

Version:  
December 1, 2022



# Current Sense Resistor Series

[Web: www.token.com.tw](http://www.token.com.tw)

[Email: rfq@token.com.tw](mailto:rfq@token.com.tw)

**Token Electronics Industry Co., Ltd.**

**Taiwan:** No.137, Sec. 1, Zhongxing Rd., Wugu District,  
New Taipei City, Taiwan. 248012  
**Tel:** +886 2981 0109    **Fax:** +886 2988 7487

**China:** 17P, Nanyuan Maple Leaf Bldg., Nanshan Ave.,  
Nanshan Dist., Shenzhen, Guangdong, China. 518054  
**Tel:** +86 755 26055363



## Production Index

### Current Sense Resistor Series

|   |    |
|---|----|
| Terminology & Glossary.....                         | 1  |
| Terminology & Glossary.....                         | 1  |
| How to Design & Select Current Sense Devices.....   | 3  |
| Design & Selection.....                             | 3  |
| Chip Current Sense Resistor (CS).....               | 7  |
| Product Introduction.....                           | 7  |
| Construction & Dimensions.....                      | 8  |
| Electrical Specifications.....                      | 9  |
| Land Pattern.....                                   | 11 |
| Soldering & Derating.....                           | 12 |
| Environmental Characteristics.....                  | 13 |
| Reel & Tape.....                                    | 14 |
| Order Codes.....                                    | 17 |
| Chip Current Sensing Precision Resistor (TCS).....  | 18 |
| Product Introduction.....                           | 18 |
| Construction & Dimensions.....                      | 19 |
| Electrical Specifications.....                      | 20 |
| Environmental Characteristics.....                  | 22 |
| Reel Tape Specifications.....                       | 23 |
| Order Codes.....                                    | 25 |
| Metal Strip Chip Current Sense Resistor (LRC).....  | 26 |
| Product Introduction.....                           | 26 |
| Construction & Dimensions.....                      | 27 |
| Electrical Specifications.....                      | 29 |
| Environmental Characteristics.....                  | 30 |
| Pad Layout.....                                     | 31 |
| Reel & Tape.....                                    | 34 |
| Order Codes.....                                    | 35 |
| Four-terminal Kelvin Connected Resistors (LRD)..... | 36 |
| Product Introduction.....                           | 36 |
| LRD Spec. & Dim.....                                | 37 |
| Derating Curve.....                                 | 37 |
| Characteristics.....                                | 38 |
| Order Codes.....                                    | 38 |
| 4-Terminal Current Sensing Resistor (LSQ).....      | 39 |
| Product Introduction.....                           | 39 |
| LSQ-A Spec. & Dim.....                              | 40 |
| LSQ-B Spec. & Dim.....                              | 41 |
| LSQ-C Spec. & Dim.....                              | 41 |
| Derating Curve.....                                 | 42 |
| Characteristics.....                                | 42 |
| Order Codes.....                                    | 42 |
| Power Low Resistance Resistor (BWL).....            | 43 |



|   |           |
|---|-----------|
| Product Introduction.....   | 43        |
| Technical Specifications & Dimensions.....                        | 44        |
| Electrical Performance .....                                      | 44        |
| Order Codes .....   | 45        |
| <b>Low Ohmic Resistor (LRA).....</b>                              | <b>45</b> |
| Product Introduction.....   | 45        |
| Dimensions.....   | 47        |
| Characteristics .....   | 48        |
| Packing Specification.....  | 49        |
| Order Codes .....   | 49        |
| <b>Metal Strip Chip High Power Low Ohmic Resistor (LRP) .....</b> | <b>50</b> |
| Product Introduction.....   | 50        |
| Construction & Dimensions.....                                    | 51        |
| Electrical Specification .....                                    | 52        |
| Reel & Tape.....  | 53        |
| Reflow Soldering .....  | 54        |
| Environmental Characteristics .....                               | 55        |
| Order Codes .....   | 56        |
| <b>4 Kelvin Current Sense Resistor (LPS).....</b>                 | <b>57</b> |
| Product Introduction.....   | 57        |
| Dimensions.....   | 58        |
| Characteristics .....   | 59        |
| Order Codes .....   | 59        |
| <b>Metal Strip Low Ohm Power Chip Resistor (LRM).....</b>         | <b>60</b> |
| Product Introduction.....   | 60        |
| Construction & Dimensions.....                                    | 61        |
| Electrical Specification .....                                    | 62        |
| Reel & Tape.....  | 64        |
| Environmental Characteristics .....                               | 66        |
| Reflow soldering .....  | 67        |
| Order Codes .....   | 67        |
| <b>Open Air Resistors (OAR) .....</b>                             | <b>68</b> |
| Product Introduction.....   | 68        |
| OAR Dimensions .....  | 69        |
| Specification.....  | 69        |
| Characteristics .....   | 70        |
| Order Codes .....   | 70        |
| <b>Low Ohmic Open Air Resistor (LRB) .....</b>                    | <b>71</b> |
| Product Introduction.....   | 71        |
| LRB Dimensions.....   | 72        |
| Specification.....  | 72        |
| Order Codes .....   | 73        |
| <b>Current Shunts Resistors (FL).....</b>                         | <b>74</b> |
| Product Introduction.....   | 74        |
| FL-2 (5A-10000A).....   | 75        |
| Dimensions (150A-1000A, Unit: mm) (FL-2) .....                    | 76        |
| Dimensions (1500A-10000A, Unit: mm) (FL-2).....                   | 77        |

|   |            |
|---|------------|
| FL-13 (30A-75A) .....   | 78         |
| FL-13-A (100A-1000A) .....  | 79         |
| FLQ54 (30A-100A) .....  | 80         |
| Characteristics .....   | 81         |
| Order Codes .....   | 81         |
| <b>4-Terminal Connection Kelvin Current Sensing Chips (LRF) .....</b> | <b>82</b>  |
| Product Introduction.....   | 82         |
| Construction & Dimensions .....                                       | 83         |
| Electrical Specifications .....                                       | 83         |
| Reel & Type .....   | 84         |
| Derating & Reflow .....   | 85         |
| Environmental Characteristics .....                                   | 86         |
| Order Codes .....   | 87         |
| <b>AEC-Q200 Metal Alloy High Power Resistors (LREA) .....</b>         | <b>88</b>  |
| Product Introduction.....   | 88         |
| Dimensions.....   | 90         |
| Electrical Specifications .....                                       | 91         |
| Land Pattern .....  | 91         |
| Reel & Type .....   | 92         |
| Derating & Soldering Condition .....                                  | 93         |
| Environmental Characteristics .....                                   | 94         |
| Order Codes .....   | 94         |
| <b>Metal Strip Low Value Chip Resistors (LRE) .....</b>               | <b>95</b>  |
| Product Introduction.....   | 95         |
| Dimensions.....   | 96         |
| Electrical Specifications .....                                       | 98         |
| Land Pattern .....  | 99         |
| Reel & Type .....   | 100        |
| Derating & Soldering Condition .....                                  | 102        |
| Environmental Characteristics .....                                   | 103        |
| Order Codes .....   | 103        |
| <b>Metal Alloy Zero Ohm Jumper Chips (LRJ) .....</b>                  | <b>104</b> |
| Product Introduction.....   | 104        |
| Dimensions.....   | 105        |
| Electrical Specifications .....                                       | 106        |
| Land Pattern .....  | 106        |
| Reel & Type .....   | 107        |
| Derating & Soldering Condition .....                                  | 108        |
| Environmental Characteristics .....                                   | 109        |
| Order Codes .....   | 109        |
| <b>Electron Beam Welding Shunts (FLW).....</b>                        | <b>110</b> |
| Product Introduction.....   | 110        |
| Dimensions & Electrical Specifications.....                           | 111        |
| Derating Curve.....   | 112        |
| Environmental Charcs.....   | 112        |
| Order Codes .....   | 112        |
| <b>High Power Chip Current Sensing Resistor Shunts (LRS).....</b>     | <b>113</b> |
| Product Introduction.....   | 113        |



|  |            |
|--|------------|
| LRS - M/K Dim. ....  | 114        |
| LRS - F Dim. ....  | 115        |
| Technical Specifications.....                                      | 116        |
| Environmental Characteristics .....                                | 117        |
| Derating Curve .....   | 118        |
| Packaging .....  | 119        |
| Order Codes .....  | 120        |
| <b>Alloy Sampling Shunt Current Sensing Resistors (FLU) .....</b>  | <b>121</b> |
| Product Introduction.....  | 121        |
| Dimensions.....  | 122        |
| Technical Specifications.....                                      | 123        |
| Environmental Characteristics .....                                | 124        |
| Derating Curve .....   | 125        |
| Packaging .....  | 126        |
| Order Codes .....  | 127        |
| <b>Four-terminal Alloy Shunt Resistors (FLH) .....</b>             | <b>128</b> |
| Product Introduction.....  | 128        |
| Dimensions.....  | 129        |
| Technical Specifications.....                                      | 130        |
| Environmental Characteristics .....                                | 131        |
| Derating Curve .....   | 132        |
| Packaging .....  | 133        |
| Order Codes .....  | 134        |
| <b>Chip Alloy Current Shunt Resistors (FLM).....</b>               | <b>135</b> |
| Product Introduction.....  | 135        |
| Dimensions.....  | 136        |
| Technical Specifications.....                                      | 137        |
| Environmental Characteristics .....                                | 138        |
| Derating Curve .....   | 139        |
| Packaging .....  | 140        |
| Order Codes .....  | 141        |
| <b>Large Current Sense Resistor Power Shunts (FLP) .....</b>       | <b>142</b> |
| Product Introduction.....  | 142        |
| Dimensions.....  | 143        |
| Technical Specifications.....                                      | 144        |
| Environmental Characteristics .....                                | 145        |
| Derating Curve .....   | 146        |
| Packaging .....  | 147        |
| Order Codes .....  | 148        |
| <b>SMD Large Current Weld Precision Resistor Shunts (LRN).....</b> | <b>149</b> |
| Product Introduction.....  | 149        |
| Dimensions.....  | 150        |
| Technical Specifications.....                                      | 151        |
| Environmental Characteristics .....                                | 152        |
| Derating Curve .....   | 153        |
| Packaging .....  | 154        |
| Order Codes .....  | 155        |
| <b>Current Sensing Metal Chip Resistors (CSM).....</b>             | <b>156</b> |



|                                     |     |
|-------------------------------------|-----|
| Product Introduction.....           | 156 |
| Dimensions.....                     | 157 |
| Electrical Characteristics.....     | 158 |
| Environmental Characteristics ..... | 159 |
| Derating Curve .....                | 160 |
| Soldering .....                     | 161 |
| Packaging .....                     | 162 |
| Order Codes .....                   | 164 |
| General Information .....           | 165 |





# Terminology & Glossary

## ► Terminology & Glossary

### Terminology & Glossary

#### What is a "Current Sense"?

Current sensing products are the newest and fastest growing resistive products in the industry today. As with most passive products, the majority of new designs are surface mount. These resistors are used to monitor the current in a circuit and translate the amount of current in that circuit into a voltage that can be easily measured and monitored.

#### Current Detecting Resistors

Due to the increase in sales of notebook PCs, the demand for the DC/DC converter has shown rapid growth because of its high-energy conversion efficiency, and its precise current-limiting capability. However, to ensure the performance of the multiple outputs DC/DC converter, the current limiting voltage must be detected precisely to protect an expensive notebook PC from an overload, which is generally due to shorts within the capacitors used in these devices.

For high-energy conversion efficiency various control ICs have been developed that utilize resistive components. To achieve the perfect cutoff mode of the DC load current at the programmed current-limiting voltage of the control IC, a very stable and accurate sense resistor with the following characteristics is required for precise voltage comparison.

- Very Low Ohmic Value should be below 25mΩ for minimizing power consumption at the current sensing resistor.
- Tight Tolerance must be ±1% or tighter for maximizing the current supply within the limit of acceptable current.
- Low TCR is required for current sensing across the ambient temperature range of 0°C to 60°C.
- Low Thermal EMF for an accurate comparison between the programmed current-limiting voltage of the control IC and the detected voltage.

