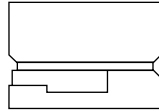


# Aluminum Capacitors



## FEATURES

- Polarized aluminum electrolytic capacitors
- SMD Style
- High CU-product
- Miniature dimension
- Reflow soldering
- Packaging: blistertape on reel
- Lead (Pb)-free


**RoHS\***  
 COMPLIANT

## APPLICATIONS

- General Use
- Consumer Electronics
- Low-headroom, height restricted low mass units
- Filtering, smoothing, coupling

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes D × L (in mm)	(3) 4 × 5.3 to 10 × 10
Rated capacitance range, C <sub>R</sub>	0.1 to 1500 μF
Tolerance on C <sub>R</sub>	± 20 %
Rated voltage range, U <sub>R</sub>	4 to 100 V
Category temperature range	- 40 to + 85 °C
Endurance test at upper category temperature	2000 hours
Lifetime at 85 °C and I <sub>R</sub>	2500 hours
Lifetime at 40 °C and I <sub>R</sub>	60 000 hours
Failure rate	≤ 100 [10 <sup>-9</sup> /h]
Based on sectional specification	IEC 60384-4 EN 130 300
Detail specifications	
Climatic category	
IEC 60068	40/085/56

SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> AND RELEVANT NOMINAL CASE SIZES (D × L in mm)									
C <sub>R</sub> (μF)	U <sub>R</sub> (V)								
	4	6.3	10	16	25	35	50	63	100
0.1	-	-	-	-	-	-	(3) 4 × 5.3	-	-
0.22	-	-	-	-	-	-	(3) 4 × 5.3	-	-
0.33	-	-	-	-	-	-	(3) 4 × 5.3	-	-
0.47	-	-	-	-	-	-	(3) 4 × 5.3	-	-
0.68	-	-	-	-	-	-	(3) 4 × 5.3	-	-
1.0	-	-	-	-	-	-	(3) 4 × 5.3	-	-
1.5	-	-	-	-	-	-	4 × 5.3	-	-
2.2	-	-	-	-	-	-	4 × 5.3	-	-
3.3	-	-	-	-	-	-	4 × 5.3	-	6.3 × 5.8
4.7	-	-	-	-	4 × 5.3	4 × 5.3	4 × 5.3	-	6.3 × 5.8
	-	-	-	-	-	-	5 × 5.3	-	8 × 6.2
6.8	-	-	-	-	4 × 5.3	4 × 5.3	5 × 5.3	-	-
	-	-	-	-	-	5 × 5.3	-	-	-
10	-	-	-	-	4 × 5.3	4 × 5.3	5 × 5.3	8 × 6.2	8 × 10
	-	-	-	-	5 × 5.3	5 × 5.3	6.3 × 5.3	-	-
15	-	-	-	4 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.3	-	-
	-	4 × 5.3	4 × 5.3	4 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.3	8 × 10	8 × 10
22	-	-	5 × 5.3	5 × 5.3	6.3 × 5.3	-	-	-	-
	4 × 5.3	4 × 5.3	4 × 5.3	5 × 5.3	5 × 5.3	6.3 × 5.3	8 × 6.2	8 × 10	10 × 10
33	-	5 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.3	-	6.3 × 7.7	-	-
	4 × 5.3	4 × 5.3	5 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.8	6.3 × 7.7	8 × 10	10 × 10
47	-	5 × 5.3	6.3 × 5.3	6.3 × 5.3	-	8 × 6.2	8 × 10	-	-
	5 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.3	8 × 6.2	6.3 × 7.7	8 × 10	-	-
68	5 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.3	8 × 6.2	6.3 × 7.7	8 × 10	-	-

