# Reliability Test Standards

(1) Section A :

1. Molded Power Inductor
2. Ferrite Chip Beads and Inductor
3. LAN Transformer
4. SMD Power Inductor SPS2520 & SPS2016
5. Ceramic Wirewound Inductor (SCI Series)

➔ Table 1 (Automotive)

(2) Section B :

6. HF Transformer
7. Standard Power Inductor
8. Wireless Charging
9. Toroidal Choke Coil

➔ Table 2 (Automotive)

(3) For other products not in the list, we shall handle it on a case-by-case basis.

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Section A

1. Molded Power Inductor
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➔Table 1 (Automotive)

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# Table 1- Reliability Test Standard (Automotive)

| Test | Failure Criteria | Test Condition |
|---|---|---|
| Pre and Post-Stress Electrical Test | a. Follow product data sheet | a. Sample Size: 77pcs<br>b. Equipment: LCR Meter<br>OHM Meter |
| High Temperature Exposure (Storage) (AEC-Q200) | a. Appearance: No damage.<br>b. Impedance change: within±15% of initial value<br>c. Inductance change: within±10% of initial value<br>d. Q value : No out of spec<br>e. RDC change: within ±15% of initial value and no out of spec | a. Pre-condition : Run through IR reflow for 2 times. ( IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 77pcs)<br>b. Temperature: Refer datasheet<br>c. Duration: 1000 hours min (measurement at 250 and 500 hrs)<br>d. Place the parts at room temperature for 24±2 hrs and then measured the electrical characteristic.<br>e. Equipment: LCR Meter & OHM Meter & microscope |
| Temperature Cycling (AEC-Q200) | a. Appearance: No damage.<br>b. Impedance change : within±15% of initial value<br>c. Inductance change: within±10% of initial value<br>d. Q value : No out of spec<br>e. RDC change : within ±15% of initial value and no out of spec | a. Pre-condition : Run through IR reflow for 2 times. ( IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 77pcs)<br>b. Highest Temperature & Lowest Temperature : Follow datasheet<br>c. Maintain the predetermined temperature at least 30 mins. Rise to highest temperature within 1 min and maintain for at least 30 mins. Drop to lowest temperature within 1 min. Cycle, 1000 times.<br>d. Place the parts at room temperature for 24±2 hrs and then measured the electrical characteristic.<br>e. Equipment: LCR Meter & OHM Meter & microscope |

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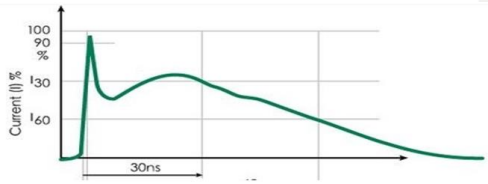
# Table 1- Reliability Test Standard (Automotive) – Cont'd

| Test | Failure Criteria | Test Condition |
|---|---|---|
| Destructive Physical Analysis | NA | NA |
| Biased Humidity (AEC-Q200) | a. Appearance: No damage.<br>b. Impedance change : within±15% of initial value<br>c. Inductance change: within±10% of initial value<br>d. Q value : No out of spec<br>e. RDC change: within ±15% of initial value and no out of spec | a. Pre-condition : Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 77pcs)<br>b. Humidity : 85±3% R.H<br>c. Temperature : 85±2 ℃<br>d. Duration: 1000 hours min<br>e. Place the parts at room temperature for 24±2 hrs and then measured the electrical characteristic.<br>f. Equipment: LCR Meter & OHM Meter & microscope |
| Operational Life (High temperature loading) (AEC-Q200) | a. Appearance: No damage.<br>b. Impedance change : within±15% of initial value<br>c. Inductance change: within±10% of initial value<br>d. Q value : No out of spec<br>e. RDC change : within ±15% of initial value and no out of spec | a. Pre-condition: Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 77pcs)<br>b. Temperature: Refer datasheet<br>c. Duration: 1000hrs min. with 100% rated current.<br>d. Place the parts at room temperature for 24±2 hrs and then measured the electrical characteristic.<br>e. Equipment: LCR Meter & OHM Meter & microscope |
| Appearance | a. Appearance: No damage. | a. Inspect outer appearance, body marking and workmanship without electrical test.<br>b. Equipment: Microscope |

