Dwg. No. :A23-0788
承認字號
Issued Date: 2023/04/20

Customer :_____
(客　戶)

Part No. :_____
(貴公司料號)

SPECIFICATION FOR APPROVAL
承　認　書

Description :V-CHIP ALUMINUM ELECTROLYTIC CAPACITORS
(零 件 名 稱)

Lelon Series :VUP Series
(立 隆 系 列)

Lelon Part No.:VUP101M1CTT-0606L
(立 隆 料 號)

LELON ELECTRONICS CORP.
立 隆 電 子 工 業 股 份 有 限 公 司

Headquarters
147, Sec. 1, Guoguang Rd., Dali District, Taichung, Taiwan
TEL: +886-4-2418-1856 FAX: +886-4-2418-1906

Manufacturing Sites

☐ Lelon Electronics Corp.
147, Sec. 1, Guoguang Rd., Dali District, Taichung, Taiwan
TEL: +886-4-2418-1856 FAX: +886-4-2418-1906

■ Lelon Electronics (Huizhou) Co., Ltd.
Taiyang Industrial Zone, Baihua Town, Huidong County, Huizhou City, Guangdong, China
TEL: +86-752-8768222 FAX: +86-752-8768199

■ Lelon Electronics (Suzhou) Co., Ltd.
1220, Zhongshan North Rd., Songling Town, Wujiang City, Jiangsu, China
TEL: +86-512-63457588 FAX: +86-512-63457791

Approval 核 准	Check 確 認	Design 作 成
研發部 APR 20 2023 蕭正浩	研發部 APR 20 2023 張 陸	研發部 APR 20 2023 蔡麗華

Approval Signatures
貴公司承認印

Please Return One Copy with Your Approval
承 認 後 請 寄 回 本 圖 一 份

Part Numbering System

Product Code Guide – SMD Type

VUP series	100μF	±20%	16V	Reel package	Standard product	6.3φ×5.8L	Automotive control code	Supplement code
VUP	**101**	**M**	**1C**	**TR**	**-**	**0606**	**L**	
□□□	□□□	□	□□	□□	□	□□□□	□	
①	②	③	④	⑤	⑥	⑦	⑧	⑨
Series	Capacitance	Capacitance Tolerance	Rated Voltage	Package Type	Terminal Type	Case size	Lead Wire and Case Type	Supplement Code

① Series:

Series is represented by a three-letter code. When the series name only has two letters, use a hyphen, "-", to fill the third blank.

② Capacitance:

Capacitance in μF is represented by a three-digit code. The first two digits are significant and the third digit indicates the number of zeros following the significant figure. "R" represents the decimal point for capacitance under 10μF.

Example:

Capacitance	0.1	0.47	1	4.7	10	47	100	470	1,000	4,700
Part number	0R1	R47	010	4R7	100	470	101	471	102	472

③ Tolerance:

K = -10% ~ +10%	M = -20% ~ +20%	V = -10% ~ +20%

④ Rated voltage:

Rated voltage in volts (V) is represented by a two-digit code

Rated Volt. (V)	4	6.3	10	16	25	35	50	80	63	100
Code	0G	0J	1A	1C	1E	1V	1H	1K	1J	2A
Rated Volt. (V)	160	200	250	350	400	450				
Code	2C	2D	2E	2V	2G	2W				

⑤ Package:

TR = Reel package	TT = Reel package of plastic	T- = Tray package for case diameter 12.5 ~ 18mm

⑥ Terminal:

- = Standard product
A = For application 10G (A must be used with automotive control code "K / L" together)
V = Anti-vibration structure

⑦ Case size:

The first two digits indicate case diameter and the last two digits indicate case length in mm.

φD×L	4×5.3	4×5.7 4×5.8*1	5×5.3	5×5.7 5×5.8*1	5×7*2	6.3×5.3	6.3×5.7 6.3×5.8*1
Code	**0405**	**0406**	**0505**	**0506**	**0507**	**0605**	**0606**
φD×L	6.3×7.0*2	6.3×7.7	6.3×8.7*2	8×6.5	8×10 8×10.5*3	10×7.7	10×10 10×10.5*3
Code	**0607**	**0607**	**0608**	**0806**	**0810**	**1008**	**1010**
φD×L	10×12.5	12.5×13.5	12.5×16	16×16.5	16×21.5	18×16.5	18×21.5
Code	**1013**	**1313**	**1316**	**1616**	**1621**	**1816**	**1821**

Note: *1.The case size are for VZL, VZS, VZT,VUP series only.
*2. The case size are for VZR series only.
*3. The case size are for Anti-vibration structure
When a case size is required and not shown in the table, please contact with us for further discussion.

⑧ Lead Wire and Coating Type:

None = Pb free wire + coated case (Standard design)	E = Sn-Bi wire + coated case
K / L = Automotive control code	

* When a supplement code following a blank digit code of lead wire and case coating type (standard design), use a hyphen, "-", to fill the blank digit. When the automotive control code is required, please contact with us for further discussion.

⑨ Supplement code (Optional):

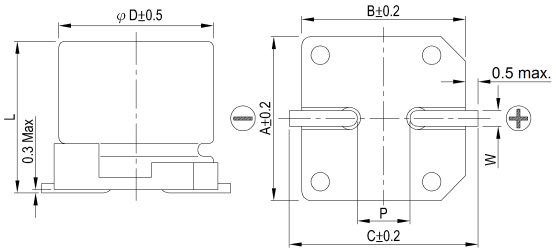
For special control purpose

Lelon P/N： VUP101M1CTT-0606L	LELON ELECTRONICS CORP. VUP 100 μF / 16 V – 6.3 φ × 5.8 L	Page：1 / 1

CUSTOMER :

CUSTOMER P/N:

PRODUCT DIMENSIONS

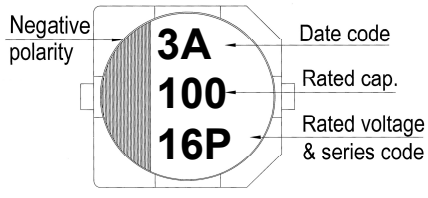


Unit: mm

φD	6.3
L	5.8 ± 0.3
A	6.6
B	6.6
C	7.2
W	0.5 ~ 0.8
P	2.0 ± 0.2

Items	Performance	
Rated Voltage V_R	16 V	
Capacitance C_R	100 μF	(120 Hz, 20℃)
Category Temperature Range	-40℃ ~ +125℃	
Capacitance Tolerance	-20 % ~ +20 %	(120 Hz, 20℃)
Surge Voltage V_S	18.4 V_{DC}	
Leakage Current (20℃)	I_{LEAK} ≦16 μA	After 2 minutes
Tan δ	≦0.23	(120 Hz, 20℃)
Impedance max	＜1.6 Ω	(100kHz, 20℃)
Ripple Current (I_{AC}, R / rms)	69 mA	(100kHz, 125℃)
Low Temperature Characteristics at 120 Hz	Rated Voltage: 16 Impedance ratio $Z_{(-40℃)}/Z_{(+20℃)}$: 8	
Ripple Current (mA) and Frequency Multipliers	Frequency (Hz): 50 / 120 / 300 / 1k / 10k up Multiplier: 0.35 / 0.50 / 0.64 / 0.83 / 1.00	
Endurance and Shelf Life Test	Items: Endurance: Shelf Life Test Test Time: 1,000 Hrs at 125℃； V_R: 1,000 Hrs at 125℃ Cap. Change: Within ±30 % of initial value: Within ±30 % of initial value Tan δ: Less than 300% of specified value: Less than 300% of specified value Leakage Current: Within specified value: Within specified value	
Vibration	Test frequency range 10 Hz ~ 2 kHz, acceleration max. 5 *g*'s (displacement amplitude max. 1.5 mm) for 20 minutes, 12 cycles each of 3 orientations.	
Standards	AEC-Q200-REV D, IEC 60384-4	
Remarks	RoHS Compliance , Halogen-free	

Marking: Each capacitor shall be marked with the following information.



3 A → 2023, January

→ Month of manufacture

→ The last digit of A. D.

Month	1	2	3	4	5	6
Code	A	B	C	D	E	F
Month	7	8	9	10	11	12
Code	G	H	I	J	K	L

Marking color: Black

* Please refer to " Precautions and Guidelines for Aluminum Electrolytic Capacitors " section in Lelon's catalog for further details.

Publication Date	April 20, 2023	Approval Signatures:	Approved	Checked	Designed
Revision Date			研發部 APR 20 2023 蕭正浩	研發部 APR 20 2023 張 陸	研發部 APR 20 2023 蔡麗華
Version No.	1	Please return one copy with your approval			

Diagram of Dimensions: Unit: mm

Fig. 1

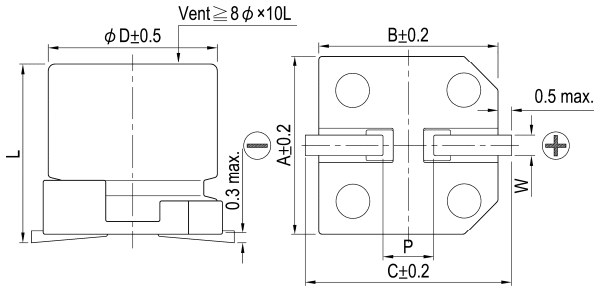
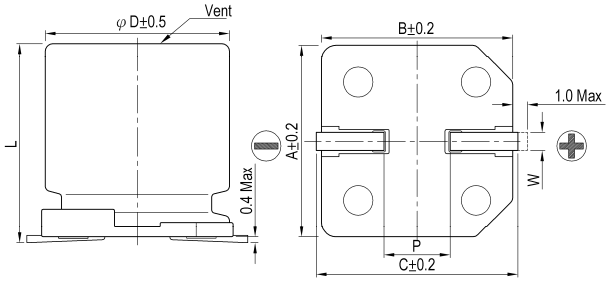


Fig. 2

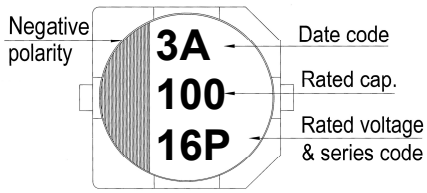


φD	L	A	B	C	W	P ± 0.2	Fig. No.
6.3	5.8 ± 0.3	6.6	6.6	7.2	0.5 ~ 0.8	2.0	1
6.3	7.7 ± 0.3	6.6	6.6	7.2	0.5 ~ 0.8	2.0	1
8	10 ± 0.5	8.3	8.3	9.0	0.7 ~ 1.1	3.1	1
10	10 ± 0.5	10.3	10.3	11.0	0.7 ~ 1.3	4.7	1
12.5	13.5 ± 0.5	13.0	13.0	13.7	1.1 ~ 1.4	4.4	2
16	16.5 ± 0.5	17.0	17.0	18.0	1.1 ~ 1.4	6.4	2
16	21.5 ± 0.5	17.0	17.0	18.0	1.1 ~ 1.4	6.4	2
18	16.5 ± 1.0	19.0	19.0	20.0	1.8 ~ 2.0	6.4	2
18	21.5 ± 1.0	19.0	19.0	20.0	1.8 ~ 2.0	6.4	2

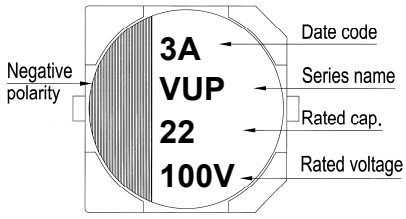
Marking:

Each capacitor shall be marked with the following information.

