

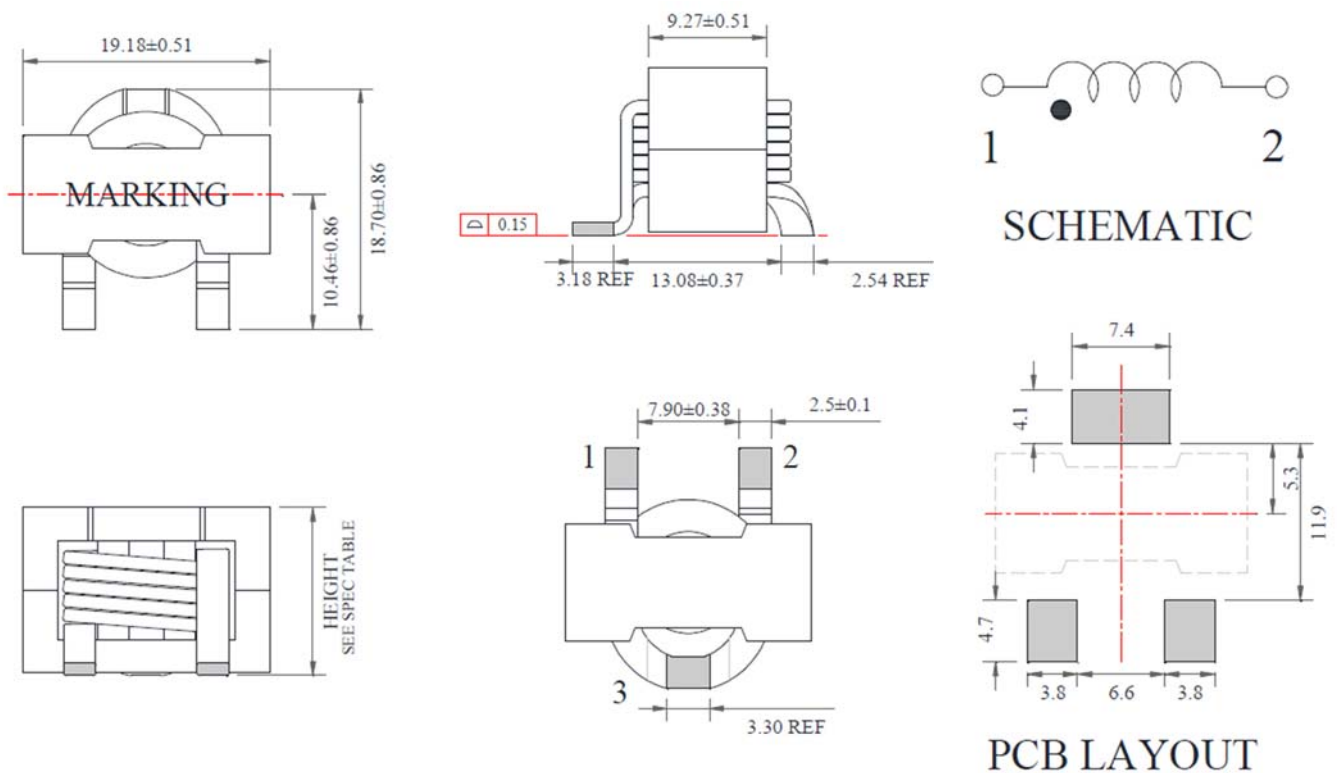
FEATURES

- Susing flat wire, and SMD type.
- Low radiation noise by magnetically shielded construction
- High current, Low resistance.
- Operating temperature : $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$.

APPLICATIONS

- high efficiency DC/DC converters.
- Single and polyphase buck converters.
- Filter for audio applications.
- Optimized for high current boost applications.