# Table 1- Reliability Test Standard (Automotive) – Cont'd

<table>
<tr><th>Test</th><th>Failure Criteria</th><th>Test Condition</th></tr>
<tr><td>Dimension</td><td>a. Follow Dimension Spec in datasheet</td><td>a. Refer datasheet<br>b. Sample Size: 30pcs<br>c. Equipment: Caliper</td></tr>
<tr><td>Terminal Strength</td><td>a. Appearance: No damage.</td><td>a. Apply 910g pull force for 5~10 secs to the pin terminal.<br>b. Sample Size: 30pcs<br>c. Equipment: Microscope</td></tr>
<tr><td>Resistance to Solvents</td><td>a. Appearance: No damage.</td><td>a. Add aqueous wash chemical - OKEM to clean or equivalent.<br>b. Sample Size: 5pcs<br>c. Equipment: Microscope</td></tr>
<tr><td>Mechanical Shock</td><td>a. Appearance: No damage.<br>b. Impedance change: within±15% of initial value<br>c. Inductance change: within±10% of initial value<br>d. Q value: No out of spec<br>e. RDC change: within ±15% of initial value and no out of spec.</td><td>a. Pre-condition: Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 30pcs)<br><table><tr><th>Type</th><th>Peak value (g's)</th><th>Normal duration (D) (ms)</th><th>Waveform</th><th>Velocity change (Vi)ft/sec</th></tr><tr><td>SMD</td><td>100</td><td>6</td><td>Half-sine</td><td>12.3</td></tr><tr><td>Lead</td><td>100</td><td>6</td><td>Half-sine</td><td>12.3</td></tr></table><br>b. Equipment: LCR Meter & OHM Meter & microscope</td></tr>
<tr><td>Vibration</td><td>a. Appearance: No damage.<br>b. Impedance change: within±15% of initial value<br>c. Inductance change: within±10% of initial value<br>d. Q value: No out of spec<br>e. RDC change: within ±15% of initial value and no out of spec</td><td>a. Pre-condition: Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 30pcs)<br>b. Equipment: Vibration Checker, LCR Meter & OHM Meter & Microscope<br>c. Total Amplitude:5g<br>d. Oscillation Frequency: 10HZ~2KHZ~10Hz for 20 minutes.<br>e. Testing Duration: 12 hours (20 minutes, 12 cycles each of 3 orientations)</td></tr>
</table>

# Table 1- Reliability Test Standard (Automotive) – Cont'd

<table>
<tr><th>Test</th><th>Failure Criteria</th><th>Test Condition</th></tr>
<tr><td>Resistance to Soldering Heat</td><td>a. Appearance: No damage.<br>b. Impedance change:<br>within±15% of initial value<br>c. Inductance change:<br>within±10% of initial value<br>d. Q value: No out of spec<br>e. RDC change: within ±15% of initial value and no out of spec</td><td>a. Sample Size: 30pcs<br><table><tr><th>Soldering Temperature(°C)</th><th>Time(s)</th><th>Temperature ramp/immersion and emersion rate</th><th>Number of heat cycle</th></tr><tr><td>260 ±5</td><td>10 ±1</td><td>25mm/s ±6 mm/s</td><td>1</td></tr></table><br>b. Equipment: LCR Meter & OHM Meter & 50X CCD</td></tr>
<tr><td>Thermal shock (AEC-Q200)</td><td>a. Appearance: No damage.<br>b. Impedance change:<br>within±15% of initial value<br>c. Inductance change:<br>within±10% of initial value<br>d. Q value: No out of spec<br>e. RDC change: within ±15% of initial value and no out of spec</td><td>a. Pre-condition: Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 30pcs)<br><br>b. Highest Temperature & Lowest Temperature : Follow datasheet<br><br>c. Maintain the low temperature for 15±1 mins. When the temperature hit the predetermined temperature, Rise to highest temperature within 20 secs for 15±1 mins. Number of cycles is 300.<br><br>d. Place the parts at room temperature for 24±2 hrs and then measured the electrical characteristic.<br><br>e. Equipment: Thermal shock tester, LCR Meter & OHM Meter</td></tr>
<tr><td>ESD</td><td>a. Appearance: No damage.</td><td>a. Sample Size: 15pcs<br>b. Equipment: microscope<br> 
</td></tr>
</table>

