CHIP COIL (CHIP INDUCTORS) LQM18PH□□□□FRL
Murata Standard Reference Specification[AEC-Q200]

1. Scope
This reference specification applies to LQM18PH_FR series for Automotive Electronics based on AEC-Q200

2. Part Numbering
(ex.)

| Product ID | Structure | Dimension (L × W) | Applications and Characteristics | L | M | 18 | P | H | R | 22 | M | F | R | L |
|------------|-----------|-------------------|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| LQM18PH    | FR        |                   |                                 |   |   |   |   |   |   |   |   |   |   |   |   |

3. Rating

- Operating Temperature Range: –55°C to +150°C
- Storage Temperature Range: –55°C to +150°C

<table>
<thead>
<tr>
<th>Customer Part Number</th>
<th>MURATA Part Number</th>
<th>Inductance (μH)</th>
<th>Tolerance</th>
<th>DC Resistance (Ω)</th>
<th>(Typ.)</th>
<th>Max</th>
<th>Self Resonant Frequency (MHz min.)</th>
<th>Rated Current (mA)</th>
<th>ESD Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>LQM18PHR22MFRL</td>
<td>0.22</td>
<td>±20%</td>
<td>0.11</td>
<td>0.138</td>
<td>100</td>
<td>1500</td>
<td>1250 850 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LQM18PHR47MFRL</td>
<td>0.47</td>
<td>±20%</td>
<td>0.15</td>
<td>0.188</td>
<td>100</td>
<td>1200</td>
<td>1100 730 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LQM18PH1R0MFRL</td>
<td>1.0</td>
<td>±20%</td>
<td>0.20</td>
<td>0.250</td>
<td>100</td>
<td>360</td>
<td>950 630 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LQM18PH1R5MFRL</td>
<td>1.5</td>
<td>±20%</td>
<td>0.23</td>
<td>0.288</td>
<td>100</td>
<td>240</td>
<td>800 570 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LQM18PH2R2MFRL</td>
<td>2.2</td>
<td>±20%</td>
<td>0.30</td>
<td>0.375</td>
<td>70</td>
<td>150</td>
<td>750 500 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LQM18PH3R3MFRL</td>
<td>3.3</td>
<td>±20%</td>
<td>0.35</td>
<td>0.438</td>
<td>60</td>
<td>80</td>
<td>700 470 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LQM18PH4R7MFRL</td>
<td>4.7</td>
<td>±20%</td>
<td>0.44</td>
<td>0.550</td>
<td>40</td>
<td>70</td>
<td>620 420 10</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

*1: When applied Rated current to the Products, Inductance will be within ±30% of initial inductance value range.
*2: When applied Rated current to the Products, temperature rise caused by self-generated heat shall be limited to 40°C max.
*3: As for the Rated current marked with *3, Rated Current is derated as below figure depending on the operating temperature.

4. Testing Conditions

| Temperature: Ordinary Temperature / 15°C to 35°C | Temperature: 20°C ± 2°C |
| Humidity: Ordinary Humidity / 25%(RH) to 85%(RH) | Humidity: 60%(RH) to 70%(RH) |
| Atmospheric Pressure: 86kPa to 106kPa | |

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5. Appearance and Dimensions

- Unit Mass (Typical value)
  0.005g

- Marking
  No marking.

6. Electrical Performance

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specification</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Inductance</td>
<td>Inductance shall meet item 3.</td>
<td>Measuring Equipment: KEYSIGHT 4294A or equivalent (1mA) Measuring Frequency: 1MHz</td>
</tr>
<tr>
<td>6.2</td>
<td>DC Resistance</td>
<td>DC Resistance shall meet item 3.</td>
<td>Measuring Equipment: Digital multi meter Digital multi meter (TR6846 or equivalent) DC resistance shall be measured after putting chip coil between the terminal 2 under the condition of opening between a and b. Every measurement the terminal 1 shall be shorted between a and b when changing chip coil.</td>
</tr>
<tr>
<td>6.3</td>
<td>Self Resonant Frequency (S.R.F)</td>
<td>S.R.F shall meet item 3.</td>
<td>Measuring Equipment: KEYSIGHT 4294A or equivalent</td>
</tr>
</tbody>
</table>