Furthermore, the self-inductance should be for high frequency applications. Recommended types are general purpose current sensing products or a flame retardant type.

#### Flip Chip Resistors

An unencapsulated resistor chip on which bead-type leads terminate on one face to permit "flip" (face down) mounting of the resistor chip by contact of the leads with interconnective circuitry.

#### Hot-Spot Temperature

The maximum temperature measured on the resistor due to both internal heating and the ambient operating temperature.

#### Low Profile

Components designed with "lower than standard heights", to save space and allow clearance when mounted on PCBs.

#### Maximum Working Voltage

The maximum specified voltage that may be applied across a resistor.

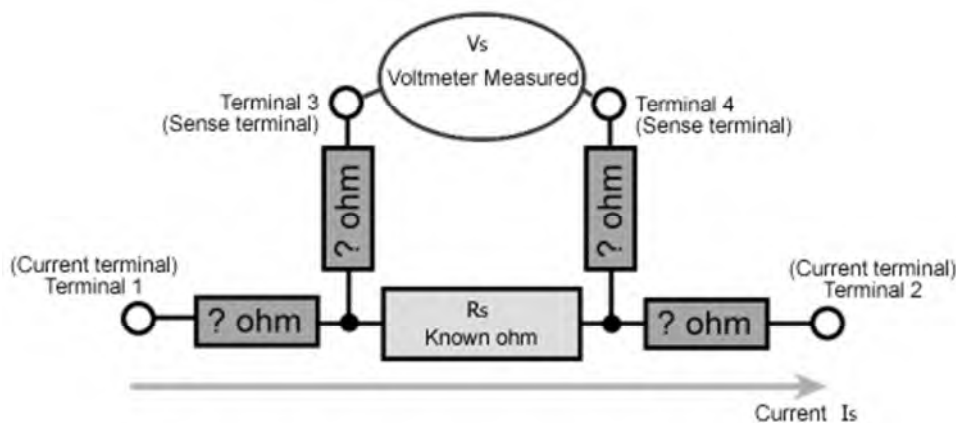


## How 4-Terminal Resistor Works

High precision resistors used for current sensing are usually low Ohmic value devices suitable for four terminal connections. To use a four terminal resistor, we force a current from Terminal 1 to Terminal 2. It's current, so the unknown resistances attached to Terminal 1 and Terminal 2 don't affect the amount of the current. The same number of electrons per second flow through from T1 to T2, regardless of the resistance.

A voltmeter measures the resulting voltage drop across the ultra-precise resistor, measuring through the unknown resistors attached to Terminal 3 and Terminal 4. The voltmeter's input impedance is very, very high compared to the unknown resistors, so the unknown resistors have essentially zero effect (typically less than 0.1 parts-per-million).

So the current flows through the 0.100 ohm resistor, unaffected by the unknown resistors, and we measure the voltage across the 0.100 ohm resistor, unaffected by the unknown resistors. And that's how a 4-terminal resistor works!



How 4-Terminal Sense Resistor Works

## PPM

Parts per million. The terminology used when describing the temperature coefficient.

## Screen

The process of printing a network pattern of thick-film ink or paste onto a substrate by means of a squeegee applied to a photo-etched wire-mesh "silk screen" or metal mask.

## Current Shunt Resistors

Current shunt resistors are precision low resistance resistors used to measure AC or DC electrical currents by the voltage drop those currents create across the resistance. Sometimes called an ammeter shunt, it is a type of current sensor.

## SMT/SMD

Surface-mount technology/surface-mount device.

## Zero Ohm Resistors

Products that look like resistors, but actually have no resistance (very low resistance) and instead perform as jumpers.



# How to Design & Select Current Sense Devices

## ► Design & Selection

### How to Design & Select Current Sense Devices

Generally, a resistor manufacturer will offer their most popular devices as standards creating a reference for Engineers to design from. Typically, and especially true in the Current Sensing category, a standard device is available for most common applications. However, for applications requiring parameters that are not currently considered industry standards, Token is uniquely equipped to offer design and development services at comparatively lower costs than our competitors. In this case, the following information is required to effectively design a current sensing resistor:

#### Power Rating

Calculate the power dissipation under operating conditions

**Equation:**  $P_{avg} = I_{RMS}^2 \times R$ ; where Power (P), Current (I), Root Mean Square (RMS), Resistance (R).

Allowing for transient or fault conditions and high ambient temperature if applicable, select the required power rating.

For many current sense resistors, only the maximum temperature of the solder joints limits the power rating.

Power rating is thus a function of the PCB layout design as well as of component selection (see point 4.).

#### Resistance Value

Determine the minimum suitable resistance value. This is the lowest value of peak sense voltage consistent with an acceptable signal to noise ratio, divided by the peak current to be measured.

#### Temperature Coefficient of Resistance (TCR)

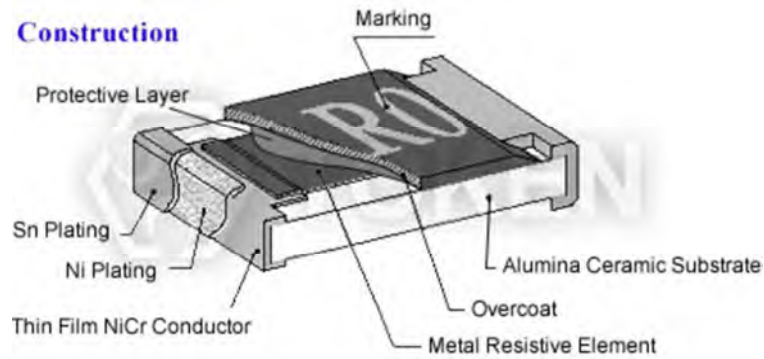
Establish the accuracy needed in terms of a tolerance on the value and of sensitivity to temperature. The latter factor is quoted as Temperature Coefficient of Resistance (TCR), defined as the value change in parts per million for a 1°C temperature rise. It is generally higher for low value resistors because the metallic leads or terminations, which have a very high TCR, make up a significant part of the total resistance value.

To achieve acceptable accuracy it is normally necessary to make four-terminal (Kelvin) connections to the resistor. This means connecting the current carrying tracks and the voltage sense tracks directly to the component pads. Even when this is done, there is still some pad area and solder in series with the resistor, which may compromise the actual tolerance and TCR of the soldered part. For very high accuracy or very low values, a four-terminal resistor type is the best choice.



## Thick Film Current-Sensing Chips (CS)

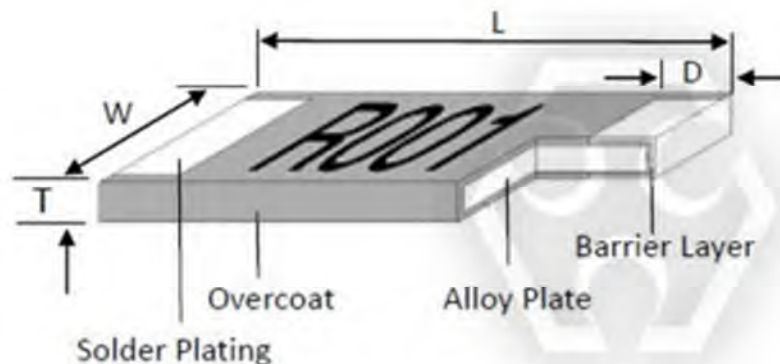
Based on thick film technology, the parasitic inductance of these chips is much lower than that of wire wound and leaded components. Token's thick film Token CS low ohmic current sense chip resistors are low cost, capable of providing low TCR down to  $\pm 100\text{ppm}/^\circ\text{C}$ , resistance values as low as  $1\text{m}\Omega$ , and power consumption up to 3 watts.



Thick Film Current-Sensing Chips (CS Series)

## Metal Plate Current-Sensing Chips (LRC, LRP, LRM, LRE, LREA)

A simple structure without multiple cuts, metal plate current sense resistors provide low TCR down to  $\pm 50\text{ppm}/^\circ\text{C}$ , Up to 5W rated power, high frequency performance and low resistance down to  $0.1\text{m}\Omega$ .



Metal Plate Current-Sensing Chips (LRC, LRP, LRM, LRE, LREA)

## PCB Layout

Care must be taken when laying out a PCB if the stated performance of a sense resistor is to be achieved. The current carrying tracks should be as wide as possible, using multiple layers connected by many vias near the component pad. This also improves the heat sinking of the joints.

The best way to make four-terminal connections to a two-terminal through-hole resistor is to use different sides of the PCB for the current and voltage connections. Failing this, current and voltage tracks should connect to opposite sides of the component pad.

In order to avoid interference from stray magnetic fields, the loop area contained by the sense resistor, the voltage sense tracks and the sense circuit input should be minimized. This means keeping the sense circuitry as close as possible to the sense resistor and running the voltage sense tracks close to each other.

## High Frequency Applications

Where transient or AC currents involving high frequencies are to be sensed, the self-inductance of the resistor must be minimised. Wirewound or spiralled film parts should be avoided, in favour of bulk metal or low value chips.

## High Heat Dissipation

When using a metallic element shunt with high heat dissipation and low sense voltage, consideration may need to be given to thermoelectric voltages. The junction between a metallic resistance element and metal terminations acts as a thermocouple, generating a voltage proportional to the temperature difference across it.

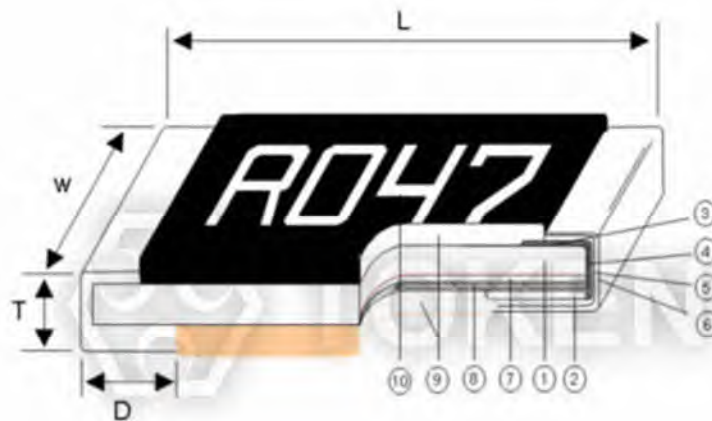
A leaded metallic element sense resistor is therefore like two thermocouples back to back. This means that, if the temperature differences across both junctions are equal, the error voltage is cancelled out. This is achieved by making the design thermally symmetrical, namely, by presenting both terminals with similar heatsinking and by keeping any other heat sources thermally distant.

## Wide Terminal Current-Sensing Chips (CSM)

Using a wider side as the connection in the mounting plate, the wide terminal current sense chip reinforces the solder joint and is reliably held to achieve higher power ratings. The wide-terminal current sensor saves space and reduces the amount of resistors in high-density board designs due to its ideal structure to suppress heat generation

## Metal Foil Current-Sensing Chips (CSM)

Metal foil current sense resistors made of manganese-copper alloy were developed with the substrate to provide better heat dissipation and a wider resistance range of up to 700m $\Omega$ . Metal foil The CSM series has a lower EMF under temperature variations.  $\mu 0.03\mu V/^{\circ}C$  is more likely to withstand harsh conditions. In the metal foil type, the TCR ranges from 50 to 100 ppm, the power is up to 5W, and the resistance is as low as 1m $\Omega$ .

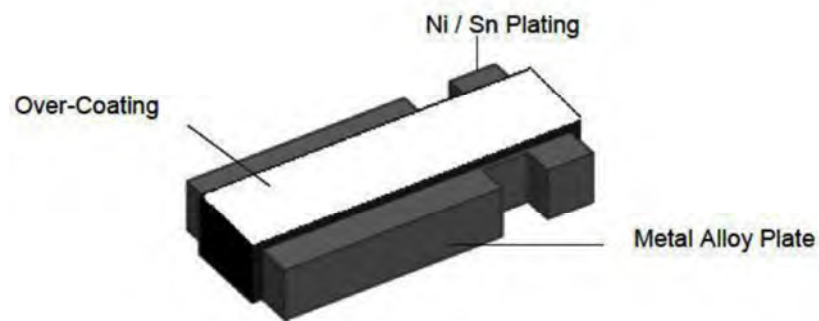


Metal Foil Current-Sensing Chips (CSM)

### Four-Terminal Current-Sensing Chips (LRF)

For accurate measurement of circuit design, lower power consumption, higher accuracy and smaller space requirements are important features of electronic control units. In order to minimize power consumption, it is necessary to measure the large current across the ( $R_{sense}$ ) resistor, and the high-side current sense amplifier IC must accurately monitor the current.

