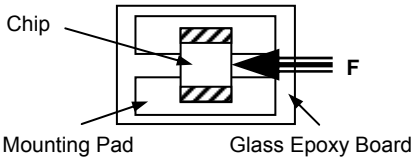
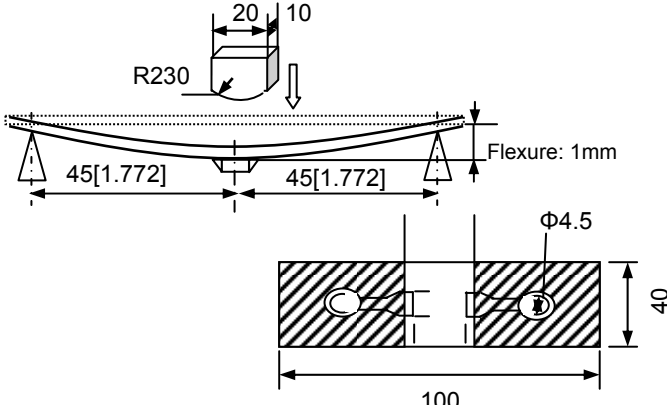
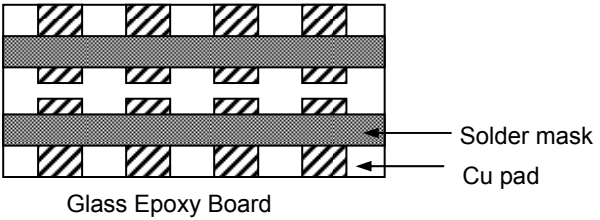


# RELIABILITY AND TEST CONDITIONS

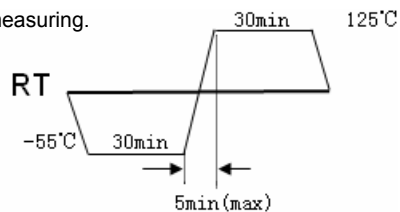
## Solid Tantalum Chip Capacitors (TC211&212 Series)

Items	Requirements	Test Methods and Remarks
1. Operating Temperature Range		-55°C to +125°C
2. Storage Temperature Range		-55°C to +125°C
3. Terminal Strength	No removal or split of the termination or other defects shall occur.	<ol style="list-style-type: none"> <li>Solder the capacitor inductor to the testing jig (glass epoxy board shown as the left figure) using eutectic solder. Then apply a force in the direction of the arrow.</li> <li>5N force</li> <li>Keep time: 10±1s</li> <li>Speed: 1.0mm/s</li> </ol> 
4. Resistance to Flexure	No visible mechanical damage.	<ol style="list-style-type: none"> <li>Solder the capacitor to the test jig (glass epoxy board) Using a eutectic solder. Then apply a force in the direction shown as the following figure.</li> <li>Flexure:1 mm;</li> <li>Pressurizing Speed: 0.5mm/sec.</li> <li>Keep time: 10 sec.</li> </ol> <p>Unit: mm [inch]</p> 
5. Vibration	No visible mechanical damage.	<ol style="list-style-type: none"> <li>Solder the capacitor to the testing jig (glass epoxy board shown as the following figure) using eutectic solder.</li> <li>The capacitor shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz.</li> <li>The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).</li> </ol> 