7. AEC-Q200 Requirement

7.1 Performance (based on Table 5 for Magnetics(Inductors / Transformer) AEC-Q200 Rev.D issued June. 1 2010

<table>
<thead>
<tr>
<th>No.</th>
<th>Stress</th>
<th>Test Method</th>
<th>Murata Specification / Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>High Temperature Exposure</td>
<td>1000hours at 150 deg C Set for 24hours at room temperature, then measured.</td>
<td>Meet Table A after testing. Table A Appearance No damage Inductance Change (at 1MHz) Within ±50%</td>
</tr>
<tr>
<td>4</td>
<td>Temperature Cycling</td>
<td>1000cycles -55 deg C to + 150 deg C Set for 24hours at room temperature,then measured.</td>
<td>Meet Table A after testing.</td>
</tr>
</tbody>
</table>

MURATA MFG.CO., LTD.
### AEC-Q200 Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Stress</th>
<th>Test Method</th>
<th>Murata Specification / Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Biased Humidity</td>
<td>1000hours at 85 deg C, 85%RH unpowered...</td>
<td>Meet Table A after testing.</td>
</tr>
<tr>
<td>8</td>
<td>Operational Life</td>
<td>Apply 150 deg C 1000 hours Set for 24hours at room temperature, then measured</td>
<td>Meet Table A after testing.</td>
</tr>
<tr>
<td>9</td>
<td>External Visual</td>
<td>Visual inspection</td>
<td>No abnormalities</td>
</tr>
<tr>
<td>10</td>
<td>Physical Dimension</td>
<td>Meet ITEM 5 (Style and Dimensions)</td>
<td>No defects</td>
</tr>
<tr>
<td>12</td>
<td>Resistance to Solvents</td>
<td>Per MIL-STD-202 Method 215</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>13</td>
<td>Mechanical Shock</td>
<td>Per MIL-STD-202 Method 213 100g's/6ms/Half sine</td>
<td>Meet Table A after testing.</td>
</tr>
<tr>
<td>14</td>
<td>Vibration</td>
<td>5g's for 20 minutes, 12cycles each of 3 orientations Test from 10-2000Hz. 12cycles each of 3 orientations</td>
<td>Meet Table A after testing.</td>
</tr>
<tr>
<td>15</td>
<td>Resistance to Soldering Heat</td>
<td>No-heating Solder temperature 260C+/-5 deg C Immersion time 10s</td>
<td>Pre-heating: 150 to 180C /90±30s Meet Table A after testing.</td>
</tr>
<tr>
<td>17</td>
<td>ESD</td>
<td>Per AEC-Q200-002</td>
<td>Meet Item 3 (Rating) No defects</td>
</tr>
<tr>
<td>18</td>
<td>Solderbility</td>
<td>Per J-STD-002</td>
<td>Method B : Not Applicable 95% of the terminations is to be soldered.</td>
</tr>
<tr>
<td>19</td>
<td>Electrical Characterization</td>
<td>Measured : Inductance</td>
<td>No defects</td>
</tr>
<tr>
<td>20</td>
<td>Flammability</td>
<td>Per UL-94</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>21</td>
<td>Board Flex</td>
<td>Epoxy-PCB(1.6mm) Deflection 2mm(min) 60s minimum holding time</td>
<td>Murata deviation request: 30s Meet Table A after testing.</td>
</tr>
<tr>
<td>22</td>
<td>Terminal Strength</td>
<td>Per AEC-Q200-006 A force of 17.7N for 60s</td>
<td>Murata deviation request: 10N for 10s No defect</td>
</tr>
</tbody>
</table>
9. Specification of Packaging

9.1 Appearance and Dimensions of plastic tape (8mm-wide)

Dimension of the Cavity is measured at the bottom side.

9.2 Specification of Taping

(1) Packing quantity (standard quantity)
4,000 pcs / reel

(2) Packing Method
Products shall be packed in the each embossed cavity of plastic tape and sealed by cover tape.

(3) Sprocket hole
The sprocket holes are to the right as the tape is pulled toward the user.

(4) Spliced point
Plastic tape and Cover tape has no spliced point.

(5) Missing components number
Missing components number within 0.1% of the number per reel or 1 pc., whichever is greater, and are not continuous. The Specified quantity per reel is kept.