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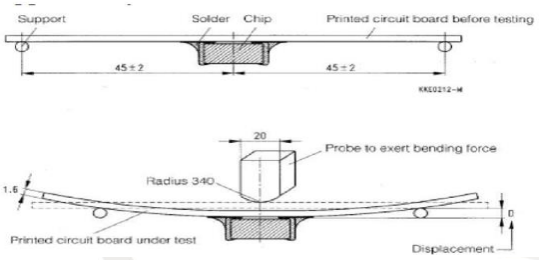
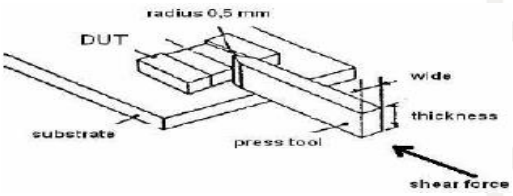
# Table 1- Reliability Test Standard (Automotive) – Cont'd

| Test | Failure Criteria | Test Condition |
|---|---|---|
| Solderability | a. Appearance: More than 95% of the terminal electrode shall be covered with solder. | a. Sample Size: 15pcs<br>b. Method B:<br>1. Baking： 155±5℃ 4 Hours；<br>2. Soldering Temp: 235±5℃;<br>3. Soldering Time: 5 + 0/-0.5S;<br>4. Depth: completely cover the termination.<br><br>c. Method D:<br>1. Steam aging: (93±3℃, 8 hours±15 min)<br>2. Soldering Temp: 260±5℃<br>3. Soldering Time: 30 + 0/-0.5 sec<br>4. Depth: completely cover the termination.<br><br>Remarks：<br>• Perform soldering until solder is formed on the terminations.<br>• All terminations shall have visible solder residues.<br><br>d. Equipment: Solder Pot & 50X CCD |
| Electrical Characteristics | a. Follow datasheet | a. Sample Size: 30pcs / lot<br>b. Lots: 3 lots<br>c. Equipment: LCR Meter & OHM Meter<br>d. Record min, max, mean and standard deviation of electrical characteristics. |
| Flammability | a. Not required electrical test | a. Sample Size: 30pcs<br>b. V-0 or V-1 are acceptable. |

# Table 1- Reliability Test Standard (Automotive) – Cont'd

| Test | Failure Criteria | Test Condition |
|---|---|---|
| Board Flex | a. Appearance: No damage. | a. Pre-condition: Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 30pcs)<br><br>b. Place the component (facing down) on the 100mm X 40mm board.<br><br>c. Apply force to bend the board until D, 2mm min for 60 + 5 sec for 1 time.<br>  <br>d. Equipment: Microscope |
| Terminal Strength (SMD) | a. Appearance: No damage. | a. Pre-condition: Run through IR reflow for 2 times. (IPC/JEDEC J-STD-020D Classification Reflow Profile) (Sample Size: 30pcs)<br><br>b. Apply 17.7 N (1.8 Kg) force gradually to the side of PCBA device for 60 +1 secs without apply shock to the component.<br>  <br>c. Equipment: Microscope |