## RELIABILITY AND TEST CONDITIONS

### Solid Tantalum Chip Capacitors (TC211&212 Series)

Items	Requirements	Test Methods and Remarks
6. Solderability	① No visible mechanical damage. ② Wetting shall be exceeded 95% coverage.	① Solder temperature: $240\pm 2^{\circ}\text{C}$ ② Duration: 3 sec ③ Solder: Sn/3.0Ag/0.5Cu ④ Flux: 25% Resin and 75% ethanol in weight
7. Resistance to Soldering Heat	① No visible mechanical damage. ② Wetting shall exceed 95% coverage. ③ Capacitance change: within $\pm 5\%$ . ④ $\tan\delta$ shall not exceed 150% of the initial requirement. ⑤ $I_0$ change shall not exceed the initial $I_0$	① Solder temperature: $260\pm 3^{\circ}\text{C}$ ② Duration: 5 sec ③ Solder: Sn/3.0Ag/0.5Cu ④ Flux: 25% Resin and 75% ethanol in weight ⑤ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
8. Temperature	A. At $-55^{\circ}\text{C}$ ① No visible mechanical damage. ② Capacitance change: within $-10\%$ . ③ $\tan\delta$ shall not exceed 150% of the initial requirement.	① Drying $30^{+4}$ min at $125^{\circ}\text{C}$ ② The chip shall be stabilized at normal condition for 1~2 hours after drying, and measured at $25^{\circ}\text{C}$ as initial data. ③ The chip shall be measured at $-55^{\circ}\text{C}$
	B. At $85^{\circ}\text{C}$ ① No visible mechanical damage. ② Capacitance change: $<10\%$ ③ $\tan\delta$ shall not exceed 150% of the initial requirement. ④ $I_0$ shall not exceed $10 I_0$	① After Step A, the chip shall cool to room temperature. ② Measure at $85^{\circ}\text{C}$ .
	C. At $125^{\circ}\text{C}$ ① No visible mechanical damage. ② Capacitance change: $<12\%$ . ③ $\tan\delta$ shall not exceed 150% of the initial requirement. ④ $I_0$ shall not exceed $12.5 I_0$	① After Step B, the chip shall be measured at $125^{\circ}\text{C}$ .
9. Thermal Shock	① Capacitance change: within $\pm 5\%$ . ② $\tan\delta$ shall not exceed the initial requirement. ③ $I_0$ shall not exceed the initial $I_0$ .	① Temperature, Time (See the following figure) ② $-55^{\circ}\text{C}$ , $30\pm 3$ min $\rightarrow$ $125^{\circ}\text{C}$ , $30\pm 3$ min. ③ Transforming interval: Max. 5min. ④ Tested cycle: 5 cycles. ⑤ The chip shall be stabilized at normal condition for 1~2 hours before measuring.



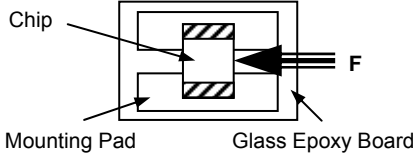
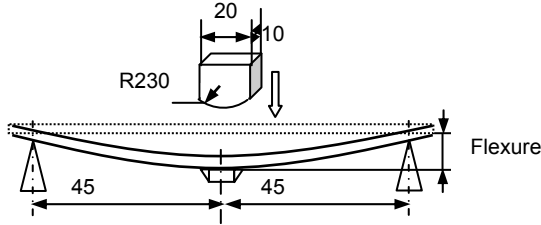
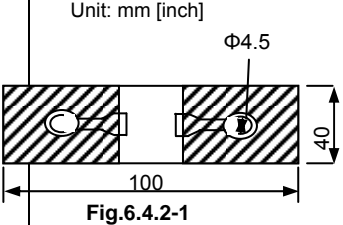
## RELIABILITY AND TEST CONDITIONS

### Solid Tantalum Chip Capacitors (TC211&212 Series)

Items	Requirements	Test Methods and Remarks
10. Moisture Resistance	<ul style="list-style-type: none"><li>① No visible mechanical damage.</li><li>② Capacitance change: within <math>\pm 10\%</math>.</li><li>③ <math>\tan\delta</math> shall not exceed 150% of the initial requirement.</li><li>④ <math>I_0</math> shall not exceed <math>2I_0</math>.</li></ul>	<ul style="list-style-type: none"><li>① Temperature: <math>40\pm 2^\circ\text{C}</math>.</li><li>② Relative Humidity: 90%~95%RH.</li><li>③ Duration: <math>500^{+24}</math> hours.</li><li>④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.</li></ul>
11. Life Test	<ul style="list-style-type: none"><li>① No visible mechanical damage.</li><li>② Capacitance change: within <math>\pm 10\%</math>.</li><li>③ <math>\tan\delta</math> shall not exceed the initial requirement.</li><li>④ <math>I_0</math> shall not exceed <math>1.25 I_0</math>.</li></ul>	<ul style="list-style-type: none"><li>① Temperature: <math>85\pm 2^\circ\text{C}</math>; Rated Voltage</li><li>② Duration: <math>2000^{+24}</math> hours</li><li>③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.</li></ul>

