

# DATA SHEET

152 RMH

**Aluminum electrolytic capacitors**  
**Radial Miniature, High voltage**

Product specification  
Supersedes data of 18th January 2000  
File under BCcomponents, BC01

2000 Apr 07

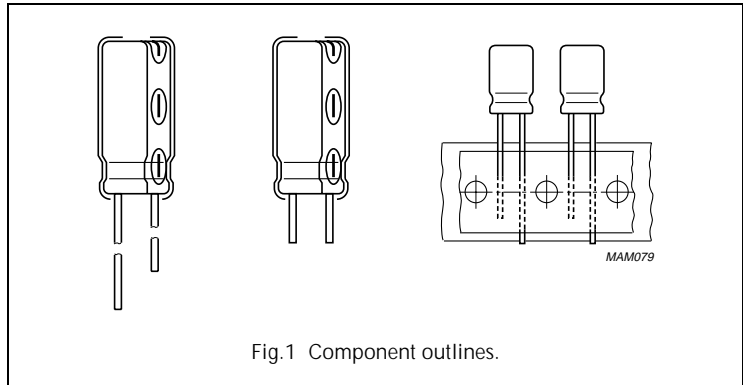
# Aluminum electrolytic capacitors

## Radial Miniature, High voltage

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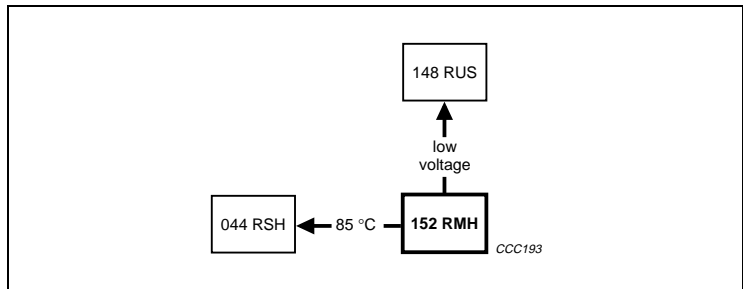
### FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue vinyl sleeve
- Pressure relief
- Charge and discharge proof
- Miniaturized, ultra high CV-product per unit volume
- Long useful life:  
3000 to 4000 hours at 105 °C,  
high reliability



### APPLICATIONS

- High-reliability and professional applications
- Lighting, monitors, consumer electronics, general industrial
- Filtering of high voltages in power supplies.



### QUICK REFERENCE DATA

DESCRIPTION	VALUE
Case sizes ( $\varnothing D_{nom} \times L_{nom}$ in mm)	10 × 12 to 18 × 35
Rated capacitance range, $C_R$	4.7 to 220 $\mu$ F
Tolerance on $C_R$	$\pm 20\%$
Rated voltage range, $U_R$	200 to 450 V
Category temperature range	-40 to +105 °C
Endurance test at 105 °C	2000 hours
Useful life at 105 °C:	
case $\varnothing D = 10$ and 12.5 mm	3000 hours
case $\varnothing D = 16$ and 18 mm	4000 hours
Useful life at 40 °C, $1.6 \times I_R$ applied:	
case $\varnothing D = 10$ and 12.5 mm	200000 hours
case $\varnothing D = 16$ and 18 mm	260000 hours
Shelf life at 0 V, 105 °C	1000 hours
Based on sectional specification	IEC 60384-4/EN130300
Climatic category IEC 60068	40/105/56

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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**.

$C_R$ ( $\mu F$ ) <sup>(1)</sup>	$U_R$ (V)			
	200	250	400	450
4.7	–	–	<b>10 × 16<sup>(2)</sup></b>	10 × 20
6.8	–	–	10 × 16	12.5 × 20
10	<b>10 × 12</b>	10 × 16	<b>10 × 20</b>	<b>12.5 × 20</b>
22	<b>10 × 16</b>	12.5 × 20	<b>12.5 × 25</b>	<b>16 × 25</b>
	–	–	16 × 20	18 × 20
33	10 × 20	12.5 × 20	16 × 20	16 × 35
	–	–	–	18 × 25
47	<b>12.5 × 20</b>	<b>12.5 × 25</b>	<b>16 × 25</b>	18 × 35
	–	16 × 20	–	–
68	12.5 × 25	–	16 × 35	–
100	<b>16 × 20</b>	16 × 25	18 × 35	–
220	16 × 35	–	–	–