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Section B

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3. Wireless Charging
4. Toroidal Choke Coil

➔ Table 2 (Automotive)

# Table 2- Reliability Test Standard (Automotive)

| Test | Failure Criteria | Test Condition |
|---|---|---|
| High Temperature Exposure (Storage) (AEC-Q200) | a. MIL-STD-202<br>b. Method 108 | a. Sample Size: 77pcs<br><br>b. 1000 hrs. at rated operating temperature (e.g. part can be stored for 1000 hrs. @ 125°C, 105°C and 85°C.)<br><br>c. Measured the electrical characteristic within 24±2 hrs after the test.<br><br>*The actual test temperature follow customer requirements. |
| Temperature Cycling (AEC-Q200) | a. JESD22 Method<br>b. JA-104 | a. Sample Size: 77pcs<br>b. Method:<br>1. -40 ± 2℃ 30mins Min.<br>2. Transition time, 1min Max.<br>3. 125℃ ± 2℃ 30min Min.<br>4. Transition time, 1min Max.<br>5. Number of cycles： 1000 |
| Biased Humidity (AEC-Q200) | a. MIL-STD-202<br>b. Method 103 | a. Sample Size: 77pcs<br>b. Humidity: 85 ± 3% RH<br>c. Temperature: 85℃± 2℃<br>d. Duration: 1000 hours |
| Appearance | a. MIL-STD-883<br>b. Method 2009 | a. Sample Size: All submitted qty<br>b. Inspect equipment, marking and workmanship<br>c. not required electrical test |
| Dimension | a. JESD22 Method<br>b. JB-100 | a. Sample Size: All submitted qty<br>b. Verify dimension<br>c. not required electrical test of user and manufacturer. |
| Resistance to Solvents (AEC-Q200) | a. MIL-STD-202<br>b. Method 215 | a. Sample Size: 5pcs<br>b. Immerse in solvent, 3+0.5/-0 mins at 25±5℃. Brush 10 times by using toothbrush, repeat 3 times and rinse with water, dry by air blow. |

## Table 2- Reliability Test Standard (Automotive) – Cont'd

| Test | Failure Criteria | Test Condition |
|---|---|---|
| Vibration Test (Component) | a. MIL-STD-202<br>b. Method 204 | a. Sample Size: 30pcs<br>b. Frequency range: 10 Hz - 2000 Hz -10 Hz for 20 minutes (1 cycle)<br>c. 12 cycles for each orientation and a total of 12 hours<br>d. Maximum acceleration (m / s2): 5G, No-load Amplitude range: 1.52mm |
| Solderability | a. Appearance: More than 95% of the terminal electrode shall be covered with solder. (J-STD-002) | a. Sample Size: 15pcs<br>b. Method:<br>1. Steam aging: (93±3℃, 16 hours±30 min)<br>2. Soldering Temp: 245±5℃<br>3. Soldering Time: 5 + 0/-0.5 sec |
| Electrical Characteristics | a. Follow datasheet | a. Sample Size: All submitted qty<br>b. Record min, max, mean and standard deviation of electrical characteristics as per lot and sampling size requirements. |
| Pre & Post Stress Electrical Test | a. Follow datasheet | a. Test is performed at 25±5°C except applicable stress reference and the additional requirements |
| Drop Test (Packaging) | a. ASTM D5276 – 98 | a. Use drop tester to drop the part in carton box from 1m height.<br>b. Test sequence: Corner, three sides, six surfaces. |
| Salt spray test | a. GB2423.17-2008 | a. Salt water (5% NaCl) solution<br>b. PH value 6.6-7.2<br>c. Temperature 35±3℃<br>d. Humidity: 95-98% RH<br>e. Duration: 24Hrs |

For other products not in the list, we shall handle it on a case-by-case basis.

➔ Please consult the Engineering/Quality Managerial teams for applicable reliability test requirements.

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