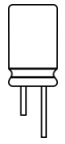
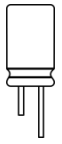


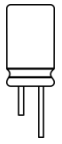
**RELIABILITY TESTS ▪ STANDARD**

**Reference JIS C 5101-1, JIS C 5101-4 and JIS 60068-2**

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
1	Shelf life	Upper category temperature Duration: 1000h	JIS C 5101-4 No. 4.17  JIS C 5101-1 No. 4.25	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 20\%</math> of initial value<sup>[2]</sup></li> <li>2. <math>\tan\delta \leq 2</math> times spec. limit<sup>[2]</sup></li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>
2	Temperature cycling	<ol style="list-style-type: none"> <li>1. Lower category temperature: 30mins</li> <li>2. Temperature change: 3mins</li> <li>3. Upper category temperature: 30mins</li> <li>4. Temperature change: 3mins</li> </ol> Step 1 to 4 as a cycle Cycle: 10 cycles	JIS C 5101-4 No. 4.7  JIS C 5101-1 No. 4.16	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 5\%</math> of initial value</li> <li>2. <math>\tan\delta \leq</math> spec. limit</li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>
3	Unbiased Humidity	Temperature: 40°C Humidity: 90 ~ 95%RH Duration: <ul style="list-style-type: none"> <li>▪ 250h for general purpose grade products<sup>[1]</sup></li> <li>▪ 500h for long life grade products<sup>[1]</sup></li> </ul>	JIS C 5101-4 No. 4.12  JIS C 5101-1 No. 4.22	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 20\%</math> of initial value for general purpose grade products<sup>[1]</sup> <math> \Delta C/C_R  \leq 10\%</math> of initial value for long life grade products<sup>[1]</sup></li> <li>2. <math>\tan\delta \leq 1.2</math> times of spec. limit</li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>
4	Endurance (load Life)	Upper category temperature $V_R$ applied Duration: specified or see detail specification	JIS C 5101-4 No. 4.13  JIS C 5101-1 No. 4.23	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 20\%</math> of initial value<sup>[2]</sup></li> <li>2. <math>\tan\delta \leq 2</math> times spec. limit<sup>[2]</sup></li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>
5	Endurance (Load ripple current life)	Upper category temperature $I_R$ and $V_R$ applied $AC + DC \approx V_R$ Duration: specified or see detail specification	JIS C 5101-4 No. 4.13  JIS C 5101-1 No. 4.23	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 20\%</math> of initial value<sup>[2]</sup></li> <li>2. <math>\tan\delta \leq 2</math> times spec. limit<sup>[2]</sup></li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>
6	Solvent resistance of marking	<ol style="list-style-type: none"> <li>a. Solvent to be used: IPA</li> <li>b. Solvent temperature: 23°C ± 5°C</li> <li>c. Conditioning: Method 1 (with rubbing)</li> <li>d. Rubbing material: Cotton wool</li> <li>e. Recovery time: Not applicable, unless otherwise stated in the detail specification</li> </ol>	JIS C 5101-1 No. 4.32  JIS C 60068-2-45 3.1.2	5 pcs	See detail specification
7	Vibration	<ol style="list-style-type: none"> <li>a. Frequency: 10 ~ 55 Hz</li> <li>b. Swing (single peak) and acceleration: 0.75mm or 98m/s<sup>2</sup></li> <li>c. Test direction and duration: X, Y, Z each one for 2h</li> </ol>	JIS C 5101-4 No. 4.8  JIS C 5101-1 No. 4.17	10 pcs	Taking from the vibration table static placed in the horizontal to test the box and carton appearance, test the electrical characteristics. <ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 5\%</math> of initial value</li> <li>2. <math>\tan\delta \leq</math> spec. limit</li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> </ol> Marking legible