CONFIGURATIONS & DIMENSIONS (unit in mm)



| Type | Height(mm) Max. | Weight(g) |
|----------|-----------------|-------------|
| HAPR2009 | 8.64 | 6.65~6.89 |
| HAPR2010 | 9.40 | 7.46~7.90 |
| HAPR2011 | 10.67 | 8.63~9.08 |
| HAPR2012 | 11.94 | 9.92~10.30 |
| HAPR2013 | 12.95 | 10.80~11.40 |
| HAPR2014 | 13.97 | 11.70~12.40 |

CAUTION:

Terminal 3 is provided for mounting stability only. This terminal is connected to the winding of the inductor and must not be connected to ground or any circuitry.

ELECTRICAL CHARACTERISTICS

| Part number | Inductance μH | DC resistance mΩ max. (typ.) | DC saturation current A max.(typ.) | | | Temperature rise current A max.(typ.) | |
|---------------|------------------|---------------------------------|---------------------------------------|----------|----------|---|---------|
| | | | ΔL≤10% | ΔL≤20% | ΔL≤30% | ΔT≤20°C | ΔT≤40°C |
| | | | | | | | |
| HAPR2009-301M | 0.3±20% | 0.74(0.63) | 100 | >100 | >100 | 41 | 54 |
| HAPR2010-301M | 0.3±20% | 1.00(0.9) | >100 | >100 | >100 | 36 | 45 |
| HAPR2009-501M | 0.5±20% | 0.74(0.63) | 60(66) | 72(77) | 78(83) | 41 | 54 |
| HAPR2010-501M | 0.5±20% | 1.00(0.9) | 81(88) | 87(94) | 92(97) | 36 | 45 |
| HAPR2011-501M | 0.5±20% | 1.34(1.2) | 100 | >100 | >100 | 30 | 40 |
| HAPR2009-601M | 0.6±20% | 0.74(0.63) | 49(55) | 60(67) | 63(70) | 41 | 54 |
| HAPR2010-601M | 0.6±20% | 1.00(0.9) | 70(76) | 75(82) | 78(86) | 36 | 45 |
| HAPR2011-601M | 0.6±20% | 1.34(1.2) | 90(97) | 100 | >100 | 30 | 40 |
| HAPR2012-601M | 0.6±20% | 1.60(1.4) | 97(>100) | >100 | >100 | 25 | 35 |
| HAPR2009-681M | 0.68±20% | 0.74(0.63) | 45(50) | 53(57) | 55(62) | 41 | 54 |
| HAPR2010-681M | 0.68±20% | 1.00(0.9) | 62(67) | 68(74) | 72(76) | 36 | 45 |
| HAPR2011-681M | 0.68±20% | 1.34(1.2) | 78(85) | 86(93) | 90(97) | 30 | 40 |
| HAPR2012-681M | 0.68±20% | 1.60(1.4) | 85(94) | 95(100) | 98(>100) | 25 | 35 |
| HAPR2013-681M | 0.68±20% | 1.82(1.7) | 98(>100) | >100 | >100 | 23 | 30 |
| HAPR2009-801M | 0.8±20% | 0.74(0.63) | 38(42) | 43(47) | 45(49) | 41 | 54 |
| HAPR2010-801M | 0.8±20% | 1.00(0.9) | 53(58) | 59(64) | 64(68) | 36 | 45 |
| HAPR2011-801M | 0.8±20% | 1.34(1.2) | 70(77) | 78(85) | 85(91) | 30 | 40 |
| HAPR2012-801M | 0.8±20% | 1.60(1.4) | 75(82) | 83(89) | 88(94) | 25 | 35 |
| HAPR2013-801M | 0.8±20% | 1.82(1.7) | 85(93) | 94(100) | 98(>100) | 23 | 30 |
| HAPR2014-801M | 0.8±20% | 2.15(1.9) | 98(>100) | >100 | >100 | 21 | 27 |
| HAPR2009-901M | 0.9±20% | 0.74(0.63) | 33(37) | 40(46) | 43(49) | 41 | 54 |
| HAPR2010-901M | 0.9±20% | 1.00(0.9) | 48(54) | 55(61) | 60(65) | 36 | 45 |
| HAPR2011-901M | 0.9±20% | 1.34(1.2) | 62(68) | 68(73) | 72(77) | 30 | 40 |
| HAPR2012-901M | 0.9±20% | 1.60(1.4) | 69(76) | 75(81) | 80(86) | 25 | 35 |
| HAPR2013-901M | 0.9±20% | 1.82(1.7) | 73(80) | 80(86) | 85(91) | 23 | 30 |
| HAPR2014-901M | 0.9±20% | 2.15(1.9) | 87(96) | 95(>100) | >100 | 21 | 27 |
| HAPR2009-102M | 1.0±20% | 0.74(0.63) | 29(34) | 37(41) | 40(44) | 41 | 54 |
| HAPR2010-102M | 1.0±20% | 1.00(0.9) | 42(47) | 48(53) | 52(57) | 36 | 45 |
| HAPR2011-102M | 1.0±20% | 1.34(1.2) | 56(62) | 62(69) | 66(73) | 30 | 40 |
| HAPR2012-102M | 1.0±20% | 1.60(1.4) | 64(70) | 70(75) | 75(79) | 25 | 35 |
| HAPR2013-102M | 1.0±20% | 1.82(1.7) | 68(75) | 75(81) | 80(86) | 23 | 30 |
| HAPR2014-102M | 1.0±20% | 2.15(1.9) | 70(76) | 77(84) | 82(88) | 21 | 27 |