\* Pb containing terminations are not RoHS compliant, exemptions may apply

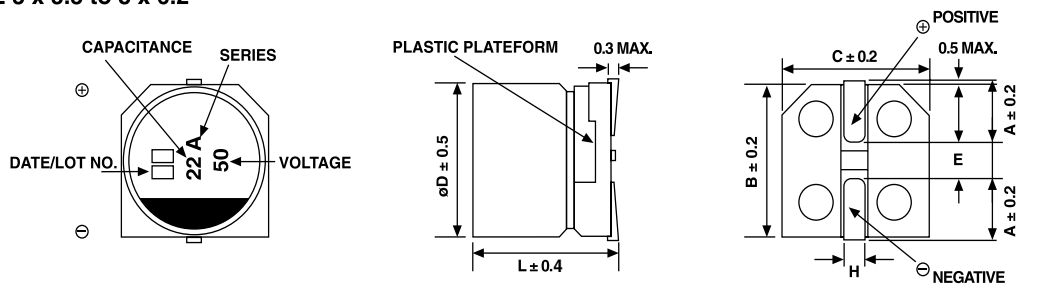
SELECTION CHART FOR $C_R$ , $U_R$ AND RELEVANT NOMINAL CASE SIZES (D × L in mm)									
$C_R$ ( $\mu F$ )	$U_R$ (V)								
	4	6.3	10	16	25	35	50	63	100
100	5 × 5.3	5 × 5.3	6.3 × 5.3	6.3 × 5.3	6.3 × 7.7	6.3 × 7.7	8 × 10	10 × 10	-
	-	6.3 × 5.3	-	8 × 6.2	8 × 6.2	8 × 10	10 × 10	-	-
150	-	-	6.3 × 5.8	6.3 × 7.7	8 × 10	8 × 10	10 × 10	-	-
	-	-	-	8 × 6.2	-	10 × 10	-	-	-
220	6.3 × 5.3	6.3 × 5.8	6.3 × 7.7	6.3 × 7.7	8 × 10	8 × 10	-	-	-
	-	8 × 6.2	8 × 6.2	8 × 10	10 × 10	10 × 10	-	-	-
330	-	6.3 × 7.7	8 × 10	8 × 10	8 × 10	10 × 10	-	-	-
	-	8 × 6.2	-	10 × 10	10 × 10	-	-	-	-
470	6.3 × 7.7	8 × 10	8 × 10	10 × 10	10 × 10	-	-	-	-
	-	-	10 × 10	-	-	-	-	-	-
680	8 × 10	8 × 10	10 × 10	10 × 10	-	-	-	-	-
1000	-	10 × 10	10 × 10	-	-	-	-	-	-
1500	-	10 × 10	-	-	-	-	-	-	-

Note

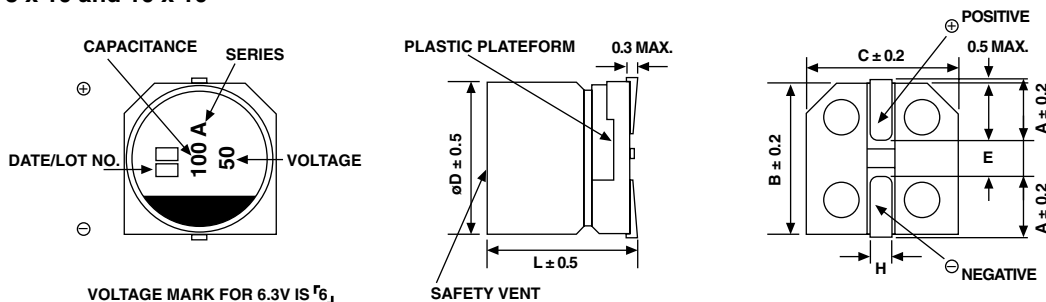
- 1. Case size 3 × 5.3 is available on request

DIMENSIONS in millimeters							
CASE SIZE CODE	D	H	B	C	E	A	H
AA	3	5.3	3.3	3.3	0.8	1.5	0.5 ~ 0.8
AB	4	5.3	4.3	4.3	1.0	1.9	0.5 ~ 0.8
AC	5	5.3	5.3	5.3	1.4	2.3	0.5 ~ 0.8
AD	6.3	5.3/5.8	6.6	6.6	2.2	2.4	0.5 ~ 0.8
BM	6.3	7.7	6.6	6.6	2.2	2.4	0.5 ~ 0.8
AE	8	6.2	8.3	8.3	2.3	3.3	0.5 ~ 0.8
AF	8	10	8.3	8.3	3.1	2.9	0.8 ~ 1.1
AG	10	10	10.3	10.3	4.5	3.2	0.8 ~ 1.1

CASE SIZE 3 x 5.3 to 8 x 6.2



CASE SIZE 8 x 10 and 10 x 10





ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	Rated capacitance at 120 Hz
$U_R$	Rated voltage
Tan $\delta$	Max. dissipation factor at 120 Hz
$R_{ESR}$	Max. equivalent series resistance at 120 Hz
$I_R$	Rated alternating current at 120 Hz and upper category temperature

**Note**

- Unless otherwise specified, all electrical values apply at  $T_{amb} = 20\text{ }^\circ\text{C}$ ,  $P = 80$  to  $120\text{ kPa}$ ,  $RH = 45$  to  $75\%$ .