**RELIABILITY TESTS ▪ STANDARD**

**Reference JIS C 5101-1, JIS C 5101-4 and JIS 60068-2**

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
8	Resistance to solder heat	Max. temperature: 260°C (0 ~ +3°C) Duration: 10s ± 1s	JIS C 5101-4 No. 4.5 JIS C 5101-1 No. 4.14	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 5\%</math> of initial value</li> <li>2. <math>\tan\delta \leq</math> spec. limit</li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>
9	Solderability	Max. temperature: 245°C ± 5°C Duration: 2s ± 0.5s	JIS C 5101-4 No. 4.6 JIS C 5101-1 No. 4.15	10 pcs	The surface soldering attachment is greater than 95%, soldering should brightness and equality, non-soldering needle hole, drop weld or concentrate at some point are not allowed.
10	Characteristics at high and low temperature	The capacitors shall be measured at each temperature step Step 1: 20°C Capacitance tangent of loss angle Impedance (at the same frequency as step 2) Step 2: Lower category temperature ▪ Impedance Step 3: Upper category temperature ▪ Leakage current See detail specification	JIS C 5101-4 No. 4.19 JIS C 5101-1 No. 4.29	10 pcs	See detail specification
11	Terminal strength	<ol style="list-style-type: none"> <li>a. Use different lead wire diameter to added weights, vertical resistance pull for 10s ± 1s</li> <li>b. Fix the capacitor, use the different lead wire diameter to added weights, bending angle to 90° with the terminal, then against the direction to do the same operation for a cycle, as rules to operate two cycles</li> </ol>	JIS C 5101-1 No. 4.13 JIS C 5104-1 No. 4.4	10 pcs	The tested terminal are not allowed those following defective situations: flexible, broken and touch defects.
12	Surge voltage	<ol style="list-style-type: none"> <li>a. Test temp.: Max. temp. for long life grade products<sup>[1]</sup> or Room temp. for general purpose grade products<sup>[1]</sup></li> <li>b. Add surge voltage to the connections: 1.15·V<sub>R</sub> when V<sub>R</sub> ≤ 315V 1.10·V<sub>R</sub> when V<sub>R</sub> &gt; 315V</li> <li>c. 6 mins as a cycle (charge time 30s, discharge time 330s) Cycle: 1000 cycles</li> </ol>	JIS C 5101-4 No. 4.14 JIS C 5101-1 No. 4.26	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 15\%</math> of initial value</li> <li>2. <math>\tan\delta \leq</math> spec. limit</li> <li>3. <math>I_{LEAK} \leq</math> spec. limit</li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> </ol> Marking legible

RELIABILITY TESTS ▪ STANDARD



Reference JIS C 5101-1, JIS C 5101-4 and JIS 60068-2

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
13	Pressure relief	See detail specification (aim at $\varnothing \geq 10\text{mm}$ )	JIS C 5101-4 No. 4.16 JIS C 5101-1 No. 4.28	10 pcs	Device shall open without danger of explosion or fire
14	Storage at low temperature	Duration: 16h or 4h after thermal stability has been reached Temperature: $-40^{\circ}\text{C}$	JIS C 5101-4 No. 4.18 JIS C 5101-1 No. 4.25	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 10\%</math> of initial value</li> <li>2. <math>\tan\delta \leq \text{spec. limit}</math></li> <li>3. <math>I_{\text{LEAK}} \leq \text{spec. limit}</math></li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>

**Note:**

[1] General purpose grade: lifetime ( $V_R$  applied)  $\leq 2000$  hours.

Long life grade: lifetime ( $V_R$  applied)  $> 2000$  hours.

[2]  $\Delta C/C_R$  &  $\tan\delta$  criteria, please refer to CapXon datasheet.