# RELIABILITY AND TEST CONDITIONS

## Solid Tantalum Chip Capacitors (TC311 Series)

Items	Requirements	Test Methods and Remarks															
1. Operating Temperature Range		-55°C to +105°C															
2. Storage Temperature Range		-55°C to +105°C															
3. Terminal Strength	No removal or split of the termination or other defects shall occur.	<p>① Solder the capacitor inductor to the testing jig (glass epoxy board shown as the left figure) using eutectic solder. Then apply a force in the direction of the arrow.</p> <p>② Case code and shear:</p> <table border="1"> <thead> <tr> <th>Case code</th> <th>Size</th> <th>Max. Shear (Kg)</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>3528-21</td> <td>3.6</td> </tr> <tr> <td>D</td> <td>7343-31</td> <td>5.0</td> </tr> <tr> <td>V</td> <td>7343-19</td> <td>5.0</td> </tr> <tr> <td>E</td> <td>7343-43</td> <td>5.0</td> </tr> </tbody> </table> <p>③ Keep time: 10±1s ④ Speed: 1.0mm/s</p> 	Case code	Size	Max. Shear (Kg)	B	3528-21	3.6	D	7343-31	5.0	V	7343-19	5.0	E	7343-43	5.0
Case code	Size	Max. Shear (Kg)															
B	3528-21	3.6															
D	7343-31	5.0															
V	7343-19	5.0															
E	7343-43	5.0															
4. Resistance to Flexure	No visible mechanical damage.	<p>① Solder the capacitor to the test jig (glass epoxy board) Using a eutectic solder. Then apply a force in the direction shown as the following figure.</p> <p>② Flexure: 1 mm; ③ Pressurizing Speed: 0.5mm/sec. ④ Keep time: 10 sec.</p> 															
5. Vibration	No visible mechanical damage.	<p>① Solder the capacitor to the testing jig (glass epoxy board shown as the following figure) using eutectic solder.</p> <p>② The capacitor shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz.</p> <p>③ The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).</p> 															

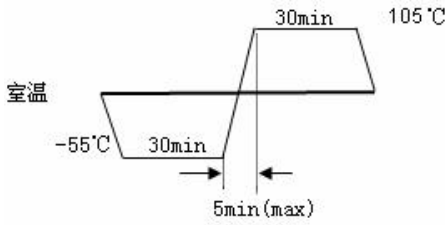
## RELIABILITY AND TEST CONDITIONS

### Solid Tantalum Chip Capacitors (TC311 Series)

Items	Requirements	Test Methods and Remarks
6. Solderability	<ul style="list-style-type: none"> <li>① No visible mechanical damage.</li> <li>② Wetting shall be exceeded 95% coverage.</li> <li>③ The less 5% of area is permitted to contain a few defect , such as pinholes、holes、un-soaking or poor soaking area which do not gather together.</li> </ul>	<ul style="list-style-type: none"> <li>① Solder temperature: 235±2℃</li> <li>② Duration: 3 sec</li> <li>③ Solder: Sn/3.0Ag/0.5Cu</li> <li>④ Flux: 25% Resin and 75% ethanol in weight</li> </ul>
7. Resistance to Soldering Heat	<ul style="list-style-type: none"> <li>① No visible mechanical damage.</li> <li>② Wetting shall exceed 95% coverage.</li> <li>③ Capacitance change: within ±10%.</li> <li>④ <math>\tan\delta</math> shall not exceed 150% of the initial requirement.</li> <li>⑤ <math>I_0</math> change shall not exceed the initial <math>I_0</math></li> </ul>	<ul style="list-style-type: none"> <li>① Solder temperature: 260±3℃</li> <li>② Duration: 5 sec</li> <li>③ Solder: Sn/3.0Ag/0.5Cu</li> <li>④ Flux: 25% Resin and 75% ethanol in weight</li> <li>⑤ The chip shall be stabilized at normal condition for 2 hours before measuring.</li> </ul>
8. Temperature	<p>A. At -55℃</p> <ul style="list-style-type: none"> <li>① No visible mechanical damage.</li> <li>② Capacitance change: within ±20%.</li> <li>③ <math>\tan\delta</math> shall not exceed the initial requirement.</li> </ul>	<ul style="list-style-type: none"> <li>① Drying 30<sup>+4</sup> min at 105℃</li> <li>② The chip shall be stabilized at normal condition for 2 hours after drying, and measured at 25℃ as initial data.</li> <li>③ The chip shall be measured at -55℃</li> </ul>
	<p>B. At 25℃</p> <ul style="list-style-type: none"> <li>① No visible mechanical damage.</li> <li>② Capacitance change: within ±10%</li> <li>③ <math>\tan\delta</math> shall not exceed the initial requirement.</li> <li>④ <math>I_0</math> shall not exceed <math>I_0</math></li> </ul>	<ul style="list-style-type: none"> <li>① After Step A, the chip shall be cooled to 85℃ and measured.</li> </ul>
	<p>C. At 85℃</p> <ul style="list-style-type: none"> <li>① No visible mechanical damage.</li> <li>② Capacitance change: within ±20%</li> <li>③ <math>\tan\delta</math> shall not exceed 120% of the initial requirement.</li> <li>④ <math>I_0</math> shall not exceed 10 <math>I_0</math>.</li> </ul>	<ul style="list-style-type: none"> <li>① After Step B, the chip shall be measured at 85℃.</li> </ul>
	<p>D. At 105℃</p> <ul style="list-style-type: none"> <li>① No visible mechanical damage.</li> <li>② Capacitance change: within ±30%.</li> <li>③ <math>\tan\delta</math> shall not exceed 150% of the initial requirement.</li> <li>⑤ <math>I_0</math> shall not exceed 10 <math>I_0</math>.</li> </ul>	<ul style="list-style-type: none"> <li>① After Step C, the chip shall be measured at 105℃.</li> </ul>