| | | | | | | | |
|---------------|---------|------------|--------|--------|--------|----|----|
| HAPR2009-122M | 1.2±20% | 0.74(0.63) | 28(33) | 36(40) | 38(43) | 41 | 54 |
| HAPR2010-122M | 1.2±20% | 1.00(0.9) | 37(41) | 40(45) | 43(48) | 36 | 45 |
| HAPR2011-122M | 1.2±20% | 1.34(1.2) | 49(55) | 54(59) | 57(62) | 30 | 40 |
| HAPR2012-122M | 1.2±20% | 1.60(1.4) | 54(59) | 60(66) | 65(71) | 25 | 35 |
| HAPR2013-122M | 1.2±20% | 1.82(1.7) | 58(65) | 63(70) | 68(74) | 23 | 30 |
| HAPR2014-122M | 1.2±20% | 2.15(1.9) | 63(71) | 72(77) | 76(83) | 21 | 27 |
| HAPR2009-202K | 2.0±10% | 0.74(0.63) | 16(19) | 23(27) | 26(31) | 41 | 54 |
| HAPR2010-202K | 2.0±10% | 1.00(0.9) | 27(32) | 32(37) | 35(42) | 36 | 45 |
| HAPR2011-202K | 2.0±10% | 1.34(1.2) | 37(42) | 43(48) | 47(53) | 30 | 40 |
| HAPR2012-202K | 2.0±10% | 1.60(1.4) | 38(43) | 41(49) | 45(54) | 25 | 35 |
| HAPR2013-202K | 2.0±10% | 1.82(1.7) | 40(47) | 48(54) | 53(59) | 23 | 30 |
| HAPR2014-202K | 2.0±10% | 2.15(1.9) | 45(54) | 52(59) | 57(63) | 21 | 27 |
| HAPR2013-362K | 3.6±10% | 1.82(1.7) | 25(29) | 30(34) | 33(37) | 23 | 30 |
| HAPR2013-402K | 4.0±10% | 1.82(1.7) | 20(24) | 25(30) | 27(33) | 23 | 30 |
| HAPR2014-402K | 4.0±10% | 2.15(1.9) | 25(30) | 30(36) | 34(39) | 21 | 27 |
| HAPR2013-472K | 4.7±10% | 1.82(1.7) | 18(22) | 24(28) | 28(34) | 23 | 30 |

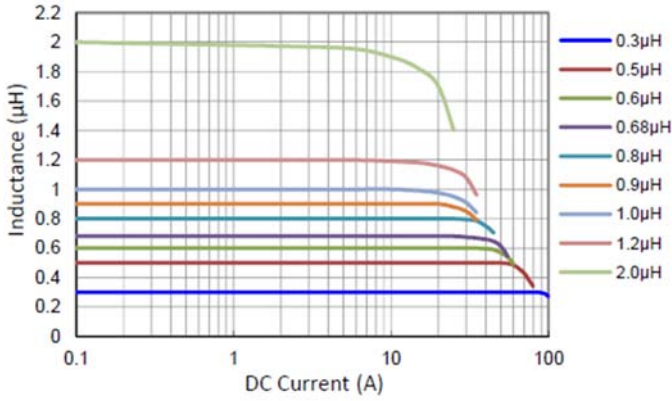
Remark

Inductance is measured with a LCR meter 4284A or equivalent. Test frequency at 100kHz

