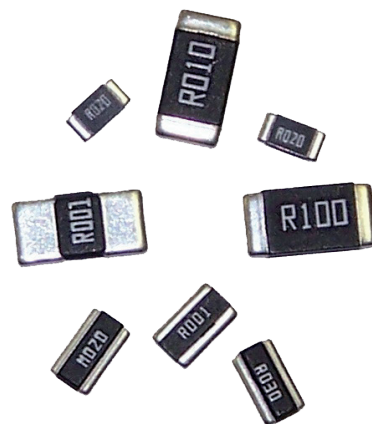


## Low Resistance Metal Alloy Resistor

## LRMA Series

- Resistance range 0.5mΩ to 500mΩ
- High temperature operation to 170°C
- Low thermal EMF version
- High power version
- Current sensing for power electronics
- RoHS compliant & halogen free
- AEC-Q200 qualified



 All parts are Pb-free and comply with EU Directive 2011/65/EU amended by (EU) 2015/863 (RoHS3)

## Electrical Data

| LRMA Version                      |        | T (Standard)              |                                                                                       | P (Power)                                                                                                                                                                                                                                     |
|-----------------------------------|--------|---------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size                              |        | 2010                      | 2512                                                                                  | 2512                                                                                                                                                                                                                                          |
| Power rating @70°C                | W      | 1.5                       | ≤R01: 2, >R01: 1                                                                      | ≤R10: 3, >R10: 2                                                                                                                                                                                                                              |
| Overload rating (5s)              | W      | 7.5                       | ≤R01: 10, >R01: 5                                                                     | ≤R10: 15, >R10: 10                                                                                                                                                                                                                            |
| Resistance range                  | mΩ     | 5 to 100                  | 1 to 100                                                                              | 0.5 to 500                                                                                                                                                                                                                                    |
| Standard values <sup>1</sup>      | mΩ     | 5, 6, 10, 15, 20, 50, 100 | 1, 1.5, 2, 3, 3.5, 4, 5, 6, 7, 8, 10, 11, 12, 15, 18, 20, 25, 30, 33, 35, 40, 50, 100 | 0.5, 0.75, 1, 1.1, 1.5, 2, 2.5, 3, 4, 5, 6, 6.8, 7, 8, 9, 10, 11, 12, 15, 18, 20, 22, 25, 27, 30, 33, 39, 40, 45, 47, 50, 57, 60, 68, 70, 75, 80, 85, 90, 100, 120, 130, 140, 150, 180, 200, 220, 240, 250, 270, 280, 300, 330, 390, 400, 500 |
| Resistance tolerance <sup>1</sup> | %      | 1, 5                      |                                                                                       |                                                                                                                                                                                                                                               |
| TCR (25 to 125°C)                 | ppm/°C | ≥R01: ±75                 | >R001 & <R01: ±100, ≤R001: ±275                                                       | <R001: ±200 ≥R001: ±50                                                                                                                                                                                                                        |
| Ambient temperature               | °C     | -55 to 170                |                                                                                       |                                                                                                                                                                                                                                               |
| Insulation resistance             | MΩ     | >100                      |                                                                                       |                                                                                                                                                                                                                                               |
| Element alloy                     |        | Cu-Ni                     |                                                                                       | Cu-Ni / Mn-Cu                                                                                                                                                                                                                                 |

| LRMA Version                      |        | M (Low thermal EMF)             |                                                                                |                                                          | N (Inverse)    |                             |                                    |
|-----------------------------------|--------|---------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------|----------------|-----------------------------|------------------------------------|
| Size                              |        | 0805                            | 1206                                                                           | 2512                                                     | 0612           | 0815                        | 1225                               |
| Power rating @70°C                | W      | 0.5                             | 1                                                                              | ≤R01: 2, >R01: 1                                         | 1 <sup>2</sup> |                             | 3                                  |
| Overload rating (5s)              | W      | 2.5                             | 5                                                                              | ≤R01: 10, >R01: 5                                        | 5              |                             | 15                                 |
| Resistance range                  | mΩ     | 2 to 25                         | 1 to 50                                                                        | 0.5 to 60                                                | 1 to 3         | 3 to 30                     | 2 to 40                            |
| Standard values <sup>1</sup>      | mΩ     | 1, 2, 3, 5, 6, 8, 9, 10, 20, 25 | 1, 1.2, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 18, 20, 22, 25, 30, 39, 40, 50 | 0.5, 0.75, 1, 1.5, 2, 3.5, 5, 10, 20, 25, 30, 40, 50, 60 | 1, 3           | 3, 4, 5, 10, 15, 20, 25, 30 | 2, 3, 4, 5, 10, 15, 20, 25, 30, 40 |
| Resistance tolerance <sup>1</sup> | %      | 1, 5                            |                                                                                |                                                          |                |                             |                                    |
| TCR (25 to 125°C)                 | ppm/°C | ±100                            | ±50                                                                            | ≥R01: ±75, >R001 & <R01: ±100 ≤R001: ±275                | ±100           |                             |                                    |
| Ambient temperature               |        | -55 to 170°C                    |                                                                                |                                                          |                |                             |                                    |
| Insulation resistance             | MΩ     | >100                            |                                                                                |                                                          |                |                             |                                    |
| Element alloy                     |        | Mn-Cu                           |                                                                                |                                                          | Mn-Cu / Cu-Ni  |                             |                                    |