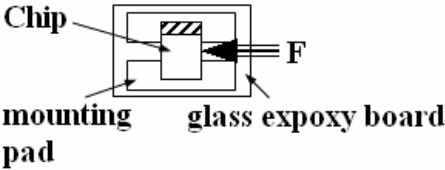
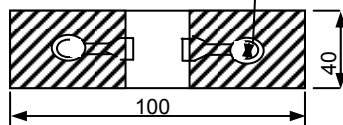
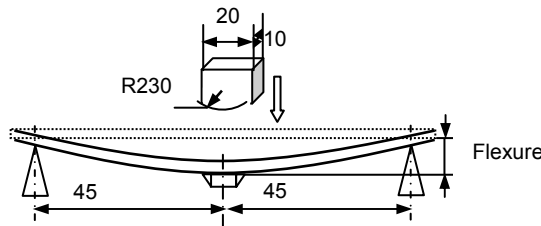
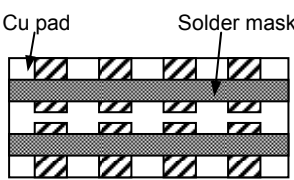
## RELIABILITY AND TEST CONDITIONS

### Solid Tantalum Chip Capacitors (TC311 Series)

Items	Requirements	Test Methods and Remarks
8. Temperature	E. At 25°C ① No visible mechanical damage. ② Capacitance change: within ±10% ③ tanδ shall not exceed the initial requirement. ④ Leakage current shall not exceed I <sub>0</sub> .	① After Step D, the chip shall be cooled to 25°C and measured.
9. Thermal Shock	① Capacitance change: within -20%~+10%. ② tanδ shall not exceed the initial requirement. ③ Leakage current shall not exceed the initial I <sub>0</sub> . ④ ESR shall not exceed 200% of the initial requirement.	① Temperature, Time (See Fig.6.4.7) ② -55°C, 30±3 min→105°C, 30±3min. ③ Transforming interval: Max.5min. ④ Tested cycle: 500cycles. ⑤ The chip shall be stabilized at normal condition for 2 hours before measuring.  <b>Fig.6.4.7</b>
10. Moisture Resistance	① No visible mechanical damage. ② Capacitance change: -5%~+35%. ③ tanδ shall not exceed of the initial requirement. ④ I <sub>0</sub> shall not exceed 5I <sub>0</sub> . ⑤ ESR shall not exceed 200% of the initial requirement.	① Temperature: 60±2°C. ② Relative Humidity: 90%~95%RH. ③ Duration: 500 <sup>+24</sup> hours. ④ The chip shall be stabilized at normal condition for 2 hours before measuring.
11. Life Test	① No visible mechanical damage. ② Capacitance change: -20%~+10%. ③ tanδ shall not exceed the initial requirement. ④ I <sub>0</sub> shall not exceed I <sub>0</sub> . ⑤ ESR shall not exceed the initial requirement.	① Temperature: 85±2°C; Rated Voltage ② Duration: 2000 <sup>+24</sup> hours ③ The chip shall be stabilized at normal condition for 2 hours before measuring.
12. Surge Voltage	① No visible mechanical damage. ② Capacitance change: -20%~+10%. ③ tanδ shall not exceed the initial requirement. ④ Leakage current shall not exceed I <sub>0</sub> . ⑤ ESR shall not exceed the initial requirement.	① Temperature: 105±2°C; ② 33ΩResistance, 1.32Rated Voltage; ③ 1000cycles.

