

## Aluminum Capacitors Power Ultra Miniature Snap-In

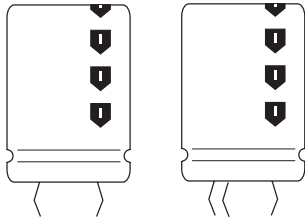
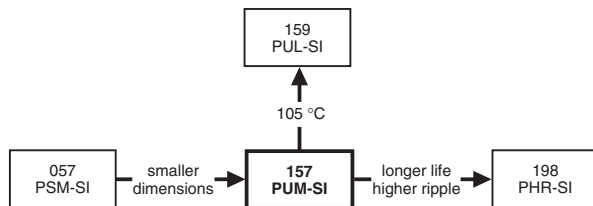


Fig.1 Component outlines.



### FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Useful life: 5000 hours at 85 °C
- Keyed polarity version available.

### APPLICATIONS

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

### MARKING

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

- Rated capacitance (in  $\mu\text{F}$ ).
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for  $\pm 20\%$ ).
- Rated voltage (in V).
- Date code (YYMM).
- Name of manufacturer.
- Code for factory of origin.
- '-' sign to identify the negative terminal, visible from the top and side of the capacitor
- Code number.
- Climatic category in accordance with IEC 60068.

### QUICK REFERENCE DATA

DESCRIPTION	VALUE	
Nominal case sizes ( $\varnothing D \times L$ in mm)	22 $\times$ 25 to 35 $\times$ 60	
Rated capacitance range (E6/E12 series), $C_R$	56 to 2200 $\mu\text{F}$	
Tolerance on $C_R$	$\pm 20\%$	
Rated voltage range, $U_R$	200 V, 250 V	400 V, 450 V
Category temperature range	-40 to +85 °C	-25 to +85 °C
Endurance test at 85 °C	3000 hours	
Load life at 85 °C	3000 hours	
Useful life at 85 °C	5000 hours	
Useful life at 40 °C, $1.4 \times I_R$ applied	90000 hours	
Shelf life at 0 V, 85 °C	1000 hours	
Based on sectional specification	IEC 60384-4/EN130300	
Climatic category IEC 60068	40/085/56	25/085/56

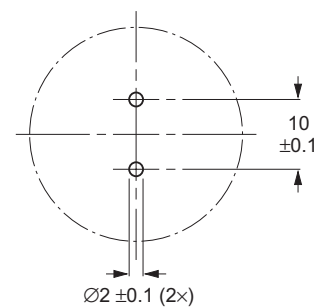
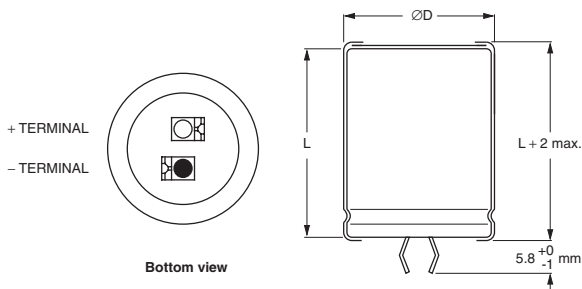
### SELECTION CHART FOR $C_R$ , $U_R$ AND RELEVANT NOMINAL CASE SIZES ( $\varnothing D \times L$ in mm)

$C_R$ ( $\mu\text{F}$ )	$U_R$ (V)			
	200	250	400	450
56	-	-	-	22 $\times$ 25
68	-	-	22 $\times$ 25	22 $\times$ 30
82	-	-	22 $\times$ 25	22 $\times$ 30
	-	-	-	25 $\times$ 25
100	-	-	22 $\times$ 30	22 $\times$ 35
	-	-	-	25 $\times$ 30
120	-	-	22 $\times$ 30	22 $\times$ 40
	-	-	-	25 $\times$ 30
	-	-	-	30 $\times$ 25

