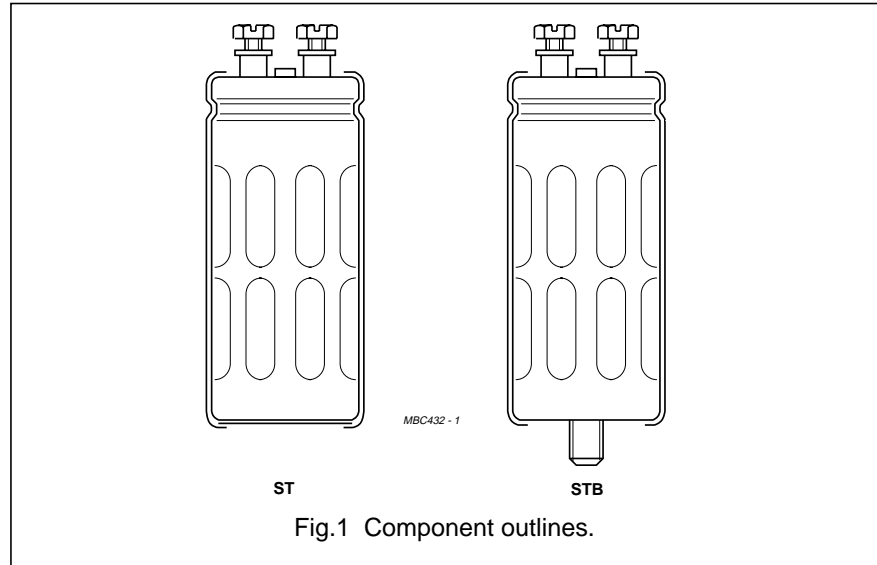


# Aluminium electrolytic capacitors Power Economic Screw Terminals

## 154/155 PEC-ST

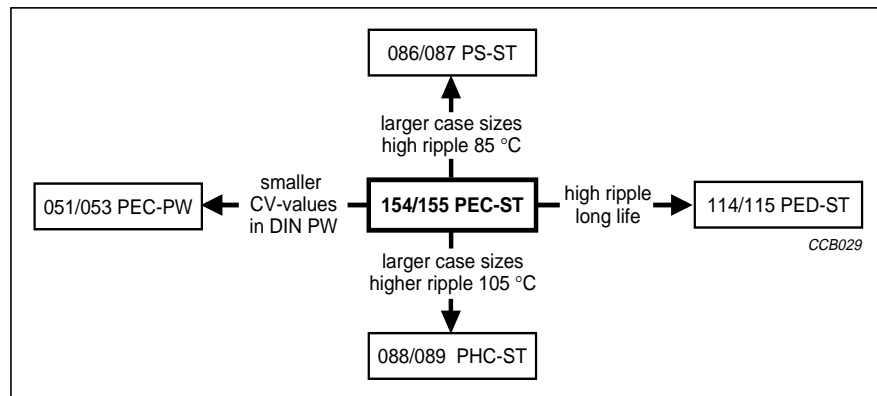
### FEATURES

- Polarized aluminium electrolytic capacitors, non-solid
- Large types, minimized dimensions, cylindrical aluminium case, insulated with a blue sleeve
- Also available in bolt version (PEC-STB)
- Pressure relief in the sealing
- Charge and discharge proof
- Long useful life: 12000 hours at 85 °C
- High ripple current capability
- High resistance to shock and vibration achieved by longitudinal rills and special internal construction.



### APPLICATIONS

- General purpose, computer and industrial systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems.



### QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	154	155
Case size ( $\varnothing D_{nom} \times L_{nom}$ in mm)	35 × 60 to 75 × 105	
Rated capacitance range (E6 series), $C_R$	220 to 470 000 $\mu F$	
Tolerance on $C_R$	±20%	
Rated voltage range, $U_R$	10 to 100 V	250 to 400 V
Category temperature range	-40 to +85 °C	
Endurance test at 85 °C	5000 hours (400 V: 2000 hours)	
Useful life at 85 °C	12000 hours (400 V: 5000 hours)	
Useful life at 40 °C, $1.4 \times I_R$ applied	200000 hours (400 V: 90000 hours)	
Shelf life at 0 V, 85 °C	500 hours	
Based on sectional specification	IEC 384-4/CECC 30300	
Climatic category IEC 68	40/085/56	

L

# Aluminium electrolytic capacitors

## Power Economic Screw Terminals

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### Selection chart for $C_R$ , $U_R$ and relevant nominal case sizes ( $\varnothing D \times L$ in mm) for 154 series

Preferred types in **bold**.

