

## Metal Element Current Sense Resistor

### ULR Series

- Robust metal strip able to withstand high temperature and high current.
- Low TCR and Inductance
- Resistance Range from 0.15mΩ to 10mΩ
- RoHS compliant
- AEC-Q200
- Higher wattage devices feature PCB clearance gap to maximize thermal performance



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

### Electrical Data

| Type            | Size | Coating         | Power Rating @80°C (W) | Standard Resistance Value mΩ <sup>1</sup>               | TCR (ppm/°C)                                       | Tolerance (%) | Dielectric Withstanding Voltage (V) | Ambient Temperature (°C) |     |
|-----------------|------|-----------------|------------------------|---|--|---------------|-------------------------------------|--------------------------|-----|
| ULRG1 / ULR1S   | 1206 | Green Underside | 1                      | 0.2, 0.25, 0.3, 0.4, 0.5, 0.6                           | 200  | 1, 5          | 200                                 | -55 to +170              |     |
| ULRG15 / ULR15S | 2010 |                 |                        | 0.75, 1, 1.2, 2, 2.5, 3, 3.5, 4, 5, 5.5, 6, 7, 8, 9, 10 | 50   |               |                                     |                          |     |
| ULRG2 / ULR2    | 2512 |                 | Black                  | 1.5   | 0.2, 0.25, 0.3, 0.4, 0.5                           |               |                                     |                          | 150 |
| ULRG25 / ULR25  |      |                 |                        |   | 0.75, 1, 1.5, 2, 2.5, 3, 4, 5, 5.5, 6, 7, 8, 9, 10 |               |                                     |                          | 50  |
| ULRG3 / ULR3    |      |                 |                        | 2   | 6.5, 7, 7.5, 8, 9, 10                              |               |                                     |                          | 50  |
| ULRB1 / ULR1    |      |                 |                        |   | 3.5, 4, 4.5, 5, 5.5, 6                             |               |                                     |                          | 150 |
| ULRB2 / ULR2    | 2    |                 | Black                  | 3   | 0.15, 0.25, 0.3, 0.4, 0.5, 0.75                    |               |                                     |                          | 50  |
|                 |      |                 |                        |   | 1, 1.5, 2, 2.5, 3                                  |               |                                     |                          | 50  |
|                 |      |                 |                        | 1   | 0.5, 0.75, 1, 1.5, 2                               |               |                                     |                          | 50  |
|                 |      |                 |                        |   | 2.5, 3, 3.5  |               |                                     |                          | 150 |
|                 | 1    | Black           | 1                      | 4, 4.5, 5, 5.5, 10                                      | 100  |               |                                     |                          |     |
|                 |      |                 |                        | 6, 6.5, 7, 7.5  | 75   |               |                                     |                          |     |
|                 | 2    | Black           | 2                      | 0.5, 0.75, 1, 1.5, 2                                    | 50   |               |                                     |                          |     |
|                 |      |                 |                        | 2.5, 3  | 150  |               |                                     |                          |     |

Notes: 1. For higher resistance values please refer to LRMA series.

### Performance Data

| ref. | Test                             | Method                 |     | Max. (add R0005)        |                      |
|------|----------------------------------|------------------------|-----|-------------------------|----------------------|
|      |                                  |                        |     | 1206, 2010 & Black 2512 | Green Underside 2512 |
| 3    | High Temp. Exposure *            | MIL-STD-202 Method 108 | ΔR% | 1                       | 1                    |
| 4    | Temperature Cycling              | JESD22 Method JA-104   | ΔR% | 0.5                     | 1                    |
| 6    | Moisture Resistance              | MIL-STD-202 Method 106 | ΔR% | 1                       | 1                    |
| 7    | Biased Humidity                  | MIL-STD-202 Method 103 | ΔR% | 1                       | 1                    |
| 8    | Operational Life (Cyclic Load) * | MIL-STD-202 Method 108 | ΔR% | 1                       | 1                    |
| 14   | Vibration                        | MIL-STD-202 Method 204 | ΔR% | 0.5                     | 1                    |
| 15   | Resistance to Soldering Heat *   | MIL-STD-202 Method 210 | ΔR% | 0.5                     | 1                    |
| 16   | Thermal Shock *                  | MIL-STD-202 Method 107 | ΔR% | 0.5                     | 1                    |
| 18   | Solderability                    | J-STD-002              |     | >95% coverage           |                      |
| 21   | Board Flex                       | AEC-Q200-005           | ΔR% | 0.5                     | 1                    |
| 22   | Terminal Strength                | AEC-Q200-006           | ΔR% | 0.25                    | 1                    |
|      | Short Term Overload *            | 5 x Pr for 5s          | ΔR% | 0.5                     | 1                    |

Notes: 1. Full AEC-Q200 qualification applies to 2512 size. The 1206 and 2010 sizes have received the tests marked \*.