<b>SELECTION CHART FOR C<sub>R</sub>, U<sub>R</sub> AND RELEVANT NOMINAL CASE SIZES (∅D × L in mm)</b>				
C <sub>R</sub> (μF)	U <sub>R</sub> (V)			
	200	250	400	450
150	-	-	22 × 35	25 × 35
	-	-	25 × 30	25 × 40
	-	-	-	30 × 30
180	-	-	22 × 40	25 × 40
	-	-	25 × 35	30 × 35
	-	-	-	35 × 25
220	-	22 × 30	25 × 40	25 × 50
	-	-	30 × 30	30 × 40
	-	-	35 × 25	35 × 30
270	22 × 25	22 × 30	25 × 45	30 × 45
	-	25 × 25	30 × 35	35 × 35
	-	-	35 × 30	-
330	22 × 30	22 × 35	30 × 40	30 × 50
	-	25 × 30	35 × 30	35 × 40
390	22 × 30	22 × 40	30 × 45	35 × 45
	-	30 × 25	35 × 35	-
470	22 × 35	25 × 35	30 × 50	35 × 50
	25 × 30	30 × 30	35 × 40	-
560	22 × 40	25 × 40	35 × 45	-
	25 × 35	30 × 30	-	-
	30 × 25	35 × 25	-	-
680	25 × 40	25 × 45	35 × 50	35 × 60
	30 × 30	30 × 35	-	-
	35 × 25	35 × 30	-	-
820	25 × 45	30 × 40	35 × 60	-
	30 × 35	35 × 35	-	-
	35 × 30	-	-	-
1000	30 × 40	30 × 45	-	-
	35 × 30	35 × 40	-	-
1200	30 × 45	35 × 45	-	-
	35 × 35	-	-	-
1500	30 × 50	35 × 50	-	-
	35 × 40	-	-	-
1800	35 × 45	-	-	-
2200	35 × 50	-	-	-

## DIMENSIONS in millimeters AND AVAILABLE FORMS

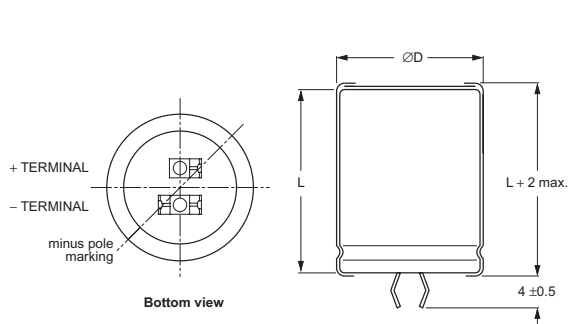
### TWO TERMINAL SNAP-IN



The minus terminal can be marked with a black dot or with an imprinted '-' sign.

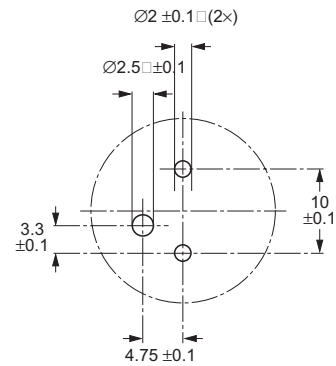
Fig.2 Two terminal snap-in.

Fig.3 Mounting hole diagram.

**THREE TERMINAL SNAP-IN**


The negative terminal has **TWO** pins which are **BOTH** electrically connected.

Fig.4 Three terminal snap-in.



The 10 mm spacing of the 2 pin snap-in is used as the base layout and a third hole is added.

The third hole is closer to the negative primary hole so that polarization is always maintained, together with added mechanical stability.

Fig.5 Mounting hole diagram.

