



### Features:

- Standard 2512, 2010 and 1206 sizes
- Resistance range down to 3mΩ
- Leach resistant plated copper wraparound terminations
- AEC-Q200 qualified
- Low thermal impedance



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

## Electrical Data

|                                   |                 | LR(F)1206                                                                           | LR(F)2010 | LR(F)2512 |
|-----------------------------------|-----------------|-------------------------------------------------------------------------------------|-----------|-----------|
| Power rating at 70°C              | W               | 0.5                                                                                 | 1         | 2         |
| Resistance range <sup>1</sup>     | Ω               | R003 to 1R0                                                                         |           |           |
| Resistance tolerance <sup>1</sup> | %               | <R01: 5, ≥R01: 1, 2, 5                                                              |           |           |
| TCR                               | ppm/°C          | ≥R05: ±100, R025 – R047: <+500, <R025: <+900                                        |           |           |
| Dielectric withstand              | V               | 200                                                                                 |           |           |
| Standard values                   |                 | E24 and integer multiples of R001 up to R01, of R005 up to R05 and of R01 preferred |           |           |
| Ambient temperature range         | °C              | -55 to +150                                                                         |           |           |
| Temperature rise at rated power   | °C              | 40                                                                                  | 80        | 90        |
| Pad / trace area <sup>2</sup>     | mm <sup>2</sup> | 30                                                                                  | 100       | 300       |

Note 1. Contact factory for value – tolerance combinations outside this range.

Note 2. Recommended minimum pad & adjacent trace area for each termination for rated dissipation on FR4 PCB.

## Physical Data

| Dimensions in mm and weight in mg |             |             |        |            |          |  |
|-----------------------------------|-------------|-------------|--------|------------|----------|---------------------------------------------------------------------------------------|
|                                   | L           | W           | T max. | A          | Wt. nom. |                                                                                       |
| 1206                              | 3.2 ± 0.31  | 1.63 ± 0.2  | 0.8    | 0.6 ± 0.25 | 12       |                                                                                       |
| 2010                              | 5.23 ± 0.38 | 2.64 ± 0.25 | 0.84   |            | 38       |                                                                                       |
| 2512                              | 6.5 ± 0.38  | 3.25 ± 0.25 |        |            | 60       |                                                                                       |

### Construction

Proprietary non-noble copper-based thick-film material and organic protection are screen printed on a 96% alumina substrate. The components are laser trimmed to achieve the required resistance tolerance. LR types (>25mΩ) have conventional orientation with resistance element on the upper surface, whilst LRF types (≤25mΩ) have flip-chip orientation with the resistance element on the lower surface.

### Terminations

The wrap-around terminations have an electroplated nickel barrier and matte tin or tin-lead finish. This ensures excellent leach resistance properties and solderability. Chips can withstand immersion in solder at 250°C for 90 seconds and are suitable for reflow or wave solder mounting processes.

### Marking

The body protection and marking are resistant to all normal industrial cleaning solvents suitable for printed circuits. Chips are packed and mounted with marking side up. Parts are marked with the value code where this is up to four characters (e.g. “R025”). For five-character value codes the value in milliohms is marked, with “m” indicating decimal point position (e.g. “2m5” for value code R0025).

### Processing

For reflow of flip-chip (LRF) parts, a solder paste thickness of not less than 100µm is recommended.

### Performance Data

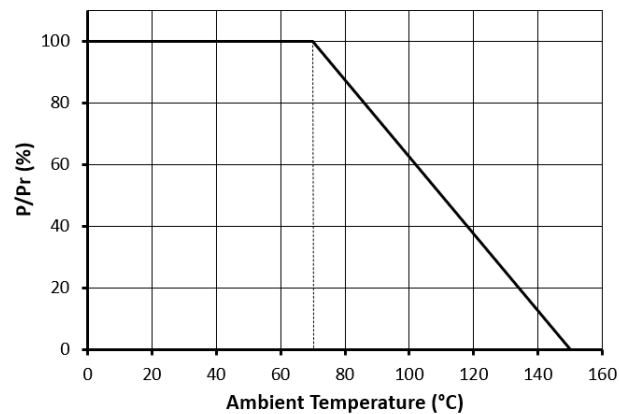
| AEC-Q200 <sup>1</sup><br>Table 7 Reference | Test                             | Method                 |      | Maximum<br>(add R05) | Typical<br>(@1R0) |
|--------------------------------------------|----------------------------------|------------------------|------|----------------------|-------------------|
| 3                                          | High temperature exposure        | MIL-STD-202 Method 108 | ±ΔR% | 0.5                  | 0.2               |
| 4                                          | Temperature cycling <sup>2</sup> | JESD22 Method JA-104   | ±ΔR% | 0.25                 | 0.1               |
| 6                                          | Moisture resistance              | MIL-STD-202 Method 106 | ±ΔR% | 0.5                  | 0.2               |
| 7                                          | Biased humidity                  | MIL-STD-202 Method 103 | ±ΔR% | 0.5                  | 0.2               |
| 8                                          | Operational life (cyclic load)   | MIL-STD-202 Method 108 | ±ΔR% | 1                    | 0.5               |
| 14                                         | Vibration                        | MIL-STD-202 Method 204 | ±ΔR% | 0.5                  | 0.05              |
| 15                                         | Resistance to solder heat        | MIL-STD-202 Method 210 | ±ΔR% | 0.25                 | 0.05              |
| 16                                         | Thermal shock <sup>2</sup>       | MIL-STD-202 Method 107 | ±ΔR% | 0.25                 | 0.1               |
| 18                                         | Solderability                    | J-STD-002              |      | >95% coverage        |                   |
| 21                                         | Board flex                       | AEC-Q200-005           | ±ΔR% | 0.5                  | 0.2               |
| 22                                         | Terminal strength                | AEC-Q200-006           | ±ΔR% | 0.25                 | 0.1               |
| Short term overload                        |                                  | 6.25 x Pr for 2s       | ±ΔR% | 0.5                  | -                 |
| Low temperature storage                    |                                  | -65°C for 100 hours    | ±ΔR% | 0.5                  |                   |
| Leach resistance                           |                                  | Solder dip at 250°C    |      | 90s minimum          |                   |

Note 1: Full AEC-Q200 qualification applies to ohmic values  $\geq R01$

Note 2: Although 2010 and 2512 sizes have passed temperature cycling and thermal shock, it is in general not recommended that ceramic chips this large be used on FR4 in a severe temperature cycle environment due to the possibility of solder joint fatigue.