$C_R$ ( $\mu F$ )	$U_R$ (V)					
	10	16	25	40	63	100
3300	–	–	–	–	–	35 × 60
<b>4700</b>	–	–	–	–	–	<b>35 × 80</b>
6800	–	–	–	–	35 × 60	35 × 105
<b>10000</b>	–	–	–	–	<b>35 × 80</b>	<b>50 × 80</b>
15000	–	–	–	35 × 60	35 × 105	50 × 105
<b>22000</b>	–	–	<b>35 × 60</b>	<b>35 × 80</b>	<b>50 × 80</b>	<b>65 × 105</b>
33000	–	35 × 60	35 × 80	50 × 80	50 × 105	75 × 105
<b>47000</b>	<b>35 × 60</b>	<b>35 × 80</b>	<b>35 × 105</b>	<b>50 × 80</b>	<b>65 × 105</b>	–
68000	35 × 80	35 × 105	50 × 80	50 × 105	75 × 105	–
<b>100000</b>	<b>35 × 105</b>	<b>50 × 80</b>	<b>50 × 105</b>	<b>65 × 105</b>	–	–
150000	50 × 80	50 × 105	65 × 105	75 × 105	–	–
<b>220000</b>	<b>50 × 105</b>	<b>65 × 105</b>	<b>75 × 105</b>	–	–	–
330000	65 × 105	75 × 105	–	–	–	–
<b>470000</b>	<b>75 × 105</b>	–	–	–	–	–

### Selection chart for $C_R$ , $U_R$ and relevant nominal case sizes ( $\varnothing D \times L$ in mm) for 155 series

Preferred types in **bold**.

$C_R$ ( $\mu F$ )	$U_R$ (V)			
	250	350	385	400
<b>220</b>	–	–	<b>35 × 60</b>	<b>35 × 60</b>
330	–	35 × 60	35 × 80	35 × 80
<b>470</b>	<b>35 × 60</b>	<b>35 × 80</b>	<b>35 × 80</b>	<b>35 × 80</b>
680	35 × 80	35 × 105	35 × 105	35 × 105
<b>1000</b>	<b>35 × 105</b>	<b>50 × 80</b>	<b>50 × 80</b>	<b>50 × 80</b>
1500	50 × 80	50 × 105	50 × 105	50 × 105
<b>2200</b>	<b>50 × 105</b>	<b>65 × 105</b>	<b>65 × 105</b>	<b>65 × 105</b>
3300	65 × 105	65 × 105	75 × 105	75 × 105
<b>4700</b>	<b>65 × 105</b>	–	–	–
6800	75 × 105	–	–	–