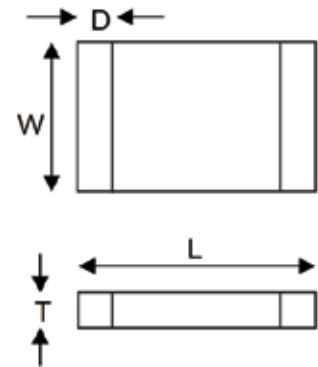
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## ULR Series

### Physical Data

| Dimensions(mm) and weight (mg) |                    |                    |                    |            |            |            |            |          |           |     |
|--------------------------------|--------------------|--------------------|--------------------|------------|------------|------------|------------|----------|-----------|-----|
| Size                           | Coating            | Values             | L<br>(±0.25)       | W          | T (±0.2)   | D          | Wt (nom)   |          |           |     |
| 1206                           | Green<br>Underside | 0.2, 0.25          | 3.2                | 1.6 ±0.3   | 1.0        | 1.5 ±0.25  | 25         |          |           |     |
|                                |                    | 0.3, 0.4           |                    |            |            | 1.4 ±0.25  |            |          |           |     |
|                                |                    | 0.5                |                    | 1.6 ±0.1   | 0.6        | 1.35 ±0.25 | 20         |          |           |     |
|                                |                    | 0.6, 1, 4, 5, 6    |                    |            |            | 1.1 ±0.25  |            |          |           |     |
|                                |                    | 2, 3, 10           |                    |            |            | 0.6 ±0.25  |            |          |           |     |
|                                |                    | 7, 8, 9            |                    |            |            | 0.9 ±0.25  |            |          |           |     |
| 2010                           |                    | Green<br>Underside | 0.2                | 5.08       | 2.54 ±0.3  | 1.0        | 2.34 ±0.25 | 50       |           |     |
|                                |                    |                    | 0.25               |            |            |            | 2.24 ±0.25 |          |           |     |
|                                |                    |                    | 0.3                |            |            |            | 2.04 ±0.25 |          |           |     |
|                                |                    |                    | 0.4                |            |            |            | 1.84 ±0.25 |          |           |     |
|                                |                    |                    | 0.5                |            | 2.54 ±0.15 | 0.6        | 2.17 ±0.25 |          | 40        |     |
|                                |                    |                    | 1, 4, 5            | 1.84 ±0.25 |            |            |            |          |           |     |
|                                | 2, 6, 7, 8         |                    | 1.54 ±0.25         |            |            |            |            |          |           |     |
|                                | 3                  |                    | 1.04 ±0.25         |            |            |            |            |          |           |     |
|                                | 9, 10              |                    | 1.29 ±0.25         |            |            |            |            |          |           |     |
|                                | 2512               |                    | Green<br>Underside | 0.15       |            |            | 6.35       | 3.0 ±0.3 |           | 1.0 |
| 0.2                            |                    |                    |                    | 2.88 ±0.25 |            |            |            |          |           |     |
| 0.25, 0.3                      |                    |                    |                    | 2.68 ±0.25 |            |            |            |          |           |     |
| 0.4                            |                    | 2.18 ±0.25         |                    |            |            |            |            |          |           |     |
| 0.5                            |                    | 3.0 ±0.2           |                    | 0.6        | 2.68 ±0.25 |            |            |          |           |     |
| 0.75                           |                    |                    |                    |            | 2.48 ±0.25 |            |            |          |           |     |
| 1, 5, 6                        |                    |                    |                    |            | 1.93 ±0.25 |            |            |          |           |     |
| 2, 3, 8, 9, 10                 |                    |                    |                    |            | 1.18 ±0.25 |            |            |          |           |     |
| 4                              |                    |                    |                    |            | 1.43 ±0.25 |            |            |          |           |     |
| 7                              |                    |                    |                    |            | 2.18 ±0.25 |            |            |          |           |     |
| Black                          |                    | Black              |                    | 0.5        | 3.18 ±0.25 | 3.18 ±0.25 | 0.6        | 1.4      | 1.3 ±0.38 |     |
|                                |                    |                    |                    | 0.75, 2.5  |            |            |            | 1.0      |           |     |
|                                |                    |                    | 1                  | 0.8        |            |            |            |          |           |     |
|                                |                    |                    | 1.5                | 0.65       |            |            |            |          |           |     |
|                                |                    |                    | 2, 5, 6            | 0.5        |            |            |            |          |           |     |
|                                |                    |                    | 3                  | 0.7        |            |            |            |          |           |     |
| 3.5                            |                    |                    | 0.71               |            |            |            |            |          |           |     |
| 4                              |                    |                    | 0.6                |            |            |            |            |          |           |     |
| 4.5                            | 0.58               |                    |                    |            |            |            |            |          |           |     |
| 5.5, 6.5                       | 0.47               |                    |                    |            |            |            |            |          |           |     |
| 7                              | 0.45               |                    |                    |            |            |            |            |          |           |     |
| 10                             | 0.8                |                    | 1.9 ±0.15          |            |            |            |            |          |           |     |