9.3 Pull Strength

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Pull Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic tape</td>
<td>10N min.</td>
</tr>
<tr>
<td>Cover tape</td>
<td>5N min.</td>
</tr>
</tbody>
</table>

9.4 Peeling off force of cover tape

<table>
<thead>
<tr>
<th>Speed of Peeling off</th>
<th>Peeling off force</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mm / min</td>
<td>Plastic tape: 0.1N to 0.7N (minimum value is typical)</td>
</tr>
</tbody>
</table>

8.5 Dimensions of Leader-tape, Trailer and Reel

There shall be leader-tape (top tape and empty tape) and trailer-tape (empty tape) as follows.
8.6 Marking for reel
Customer part number, MURATA part number, Inspection number (+1), RoHS marking (+2), Quantity etc. ・・・

*1) <Expression of Inspection No.>
(1) Factory Code
(2) Date
   First digit : Year / Last digit of year
   Second digit : Month / Jan. to Sep. → 1 to 9, Oct. to Dec. → O, N, D
   Third, Fourth digit : Day
(3) Serial No.

*2) <Expression of RoHS marking >
(1) RoHS regulation conformity parts.
(2) MURATA classification number

8.7 Marking for Outside package (corrugated paper box)
Customer name, Purchasing order number, Customer part number, MURATA part number, RoHS marking (+2), Quantity, etc. ・・・

8.8. Specification of Outer Case

<table>
<thead>
<tr>
<th>Outer Case Dimensions (mm)</th>
<th>Standard Reel Quantity in Outer Case (Reel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>D</td>
</tr>
</tbody>
</table>

* Above Outer Case size is typical. It depends on a quantity of an order.

9. Caution

9.1 Limitation of Applications
Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

(1) Aircraft equipment  (6) Transportation equipment (trains, ships, etc.)
(2) Aerospace equipment  (7) Traffic signal equipment
(3) Undersea equipment  (8) Disaster prevention / crime prevention equipment
(4) Power plant control equipment  (9) Data-processing equipment
(5) Medical equipment  (10) Applications of similar complexity and/or reliability requirements to the applications listed in the above

9.2 Caution(Rating)
Do not exceed maximum rated current of the product. Thermal stress may be transmitted to the product and short/open circuit of the product or falling off the product may be occurred.

9.3 Fail-safe
Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.

10. Notice
This product is designed for solder mounting.
Please consult us in advance for applying other mounting method such as conductive adhesive.
Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stress like heat cycle, etc. are repeatedly given to them.
The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature can be assumed.
10.1 Land pattern designing

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>1.2</td>
</tr>
<tr>
<td>b</td>
<td>3.0 to 4.0</td>
</tr>
<tr>
<td>c</td>
<td>1.0</td>
</tr>
</tbody>
</table>

(in mm)

10.2 Flux, Solder

- Use rosin-based flux.
  Don’t use highly acidic flux with halide content exceeding 0.2(wt)% (chlorine conversion value).
  Don’t use water-soluble flux.
- Use Sn-3.0Ag-0.5Cu solder.
- Standard thickness of solder paste: 100 μm to 150 μm.

10.3 Flow soldering / Reflow soldering conditions

- Pre-heating should be in such a way that the temperature difference between solder and product surface is limited to 150°C max. Cooling into solvent after soldering also should be in such a way that the temperature difference is limited to 100°C max.
  Insufficient pre-heating may cause cracks on the product, resulting in the deterioration of products quality.
- Standard soldering profile and the limit soldering profile is as follows.
  The excessive limit soldering conditions may cause leaching of the electrode and/or resulting in the deterioration of product quality.

Soldering profile

(1) Flow soldering profile

<table>
<thead>
<tr>
<th></th>
<th>Standard Profile</th>
<th>Limit Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-heating</td>
<td>150°C, 60s min.</td>
<td></td>
</tr>
<tr>
<td>Heating</td>
<td>250°C, 4s~6s</td>
<td>265°C±3°C, 5s</td>
</tr>
<tr>
<td>Cycle of flow</td>
<td>2 times</td>
<td>2 times</td>
</tr>
</tbody>
</table>
(2) Reflow soldering profile

<table>
<thead>
<tr>
<th></th>
<th>Standard Profile</th>
<th>Limit Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-heating</td>
<td>150°C ~ 180°C, 90s ± 30s</td>
<td></td>
</tr>
<tr>
<td>Heating</td>
<td>above 220°C, 30s ~ 60s</td>
<td>above 230°C, 60s max.</td>
</tr>
<tr>
<td>Peak temperature</td>
<td>245°C ± 3°C</td>
<td>260°C, 10s</td>
</tr>
<tr>
<td>Cycle of reflow</td>
<td>2 times</td>
<td>2 times</td>
</tr>
</tbody>
</table>

10.4 Reworking with soldering iron

The following conditions must be strictly followed when using a soldering iron.