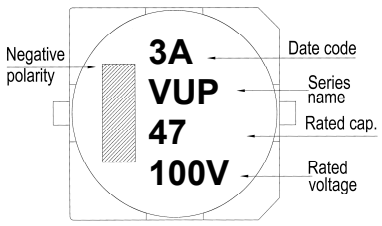
φD = 6.3 mm



φD = 8 ~ 10 mm



φD ≧ 12.5 mm



Description of Date Code:

3 A → January, 2023

- A → Month of manufacture
- 3 → The last digit of A. D

Month	1	2	3	4	5	6
Code	**A**	**B**	**C**	**D**	**E**	**F**
Month	7	8	9	10	11	12
Code	**G**	**H**	**I**	**J**	**K**	**L**

Origin code:

Huizhou: A3, B3, … , K3, L3

Suzhou: 3A, 3B, … , 3K, 3L

Marking Color: Black

Taping Specification for SMD Type

1. Carrier Tape

Fig. 1-1

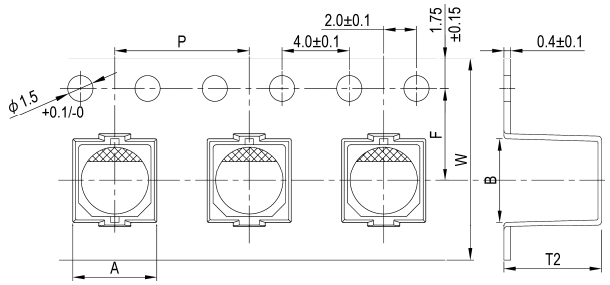


Fig. 1-2

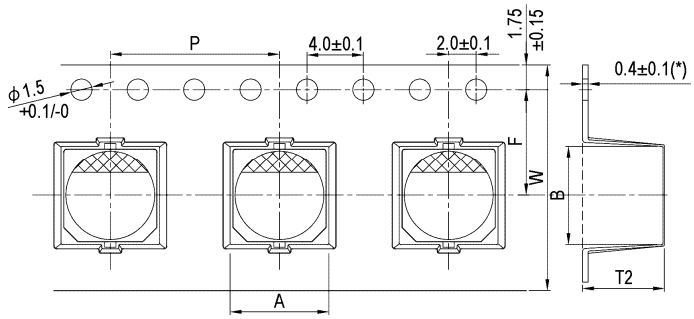
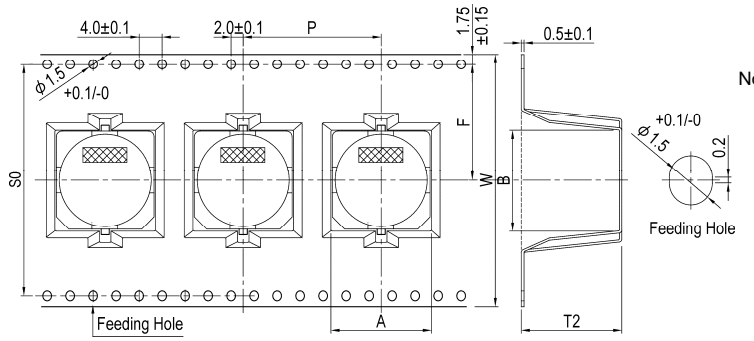


Fig. 1-3



Note: *1: The case size in the below table is marked with " * ", which means the marked with " * " in Fig. 1-2 is 0.5 mm.
*2: The carrier tape dimensions for 16 ~ 18ϕ of the anti-vibration structure are the same as general structure.

Unit: mm

ϕD ×L	A	B	F	P	T2	W	S0	Fig. No.	Anti-vibration
4 × 5.3	4.7	4.7	5.5	8	5.8	12.0	---	1-1	---
4 × 5.7 / 5.8					6.2				
5 × 5.3	5.7	5.7		12	5.8			1-2	
5 × 5.7 / 5.8					6.2				
5 × 7.0					7.6	16.0			
6.3 ×5.3	7.0	7.0	7.5		5.8	16.0			
6.3 × 5.7 / 5.8					6.2				
6.3 × 7.0 / 7.7					7.6 / 8.3				
6.3 × 8.7					9.3				
8 × 6.5	8.7	8.7			7.4				
8 × 10			11.5	16	11.0	24.0			
8 × 10.5 / 10	9.4	9.4			11.4				V
10 × 7.7	10.7	10.7			8.7				---
10 × 10					11.0				---
10 × 12.5 *1					13.0				V
10 × 10.5 / 10	11.4	11.4			11.4				V
12.5 × 13.5	13.4	13.4	14.2	24	14.5	32.0	28.4	1-3	---
12.5 × 16					17.0				---
12.5 × 13.5	13.7	13.7			15.0				V
12.5 × 16					17.5				V
16 × 16.5	17.5	17.5	20.2	28	17.5	44.0	40.4		V *2
16 × 21.5					22.2				
18 × 16.5	19.5	19.5		32	17.5				
18 × 21.5					23.0				
Tol.	± 0.2	± 0.2	± 0.1	± 0.1	± 0.2	± 0.3	± 0.1		

2. Reel Package

Fig. 2-1

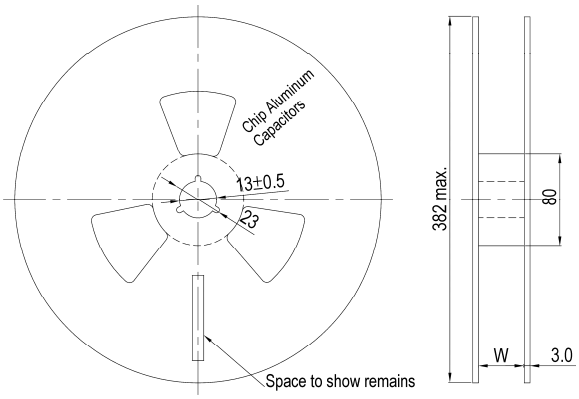
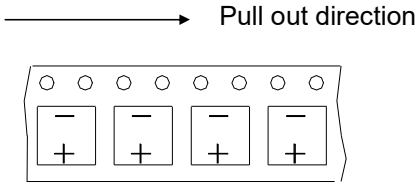