A four-terminal current-sense resistor that separates the current transfer from the voltage-sensing terminal, from the ideal Kelvin configuration, improves voltage and current measurement accuracy. They also improve interference and thermoelectric effects in higher power applications.



Four-Terminal Current-Sensing Chips (LRF)



# Chip Current Sense Resistor (CS)

## ► Product Introduction

**Token Chip Current Detecting Chip Resistor (CS) saves space and weight.**

### Features :

- Low TCR of  $\pm 100$  PPM/ $^{\circ}$ C.
- Resistance Values from  $1\text{m}\Omega$  to  $8000\text{m}\Omega$ .
- 3W Power Rating in 1W size, 1225 Package.
- Long size Terminations with Higher Power Rating.
- High Purity Alumina Substrate for High Power Dissipation.
- Products with Pb-free Terminations Meet RoHS Requirements.

### Applications :

- Voltage Regulation Module (VRM).
- Portable Devices (PDA, Cell phone).
- Disk Driver, Switching Power Supply.
- Over Current Protection in Audio Application.
- DC-DC Converter, Battery Pack, Charger, Adaptor.
- Automotive Engine Control, Power Management Applications.

Token Electronics has launched the (CS) series, a family of ultra-small and low value surface mount current sensing resistor. These smaller sizes save space on the circuit board, allowing the production of smaller and lighter products.

The new series complements Token's existing (LRC) Series, offering metal resistive film on ceramic construction but providing increased choice for product designers in the form of smaller sizes options of 0201, 0402, 0603, 0805, 1206, 2010, 2512, 1225, 3720, 7520, and 0612.

Designed for current detecting in power electronic systems, the fully RoHS compliant (CS) series is suitable for a range of applications including the monitoring of power usage and battery life; and provision of output protection for power supplies; as well as for a range of consumer and automotive products such as satellite navigation, handheld PDAs and digital set-top boxes.

The series offers ohm values as low as  $1\text{m}\Omega$  to minimize power consumption and has an ambient temperature range of  $-55^{\circ}\text{C}$  to  $+155^{\circ}\text{C}$ .

Exhibiting a resistance range up to  $8000\text{m}\Omega$  and excellent heat dissipation qualities, the series offers designers enhanced power handling capabilities and protection from the threat of localized heating, resulting in the production of a more energy efficient product.

As demand continues to grow for reduced size, handheld and portable devices operating at low voltages, designers will look to manufacturers to produce smaller and smaller current sense resistors. Token expects that demand for its latest range of small size resistor will be high.

For more chip low ohm thick film resistors, please link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.

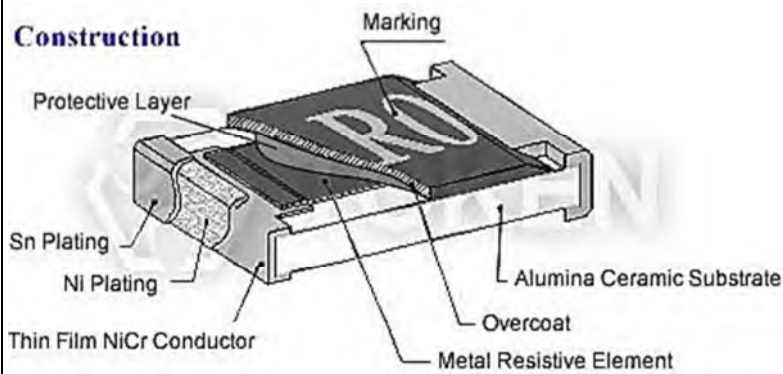


## Construction & Dimensions

### Construction & Dimensions (Unit: mm)

| Type                          | L (mm)    | W (mm)    | T (mm)    | D1 (mm)   | D2 (mm)   | Weight (g) / 1000pcs |
|-------------------------------|-----------|-----------|-----------|-----------|-----------|----------------------|
| CS01 (0201)                   | 0.60±0.03 | 0.30±0.03 | 0.23±0.05 | 0.12±0.05 | 0.15±0.05 | 0.18                 |
| CS02 (0402)                   | 1.00±0.05 | 0.50±0.05 | 0.32±0.10 | 0.25±0.10 | 0.20±0.10 | 0.7                  |
| CS03 (0603)                   | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 1.99                 |
| CS05 (0805)                   | 2.00±0.10 | 1.25±0.10 | 0.55±0.10 | 0.30±0.20 | 0.40±0.25 | 5.3                  |
| CS06 (1206)                   | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.30 | 0.40±0.25 | 8.82                 |
| CS13 (1210)                   | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.30 | 0.50±0.25 | 15.5                 |
| CS10 (2010)                   | 5.00±0.10 | 2.50±0.15 | 0.60±0.15 | 0.60±0.30 | 0.50±0.25 | 27.03                |
| CS12 (2512)                   | 6.35±0.10 | 3.10±0.15 | 0.60±0.10 | 0.60±0.30 | 0.55±0.25 | 43.08                |
| CS12 (2512) 2W (10 ~ 99)mΩ    | 6.35±0.20 | 3.15±0.15 | 0.74±0.10 | 0.60±0.30 | 0.55±0.25 | 53.08                |
| CS12 (2512) 2W (100 ~ 1000)mΩ | 6.35±0.20 | 3.15±0.15 | 0.74±0.10 | 0.60±0.30 | 2.10±0.10 | 53.08                |
| CS25 (1225)                   | 3.10±0.15 | 6.30±0.15 | 0.90±0.15 | 0.60±0.30 | 0.80±0.25 | 64.88                |
| CS37 (3720)                   | 2.00±0.20 | 3.75±0.20 | 0.60±0.10 | 0.40±0.20 | 0.40±0.20 | 19.96                |
| CS75 (7520)                   | 2.00±0.20 | 7.50±0.30 | 0.60±0.10 | 0.40±0.20 | 0.40±0.20 | 35.71                |
| CS62 (0612)                   | 1.55±0.10 | 3.10±0.15 | 0.55±0.10 | 0.30±0.15 | 0.45±0.15 | 10.19                |

### Construction



(CS) Surface Mount Construction

0201/0402/0603/0805/1206/2010/2512



1225/3720/7520



Current Detecting (CS) - Dimensions

### Marking for 0603 Current Detecting Resistor (CS)

| Marking | Value  |
|---------|--------|
| 1R0     | 1.000Ω |
| R10     | 0.100Ω |
| R01     | 0.010Ω |
| 138     | 0.138Ω |
| 039     | 0.039Ω |



## Electrical Specifications

### Standard Electrical Specifications (CS)

| Type        | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (%) | Max. Operating Current (A) | Resistance Range (mΩ)                          | TCR (PPM/°C)                                  |
|-------------|----------------------|-----------------------|--------------------------|----------------------------|--|---|
| CS01 (0201) | 1/20W                | (-55 ~ +155)°C        | ±1%<br>±2%<br>±5%        | 0.70A                      | 100 - 147<br>150 - 500<br>510 - 1000           | ±1000<br>±600<br>±300                         |
| CS02 (0402) | 1/16W                |                       |                          | 1.11A                      | 50 - 100<br>102 - 500<br>510 - 1000            | ±400<br>±300<br>±200                          |
| CS03 (0603) | 1/10W                |                       |                          | 2.23A                      | 20 - 50<br>51 - 100<br>102 - 500<br>510 - 1000 | ±600<br>±400<br>±300<br>±200                  |
| CS05 (0805) | 1/8W                 |                       |                          | 2.50A                      | 20 - 50<br>51 - 100<br>102 - 196<br>200 - 1000 | ±600<br>±400<br>±300<br>±200                  |
| CS06 (1206) | 1/4W                 |                       |                          | 5.00A                      | 10 - 20<br>21 - 50<br>51 - 91<br>100 - 1000    | ±600<br>±400<br>±300<br>±200                  |
| CS13 (1210) | 1/2W                 |                       |                          | 7.07A                      |  |   |
| CS10 (2010) | 3/4W                 |                       |                          | 8.66A                      |  |   |
| CS12 (2512) | 1W                   |                       |                          | 10.0A                      |  |   |
| CS25 (1225) | 3W                   |                       |                          | 31.6A                      | 3 - 5<br>6 - 20<br>21 - 30<br>33 - 8000        | ±300<br>±200<br>±150<br>±100                  |
| CS37 (3720) | 1W                   |                       |                          | 10.0A                      | 10 - 18<br>20 - 500                            | ±300<br>±150                                  |
| CS75 (7520) | 2W                   |                       |                          | ±2%, ±5%                   | 1 - 4  | ±300  |
|             |                      |                       |                          | ±1%<br>±2%<br>±5%          | 44.7A  | 5 - 10<br>11 - 350                            |
| CS62 (0612) | 1W                   |                       |                          |                            | 10.0A  | 10 - 27<br>30 - 91<br>100 - 499<br>500 - 1000 |

- Operating Current  $I = \sqrt{(P / R)}$ , Operating Voltage  $V = \sqrt{(P / R)}$ , or Max. Operating voltage whichever is lower.
- Optional specifications can be required.



## High Power Rating Electrical Specifications Energy Efficient (CS)

| Type        | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (%) | Max. Operating Current (A) | Resistance Range (mΩ)                       | TCR (PPM/°C)                 |
|-------------|----------------------|-----------------------|--------------------------|----------------------------|---|------------------------------|
| CS02 (0402) | 1/8W                 | (-55 ~ +155)°C        | ±1%<br>±2%<br>±5%        | 1.56A                      | 51 - 100<br>102 - 500<br>510 - 1000         | ±400<br>±300<br>±200         |
| CS03 (0603) | 1/8W, 1/5W           |                       |                          | 1.98A                      |   |                              |
| CS05 (0805) | 1/4W                 |                       |                          | 2.21A                      |   |                              |
| CS06 (1206) | 1/2W                 |                       |                          | 7.07A                      | 10 - 20<br>21 - 50<br>51 - 91<br>100 - 1000 | ±600<br>±400<br>±300<br>±200 |
| CS13 (1210) | 3/4W                 |                       |                          | 8.66A                      |   |                              |
| CS10 (2010) | 1W                   |                       |                          | 10.0A                      |   |                              |
| CS12 (2512) | 1.5W                 |                       |                          | 12.2A                      |   |                              |
| CS12 (2512) | *2W                  |                       |                          | 14.1A                      |   |                              |

● \* Ultra High Power

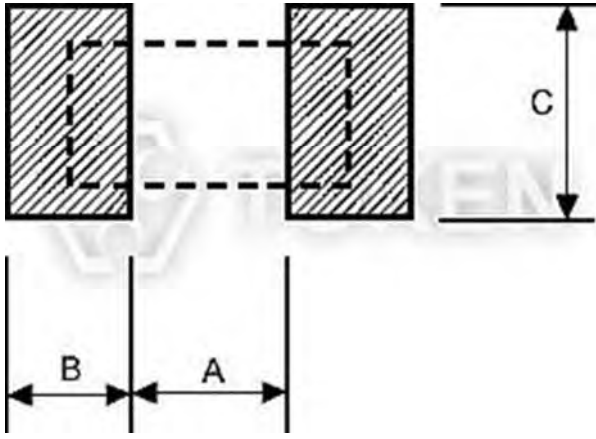
## Low TCR Electrical Specifications (CS)

| Type        | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (%) | Max. Operating Current (A) | Resistance Range (mΩ) | TCR (PPM/°C) |
|-------------|----------------------|-----------------------|--------------------------|----------------------------|-----------------------|--------------|
| CS05 (0805) | 1/8W                 | (-55 ~ +155)°C        | ±1%<br>±2%<br>±5%        | 1.11A                      | 100 - 1000            | ±100         |
| CS06 (1206) | 1/4W                 |                       |                          | 1.58A                      | 100 - 1000            | ±100         |
| CS13 (1210) | 1/2W                 |                       |                          | 2.58A                      | 75 - 1000             | ±100         |
| CS10 (2010) | 3/4W                 |                       |                          | 2.58A                      | 50 - 1000             | ±100         |
| CS12 (2512) | 1W                   |                       |                          | 7.07A                      | 20 - 1000             | ±100         |
| CS12 (2512) | *2W                  |                       |                          | 6.32A                      | 50 - 1000             | ±100         |
| CS37 (3720) | 1W                   |                       |                          | 3.16A                      | 100 - 500             | ±100         |
| CS75 (7520) | 2W                   |                       |                          | 6.32A                      | 50 - 350              | ±100         |



