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Aluminum Capacitors
Power Ultra Long Life Snap-In



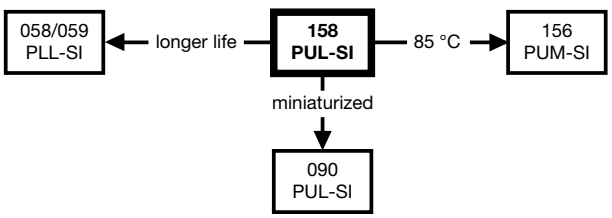


Fig. 1

FEATURES

- Useful life: 5000 h at +105 °C
- High ripple current capability
- Keyed polarity version available
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT

APPLICATIONS

- General purpose, industrial telecommunication 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 µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 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 (Ø D x L in mm)	22 x 25 to 35 x 50
Rated capacitance range (E6/E12 series), C_R	560 µF to 47 000 µF
Tolerance on C_R	± 20 %
Rated voltage range, U_R	16 V to 100 V
Category temperature range	-40 °C to +105 °C
Endurance test at 105 °C	2000 h
Useful life at 105 °C	5000 h
Useful life at 40 °C, 1.9 x I_R applied	125 000 h
Shelf life at 0 V, 105 °C	500 h
Based on sectional specification	IEC 60384-4/EN130300
Climatic category IEC 60068	40/105/56

SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

C_R (µF)	U_R (V)						
	16	**25**	**40**	**50**	**63**	**80**	**100**
560	-	-	-	-	-	-	22 x 25
820	-	-	-	-	-	22 x 25	22 x 30
1000	-	-	-	-	-	-	22 x 35
	-	-	-	-	-	-	25 x 30
1200	-	-	-	-	22 x 25	22 x 30	25 x 35
1500	-	-	-	22 x 25	22 x 30	22 x 35	-
	-	-	-	-	-	25 x 30	25 x 40
1800	-	-	-	-	-	25 x 35	-
	-	-	-	-	-	-	30 x 30

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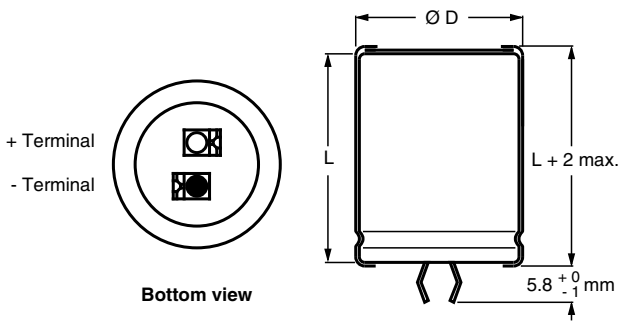
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SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)							
C_R (µF)	U_R (V)						
	16	25	40	50	63	80	100
2200	-	-	22 x 25	22 x 30	22 x 35	25 x 40	30 x 35
	-	-	-	-	25 x 30	30 x 30	-
2700	-	-	-	22 x 35	-	-	30 x 40
	-	-	-	25 x 30	25 x 35	30 x 35	-
3300	-	22 x 25	22 x 30	-	25 x 40	25 x 50	30 x 50
	-	-	-	25 x 35	30 x 30	-	35 x 35
3900	-	-	22 x 35	22 x 45	-	30 x 40	35 x 40
	-	-	25 x 30	25 x 40	30 x 35	-	-
4700	-	22 x 30	22 x 40	-	30 x 40	35 x 35	35 x 50
	-	-	-	30 x 30	-	-	-
5600	22 x 25	-	-	25 x 50	-	35 x 40	-
	-	-	25 x 35	30 x 35	35 x 35	-	-
6800	-	22 x 35	-	30 x 40	30 x 50	35 x 50	-
	-	25 x 30	30 x 30	-	35 x 40	-	-
8200	22 x 30	22 x 40	25 x 50	-	35 x 45	-	-
	-	25 x 35	30 x 35	35 x 35	-	-	-
10 000	22 x 35	25 x 40	30 x 40	35 x 40	35 x 50	-	-
	25 x 30	30 x 30	35 x 30	-	-	-	-
12 000	22 x 40	-	-	35 x 45	-	-	-
	25 x 35	30 x 35	35 x 35	-	-	-	-
15 000	25 x 40	30 x 40	35 x 45	-	-	-	-
18 000	-	-	35 x 50	-	-	-	-
	30 x 35	35 x 35	-	-	-	-	-
22 000	30 x 40	30 x 50	-	-	-	-	-
27 000	-	35 x 45	-	-	-	-	-
	35 x 35	-	-	-	-	-	-
33 000	30 x 50	35 x 50	-	-	-	-	-
	35 x 40	-	-	-	-	-	-
39 000	35 x 45	-	-	-	-	-	-
47 000	35 x 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