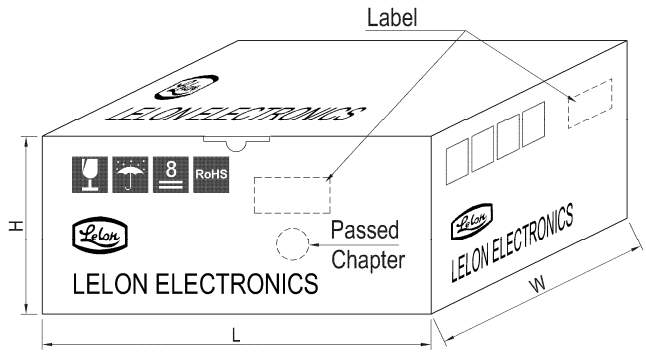
Fig. 2-2 Reel Polarity



Case size	4 ~ 5φ	6.3φ, 8φ×6.5L	8φ×7.7 ~12L, 10φ	12.5φ	16 ~ 18φ
W	14	18	26	34	46

3. Packing specification

Fig. 3-1 Carrier Tape



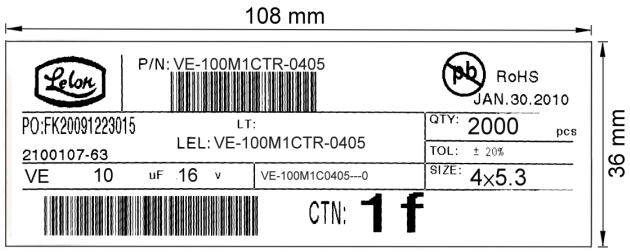
Unit: pcs

Case size	Q'ty / Reel	Q'ty / Box
4φ	2,000	20,000
5φ	1,000	10,000
6.3φ × 5.3 ~ 7.7L	1,000	10,000
6.3φ×8.7L	800	8,000
8φ×6.5L	1,000	10,000
8φ×10L	500	5,000
10φ × 7.7 ~ 10L	500	5,000
10φ × 12.5L	400	4,000
12.5φ × 13.5L	200	1,600
12.5φ × 16L	200	1,600
16φ × 16.5L	200	1,600
16φ × 21.5L	100	800
18φ × 16.5L	150	1,200
18φ × 21.5L	100	800

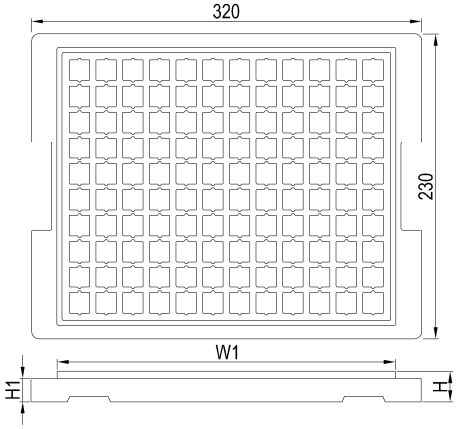
Unit: mm

Case size	4 ~ 5φ	6.3φ, 8φ × 6.5L	8φ × 10L 10 ~ 12.5φ	16 ~ 18φ
H	210	250	330	425
W, L	395			

Fig. 3-2 Label



4. Chip Tray

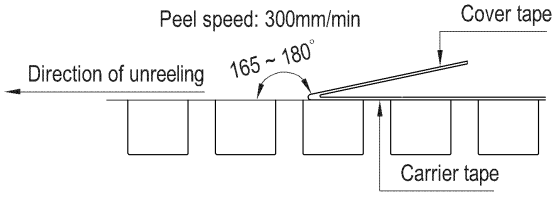


Dimension and package quantity Unit: mm

Case size	W1	H	H1	Q'ty / Tray	Q'ty / Box
12.5φ×13.5L	284	21	18.5	120	600
12.5φ×16L	284	21	18.5	120	600
16φ×16.5L	284	28	24.0	80	400
16φ×21.5L	284	28	24.0	80	400
18φ×16.5L	284	28	24.0	60	300
18φ×21.5L	284	28	24.0	60	300

5. Sealing Tape Reel Strength

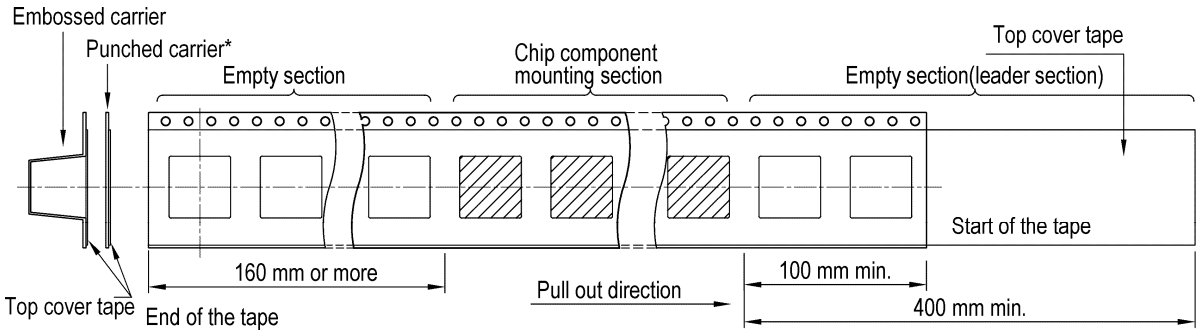
5.1 Peel angle: 165 to 180℃refered to the surface on which the tape is glued.
5.2 Peel speed: 300mm per minutes
5.3 The peel strength must be 0.1 ~ 0.7N under these conditions.



6. Packing Method

6.1 The leader length of the tape shall not be less than 400 mm including 10 or more embossed sections in which no parts are contained.

6.2 The winding core is provided with an over 160mm long empty section; punched carrier is only suitable for φD ≦ 5 mm.



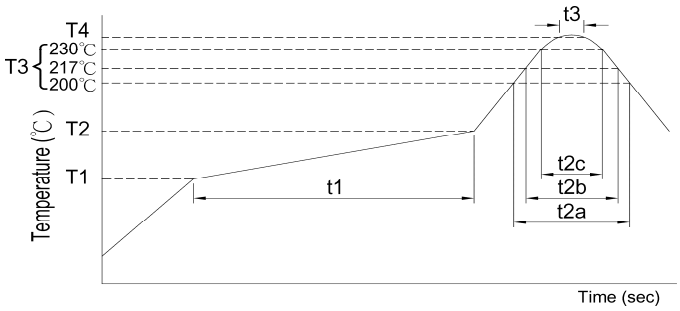
7. Other: Specifications stated above is in accordance with JIS C 0806-3.