## Land Pattern

### Pad Layout (Except For CS12: Ultra High Power Rating Series) (CS)

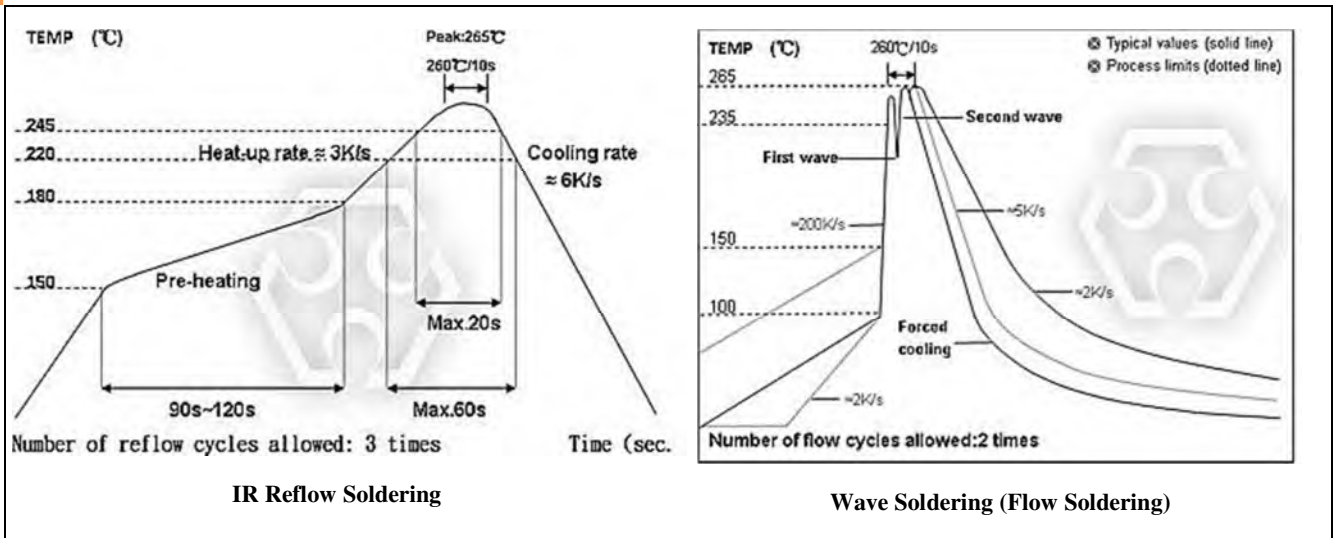
| Figure   | Codes | A    | B    | C        |
|--|-------|------|------|----------|
|  <p>(CS) Recommend Land Pattern</p> | CS01  | 0.25 | 0.30 | 0.40±0.2 |
|  | CS02  | 0.50 | 0.50 | 0.60±0.2 |
|  | CS03  | 0.80 | 1.00 | 0.90±0.2 |
|  | CS05  | 1.00 | 1.00 | 1.35±0.2 |
|  | CS06  | 2.00 | 1.15 | 1.70±0.2 |
|  | CS13  | 2.00 | 1.15 | 2.50±0.2 |
|  | CS10  | 3.60 | 1.40 | 2.50±0.2 |
|  | CS12  | 4.90 | 1.60 | 3.20±0.2 |
|  | CS25  | 1.20 | 2.00 | 7.00±0.2 |
|  | CS37  | 1.00 | 1.80 | 3.90±0.2 |
|  | CS75  | 1.00 | 1.80 | 7.60±0.2 |
|  | CS62  | 0.60 | 1.00 | 3.20±0.2 |

### Pad Layout (For CS12: Ultra High Power Rating Series) (CS)

| Codes | Resistance Range | A    | B    | C        |
|-------|------------------|------|------|----------|
| CS12  | (10~99)mΩ        | 4.90 | 1.60 | 3.20±0.2 |
| CS12  | (100~1000)mΩ     | 1.00 | 3.55 | 3.20±0.2 |

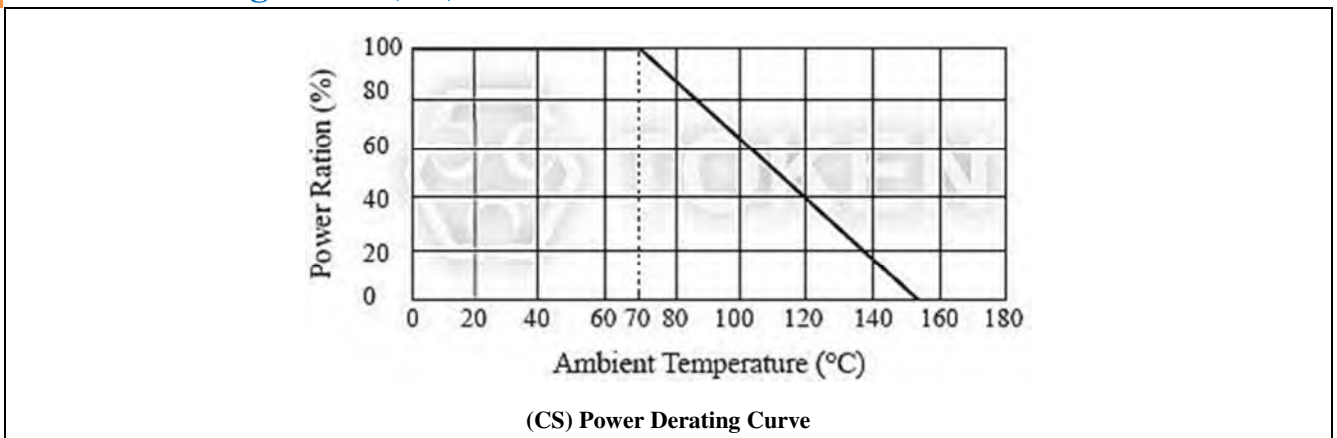
## ► Soldering & Derating

### Soldering Condition (CS)



- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

### Power Derating Curve (CS)



## Environmental Characteristics

### Environmental Characteristics (CS)

| Item  | Specification  | Test Method   |
|---|--|---|
| Temperature Coefficient of Resistance (T.C.R) | As Spec  | JIS-C-5201-1 4.8<br>IEC-60115-1 4.8<br>-55°C ~+125°C, 25°C is the reference temperature                             |
| Short Time Overload                           | ±(0.5%+0.05Ω)  | JIS C 5201-1 4.13<br>IEC 60115-1 4.13   |
|   | ±(1.0%+0.05Ω For High power rating)                      | RCWV*2.5 or Max. Overload Voltage whichever is less for 5 seconds.  |
| Insulation Resistance                         | ≥10GΩ  | JIS-C-5201-1 4.6<br>IEC-60115-1 4.6<br>Max. Overload Voltage for 1 minute   |
| Endurance                                     | ±(1.0%+0.05Ω)  | JIS-C-5201-1 4.25<br>IEC-60115-1 4.25.1<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"            |
| Damp Heat with Load                           | ±(0.5%+0.05Ω)  | JIS-C-5201-1 4.24<br>IEC-60115-1 4.24<br>40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" |
| Dry Heat                                      | ±(0.5%+0.05Ω)  | JIS-C-5201-1 4.23<br>IEC-60115-1 4.23.2<br>at +155°C for 1000 hrs   |
| Bending Strength                              | ±(1.0%+0.05Ω)  | JIS-C-5201-1 4.33<br>IEC-60115-1 4.33<br>Bending once for 5 seconds with 3mm 2010, 2512 sizes: 2mm                  |
| Solderability                                 | 95% Min. coverage  | JIS-C-5201-1 4.17<br>IEC-60115-1 4.17<br>245±5°C for 3 seconds  |
| Resistance to Soldering Heat                  | ±(0.5%+0.05Ω)  | JIS-C-5201-1 4.18<br>IEC-60115-1 4.18<br>260±5°C for 10 seconds   |
| Voltage Proof                                 | No breakdown or flashover                                | JIS-C-5201-1 4.7<br>IEC-60115-1 4.7<br>1.42 times Max. Operating Voltage for 1 minute                               |
| Leaching                                      | Individual leaching area ≤5%<br>Total leaching area ≤10% | JIS-C-5201-1 4.18<br>IEC-60068-2-58 8.2.1<br>260±5°C for 30 seconds   |
| Rapid Change of Temperature                   | ±(0.5%+0.05Ω)  | JIS-C-5201-1 4.19<br>IEC-60115-1 4.19<br>-55°C to +155°C, 5 cycles  |

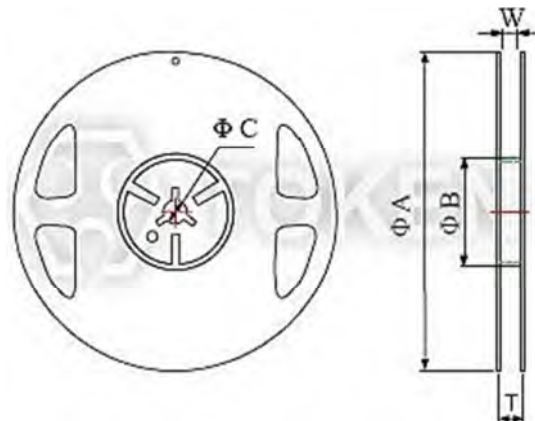
- Rated continuous Working Voltage (RCWV) =  $\sqrt{\text{Power Rating} \times \text{Resistance Value}(\Omega)}$  or Max. Operating voltage whichever is lower.
- Storage Temperature: 15 ~ 28°C; Humidity < 80%RH;



## ▶ Reel & Tape

### Packing Quantity & Reel Specifications (CS)

| Type      | ΦA (mm)   | ΦB (mm)  | ΦC (mm)  | W (mm)   | T (mm)   | Paper Tape(EA) | Embossed Tape (EA) |
|-----------|-----------|----------|----------|----------|----------|----------------|--------------------|
| CS01      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 10,000         | -                  |
| CS02      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 10,000         | -                  |
| CS03      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 5,000          | -                  |
| CS05      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 5,000          | -                  |
| CS06      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 5,000          | -                  |
| CS13      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 5,000          | -                  |
| CS10      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -              | 4,000              |
| CS12      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -              | 4,000              |
| CS12 (2W) | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -              | 2,000              |
| CS25      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -              | 2,000              |
| CS37      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -              | 2,000              |
| CS75      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -              | 2,000              |
| CS62      | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±0.1  | 11.5±1.0 | 5,000          | -                  |