**RELIABILITY TESTS ▪ HIGH RELIABILITY**

**Reference JIS C 5101-1, JIS C 5101-4 and JIS 60068-2**

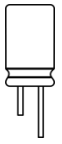
No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
1	Shelf life	Upper category temperature Duration: 1000h	JIS C 5101-4 No. 4.17  JIS C 5101-1 No. 4.25	10 pcs	1. $ \Delta C/C_R  \leq 20\%$ of initial value <sup>[1]</sup> 2. $\tan\delta \leq 2$ times spec. limit <sup>[1]</sup> 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible
2	Temperature cycling	1. Lower category temperature: 30mins 2. Temperature change: 3mins 3. Upper category temperature: 30mins 4. Temperature change: 3mins Step 1 to 4 as a cycle Cycle: 10 cycles	JIS C 5101-4 No. 4.7  JIS C 5101-1 No. 4.16	10 pcs	1. $ \Delta C/C_R  \leq 5\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible
3	Unbiased humidity	Temperature: 40°C Humidity: 90 ~ 95%RH Duration: 500h	JIS C 5101-4 No. 4.12  JIS C 5101-1 No. 4.22	10 pcs	1. $ \Delta C/C_R  \leq 10\%$ of initial value for long life grade products 2. $\tan\delta \leq 1.2$ times of spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible
4	Endurance (load Life)	Upper category temperature $V_R$ applied Duration: specified or see detail specification	JIS C 5101-4 No. 4.13  JIS C 5101-1 No. 4.23	10 pcs	1. $ \Delta C/C_R  \leq 20\%$ of initial value <sup>[1]</sup> 2. $\tan\delta \leq 2$ times spec. limit <sup>[1]</sup> 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible
5	Endurance (Load ripple current life)	Upper category temperature $I_R$ and $V_R$ applied $AC + DC \approx V_R$ Duration: specified or see detail specification	JIS C 5101-4 No. 4.13  JIS C 5101-1 No. 4.23	10 pcs	1. $ \Delta C/C_R  \leq 20\%$ of initial value <sup>[1]</sup> 2. $\tan\delta \leq 2$ times spec. limit <sup>[1]</sup> 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible
6	Solvent resistance of marking	a. Solvent to be used: IPA b. Solvent temperature: 23°C ± 5°C c. Conditioning: Method 1 (with rubbing) d. Rubbing material: Cotton wool e. Recovery time: Not applicable, unless otherwise stated in the detail specification	JIS C 5101-1 No. 4.32  JIS C 60068-2-45 3.1.2	5 pcs	See detail specification
7	Vibration	a. Frequency: 10 ~ 55 Hz b. Swing (single peak) and acceleration: 0.75mm or 98m/s <sup>2</sup> c. Test direction and duration: X, Y, Z each one for 2h	JIS C 5101-4 No. 4.8  JIS C 5101-1 No. 4.17	10 pcs	Taking from the vibration table static placed in the horizontal to test the box and carton appearance, test the electrical characteristics. 1. $ \Delta C/C_R  \leq 5\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible

**RELIABILITY TESTS ▪ HIGH RELIABILITY**

**Reference JIS C 5101-1, JIS C 5101-4 and JIS 60068-2**

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
8	Resistance to soldering heat	Max. temperature: 260°C (0 ~ +3°C) Duration: 10s ± 1s	JIS C 5101-4 No. 4.5  JIS C 5101-1 No. 4.14	10 pcs	1. $ \Delta C/C_R  \leq 5\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible
9	Solderability	Max. temperature: 245°C ± 5°C Duration: 2s ± 0.5s	JIS C 5101-4 No. 4.6  JIS C 5101-1 No. 4.15	10 pcs	The surface soldering attachment is greater than 95%, soldering should brightness and equality, non-soldering needle hole, drop weld or concentrate at some point are not allowed
10	Characteristics at high and low temperature	The capacitors shall be measured at each temperature step Step 1: 20°C Capacitance tangent of loss angle Impedance (at the same frequency as step 2) Step 2: Lower category temperature ▪ Impedance Step 3: Upper category temperature ▪ Leakage current See detail specification	JIS C 5101-4 No. 4.19  JIS C 5101-1 No. 4.29	10 pcs	See detail specification
11	Terminal strength	a. Use different lead wire diameter to added weights, vertical resistance pull for 10s ± 1s b. Fix the capacitor, use the different lead wire diameter to added weights, bending angle to 90° with the terminal, then against the direction to do the same operation for a cycle, as rules to operate two cycles	JIS C 5101-1 No. 4.13  JIS C 5104-1 No. 4.4	10 pcs	The tested terminal are not allowed those following defective situations: flexible, broken and touch defects
12	Surge voltage	a. Test temp.: Max. temp. b. Add surge voltage to the connections: 1.15·V <sub>R</sub> when V <sub>R</sub> ≤ 315V 1.10·V <sub>R</sub> when V <sub>R</sub> > 315V c. 6 min as a cycle (charge time 30s, discharge time 330s) d. Cycle: 1000 cycles	JIS C 5101-4 No. 4.14  JIS C 5101-1 No. 4.26	10 pcs	1. $ \Delta C/C_R  \leq 15\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte Marking legible

