Ultra Precision Thermosensitive Resistor

This ultra precision thermosensitive resistor is a new type of resistor produced by the application of Alpha foil resistor technology. It is made of material only a few µm thick and responds rapidly to temperature changes. The metal foil that is used has a resistivity that varies linearly with temperature change. The metal foil that is used has a resistivity that varies linearly with temperature change. Strict control of foil composition maintains uniform quality without fluctuation of temperature characteristics of resistance. This thermosensitive resistor is produced by the same fine photo-etching technology used in the metal foil precision resistors. The pattern is ideally designed for temperature detection, providing small size and rapid response.

**Characteristics**
- Since the resistance is provided by metal foil, the resistance is highly stable with little change over time.
- Temperature characteristics of resistance are almost linear.
- Response to temperature changes is rapid.
- This thermosensitive resistor is small and low-priced.
- Highly accurate with tolerance of resistance values ±0.5%.
- Temperature characteristics can be freely adjusted (KLC type).

**Main Applications**
- Cold-junction reference for thermocouple.
- Temperature-compensation in load cell.
- Temperature-compensation device in semiconductor circuit.
- Temperature-sensing device.

**COMPOSITION OF TYPE NUMBER**

<table>
<thead>
<tr>
<th>Type</th>
<th>Resistance Value*</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLA</td>
<td>100R0</td>
<td>F</td>
</tr>
<tr>
<td>KLC</td>
<td>3000-500R0</td>
<td>F</td>
</tr>
<tr>
<td>NMQ</td>
<td>100R0 F L</td>
<td></td>
</tr>
</tbody>
</table>

Example 1:
- Type: NLA
- Resistance Value: 100R0
- Tolerance: F

Example 2:
- Type: KLC
- Resistance Value: 3000-500R0
- Tolerance: F

Example 3:
- Type: NMP
- Resistance Value: 100R0
- Tolerance: F L

*Resistance value, in ohm, is expressed by a series of five characters, four of which represent significant digits. R or K is a dual-purpose letter that designates both the value range (R for ohmic; K for kilo-ohm) and the location of decimal point.

**TCR, RESISTANCE RANGE, TOLERANCE, RATED POWER**

<table>
<thead>
<tr>
<th>Type</th>
<th>TCR (ppm/°C)</th>
<th>TCR (ppm/°C) Effective September 1, 2013</th>
<th>Resistance Range (Ω)</th>
<th>Resistance Tolerance (%) at 0°C</th>
<th>Rated Power (W) at 70°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMP</td>
<td>+6,040±2% (0 to 25°C)</td>
<td>+6,060±2% (0 to 25°C)</td>
<td>5 to 250</td>
<td>±0.5 (D)</td>
<td>0.1</td>
</tr>
<tr>
<td>NMP</td>
<td>+6,590±2% (0 to 100°C)</td>
<td>+6,660±2% (0 to 100°C)</td>
<td>5 to 500</td>
<td>±1.0 (F)</td>
<td>0.125</td>
</tr>
<tr>
<td>NLA</td>
<td>+6,040±1% (0 to 25°C)</td>
<td>+6,060±1% (0 to 25°C)</td>
<td>5 to 500</td>
<td>±2.0 (G)</td>
<td>0.125</td>
</tr>
<tr>
<td>NLA</td>
<td>+6,590±1% (0 to 100°C)</td>
<td>+6,660±1% (0 to 100°C)</td>
<td>5 to 1k</td>
<td>±5.0 (J)</td>
<td>0.25</td>
</tr>
<tr>
<td>CLA</td>
<td>+4,250±1% (0 to 100°C)</td>
<td>+4,250±1% (0 to 100°C)</td>
<td>5 to 100</td>
<td></td>
<td>0.125</td>
</tr>
<tr>
<td>CLB</td>
<td>+4,250±1% (0 to 100°C)</td>
<td>+4,250±1% (0 to 100°C)</td>
<td>5 to 200</td>
<td></td>
<td>0.25</td>
</tr>
</tbody>
</table>

**TAPE AND REEL PACKAGE**

(BASED ON EIA-481-1)

For details, refer to MP, MQ Series Ultra Precision SMT Resistor (Molded, J-Lead Terminal) datasheet at:

*Symbols parenthesized are for type number composition.
CLA, CLB, KLC, NLA, NLB, NMP, NMQ Series

TCR SPREAD FROM NOMINAL AND DISTRIBUTION

FIG. 1 TCR AND RESISTANCE AVAILABLE IN KLC TYPE

TEMPERATURE CHARACTERISTICS OF RESISTANCE

TEMPERATURE OF RESISTOR SURFACE

RESPONSE TIME TO TEMPERATURE CHANGE

For any questions, contact sales-alpha@alpha-elec.co.jp

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### APPLICATIONS OF THERMOSENSITIVE RESISTORS

**Example:** Cold-junction compensation for temperature measurement using thermocouple

![Thermocouple Diagram](image)

**Example:** Temperature-sensing circuit

![Temperature-sensing Circuit](image)

### PRECAUTION IN USING NMP AND NMQ RESISTORS

1. **Storage**
   - Storage condition or environment may adversely affect solderability of the exterior terminals. Do not store in high temperature and humidity.
   - The recommended storage environment is lower than 40°C, has less than 70% RH humidity and is free from harmful gases such as sulphur and chlorine.

2. **Hand Soldering**
   - Hand soldering is applicable as shown at right.
   - **Recommended**
     - Temperature of Iron Tip: 240°C to 270°C
     - Power of Iron: 20W or less
     - Diameter of Tip: Dia. 3 mm max.
   - **Solder Reflow in Furnace**
     - **Recommended**
       - Peak Temperature: 250±0/5°C
       - Holding time: 10 sec. max.
     - **Dipping in Solder (Wave or Still)**
       - **Recommended**
         - Temp. of Solder: 260°C max.
         - Length of Dipping: 10 sec. max.
         - To cool gradually at room temperature
   - **Other**
     - Corrosion-free flux, such as rosin, is recommended.
     - Do not apply pressure to the molded housing immediately after soldering.

3. **Cleaning**
   - Use volatile cleaner such as methylalcohol or propylalcohol.

4. **Circuit Board Design**
   - The dimensions of solder land must be determined in conformity with the size of resistors and with the soldering method. They are also subject to the mounting machine and the material of the substrate. See example below.

   - **Solder Resist**
   - **Adhesive (in wave soldering)**

   ![Adhesive Diagram](image)

   - **Dimensions in mm**
     - When parts are mounted on a board in high density, solder can possibly attach to the resistors in an excessive amount to affect performance or reliability of the resistors. To prevent this effect, the use of solder resist is recommended to isolate solder lands.