Reliability for Car- Tronics

AEC-Q200-REV D

Endurance Characteristic:

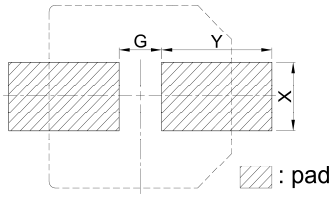
<table>
<tr><th>No.</th><th>Item</th><th>Conditions</th><th colspan="2">Specification</th><th>Reference</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">High Temperature Exposure (Storage)</td><td rowspan="4">Capacitor is placed in the highest temperature for 1000+48/-0Hrs.</td><td>Capacitance change</td><td>Within ±30% of initial value</td><td rowspan="4">MIL-STD-202 Method108</td></tr>
<tr><td>Tan δ</td><td>Less than 300% of specified value</td></tr>
<tr><td>Leakage Current</td><td>Within specified value</td></tr>
<tr><td>Appearance</td><td>No abnormality</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Temperature Cycling</td><td rowspan="4">Step1: Max. rated temperature+3/-3℃(30±3mins)
Step2: Min. rated temperature+3/-3℃(30±3mins)
Max. transfer time: 1min
According to the step1 to step2, and do 1000cycles</td><td>Capacitance change</td><td>Within ±10% of initial value</td><td rowspan="4">JESD22 Method JA-104</td></tr>
<tr><td>Tan δ</td><td>Within specified value</td></tr>
<tr><td>Leakage Current</td><td>Within specified value</td></tr>
<tr><td>Appearance</td><td>No abnormality</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Biased Humidity</td><td rowspan="4">Capacitor is placed at the temperature of 85±3°C, and humidity of 85% with rated voltage for 1000Hrs</td><td>Capacitance change</td><td>Within ±20% of initial value</td><td rowspan="4">MIL-STD-202 Method 103</td></tr>
<tr><td>Tan δ</td><td>Less than 150% of specified value</td></tr>
<tr><td>Leakage Current</td><td>Within specified value</td></tr>
<tr><td>Appearance</td><td>No abnormality</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Operational Life</td><td rowspan="4">Capacitor is placed in the highest temperature with rated voltage for 1000+48/-0Hrs.</td><td>Capacitance change</td><td>Within ±30% of initial value</td><td rowspan="4">MIL-STD-202 Method 108</td></tr>
<tr><td>Tan δ</td><td>Less than 300% of specified value</td></tr>
<tr><td>Leakage Current</td><td>Within specified value</td></tr>
<tr><td>Appearance</td><td>No abnormality</td></tr>
<tr><td>5</td><td>Physical Dimension</td><td></td><td>Appearance</td><td>No abnormality</td><td>JESD22 Method JB-100</td></tr>
<tr><td>6</td><td>Resistance To Solvent</td><td>1.The capacitor shall be immersed into the isopropyl.
2.Immersion time: 3 +0.5/-0 minutes at 25±5℃.
3.Use wool brush to brush capacitor for 10 times.
Conduct the steps 1~3 for 3 cycles.</td><td colspan="2">Print cannot fall off or ambiguous</td><td>MIL-STD-202 Method 215</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Mechanical Shock</td><td rowspan="4">Capacitor is placed on the PCB and fixed. Conditions as below:
<table>
<tr><th>Test items</th><th>For automobile</th></tr>
<tr><td>Acceleration speed</td><td>100g(1000 m/s²)</td></tr>
<tr><td>Shocking direction</td><td>X-Y-Z three axles (6 planes)</td></tr>
<tr><td>Duration(D)(ms)</td><td>6</td></tr>
<tr><td>Velocity(m/s)</td><td>3.75</td></tr>
<tr><td>Wave</td><td>Half sine</td></tr>
<tr><td>Test times</td><td>18times (3*6=18)</td></tr>
</table></td><td>Capacitance change</td><td>Within ±10% of initial value</td><td rowspan="4">MIL-STD-202 Method 213</td></tr>
<tr><td>Tan δ</td><td>Within specified value</td></tr>
<tr><td>Leakage Current</td><td>Within specified value</td></tr>
<tr><td>Appearance</td><td>No abnormality</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Vibration</td><td rowspan="4">Capacitor is placed in the PCB and fixed .Setting the acceleration (5g)and frequency (10-2000Hz) according to the test condition ,vibration 4Hrs from three directions (X-Y-Z).</td><td>Capacitance change</td><td>Within ±10% of initial value</td><td rowspan="4">MIL-STD-202 Method 204</td></tr>
<tr><td>Tan δ</td><td>Within specified value</td></tr>
<tr><td>Leakage Current</td><td>Within specified value</td></tr>
<tr><td>Appearance</td><td>No abnormality</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Conditions</th><th colspan="2">Specification</th><th>Reference</th></tr>
<tr><td>9</td><td>Resistance to Soldering Heat</td><td>According to the Control standard operating of Lelon as follows.


<table>
<tr><td colspan="2">Rated voltage (V)</td><td>4 ~ 50</td><td colspan="2">4 ~ 50</td><td>63 up</td><td colspan="2">4 ~ 100</td><td>160up</td></tr>
<tr><td colspan="2">Case size (φ)</td><td>4 ~ 6.3
With 4.5 mm</td><td colspan="2">3* ~ 6.3</td><td>4 ~ 6.3</td><td colspan="2">8 ~ 18</td><td>12.5up</td></tr>
<tr><td rowspan="2">Preheat</td><td>Temp.
(T1 ~ T2,℃)</td><td colspan="8">150 ~ 180</td></tr>
<tr><td>Time (t1)
(max., secs)</td><td>120</td><td colspan="7">100</td></tr>
<tr><td rowspan="3">Duration</td><td>Temp.
(T3, ℃)</td><td>230</td><td>217</td><td>230</td><td>217</td><td>217</td><td>230</td><td>217</td></tr>
<tr><td rowspan="2">Time
(max., secs)</td><td>t2c</td><td>t2b</td><td>t2c</td><td>t2b</td><td>t2b</td><td>t2c</td><td>t2b</td></tr>
<tr><td>30</td><td>90</td><td>60</td><td>60</td><td>60</td><td>40</td><td>40</td></tr>
<tr><td rowspan="2">Peak</td><td>Temp.
(T4, ℃)</td><td>250</td><td colspan="2">260*</td><td>250</td><td colspan="2">250</td><td>240</td></tr>
<tr><td>Time
(t3, secs)</td><td colspan="8">5</td></tr>
<tr><td colspan="2">Reflow cycles</td><td>1</td><td colspan="7">2 or less</td></tr>
</table>
*The peak temperature(T4) in marking with" *"symbol for 3φis250℃
* Please ensure that the capacitor became cold enough to the room temperature (5℃ ~ 35℃) before the second reflow.</td><td>Capacitance change</td><td>Within ±10% of initial value</td><td>MIL-STD-202 Method 210</td></tr>
<tr><td></td><td></td><td>Tan δ</td><td>Within specified value</td><td></td></tr>
<tr><td></td><td></td><td>Leakage Current</td><td>Within specified value</td><td></td></tr>
<tr><td></td><td></td><td>Appearance</td><td>No abnormality</td><td></td></tr>
<tr><td>10</td><td>Solder ability test (SMD)</td><td>Solder ability test 1:
Pre-conditioning:
execution according to RDD0302 (Solder ability Test Method), item 4.4.2-1（chart 3）
Pretreatment: Baking temperature :155℃
Duration: 4Hrs±8min
Solder bath temperature: 235±5℃
Duration:5+0/-0.5s