Table 1

<b>DIMENSIONS</b> in millimeters, <b>MASS AND PACKAGING QUANTITIES</b>					
<b>NOMINAL CASE SIZE</b> ØD × L	ØD <sub>MAX</sub>	L <sub>MAX</sub>	<b>MASS</b> (g)	<b>PACKAGING QUANTITIES</b> (UNITS PER BOX)	<b>CARDBOARD BOX DIMENSIONS</b> L × W × H
22 × 25	23	27	≈12	100	260 × 250 × 39
22 × 30	23	32	≈16	100	260 × 250 × 44
22 × 35	23	37	≈20	100	260 × 250 × 49
22 × 40	23	42	≈23	100	260 × 250 × 54
25 × 25	26	27	≈20	100	290 × 280 × 39
25 × 30	26	32	≈22	100	290 × 280 × 44
25 × 35	26	37	≈24	100	290 × 280 × 49
25 × 40	26	42	≈27	100	290 × 280 × 54
25 × 45	26	47	≈32	100	290 × 280 × 59
25 × 50	26	52	≈38	100	290 × 280 × 64
30 × 25	31	27	≈25	100	340 × 330 × 39
30 × 30	31	32	≈30	100	340 × 330 × 44
30 × 35	31	37	≈35	100	340 × 330 × 49
30 × 40	31	42	≈40	100	340 × 330 × 54
30 × 45	31	47	≈45	100	340 × 330 × 59
30 × 50	31	52	≈50	100	340 × 330 × 64
35 × 25	36	27	≈33	50	390 × 198 × 39
35 × 30	36	32	≈40	50	390 × 198 × 44
35 × 35	36	37	≈48	50	390 × 198 × 49
35 × 40	36	42	≈55	50	390 × 198 × 54
35 × 45	36	47	≈63	50	390 × 198 × 59
35 × 50	36	52	≈72	50	390 × 198 × 64
35 × 60	36	62	≈82	50	390 × 198 × 74

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	rated capacitance at 100/120 Hz
$I_R$	rated RMS ripple current at 120 Hz, 85 °C
$I_{L5}$	max. leakage current after 5 minutes at $U_R$
ESR	typ./max. equivalent series resistance at 100 Hz; note 1
Z	typ./max. impedance at 10 kHz

**Note**

- ESR at 120 Hz is approximately  $0.95 \times \text{ESR } 100 \text{ Hz}$ .
- Unless otherwise specified, all electrical values in Table 2 apply at  $T_{\text{amb}} = 20 \text{ °C}$ ,  $P = 86 \text{ to } 106 \text{ kPa}$ ,  $\text{RH} = 45 \text{ to } 75\%$ .

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION										
$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 120 Hz 85 °C (A)	$I_{L5}$ 5 MIN (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (M $\Omega$ )	MAX. ESR 100 Hz <sup>(1)</sup> (M $\Omega$ )	TYP. Z 10 kHz (M $\Omega$ )	MAX. Z 10 kHz (M $\Omega$ )	CATALOG NUMBER 2222 157 .....	
									2-TERM.	3-TERM.
200	270	22 × 25	1.15	0.54	550	880	420	700	52271	72271
	330	22 × 30	1.36	0.66	430	720	300	500	52331	72331
	390	22 × 30	1.46	0.78	390	650	295	490	52391	72391
	470	22 × 35	1.68	0.94	350	580	240	400	32471	12471
	470	25 × 30	1.67	0.94	350	580	240	400	52471	72471
	560	22 × 40	1.91	1.12	255	425	235	390	42561	22561
	560	25 × 35	1.91	1.12	255	425	235	390	32561	12561
	560	30 × 25	1.89	1.12	255	425	235	390	52561	72561
	680	25 × 40	2.18	1.36	210	350	205	340	42681	22681
	680	30 × 30	2.04	1.36	210	350	205	340	52681	72681
	680	35 × 25	2.06	1.36	210	350	205	340	62681	82681
	820	25 × 45	2.46	1.64	170	290	145	240	62821	82821
	820	30 × 35	2.35	1.64	170	290	145	240	32821	12821
	820	35 × 30	2.29	1.64	170	290	145	240	52821	72821
	1000	30 × 40	2.66	2.00	140	235	135	225	52102	72102
	1000	35 × 30	2.33	2.00	140	235	135	225	62102	82102
	1200	30 × 45	2.98	2.40	120	200	110	190	32122	12122
	1200	35 × 35	2.69	2.40	120	200	110	190	62122	82122
1500	30 × 50	3.31	3.00	110	180	95	155	42152	22152	
1500	35 × 40	3.04	3.00	110	180	95	155	52152	72152	
1800	35 × 45	3.36	3.60	100	160	80	130	42182	22182	
2200	35 × 50	3.68	4.40	90	150	65	105	52222	72222	
250	220	22 × 30	1.23	0.55	600	1080	420	700	53221	73221
	270	22 × 30	1.32	0.67	490	880	335	560	43271	23271
	270	25 × 25	1.23	0.67	490	880	335	560	53271	73271
	330	22 × 35	1.53	0.82	400	720	255	430	33331	13331
	330	25 × 30	1.56	0.82	400	720	255	430	53331	73331