Notes: 1. Non-standard values and tighter tolerances may be available for high volume requirements. 2. Requires 300mm<sup>2</sup> copper pad & trace area

### Physical Data

(All dimensions in mm and nominal weight in mg)

| Size                                   | L         | W         | C        | t          | Wt       |
|----------------------------------------|-----------|-----------|----------|------------|----------|
| <b>0805</b>                            | 2.0 ±0.1  | 1.25 ±0.1 | 0.4 ±0.2 | 0.6 ±0.2   | 5.5      |
| <b>0805</b> ≤R002                      |           |           | 0.6 ±0.2 |            |          |
| <b>1206</b> <R002                      | 3.2 ±0.2  | 1.6 ±0.2  | 1.1 ±0.3 | 0.75 ±0.2  | 18.3     |
| <b>1206</b> ≥R002                      |           |           | 0.5 ±0.3 | 0.6 ±0.2   |          |
| <b>0612</b>                            | 1.7±0.2   | 3.2±0.2   | 0.4±0.2  | 0.6 ±0.2   | 12.9     |
| <b>0815</b>                            | 2.1 ±0.25 | 3.75 ±0.3 | 0.5 ±0.2 | 0.7 ±0.2   | 14.1     |
| <b>2010</b>                            | 5.0 ±0.2  | 2.5 ±0.2  | 0.6 ±0.3 | 0.6 ±0.2   | 35.6     |
| <b>2512</b> <R001                      | 6.4 ±0.2  | 3.2 ±0.2  | 2.6 ±0.2 | 0.65 ±0.25 | 57 to 63 |
| <b>2512</b> ≥R001 & ≤R003 <sup>1</sup> |           |           | 2.0 ±0.2 |            |          |
| <b>2512</b> >R003 <sup>1</sup>         |           |           | 0.9 ±0.2 |            |          |
| <b>1225</b>                            | 3.2 ±0.3  | 6.4 ±0.3  | 0.5 ±0.2 | 0.9 ±0.2   | 70       |



Note 1 - This applies to LRMAT2512 and LRMAM2512. For LRMAP2512 this threshold is R004

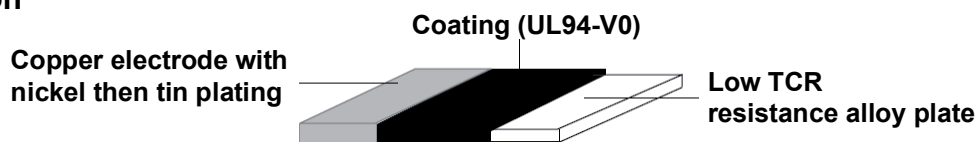
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## Construction



## Marking

The components are marked with ohmic value, e.g. "R002" = 2mΩ, "R010" = 10 mΩ. Due to space restrictions, for LRMAM1206-R001, "01" = 1mΩ is used, and for LRMAM0805, "2" = 2mΩ, "010" = 10 mΩ are used.

## Solvent Resistance

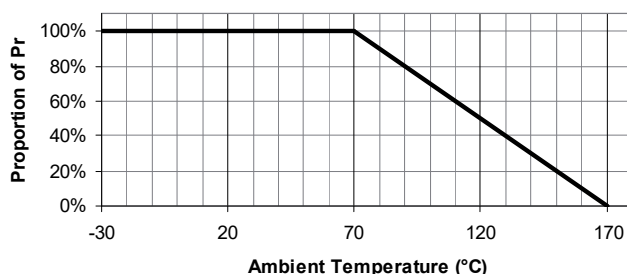
The component is resistant to all normal industrial cleaning solvents suitable for printed circuits.