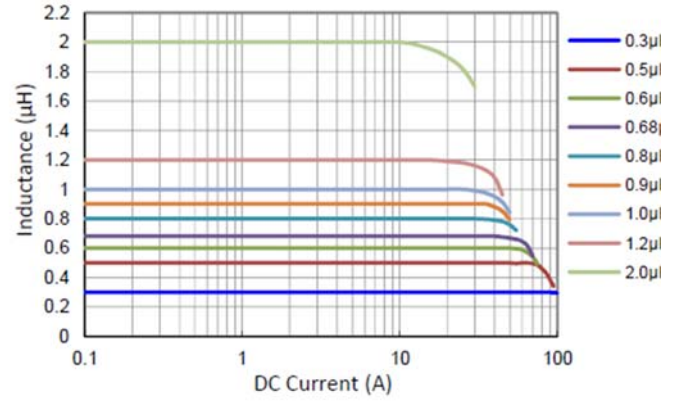
DC resistance is measured with 16502 Milliohm Meter , or equivalent. Reference ambient temperature 25°C

Electrical Characteristic Curve

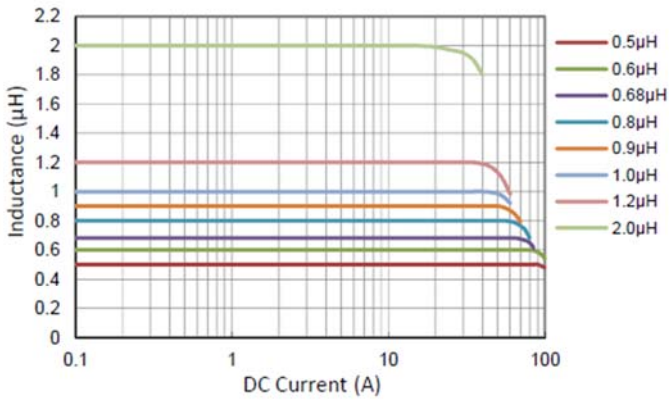
HAPR2009



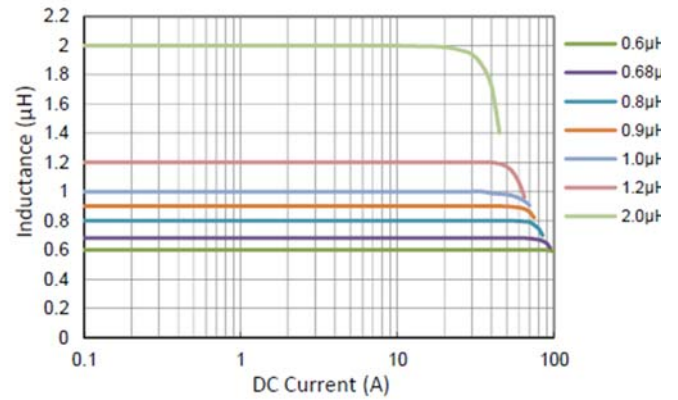
HAPR2010



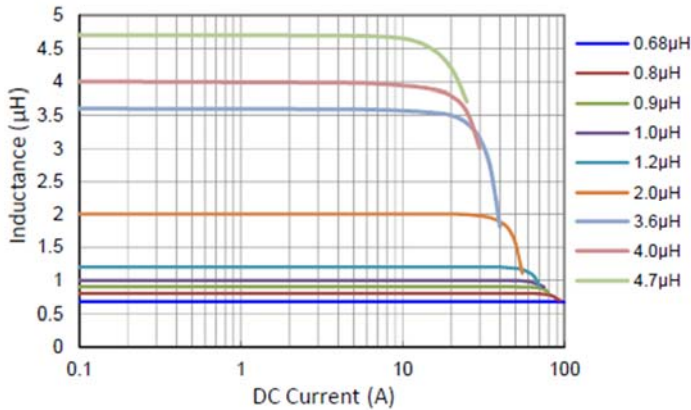
HAPR2011



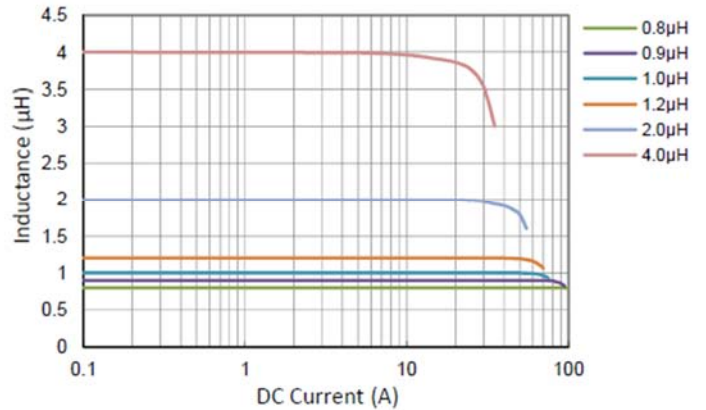
HAPR2012

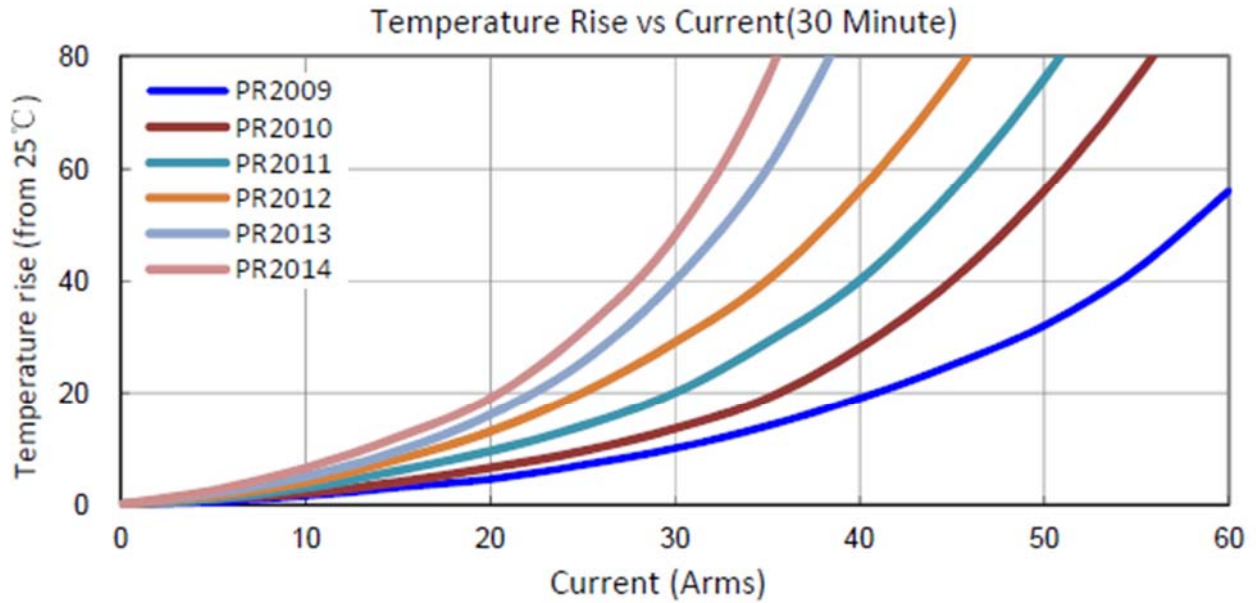


HAPR2013



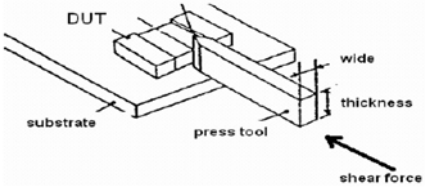
HAPR2014





Reliability and Test Condition

| Item | Performance | Test Condition |
|------------------------------------|---|--|
| Operating temperature | -40~+125°C (Including self - temperature rise) | |
| Storage temperature | 1. -10~+40°C,50~60%RH (Product with taping) 2. -40~+125°C (on board) | |
| Electrical Performance Test | | |
| Inductance | Refer to standard electrical characteristics list. | HP4284A,CH11025,CH3302,CH1320,CH1320S LCR Meter. |
| DCR | | CH16502,Agilent33420A Micro-Ohm Meter. |
| Saturation Current (Isat) | Approximately $\Delta L30\%$ | Saturation DC Current (Isat) will cause L0 to drop $\Delta L(\%)$ |
| Heat Rated Current (Irms) | Approximately $\Delta T40^\circ\text{C}$ | Heat Rated Current (Irms) will cause the coil temperature rise $\Delta T(^\circ\text{C})$. 1.Applied the allowed DC current 2.Temperature measured by digital surface thermometer |
| Reliability Test | | |
| Life Test | Appearance : No damage. | Preconditioning: Run through IR reflow for 2 times.(IPC/JEDEC J-STD-020DClassification Reflow Profiles) Temperature : 125 \pm 2°C (Inductor) Applied current : rated current Duration : 1000 \pm 12hrs Measured at room temperature after placing for 24 \pm 2 hrs |
| Load Humidity | Inductance : within $\pm 10\%$ of initial value Q : Shall not exceed the specification value. RDC : within $\pm 15\%$ of initial value and shall not exceed the specification value | Preconditioning: Run through IR reflow for 2 times.(IPC/JEDEC J-STD-020DClassification Reflow Profiles) Humidity : 85 $\pm 2\%$ R.H. Temperature : 85°C $\pm 2^\circ\text{C}$ Duration : 1000hrs Min. with 100% rated current Measured at room temperature after placing for 24 \pm 2 hrs |