### Notes

1. Other values are available on request.
2. Also available in case size 10 × 12.

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MECHANICAL DATA, AVAILABLE FORMS AND PACKAGING QUANTITIES

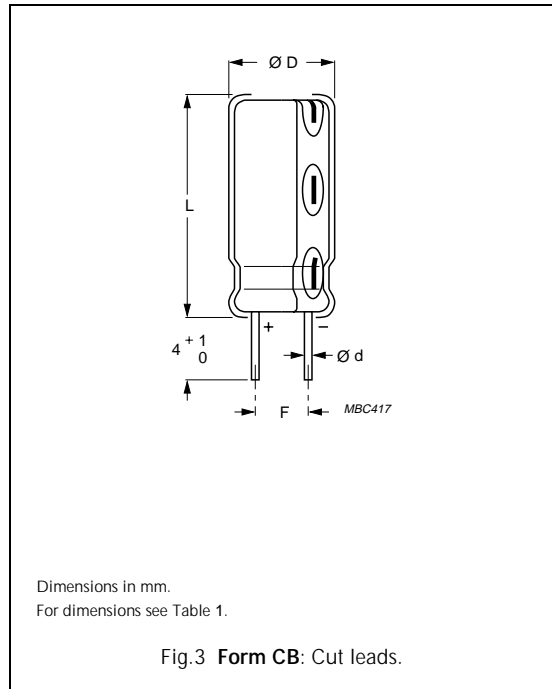
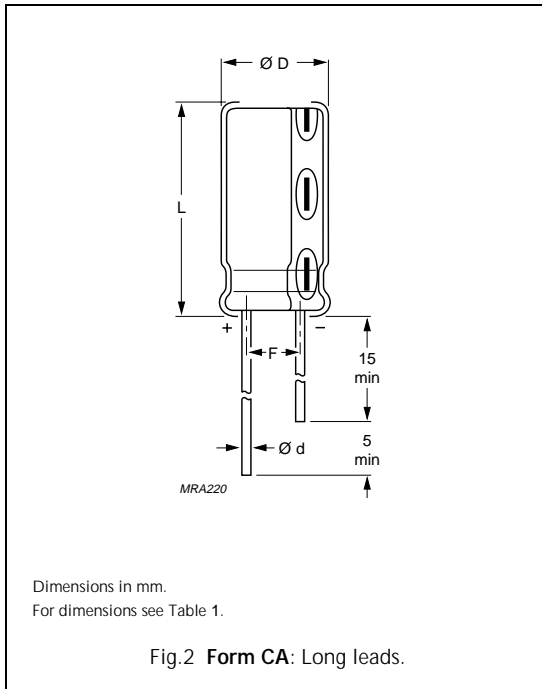


Table 1 Physical dimensions, mass and packaging quantities; see Figs 2 and 3

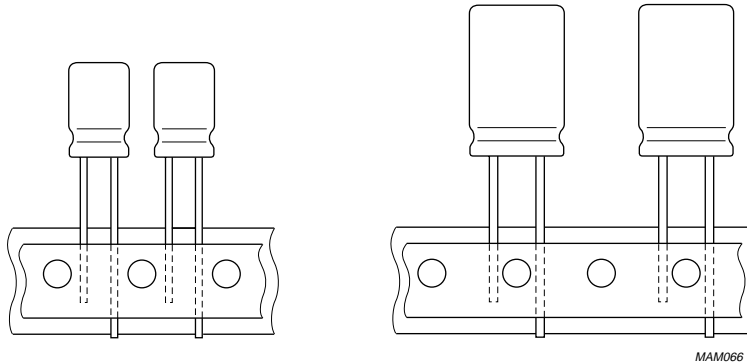
NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	Ød (mm)	ØD <sub>max</sub> (mm)	L <sub>max</sub> (mm)	F (mm)	MASS (g)	PACKAGING QUANTITIES PER BOX		
							FORM CA	FORM CB	FORM TFA
10 × 12	14	0.6	10.5	13.5	5.0 ±0.5	≈1.6	1000	500	800
10 × 16	15	0.6	10.5	17.5	5.0 ±0.5	≈1.9	500	500	800
10 × 20	16	0.6	10.5	22.0	5.0 ±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
12.5 × 25	18	0.6	13.0	27.0	5.0 ±0.5	≈5.0	250	250	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 × 35	21	0.8	16.5	37.5	7.5 ±0.5	≈11.0	100	100	–
18 × 20	1820	0.8	18.5	22.0	7.5 ±0.5	≈8.0	100	100	–
18 × 25	1825	0.8	18.5	27.0	7.5 ±0.5	≈10.0	100	100	–
18 × 35	22	0.8	18.5	37.5	7.5 ±0.5	≈14.5	100	100	–