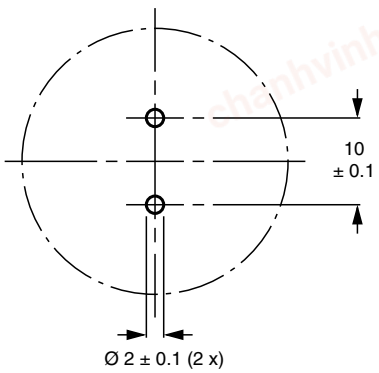
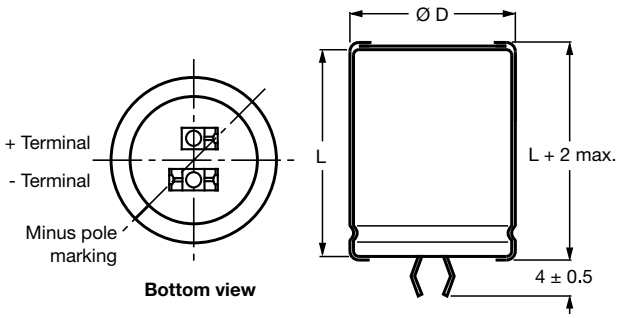


Fig. 3 - Mounting hole diagram

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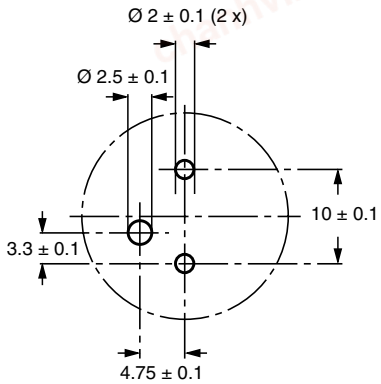
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THREE TERMINAL SNAP-IN



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

DIMENSIONS in millimeters, **MASS AND PACKAGING QUANTITIES**					
NOMINAL CASE SIZE Ø D x L	**Ø $D_{max.}$**	**$L_{max.}$**	**MASS (g)**	**PACKAGING QUANTITIES (units per box)**	**CARDBOARD BOX DIMENSIONS L x W x H**
22 x 25	23	27	≈ 12	100	260 x 250 x 39
22 x 30	23	32	≈ 16	100	260 x 250 x 44
22 x 35	23	37	≈ 20	100	260 x 250 x 49
22 x 40	23	42	≈ 23	100	260 x 250 x 54
25 x 30	26	32	≈ 22	100	290 x 280 x 44
25 x 35	26	37	≈ 24	100	290 x 280 x 49
25 x 40	26	42	≈ 27	100	290 x 280 x 54
25 x 50	26	52	≈ 38	100	290 x 280 x 64
30 x 30	31	32	≈ 30	100	340 x 330 x 44
30 x 35	31	37	≈ 35	100	340 x 330 x 49
30 x 40	31	42	≈ 40	100	340 x 330 x 54
30 x 50	31	52	≈ 50	100	340 x 330 x 64
35 x 35	36	37	≈ 48	50	390 x 198 x 49
35 x 40	36	42	≈ 55	50	390 x 198 x 54
35 x 45	36	47	≈ 63	50	390 x 198 x 59
35 x 50	36	52	≈ 72	50	390 x 198 x 64

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ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	Rated capacitance at 100 Hz
I_R	Rated RMS ripple current at 100 Hz, 105 °C
I_{L5}	Max. leakage current after 5 min at U_R
ESR	Typ./max. equivalent series resistance at 100 Hz (1)
Z	Typ./max. impedance at 10 kHz

Notes

(1) ESR at 120 Hz is approximately 0.95 x ESR 100 Hz

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

ORDERING EXAMPLE

Electrolytic capacitor 158 series

3900 µF/80 V; ± 20 %

Nominal case size: Ø 30 mm x 40 mm

2-terminal snap-in:

Ordering code: MAL2 158 32392 E3
Former 12NC: 2222 158 32392

3-terminal snap-in:

Ordering code: MAL2 158 72392 E3
Former 12NC: 2222 158 72392

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION									
U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R 10 kHz 105 °C (A)	I_{L5} 5 min (mA)	MAX. ESR 100 Hz (1) (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2158.....	
								2-TERM.	3-TERM.
16	5600	22 x 25	2.50	2.95	0.18	111	98	15562E3	55562E3
	8200	22 x 30	3.10	3.66	0.27	79	70	15822E3	55822E3
	10 000	22 x 35	3.56	4.20	0.32	65	58	15103E3	55103E3
	10 000	25 x 30	3.42	4.04	0.32	70	63	25103E3	65103E3
	12 000	22 x 40	4.00	4.72	0.39	56	50	15123E3	55123E3
	12 000	25 x 35	3.91	4.61	0.39	59	53	25123E3	65123E3
	15 000	25 x 40	4.39	5.18	0.48	49	45	25153E3	65153E3
	15 000	30 x 30	3.80	4.48	0.48	61	55	35153E3	75153E3
	18 000	30 x 35	4.36	5.14	0.58	50	46	35183E3	75183E3
	22 000	30 x 40	4.85	5.72	0.71	43	39	35223E3	75223E3
	27 000	35 x 35	4.49	5.30	0.87	49	43	45273E3	85273E3
	33 000	30 x 50	5.70	6.73	1.06	33	31	35333E3	75333E3
	33 000	35 x 40	4.97	5.86	1.06	42	37	45333E3	85333E3
	39 000	35 x 45	5.42	6.40	1.25	37	33	45393E3	85393E3
	47 000	35 x 50	5.80	6.84	1.51	33	30	45473E3	85473E3
25	3300	22 x 25	2.27	2.68	0.17	130	105	16332E3	56332E3
	4700	22 x 30	2.82	3.33	0.24	93	76	16472E3	56472E3
	6800	22 x 35	3.37	3.98	0.34	69	57	16682E3	56682E3
	6800	25 x 30	3.25	3.84	0.34	74	62	26682E3	66682E3
	8200	22 x 40	3.79	4.47	0.41	58	49	16822E3	56822E3
	8200	25 x 35	3.72	4.39	0.41	62	52	26822E3	66822E3
	10 000	25 x 40	4.18	4.93	0.50	52	44	26103E3	66103E3
	10 000	30 x 30	3.65	4.31	0.50	64	55	36103E3	76103E3
	12 000	30 x 35	4.19	4.94	0.60	53	46	36123E3	76123E3
	15 000	30 x 40	4.66	5.50	0.75	45	39	36153E3	76153E3
	18 000	35 x 35	4.36	5.14	0.90	51	43	46183E3	86183E3
	22 000	30 x 50	5.52	6.51	1.10	35	31	36223E3	76223E3
	22 000	35 x 40	4.83	5.70	1.10	44	37	46223E3	86223E3
	27 000	35 x 45	5.24	6.18	1.35	39	33	46273E3	86273E3
	33 000	35 x 50	5.32	6.27	1.65	36	31	46333E3	86333E3