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## ULR Series

### Construction

#### Black Coat

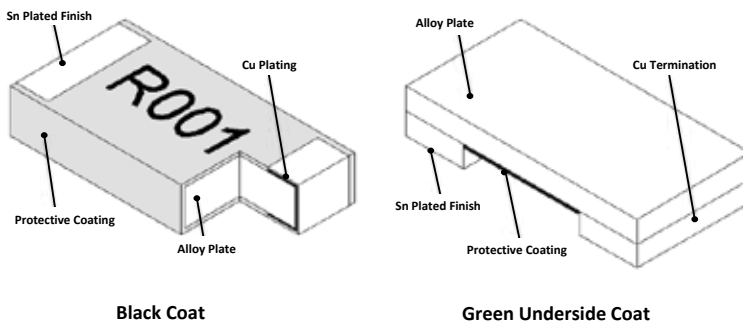
A low TCR resistance alloy plate, with tin plated connection bands is protectively coated on the upper and lower faces and numerically marked with the resistance value. This part is suitable for wave or reflow soldering.

#### Green Underside Coat

A low TCR resistance alloy plate is grooved to set the final resistance and the lower face only is protected with an epoxy coating. The lower faces are tin plated for connections. This part is ONLY suitable for reflow soldering.

#### Marking

Only black coated parts are marked. For values which are integer numbers of milliohms, the marking is 4-character IEC62 code; e.g. "R002" for 2mΩ, "R010" for 10mΩ. For values including fractions of a milliohm the marking is 3 or 4-character code using "M" to indicate the decimal point, e.g. "M75" for 0.75mΩ, "1M50" for 1.5mΩ.