Solder ability test 2:
Pre-conditioning: execution according to RDD0302 (Solder ability Test Meth ode) , item 4.4.2-1 (chart 3)
Pretreatment: Vapor limit boiling point：93±3℃
Duration: 8Hrs±15min
Solder bath temperature: 215±3℃
Duration: 5+0/-0.5s

Solder ability test 3:
Pre-conditioning: execution according to RDD0302 (Solder ability Test Meth ode) , item 4.4.2-1 (chart 3)
Pretreatment: Vapor limit boiling point：93±3℃
Duration: 8Hrs±15min
Solder bath temperature:260±5℃
Duration:7±0.5s</td><td colspan="2">Sn is more than 95% in the surface of terminal</td><td>J-STD-002B</td></tr>
<tr><td>11</td><td>Electrical Characterization</td><td>Whether there is abnormality about electrical characterization in the test that under the ensurance temperature(the lowest ,the highest, atmospheric temperature).</td><td colspan="2">Appearance: No abnormality</td><td>User Spec.</td></tr>
<tr><td>12</td><td>Board Flex</td><td>Capacitor is placed in the PCB and pressed to deviate from Original fulcrum less than 2mm for 60（+5）s.</td><td>Capacitance change</td><td>Within ±10% of initial value</td><td>AEC-Q200-005</td></tr>
<tr><td></td><td></td><td></td><td>Tan δ</td><td>Within specified value</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Leakage Current</td><td>Within specified value</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Appearance</td><td>No abnormality</td><td></td></tr>
<tr><td>13</td><td>Terminal Strength (SMD)</td><td>Test condition: Capacitor is placed in the PCB by solder paste and do high temperature test (Reflow)2 twice to endurance the power of 1.8kg for 60S,no dropping condition.</td><td>Capacitance change</td><td>Within ±10% of initial value</td><td>AEC-Q200-006</td></tr>
<tr><td></td><td></td><td></td><td>Tan δ</td><td>Within specified value</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Leakage Current</td><td>Within specified value</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Appearance</td><td>No abnormality</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th colspan="4">Conditions</th></tr>
<tr><td>14</td><td>Surge Voltage</td><td colspan="2">Capacitor is placed at 15℃~35℃ with breakthrough voltage for 30±5(charging) and 330s(discharging),do surge Voltage test continuity for 1000 times.
Applying voltage:
<table>
<tr><td>W. V. V</td><td>6.3</td><td>10</td><td>16</td><td>25</td><td>35</td><td>50</td><td>63</td></tr>
<tr><td>S. V. (V)</td><td>7.3</td><td>11.5</td><td>18.4</td><td>28.8</td><td>40.3</td><td>57.5</td><td>72.5</td></tr>
<tr><td>W. V. (V)</td><td>100</td><td>160</td><td>200</td><td>250</td><td>350</td><td>400</td><td>450</td></tr>
<tr><td>S. V. (V)</td><td>115</td><td>184</td><td>230</td><td>288</td><td>385</td><td>440</td><td>495</td></tr>
</table></td><td>Capacitance change
Tan δ
Leakage Current
Appearance</td><td>Within ±20% of initial value
Less than 175% of specified value
Within specified value
No abnormality</td><td>AEC-Q200-007</td></tr>
<tr><td>15</td><td>Land Pattern</td><td colspan="4">Recommended pad pattern and size
 

<table>
<tr><th rowspan="2">Case size</th><th colspan="3">Land size</th><th rowspan="2">Case size</th><th colspan="3">Land size</th></tr>
<tr><th>G</th><th>Y</th><th>X</th><th>G</th><th>Y</th><th>X</th></tr>
<tr><td>4φ</td><td>1.0</td><td>2.6</td><td>1.6</td><td>8φ</td><td>3.0</td><td>3.5</td><td>2.5</td></tr>
<tr><td>5φ</td><td>1.4</td><td>3.0</td><td>1.6</td><td>10φ</td><td>4.0</td><td>4.0</td><td>2.5</td></tr>
<tr><td>6.3φ</td><td>1.9</td><td>3.5</td><td>1.6</td><td>12.5φ</td><td>4.0</td><td>6.0</td><td>3.2</td></tr>
<tr><td>8φ×6.5L</td><td>2.1</td><td>4.0</td><td>1.6</td><td>16φ</td><td>6.0</td><td>7.0</td><td>3.2</td></tr>
<tr><td></td><td></td><td></td><td></td><td>18φ</td><td>6.0</td><td>8.0</td><td>3.2</td></tr>
</table></td></tr>
</table>

Precautions and Guidelines for Aluminum Electrolytic Capacitors

1. Guidelines for Circuit Design (General / Application guidelines for using electrolytic capacitors)

Selecting of a right capacitor is a key to a good circuit design.

(1) Polarity

Most of the aluminum electrolytic capacitors are polarized. Therefore, they must be installed with the correct polarity. Usage in the reverse polarity results into a short-circuit condition that may damage or even explode the capacitor. In addition, it may influence circuit functionality. A bi-polar electrolytic capacitor should be installed when polarity across a capacitor is unstable / reversible. It should be, however, noted that usage of both polar and bi-polar capacitors are limited to DC applications. They must NOT be used for AC application.

(2) Operating Voltage

Applied DC voltage must not exceed rated voltage of the capacitor. Applying higher voltage than its rated voltage across a capacitor terminals cause overheating due to higher leakage currents and capacitor dielectric/insulation deterioration that will ultimately affect a capacitor's performance. The device, however, is capable of working under short-time transient voltages such as DC transients and peak AC ripples. Reverse voltages higher than 1 Volt within a specified temperature limit or AC voltages are not permissible. Overall, using capacitors at recommended operating voltages can prolong its lifespan. Note that the result of DC voltage overlapped with peak ripple voltage should not exceed rated voltage.

