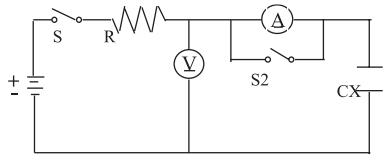
SMD Aluminium Electrolytic Capacitors

<table>
<tr><th>Items</th><th>Characteristics</th></tr>
<tr><td>Operating Temperature Range</td><td>-55°C to +105°C</td></tr>
<tr><td>Voltage Range</td><td>4V to 100V</td></tr>
<tr><td>Capacitance Range</td><td>0.1µF to 6800µF</td></tr>
<tr><td>Capacitance Tolerance</td><td>±20% at 120 Hz, 20°C</td></tr>
<tr><td>Leakage Current</td><td>For Φ4 to Φ10, after 2 minutes' application of rated voltage, leakage current is not more than 0.01CV or 3(µA), whichever is greater.
For Φ12.5 to Φ16, after 1 minute's application of rated voltage, leakage current is not more than 0.03CV or 4(µA), whichever is greater.</td></tr>
<tr><td>Tan δ</td><td>
<table>
<tr><td colspan="11">Measurement Frequency: 120Hz. Temperature: 20°C</td></tr>
<tr><td colspan="2">Rated voltage (V DC)</td><td>4</td><td>6.3</td><td>10</td><td>16</td><td>25</td><td>35</td><td>50</td><td>63</td><td>100</td></tr>
<tr><td rowspan="2">Tanδ (max)</td><td>Φ4 to Φ10</td><td>0.35</td><td>0.26</td><td>0.2</td><td>0.16</td><td>0.14</td><td>0.12</td><td>0.12</td><td>0.12</td><td>0.12</td></tr>
<tr><td>Φ12.5 to Φ16</td><td>0.42</td><td>0.38</td><td>0.34</td><td>0.3</td><td>0.26</td><td>0.22</td><td>0.18</td><td>0.14</td><td>0.12</td></tr>
</table>
</td></tr>
<tr><td>Stability at Low Temperature</td><td>
<table>
<tr><td colspan="12">Measurement Frequency: 120Hz.</td></tr>
<tr><td colspan="3">Rated voltage (V DC)</td><td>4</td><td>6.3</td><td>10</td><td>16</td><td>25</td><td>35</td><td>50</td><td>63</td><td>100</td></tr>
<tr><td rowspan="4">Impedance ratio ZT/Z20 (max)</td><td rowspan="2">Φ4 to Φ10</td><td>Z(-25°C)/Z(20°C)</td><td>7</td><td>4</td><td>3</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>Z(-55°C)/Z(20°C)</td><td>15</td><td>8</td><td>6</td><td>4</td><td>4</td><td>3</td><td>3</td><td>3</td><td>4</td></tr>
<tr><td rowspan="2">Φ12.5 to Φ16</td><td>Z(-25°C)/Z(20°C)</td><td>7</td><td>5</td><td>4</td><td>3</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Z(-55°C)/Z(20°C)</td><td>17</td><td>12</td><td>10</td><td>8</td><td>5</td><td>4</td><td>3</td><td>3</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>Load Life</td><td>
<table>
<tr><td colspan="2">After 2000 hours' application of rated voltage at 105°C, capacitors meet the characteristics requirements listed at right .</td></tr>
<tr><td>Capacitance Change</td><td>Within ±20% of the initial value for capacitors of 10V or more, and within ±30% of the initial value for capacitors of 4V & 6.3V</td></tr>
<tr><td>tan δ</td><td>200% or less of Initial Specified Value</td></tr>
<tr><td>Leakage Current</td><td>Initial Specified Value or less</td></tr>
</table>
</td></tr>
<tr><td>Shelf Life</td><td>After leaving capacitors under no load at 105°C for 1000 hours, they meet the specified value for load life characteristics listed above.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>
<table>
<tr><td rowspan="3">After reflow soldering and restored at room temperature, they meet the characteristics requirements listed at right.</td><td>Capacitance Change</td><td>Within ±10% of Initial Value</td></tr>
<tr><td>Tan δ</td><td>Initial Specified Value or less</td></tr>
<tr><td>Leakage Current</td><td>Initial Specified Value or less</td></tr>
</table>
</td></tr>
<tr><td>Applicable Standards</td><td>JIS C-5141 and JIS C-5102</td></tr>
</table>

Scope

This specification applies to aluminium electrolytic capacitor, used in electronic equipment.