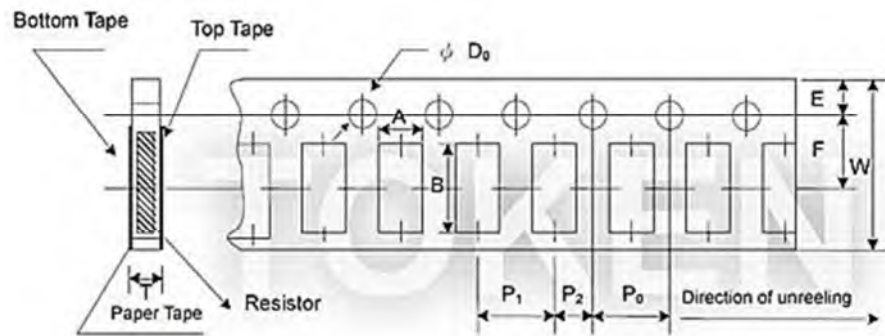


Reel Dimensions



## Paper Tape Specifications (CS)

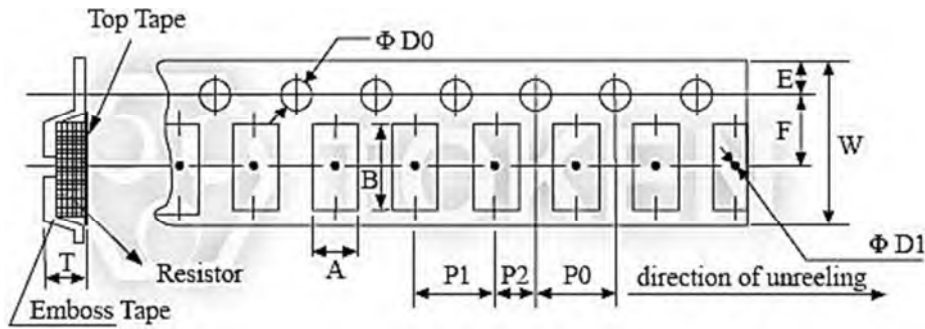
| Type | A (mm)    | B (mm)    | W (mm)   | E (mm)    | F (mm)    | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | T         |
|------|-----------|-----------|----------|-----------|-----------|---------------------|---------------------|---------------------|----------------------|-----------|
| CS01 | 0.38±0.05 | 0.68±0.05 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 2.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.42±0.20 |
| CS02 | 0.65±0.10 | 1.15±0.10 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 2.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.45±0.10 |
| CS03 | 1.10±0.10 | 1.90±0.10 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.70±0.10 |
| CS05 | 1.60±0.10 | 2.40±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |
| CS06 | 1.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |
| CS13 | 2.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |
| CS62 | 1.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |



Paper Tape Specifications

## Emboss Plastic Tape Specifications (CS)

| Type      | A (mm)    | B (mm)    | W (mm)    | E (mm)    | F (mm)   | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | ΦD <sub>1</sub> (mm) | T         |
|-----------|-----------|-----------|-----------|-----------|----------|---------------------|---------------------|---------------------|----------------------|----------------------|-----------|
| CS10      | 2.80±0.10 | 5.50±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05           | 4.00±0.10           | 2.00±0.05           | 1.50+0.10            | 1.4 Min.             | 1.00±0.20 |
| CS12      | 3.50±0.10 | 6.70±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05           | 4.00±0.10           | 2.00±0.05           | 1.50+0.10            | 1.4 Min.             | 1.00±0.20 |
| CS12 (2W) | 3.38±0.10 | 6.68±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.10 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.55+0.05            | 1.4 Min.             | 1.45±0.20 |
| CS25      | 3.38±0.10 | 6.68±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.10 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.55+0.05            | 1.4 Min.             | 1.45±0.20 |
| CS37      | 2.50±0.20 | 4.45±0.20 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05           | 4.00±0.10           | 2.00±0.05           | 1.50+0.10            | 1.4 Min.             | 1.20±0.20 |
| CS75      | 2.50±0.20 | 8.30±0.20 | 16.0±0.30 | 1.75±0.10 | 7.8±0.05 | 4.00±0.05           | 4.00±0.10           | 2.00±0.05           | 1.50+0.10            | 1.4 Min.             | 1.20±0.20 |



Emboss Plastic Tape Specifications

## Order Codes

### Order Codes (CS)

| CS           | 12                   | J    | TR      | G    | A            | R100  | N               |      |                |      |         |            |
|--------------|----------------------|------|---------|------|--------------|-------|-----------------|------|----------------|------|---------|------------|
| Product Type | Dimensions (L×W)(mm) |      | Package |      | TCR (PPM/°C) |       | Power Rating(W) |      | Resistance (Ω) |      | Marking |            |
|              | 01                   | 0201 | P       | Bulk | E            | ±100  | R               | 3    | R010           | 0.01 | N       | No Marking |
|              | 02                   | 0402 |         | TR   | Taping Reel  | K     | ±150            | S    | 2              | R100 | 0.1     | W          |
|              | 03                   | 0603 | J       |      | F            | ±200  | A               | 1.5  | 1R00           | 1    |         |            |
|              | 05                   | 0805 | G       |      | G            | ±300  | T               | 1    |                |      |         |            |
|              | 06                   | 1206 | F       |      | H            | ±400  | Q               | 3/4  |                |      |         |            |
|              | 13                   | 1210 |         |      | J            | ±600  | U               | 1/2  |                |      |         |            |
|              | 10                   | 2010 |         |      | R            | ±1000 | V               | 1/4  |                |      |         |            |
|              | 12                   | 2512 |         |      |              |       | W               | 1/8  |                |      |         |            |
|              | 25                   | 1225 |         |      |              |       | X               | 1/10 |                |      |         |            |
|              | 37                   | 3720 |         |      |              |       | Y               | 1/16 |                |      |         |            |
|              | 75                   | 7520 |         |      |              |       |                 |      |                |      |         |            |
|              | 62                   | 0612 |         |      |              |       |                 |      |                |      |         |            |



# Chip Current Sensing Precision Resistor (TCS)

## ► Product Introduction

**Token's TCS (thin film current sensing chip resistor) makes sense of current.**

### Features :

- Thin Film Process.
- Resistance Values from 50mΩ to 1Ω.
- Very Tight Tolerance from ±1% to ±0.5%.
- Extremely Low TCR from ±200 PPM/°C to ±50PPM/°C.
- High Purity Alumina Substrate for High Power Dissipation.
- RoHS Requirments with Pb-free Terminations.

### Applications :

- Voltage Regulation Module (VRM),
- Portable Devices (PDA, Cell phone),
- Disk Driver, Switching Power Supply,
- Over Current Protection in Audio Application,
- DC-DC Converter, Battery Pack, Charger, Adaptor,
- Automotive Engine Control, Power Management Applications,

The trend towards smaller handheld and portable electronics equipment has also increased the need for ultra-small current sensing resistor. Devices from the Token Electronics' TCS series use a thin film construction that enables them to achieve precision resistance tolerances, low noise and long-term stability.

The Token TCS Series precision resistors are nichrome thin film chip resistors with a temperature coefficient of resistance of just ±50PPM/°C and tolerances of ±0.5%.

They offer excellent stability at high frequencies and are suitable for operating high voltages with more options in the smaller form sizes of 0402, 0603, 0402, 0805, 1206, 2010, and 2512.

The full range of values is from 50mΩ to 1Ω. This low ohm devices are particularly suited to car engine management units to act as current shunt resistors.

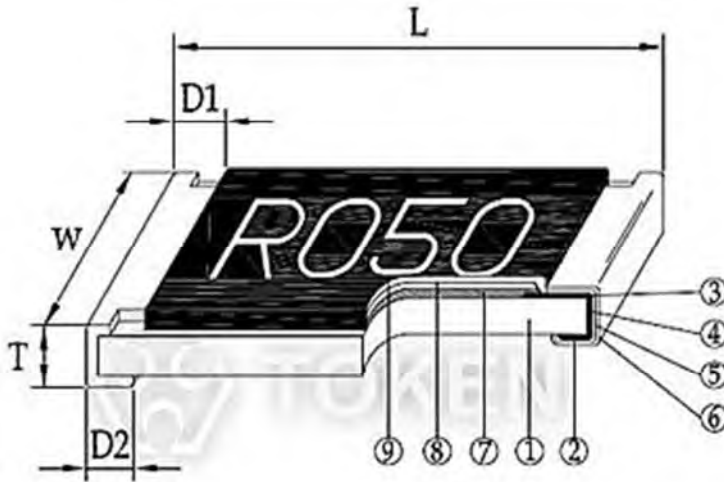
The TCS current sense series is fully RoHS compliant and is supplied in tape and reel packaging ready for use with automated assembly processes.

For more chip low ohm resistors, please link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## Construction & Dimensions

### Construction & Dimensions (Unit: mm)



|   |                    |
|---|--------------------|
| ① | Alumina Substrate  |
| ② | Bottom Electrode   |
| ③ | Top Electrode      |
| ④ | Edge Electrode     |
| ⑤ | Barrier Layer      |
| ⑥ | External Electrode |
| ⑦ | Resistor Layer     |
| ⑧ | Overcoat           |
| ⑨ | Marking            |

Thin Film Chip Construction

| Type         | L (Unit: mm) | W (Unit: mm) | T (Unit: mm) | D1 (Unit: mm) | D2 (Unit: mm) | Weight(g)/1000pcs |
|--------------|--------------|--------------|--------------|---------------|---------------|-------------------|
| TCS02 (0402) | 1.00±0.05    | 0.50±0.05    | 0.32±0.10    | 0.25±0.10     | 0.20±0.10     | 0.56              |
| TCS03 (0603) | 1.60±0.10    | 0.80±0.10    | 0.45±0.10    | 0.30±0.20     | 0.30±0.20     | 3.1               |
| TCS05 (0805) | 2.00±0.15    | 1.25±0.15    | 0.55±0.10    | 0.30±0.20     | 0.40±0.25     | 5.6               |
| TCS06 (1206) | 3.05±0.15    | 1.55±0.15    | 0.55±0.10    | 0.50±0.30     | 0.40±0.25     | 12.3              |
| TCS10 (2010) | 5.00±0.20    | 2.45±0.15    | 0.60±0.15    | 0.60±0.30     | 0.50±0.25     | 26.7              |
| TCS12 (2512) | 6.35±0.20    | 3.15±0.15    | 0.60±0.10    | 0.60±0.30     | 0.55±0.25     | 49.6              |

## ► Electrical Specifications

### Standard Electrical Specifications Thin Film (TCS)

| Type         | Power Rating at 70°C | Resistance Tolerance | Resistance Range            | TCR                     | Operating Temp. Range |
|--------------|----------------------|----------------------|-----------------------------|-------------------------|-----------------------|
| TCS02 (0402) | 1/16W                | ±0.5%, ±1.0%         | 500mΩ~1000mΩ                | ±100PPM/°C<br>±50PPM/°C | -55 ~ +155°C          |
| TCS03 (0603) | 1/10W                | ±0.5%, ±1.0%         | 200mΩ~300mΩ                 | ±100PPM/°C<br>±50PPM/°C |                       |
| TCS05 (0805) | 1/8W                 |                      | 301mΩ~1000mΩ                |                         |                       |
| TCS06 (1206) | 1/4W                 | ±1.0%                | 50mΩ~100mΩ                  | ±200PPM/°C              |                       |
|              |                      | ±0.5%,±1.0%          | 101mΩ~300mΩ<br>301mΩ~1000mΩ | ±100PPM/°C<br>±50PPM/°C |                       |
| TCS10 (2010) | 3/4W                 | ±0.5%,±1.0%          | 50mΩ~100mΩ                  | ±200PPM/°C              |                       |
| TCS12 (2512) | 1W                   |                      | 101mΩ~300mΩ<br>301mΩ~1000mΩ | ±100PPM/°C<br>±50PPM/°C |                       |

### High Power Rating Electrical Specifications Thin Film (TCS)

| Type         | Power Rating at 70°C | Resistance Tolerance | Resistance Range | TCR        | Operating Temp. Range |
|--------------|----------------------|----------------------|------------------|------------|-----------------------|
| TCS12 (2512) | 3W                   | ±0.5%, ±1.0%         | 100mΩ~1000mΩ     | ±100PPM/°C | -55 ~ +155°C          |

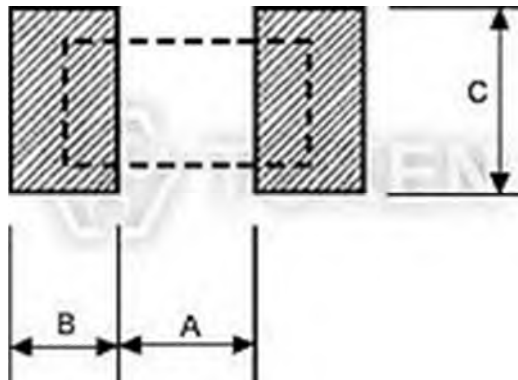
- Token has the ability to manufacture following options based on customer's requirement.