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MECHANICAL DATA AND PACKAGING QUANTITIES

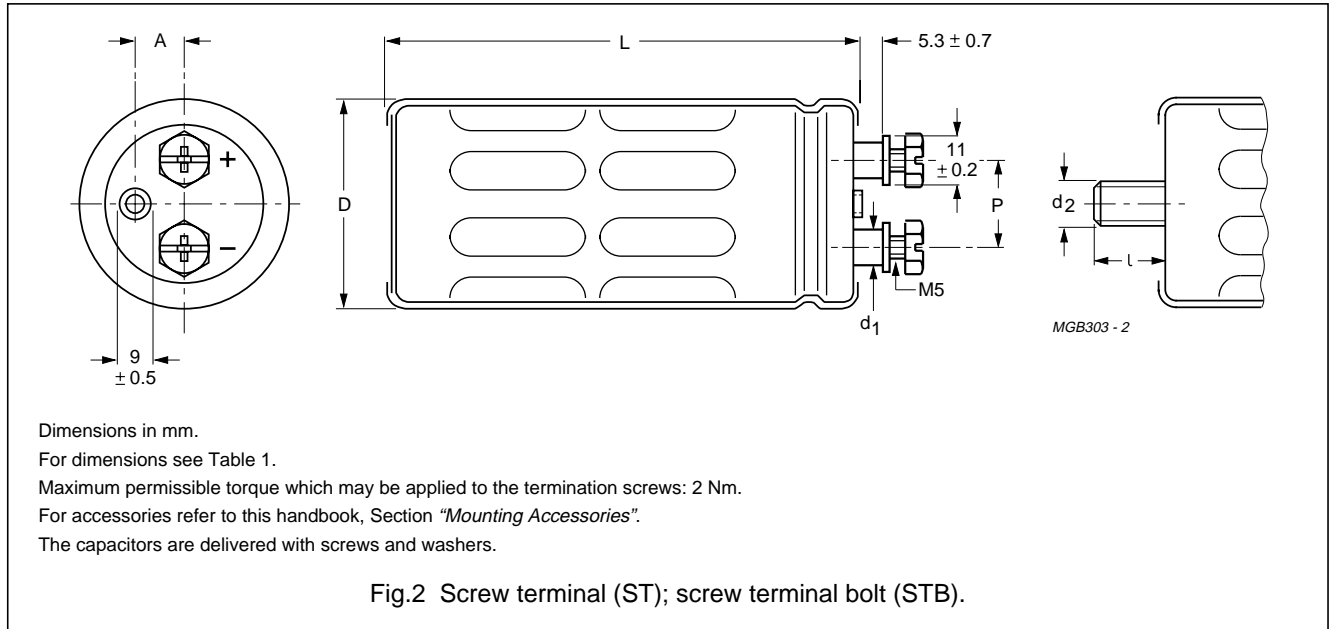


Table 1 Physical dimensions, mass and packaging information; see Fig.2

NOMINAL CASE SIZE ØD × L (mm)	ØD <sub>max</sub> (mm)	L <sub>max</sub> (mm)	P ±0.1 (mm)	A (mm)	d <sub>1</sub> ±0.2 (mm)	d <sub>2</sub> × l	MASS (g)	PACKAGING QUANTITIES (per box)	CARDBOARD BOX DIMENSIONS l × w × h (mm)
35 × 60	36.5	63	13.0	8.4	8.0	M8 × 12	≈55	25	196 × 192 × 110
35 × 80	36.5	83	13.0	8.4	8.0	M8 × 12	≈80	25	196 × 192 × 115
35 × 105	36.5	108	13.0	8.4	8.0	M8 × 12	≈110	25	196 × 192 × 140
50 × 80	51.5	83	22.0	14.3	8.0	M12 × 16	≈160	25	293 × 273 × 115
50 × 105	51.5	108	22.0	14.3	8.0	M12 × 16	≈210	25	293 × 273 × 140
65 × 105	66.5	108	28.5	19.0	9.6	M12 × 16	≈370	10	368 × 151 × 140
75 × 105	76.5	108	32.0	21.0	9.6	M12 × 16	≈535	10	418 × 173 × 140

MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance code on rated capacitance (M for ±20%)
- Rated voltage (in V)
- Climatic category in accordance with "IEC 68"
- Date code (year and week) in accordance with "IEC 62"
- Code for factory of origin
- Name of manufacturer
- Code number (last 8 digits)
- Code for basic specification in accordance with "IEC 384-4-1" and "CECC 30301".



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**Ordering Example**

Electrolytic capacitor 154 series

10000  $\mu\text{F}/63\text{ V}; \pm 20\%$ Nominal case size:  $\varnothing 35 \times 80\text{ mm}$ ; ST version

Catalogue number: 2222 154 18103.

