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Aluminum Electrolytic Capacitors
Power High Ripple Current Miniaturized Snap-In



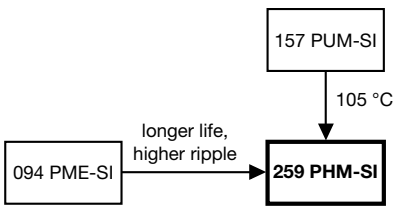


Fig. 1

FEATURES

- Compact design
- Useful life: 3000 h at 105 °C
- > 10 years 24/7 application life up to 60 °C
- Available up to 500 V
- 30 % higher ripple current rating than 094 PME-SI series
- Keyed polarity snap-in version available
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Solar PV inverters
- Motor controls / small drives
- Welding / cutting / melting
- Industrial cooling / heating
- Industrial lamp driver

MARKING

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

- Rated capacitance (in µF)
- Tolerance code on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code (YYMM or in 2 digits according to IEC 60062)
- 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, at least last 8 digits 259 xxxxx
- Climatic category in accordance with IEC 60068

QUICK REFERENCE DATA	
DESCRIPTION	**VALUE**
Nominal case size (Ø D x L in mm)	22 x 25 to 35 x 60
Rated capacitance range, C_R	39 µF to 2200 µF
Tolerance on C_R	± 20 %
Rated voltage range, U_R	200 V to 500 V
Category temperature range	-40 °C to +105 °C
Endurance test at 105 °C	3000 h
Useful life at 105 °C	3000 h
Shelf life at 0 V, 105 °C	1000 h
Based on sectional specification	IEC 60384-4 / EN 130300
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)				
	200	**250**	**400**	**450**	**500**
39	-	-	-	-	22 x 25
56	-	-	-	-	22 x 30 25 x 25
68	-	-	-	22 x 25	22 x 35 25 x 30
82	-	-	22 x 25	25 x 25	-
100	-	-	-	22 x 30	22 x 40 25 x 35 30 x 25
120	-	-	22 x 30 25 x 25	22 x 35 25 x 30 30 x 25	22 x 45 25 x 40 30 x 30 35 x 25
150	-	-	22 x 35 25 x 30	22 x 40 25 x 35	25 x 45 30 x 35
180	-	-	22 x 40 30 x 25	22 x 45 25 x 40 30 x 30 35 x 25	25 x 50 30 x 40 35 x 30
220	-	22 x 30	22 x 45 25 x 35 30 x 30	25 x 50 30 x 35 35 x 30	30 x 45 35 x 35

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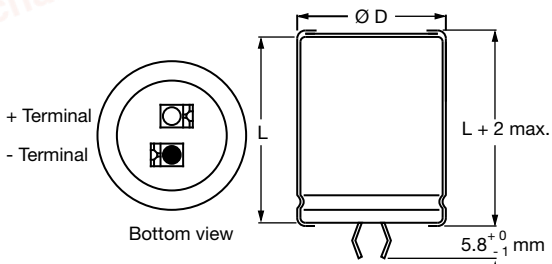
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SELECTION CHART FOR C_R, U_R, AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)					
C_R (µF)	U_R (V)				
	200	250	400	450	500
270	22 x 25	22 x 30 25 x 25	25 x 45 35 x 25	30 x 40	30 x 50 35 x 40
330	22 x 30	22 x 35	25 x 50 30 x 35 35 x 30	30 x 45 35 x 35	35 x 45
390	22 x 30	22 x 40 25 x 30 30 x 25	30 x 40	35 x 40	35 x 55
470	22 x 35 25 x 30	25 x 35 30 x 30	30 x 45 35 x 35	35 x 45	35 x 60
560	22 x 40 25 x 35 30 x 25	25 x 40 30 x 30 35 x 25	35 x 45	35 x 55	-
680	25 x 40 30 x 30	25 x 45 30 x 35 35 x 30	35 x 50	35 x 60	-
820	25 x 45 30 x 30 35 x 25	25 x 50 30 x 40 35 x 30	35 x 60	-	-
1000	25 x 50 30 x 35 35 x 30	30 x 45 35 x 35	-	-	-
1200	30 x 40	30 x 50 35 x 40	-	-	-
1500	30 x 45 35 x 35	35 x 45	-	-	-
1800	35 x 40	35 x 55	-	-	-
2200	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