**ORDERING EXAMPLE**

ECA 10  $\mu\text{F}$  / 25 V,  $\pm 20\%$

Size: 5 mm x 5.3 mm

Ordering Code: ECA00AC210EA0□

The 14<sup>th</sup> place (□), not indicated in the following table, is an inter-company code.

RoHS/Lead (Pb)-free

If you need "RoHS" compliant parts please replace the 13<sup>th</sup> figure "0" of the Part Number through "R".

example: ECA00AB233AAR□

ELECTRICAL DATA AND ORDERING INFORMATION						
$U_R$ (V)	$C_R$ 120 Hz ( $\mu\text{F}$ )	DIMENSIONS D x L (mm)	TAN $\delta$ 120 Hz	$R_{ESR}$ 120 Hz ( $\Omega$ )	$I_R$ 120 Hz/85 $^\circ\text{C}$ (mA)	CATALOG NUMBER PART NUMBER*
4	33	4 x 5.3	0.40	16.4	27	ECA00AB233AA0□
	47	4 x 5.3	0.40	11.5	32	ECA00AB247AA0□
	68	5 x 5.3	0.40	8.0	44	ECA00AC268AA0□
	100	5 x 5.3	0.40	5.4	54	ECA00AC310AA0□
	220	6.3 x 5.3	0.40	2.5	93	ECA00AD322AA0□
	470	6.3 x 7.7	0.40	1.2	115	ECA00BM347AA0□
	680	8 x 10	0.40	0.8	200	ECA00AF368AA0□
6.3	22	4 x 5.3	0.30	18.5	24	ECA00AB222BA0□
	33	4 x 5.3	0.30	12.3	30	ECA00AB233BA0□
	33	5 x 5.3	0.30	12.3	41	ECA00AC233BA0□
	47	4 x 5.3	0.30	8.6	36	ECA00AB247BA0□
	47	5 x 5.3	0.30	8.6	48	ECA00AC247BA0□
	68	5 x 5.3	0.30	6.0	50	ECA00AC268BA0□
	100	5 x 5.3	0.30	4.1	60	ECA00AC310BA0□
	100	6.3 x 5.3	0.30	4.1	82	ECA00AD310BA0□
	220	6.3 x 5.8	0.30	1.9	91	ECA00AD322BA0□
	220	8 x 6.2	0.30	1.9	140	ECA00AE322BA0□
	330	6.3 x 7.7	0.30	1.3	188	ECA00BM333BA0□
	330	8 x 6.2	0.30	1.3	190	ECA00AE333BA0□
	470	8 x 10	0.30	0.9	265	ECA00AF347BA0□
	680	8 x 10	0.30	0.6	290	ECA00AF368BA0□
	1000	10 x 10	0.35	0.5	400	ECA00AG410BA0□
1500	10 x 10	0.35	0.4	450	ECA00AG415BA0□	
10	22	4 x 5.3	0.25	15.4	28	ECA00AB222CA0□
	22	5 x 5.3	0.25	15.4	36	ECA00AC222CA0□
	33	4 x 5.3	0.25	10.3	34	ECA00AB233CA0□
	33	5 x 5.3	0.25	10.3	44	ECA00AC233CA0□
	47	5 x 5.3	0.25	7.2	47	ECA00AC247CA0□
	47	6.3 x 5.3	0.25	7.2	62	ECA00AD247CA0□
	68	6.3 x 5.3	0.25	5.0	66	ECA00AD268CA0□
	100	6.3 x 5.3	0.25	3.4	80	ECA00AD310CA0□
	150	6.3 x 5.8	0.25	2.3	95	ECA00AD315CA0□
	220	6.3 x 7.7	0.25	1.6	173	ECA00BM322CA0□
	220	8 x 6.2	0.25	1.6	175	ECA00AE322CA0□
	330	8 x 10	0.25	1.1	240	ECA00AF333CA0□
	470	8 x 10	0.25	0.8	307	ECA00AF347CA0□
	470	10 x 10	0.25	0.8	330	ECA00AG347CA0□
	680	10 x 10	0.25	0.5	375	ECA00AG368CA0□
	1000	10 x 10	0.25	0.4	454	ECA00AG410CA0□
	15	4 x 5.3	0.20	18.1	26	ECA00AB215DA0□