**ELECTRICAL DATA AND ORDERING INFORMATION**

Unless otherwise specified, all electrical values in Tables 2 and 3 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
$I_R$	rated RMS ripple current at 100 Hz, 85 °C and 20 kHz, 70 °C
$I_{L1}$	max. leakage current after 1 minute at $U_R$
$I_{L5}$	max. leakage current after 5 minutes at $U_R$
ESR	typical equivalent series resistance at 100 Hz
Z	impedance at 20 kHz
Tan $\delta$	max. dissipation factor at 100 Hz

**Table 2** Electrical data and ordering information for **154** series; preferred types in **bold**

$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 100 Hz 85 °C (A)	$I_R$ 20 kHz 70 °C (A)	$I_{L1}$ 1 min (mA)	$I_{L5}$ 5 min (mA)	ESR TYP. 100 Hz ( $\text{m}\Omega$ )	Tan $\delta$ MAX. 100 Hz	Z TYP. 20 kHz ( $\text{m}\Omega$ )	Z MAX. 20 kHz ( $\text{m}\Omega$ )	CATALOGUE NUMBER (see Table 3, note 1) 2222 ... ..
10	<b>47000</b>	<b>35 × 60</b>	8.4	15.9	2.82	0.94	14	0.48	11	16.5	<b>154 14473</b>
	68000	35 × 80	8.7	16.5	4.08	1.36	11	0.88	9	13.5	154 14683
	<b>100000</b>	<b>35 × 105</b>	10.7	20.3	6.00	2.00	10.5	0.92	8	12	<b>154 14104</b>
	150000	50 × 80	13.2	25.0	9.00	3.00	8	1.03	8	12	154 14154
	<b>220000</b>	<b>50 × 105</b>	16.5	31.4	13.20	4.40	6.5	1.26	7	10.5	<b>154 14224</b>
	330000	65 × 105	20.8	39.5	19.80	6.60	5.5	1.59	7	10.5	154 14334
	<b>470000</b>	<b>75 × 105</b>	22.6	42.9	28.20	9.40	5.5	2.21	7	10.5	<b>154 14474</b>
16	33000	35 × 60	8.4	15.9	3.17	1.06	14	0.32	10	15	154 15333
	<b>47000</b>	<b>35 × 80</b>	8.7	16.5	4.51	1.51	11	0.32	9	13.5	<b>154 15473</b>
	68000	35 × 105	12.2	23.2	6.53	2.18	8	0.45	8	12	154 15683
	<b>100000</b>	<b>50 × 80</b>	13.2	25.0	9.60	3.20	8	0.70	8	12	<b>154 15104</b>
	150000	50 × 105	14.9	28.3	14.40	4.80	8	0.88	7	10.5	154 15154
	<b>220000</b>	<b>65 × 105</b>	20.8	39.5	21.10	7.04	5.5	1.07	7	10.5	<b>154 15224</b>
	330000	75 × 105	22.6	42.9	31.70	10.60	5.5	1.58	7	10.5	154 15334