Electrical Characteristics

<table>
<tr><th>Item</th><th>Test Method</th><th>Specification</th></tr>
<tr><td>Rated Voltage</td><td></td><td>Voltage range, capacitance range, see specification of this series.</td></tr>
<tr><td>Capacitance
Dissipation factor</td><td>Measuring frequency : 120 ±12Hz
Measuring voltage : ≦0.5Vrms + 0.5 ~ 2V DC
Measurement circuit :  </td><td>Voltage range, capacitance range, see specification of this series.
Dissipation factor, leakage current, see specification of this series.</td></tr>
<tr><td>Leakage current</td><td>DC leakage current shall be measured after 1~2 minutes application of the DC rated working voltage through the 1000Ω resistor at 20°C
 
R : 1000 ±100Ω S1 : Switch
A : DC current meter S2 : Switch for protect of current meter
V : DC voltage meter CX : Testing capacitor</td><td>Dissipation factor leakage current, see specification of this series.</td></tr>
<tr><td>Temperature characteristics</td><td><table><tr><th>Step</th><th>Temperature</th><th>Storage Time</th></tr><tr><td>1</td><td>20 ±2°C</td><td>30 minutes</td></tr><tr><td>2</td><td>-40 ±3°C</td><td>2 hours</td></tr><tr><td>3</td><td>20 ±2°C</td><td>15 minutes</td></tr><tr><td>4</td><td>105 ±2°C</td><td>2 hours</td></tr></table>Step 1. Measure the capacitance and impedance. (Z_{r0}) (|Z|, 20°C , 120Hz ±10%)
Step 2. Measure the impedance at thermal balance after 2 hours. (|Z|, 20°C , 120Hz ±10%)
Step 4. Measure the capacitance and leakage current at thermal balance after 2 hours.</td><td>Step 2. Impedance ratio (Zr / Z_{r0}) less than specified value.
Step 4. Capacitance change : within ± 20% of the initial measured value.
Leakage current :
Less than 10 times of initial specified value .</td></tr>
<tr><td>Surge test</td><td>Rated surge voltage shall be applied (switch on) for 30 ±5 seconds and then shall be applied (switch off) with discharge for 5 ±0.5 min at room temperature . This cycle shall be repeated for 1000 cycles.
Duration of one cycle is 6 ± 0.5 minutes .</td><td rowspan="2">Capacitance change : within ± 20% of the initial specified value.
Dissipation factor : less than 200% of the initial specified value.
Leakage current : within initial specified value.</td></tr>
<tr><td>Applicable Ripple Current</td><td>The maximum A.C. current having frequency of 100k Hz which can be applied to the capacitor at 105 ±2°C continuously. Peak voltage not to exceed rated D.C. voltage.</td></tr>
</table>

