14	300	27	8	0.10	3.39	0.440	2.80	140 51479	140 61479	140 31479
50	100	10 × 16	15	380	53	13	0.10	1.59	0.350	2.20	140 51101	140 61101	140 31101
	220	12.5 × 20	17	700	113	25	0.10	0.72	0.150	1.00	140 51221	140 61221	140 31221
	330	12.5 × 20	17	700	168	36	0.10	0.48	0.150	1.00	140 51331	140 61331	140 31331
	470	16 × 20	19a	900	238	50	0.10	0.34	0.120	0.80	140 51471	140 61471	140 31471
	1000	16 × 31	20	1450	503	103	0.10	0.16	0.050	0.30	140 51102	140 61102	140 31102
	22	10 × 12	14	300	17	6	0.10	7.23	0.440	2.80	140 58229	140 68229	140 38229
63	47	10 × 12	14	300	33	9	0.10	3.39	0.440	2.80	140 58479	140 68479	140 38479
	100	10 × 20	16	500	66	16	0.10	1.59	0.250	1.60	140 58101	140 68101	140 38101
	220	16 × 20	19a	900	142	31	0.10	0.72	0.120	0.80	140 58221	140 68221	140 38221
	330	16 × 20	19a	900	211	45	0.10	0.48	0.120	0.80	140 58331	140 68331	140 38331
	470	16 × 25	19	1100	299	62	0.10	0.34	0.080	0.50	140 58471	140 68471	140 38471
	1000	18 × 31	1831	1600	633	129	0.10	0.16	0.050	0.30	140 58102	140 68102	-