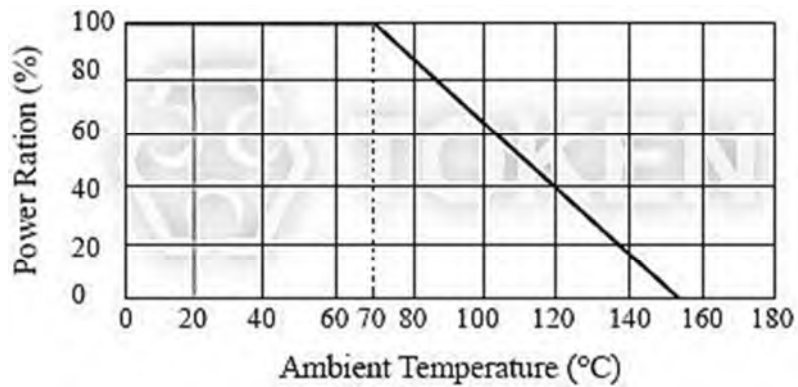
## Recommend Land Pattern (TCS)

| Type  | A (mm) | B (mm) | C (mm)   |
|-------|--------|--------|----------|
| TCS02 | 0.50   | 0.50   | 0.60±0.2 |
| TCS03 | 0.80   | 1.00   | 0.90±0.2 |
| TCS05 | 1.00   | 1.00   | 1.35±0.2 |
| TCS06 | 2.00   | 1.15   | 1.70±0.2 |
| TCS10 | 3.60   | 1.40   | 2.50±0.2 |
| TCS12 | 4.90   | 1.60   | 3.10±0.2 |



Recommend Land Pattern

## Power Derating Curve (TCS)



Power Derating Curve (TCS) Series

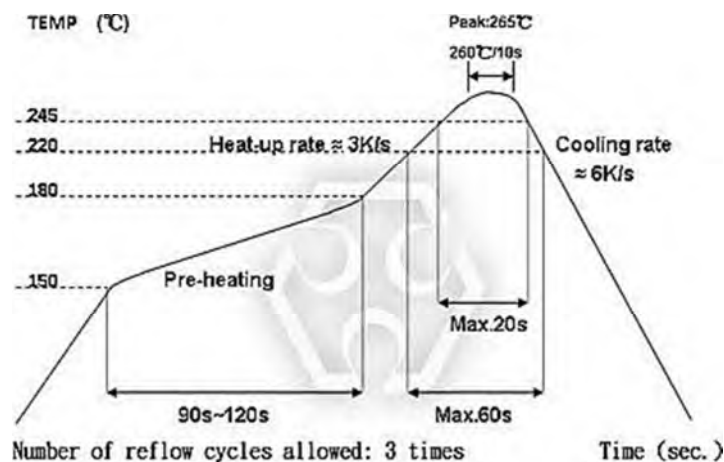
## Environmental Characteristics

### Environmental Characteristics (TCS)

| Item                                  | Specification    | Test Method   |
|---------------------------------------|------------------|---|
| Temperature Coefficient of Resistance | As Spec          | MIL-STD-202F Method 304<br>+25/-55/+25/+125/+25°C   |
| Short Time Overload                   | ±1%              | JIS-C-5202-5.5<br>RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds              |
| Dielectric Withstand Voltage          | by Type          | MIL-STD-202F Method 301<br>Apply Max Overload Voltage for 1 minute                                |
| Insulation Resistance                 | >1000MΩ          | MIL-STD-202F Method 302<br>Apply 100VDC for 1 minute  |
| Thermal Shock                         | ±0.5%            | MIL-STD-202F Method 107G<br>-55°C ~150°C, 100cycles   |
| Load Life (Endurance)                 | ±1%              | MIL-STD-202F Method 108A<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"         |
| Humidity (Damp Heat with Load)        | ±0.5%            | MIL-STD-202F Method 103B<br>40°C, 90~95%RH, RCWV 1.5 hours ON,<br>0.5 hours OFF, total 1000 hours |
| Low Temperature Operation             | ±0.5%            | JIS-C-5202-7.1<br>1hour, -65°C followed by 45minutes of RCWV                                      |
| Bending Strength                      | As Spec          | JIS-C-5202-6.1.4<br>Bending Amplitude 3mm for 10seconds   |
| Solderability                         | 95%Min. coverage | MIL-STD-202F Method 208H<br>245°C±5°C, 3 seconds  |
| Resistance to Soldering Heat          | ±0.5%            | MIL-STD-202F Method 210E<br>260±5°C, 10±1 seconds   |

- Rated continuous Working Voltage (RCWV) =  $\sqrt{\text{Power Rating} \times \text{Resistance Value } (\Omega)}$  or Max. Operating voltage whichever is lower.
- Storage Temperature: 15~28°C, Humidity < 80%RH

### Reflow Soldering (TCS)

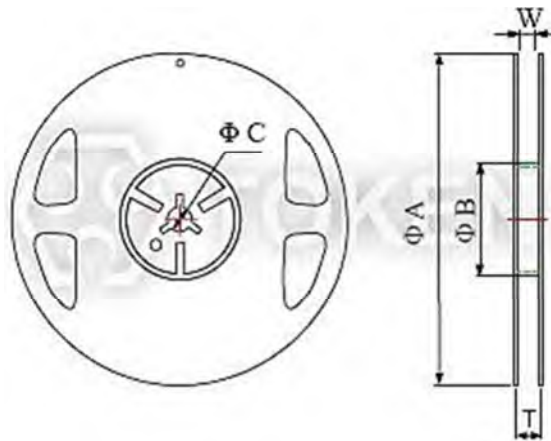


Power Derating Curve (TCS) Series

## ▶ Reel Tape Specifications

### Packaging Quantity & Reel Specifications (TCS)

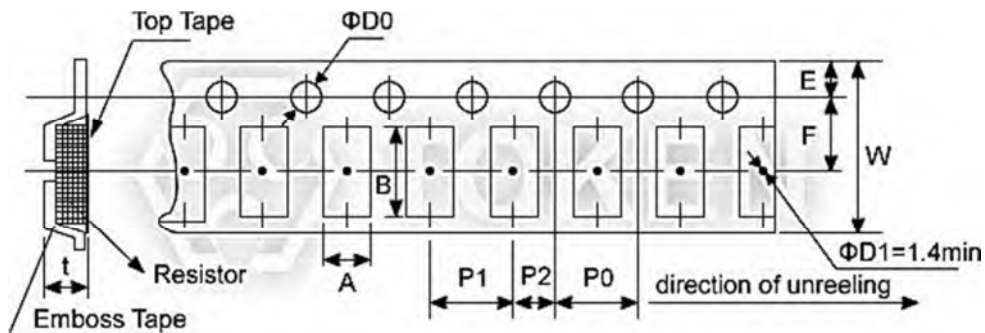
| Type  | $\Phi A$  | $\Phi B$ | $\Phi C$ | W        | T        | Paper Tape (EA) | Emboss Plastic Tape (EA) |
|-------|-----------|----------|----------|----------|----------|-----------------|--------------------------|
| TCS02 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 10,000          | -                        |
| TCS03 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 5,000           | -                        |
| TCS05 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 5,000           | -                        |
| TCS06 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 5,000           | -                        |
| TCS10 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -               | 4,000                    |
| TCS12 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -               | 4,000                    |



Packaging Reel Specifications

### Emboss Plastic Tape Specifications (TCS)

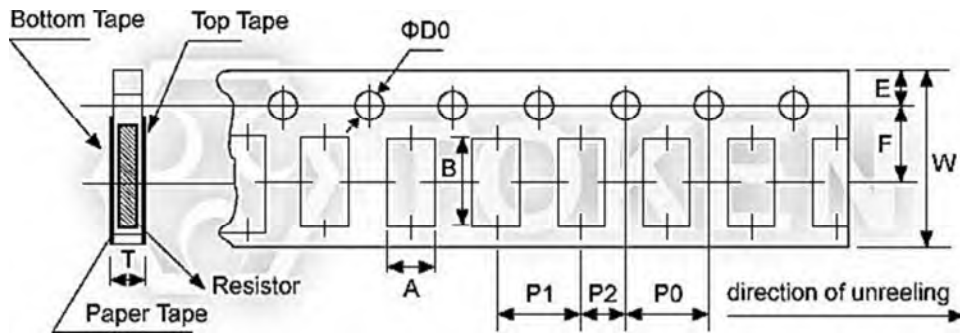
| Type  | A         | B         | W         | E         | F        | P0        | P1        | P2        | $\Phi D0$ | T         |
|-------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|
| TCS10 | 2.85±0.10 | 5.45±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 1.00±0.20 |
| TCS12 | 3.40±0.10 | 6.65±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 1.00±0.20 |



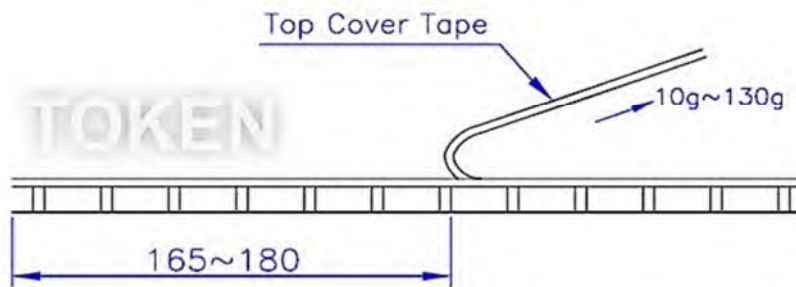
Emboss Plastic Tape Specifications (TCS)

## Paper Tape Specifications (TCS)

| Type  | A         | B         | W         | E         | F         | P0        | P1        | P2        | ΦD0       | T         |
|-------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| TCS02 | 0.70±0.05 | 1.16±0.05 | 8.00±0.10 | 1.75±0.05 | 3.50±0.05 | 4.00±0.10 | 2.00±0.10 | 2.00±0.05 | 1.55±0.05 | 0.40±0.03 |
| TCS03 | 1.10±0.05 | 1.90±0.05 | 8.00±0.10 | 1.75±0.05 | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.55±0.05 | 0.60±0.03 |
| TCS05 | 1.60±0.05 | 2.37±0.05 | 8.00±0.10 | 1.75±0.05 | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.55±0.05 | 0.75±0.05 |
| TCS06 | 2.00±0.05 | 3.55±0.05 | 8.00±0.10 | 1.75±0.05 | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.55±0.05 | 0.75±0.05 |



Paper Tape Specifications



Peel - off force

- Peel force of top cover tape
- The peel speed shall be about 300mm/Min.5±5%
- The peel force of top cover tape shall be between 10 to 100g

## Order Codes

### Order Codes (TCS)

| TCS       | 02                    | D    | TR      | E           |              | 1R00 | N                |    |                |       |                  |            |       |
|-----------|-----------------------|------|---------|-------------|--------------|------|------------------|----|----------------|-------|------------------|------------|-------|
| Part Type | Dimensions (L×W) (mm) |      | Package |             | TCR (ppm/°C) |      | Power Rating (W) |    | Resistance (Ω) |       | Marking          |            |       |
|           |                       |      | P       | Bulk        |              |      | Standard         |    | R010           | 0.01  | Standard Marking |            |       |
|           | 02                    | 0402 | F       | Taping Reel | D            | ±50  | R                | 3W | R100           | 0.100 | N                | No Marking |       |
|           | 03                    | 0603 | D       |             | ±0.5         | E    | ±100             |    |                | 1R00  |                  |            | 1.000 |
|           | 05                    | 0805 |         |             |              | F    | ±200             |    |                |       |                  |            |       |
|           | 06                    | 1206 |         |             |              |      |                  |    |                |       |                  |            |       |
|           | 10                    | 2010 |         |             |              |      |                  |    |                |       |                  |            |       |
|           | 12                    | 2512 |         |             |              |      |                  |    |                |       |                  |            |       |

### 3 Digit Marking (0603) (TCS)

| Resistance | 1Ω  | 0.1Ω | 0.15Ω | 0.01Ω | 0.101Ω | 0.035Ω |
|------------|-----|------|-------|-------|--------|--------|
| Codes      | 1R0 | R10  | R15   | R01   | 101    | 035    |

### 4 Digit Marking (0805~2512) (TCS)

| Resistance | 1Ω   | 0.1Ω | 0.05Ω | 0.015Ω | 0.01Ω | 0.39Ω |
|------------|------|------|-------|--------|-------|-------|
| Codes      | 1R00 | R100 | R050  | R015   | R010  | R390  |



# Metal Strip Chip Current Sense Resistor (LRC)

## ► Product Introduction

**Token (LRC) metal strip current sense chip resistor save space, time, and cost.**

### Features :

- Low TCR  $\pm 50\text{PPM}/^\circ\text{C}$ ,  $\pm 100\text{PPM}/^\circ\text{C}$ .
- High Wattage Rating Up to 3W.
- Customized Resistance Available.
- Resistance Values from  $0.5\text{m}\Omega$  to  $15\text{m}\Omega$ .
- Without Laser Trimmed with Very Low Inductance.