- Pre-heating: 150°C, 1 min
- Tip temperature: 350°C max.
- Soldering iron output: 80W max.
- Tip diameter: φ3mm max.
- Soldering time: 3(s ± 1, -0)s
- Time: 2 times

Note: Do not directly touch the products with the tip of the soldering iron in order to prevent the crack on the products due to the thermal shock.

10.5 Solder Volume

- Solder shall be used not to be exceeded the upper limits as shown below.
- Accordingly increasing the solder volume, the mechanical stress to Chip is also increased. Exceeding solder volume may cause the failure of mechanical or electrical performance.

![Solder Volume Diagram]

10.6 Product's location

The following shall be considered when designing and laying out P.C.B.'s.

1. P.C.B. shall be designed so that products are not subject to the mechanical stress due to warping the board.

   [Products direction]

   (Poor example)  →  (Good example)

   Products shall be located in the sideways direction (Length: a-b) to the mechanical stress.
(2) Components location on P.C.B. separation.

It is effective to implement the following measures, to reduce stress in separating the board. It is best to implement all of the following three measures; however, implement as many measures as possible to reduce stress.

<table>
<thead>
<tr>
<th>Contents of Measures</th>
<th>Stress Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Turn the mounting direction of the component parallel to the board separation surface.</td>
<td>A &gt; D *1</td>
</tr>
<tr>
<td>(2) Add slits in the board separation part.</td>
<td>A &gt; B</td>
</tr>
<tr>
<td>(3) Keep the mounting position of the component away from the board separation surface.</td>
<td>A &gt; C</td>
</tr>
</tbody>
</table>

*1 A > D is valid when stress is added vertically to the perforation as with Hand Separation. If a Cutting Disc is used, stress will be diagonal to the PCB, therefore A > D is invalid.

(3) Mounting Components Near Screw Holes

When a component is mounted near a screw hole, it may be affected by the board deflection that occurs during the tightening of the screw. Mount the component in a position as far away from the screw holes as possible.

10.7 Cleaning Conditions

Products shall be cleaned under the following conditions.

1. Cleaning temperature shall be limited to 60°C max. (40°C max for IPA.)
2. Ultrasonic cleaning shall comply with the following conditions with avoiding the resonance phenomenon at the mounted products and P.C.B.
   - Power: 20 W / l max.
   - Frequency: 28kHz to 40kHz
   - Time: 5 min max.
3. Cleaner
   - Alcohol type cleaner
     - Isopropyl alcohol (IPA)
   - Aqueous agent
     - PINE ALPHA ST-100S
4. There shall be no residual flux and residual cleaner after cleaning. In the case of using aqueous agent, products shall be dried completely after rinse with de-ionized water in order to remove the cleaner.
5. Other cleaning Please contact us.

10.8 Resin coating

The inductance value may change and/or it may affect on the product's performance due to high cure-stress of resin to be used for coating/molding products. So please pay your careful attention when you select resin. In prior to use, please make the reliability evaluation with the product mounted in your application set.

10.9 Caution for use

There is possibility that the inductance value change due to magnetism. Don't use a magnet or a pair of tweezers with magnetism when chip coil are handled. (The tip of the tweezers should be molded with resin or pottery.)
10.10 Magnetic Saturation
When the excessive current over rated current is applied, the inductance value may change due to magnetism.

10.11 Handling of a substrate
After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening screw to the substrate.
Excessive mechanical stress may cause cracking in the product.

Bending
Twisting

10.12 Storage and Handing Requirements
(1) Storage period
Use the products within 6 months after delivered.
Solderability should be checked if this period is exceeded.

(2) Storage conditions
• Products should be stored in the warehouse on the following conditions.
  Temperature : -10°C to 40°C
  Humidity : 15% to 85% relative humidity  No rapid change on temperature and humidity
Don't keep products in corrosive gases such as sulfur, chlorine gas or acid, or it may cause oxidization of electrode, resulting in poor solderability.
• Products should be stored on the palette for the prevention of the influence from humidity, dust and so on.
• Products should be stored in the warehouse without heat shock, vibration, direct sunlight and so on.
• Products should be stored under the airtight packaged condition.

(3) Handling Condition
Care should be taken when transporting or handling product to avoid excessive vibration or mechanical shock.

11 Note
(1) Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
(2) You are requested not to use our product deviating from the reference specifications.
(3) The contents of this reference specification are subject to change without advance notice.
Please approve our product specifications or transact the approval sheet for product specifications before order