#### Termination Details:

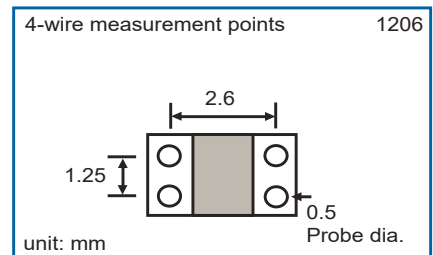
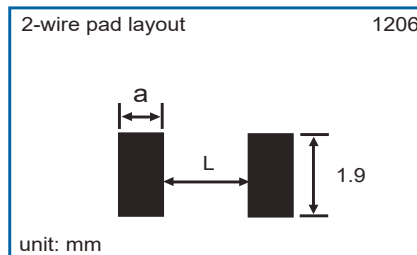
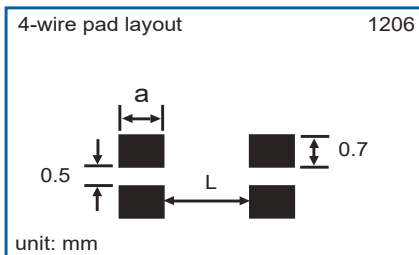
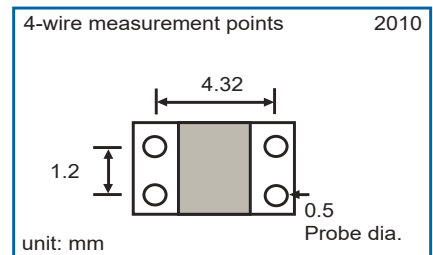
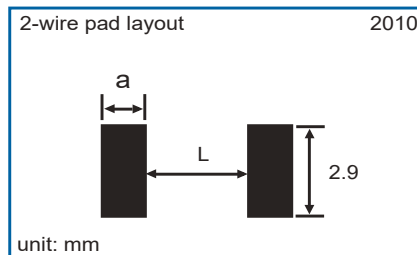
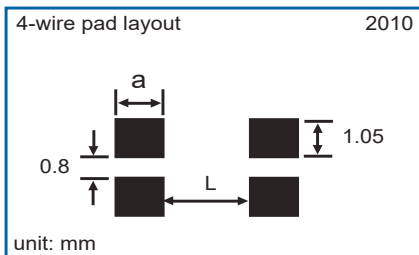
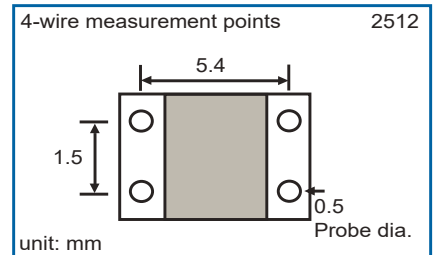
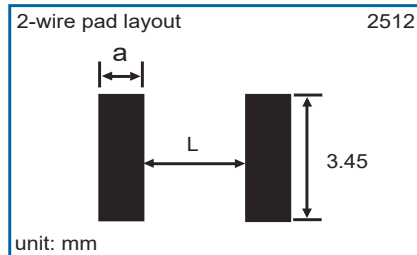
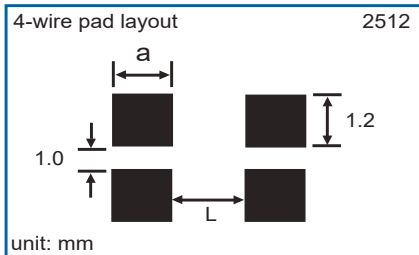
**Material** Matt tin plated finish over copper.  
**Solderability** 95% min coverage (MIL-STD 202F / 208H, 235°C 2 secs)

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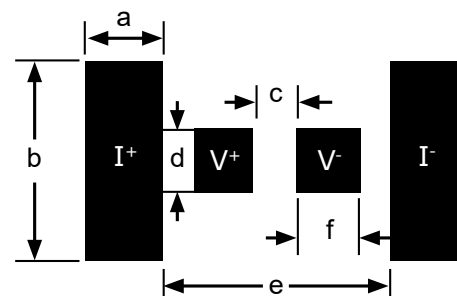
## ULR Series

### Electrical Connections



| Package                | Resistance         | a    | L    |
|------------------------|--------------------|------|------|
| 1206                   | 0.5, 0.6, 1, 4 - 6 | 1.55 | 0.55 |
|                        | 2 - 3, 10          | 1.05 | 1.55 |
|                        | 7 - 9              | 1.35 | 0.95 |
| 2010                   | 0.5                | 2.61 | 0.3  |
|                        | 1, 4 - 5           | 2.29 | 0.95 |
|                        | 2, 6 - 8           | 1.99 | 1.55 |
|                        | 3                  | 1.49 | 2.55 |
|                        | 9 - 10             | 1.74 | 2.05 |
| 2512 - Black           | All                | 2.7  | 2.9  |
| 2512 - Green Underside | 0.5                | 3.13 | 0.54 |
|                        | 0.75               | 2.93 | 0.94 |
|                        | 1                  | 2.38 | 2.04 |
|                        | 1.5                | 1.88 | 3.04 |
|                        | 2 - 3              | 1.63 | 3.54 |
|                        | 4, 4.5             | 2.63 | 1.54 |
|                        | 5 - 6              | 2.38 | 2.04 |
|                        | 6.5, 7             | 1.88 | 3.04 |
| 8 - 10                 | 1.63               | 3.54 |      |

| Package                | Resistance (mΩ) | a    | b    | c   | d   | e    | f   |
|------------------------|-----------------|------|------|-----|-----|------|-----|
| 1206                   | 0.2 - 0.4       | 0.75 | 1.9  | 0.6 | 0.6 | 2.15 | 0.4 |
| 2010                   | 0.2 - 0.4       | 1.35 | 2.89 | 0.6 | 0.6 | 3.08 | 1.4 |
| 2512 - Green Underside | 0.15 - 0.3      | 2    | 3.4  | 0.6 | 0.6 | 2.8  | 1.0 |
|                        | 0.4             | 1.5  | 3.4  | 0.6 | 0.6 | 3.8  | 2.0 |

