

# Wire-wound Ferrite Bead Inductors for Power Lines LAMG series for Automotive Powertrain and Safety

## ■ RELIABILITY DATA

### 1. Operating Temperature Range

Specified Value       $-40^{\circ}\text{C} \sim +150^{\circ}\text{C}$  (Including self-generated heat)

Test Methods and Remarks      Including self-generated heat

### 2. Storage Temperature Range

Specified Value       $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$

Test Methods and Remarks      \*Note:  $-5$  to  $+40^{\circ}\text{C}$  in taped packaging

### 3. Impedance

Specified Value      Within the specified range

Test Methods and Remarks      Measuring equipment : Impedance analyzer (E4991) or its equivalent  
Measuring frequency :  $100 \pm 1$  MHz

### 4. DC Resistance

Specified Value      Within the specified range

Test Methods and Remarks      Four-terminal method  
Measuring equipment : Milliohm High-Tester 3226 (Hioki Denki) or its equivalent

### 5. Rated Current

Specified Value      Within the specified range

### 6. Vibration

Specified Value      Appearance : No significant abnormality  
Impedance change : Within  $\pm 30\%$  of the initial value

Test Methods and Remarks      AEC-Q200 Test No.14 qualified (MIL-STD-202 Method 204)  
The test samples shall be soldered to the test board by the reflow.  
Then it shall be submitted to below test conditions.

|                 |                                   |   |
|-----------------|-----------------------------------|---|
| Frequency Range | 10~2000Hz                         |   |
| Total Amplitude | 5G                                |   |
| Sweeping Method | 10Hz to 2000Hz to 10Hz for 20min. |   |
| Number of cycle | X                                 | For 12 cycles on each X, Y, and Z axis. |
|                 | Y                                 |   |
|                 | Z                                 |   |

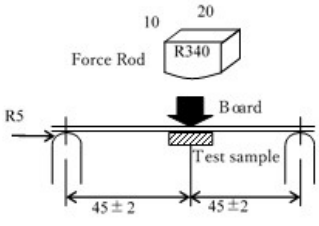
### 7. Mechanical Shock

Specified Value      Appearance : No significant abnormality  
Impedance change : Within  $\pm 30\%$  of the initial value

Test Methods and Remarks      AEC-Q200 Test No.13qualified (MIL-STD-202 Method213)  
The test samples shall be soldered to the test board by the reflow.  
Then it shall be submitted to below test conditions.

|                |                              |
|----------------|------------------------------|
| Acceleration   | 981m/s <sup>2</sup>          |
| Duration       | 6msec(Half sine pulse)       |
| Direction      | +X, +Y, +Z, -X, -Y, -Z       |
| Number of time | Each 3 times, Total 18 times |