(3) Ripple Current

One of the key functions of any capacitor is removal of the ripple current i.e. the RMS value of AC flowing through a capacitor. But, a ripple current higher than rated ripple current will drop resultant capacitance, cause undue internal heating and thus reduces life span of the capacitor. In extreme cases, internal high temperature will cause the pressure relief vent to operate while destroying the device. Overall, it is important to note that an electrolytic capacitor must be used within a permissible range of ripple current. Indicators like temperature coefficient of allowable ripple current are generally used to determine life expectancy of the capacitor, but to avoid related complex calculations and for the sake of simplicity, we haven't provided temperature coefficient in the catalogue. But it offers key indicators like maximum operating temperature for calculation of life expectancy at a given temperature.

(4) Operating Temperature

Capacitors should be used within a permissible range of operating temperatures. Using capacitor at a higher temperature than maximum rated temperature will considerably shorten its life. In the worst-case scenario, high temperature can cause pressure relief vent to operate and the device will get destroyed. Using capacitors at an ambient room temperature assure their longer life.

(5) Leakage Current

Leakage current flows through a capacitor when DC voltage is applied across it. Leakage current varies with changes in ambient temperature and applied DC voltage level and its time of application. Overvoltage situation, presence of moisture, and thermal stresses, especially occurring during the soldering process can enhance leakage current. Initial leakage current is usually higher and does not decrease until voltage is applied for a certain period of time. It is recommended to keep initial leakage current within specified levels.

(6) Charge and Discharge

Regular electrolytic capacitors are not suitable for rapid charging/discharging circuits. Such usage may either cause reduction in overall capacitance or damage due to overheating. Lelon provides special assistance for selecting appropriate capacitors for rapid charging/discharging circuits.

(7) Surge Voltage

The Surge voltage rating is referred as the maximum DC overvoltage that may be applied to an electrolytic capacitor for a short time interval of 30 seconds at infrequent time intervals not exceeding 5.5minutes with a limiting resistance of 1kΩ. Unless otherwise described on the catalogue or product specifications, please do not apply a voltage exceeding the capacitor's voltage rating. The rated surge voltages corresponding to rated voltages of electrolytic capacitors are presented as follows:

Rated Voltage(V)	4	6.3	10	16	25	35	50
Surge Voltage(V)	**4.6**	**7.3**	**11.5**	**18.4**	**28.8**	**40.3**	**57.5**

Rated Voltage(V)	63	80	100	160	180	200	250
Surge Voltage(V)	**72.5**	**92**	**115**	**184**	**207**	**230**	**288**

Rated Voltage(V)	315	350	400	420	450	500	525
Surge Voltage(V)	**347**	**385**	**440**	**462**	**495**	**550**	**578**

(8) Condition of Use

The capacitors shall NOT be exposed to:

(a) Fluids including water, saltwater spray, oil, fumes, highly humid or condensed climates, etc.
(b) Ambient conditions containing hazardous gases/fumes like hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or bromine gas, ammonia, etc.
(c) Exposed to ozone, ultraviolet rays and radiation.
(d) Severe vibrations or physical shocks that exceeds the specifications mentioned in this catalogue.

(9) Circuit Design Consideration

(a) Please ensure whether application, operating and mounting conditions satisfy the conditions specified in the catalog before installation of a capacitor. Please consult Lelon, if any of the conditions are beyond the conditions specified in the catalog.
(b) Heat-generating components or heat sinks should not be placed closer to Aluminum electrolytic capacitors on the PCB to avoid their premature failure. A cooling system is recommended to improve their reliable working.
(c) Electrical characteristics and performance of aluminum electrolytic capacitors are affected by variation of applied voltage, ripple current, ripple frequency and operating temperature. Therefore, these parameters shall not exceed specified values in the catalog.
(d) Aluminum capacitors may be connected in the parallel fashion for increasing total capacitance and/or for achieving higher ripple current capability. But, such design may cause unequal current flow through each of the capacitors due to differences in their impedances.
(e) When two or more capacitors are connected in series, voltage across each capacitor may differ and fall below the applied voltage. A resistor should be placed across each capacitor so as to match applied voltage with voltage across a capacitor.
(f) Please consult Lelon while selecting a capacitor for high-frequency switching circuit or a circuit that undergoes rapid charging/ discharging
(g) Standard outer sleeve of the capacitor is not a perfect electrical insulator therefore is unsuitable for the applications that requires perfect electrical insulation. Please consult Lelon, if your application requires perfect electrical insulation.
(h) Tilting or twisting capacitor body is not recommended once it is soldered to the PCB.

2. Caution for Assembling Capacitors

(1) Mounting

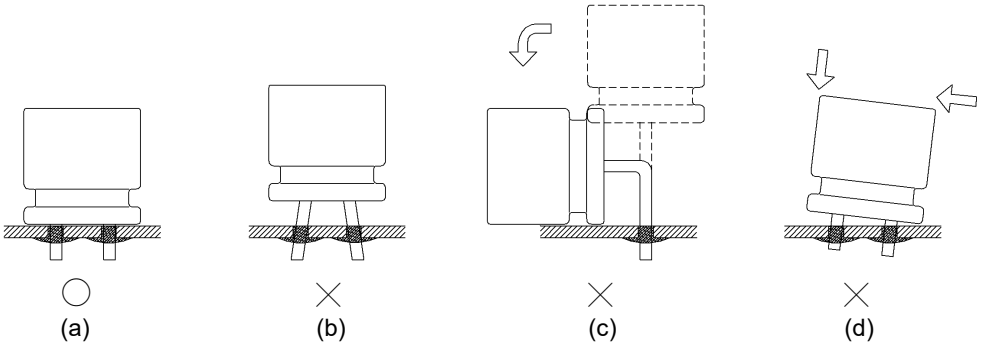
(a) Aluminum electrolytic capacitors are not recommended to re-use in other circuits once they are mounted and powered in a circuit.