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$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 100 Hz 85 °C (A)	$I_R$ 20 kHz 70 °C (A)	$I_{L1}$ 1 min (mA)	$I_{L5}$ 5 min (mA)	ESR TYP. 100 Hz (m $\Omega$ )	Tan $\delta$ MAX. 100 Hz	Z TYP. 20 kHz (m $\Omega$ )	Z MAX. 20 kHz (m $\Omega$ )	CATALOGUE NUMBER (see Table 3, note 1) 2222 ... ..
25	<b>22000</b>	<b>35 × 60</b>	8.1	15.4	3.30	1.10	12	0.23	10	15	<b>154 16223</b>
	33000	35 × 80	9.6	18.2	4.95	1.65	10	0.28	9	13.5	154 16333
	<b>47000</b>	<b>35 × 105</b>	12.2	23.2	7.05	2.35	8	0.33	8	12	<b>154 16473</b>
	68000	50 × 80	13.2	25.0	10.20	3.40	8	0.49	8	12	154 16683
	<b>100000</b>	<b>50 × 105</b>	15.9	30.2	15.00	5.00	7	0.60	8	12	<b>154 16104</b>
	150000	65 × 105	19.7	37.4	22.50	7.50	7	0.93	8	12	154 16154
	<b>220000</b>	<b>75 × 105</b>	22.6	42.9	33.00	11.00	5.5	1.07	7	10.5	<b>154 16224</b>
40	15000	35 × 60	7.7	14.6	3.60	1.20	13	0.17	10	15	154 17153
	<b>22000</b>	<b>35 × 80</b>	9.8	18.6	5.28	1.76	11	0.20	9	13.5	<b>154 17223</b>
	33000	50 × 80	11.8	22.4	7.92	2.64	10	0.29	9	13.5	154 17333
	<b>47000</b>	<b>50 × 80</b>	11.8	22.4	11.30	3.76	10	0.42	9	13.5	<b>154 17473</b>
	68000	50 × 105	14.1	26.8	16.30	5.44	9	0.45	8	12	154 17683
	<b>100000</b>	<b>65 × 105</b>	17.3	32.9	24.00	8.00	9	0.80	8	12	<b>154 17104</b>
	150000	75 × 105	20.8	39.5	36.00	12.00	6.5	0.83	7	10.5	154 17154
63	6800	35 × 60	6.6	12.5	2.57	0.86	17	0.10	13	19	154 18682
	<b>10000</b>	<b>35 × 80</b>	8.6	16.3	3.78	1.26	12.5	0.11	10	15	<b>154 18103</b>
	15000	35 × 105	10.9	20.7	5.67	1.89	10	0.13	9	13.5	154 18153
	<b>22000</b>	<b>50 × 80</b>	11.8	22.4	8.32	2.77	10	0.20	9	13.5	<b>154 18223</b>
	33000	50 × 105	14.1	26.8	12.50	4.16	9	0.24	8	12	154 18333
	<b>47000</b>	<b>65 × 105</b>	17.3	32.9	17.80	5.92	9	0.36	8	12	<b>154 18473</b>
	68000	75 × 105	17.7	33.6	25.70	8.57	9	0.58	8	12	154 18683
100	3300	35 × 60	3.8	7.2	1.98	0.66	50	0.13	35	55	154 19332
	<b>4700</b>	<b>35 × 80</b>	5.3	10.0	2.82	0.94	35	0.13	25	40	<b>154 19472</b>
	6800	35 × 105	7.1	13.5	4.08	1.36	25	0.14	18	28	154 19682
	<b>10000</b>	<b>50 × 80</b>	8.9	16.9	6.00	2.00	18	0.14	13	20	<b>154 19103</b>
	15000	50 × 105	11.5	21.8	9.00	3.00	14	0.16	10	16	154 19153
	<b>22000</b>	<b>65 × 105</b>	18.2	34.5	13.20	4.40	7.5	0.13	6	9	<b>154 19223</b>
	33000	75 × 105	24.1	45.7	19.80	6.60	5.0	0.13	4	6	154 19333

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**Table 3** Electrical data and ordering information for **155** series; preferred types in **bold**

$U_R$ (V)	$C_R$ 100 Hz ( $\mu$ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 100 Hz 85 °C (A)	$I_R$ 20 kHz 70 °C (A)	$I_{L1}$ 1 min (mA)	$I_{L5}$ 5 min (mA)	ESR TYP. 100 Hz (m $\Omega$ )	Tan $\delta$ MAX. 100 Hz	Z TYP. 20 kHz (m $\Omega$ )	Z MAX. 20 kHz (m $\Omega$ )	CATALOGUE NUMBER (note 1) 2222 ... ..
250	<b>470</b>	<b>35 × 60</b>	1.6	3.0	0.70	0.24	360	0.16	300	450	<b>155 13471</b>
	680	35 × 80	2.2	4.2	1.02	0.34	250	0.16	216	325	155 13681
	<b>1000</b>	<b>35 × 105</b>	2.9	5.5	1.50	0.50	175	0.16	140	210	<b>155 13102</b>
	1500	50 × 80	3.9	7.4	2.25	0.75	115	0.16	100	150	155 13152
	<b>2200</b>	<b>50 × 105</b>	5.3	10.1	3.30	1.10	80	0.17	70	105	<b>155 13222</b>
	3300	65 × 105	7.7	14.6	4.95	1.65	50	0.17	43	65	155 13332
	<b>4700</b>	<b>65 × 105</b>	8.2	15.6	7.05	2.35	44	0.19	40	60	<b>155 13472</b>
	6800	75 × 105	10	19	10.20	3.40	35	0.22	33	50	155 13682
350	330	35 × 60	1.5	2.9	0.69	0.23	370	0.12	313	470	155 15331
	<b>470</b>	<b>35 × 80</b>	2.1	4.0	0.99	0.33	260	0.12	223	335	<b>155 15471</b>
	680	35 × 105	2.9	5.5	1.43	0.48	180	0.12	146	220	155 15681
	<b>1000</b>	<b>50 × 80</b>	3.7	7.0	2.10	0.70	125	0.12	113	170	<b>155 15102</b>
	1500	50 × 105	4.3	8.2	3.15	1.05	120	0.18	106	160	155 15152
	<b>2200</b>	<b>65 × 105</b>	6.5	12.6	4.62	1.54	70	0.18	63	95	<b>155 15222</b>
	3300	65 × 105	7.1	13.5	6.93	2.31	60	0.19	63	95	155 15332
385	<b>220</b>	<b>35 × 60</b>	1.0	2.0	0.51	0.17	650	0.15	475	955	<b>155 18221</b>
	330	35 × 80	1.5	2.9	0.76	0.25	430	0.15	326	635	155 18331
	<b>470</b>	<b>35 × 80</b>	1.8	3.4	1.08	0.36	300	0.15	220	445	<b>155 18471</b>
	680	35 × 105	2.4	4.6	1.57	0.52	210	0.15	150	310	155 18681
	<b>1000</b>	<b>50 × 80</b>	3.4	6.5	2.31	0.77	125	0.15	90	210	<b>155 18102</b>
	1500	50 × 105	4.7	8.9	3.46	1.15	85	0.15	60	140	155 18152
	<b>2200</b>	<b>65 × 105</b>	6.5	12.4	5.08	1.69	58	0.15	40	95	<b>155 18222</b>
	3300	75 × 105	7.6	14.5	7.62	2.54	50	0.15	35	70	155 18332