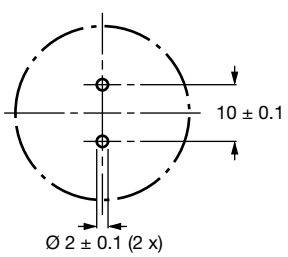
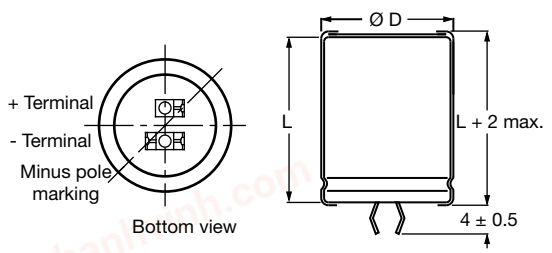


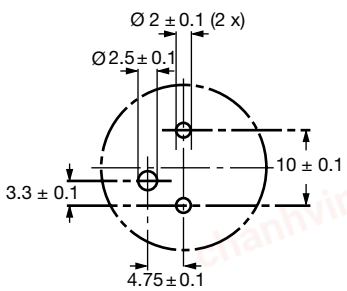
Fig. 3 - Mounting hole diagram

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

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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
22 x 45	23	47	≈ 26	100	260 x 250 x 59
25 x 25	26	27	≈ 20	100	290 x 280 x 39
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 45	26	47	≈ 32	100	290 x 280 x 59
25 x 50	26	52	≈ 38	100	290 x 280 x 64
30 x 25	31	27	≈ 25	100	340 x 330 x 39
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 45	31	47	≈ 45	100	340 x 330 x 59
30 x 50	31	52	≈ 50	100	340 x 330 x 64
35 x 25	36	27	≈ 33	50	390 x 198 x 39
35 x 30	36	32	≈ 40	50	390 x 198 x 44
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
35 x 55	36	57	≈ 80	50	390 x 198 x 69
35 x 60	36	62	≈ 82	50	390 x 198 x 74

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
Z	Typ. / max. impedance at 10 kHz

Notes

- 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 259 series

1000 µF / 200 V; ± 20 %

Nominal case size: Ø 25 mm x 50 mm

2-terminal snap-in:

Ordering code: MAL225942102E3
Former 12NC: 222225942102

3-terminal snap-in:

Ordering code: MAL225982102E3
Former 12NC: 222225982102

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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_{L5} 5 min (mA)	TYP. ESR 100 Hz 60 °C (mΩ)	TYP. ESR 300 Hz 60 °C (mΩ)	MAX. ESR 100 Hz (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2259.....	
									2-TERM.	3-TERM.
200	270	22 x 25	1.44	0.54	181	113	420	260	52271E3	12271E3
	330	22 x 30	1.68	0.66	146	92	340	210	52331E3	12331E3
	390	22 x 30	1.78	0.78	125	78	290	180	52391E3	12391E3
	470	22 x 35	2.05	0.94	103	65	240	150	52471E3	12471E3
	470	25 x 30	1.99	0.94	108	68	250	160	42471E3	82471E3
	560	22 x 40	2.31	1.12	99	62	230	160	52561E3	12561E3
	560	25 x 35	2.29	1.12	90	57	210	130	42561E3	82561E3
	560	30 x 25	1.98	1.12	112	70	260	180	32561E3	72561E3
	680	25 x 40	2.61	1.36	77	49	180	110	42681E3	82681E3
	680	30 x 30	2.38	1.36	86	54	200	140	32681E3	72681E3
	820	25 x 45	2.99	1.64	65	41	150	90	42821E3	82821E3
	820	30 x 30	2.43	1.64	77	49	180	130	32821E3	72821E3
	820	35 x 25	2.23	1.64	103	65	240	170	22821E3	62821E3
	1000	25 x 50	3.39	2.00	52	32	120	80	42102E3	82102E3
	1000	30 x 35	2.83	2.00	65	41	150	100	32102E3	72102E3
	1000	35 x 30	2.75	2.00	73	46	170	120	22102E3	62102E3
	1200	30 x 40	3.17	2.40	52	32	120	90	32122E3	72122E3
	1500	30 x 45	3.58	3.00	43	27	100	70	32152E3	72152E3
	1500	35 x 35	3.15	3.00	56	35	130	90	22152E3	62152E3
	1800	35 x 40	3.49	3.60	47	30	110	80	22182E3	62182E3
	2200	35 x 50	4.20	4.40	39	24	90	60	22222E3	62222E3
250	220	22 x 30	1.45	0.55	181	113	420	240	53221E3	13221E3
	270	22 x 30	1.57	0.68	151	95	350	210	53271E3	13271E3
	270	25 x 25	1.51	0.68	163	103	380	230	43271E3	83271E3
	330	22 x 35	1.82	0.83	125	78	290	170	53331E3	13331E3
	390	22 x 40	2.06	0.98	108	68	250	140	53391E3	13391E3
	390	25 x 30	1.87	0.98	112	70	260	160	43391E3	83391E3
	390	30 x 25	1.83	0.98	129	81	300	190	33391E3	73391E3
	470	25 x 35	2.16	1.18	95	59	220	130	43471E3	83471E3
	470	30 x 30	2.17	1.18	99	62	230	150	33471E3	73471E3
	560	25 x 40	2.45	1.40	77	49	180	110	43561E3	83561E3
	560	30 x 30	2.24	1.40	90	57	210	140	33561E3	73561E3
	560	35 x 25	2.13	1.40	112	70	260	180	23561E3	63561E3
	680	25 x 45	2.82	1.70	65	41	150	90	43681E3	83681E3
	680	30 x 35	2.60	1.70	73	46	170	110	33681E3	73681E3
	680	35 x 30	2.59	1.70	82	51	190	130	23681E3	63681E3
	820	25 x 50	3.19	2.05	56	35	130	80	43821E3	83821E3
	820	30 x 40	2.92	2.05	60	38	140	90	33821E3	73821E3
	820	35 x 30	2.60	2.05	77	49	180	130	23821E3	63821E3
	1000	30 x 45	3.31	2.50	52	32	120	80	33102E3	73102E3
	1000	35 x 35	3.01	2.50	60	38	140	100	23102E3	63102E3
	1200	30 x 50	3.70	3.00	43	27	100	70	33122E3	73122E3
	1200	35 x 40	3.34	3.00	52	32	120	90	23122E3	63122E3
	1500	35 x 45	3.71	3.75	43	27	100	70	23152E3	63152E3
	1800	35 x 55	4.42	4.50	34	22	80	60	23182E3	63182E3