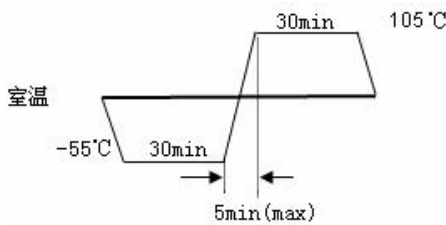
# RELIABILITY AND TEST CONDITIONS

## Solid Tantalum Chip Capacitors (TC312 Series)

Item	Requirements	Test Methods and Remarks																		
6.4.1 Terminal Strength	<p>1、shear</p>  <p>Fig.6.4.1-1</p>	<p>1、shear</p> <p>① Solder the capacitor to the test board(glass epoxy board shown in <b>Fig. 6.4.1-1</b>) , then apply a force in the direction as <b>Fig. 6.4.1-1</b>;</p> <p>② Case code and shear:</p> <table border="1"> <thead> <tr> <th>Case code</th> <th>Size</th> <th>Max. Shear (Kg)</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>3528-21</td> <td>3.6</td> </tr> <tr> <td>C</td> <td>6032-28</td> <td>4.5</td> </tr> <tr> <td>D</td> <td>7343-31</td> <td>5.0</td> </tr> <tr> <td>V</td> <td>7343-19</td> <td>5.0</td> </tr> <tr> <td>E</td> <td>7343-43</td> <td>5.0</td> </tr> </tbody> </table> <p>③ Keep time: 10±1sec; ④ speed: 1.0mm/sec.</p>	Case code	Size	Max. Shear (Kg)	B	3528-21	3.6	C	6032-28	4.5	D	7343-31	5.0	V	7343-19	5.0	E	7343-43	5.0
Case code	Size	Max. Shear (Kg)																		
B	3528-21	3.6																		
C	6032-28	4.5																		
D	7343-31	5.0																		
V	7343-19	5.0																		
E	7343-43	5.0																		
6.4.2 Resistance to Flexure	<p>No visible mechanical damage.</p> <p>unit: mm</p>  <p>Fig.6.4.2-1</p>	<p>① Solder the capacitor to the test jig (glass epoxy board shown in <b>Tab. 5-1</b>) Using a eutectic solder. Then apply a force in the direction shown in <b>Fig. 6.4.2-1~Fig. 6.4.2-2</b></p> <p>② Flexure:1 mm; ③ Pressurizing Speed: 0.5mm/sec. ④ Keep time: 10 sec.</p>  <p>Fig.6.4.2-2</p>																		
6.4.3 Vibration	<p>No visible mechanical damage.</p>  <p>Fig.6.4.3-1</p>	<p>① Solder the capacitor to the testing jig (glass epoxy board shown in <b>Fig.6.4.3-1</b>) using eutectic solder.</p> <p>② The capacitor shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz.</p> <p>③ The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).</p>																		
6.4.4 Solderability	<p>① No visible mechanical damage.</p> <p>② Wetting shall exceed 95% coverage.</p> <p>③ The less 5% of area is permitted to contain a few defect , such as pinholes、holes、un-soaking or poor soaking area which do not gather together.</p>	<p>① Solder temperature: 235±2℃</p> <p>② Duration: 3 sec.</p> <p>③ Solder: Sn/3.0Ag/0.5Cu</p> <p>④ Flux: 25% Resin and 75% ethanol in weight.</p>																		
6.4.5 Resistance to Soldering Heat	<p>① No visible mechanical damage.</p> <p>② Wetting shall exceed 95% coverage.</p> <p>③ Capacitance change: within ±10%.</p> <p>④ tanδ shall not exceed 150% of the initial requirement.</p> <p>⑤ Leakage current change shall not exceed the initial I<sub>0</sub>.</p>	<p>① Solder temperature: 260±3℃</p> <p>② Duration: 5 sec.</p> <p>③ Solder: Sn/3.0Ag/0.5Cu</p> <p>④ Flux: 25% Resin and 75% ethanol in weight.</p> <p>⑤ The chip shall be stabilized at normal condition for 2 hours before measuring.</p>																		