**ORDERING EXAMPLES**

Electrolytic capacitor 157 series

1 000  $\mu\text{F}$ /200 V;  $\pm 20\%$ Nominal case size:  $\varnothing 30 \times 40 \text{ mm}$ 

2-terminal snap-in:

Catalogue number: 2222 157 52102.

3-terminal snap-in:

Catalog number: 2222 157 72102.



Aluminum Capacitors  
Power Ultra Miniature Snap-In

Vishay BCcomponents

ELECTRICAL DATA AND ORDERING INFORMATION										
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ØD × L (mm)	I <sub>R</sub> 120 Hz 85 °C (A)	I <sub>L5</sub> 5 MIN (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (MΩ)	MAX. ESR 100 Hz <sup>(1)</sup> (MΩ)	TYP. Z 10 kHz (MΩ)	MAX. Z 10 kHz (MΩ)	CATALOG NUMBER 2222 157 .....	
									2-TERM.	3-TERM.
250	390	22 × 40	1.74	0.97	330	610	250	425	43391	23391
	390	30 × 25	1.58	0.97	330	610	250	425	53391	73391
	470	25 × 35	1.87	1.17	280	505	190	320	33471	13471
	470	30 × 30	1.89	1.17	280	505	190	320	53471	73471
	560	25 × 40	2.12	1.40	240	425	185	310	43561	23561
	560	30 × 30	1.97	1.40	240	425	185	310	53561	73561
	560	35 × 25	1.80	1.40	240	425	185	310	63561	83561
	680	25 × 45	2.29	1.70	200	350	155	260	63681	83681
	680	30 × 35	2.28	1.70	200	350	155	260	33681	13681
	680	35 × 30	2.20	1.70	200	350	155	260	53681	73681
	820	30 × 40	2.57	2.05	160	290	125	210	53821	73821
	820	35 × 35	2.54	2.05	160	290	125	210	63821	83821
	1000	30 × 45	2.88	2.50	140	235	105	180	33102	13102
	1000	35 × 40	2.86	2.50	140	235	105	180	53102	73102
	1200	35 × 45	3.17	3.00	120	200	95	160	43122	23122
	1500	35 × 50	3.49	3.75	90	160	85	140	53152	73152
400	68	22 × 25	0.71	0.27	1400	2800	1170	1950	56689	76689
	82	22 × 25	0.77	0.33	1250	2500	970	1620	56829	76829
	100	22 × 30	0.94	0.40	1125	2250	750	1220	56101	76101
	120	22 × 30	0.97	0.48	990	1980	700	1140	56121	76121
	150	22 × 35	1.13	0.60	750	1500	540	900	36151	16151
	150	25 × 30	1.16	0.60	750	1500	540	900	56151	76151
	180	22 × 40	1.29	0.72	630	1260	435	725	46181	26181
	180	25 × 35	1.35	0.72	630	1260	435	725	36181	16181
	220	25 × 40	1.54	0.88	520	1040	355	590	46221	26221
	220	30 × 30	1.50	0.88	520	1040	355	590	56221	76221
	220	35 × 25	1.42	0.88	520	1040	355	590	66221	86221
	270	25 × 45	1.72	1.08	430	860	335	560	66271	86271
	270	30 × 35	1.74	1.08	430	860	335	560	36271	16271
	270	35 × 30	1.71	1.08	430	860	335	560	56271	76271
	330	30 × 40	1.97	1.32	350	700	315	525	56331	76331
	330	35 × 30	1.76	1.32	350	700	315	525	66331	86331
	390	30 × 45	2.19	1.56	300	610	250	420	56391	76391
	390	35 × 35	2.04	1.56	300	610	250	420	36391	16391
	470	30 × 50	2.40	1.88	250	505	210	350	46471	26471
	470	35 × 40	2.30	1.88	250	505	210	350	56471	76471
560	35 × 45	2.55	2.24	210	425	180	305	46561	26561	
680	35 × 50	2.79	2.72	190	380	160	265	56681	76681	
820	35 × 60	3.33	3.28	155	315	115	215	56821	76821	