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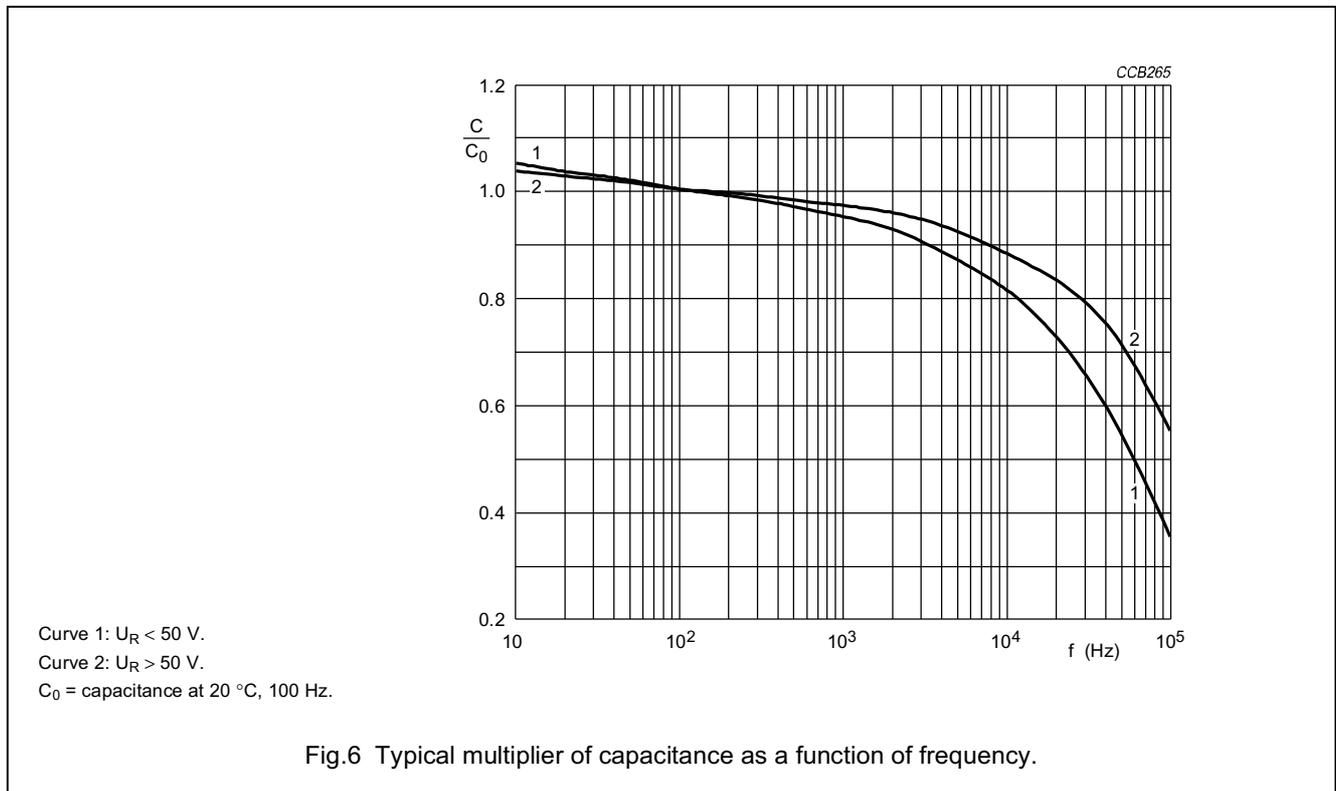
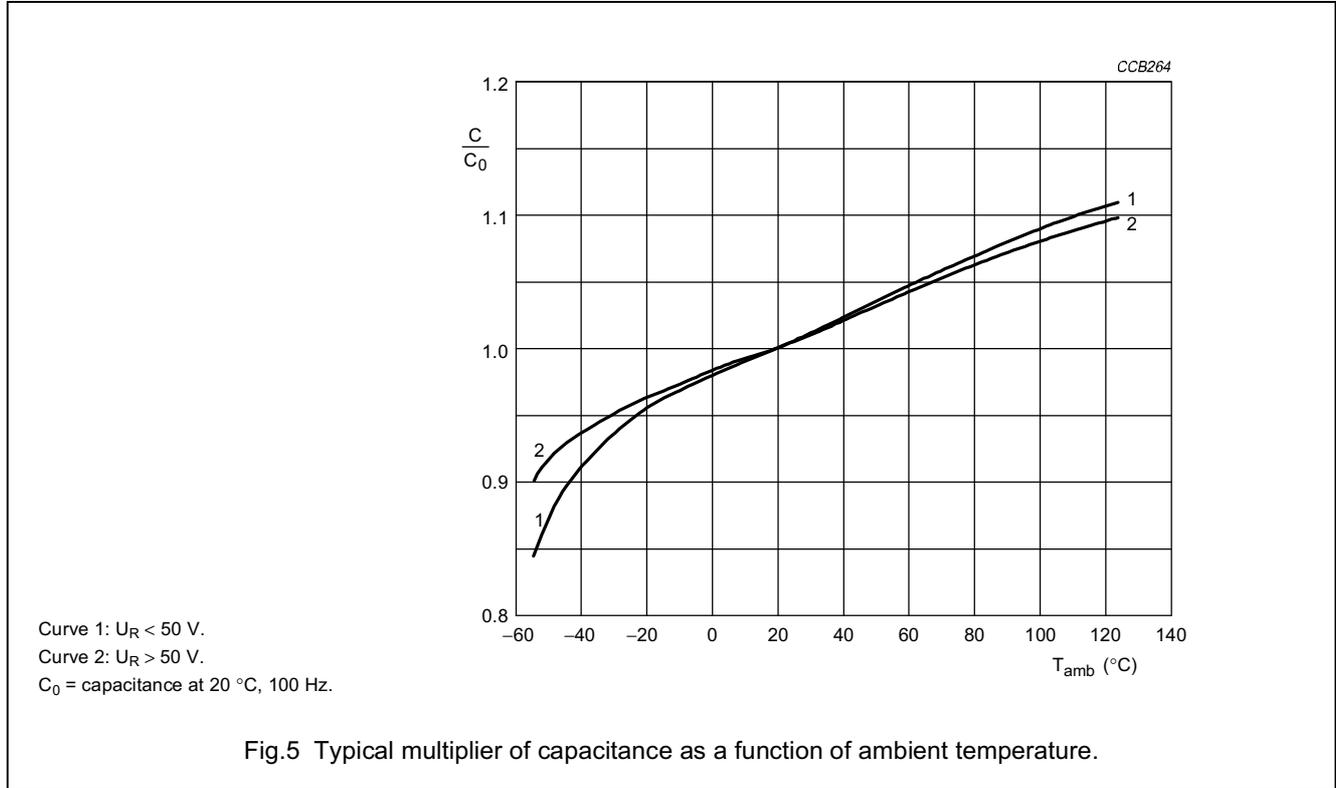
Additional electrical data

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage for short periods		$U_s \leq 1.3 U_R$
Reverse voltage		$U_{rev} \leq 1 V$
Current		
Leakage current	after 1 minute at U_R	$I_{L1} \leq 0.01 C_R \times U_R + 3 \mu A$
	after 5 minutes at U_R	$I_{L5} \leq 0.002 C_R \times U_R + 3 \mu A$
Inductance		
Equivalent series inductance (ESL)	case $\varnothing D = 10 \text{ mm}$	typ. 16 nH
	case $\varnothing D \geq 12.5 \text{ mm}$	typ. 18 nH