# RELIABILITY AND TEST CONDITIONS

## Solid Tantalum Chip Capacitors (TC312 Series)

Item	Requirements	Test Methods and Remarks
6.4.6 Temperature properties	A. At -55°C ① No visible mechanical damage. ② Capacitance change: within ±20%. ③ $\tan\delta$ shall not exceed the initial requirement.	① Drying 30 <sup>+4</sup> min at 105°C ② The chip shall be stabilized at normal condition for 2 hours after drying, and measured at 25°C as initial data. ③ The chip shall be measured at -55°C.
	B. At 25°C ① No visible mechanical damage. ② Capacitance change: within ±10% ③ $\tan\delta$ shall not exceed the initial requirement. ④ Leakage current shall not exceed $I_0$ .	① After Step A, the chip shall be cooled to 25°C and measured.
	C. At 85°C ① No visible mechanical damage. ② Capacitance change: within ±20% ③ $\tan\delta$ shall not exceed 120% of the initial requirement. ④ Leakage current shall not exceed 10 $I_0$ .	① After Step B, the chip shall be measured at 85°C.
	D. At 105°C ① No visible mechanical damage. ② Capacitance change: within ±30%. ③ $\tan\delta$ shall not exceed 150% of the initial requirement. ④ Leakage current shall not exceed 10 $I_0$ .	① After Step C, the chip shall be measured at 105°C.
	E. At 25°C ① No visible mechanical damage. ② Capacitance change: within ±10% ③ $\tan\delta$ shall not exceed the initial requirement. ④ Leakage current shall not exceed $I_0$ .	① After Step D, the chip shall be cooled to 25°C and measured.
6.4.7 Thermal Shock	① Capacitance change: within -20%~+10%. ② $\tan\delta$ shall not exceed the initial requirement. ③ Leakage current shall not exceed the initial $I_0$ . ④ ESR shall not exceed 200% of the initial requirement.	① Temperature, Time (See Fig.6.4.7) ② -55°C, 30±3 min→105°C, 30±3min. ③ Transforming interval: Max.5min. ④ Tested cycle: 500cycles. ⑤ The chip shall be stabilized at normal condition for 2 hours before measuring.  
6.4.8 Moisture Resistance	① No visible mechanical damage. ② Capacitance change: -5%~+35%. ③ $\tan\delta$ shall not exceed of the initial requirement. ④ Leakage current shall not exceed 5 $I_0$ . ⑤ ESR shall not exceed 200% of the initial requirement.	① Temperature: 60±2°C. ② Relative Humidity: 90%~95%RH. ③ Duration: 500 <sup>+24</sup> hours. ④ The chip shall be stabilized at normal condition for 2 hours before measuring.



## RELIABILITY AND TEST CONDITIONS

### Solid Tantalum Chip Capacitors (TC312 Series)

Item	Requirements	Test Methods and Remarks
6.4.9 Life Test	<ul style="list-style-type: none"><li>① No visible mechanical damage.</li><li>② Capacitance change: -20%~+10%.</li><li>③ <math>\tan\delta</math> shall not exceed the initial requirement.</li><li>④ Leakage current shall not exceed <math>I_0</math>.</li><li>⑤ ESR shall not exceed the initial requirement.</li></ul>	<ul style="list-style-type: none"><li>① Temperature: <math>85\pm 2^\circ\text{C}</math>; Rated Voltage</li><li>② Duration: <math>2000^{+24}</math> hours</li><li>③ The chip shall be stabilized at normal condition for 2 hours before measuring.</li></ul>
6.4.10 Surge Voltage	<ul style="list-style-type: none"><li>① No visible mechanical damage.</li><li>② Capacitance change: -20%~+10%.</li><li>③ <math>\tan\delta</math> shall not exceed the initial requirement.</li><li>④ Leakage current shall not exceed <math>I_0</math>.</li><li>⑤ ESR shall not exceed the initial requirement.</li></ul>	<ul style="list-style-type: none"><li>① Temperature: <math>105\pm 2^\circ\text{C}</math>;</li><li>② <math>33\Omega</math> Resistance, 1.32 Rated Voltage;</li><li>③ 1000 cycles.</li></ul>