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### Taped products



#### Form TFA

Case  $\varnothing D \times L \leq 16 \times 30$  mm.

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

Fig.4 Taped in box (ammopack).

### MARKING

The capacitors are marked with the following information:

- Rated capacitance value (in  $\mu\text{F}$ )
- Tolerance on rated capacitance, code letter in accordance with "IEC 60062" (M for  $\pm 20\%$ )
- Rated voltage (in V)
- Upper category temperature (105 °C)
- Group number (152)
- Code indicating factory of origin
- Name of manufacturer
- Date code, in accordance with "IEC 60062"
- Negative terminal identification.

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### Ordering example

Electrolytic capacitor 152 series

4.7  $\mu\text{F}/400\text{ V}; \pm 20\%$

Nominal case size:  $\varnothing 10 \times 16\text{ mm}$ ; Form TFA

Catalogue number: 2222 152 36478.

### ELECTRICAL DATA AND ORDERING INFORMATION

Unless otherwise specified, all electrical values in Table 2 apply at  $T_{\text{amb}} = 20\text{ }^{\circ}\text{C}$ ,  
 $P = 86\text{ to }106\text{ kPa}$ ,  $\text{RH} = 45\text{ to }75\%$ .

SYMBOL	DESCRIPTION
$C_R$	rated capacitance at 100 Hz, tolerance $\pm 20\%$
$I_R$	rated RMS ripple current at 100 Hz, 105 $^{\circ}\text{C}$
$I_{L1}$	max. leakage current after 1 minute at $U_R$
$I_{L5}$	max. leakage current after 5 minutes at $U_R$
$\text{Tan } \delta$	max. dissipation factor at 100 Hz
ESR	equivalent series resistance at 100 Hz (calculated from $\text{tan } \delta_{\text{max}}$ and $C_R$ )
Z	max. impedance at 10 kHz

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

$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	$I_R$ 100 Hz 105 $^{\circ}\text{C}$ (mA)	$I_{L1}$ 1 min ( $\mu\text{A}$ )	$I_{L5}$ 5 min ( $\mu\text{A}$ )	$\text{Tan } \delta$ 100 Hz	ESR 100 Hz ( $\Omega$ )	Z 10 kHz +20 $^{\circ}\text{C}$ ( $\Omega$ )	CATALOGUE NUMBER 2222 ... ..		
										BULK PACKAGING		TAPED
										FORM CA	FORM CB	FORM TFA
200	<b>10</b>	<b>10 <math>\times</math> 12</b>	<b>14</b>	85	130	60	0.12	19.1	6.3	152 52109	<b>152 62109</b>	<b>152 32109</b>
	<b>22</b>	<b>10 <math>\times</math> 16</b>	<b>15</b>	120	202	96	0.12	8.7	3.2	152 52229	<b>152 62229</b>	<b>152 32229</b>
	33	10 $\times$ 20	16	150	268	129	0.12	5.8	2.3	152 52339	152 62339	152 32339
	<b>47</b>	<b>12.5 <math>\times</math> 20</b>	<b>17</b>	240	352	171	0.12	4.1	0.9	152 52479	<b>152 62479</b>	<b>152 32479</b>
	68	12.5 $\times$ 25	18	310	478	234	0.12	2.8	0.6	152 52689	152 62689	152 32689
	<b>100</b>	<b>16 <math>\times</math> 20</b>	<b>19a</b>	340	670	330	0.12	1.9	0.4	152 52101	<b>152 62101</b>	<b>152 32101</b>
	220	16 $\times$ 35	21	630	1390	690	0.12	0.9	0.2	152 52221	152 62221	–
250	10	10 $\times$ 16	15	105	145	68	0.12	19.1	6.3	152 53109	152 63109	152 33109
	22	12.5 $\times$ 20	17	180	235	113	0.12	8.7	2.3	152 53229	152 63229	152 33229
	33	12.5 $\times$ 20	17	180	318	154	0.12	5.8	1.5	152 53339	152 63339	152 33339
	<b>47</b>	<b>12.5 <math>\times</math> 25</b>	<b>18</b>	310	423	206	0.12	4.1	0.9	152 53479	<b>152 63479</b>	<b>152 33479</b>
	47	16 $\times$ 20	19a	310	423	206	0.12	4.1	0.9	152 93475	152 93476	152 93473
	100	16 $\times$ 25	19	340	820	405	0.12	1.9	0.4	152 53101	152 63101	152 33101