### Thermal Data

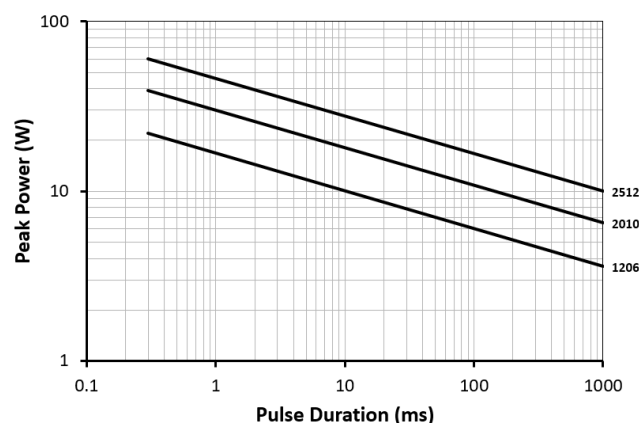
Temperature Derating



### Pulse Data

Continuous Pulse Performance

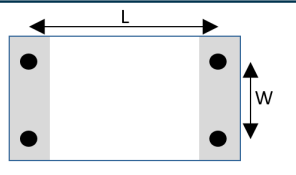
(mean power  $\leq$  rated power)



### Value Measurement

LR(F) resistors are measured using 4-terminal probes on the lower side of the chip, centred on the chip and at the spacings shown below.

| Probe Spacing (mm) |      |      |
|--------------------|------|------|
|                    | L    | W    |
| 1206               | 2.54 | 0.8  |
| 2010               | 4.57 | 1.02 |
| 2512               | 5.84 |      |



The diagram shows a rectangular component with four terminals, two on each of the longer sides. The length of the component is labeled 'L' and the width is labeled 'W'.

### Packaging

LR(F) resistors are supplied taped and reeled as per IEC 286-3. For full details of tape and reel dimensions see:

<https://www.ttelectronics.com/TTElectronics/media/ProductFiles/Application-Note/PS003-Packing-of-Specialist-Chip-Resistors.pdf>

### Ordering Procedure

This product has two valid part numbers:

**European (Welwyn) Part Number: LRF1206-R02FW** (1206, 20mΩ ±1%, Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |  |   |   |  |
|---|---|---|---|---|---|---|---|---|---|---|--|---|---|--|
| L | R | F | 1 | 2 | 0 | 6 | - | R | 0 | 2 |  | F | W |  |
| 1 | 2 | 3 | 4 | 5 |   |   |   |   |   |   |  |   |   |  |

| 1<br>Type                                       | 2<br>Size | 3<br>Value              | 4<br>Tolerance | 5<br>Termination & Packing      |         |                        |
|-------------------------------------------------|-----------|-------------------------|----------------|---------------------------------|---------|------------------------|
| LR = Conventional orientation<br>(values >R025) | 1206      | E24 = 3-5<br>characters | F = ±1%        | W                               | Pb-free | Standard packing       |
|                                                 | 2010      |                         | G = ±2%        | PB                              | SnPb    |                        |
| LRF = Flip-chip orientation<br>(values ≤R025)   | 2512      | R = ohms                | J = ±5%        | T1                              | Pb-free | 1000/reel              |
|                                                 |           |                         |                | T1PB                            | SnPb    | (non-standard packing) |
|                                                 |           |                         |                | Standard packing is tape & reel |         |                        |
|                                                 |           |                         |                | 1206 & 2010                     |         | 3000/reel              |
|                                                 |           |                         |                | 2512                            |         | 1800/reel              |

**USA (IRC) Part Number: LRC-LRF1206LF-01-R020-F** (1206, 20mΩ ±1%, Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | C | - | L | R | F | 1 | 2 | 0 | 6 | L | F | - | 0 | 1 | - | R | 0 | 2 | 0 | - | F |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

| 1<br>Family | 2<br>Model                                      | 3<br>Size | 4<br>Termination              | 5<br>TCR                                     | 6<br>Value                      | 7<br>Tolerance | Packing                         |             |           |
|-------------|-------------------------------------------------|-----------|-------------------------------|----------------------------------------------|---------------------------------|----------------|---------------------------------|-------------|-----------|
| LRC         | LR = Conventional orientation<br>(values >R025) | 1206      | Omit for SnPb<br>LF = Pb-free | 01 = standard<br>(±100ppm/°C<br>values ≥R05) | E24<br>4 characters<br>R = ohms | F = ±1%        | Standard packing is tape & reel |             |           |
|             |                                                 | 2010      |                               |                                              |                                 | G = ±2%        | Pb-free                         | All sizes   | 1000/reel |
|             | LRF = Flip-chip orientation<br>(values ≤R025)   | 2512      |                               |                                              |                                 | J = ±5%        | SnPb                            | 1206 & 2010 | 3000/reel |
|             |                                                 |           |                               |                                              |                                 |                |                                 | 2512        | 1800/reel |