RELIABILITY TESTS ▪ HIGH RELIABILITY

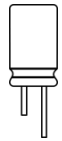


Reference JIS C 5101-1, JIS C 5101-4 and JIS 60068-2

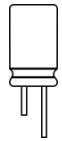
No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
13	Pressure relief	See detail specification (aim at $\varnothing \geq 10\text{mm}$ )	JIS C 5101-4 No. 4.16 JIS C 5101-1 No. 4.28	10 pcs	Device shall open without danger of explosion or fire
14	Storage at low temperature	Duration: 16h or 4h after thermal stability has been reached Temperature: $-40^{\circ}\text{C}$	JIS C 5101-4 No. 4.18 JIS C 5101-1 No. 4.25	10 pcs	<ol style="list-style-type: none"> <li>1. <math> \Delta C/C_R  \leq 10\%</math> of initial value</li> <li>2. <math>\tan\delta \leq \text{spec. limit}</math></li> <li>3. <math>I_{LEAK} \leq \text{spec. limit}</math></li> <li>4. No visible damage</li> <li>5. No leakage of electrolyte</li> <li>6. Marking legible</li> </ol>

**Note:**

[1]  $\Delta C/C_R$  &  $\tan\delta$  criteria, please refer to CapXon datasheet.

**RELIABILITY TESTS ▪ AUTOMOTIVE**

**Reference MIL-STD-202, JESD22, J-STD-002 and AEC-Q200**

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria															
1	High temperature exposure (Storage at upper category temperature)	Test temp: Upper category temperature No voltage applied Duration: 1000h Pre-treatment for measurements shall be conducted after application of DC working voltage for 30 minutes Measurement at 24h after test conclusion	MIL-STD-202 Method 108	77 pcs	<ol style="list-style-type: none"> <li><math> \Delta C/C_R  \leq 20\%</math> of initial value</li> <li><math>\tan\delta \leq 2</math> times spec. limit</li> <li><math>I_{LEAK} \leq</math> spec. limit</li> <li>No visible damage</li> </ol>															
2	Temperature cycling	<table border="1"> <thead> <tr> <th>Stage</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Lower category temperature</td> <td>Within 30min</td> </tr> <tr> <td>2</td> <td>Temperature change</td> <td>Within 1min</td> </tr> <tr> <td>3</td> <td>Upper category temperature</td> <td>Within 30min</td> </tr> <tr> <td>4</td> <td>Temperature change</td> <td>Within 1min</td> </tr> </tbody> </table> <p>Stage 1 to 4 is one cycle Test time: 1000 cycles Measurement at 24h after test conclusion</p>	Stage	Temperature	Time	1	Lower category temperature	Within 30min	2	Temperature change	Within 1min	3	Upper category temperature	Within 30min	4	Temperature change	Within 1min	JESD22 Method JA-104	77 pcs	<ol style="list-style-type: none"> <li><math> \Delta C/C_R  \leq 10\%</math> of initial value</li> <li><math>\tan\delta \leq</math> spec. limit</li> <li><math>I_{LEAK} \leq</math> spec. limit</li> <li>No visible damage</li> <li>No leakage of electrolyte</li> <li>Marking legible</li> </ol>
Stage	Temperature	Time																		