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U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	CASE CODE	I <sub>R</sub> 100 Hz 105 °C (mA)	I <sub>L1</sub> 1 min (μA)	I <sub>L5</sub> 5 min (μA)	Tan δ 100 Hz	ESR 100 Hz (Ω)	Z 10 kHz +20 °C (Ω)	CATALOGUE NUMBER 2222 ... ..		
										BULK PACKAGING		TAPED
										FORM CA	FORM CB	FORM TFA
400	4.7	10 × 16	15	65	126	58	0.15	50.8	18.0	152 56478	152 66478	152 36478
	6.8	10 × 16	15	65	152	71	0.15	35.1	12.0	152 56688	152 66688	152 36688
	10	10 × 20	16	80	190	90	0.15	23.9	9.0	152 56109	152 66109	152 36109
	22	12.5 × 25	18	150	334	162	0.15	10.9	3.8	152 56229	152 66229	152 36229
	22	16 × 20	19a	150	334	162	0.15	10.9	3.8	152 96225	152 96226	152 96223
	33	16 × 20	19a	190	466	228	0.15	7.2	2.6	152 56339	152 66339	152 36339
	47	16 × 25	19	240	634	312	0.15	5.1	2.0	152 56479	152 66479	152 36479
	68	16 × 35	21	310	886	138	0.15	3.5	1.7	152 56689	152 66689	–
	100	18 × 35	22	380	1270	630	0.15	2.4	0.9	152 56101	152 66101	–
450	4.7	10 × 20	16	65	133	62	0.20	67.8	20.0	152 57478	152 67478	152 37478
	6.8	12.5 × 20	17	80	162	76	0.20	46.8	16.0	152 57688	152 67688	152 37688
	10	12.5 × 20	17	90	205	98	0.20	31.8	10.0	152 57109	152 67109	152 37109
	22	16 × 25	19	150	367	179	0.20	14.5	4.6	152 57229	152 67229	152 37229
	22	18 × 20	1820	150	367	179	0.20	14.5	4.6	152 97225	152 97226	–
	33	16 × 35	21	200	516	253	0.20	9.7	3.4	152 57339	152 67339	–
	33	18 × 25	1825	200	516	253	0.20	9.7	3.4	152 97335	152 97336	–
47	18 × 35	22	260	705	347	0.20	6.8	2.0	152 57479	152 67479	–	

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### Additional electrical data

PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage	$U_R = 200 \text{ to } 250 \text{ V}$	$U_s \leq 1.15 \times U_R$
	$U_R = 400 \text{ to } 450 \text{ V}$	$U_s \leq 1.10 \times U_R$
Reverse voltage		$U_{rev} \leq 1 \text{ V}$
<b>Current</b>		
Leakage current	after 1 minute at $U_R$	$I_{L1} \leq 0.03C_R \times U_R + 70 \mu\text{A}$
	after 5 minutes at $U_R$	$I_{L5} \leq 0.015C_R \times U_R + 30 \mu\text{A}$
<b>Inductance</b>		
Equivalent series inductance (ESL)	case $\varnothing D = 10 \text{ mm}$	typ. 16 nH
	case $\varnothing D \geq 12.5 \text{ mm}$	typ. 18 nH