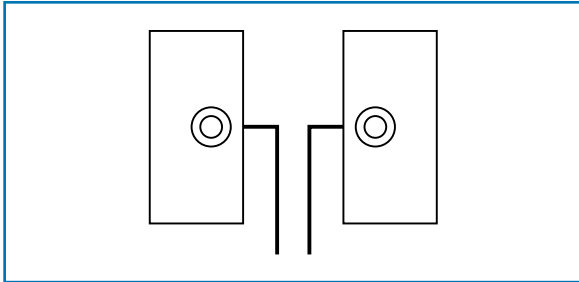


#### General Note

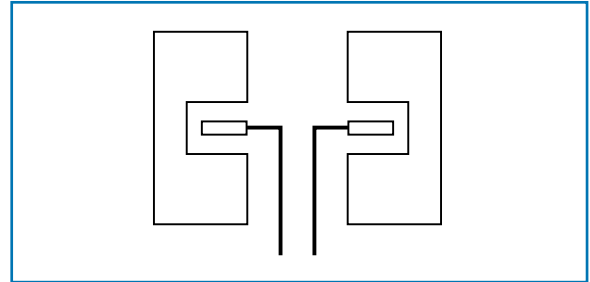
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## ULR Series

### Suggested Alternative 4-Wire Design Methods

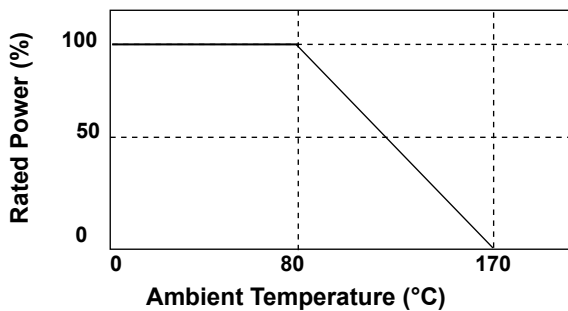


Vias with copper traces on internal layers.



Sense traces on Solder pads beneath the chip

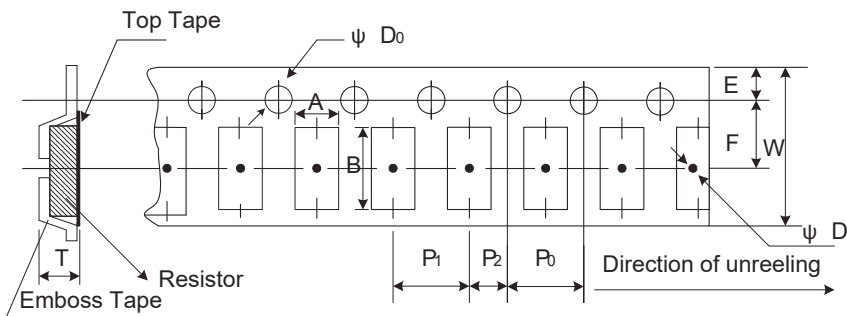
### Power Derating Curve



**Note:**

The power derating curve is a guidance based on a conservative design model. The ULR is a solid metal alloy construction that can withstand significantly greater operating temperatures than the conservative model permits. The protective coating will operate up to 260°C and the alloy can withstand in excess of 350°C. Therefore, the system thermal design will be a more significant design parameter due to the heat limitations of the solder joint.

### Packaging



| Type                 | Resistance (mΩ) | A          | B          | W          | E          | F          | P0        | P1        | P2         | ØD0         | ØD1    | T          | Quantity (EA) |
|----------------------|-----------------|------------|------------|------------|------------|------------|-----------|-----------|------------|-------------|--------|------------|---------------|
| 1206                 | <0.5            | 1.90 ± 0.1 | 3.60 ± 0.1 | 8.0 ± 0.2  | 1.75 ± 0.1 | 3.5 ± 0.05 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 1.0min | 1.25 ± 0.1 | 2,000         |
|                      | ≥0.5            |            |            |            |            |            |           |           |            |             |        | 0.87 ± 0.1 |               |
| 2010                 | <0.5            | 2.85 ± 0.1 | 5.55 ± 0.1 | 12.0 ± 0.2 | 1.75 ± 0.1 | 5.5 ± 0.05 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 1.5min | 1.35 ± 0.1 | 2,000         |
|                      | ≥0.5            |            |            |            |            |            |           |           |            |             |        | 0.85 ± 0.1 |               |
| 2512 Black           | 0.50 - 0.75     | 3.40 ± 0.1 | 6.75 ± 0.1 | 12.0 ± 0.1 | 1.75 ± 0.1 | 5.5 ± 0.05 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 1.4min | 1.45 ± 0.2 | 2,000         |
|                      | 1.45 ± 0.2      |            |            |            |            |            |           |           |            |             |        | 0.81 ± 0.1 |               |
| 2512 Green Underside | <0.5            | 3.40 ± 0.1 | 6.75 ± 0.1 | 12.0 ± 0.1 | 1.75 ± 0.1 | 5.5 ± 0.05 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 1.5min | 1.4 ± 0.1  | 2,000         |
|                      | ≥0.5            |            |            |            |            |            |           |           |            |             |        | 0.8 ± 0.1  |               |