ELECTRICAL DATA AND ORDERING INFORMATION										
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I <sub>R</sub> 120 Hz 85 °C (A)	I <sub>L5</sub> 5 MIN (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (MΩ)	MAX. ESR 100 Hz <sup>(1)</sup> (MΩ)	TYP. Z 10 kHz (MΩ)	MAX. Z 10 kHz (MΩ)	CATALOG NUMBER 2222 157 .....	
									2-TERM.	3-TERM.
450	56	22 × 25	0.68	0.25	1650	3300	1120	1880	57569	77569
	68	22 × 30	0.80	0.30	1400	2800	920	1530	57689	77689
	82	22 × 30	0.87	0.36	1200	2400	780	1290	47829	27829
	82	25 × 25	0.85	0.36	1200	2400	780	1290	57829	77829
	100	22 × 35	1.00	0.45	1000	2000	630	1050	37101	17101
	100	25 × 30	1.02	0.45	1000	2000	630	1050	57101	77101
	120	22 × 40	1.15	0.54	800	1600	530	885	47121	27121
	120	25 × 30	1.09	0.54	800	1600	530	885	57121	77121
	120	30 × 25	1.10	0.54	800	1600	530	885	67121	87121
	150	25 × 40	1.35	0.67	650	1300	420	705	47151	27151
	150	25 × 35	1.27	0.67	650	1300	420	705	67151	87151
	150	30 × 30	1.32	0.67	650	1300	420	705	57151	77151
	180	25 × 40	1.45	0.81	570	1150	360	605	47181	27181
	180	30 × 35	1.49	0.81	570	1150	360	605	57181	77181
	180	35 × 25	1.35	0.81	570	1150	360	605	67181	87181
	220	25 × 50	1.73	0.99	450	900	315	525	47221	27221
	220	30 × 40	1.72	0.99	450	900	315	525	57221	77221
	220	35 × 30	1.61	0.99	450	900	315	525	67221	87221
	270	30 × 45	1.95	1.21	380	770	270	450	37271	17271
	270	35 × 35	1.86	1.21	380	770	270	450	67271	87271
330	30 × 50	2.19	1.48	300	600	230	390	47331	27331	
330	35 × 40	2.10	1.48	300	600	230	390	57331	77331	
390	35 × 45	2.34	1.75	250	500	190	340	47391	27391	
470	35 × 50	2.60	2.11	210	420	170	290	57471	77471	
680	35 × 60	3.15	3.06	150	300	110	200	57681	77681	