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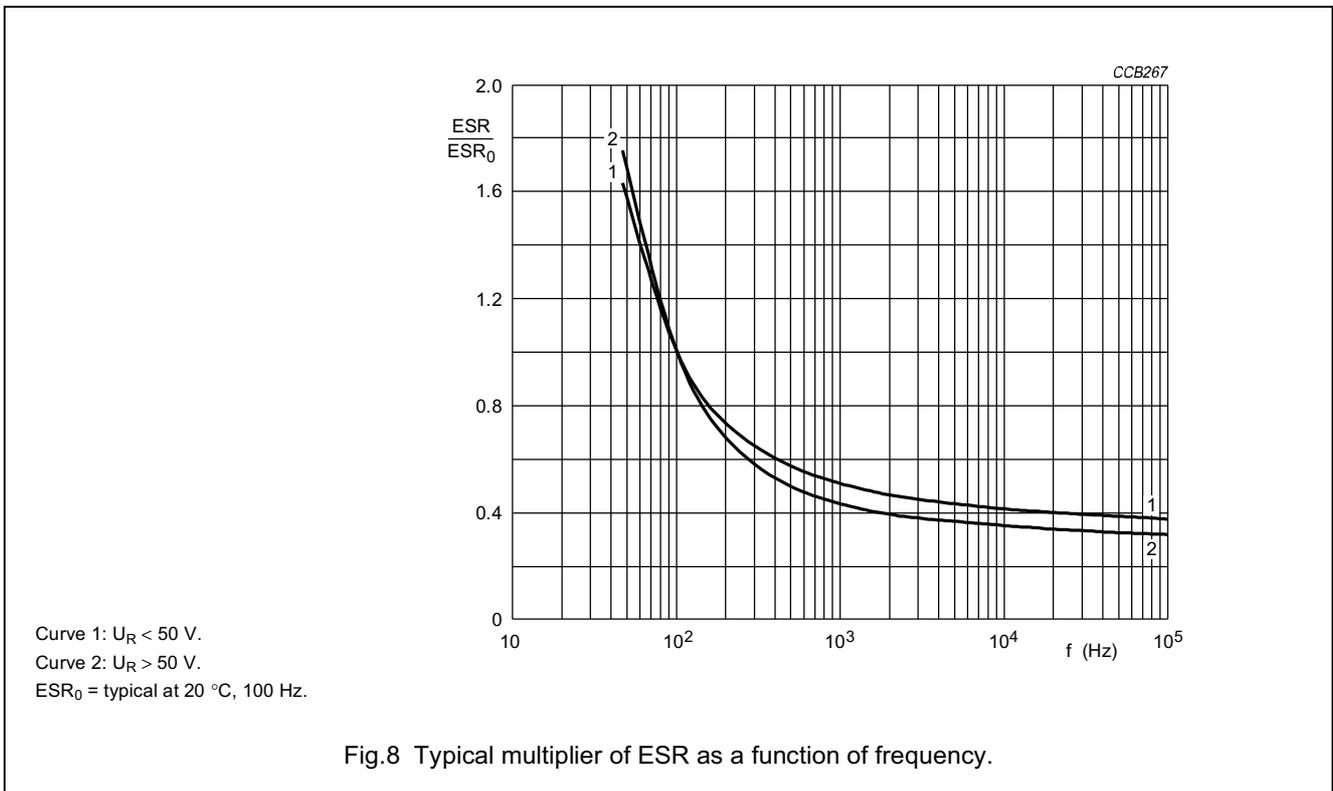
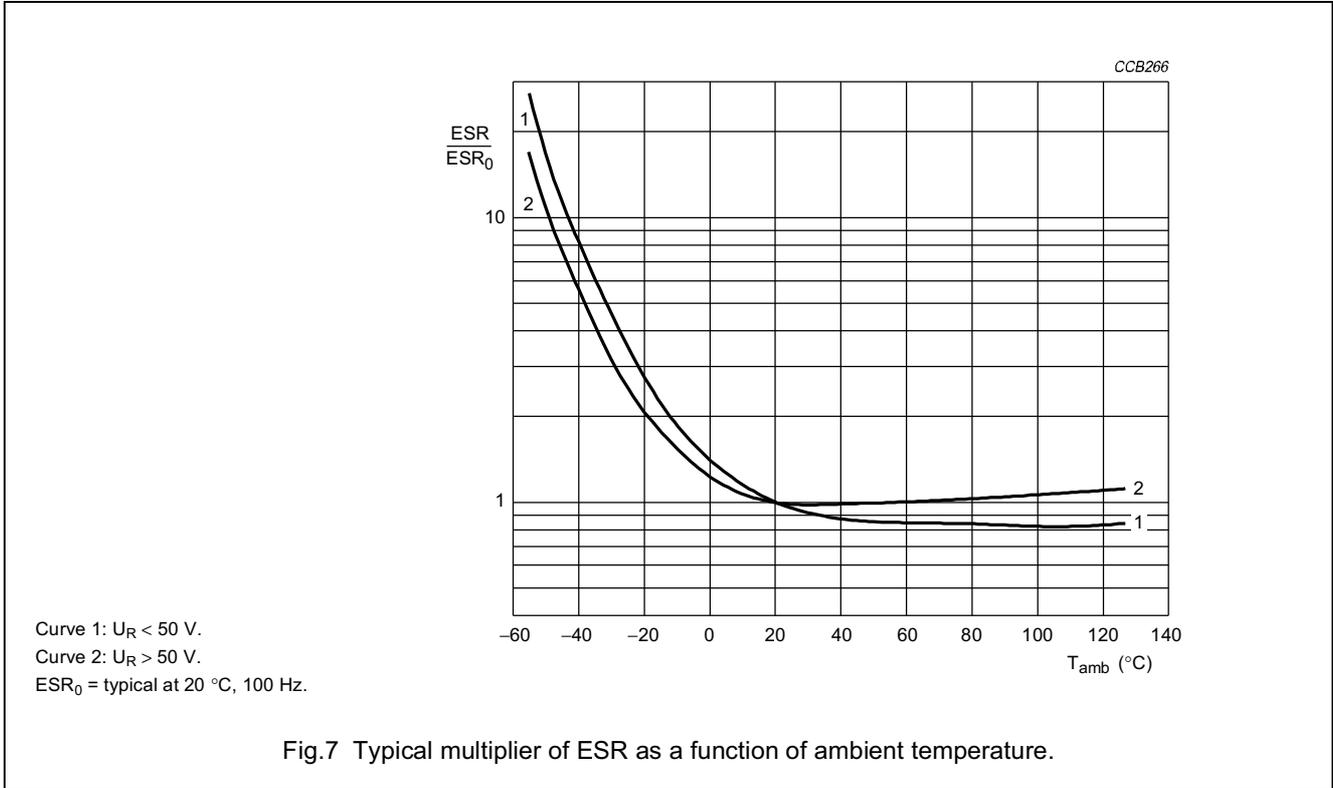
Capacitance (C)