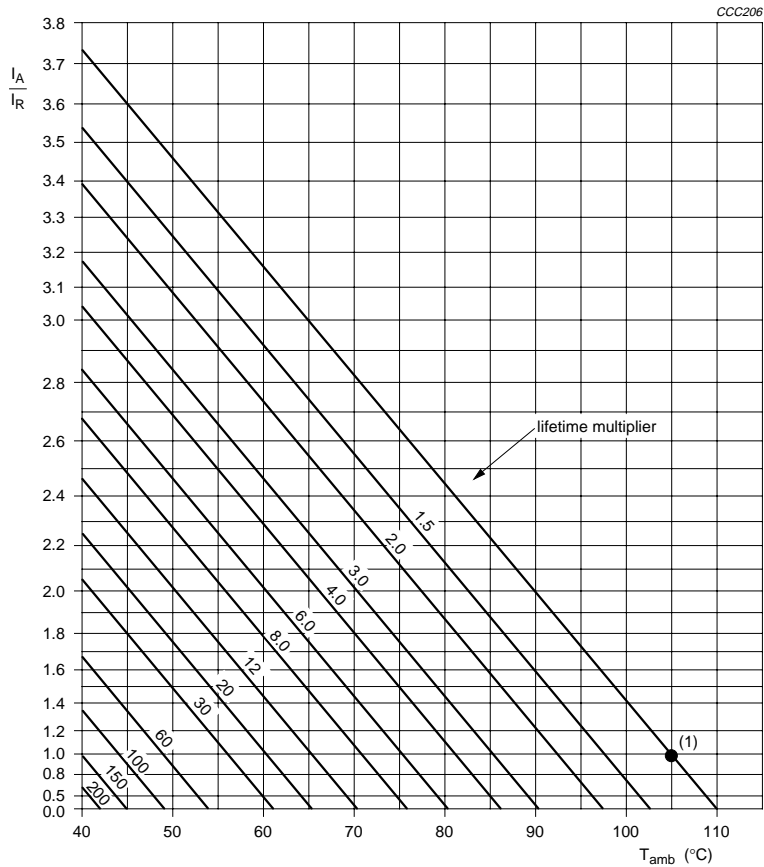


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### RIPPLE CURRENT AND USEFUL LIFE



$I_A$  = 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: see Table 4.

Fig.5 Multiplier of useful life as a function of ambient temperature and ripple current load.

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

FREQUENCY (Hz)	$I_R$ MULTIPLIER	
	$U_R \leq 250$ V	$U_R > 250$ V
50	0.75	0.75
100	1.00	1.00
300	1.50	1.30
1000	2.00	1.60
3000	2.20	1.90
10000	2.50	2.20
$\geq 100000$	3.00	2.50

**Table 4** Endurance test duration and useful life as a function of case size; see Fig.5

NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	ENDURANCE TEST at 105 °C (hours)	USEFUL LIFE at 105 °C (hours)
10 × 12	14	2000	3000
10 × 16	15	2000	3000
10 × 20	16	2000	3000
12.5 × 20	17	2000	3000
12.5 × 25	18	2000	3000
16 × 20	19a	2000	4000
16 × 25	19	2000	4000
16 × 35	21	2000	4000
18 × 20	1820	2000	4000
18 × 25	1825	2000	4000
18 × 35	22	2000	4000

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### SPECIFIC TESTS AND REQUIREMENTS

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

**Table 5** 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; 2000 hours	$\Delta C/C: \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105\text{ °C}$ ; $U_R$ and $I_R$ applied; for test duration see Table 4	$\Delta C/C: \pm 50\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 105\text{ °C}$ ; no voltage applied; 1000 hours  after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$
Reverse voltage	IEC 60384-4/ EN130300 subclause 4.15	$T_{amb} = 105\text{ °C}$ : 125 hours at $U = -1\text{ V}$ , followed by 125 hours at $U_R$	$\Delta C/C: \pm 15\%$ $I_{L5} \leq \text{spec. limit}$ $\tan \delta \leq \text{spec. limit}$