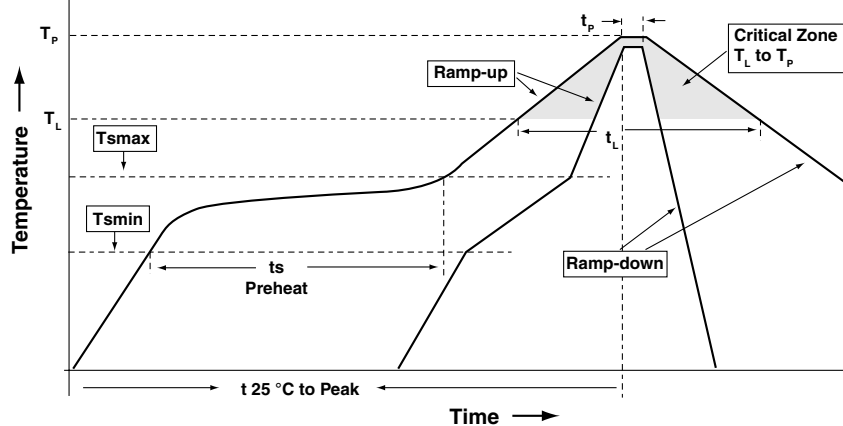
ELECTRICAL DATA AND ORDERING INFORMATION						
U <sub>R</sub> (V)	C <sub>R</sub> 120 Hz (μF)	DIMENSIONS D × L (mm)	TAN δ 120 Hz	R <sub>ESR</sub> 120 Hz (Ω)	I <sub>R</sub> 120 Hz/85 °C (mA)	CATALOG NUMBER PART NUMBER*
16	22	4 × 5.3	0.20	12.3	30	ECA00AB222DA0□
	22	5 × 5.3	0.20	12.3	37	ECA00AC222DA0□
	33	5 × 5.3	0.20	8.2	43	ECA00AC233DA0□
	33	6.3 × 5.3	0.20	8.2	58	ECA00AD233DA0□
	47	5 × 5.3	0.20	5.8	52	ECA00AC247DA0□
	47	6.3 × 5.3	0.20	5.8	69	ECA00AD247DA0□
	68	6.3 × 5.3	0.20	4.0	78	ECA00AD268DA0□
	100	6.3 × 5.3	0.20	2.7	88	ECA00AD310DA0□
	100	8 × 6.2	0.20	2.7	130	ECA00AE310DA0□
	150	6.3 × 7.7	0.20	1.8	140	ECA00BM315DA0□
	150	8 × 6.2	0.20	1.8	150	ECA00AE315DA0□
	220	6.3 × 7.7	0.20	1.3	162	ECA00BM322DA0□
	220	8 × 10	0.20	1.3	215	ECA00AF322DA0□
	330	8 × 10	0.20	0.8	270	ECA00AF333DA0□
	330	10 × 10	0.20	0.8	300	ECA00AG333DA0□
	470	10 × 10	0.20	0.6	340	ECA00AG347DA0□
	680	10 × 10	0.20	0.4	385	ECA00AG368DA0□
25	4.7	4 × 5.3	0.16	46	18	ECA00AB147EA0□
	6.8	4 × 5.3	0.16	32	20	ECA00AB168EA0□
	10	4 × 5.3	0.16	22	24	ECA00AB210EA0□
	10	5 × 5.3	0.16	22	30	ECA00AC210EA0□
	15	5 × 5.3	0.16	14.5	35	ECA00AC215EA0□
	22	5 × 5.3	0.16	9.9	41	ECA00AC222EA0□
	22	6.3 × 5.3	0.16	9.9	53	ECA00AD222EA0□
	33	5 × 5.3	0.16	6.6	50	ECA00AC233EA0□
	33	6.3 × 5.3	0.16	6.6	64	ECA00AD233EA0□
	47	6.3 × 5.3	0.16	4.6	70	ECA00AD247EA0□
	68	8 × 6.2	0.16	3.2	100	ECA00AE268EA0□
	100	6.3 × 7.7	0.16	2.2	110	ECA00BM310EA0□
	100	8 × 6.2	0.16	2.2	145	ECA00AE310EA0□
	150	8 × 10	0.16	1.5	190	ECA00AF315EA0□
	220	8 × 10	0.16	1.0	232	ECA00AF322EA0□
	220	10 × 10	0.16	1.0	250	ECA00AG322EA0□
	330	8 × 10	0.16	0.7	275	ECA00AF333EA0□
330	10 × 10	0.16	0.7	305	ECA00AG333EA0□	
470	10 × 10	0.16	0.5	350	ECA00AG347EA0□	
35	4.7	4 × 5.3	0.15	43	18	ECA00AB147FA0□
	6.8	4 × 5.3	0.15	30	21	ECA00AB168FA0□
	6.8	5 × 5.3	0.15	30	25	ECA00AC168FA0□
	10	4 × 5.3	0.15	20.5	27	ECA00AB210FA0□
	10	5 × 5.3	0.15	20.5	32	ECA00AC210FA0□
	15	6.3 × 5.3	0.15	13.6	45	ECA00AD215FA0□
	22	6.3 × 5.3	0.15	9.3	53	ECA00AD222FA0□
	33	6.3 × 5.3	0.15	6.2	60	ECA00AD233FA0□
	47	6.3 × 5.8	0.15	4.3	94	ECA00AD247FA0□
	47	8 × 6.2	0.15	4.3	105	ECA00AE247FA0□
	68	6.3 × 7.7	0.15	3.0	120	ECA00BM268FA0□
	100	6.3 × 7.7	0.15	2.1	132	ECA00BM310FA0□
	100	8 × 10	0.15	2.1	175	ECA00AF310FA0□
	150	8 × 10	0.15	1.4	200	ECA00AF315FA0□
	150	10 × 10	0.15	1.4	220	ECA00AG315FA0□
	220	8 × 10	0.15	1.0	240	ECA00AF322FA0□
	220	10 × 10	0.15	1.0	265	ECA00AG322FA0□
330	10 × 10	0.15	0.7	335	ECA00AG323FA0□	
	0.1	4 × 5.3	0.12	1625	4	ECA00AB010HA0□