| Moisture Resistance | | <p>Preconditioning: Run through IR reflow for 2 times.(IPC/JEDEC J-STD-020DClassification Reflow Profiles</p> <ol style="list-style-type: none"> 1. Baked at 50°C for 25hrs, measured at room temperature after placing for 4 hrs. 2. Raise temperature to 65±2°C 90-100%RH in 2.5hrs, and keep 3 hours, cool down to 25°C in 2.5hrs. 3. Raise temperature to 65±2°C 90-100%RH in 2.5hrs, and keep 3 hours, cool down to 25°C in 2.5hrs,keep at 25°C for 2 hrs then keep at -10°C for 3 hrs 4. Keep at 25°C 80-100%RH for 15min and vibrate at the frequency of 10 to 55 Hz to 10 Hz, measure at room temperature after placing for 1~2 hrs. | | | | | | | | | | | | | | | |
|------------------------------|---|---|-----------------------|----------------------------|--|-----------------------|----------------------------|-------|----------------|----|-----------|------|------|----|----|-----------|------|
| Thermal shock | | <p>Preconditioning: Run through IR reflow for 2 times.(IPC/JEDEC J-STD-020DClassification Reflow Profiles Condition for 1 cycle</p> <p>Step1 : -40±2°C 30±5min</p> <p>Step2 : 25±2°C ≤0.5min</p> <p>Step3 : 125±2°C 30±5min</p> <p>Number of cycles : 500</p> <p>Measured at room temperature after placing for 24±2 hrs</p> | | | | | | | | | | | | | | | |
| Vibration | | <p>Oscillation Frequency: 10 ~ 2K ~ 10Hz for 20 minutes</p> <p>Equipment : Vibration checker</p> <p>Total Amplitude:1.52mm±10%</p> <p>Testing Time : 12 hours(20 minutes, 12 cycles each of 3 orientations).</p> | | | | | | | | | | | | | | | |
| Bending | | <p>Shall be mounted on a FR4 substrate of the following dimensions: >=0805 inch(2012mm):40x100x1.2mm <0805 inch(2012mm):40x100x0.8mm</p> <p>Bending depth: >=0805 inch(2012mm):1.2mm <0805 inch(2012mm):0.8mm</p> <p>duration of 10 sec.</p> | | | | | | | | | | | | | | | |
| Shock | <p>Appearance : No damage.</p> <p>Impedance : within±15% of initial value</p> <p>Inductance : within±10% of initial value</p> <p>Q : Shall not exceed the specification value.</p> <p>RDC : within ±15% of initial value and shall not exceed the specification value</p> | <table border="1"> <thead> <tr> <th>Type</th> <th>Peak value (g's)</th> <th>Normal duration (D) (ms)</th> <th>Wave form</th> <th>Velocity change (Vi)ft/sec</th> </tr> </thead> <tbody> <tr> <td>SMD</td> <td>50</td> <td>11</td> <td>Half-sine</td> <td>11.3</td> </tr> <tr> <td>Lead</td> <td>50</td> <td>11</td> <td>Half-sine</td> <td>11.3</td> </tr> </tbody> </table> | Type | Peak value (g's) | Normal duration (D) (ms) | Wave form | Velocity change (Vi)ft/sec | SMD | 50 | 11 | Half-sine | 11.3 | Lead | 50 | 11 | Half-sine | 11.3 |