1	Lower category temperature	Within 30min																		
2	Temperature change	Within 1min																		
3	Upper category temperature	Within 30min																		
4	Temperature change	Within 1min																		
3	Biased humidity	Temperature: 85°C Humidity: 85%RH Applied voltage: $V_R$ Duration: 1000h Measurement at 24h after test conclusion	MIL-STD-202 Method 103	77 pcs	<ol style="list-style-type: none"> <li><math> \Delta C/C_R  \leq 20\%</math> of initial value</li> <li><math>\tan\delta \leq 1.2</math> times spec. limit</li> <li><math>I_{LEAK} \leq</math> spec. limit</li> <li>No visible damage</li> <li>No leakage of electrolyte</li> <li>Marking legible</li> </ol>															
4	Operational life	Test temp: Upper category temperature $V_R$ applied (& $I_R$ applied if specified) Duration: specified or see detail specification Measurement at 24h after test conclusion	MIL-STD-202 Method 108	77 pcs	<ol style="list-style-type: none"> <li><math> \Delta C/C_R  \leq 20\%</math> of initial value</li> <li><math>\tan\delta \leq 2</math> times spec. limit</li> <li><math>I_{LEAK} \leq</math> spec. limit</li> <li>No visible damage</li> <li>No leakage of electrolyte</li> </ol>															
5	Tensile strength (DIP)	<table border="1"> <thead> <tr> <th>Terminal wire Diameter (mm)</th> <th>Force/Weight (<math>\pm 10\%</math>)</th> </tr> </thead> <tbody> <tr> <td><math>0.3 &lt; d \leq 0.5</math></td> <td>5N (0.51kg)</td> </tr> <tr> <td><math>0.5 &lt; d \leq 0.8</math></td> <td>10N (1.02kg)</td> </tr> <tr> <td><math>0.8 &lt; d \leq 1.25</math></td> <td>20N (2.04kg)</td> </tr> <tr> <td>Snap-In terminals</td> <td>40N (4.08kg)</td> </tr> </tbody> </table> <p>Fix the tested capacitor, then add the hammer of above weight on the lead pin continuously, keep for <math>10s \pm 1s</math></p>	Terminal wire Diameter (mm)	Force/Weight ( $\pm 10\%$ )	$0.3 < d \leq 0.5$	5N (0.51kg)	$0.5 < d \leq 0.8$	10N (1.02kg)	$0.8 < d \leq 1.25$	20N (2.04kg)	Snap-In terminals	40N (4.08kg)	MIL-STD-202 Method 211	30 pcs	No visible damage					
Terminal wire Diameter (mm)	Force/Weight ( $\pm 10\%$ )																			
$0.3 < d \leq 0.5$	5N (0.51kg)																			
$0.5 < d \leq 0.8$	10N (1.02kg)																			
$0.8 < d \leq 1.25$	20N (2.04kg)																			
Snap-In terminals	40N (4.08kg)																			
6	Resistance to solvents	<ol style="list-style-type: none"> <li>Solvent to be used: IPA</li> <li>Soak time: Using the brush according to mark place to brush with 10 times after 180s, repeat above step again with 2 times (namely is total 3 times)</li> <li>After test place in air nature drying</li> <li>Test temperature: <math>25^\circ C \pm 5^\circ C</math></li> </ol>	MIL-STD-202 Method 215	5 pcs	<ol style="list-style-type: none"> <li>No visible damage</li> <li>Marking legible</li> </ol>															