## Aluminium electrolytic capacitors Power Economic Screw Terminals

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$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 100 Hz 85 °C (A)	$I_R$ 20 kHz 70 °C (A)	$I_{L1}$ 1 min (mA)	$I_{L5}$ 5 min (mA)	ESR TYP. 100 Hz (m $\Omega$ )	Tan $\delta$ MAX. 100 Hz	Z TYP. 20 kHz (m $\Omega$ )	Z MAX. 20 kHz (m $\Omega$ )	CATALOGUE NUMBER (note 1) 2222 ... ..
400	220	35 × 60	1.0	2.0	0.53	0.18	650	0.15	475	955	155 16221
	330	35 × 80	1.5	2.9	0.79	0.27	430	0.15	320	635	155 16331
	470	35 × 80	1.8	3.4	1.13	0.38	300	0.15	220	445	155 16471
	680	35 × 105	2.4	4.6	1.63	0.54	210	0.15	150	310	155 16681
	1000	50 × 80	3.4	6.5	2.40	0.80	125	0.15	90	210	155 16102
	1500	50 × 105	4.7	8.9	3.60	1.20	85	0.15	60	140	155 16152
	2200	65 × 105	6.5	12.4	5.28	1.76	58	0.15	40	95	155 16222
	3300	75 × 105	7.6	14.5	7.92	2.64	50	0.15	35	70	155 16332

**Note**

1. Catalogue number applies to the ST version; for STB version (not preferred) replace 8<sup>th</sup> digit by '5' (2222 154/155 5....).

**Additional electrical data**

PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage for short periods	≤250 V versions	$U_s = 1.15 \times U_R$
	≥350 V versions	$U_s = 1.1 \times U_R$
Reverse voltage		$U_{rev} \leq 1 \text{ V}$
<b>Current</b>		
Leakage current	after 1 minute at $U_R$	$I_{L1} \leq 0.006C_R \times U_R + 4 \mu\text{A}$
	after 5 minutes at $U_R$	$I_{L5} \leq 0.002C_R \times U_R + 4 \mu\text{A}$
<b>Inductance</b>		
Equivalent series inductance (ESL)	case $\varnothing D = 35 \text{ mm}$	typ. 18 nH
	case $\varnothing D = 50 \text{ mm}$	typ. 25 nH
	case $\varnothing D = 65 \text{ mm}$	typ. 27 nH
	case $\varnothing D = 75 \text{ mm}$	typ. 29 nH