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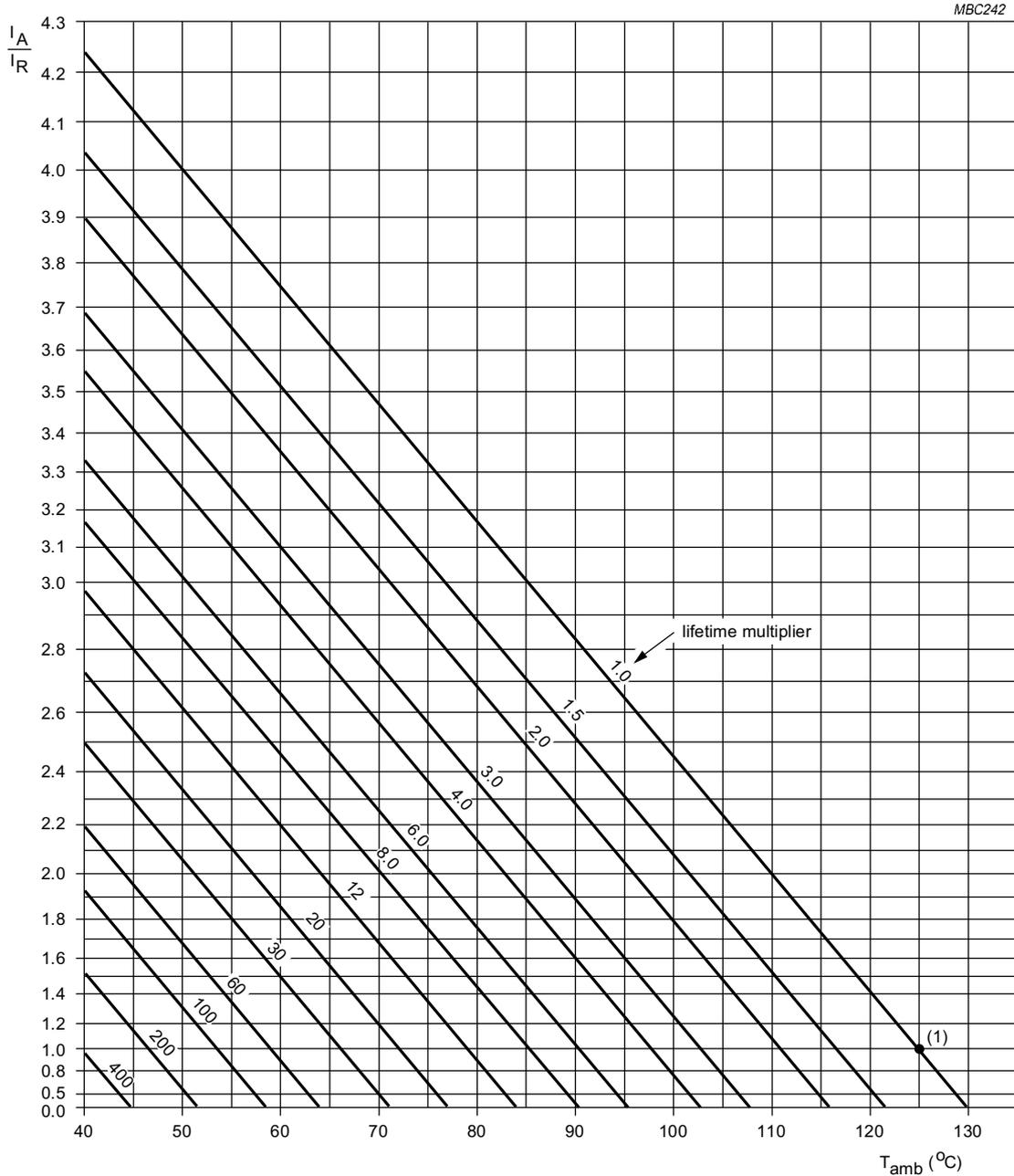
Equivalent series resistance (ESR)