**RELIABILITY TESTS ▪ AUTOMOTIVE**

**Reference MIL-STD-202, JESD22, J-STD-002 and AEC-Q200**

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria
7	Mechanical shock	a. Pulse shape: Half-sine waveform b. Max. acceleration: 980m/s <sup>2</sup> (100g's) c. Pulse duration time: 6ms d. Direction: X, Y, Z e. Shock time: 10 times in one direction, 30 times in total	MIL-STD-202 Method 213	30 pcs	1. $ \Delta C/C_R  \leq 5\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte
8	Vibration	a. 10Hz ~ 2kHz ~ 10Hz (20min) b. Amplitude (unimodal): 0.35mm@10 ~ 55Hz c. Acceleration: 49m/s <sup>2</sup> (5g's)@55Hz ~ 2kHz d. X direction 4h Y direction 4h Z direction 4h Total: 12h	MIL-STD-202 Method 204	30 pcs	1. $ \Delta C/C_R  \leq 5\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte
9	Resistance to solder heat	DIP solder groove immerse method a. Kind of solder: Sn 96.5%; Ag 3%; Cu 0.5% b. Solder stove temp: 260°C -0°C/+5°C c. Immerse time: 10 ± 1s d. The tested terminal must be soldered into the groove with a speed of: 25mm/s ± 6mm/s e. Solder within 1.5mm of device body for lead f. Immerse time: once g. Measurement at 24h after test conclusion	MIL-STD-202 Method 210	30 pcs	1. $ \Delta C/C_R  \leq 5\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte
10	Solderability	DIP solder groove immerse method a. Kind of solder: Sn 96.5%; Ag 3%; Cu 0.5% b. Pre-handle: Water steam steams to cook 8hours + 15mins c. Solder stove temp.: 245°C ± 3°C d. Solder solvent: Resin alcohol solution (25 wts%) or resin IPA solution e. Immerse time: within 3s ± 0.5s f. Immerse speed: 25 ± 2.5mm/s	J-STD-002	15 pcs	Up to immerse position, above 95% area of surroundings surface shall be cover by the new soldering



**RELIABILITY TESTS ▪ AUTOMOTIVE**

**Reference MIL-STD-202, JESD22, J-STD-002 and AEC-Q200**

No.	Test	Test Specification	Test Standard	Sample Quantity	Test Criteria												
11	Electrical characterization	a. In different environment to deposit the products	User spec.	30 pcs	<b>Products with lower category temperature -40°C</b> <table border="1"> <tr> <td>Comparison of temp section</td> <td>Magnification</td> </tr> <tr> <td>Z-25°C / Z+20°C</td> <td>According to spec.</td> </tr> <tr> <td>Z-40°C / Z+20°C</td> <td>According to spec.</td> </tr> </table> <b>Products with lower category temperature -55°C</b> <table border="1"> <tr> <td>Comparison of temp section</td> <td>Magnification</td> </tr> <tr> <td>Z-25°C / Z+20°C</td> <td>According to spec.</td> </tr> <tr> <td>Z-55°C / Z+20°C</td> <td>According to spec.</td> </tr> </table>	Comparison of temp section	Magnification	Z-25°C / Z+20°C	According to spec.	Z-40°C / Z+20°C	According to spec.	Comparison of temp section	Magnification	Z-25°C / Z+20°C	According to spec.	Z-55°C / Z+20°C	According to spec.
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Stage	Temp. (°C)	Impedance comparison															
1 (initial value)	20 ± 2																
2	-25 ± 3																
3	-40 ± 3																
4	20 ± 2																
5	Upper category temperature ± 2																
6	20 ± 2																
		b. Test frequency: 120Hz			stage 2 stage 3 stage 5												
		c. Each stage of time: Reached time of hot balance (temperature stability)				1. $ \Delta C/C_R  \leq 30\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq 5$ times spec. limit											
12	Surge voltage	a. Test temp.: Max. temp. for long life grade products <sup>[1]</sup> or Room temp. for general purpose grade products <sup>[1]</sup> b. Add surge voltage to the connections: 1.15·V <sub>R</sub> when V <sub>R</sub> ≤ 315V 1.10·V <sub>R</sub> when V <sub>R</sub> > 315V c. 6 min as a cycle (charge time 30s, discharge time 330s) d. Cycle: 1000 cycles	JIS C 5101-1 No. 4.26	30 pcs	1. $ \Delta C/C_R  \leq 15\%$ of initial value 2. $\tan\delta \leq$ spec. limit 3. $I_{LEAK} \leq$ spec. limit 4. No visible damage 5. No leakage of electrolyte 6. Marking legible												

**Note:**

 [1] General purpose grade: lifetime (V<sub>R</sub> applied) ≤ 2000 hours.

 Long life grade: lifetime (V<sub>R</sub> applied) > 2000 hours.