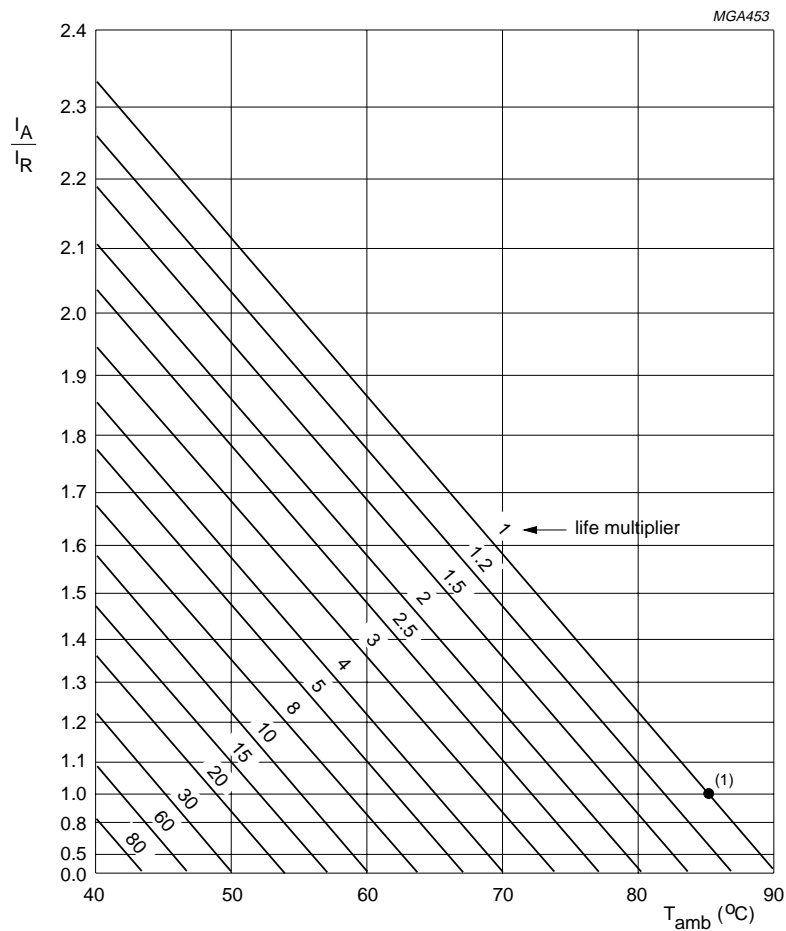
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**RIPPLE CURRENT AND USEFUL LIFE**

**Table 4** Multiplier of ripple current ( $I_R$ ) as a function of frequency

FREQUENCY (Hz)	$I_R$ MULTIPLIER
50	0.83
100	1.00
200	1.10
400	1.15
1000	1.19
$\geq 2000$	1.20



$I_A$  = actual ripple current at 100 Hz and 85 °C.

$I_R$  = rated ripple current at 100 Hz and 85 °C.

With an absolute maximum of 50 A at 85 °C.

(1) Useful life at 85 °C and  $I_R$  applied: 12000 hours; (5000 hours for 400 V types).

**Fig.3** Multiplier of useful life as a function of ambient temperature and ripple current load.



# Aluminium electrolytic capacitors

## Power Economic Screw Terminals

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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 384-4/ CECC 30300 subclause 4.13	$T_{amb} = 85\text{ °C}$ ; $U_R$ applied; 5000 hours (400 V types: 2000 hours)	$U_R \leq 100\text{ V}$ ; $\Delta C/C$ : $\pm 15\%$ $U_R > 100\text{ V}$ ; $\Delta C/C$ : $\pm 10\%$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ °C}$ ; $U_R$ and $I_R$ applied; 12000 hours (400 V types: 5000 hours)	$U_R \leq 100\text{ V}$ ; $\Delta C/C$ : $\pm 45\%$ $U_R > 100\text{ V}$ ; $\Delta C/C$ : $\pm 30\%$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $U_R \leq 100\text{ V}$ : $\leq 1\%$ ; $U_R > 100\text{ V}$ : $\leq 3\%$
Shelf life (storage at high temperature)	IEC 384-4/ CECC 30300 subclause 4.17	$T_{amb} = 85\text{ °C}$ ; no voltage applied; 500 hours after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C$ : $\pm 10\%$ $I_{L5} \leq 2 \times \text{spec. limit}$