**Note**

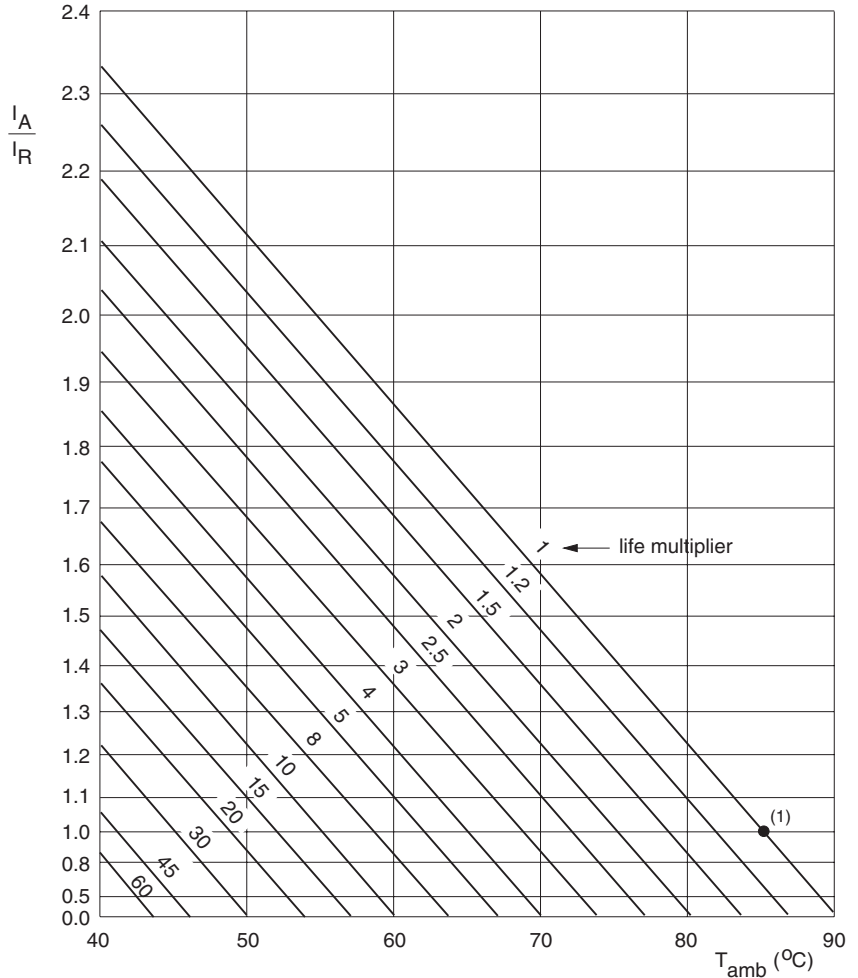
1. ESR at 120 Hz is approximately 0.95 × ESR 100 Hz.

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage	≥ 400 V versions	U <sub>s</sub> = 1.1 × U <sub>R</sub>
	≤ 250 V versions	U <sub>s</sub> = 1.15 × U <sub>R</sub>
Reverse voltage		≤ 1 V
<b>Current</b>		
Leakage current	after 5 minutes at U <sub>R</sub>	I <sub>L5</sub> ≤ 0.01 C <sub>R</sub> × U <sub>R</sub>
<b>Inductance</b>		
Equivalent series inductance (ESL)	all case sizes	typ. 19 nH
		max. 25 nH



**RIPPLE CURRENT AND USEFUL LIFE**

MGA453



$I_A$  = actual ripple current at 120 Hz.  
 $I_R$  = rated ripple current at 120 Hz and 85 °C.  
 (1) Useful life at 85 °C and  $I_R$  applied: 5000 hours.

Fig.6 Multiplier of useful life as a function of ambient temperature and ripple current load.

Table 3

MULTIPLIER OF RIPPLE CURRENT ( $I_R$ ) AS A FUNCTION OF FREQUENCY	
FREQUENCY (HZ)	$I_R$ MULTIPLIER
50	0.90
100	0.95
120	1.00
200	1.15
1000	1.30
≥10000	1.40



Table 4

<b>TEST PROCEDURES AND REQUIREMENTS</b>			
<b>TEST</b>		<b>PROCEDURE (QUICK REFERENCE)</b>	<b>REQUIREMENTS</b>
<b>NAME OF TEST</b>	<b>REFERENCE</b>		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ applied; 3000 hours	$\Delta C/C: \pm 10\%$ $ESR \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Load life		$T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied; 3000 hours	$\Delta C/C: \pm 20\%$ $ESR \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ }^{\circ}\text{C}$ ; $U_R$ and $I_R$ applied; 5000 hours	$\Delta C/C: \pm 30\%$ $ESR \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 85\text{ }^{\circ}\text{C}$ ; no voltage applied; 1000 hours after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 15\%$ $ESR \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq 1 \times \text{spec. limit}$