Mechanical characteristics

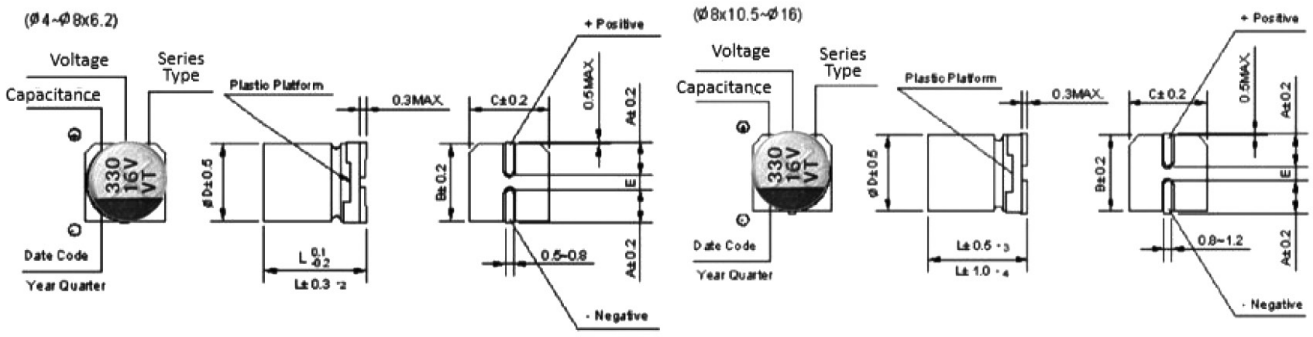
<table>
<tr><th>Item</th><th>Test Method</th><th>Specification</th></tr>
<tr><td>Lead strength</td><td>(A) Tensile strength :
wire lead terminal :
<table>
<tr><td>d (mm)</td><td>≦0.45</td><td>0.5 ~ 0.8</td><td>0.8<d ≦1.25</td></tr>
<tr><td>Load (kg)</td><td>0.51</td><td>1</td><td>2</td></tr>
</table>
Snap-in terminal
<table>
<tr><td>d (mm)</td><td>snap-in terminal</td></tr>
<tr><td>Load (kg)</td><td>2</td></tr>
</table>
The capacitor shall withstand the constant tensile force specified between the body and each lead for 10 seconds without damage either mechanical or electrical.
(B) Bending strength :
wire lead terminal :
<table>
<tr><td>d (mm)</td><td>≦0.45</td><td>0.5 ~ 0.8</td><td>0.8<d ≦1.25</td></tr>
<tr><td>Load (kg)</td><td>0.25</td><td>0.51</td><td>1</td></tr>
</table>
Snap-in terminal
<table>
<tr><td>Cross section area of terminal</td><td>Force (kg)</td></tr>
<tr><td>0.5<S≦1</td><td>1</td></tr>
<tr><td>S>1</td><td>2.5</td></tr>
</table>
With the capacitor in a vertical position apply the load specified axially to each lead. The capacitor shall be rotated slowly from the vertical to the horizontal position, back to the vertical position. The 90° in the opposite direction and back the original position. Performance of capacitor shall not have changed and leads shall be undamaged</td><td>When the capacitance is measured, there shall be no intermittent contacts, or open- or short-circuiting.
There shall be no such mechanical damage as terminal damage etc.</td></tr>
<tr><td>Vibration resistance</td><td>The frequency of the vibration shall vary uniformly within the range 10 to 55 Hz with the amplitude of 1.5mm, completing the cycle in the internal of one minute.
The capacitor shall be securely mounted by its leads with hold the body of capacitor. The capacitor shall be vibrated in three mutually perpendicular directions for a period of 2 hours in each direction .</td><td>Capacitance : no unsteady.
Appearance : no abnormal.
Capacitance change : within ± 5% of initial measured value .</td></tr>
<tr><td>Solderability</td><td>The leads are dipped in the solder bath of Sn at 260 ±5°C for 2 ± 0.5 seconds . The dipping depth should be set at 1.5 ~ 2mm .</td><td>The solder alloy shall cover the 95% or more of the dipped lead’s area .</td></tr>
</table>

Reliability

Item	Test Method	Specification
Soldering heat resistance	The leads immerse in the solder bath of Sn at 260 ±5°C for 10 ±1 seconds until a distance of 1.5 ~ 2mm from the case.	No damage or leakage of electrolyte. Capacitance change : within ± 10% of the initial measured value. Tan δ : less than specified value. Leakage current : less than specified value.
Damp heat (Steady state)	Subject the capacitors to 40 ±2°C and 90% to 95% relative humidity for 240 ±8 hours.	Capacitance change : within ±10% of the initial measured value. Tan δ : less than specified value. Leakage current : less than specified value.
Load life	After X hours continuous application of DC rated working voltage at 105 ±2°C, the measurements shall meet the following limits. Measurements shall be performed after 2 hours exposed at room temperature .	Standard of judgement is according to requirement of this series.
Shelf life	After storage for Y hours at 105 ±2°C without voltage application , the measurements shall meet the following limits. Measurements shall be performed after exposed for 1 to 2 hrs at room temperature after application of DC rated voltage to the capacitor for Z minutes .	
Storage at Low Temperature	The capacitor shall be stored at temperature of -40 ±3°C for 240 ±8 hours, during which time no voltage shall be applied. And then the capacitor shall be subjected to standard atmospheric conditions for 16 hours or more, after which measurements shall be made.	Capacitance change : within ±10% of the initial value. Tan δ : less than specified value. Leakage current : less than specified value Appearance : no abnormal.