|   |   |                               |                  |
|---|---|-------------------------------|------------------|
| 8. Solderability                          |   |                               |                  |
| Specified Value                           | 90% or more of immersed surface of terminal electrode shall be covered with fresh solder.   |                               |                  |
| Test Methods and Remarks                  | AEC-Q200 Test No.18qualified (J-STD-002)  |                               |                  |
|   |   | (a) Method B                  | (c) Method D     |
|   | Preconditioning   | 155°C 4hrs                    | Steam 8hrs±15min |
|   | Solder Temperature  | 235±5°C                       | 260±5°C          |
|   | Time  | 5+0/-0.5 sec                  | 30+0/-0.5 sec.   |
| 9. Resistance to Soldering Heat           |   |                               |                  |
| Specified Value                           | Appearance : No significant abnormality<br>Impedance change : Within ±30% of the initial value  |                               |                  |
| Test Methods and Remarks                  | AEC-Q200 Test No.15 qualified (MIL-STD-202 Method210)<br>Condition:K<br>The test sample shall be exposed to reflow oven at 183°C for 90-120 seconds, with peak temperature at 250±5°C for 30±5 seconds, 3 times.  |                               |                  |
| 10. Thermal Shock                         |   |                               |                  |
| Specified Value                           | Appearance : No significant abnormality<br>Impedance change : Within±50% of the initial value   |                               |                  |
| Test Methods and Remarks                  | AEC-Q200 Test No.04 qualified (JESD22 Method JA-104)<br>The test samples shall be soldered to the test board by the reflow. The test samples shall be placed at specified temperature for specified time by following condition.  |                               |                  |
|   | 1Cycle  | -40±3°C/30 min⇄150±3°C/30 min |                  |
|   | Number of cycle   | 1000 cycles                   |                  |
|   |   |                               |                  |
| 11. Resistance to Humidity (steady state) |   |                               |                  |
| Specified Value                           | Appearances : No significant abnormality<br>Impedance change : Within ±50% of the initial value   |                               |                  |
| Test Methods and Remarks                  | AEC-Q200 Test No.07 qualified (MIL-STD-202 Method 103)<br>The test samples shall be soldered to the test board by the reflow.<br>The test samples shall be placed in thermostatic oven set at specified temperature and humidity as shown in below table.                             |                               |                  |
|   | Temperature   | 85±2°C                        |                  |
|   | Humidity  | 85%RH                         |                  |
|   | Time  | 1000+24/-0 hour               |                  |
|   |   |                               |                  |
| 12. High Temperature Exposure             |   |                               |                  |
| Specified Value                           | Appearances : No significant abnormality<br>Impedance change : Within ±50% of the initial value   |                               |                  |
| Test Methods and Remarks                  | AEC-Q200 Test No.03 qualified (MIL-STD-202 Method 108)<br>The test samples shall be soldered to the test board by the reflow soldering.<br>The test samples shall be placed in thermostatic oven set at specified temperature as shown in below table.                                |                               |                  |
|   | Temperature   | 150±3°C                       |                  |
|   | Time  | 1000+24/-0 hour               |                  |
|   |   |                               |                  |
| 13. High Temperature Loading Test         |   |                               |                  |
| Specified Value                           | Appearance No ignificant abnormality<br>Impedance change Within ±50% of the initial value   |                               |                  |
| Test Methods and Remarks                  | AEC-Q200 Test No.08 qualified (MIL-PRF-27)<br>The test samples shall be soldered to the test board by the reflow soldering.<br>The test samples shall be placed in thermostatic oven set at specified temperature and applied the rated current continuously as shown in below table. |                               |                  |
|   | Temperature   | 125±3°C                       |                  |
|   | Applied current   | Rated current                 |                  |
|   | Time  | 1000+24/-0 hour               |                  |
|   |   |                               |                  |

| 14. Bending Strength     |  |
|--------------------------|--|
| Specified Value          | Appearance : No mechanical damage.   |
| Test Methods and Remarks | <p>AEC-Q200 Test No.21 qualified (AEC-Q200-005)</p> <p>The test samples shall be soldered to the test board by the reflow. As illustrated below, apply force in the direction of the arrow indicating until deflection of the test board reaches to 2 mm for 60 s.</p> <p>Test board size : 100 × 40 × 1.6</p> <p>Test board material : glass epoxy-resin</p>  |

| 15. Adhesion of Electrode |   |
|---------------------------|---|
| Specified Value           | Impedance change : Within $\pm 30\%$ of the initial value   |
| Test Methods and Remarks  | <p>AEC-Q200 Test No.22 qualified (AEC-Q200-006)</p> <p>The test samples shall be soldered to the test board by the reflow soldering.</p> <p>Applied force : 10N</p> <p>Duration : 60 sec.</p> |

Note on standard condition: "standard condition" referred to herein is defined as follows:

5 to 35°C of temperature, 45 to 85% relative humidity and 86 to 106kPa of air pressure.

When there are questions concerning measurement results:

In order to provide correlation data, the test shall be conducted under condition of  $20 \pm 2^\circ\text{C}$  of temperature, 60 to 70% relative humidity and 86 to 106kPa of air pressure. Unless otherwise specified, all the tests are conducted under the "standard condition."