ELECTRICAL DATA AND ORDERING INFORMATION						
$U_R$ (V)	$C_R$ 120 Hz ( $\mu$ F)	DIMENSIONS $D \times L$ (mm)	$TAN \delta$ 120 Hz	$R_{ESR}$ 120 Hz ( $\Omega$ )	$I_R$ 120 Hz/85 °C (mA)	CATALOG NUMBER PART NUMBER*
50	0.22	4 × 5.3	0.12	740	5	ECA00AB022HA0□
	0.33	4 × 5.3	0.12	495	6	ECA00AB033HA0□
	0.47	4 × 5.3	0.12	345	8	ECA00AB047HA0□
	0.68	4 × 5.3	0.12	239	9	ECA00AB068HA0□
	1.0	4 × 5.3	0.12	163	11	ECA00AB110HA0□
	1.5	4 × 5.3	0.12	109	14	ECA00AB115HA0□
	2.2	4 × 5.3	0.12	74	17	ECA00AB122HA0□
	3.3	4 × 5.3	0.12	50	20	ECA00AB133HA0□
	4.7	4 × 5.3	0.12	35	24	ECA00AB147HA0□
	4.7	5 × 5.3	0.12	35	26	ECA00AC147HA0□
	6.8	5 × 5.3	0.12	24	33	ECA00AC168HA0□
	10	5 × 5.3	0.12	16.5	41	ECA00AC210HA0□
	10	6.3 × 5.3	0.12	16.5	44	ECA00AD210HA0□
	15	6.3 × 5.3	0.12	10.9	58	ECA00AD215HA0□
	22	6.3 × 5.3	0.12	7.4	71	ECA00AD222HA0□
	33	8 × 6.2	0.12	5.0	95	ECA00AE233HA0□
	33	6.3 × 7.7	0.12	5.0	94	ECA00BM233HA0□
	47	6.3 × 7.7	0.12	3.5	105	ECA00BM247HA0□
	47	8 × 10	0.12	3.5	140	ECA00AF247HA0□
	68	8 × 10	0.12	2.4	150	ECA00AF268HA0□
100	8 × 10	0.12	1.7	181	ECA00AF310HA0□	
100	10 × 10	0.12	1.7	195	ECA00AG310HA0□	
150	10 × 10	0.12	1.1	230	ECA00AG315HA0□	
63	10	8 × 6.2	0.12	16.5	46	ECA00AE210JA0□
	22	8 × 10	0.12	7.4	96	ECA00AF222JA0□
	33	8 × 10	0.12	5.0	117	ECA00AF233JA0□
	47	8 × 10	0.12	3.5	150	ECA00AF247JA0□
	100	10 × 10	0.12	1.7	232	ECA00AG310JA0□
100	2.2	5 × 5.3	0.12	74	20	ECA00AC122LA0□
	3.3	6.3 × 5.8	0.12	50	29	ECA00AD133LA0□
	4.7	6.3 × 5.8	0.12	35	35	ECA00AD147LA0□
	4.7	8 × 6.2	0.12	35	40	ECA00AE147LA0□
	10	8 × 10	0.12	16.5	77	ECA00AF210LA0□
	22	8 × 10	0.12	7.4	100	ECA00AF222LA0□
	33	10 × 10	0.12	5.0	130	ECA00AG233LA0□
47	10 × 10	0.12	3.5	155	ECA00AG247LA0□	