MCVVT Series

Dimensions:



1. Voltage mark [6V] represents 6.3V for Φ4 ~ Φ10;
2. [L±0.3] is applicable to Φ6.3×7.7 and Φ8×6.2
3 [L±0.5] is applicable to Φ8×10.5 ~ Φ10
4. [L±1.0] is applicable to Φ12.5 ~ Φ16.

D×L	4×5.4	5×5.4	6.3×5.4/7.7	8×6.2	8×10.5	10×10.5/13.5	12.5×13.5/16	16×16.5
A	1.8	2.1	2.4	3.3	2.9	3.2	4.7	5.5
B	4.3	5.3	6.6	8.3	8.3	10.3	13	16.3
C	4.3	5.3	6.6	8.3	8.3	10.3	13	16.3
E ±0.2	1	1.3	2.2	2.2	3.1	4.4	4.4	6.7
L	5.4	5.4	5.4/7.7	6.2	10.5	10.5/13.5	13.5/16	16.5

Dimensions : Millimetres

Standard size and Maximum permissible ripple current

WV		4		6.3		10		16		25	
Cap.(µF)		0G		0J		1A		1C		1E	
4.7	4R7									4×5.4	13
10	100							4×5.4	18	5×5.4 (4×5.4)	20 (14)
22	220			4×5.4	22	5×5.4 4×5.4)	25 (20)	5×5.4 (4×5.4)	27 (20)	6.3×5.4 (5×5.4)	36 (25)
33	330	5×5.4 (4×5.4)	30 (18)	5×5.4 (4×5.4)	27 (22)	5×5.4 (4×5.4)	30 (22)	6.3×5.4 (5×5.4)	40 (28)	6.3×5.4 (5×5.4)	44 (29)
47	470	5×5.4 (4×5.4)	36 (24)	5×5.4 (4×5.4)	33 (25)	6.3×5.4 (5×5.4)	41 (30)	6.3×5.4 (5×5.4)	48 (31)	6.3×5.4 (8×6.2)	48 (91)
100	101	6.3×5.4 (5×5.4)	60 (43)	6.3×5.4 (5×5.4)	50 (39)	6.3×5.4 (8×6.2)	53 (110)	6.3×5.4 (8×6.2)	60 (120)	6.3×7.7	91
150	151	6.3×5.4	52	6.3×5.4	55	6.3×5.4	62	6.3×7.7	95	8×10.5 (6.3×7.7)	140 (100)
220	221	6.3×5.4	57	6.3×7.7 (6.3×5.4)	105 (67)	6.3×7.7 (8×6.2)	105 (105)	8×10.5 (6.3×7.7) (8×6.2)	150 (105) (85)	8×10.5	175
330	331	6.3×7.7	100	6.3×7.7	105	8×10.5	196	8×10.5	195	10×10.5 (8×10.5)	240 (220)
470	471	6.3×7.7	105	8×10.5 (6.3x7.7)	210 (120)	10×10.5 (8×10.5)	260 (210)	10×10.5 (8×10.5)	295 (230)	10×10.5	280
680	681	8×10.5	210	8×10.5	210	10×10.5	270	10×10.5	315	10×13.5	400
1000	102	8×10.5	230	10×10.5 (8×10.5)	300 (230)	10×10.5	315	12.5×13.5 (10×13.5) (10×10.5)	500 (340) (390)	12.5×13.5	580
1500	152	10×10.5	315	10×13.5 (10×10.5)	450 (315)	10×13.5	460	12.5×13.5	550	12.5×16	850
2200	222	10×13.5 (10×10.5)	440 (340)	12.5×13.5 (10×13.5)	620 (500)	12.5×13.5	680	16×16.5 (12.5×16)	950 (750)	16×16.5	1050
3300	332	10×13.5	490	12.5×16 (12.5×13.5)	700 (660)	16×16.5	1000	16×16.5	1000		
4700	472	12.5×13.5	600	16×16.5	1000						
6800	682	16×16.5 (12.5×16)	950 (650)							Case Size	Ripple Current