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ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R 10 kHz 105 °C (A)	I_{L5} 5 min (mA)	MAX. ESR 100 Hz (1) (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2158.....	
								2-TERM.	3-TERM.
40	2200	22 x 25	2.17	2.65	0.18	131	100	17222E3	57222E3
	3300	22 x 30	2.73	3.33	0.27	91	70	17332E3	57332E3
	3900	22 x 35	3.12	3.81	0.32	77	59	17392E3	57392E3
	3900	25 x 30	3.02	3.68	0.32	83	65	27392E3	67392E3
	4700	22 x 40	3.52	4.29	0.38	65	51	17472E3	57472E3
	5600	25 x 35	3.53	4.31	0.45	63	51	27562E3	67562E3
	6800	30 x 30	3.39	4.14	0.55	69	56	37682E3	77682E3
	8200	25 x 50	4.72	5.76	0.66	44	36	27822E3	67822E3
	8200	30 x 35	3.90	4.76	0.66	57	47	37822E3	77822E3
	10 000	30 x 40	4.36	5.32	0.80	48	40	37103E3	77103E3
	12 000	35 x 35	4.00	4.88	0.96	56	45	47123E3	87123E3
	15 000	35 x 45	4.99	6.09	1.20	42	35	47153E3	87153E3
	18 000	35 x 50	5.36	6.54	1.44	38	31	47183E3	87183E3
50	1500	22 x 25	1.99	2.43	0.15	148	102	11152E3	51152E3
	2200	22 x 30	2.50	3.05	0.22	104	73	11222E3	51222E3
	2700	22 x 35	2.88	3.51	0.27	85	60	11272E3	51272E3
	2700	25 x 30	2.81	3.43	0.27	91	66	21272E3	61272E3
	3300	22 x 40	3.27	3.99	0.33	71	51	11332E3	51332E3
	3300	25 x 35	3.23	3.94	0.33	75	55	21332E3	61332E3
	3900	25 x 40	3.62	4.42	0.39	64	47	21392E3	61392E3
	4700	30 x 30	3.24	3.95	0.47	74	57	31472E3	71472E3
	5600	25 x 50	4.43	5.40	0.56	48	36	21562E3	61562E3
	5600	30 x 35	3.73	4.55	0.56	61	47	31562E3	71562E3
	6800	30 x 40	4.17	5.09	0.68	52	41	31682E3	71682E3
	8200	35 x 35	3.88	4.73	0.82	61	46	41822E3	81822E3
	10 000	35 x 40	4.33	5.28	1.00	52	40	41103E3	81103E3
	12 000	35 x 45	4.72	5.76	1.20	46	35	41123E3	81123E3
63	1200	22 x 25	2.07	2.53	0.16	137	100	18122E3	58122E3
	1500	22 x 30	2.49	3.04	0.19	107	78	18152E3	58152E3
	2200	22 x 35	3.00	3.66	0.26	79	58	18222E3	58222E3
	2200	25 x 30	2.90	3.54	0.28	85	64	28222E3	68222E3
	2700	25 x 35	3.34	4.07	0.34	70	53	28272E3	68272E3
	3300	25 x 40	3.76	4.59	0.42	59	45	28332E3	68332E3
	3300	30 x 30	3.28	4.00	0.42	74	58	38332E3	78332E3
	3900	30 x 35	3.77	4.60	0.50	61	48	38392E3	78392E3
	4700	30 x 40	4.22	5.15	0.60	52	41	38472E3	78472E3
	5600	35 x 35	3.97	4.84	0.71	59	47	48562E3	88562E3
	6800	30 x 50	5.04	6.15	0.86	40	33	38682E3	78682E3
	6800	35 x 40	4.42	5.39	0.86	51	40	48682E3	88682E3
	8200	35 x 45	4.82	5.88	1.04	45	35	48822E3	88822E3
	10 000	35 x 50	5.17	6.31	1.26	40	32	48103E3	88103E3

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ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 100 Hz 105 °C (A)	I_R 10 kHz 105 °C (A)	I_{L5} 5 min (mA)	MAX. ESR 100 Hz (1) (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2158.....	
								2-TERM.	3-TERM.
80	820	22 x 25	1.44	1.76	0.14	422	397	12821E3	52821E3
	1200	22 x 30	1.82	2.22	0.20	291	274	12122E3	52122E3
	1500	22 x 35	2.12	2.59	0.24	234	221	12152E3	52152E3
	1500	25 x 30	2.10	2.56	0.24	240	228	22152E3	62152E3
	1800	25 x 35	2.41	2.94	0.29	201	189	22182E3	62182E3
	2200	25 x 40	2.74	3.34	0.36	166	156	22222E3	62222E3
	2200	30 x 30	2.55	3.11	0.36	180	172	32222E3	72222E3
	2700	30 x 35	2.93	3.57	0.44	147	141	32272E3	72272E3
	3300	25 x 50	3.46	4.22	0.53	114	109	22332E3	62332E3
	3900	30 x 40	3.39	4.14	0.63	110	106	32392E3	72392E3
	4700	35 x 35	3.29	4.01	0.76	110	107	42472E3	82472E3
	5600	35 x 40	3.69	4.50	0.90	93	90	42562E3	82562E3
	6800	35 x 50	4.43	5.40	1.09	75	71	42682E3	82682E3
100	560	22 x 25	1.33	1.62	0.12	461	412	19561E3	59561E3
	820	22 x 30	1.69	2.06	0.17	318	284	19821E3	59821E3
	1000	22 x 35	1.95	2.38	0.20	261	234	19102E3	59102E3
	1000	25 x 30	1.95	2.38	0.20	267	240	29102E3	69102E3
	1200	25 x 35	2.23	2.72	0.24	223	200	29122E3	69122E3
	1500	25 x 40	2.56	3.12	0.30	180	162	29152E3	69152E3
	1800	30 x 30	2.49	3.04	0.36	172	158	39182E3	79182E3
	2200	30 x 35	2.87	3.50	0.44	141	129	39222E3	79222E3
	2700	30 x 40	3.24	3.95	0.54	117	108	39272E3	79272E3
	3300	30 x 50	3.87	4.72	0.66	94	87	39332E3	79332E3
	3300	35 x 35	3.19	3.89	0.66	115	107	49332E3	89332E3
	3900	35 x 40	3.58	4.37	0.78	98	91	49392E3	89392E3
	4700	35 x 50	4.29	5.23	0.94	78	73	49472E3	89472E3