### Applications :

- For NB power management.
- For MB power management.
- For Monitor power management.
- SWPS: DC-DC converter, Charger, Adaptor.

Providing design engineers with an economical low Ohmic value, metal strip current sense surface mount resistor with high quality performance, Token Electronics LRC Series is suitable for applications in the automotive sector for applications that require high power handling (Up to 3W) and low resistance  $0.5\text{m}\Omega$ .

From a certified supplier offering the automotive quality, Token's LRC Series gives all round superior performance for current sensing in lamp detection, mirrors, window lift, steering and seat controls.

As a first instance, the LRC Series displays enhanced power handling capabilities, against other technologies.

Thermal conductivity is important for chip resistors - little heat is dissipated directly into the air, and instead, is conducted out through the solder pads.

The heat generated from the specially constructed LRC resistor is more readily dispersed, therefore preventing localized heating, which contributes to TCR and thermal EMF errors, premature aging and possible scorching of the PC board.

The current sensing resistors (LRC) are rated for ambient operation from  $-55^\circ\text{C}$  to  $+170^\circ\text{C}$ . The LRC Series is RoHS compliant and lead free.

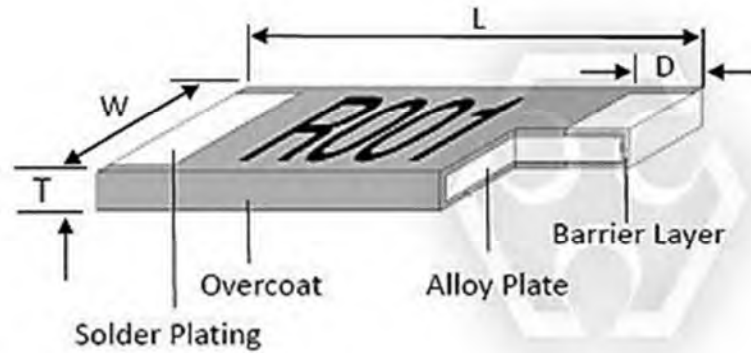
Need more detail information about (LRC), please link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



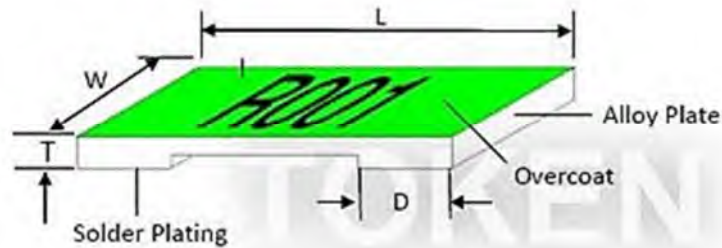


## Construction & Dimensions

### 2512 Construction & Dimension (LRC) (Unit: mm)



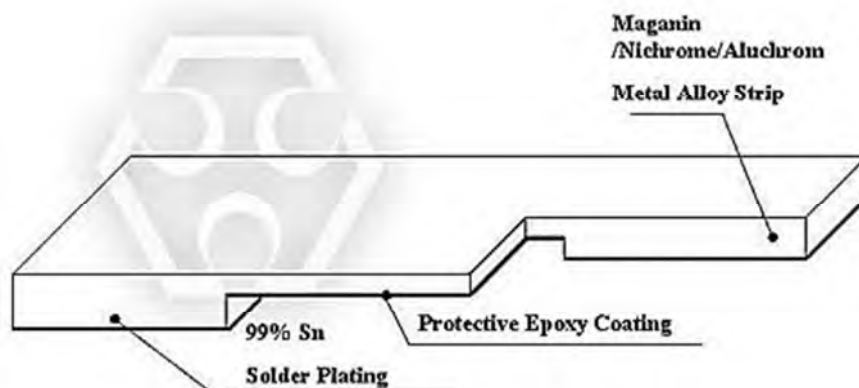
Black 2512 - Wave or IR reflow soldering



Green 2512 - IR reflow soldering only

### 1206 & 2010 Construction (LRC)

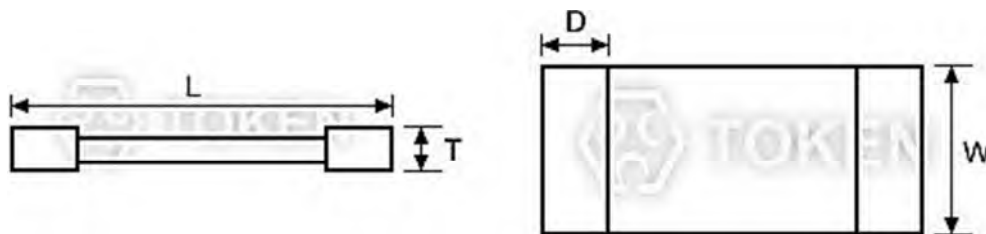
| Type        | Material                 |
|-------------|--------------------------|
| 0M50 ~ R003 | Manganese, Copper        |
| 3M5 ~ R010  | Aluminum, Iron, Chromium |



1206 & 2010 Construction

## Chip 2512, 2010, 1206 Dimensions (LRC)

| Type           | Resistance (mΩ)         | L(mm)      | W(mm)      | T(mm)     | D(mm)     | Weight(g) / 1000pcs |
|----------------|-------------------------|------------|------------|-----------|-----------|---------------------|
| LRC06*TF0M50   | 0.50                    | 3.20±0.25  | 1.60±0.10  | 0.60±0.20 | 1.35±0.25 | 22.6                |
| LRC06*TD0M75   | 0.75                    | 3.20±0.25  | 1.60±0.10  | 0.60±0.20 | 1.23±0.25 | 22.6                |
| LRC06*T*****   | 1.0, 3.5, 4.0, 5.0, 6.0 | 3.20±0.25  | 1.60±0.10  | 0.60±0.20 | 1.10±0.25 | 22.6                |
| LRC06*T*****   | 2.0, 3.0, 10            | 3.20±0.25  | 1.60±0.10  | 0.60±0.20 | 0.60±0.25 | 22.6                |
| LRC06*T*****   | 1.2, 1.5, 7.0, 8.0, 9.0 | 3.20±0.25  | 1.60±0.10  | 0.60±0.20 | 0.90±0.25 | 22.6                |
| LRC10*TEA0M50  | 0.5                     | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 2.17±0.25 | 42.3                |
| LRC10*TDA0M75  | 0.75                    | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 2.04±0.25 | 42.3                |
| LRC10*TDAR001  | 1.0                     | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 1.84±0.25 | 42.3                |
| LRC10*TDA****  | 2.0, 6.0, 7.0, 8.0      | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 1.54±0.25 | 42.3                |
| LRC10*TDAR003  | 3.0                     | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 1.04±0.25 | 42.3                |
| LRC10*TDA****  | 4.0, 5.0                | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 1.84±0.25 | 42.3                |
| LRC10*TDA****  | 9.0, 10                 | 5.08±0.25  | 2.54±0.15  | 0.60±0.20 | 1.29±0.25 | 42.3                |
| LRC12*T**0M50G | 0.50                    | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 2.68±0.25 | 59.13               |
| LRC12*T**0M75G | 0.75                    | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 2.48±0.25 | 59.13               |
| LRC12*T*****G  | 1.0, 6.0                | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 1.93±0.25 | 59.13               |
| LRC12*T*****G  | 1.5, 6.5, 7.0           | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 1.43±0.25 | 59.13               |
| LRC12*T*****G  | 2.0, 2.5, 3.0, 3.5      | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 1.18±0.25 | 59.13               |
| LRC12*T*****G  | 4.0, 4.5                | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 2.18±0.25 | 59.13               |
| LRC12*T*****G  | 5.0, 6.0                | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 1.93±0.25 | 59.13               |
| LRC12*T*****G  | 8.0 - 10                | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 1.18±0.25 | 59.13               |
| LRC12*T*****G  | 11 - 15                 | 6.35±0.25  | 3.00±0.20  | 0.60±0.20 | 1.18±0.25 | 59.13               |
| LRC12*T*0M50   | 0.50                    | 6.35±0.254 | 3.18±0.254 | 1.25±0.20 | 1.30±0.38 | 184.11              |
| LRC12*T*0M75   | 0.75                    | 6.35±0.254 | 3.18±0.254 | 0.75±0.20 | 1.30±0.38 | 131.11              |
| LRC12*T*R001   | 1.00                    | 6.35±0.254 | 3.18±0.254 | 0.65±0.20 | 1.30±0.38 | 110.85              |
| LRC12*T*1M50   | 1.50                    | 6.35±0.254 | 3.18±0.254 | 0.45±0.20 | 1.30±0.38 | 67.16               |
| LRC12*T*R002   | 2.00                    | 6.35±0.254 | 3.18±0.254 | 0.35±0.20 | 1.30±0.38 | 49.30               |
| LRC12*T*2M50   | 2.50                    | 6.35±0.254 | 3.18±0.254 | 0.65±0.20 | 1.30±0.38 | 97.95               |
| LRC12*T*R003   | 3.00                    | 6.35±0.254 | 3.18±0.254 | 0.55±0.20 | 1.30±0.38 | 83.49               |
| LRC12*T*R004   | 4.00                    | 6.35±0.254 | 3.18±0.254 | 0.45±0.20 | 1.30±0.38 | 62.59               |
| LRC12*T*R005   | 5.00                    | 6.35±0.254 | 3.18±0.254 | 0.35±0.20 | 1.30±0.38 | 49.84               |
| LRC12*T*R006   | 6.00                    | 6.35±0.254 | 3.18±0.254 | 0.32±0.20 | 1.30±0.38 | 41.76               |
| LRC12*T*6M50   | 6.50                    | 6.35±0.254 | 3.18±0.254 | 0.30±0.20 | 1.30±0.38 | 35.85               |
| LRC12*T*R007   | 7.00                    | 6.35±0.254 | 3.18±0.254 | 0.27±0.20 | 1.30±0.38 | 34.01               |
| LRC12*T*R010   | 10.00                   | 6.35±0.254 | 3.18±0.254 | 0.25±0.20 | 1.30±0.38 | 25.97               |



Chip 2512, 2010, 1206 Dimensions (LRC)

● Notice: TOKEN is capable of manufacturing the optional spec based on customer's requirement.