**REFLOW SOLDERING CONDITIONS FOR SMD ALUMINUM ELECTROLYTIC CAPACITORS**

Lead (Pb)-free/RoHS



Profile Feature	Lead (Pb)-free/RoHS	
	4 ~ 6.3 φ	8 ~ 10 φ
Average Ramp-up Rate (T <sub>L</sub> to T <sub>P</sub> )	3 °C/second max.	
Preheat - Temperature Min (T <sub>s</sub> min.) - Temperature Max (T <sub>s</sub> max.) - Time (T <sub>s</sub> min. to T <sub>s</sub> max.)	150 °C 200 °C 60 ~ 150 seconds	
T <sub>s</sub> max. to T <sub>L</sub> - Ramp-up Rate	3 °C/second max.	
Time maintained above: - Temperature (T <sub>L</sub> ) - Time (T <sub>L</sub> )	217 °C 60 ~ 90 seconds	
Peak/Classification Temperature (T <sub>P</sub> )	250 °C ± 5 °C	
Time within 5 °C of actual Peak Temperature (T <sub>P</sub> )	10 seconds	5 seconds
Ramp-down Rate	3 °C/second max.	
Time 25 °C to Peak Temperature	8 minutes max.	

RESISTANCE TO SOLDERING HEAT	
Leakage current	less than specified value
Capacitance value	within ± 10 % of initial value
Tan δ	less than specified value

**LOW TEMPERATURE CHARACTERISTICS**

IMPEDANCE RATIO Z <sub>9T2</sub> /Z (T <sub>1</sub> ) AT 120HZ									
T1/T2	RATED VOLTAGE (V)								
	4	6.3	10	16	25	35	50	63	100
- 25 °C/+ 20 °C	6	5	4	3	2	2	2	2	2
- 40 °C/+ 20 °C	12	10	8	6	4	3	3	3	3

ENDURANCE TEST (rated voltage/2000 hours/85 °C)	
Leakage current	less than specified value
Capacitance value	within ± 25 % of initial value
Tan δ	less than 200 % of specified value

**LEAKAGE CURRENT**

Formula for calculation of the maximum leakage current.

(Test conditions: U<sub>R</sub>, 20 °C, 2 resp. 1 minute)

$$I_{L1} [\mu A] < 0.03 \cdot C_R [\mu F] \cdot U_R [V] \text{ (after 1 minute)}$$

$$I_{L2} [\mu A] < 0.01 \cdot C_R [\mu F] \cdot U_R [V] \text{ or } 3 \mu A \text{ whichever is greater (after 2 minutes)}$$



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