(b) Aluminum electrolytic capacitors may hold static charge between its anode and cathode, which is recommended to be discharged through a 1kΩ resistor before re-use.
(c) A long storage of capacitors may result into its insulation deterioration. This can lead to a high leakage current when voltage is applied that may damage the capacitor. Capacitors following a long storage period must undergo voltage treatment/re-forming.
Capacitors are charged by applying rated DC voltage through a resistor of 1kΩ in series at least for an hour. It is recommended to increase applied voltage gradually using a voltage regulator unit once capacitors are assembled on the board. The charging should be followed by discharging through a 1KΩ resistor.
(d) Please check capacitor rated voltage before mounting.
(e) Please check capacitor polarity before mounting.
(f) Please don't drop capacitor on the floor / hard object.
(g) Please don't deform the capacitor during installation.
(h) Please confirm whether the lead spacing of the capacitors match with its pad spacing / footprint on PCB prior to installation.
(i) Please avoid excessive mechanical shocks to capacitor during the auto-insertion process, inspection or centering operations.
(j) Please don't place any wiring or circuit over the capacitor's pressure relief vent. The pressure relief vent may fail to open if adequate clearance space is not provided. Following table shows minimum clearance space required for different case diameters.

Case Diameter	ϕ6.3 ~ ϕ16	ϕ18 ~ ϕ35	ϕ40 or above
Clearance (min)	2 mm	3 mm	5 mm

(2) Soldering
(a) Please confirm that soldering conditions, especially temperature and contact time are within our specifications. Dip or flow preheat temperature is 150℃ with 120 sec (max.), the soldering temperature should be limited at 260 ± 5℃ for 10 ± 1 sec while manual soldering using soldering iron should be limited at 350 ± 5℃ for 3 +1/-0 seconds. Please do not dip capacitor body into molten solder. A capacitor's life will be negatively affected if these conditions are violated.
(b) Storage of capacitors in high humidity conditions is likely to affect the solder-ability of lead wires and terminals.
(c) **Reflow soldering should ONLY be used for SMD type capacitors.** The temperature and duration shall not exceed the specified temperature and duration in the specification. If the temperature or duration is higher than the value specified, please consult Lelon before usage.
(d) Standard aluminum electrolytic capacitors are not designed to withstand multiple reflow processes. Please consult Lelon if repeated reflowing is unavoidable.
(e) Incorrect mounting on PCB with improper external strength applied on its lead wires or capacitor body after soldering may damage a capacitor's internal structure, cause short circuit, or lead to high leakage current issues. Do not bend or twist the capacitor body after soldering. Referring to the drawings below only case (i) is recommended.
(i) Correct soldering
(ii) Hole-to-hole spacing on PCB differs from the lead space of lead wires.
(iii) Lead wires are bent after soldering.
(iv) Capacitor body doesn't stand vertical on PCB after soldering.

(3) Cleaning Circuit Boards after Soldering
(a) Following chemicals are not recommended for cleaning: Solvent containing halogen ions, Alkaline solvent, Xylene, Acetone, Terpene, petro-based solvent.
(b) Recommended cleaning conditions:
Fatty-alcohol - Pine Alpha ST-100S, Clean Through-750H and IPA (isopropyl alcohol) are examples of the most acceptable cleaning agents. Temperature of the cleaning agent must not exceed 60℃. Flux content in the cleaning agents should be limited to 2 Wt. %. Overall length of cleaning process (e.g., immersion, ultrasonic or other) shall be within 5 minutes (5 ~ 7mm height within 3 minutes). CFC substitute cleaning agents such as AK225AES can also be used for cleaning. In this case, its temperature shall not exceed 40 C and cleaning process (e.g., immersion, ultrasonic or other) shall be completed within 2 ~ 3 minutes. After cleaning capacitors should be dried with hot air for at least 10 minutes along with the PCB. Temperature of hot air shall not exceed maximum category temperature of the capacitor. Insufficient drying may cause appearance defects, sleeve shrinkage, and bottom-plate bulging. However, usage of this CFC substitute must completely regulated for protection of environment.



3. Maintenance Inspection

Periodical inspection of aluminum capacitors is absolutely necessary, especially when they are used with industrial equipment. The following items should be checked:
(1) Appearance: Bloated, vent operated, leaked, etc.
(2) Electrical characteristic: Capacitance, Tan δ, leakage current, and other specified items listed in specification.
Lelon recommend replacing the capacitors if any of the abovementioned items fail to meet specifications.

4. Storage

(1) The most suitable conditions for aluminum capacitor storage are 5 ℃ ~ 35℃ and indoor relative humidity less than 75%. High temperature and/or humidity storage is detrimental to the capacitors.
(2) Capacitors shall not be stored in wet or damp atmospheres containing water, brine, fumes or oil.
(3) Capacitors storage area shall neither be exposed to hazardous gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc. nor to acidic or alkaline solutions.
(4) Capacitors shall not be exposed to ozone, ultraviolet rays or radiation.

5. Estimation of life time

$$L_r = L_0 \times 2^{\frac{T_{0\max} - T_{r\max}}{10}}$$

L_r: Estimated lifetime (hours)

L_0: Base lifetime specified at maximum operating temperature with applied the DC voltage and the ripple current (hours)

$T_{0\,max}$: The core temperature that rated ripple current applied at maximum operating temperature.

$T_{r\,max}$: The core temperature that applied actual ripple current at ambient temperature.

6. Disposal

Please consult with a local industrial waste disposal specialist when disposing of aluminum electrolytic capacitors.

7. Environmental Consideration

Lelon already have received IECQ QC 080000 certificate. Cadmium (Cd), Lead (Pb), Mercury (Hg), Hexavalent Chromium (Cr^{+6}), PBB, PBDE, DEHP, BBP, DBP and DIBP have never been using in capacitor. If you need “Halogen-free” products, please consult with us.

8. AEC-Q200 Compliance

Automotive Electronics Counsel (AEC) has established various electronic component qualification/reliability standards in order to serve automotive electronics industry. AEC-Q200 standard is dedicated for passive components like capacitors, inductors, etc. and is widely adopted domestically as well as internationally.
Lelon offers compliant product designs and support services to satisfy customers’ product requirements, including the AEC-Q200 required criteria of the reliability tests. Lelon’s capacitors are professionally designed to outperform all requirements of AEC-Q200.

For further details, please refer to
IEC 60384-4- Fixed capacitors for use in electronic equipment – Part 4: Sectional specification – Aluminum electrolytic capacitors with solid (MnO_2) and non-solid electrolyte (Established in January 1995, Revised in March 2007), and

JEITA RCR-2367D- Safety application guide for fixed aluminum electrolytic capacitors for use in electronic equipment (Established in March 1995, Revised in October 2017)