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RIPPLE CURRENT AND USEFUL LIFE



I_A = actual ripple current at 100 kHz.
 I_R = rated ripple current at 100 kHz, 125 °C.
 (1) Useful life at 125 °C and I_R applied: 2500 to 4 000 hours; see Table 4.

Fig.9 Multiplier of useful life as a function of ambient temperature and ripple current load; see Table 3.

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Table 3 Multiplier of ripple current (I_R/I_{R0}) as a function of frequency; I_{R0} = ripple current at 100 kHz; see Fig.9

FREQUENCY (Hz)	I_R MULTIPLIER		
	$U_R = 10 \text{ to } 25 \text{ V}$	$U_R = 35 \text{ V}$	$U_R = 50 \text{ and } 63 \text{ V}$
50	0.6	0.5	0.35
100	0.7	0.65	0.5
300	0.85	0.8	0.65
1000	0.9	0.85	0.8
3000	0.95	0.9	0.9
10000	1.0	0.95	0.9
100000	1.0	1.0	1.0

Table 4 Endurance test duration and useful life as a function of case size; see Fig.9

NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	ENDURANCE TEST at 125 °C (hours)	USEFUL LIFE at 125 °C (hours)
10 × 12	14	2000	2500
10 × 16	15	2000	3000
10 × 20	16	2000	3000
12.5 × 20	17	2000	3000
16 × 20	19a	2000	3000
16 × 25	19	2000	4000
16 × 31	20	2000	4000
18 × 31	1831	2000	4000

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SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in data handbook PA01, Section "Tests and Requirements".

Table 5 Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ CECC 30300 subclause 4.13	$T_{amb} = 125\text{ °C}$; U_R applied; 2000 hours	$\Delta C/C: \pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 125\text{ °C}$; U_R and I_R applied; for test duration see Table 4	$\Delta C/C: \pm 30\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$
Shelf life	IEC 60384-4/ CECC 30300 subclause 4.17	$T_{amb} = 125\text{ °C}$; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 15\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$

**Aluminium electrolytic capacitors
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140 RTM**DEFINITIONS**

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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