| Type | Peak value (g's) | Normal duration (D) (ms) | Wave form | Velocity change (Vi)ft/sec | | | | | | | | | | | | | |
| SMD | 50 | 11 | Half-sine | 11.3 | | | | | | | | | | | | | |
| Lead | 50 | 11 | Half-sine | 11.3 | | | | | | | | | | | | | |
| Solder ability | <p>More than 95% of the terminal electrode should be covered with solder.</p> | <p>Preheat: 150°C,60sec.◦</p> <p>Solder: Sn96.5% Ag3% Cu0.5%</p> <p>Temperature: 245±5°C ◦</p> <p>Flux for lead free: Rosin. 9.5% ◦</p> <p>Dip time: 4±1sec ◦</p> <p>Depth: completely cover the termination</p> | | | | | | | | | | | | | | | |
| Resistance to Soldering Heat | | <p>Depth: completely cover the termination</p> <table border="1"> <thead> <tr> <th>Temperature(°C)</th> <th>Time(s)</th> <th>Temperature ramp/immersion and emersion rate</th> <th>Number of heat cycles</th> </tr> </thead> <tbody> <tr> <td>260 ±5 (solder temp)</td> <td>10 ±1</td> <td>25mm/s ±6 mm/s</td> <td>1</td> </tr> </tbody> </table> | Temperature(°C) | Time(s) | Temperature ramp/immersion and emersion rate | Number of heat cycles | 260 ±5 (solder temp) | 10 ±1 | 25mm/s ±6 mm/s | 1 | | | | | | | |
| Temperature(°C) | Time(s) | Temperature ramp/immersion and emersion rate | Number of heat cycles | | | | | | | | | | | | | | |
| 260 ±5 (solder temp) | 10 ±1 | 25mm/s ±6 mm/s | 1 | | | | | | | | | | | | | | |
| Terminal Strength | <p>Appearance : No damage.</p> <p>Impedance : within±15% of initial value</p> <p>Inductance : within±10% of initial value</p> <p>Q : Shall not exceed the specification value.</p> <p>RDC : within ±15% of initial value and shall not exceed the specification value e</p> | <p>Preconditioning: Run through IR reflow for 2 times.(IPC/JEDEC J-STD-020DClassification Reflow Profiles</p> <p>With the component mounted on a PCB with the device to be tested, apply a force(>0805:1kg , <=0805:0.5kg)to the side of a device being tested. This force shall be applied for 60 +1 seconds. Also the force shall be applied gradually as not to apply a shock to the component being tested.</p>  | | | | | | | | | | | | | | | |

Note : When there are questions concerning measurement result : measurement shall be made after 48 ± 2 hours of recovery under the standard condition.