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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_{L5} 5 min (mA)	TYP. ESR 100 Hz 60 °C (mΩ)	TYP. ESR 300 Hz 60 °C (mΩ)	MAX. ESR 100 Hz (mΩ)	MAX. Z 10 kHz (mΩ)	ORDERING CODE MAL2259.....	
									2-TERM.	3-TERM.
400	82	22 x 25	0.74	0.33	754	345	1570	1130	56829E3	16829E3
	120	22 x 30	0.93	0.48	518	238	1080	780	56121E3	16121E3
	120	25 x 25	0.92	0.48	528	242	1100	800	66121E3	26121E3
	150	22 x 35	1.08	0.60	413	189	860	620	56151E3	16151E3
	150	25 x 30	1.07	0.60	418	191	870	630	66151E3	26151E3
	180	22 x 40	1.24	0.72	346	158	720	520	56181E3	16181E3
	180	30 x 25	1.18	0.72	370	169	770	570	66181E3	26181E3
	220	22 x 45	1.41	0.88	283	130	590	430	56221E3	16221E3
	220	25 x 35	1.34	0.88	288	132	600	440	66221E3	26221E3
	220	30 x 30	1.38	0.88	298	136	620	460	76221E3	36221E3
	270	25 x 45	1.64	1.08	235	108	490	350	56271E3	16271E3
	270	35 x 25	1.49	1.08	274	125	570	440	66271E3	26271E3
	330	25 x 50	1.89	1.32	192	88	400	290	56331E3	16331E3
	330	30 x 35	1.71	1.32	202	92	420	320	66331E3	26331E3
	330	35 x 30	1.77	1.32	216	99	450	340	76331E3	36331E3
	390	30 x 40	1.92	1.56	173	79	360	270	56391E3	16391E3
	470	30 x 45	2.18	1.88	144	66	300	220	56471E3	16471E3
	470	35 x 35	2.09	1.88	154	70	320	250	66471E3	26471E3
	560	35 x 45	2.50	2.24	125	57	260	200	66561E3	26561E3
	680	35 x 50	2.79	2.72	106	48	220	170	56681E3	16681E3
	820	35 x 60	3.25	3.28	86	40	180	140	56821E3	16821E3
450	68	22 x 25	0.69	0.31	787	361	1640	1120	57689E3	17689E3
	82	25 x 25	0.79	0.37	658	301	1370	940	57829E3	17829E3
	100	22 x 30	0.87	0.45	538	246	1120	760	57101E3	17101E3
	120	22 x 35	0.99	0.54	446	205	930	630	57121E3	17121E3
	120	25 x 30	0.99	0.54	451	207	940	640	67121E3	27121E3
	120	30 x 25	1.03	0.54	466	213	970	670	77121E3	37121E3
	150	22 x 40	1.16	0.68	360	165	750	510	57151E3	17151E3
	150	25 x 35	1.15	0.68	360	165	750	520	67151E3	27151E3
	180	22 x 45	1.31	0.81	298	136	620	430	57181E3	17181E3
	180	25 x 40	1.32	0.81	302	139	630	430	67181E3	27181E3
	180	30 x 30	1.29	0.81	312	143	650	460	77181E3	37181E3
	180	35 x 25	1.34	0.81	336	154	700	500	87181E3	47181E3
	220	25 x 50	1.60	0.99	254	117	530	360	57221E3	17221E3
	220	30 x 35	1.48	0.99	259	119	540	380	67221E3	27221E3
	220	35 x 30	1.56	0.99	269	123	560	400	77221E3	37221E3
	270	30 x 40	1.68	1.22	216	99	450	310	57271E3	17271E3
	330	30 x 45	1.92	1.49	178	81	370	260	57331E3	17331E3
	330	35 x 35	1.89	1.49	187	86	390	280	67331E3	27331E3
	390	35 x 40	2.11	1.76	158	73	330	240	57391E3	17391E3
	470	35 x 45	2.36	2.12	134	62	280	200	57471E3	17471E3
	560	35 x 55	2.76	2.52	110	51	230	170	57561E3	17561E3
	680	35 x 60	3.06	3.06	91	42	190	140	57681E3	17681E3

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									2-TERM.	3-TERM.
500	39	22 x 25	0.53	0.20	1192	662	3310	2440	59399E3	19399E3
	56	22 x 30	0.67	0.28	832	462	2310	1700	59569E3	19569E3
	56	25 x 25	0.66	0.28	878	488	2440	1830	69569E3	29569E3
	68	22 x 35	0.76	0.34	684	380	1900	1400	59689E3	19689E3
	68	25 x 30	0.77	0.34	688	382	1910	1410	69689E3	29689E3
	100	22 x 40	0.97	0.50	468	260	1300	960	59101E3	19101E3
	100	25 x 35	0.96	0.50	472	262	1310	960	69101E3	29101E3
	100	30 x 25	0.95	0.50	508	282	1410	1070	79101E3	39101E3
	120	22 x 45	1.09	0.60	410	228	1140	850	59121E3	19121E3
	120	25 x 40	1.10	0.60	392	218	1090	810	69121E3	29121E3
	120	30 x 30	1.09	0.60	400	222	1110	830	79121E3	39121E3
	120	35 x 25	1.16	0.60	432	240	1200	920	89121E3	49121E3
	150	25 x 45	1.29	0.75	313	174	870	650	59151E3	19151E3
	150	30 x 35	1.27	0.75	320	178	890	660	69151E3	29151E3
	180	25 x 50	1.48	0.90	263	146	730	540	59181E3	19181E3
	180	30 x 40	1.44	0.90	263	146	730	540	69181E3	29181E3
	180	35 x 30	1.44	0.90	277	154	770	590	79181E3	39181E3
	220	30 x 45	1.64	1.10	220	122	610	450	59221E3	19221E3
	220	35 x 35	1.64	1.10	227	126	630	480	69221E3	29221E3
	270	30 x 50	1.89	1.35	176	98	490	370	59271E3	19271E3
	270	35 x 40	1.85	1.35	187	104	520	390	69271E3	29271E3
	330	35 x 45	2.09	1.65	155	86	430	320	59331E3	19331E3
	390	35 x 55	2.42	1.95	130	72	360	270	59391E3	19391E3
	470	35 x 60	2.70	2.35	108	60	300	230	59471E3	19471E3