Ripple Current (mA rms) at 105°C 120Hz

Standard size and Maximum permissible ripple current

WV		35		50		63		100	
Cap.(μF)		1V		1H		1J		2A	
0.1	0R1			4×5.4	0.7	4×5.4	0.7		
0.22	R22			4×5.4	1.6	4×5.4	1.6		
0.33	R33			4×5.4	2.5	4×5.4	2.5		
0.47	R47			4×5.4	3.5	4×5.4	3.5		
1	010			4×5.4	7	4×5.4	7	4×5.4	7
2.2	2R2			4×5.4	11	4×5.4	11	6.3×5.4	14
3.3	3R3	4×5.4	13	4×5.4	13	5×5.4	13	6.3×7.7 (6.3×5.4) (8×6.2)	32 (20) (30)
4.7	4R7	4×5.4	14	5×5.4 (4×5.4)	16 (13)	5×5.4	16	6.3×7.7 (6.3×5.4)	35 (21)
10	100	5×5.4 (4×5.4)	21 (14)	6.3×5.4	24	6.3×7.7 (6.3×5.4) (8×6.2)	39 (24) (25)	8×10.5 (6.3×7.7)	77 (35)
22	220	6.3×5.4 (5×5.4)	38 (18)	6.3×7.7 (6.3×5.4) (8×6.2)	51 (42) (70)	8×10.5 (6.3×7.7)	98 (49)	10×10.5 (8×10.5)	126 (84)
33	330	6.3×5.4 (8×6.2)	42 (84)	6.3×7.7	60	8×10.5	112	10×10.5	133
47	470	6.3×7.7 (6.3×5.4)	70 (50)	8×10.5 (6.3×7.7)	120 (63)	10×10.5 (8×10.5)	160 (119)	12.5×13.5 (10×13.5) (10×10.5)	250 (160) (140)
68	680	6.3×7.7	80			8×10.5	170	12.5×13.5 (10×13.5)	300 (180)
100	101	8×10.5 (6.3×7.7)	120 (84)	10×10.5 (8×10.5)	170 (140)	12.5×13.5 (10×13.5) (10×10.5)	270 (210) (196)	16×16.5 (12.5×13.5)	450 (380)
150	151	8×10.5	155	10×10.5	170	10×13.5	225		
220	221	10×10.5 (8×10.5)	220 (190)	10×13.5 (10×10.5)	280 (220)	16×16.5 (12.5×13.5) (10×13.5)	560 (470) (235)	16×16.5	550
330	331	10×10.5	245	16×16.5 (12.5×13.5) (10×13.5)	600 (420) (295)	16×16.5 (12.5×16)	700 (510)		
470	471	12.5×13.5 (10×13.5) (10×10.5)	520 (375) (280)	16×16.5 (12.5×16)	700 (520)	16×16.5	750		
680	681	12.5×13.5 (10×13.5)	530 (395)	16×16.5	750				
1000	102	16×16.5 (12.5×16)	750 (600)					Case Size	Ripple Current

Ripple Current (mA rms) at 105°C 120Hz

Frequency Correction Factor of Rated Ripple Current

Frequency Capacitance (μF)		50Hz	120Hz	300Hz	1kHz	10kHz~
Φ4~Φ10	0.1~68	0.7	1	1.17	1.36	1.5
	100~3300	0.85		1.08	1.2	1.3
Φ12.5~Φ16	~68	0.75		1.35	1.57	2
	100~680	0.8		1.23	1.34	1.5
	1000~6800	0.85		1.1	1.13	1.15

Explanation of parts numbers