## Performance Data

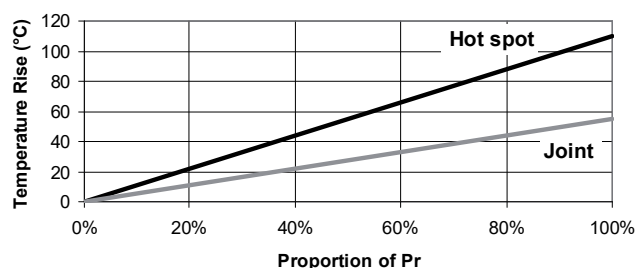
|                                                                       |     | Maximum (%)          | Typical (%) |
|-----------------------------------------------------------------------|-----|----------------------|-------------|
| Load at rated power (cyclic load, 1000 hours at 70°C)                 | ±ΔR | 0805: 1.5 Others 1   | 0.3         |
| Short term overload (5 x rated power for 5s)                          | ±ΔR | 0.5                  | 0.15        |
| Humidity (1000 hours, 85°C, 85%RH)                                    | ±ΔR | 0805: 1 Others 0.5   | 0.15        |
| Temperature cycle (-40 to +125°C, 1000 cycles, 15 minute dwell)       | ±ΔR | 0805: 1 Others 0.5   | 0.15        |
| Resistance to solder heat (260°C ±5°C for 20s ±1s)                    | ±ΔR | 0.5                  | 0.3         |
| Solderability (245°C ±5°C for 2s ±0.5s)                               |     | >95% coverage        |             |
| Dry heat (1000 hours at 170°C)                                        | ±ΔR | 0805: 1.5 Others 0.5 | 0.3         |
| Low temperature storage (1000 hours at -55°C)                         | ±ΔR | 0.5                  | 0.15        |
| Substrate bending (board 1.6mm, fulcrum spacing 90mm, deflection 2mm) | ±ΔR | 0805: 1 Others 0.5   | 0.3         |
| Insulation resistance (1 minute @ 100Vdc)                             |     | >100M                |             |

## Thermal Performance & Mounting

Temperature Derating

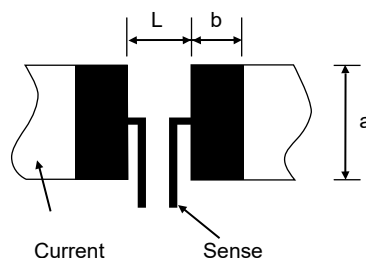


Typical Temperature Rise



Reference Pad Dimensions (mm)

| Size                    | a   | b    | L   |
|-------------------------|-----|------|-----|
| 0612                    | 3.8 | 0.7  | 0.7 |
| 0805                    | 1.4 | 1.15 | 1.2 |
| 1206 <R002              | 1.8 | 2.3  | 1.0 |
| 1206 ≥R002              | 1.8 | 1.7  | 1.6 |
| 0815                    | 7.9 | 1.5  | 0.9 |
| 2010                    | 3.4 | 1.5  | 3.5 |
| 2512 ≤R003 <sup>1</sup> | 4.0 | 3.1  | 1.3 |
| 2512 >R003 <sup>1</sup> | 4.0 | 2.1  | 4.1 |
| 1225                    | 7.0 | 1.0  | 2.3 |



The temperature rise shown is highly dependent on mounting conditions. Reference conditions assume 20μ copper with thermal vias to multiple layers. The self-heating in the current tracks should be kept negligible, or allowed for by temperature derating.

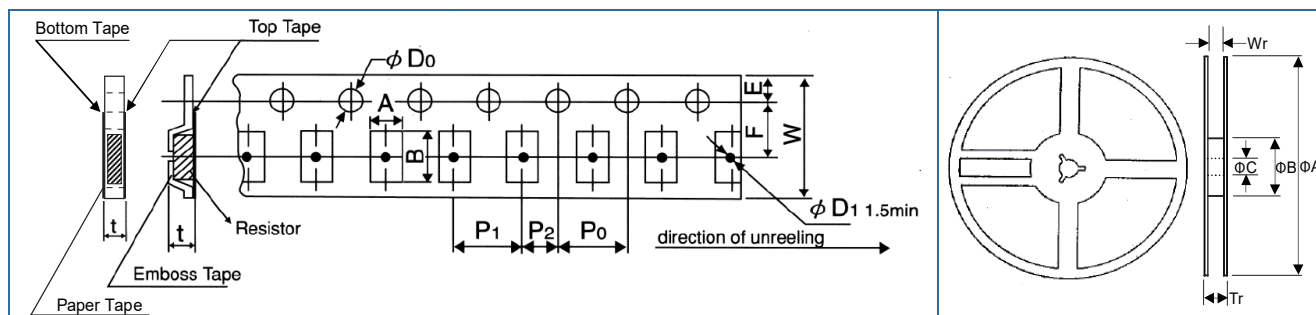
Note 1 - This applies to LRMAT2512 and LRMAM2512. For LRMAT2512 this threshold is R004

Standard 4-terminal probe pitches for measuring unmounted parts are 2.8 x 1.7mm (0612), 0.4 x 1.83mm (0805), 0.4 x 2.8mm (1206), 1.2 x 4.5mm (2010), 1.5 x 5.8mm (2512), and 5.4 x 3.4mm (1225). All probe location tolerances ±0.02mm.