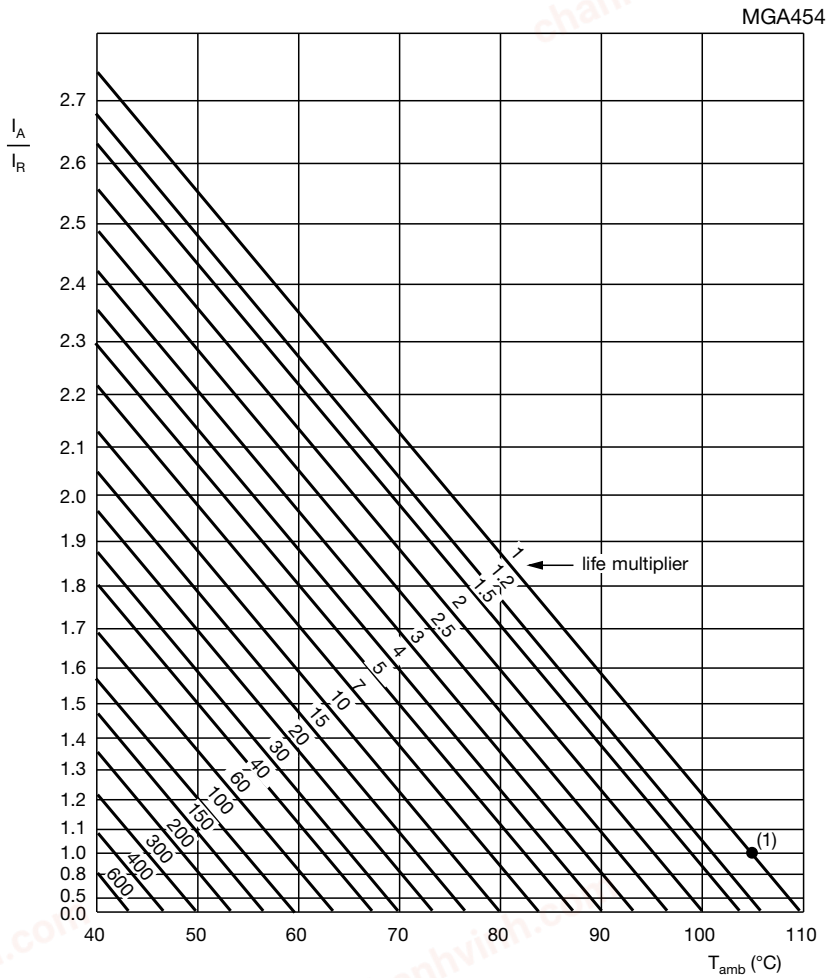
ADDITIONAL ELECTRICAL DATA

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage		$U_s = 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 min at U_R	$I_{L1} \leq 0.006\ C_R \times U_R + 4$ µA
	After 5 min at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4$ µA
Inductance		
Equivalent series inductance (ESL)	All case sizes	Typ. 19 nH
		Max. 25 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 and 105 °C
(1) Useful life at 105 °C and I_R applied: 5000 h

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	
	U_R = 16 V TO 25 V	U_R = 40 V TO 100 V
50	0.93	0.91
100	1.00	1.00
200	1.04	1.05
400	1.07	1.09
1000	1.11	1.13
2000	1.13	1.15
4000	1.15	1.18
≥ 10 000	1.18	1.22

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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 °C; U_R applied; 2000 h	ΔC/C: ± 15 % ESR ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I_{L5} ≤ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_{amb} = 105 °C; U_R and I_R applied; 5000 h	ΔC/C: ± 20 % ESR ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_{L5} ≤ spec. limit no short or open circuit, no visible damage total failure percentage: U_R: ≤ 1 %
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	T_{amb} = 105 °C; no voltage applied; 500 h After test: U_R to be applied for 30 min, 24 h to 48 h before measurement	ΔC/C: ± 15 % ESR ≤ 1.5 x spec. limit I_{L5} ≤ 2 x spec. limit

For technical questions, contact: aluminumcaps2@vishay.com
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