**Note:**

1. The cumulative tolerance of 10 sprocket hole pitch is ± 0.2 mm.
2. Carrier camber shall not be more than 1 mm per 100 mm through a length of 250 mm.
3. A & B measured 0.3 mm from the bottom of the packet.
4. T measured at a point on the inside bottom of the packet to the top surface of the carrier.
5. Pocket position relative to sprocket hole is measured as the true position of the pocket and not the pocket hole.

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## ULR Series

### Ordering Procedure

This product has two valid part numbers:

**European (Welwyn) Part Number: ULR2-R0015FT2** (2512, 1.5 milliohms  $\pm 1\%$ , Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | L | R | 2 | - | R | 0 | 0 | 1 | 5 | F | T | 2 |
| 1 |   |   | 2 |   |   |   | 3 | 4 |   |   |   |   |

| 1      | 2                 | 3             | 4                     |
|--------|-------------------|---------------|-----------------------|
| Type   | Value             | Tolerance     | Packing               |
| ULR1S  | 3 to 6 characters | F = $\pm 1\%$ | T2 = Plastic tape     |
| ULR1   | R = ohms          | J = $\pm 5\%$ | All sizes   2000/reel |
| ULR15S |                   |               |                       |
| ULR2   |                   |               |                       |
| ULR25  |                   |               |                       |
| ULR3   |                   |               |                       |

**USA (IRC) Part Number: ULRB22512R0015FLFSLT** (2512, 1.5 milliohms  $\pm 1\%$ , Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | L | R | B | 2 | 2 | 5 | 1 | 2 | R | 0 | 0 | 1 | 5 | F | L | F | S | L | T |
| 1 |   |   | 2 |   |   | 3 |   |   | 4 | 5 | 6 |   |   |   |   |   |   |   |   |

| 1      | 2    | 3                | 4             | 5            | 6                     |
|--------|------|------------------|---------------|--------------|-----------------------|
| Type   | Size | Value            | Tolerance     | Termination  | Packing               |
| ULRG1  | 1206 | 4 - 6 characters | F = $\pm 1\%$ | LF = Pb-free | SLT = Plastic tape    |
| ULRG15 | 2010 | R = ohms         | J = $\pm 5\%$ |              | All sizes   2000/reel |
| ULRG2  | 2512 |                  |               |              |                       |
| ULRG25 |      |                  |               |              |                       |
| ULRG3  |      |                  |               |              |                       |
| ULRB1  |      |                  |               |              |                       |
| ULRB2  |      |                  |               |              |                       |

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[ULRG252512R0035FLFSLT](#) [ULRG32512R00075FLFSLT](#) [ULR1S-R002FT2](#) [ULR2-R008FT2](#) [ULR2-R01FT2](#) [ULR3-](#)  
[R0005FT2](#) [ULR1S-R003FT2](#) [ULR1-R001FT2](#) [ULR3-R001FT2](#) [ULR2-R002FT2](#) [ULR1S-R007FT2](#) [ULR1S-R01FT2](#)  
[ULR3-R0015FT2](#) [ULR15S-R002FT2](#) [ULR2-R0015FT2](#) [ULR1S-R008FT2](#) [ULR1-R006FT2](#) [ULR1S-R005FT2](#) [ULR3-](#)  
[R003FT2](#) [ULR3-R002FT2](#) [ULR1-R005FT2](#) [ULR1-R003FT2](#) [ULR15S-R005FT2](#) [ULR25-R004FT2](#) [ULR1S-R001FT2](#)  
[ULR25-R006FT2](#) [ULR15S-R006FT2](#) [ULR25-R005FT2](#) [ULR1S-R006FT2](#) [ULR1S-R0055FT2](#) [ULR15S-R004FT2](#)  
[ULR15S-R0055FT2](#) [ULRG2.5-2512-R006-F-LF-SLT](#)