## General Note

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### Packaging



| Size          | Tape   | A            | B           | W           | F            | E            | P <sub>1</sub> | P <sub>2</sub> | P <sub>0</sub> | ΦD <sub>0</sub> | t             | ΦA     | ΦB    | ΦC    | Wr    | Tr         |
|---------------|--------|--------------|-------------|-------------|--------------|--------------|----------------|----------------|----------------|-----------------|---------------|--------|-------|-------|-------|------------|
| 0805          | Paper  | 1.6<br>±0.15 | 2.4<br>±0.2 | 8.0<br>±0.2 | 3.5<br>±0.05 | 1.75<br>±0.1 | 4.0<br>±0.1    | 2.0<br>±0.1    | 4.0<br>±0.1    | 1.5<br>+0.1/-0  | 0.84<br>±0.1  | 178 ±2 | 60 ±1 | 13 ±1 | 9 ±1  | 11.4<br>±1 |
| 0612,<br>1206 | Paper  | 2.0<br>±0.15 | 3.6<br>±0.2 | 8.0<br>±0.2 | 3.5<br>±0.05 | 1.75<br>±0.1 | 4.0<br>±0.1    | 2.0<br>±0.05   | 4.0<br>±0.1    | 1.5<br>+0.1/-0  | 0.84<br>±0.1  | 178 ±2 | 60 ±1 | 13 ±1 | 9 ±1  | 11.5<br>±1 |
| 0815          | Emboss | 2.6<br>±0.2  | 4.5<br>±0.2 | 12<br>±0.2  | 5.5<br>±0.1  | 1.75<br>±0.1 | 4.0<br>+0.1/-0 | 2.0<br>±0.2    | 4.0<br>±0.1    | 1.55<br>±0.05   | 1.1<br>±0.1   | 178 ±2 | 60 ±1 | 13 ±1 | 13 ±1 | 15.4<br>±2 |
| 2010          | Emboss | 2.8<br>±0.2  | 5.3<br>±0.2 | 12<br>±0.05 | 5.5<br>±0.05 | 1.75<br>±0.1 | 4.0<br>±0.1    | 2.0<br>±0.05   | 4.0<br>±0.05   | 1.5<br>+0.1/-0  | 0.85<br>±0.15 | 178 ±2 | 60 ±1 | 13 ±1 | 13 ±1 | 15.4<br>±2 |
| 2512<br>1225  | Emboss | 3.6<br>±0.2  | 6.9<br>±0.2 | 12<br>±0.2  | 5.5<br>±0.05 | 1.75<br>±0.1 | 4.0<br>±0.1    | 2.0<br>±0.05   | 4.0<br>±0.05   | 1.5<br>+0.1/-0  | 0.85<br>±0.15 | 178 ±2 | 60 ±1 | 13 ±1 | 13 ±1 | 15.4<br>±2 |

### Storage

**Conditions:** 5°C to 35°C and 40% to 75%RH

**Shelf life:** 2 years from manufacture

### Processing

LRMA series resistors are suitable for both wave and IR reflow soldering. The recommended reflow profile for Pb-free SAC305 alloy (Sn 96.5%, Ag 3%, Cu 0.5%) soldering is as follows:

**Pre-heat:** 60s to 120s at 150°C to 180°C

**Soldering:** 20s to 40s at ≥230°C

**Peak:** 5s at 255°C to 260°C

### Ordering Procedure

**Example:** LRMAM2512-R01FT4 (LRMA2512, low thermal EMF, 10 milliohms ±1%, Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|---|---|---|
| L | R | M | A | M | 2 | 5 | 1 | 2 | 1 | R | 0 | 1 |  |  | F | T | 4 |
| 1 |   | 2 | 3 |   | 4 |   |   |   | 5 | 6 |   |   |  |  |   |   |   |

| 1    | 2       | 3               | 4     | 5          | 6       |
|------|---------|-----------------|-------|------------|---------|
| Type | Version | Size            | Value | Tolerance  | Packing |
| LRMA | T       | Standard        | 0612  | 3 to 6     | F = ±1% |
|      | P       | Power           | 0805  | characters | J = ±5% |
|      | M       | Low thermal EMF | 1206  | R = ohms   | T5      |
|      | N       | Inverse         | 0815  |            | T4      |
|      |         |                 | 2010  |            |         |
|      |         |                 | 2512  |            |         |
|      |         |                 | 1225  |            |         |

Note 1: For values which require all 6 characters, e.g. R00075, the hyphen is omitted.

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