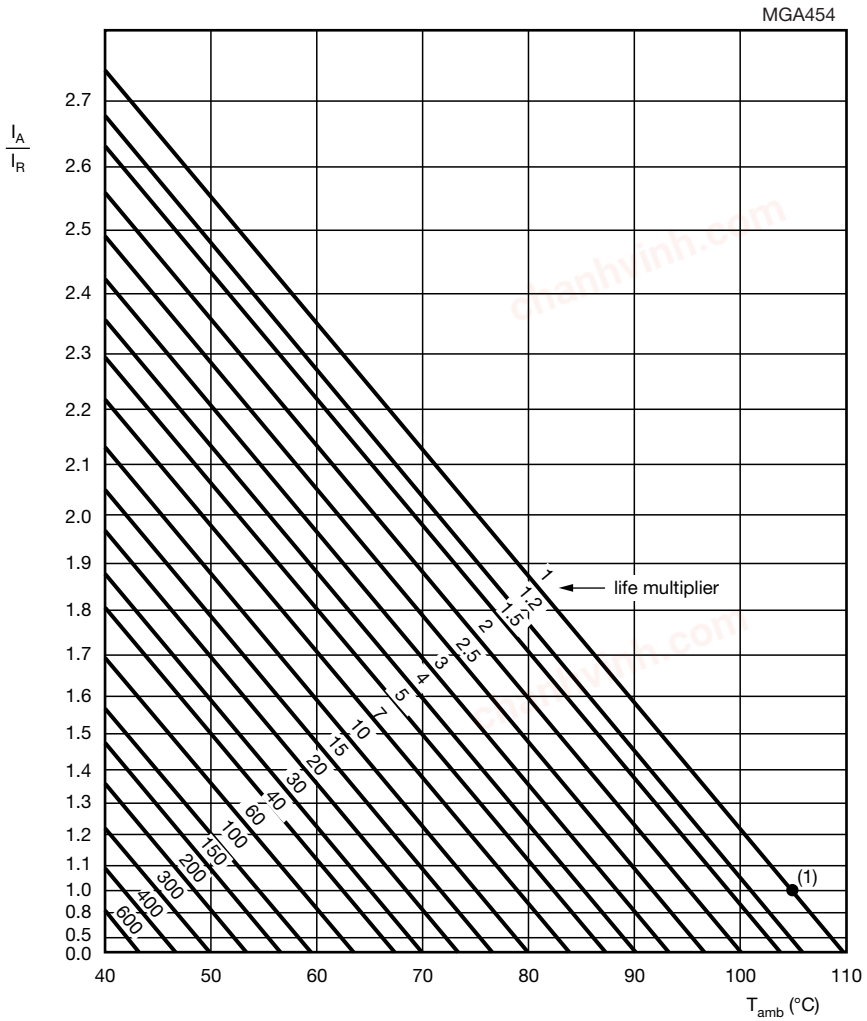
ADDITIONAL ELECTRICAL DATA

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≥ 200 V versions	$U_S = 1{,}1 \times U_R$
Reverse voltage	≤ 1 V	-
Current		
Leakage current	After 5 min at U_R	$I_{L5} \leq 0.01\ C_R \times U_R$
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 120 Hz
I_R = Rated ripple current at 100 Hz and 105 °C
(1) Useful life at 105 °C and I_R applied: 3000 h

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

Table 3

ENDURANCE TEST DURATION AND USEFUL LIFE	
ENDURANCE AT 105 °C (h)	USEFUL LIFE AT 105 °C (h)
3000	3000

Note

- Multiplier of useful life code: MGA454

Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY					
FREQUENCY (Hz)					
50	100	120	200	1000	≥ 10 000
I_R MULTIPLIER					
0.8	1.0	1.05	1.2	1.4	1.5

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Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN 130300 subclause 4.13	T_{amb} = 105 °C; U_R applied; 3000 h	ΔC/C: ± 15 % ESR ≤ 1.3 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; 3000 h	ΔC/C: ± 30 % ESR ≤ 3 x spec. limit I_{L5} ≤ spec. limit total failure percentage: ≤ 3 %
Shelf life (storage at high temperature)	IEC 60384-4 / EN 130300 subclause 4.17	T_{amb} = 105 °C; no voltage applied; 1000 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} ≤ spec. limit

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.

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