## Electrical Specifications

### Standard Electrical Specifications (LRC)

| Type          | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (±%) | Resistance (mΩ)      | TCR (±PPM/°C) |
|---------------|----------------------|-----------------------|---------------------------|----------------------|---------------|
| LRC06*TF0M50  | 1W                   | -55°C ~ +170°C        | ±1, ±3, ±5                | 0.5                  | ±200          |
| LRC06*TD****  | 1W                   |                       |                           | 0.75 - 10            | ±50           |
| LRC12*TD****  | 1W                   |                       |                           | 0.5, 0.75, 1, 1.5, 2 | ±50           |
| LRC12*TW****  | 1W                   |                       |                           | 6, 6.5, 7            | ±75           |
| LRC12*TE****  | 1W                   |                       |                           | 4, 5, 10             | ±100          |
| LRC12*TK****  | 1W                   |                       |                           | 2.5, 3               | ±150          |
| LRC12*TD****G | 1W                   |                       |                           | 11, 12, 13, 14, 15   | ±50           |

### High Power Rating Electrical Specifications (LRC)

| Type           | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (±%) | Resistance (mΩ)        | TCR (±PPM/°C) |
|----------------|----------------------|-----------------------|---------------------------|------------------------|---------------|
| LRC10*TEA0M50  | 1.5W                 | -55°C ~ +170°C        | ±1, ±3, ±5                | 0.5                    | ±100          |
| LRC10*TDA****  | 1.5W                 |                       |                           | 0.75 - 10              | ±50           |
| LRC12*TDS****  | 2W                   |                       |                           | 0.5, 0.75, 1, 1.5, 2   | ±50           |
| LRC12*TWS****  | 2W                   |                       |                           | 6, 6.5, 7              | ±75           |
| LRC12*TES****  | 2W                   |                       |                           | 4, 5, 10               | ±100          |
| LRC12*TKS****  | 2W                   |                       |                           | 2.5, 3                 | ±150          |
| LRC12*TDS****G | 2W                   |                       |                           | 6.5, 7, 8, 9, 10       | ±50           |
| LRC12*TDB****G | 2.5W                 |                       |                           | 4, 4.5, 5, 6           | ±50           |
| LRC12*TDR****G | 3W                   |                       |                           | 1, 1.5, 2, 2.5, 3, 3.5 | ±50           |
| LRC12*TER****G | 3W                   |                       |                           | 0.5, 0.75              | ±100          |

● Remark : Operating Current  $I = \sqrt{(P / R)}$  , Operating Voltage  $V = \sqrt{(P * R)}$

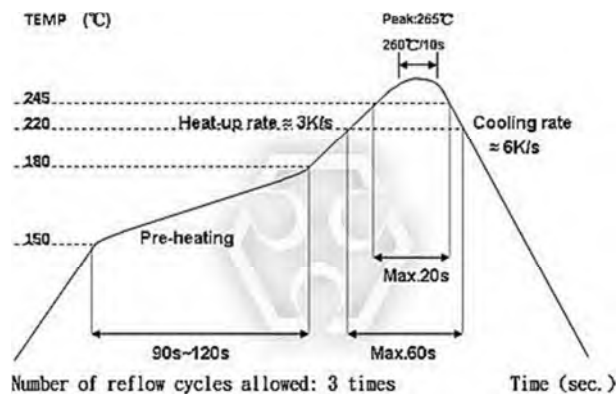
## ► Environmental Characteristics

### Environmental Characteristics (LRC)

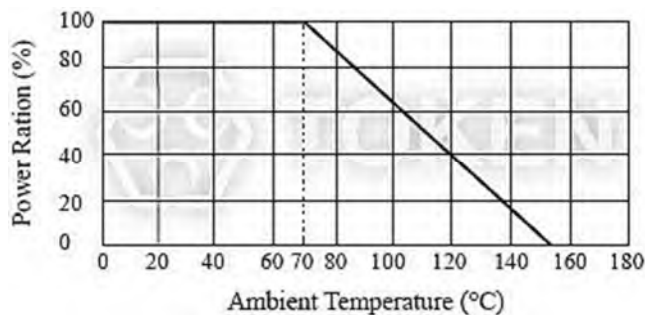
| Item                                  | Specification     |               | Test Method  |
|---------------------------------------|-------------------|---------------|--|
|                                       | Black coating     | Green coating |  |
| Thermal Shock                         | ±0.5%             | ±1%           | -55°C ~150°C, 100 cycles. MIL-STD-202 Method 107G                  |
| Short Time Overload                   | ±0.5%             | ±1%           | 5*Rated Power for 5 seconds. JIS-C-5202-5.5                        |
| Endurance                             | ±1%               | ±1%           | 70±2°C, Max. working voltage for 1000 hrs with 1.5 hrs and 0.5 hrs |
| Dry Heat                              | ±1%               | ±1%           | at +170°C for 1000 hrs   |
| Resistance to Soldering Heat          | ±0.5%             | ±1%           | 260±5°C, for 10 seconds. MIL-STD-202F Method 210E                  |
| Solderability                         | 95% Min. coverage |               | 245±5°C for 3 seconds. MIL-STD-202F Method 210E                    |
| Temperature Coefficient of Resistance | As Spec.          |               | +25/-55/+25/+125/+25°C. MIL-STD-202 Method 304                     |

- Rated continuous Working Voltage (RCWV) =  $\sqrt{\text{Power Rating} \times \text{Resistance Value } (\Omega)}$  or Max. Operating voltage whichever is lower.
- Green coating can't be work with wave soldering bath.
- Humidity < 80%RH; Storage Temperature: 25±3°C

### Soldering Condition (LRC)



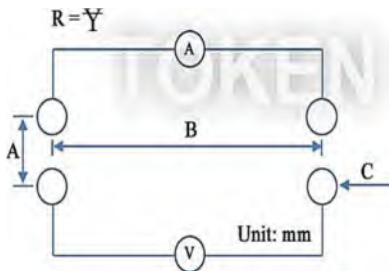
Green coating "Reflow Air Convection" is available  
Green coating can't be working with wave soldering bath



Power Derating Curve

## ▶ Pad Layout

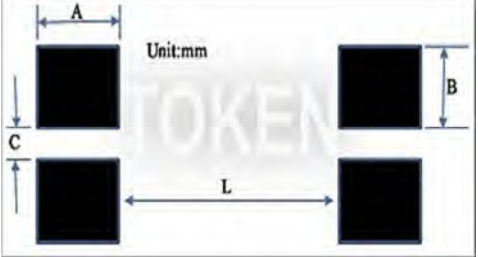
### 4-Wire Precision Measurement (LRC)

| Figure  | Type                | A    | B    | C          | Excitation Current (A) | Resistance ( $\Omega$ ) |
|---|---------------------|------|------|------------|------------------------|-------------------------|
|  <p>4-Wire Precision Measurement</p> | LRC12 Black Coating | 1.5  | 5.4  | $\Phi 0.5$ | 3A                     | 0.5m ~ 1.5 m            |
|   | LRC12 Black Coating | 1.5  | 5.4  | $\Phi 0.5$ | 1A                     | 2m ~ 10m                |
|   | LRC12 Green Coating | 1.5  | 5.4  | $\Phi 0.5$ | 3A                     | 0.5m ~ 1.5m             |
|   | LRC12 Green Coating | 1.5  | 5.4  | $\Phi 0.5$ | 1A                     | 2m ~ 15m                |
|   | LRC06               | 1.25 | 2.6  | $\Phi 0.5$ | 3A                     | 0.5m ~ 1.5m             |
|   | LRC06               | 1.25 | 2.6  | $\Phi 0.5$ | 1A                     | 2m ~ 10m                |
|   | LRC10               | 1.2  | 4.32 | $\Phi 0.5$ | 3A                     | 0.5m ~ 1.5m             |
|   | LRC10               | 1.2  | 4.32 | $\Phi 0.5$ | 1A                     | 2m ~ 10m                |

● Note: Equipment: ADEX AX-1152D DC Low Ohm Meter



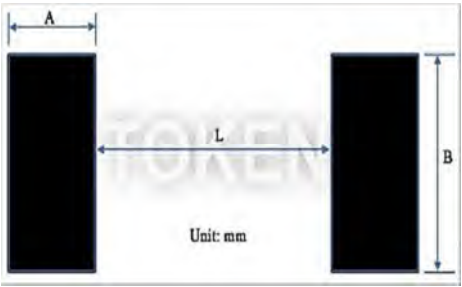
## 4-Wire Pad Layout (LRC)

| Figure   | Type                       | Resistance ( $\Omega$ ) | A    | B     | C    | L    |
|--|----------------------------|-------------------------|------|-------|------|------|
|  <p>4-Wire Pad Layout<br/>(recommended for precision current sensing)</p> | <b>LRC12 Black Coating</b> | -                       | 1.0  | 2.7   | 2.95 | 1.45 |
|  | <b>LRC12 Green Coating</b> | 0M50                    | 3.13 | 1.2   | 1.0  | 0.52 |
|  |                            | 0M75                    | 2.93 | 1.2   | 1.0  | 0.94 |
|  |                            | R001                    | 2.38 | 1.2   | 1.0  | 2.04 |
|  |                            | 1M5                     | 1.88 | 1.2   | 1.0  | 3.04 |
|  |                            | R002~3M5                | 1.63 | 1.2   | 1.0  | 3.54 |
|  |                            | R004~4M5                | 2.63 | 1.2   | 1.0  | 1.54 |
|  |                            | R005~R006               | 2.38 | 1.2   | 1.0  | 2.04 |
|  |                            | 6M5~R007                | 1.88 | 1.2   | 1.0  | 3.04 |
|  | <b>LRC10</b>               | R008~R015               | 1.63 | 1.2   | 1.0  | 3.54 |
|  |                            | 0M50                    | 2.61 | 1.045 | 0.8  | 0.60 |
|  |                            | 0M75                    | 2.49 | 1.045 | 0.8  | 0.80 |
|  |                            | R001                    | 2.29 | 1.045 | 0.8  | 0.95 |
|  |                            | R002                    | 1.99 | 1.045 | 0.8  | 1.55 |
|  |                            | R003                    | 1.49 | 1.045 | 0.8  | 2.55 |
|  |                            | R004~R005               | 2.29 | 1.045 | 0.8  | 0.95 |
|  |                            | R006~R008               | 1.99 | 1.045 | 0.8  | 1.55 |
|  | <b>LRC06</b>               | R009~R010               | 1.74 | 1.045 | 0.8  | 2.05 |
|  |                            | 0M50                    | 1.80 | 0.7   | 0.5  | 0.55 |
|  |                            | 0M75                    | 1.68 | 0.7   | 0.5  | 0.55 |
|  |                            | R001                    | 1.55 | 0.7   | 0.5  | 0.55 |
|  |                            | 1M2                     | 1.35 | 0.7   | 0.5  | 0.95 |
|  |                            | 1M5                     | 1.35 | 0.7   | 0.5  | 1.55 |
|  |                            | R002~R003               | 1.05 | 0.7   | 0.5  | 1.55 |
|  |                            | 3M5~R006                | 1.55 | 0.7   | 0.5  | 0.55 |
|  |                            | R007~R009               | 1.35 | 0.7   | 0.5  | 0.95 |
|  | R010                       | 1.05                    | 0.7  | 0.5   | 1.55 |      |

● **Note: No circuits between pads to avoid short circuit**



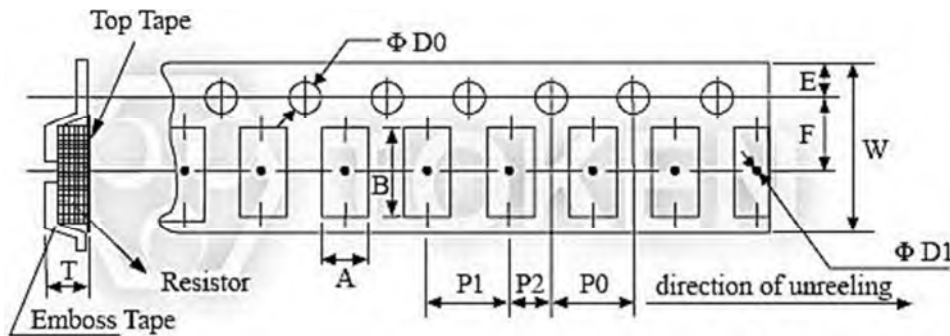
## 2-Wire Pad Layout (LRC)

| Figure   | Type                       | Resistance ( $\Omega$ ) | A    | B    | L    |
|--|----------------------------|-------------------------|------|------|------|
|  <p>2-Wire Pad Layout</p> | <b>LRC12 Black Coating</b> | -                       | 2.7  | 3.6  | 2.95 |
|  | <b>LRC12 Green Coating</b> | 0M50                    | 3.13 | 3.4  | 0.52 |
|  |                            | 0M75                    | 2.93 | 3.4  | 0.94 |
|  |                            | R001                    | 2.38 | 3.4  | 2.04 |
|  |                            | 1M5                     | 1.88 | 3.4  | 3.04 |
|  |                            | R002~3M5                | 1.63 | 3.4  | 3.54 |
|  |                            | R004~4M5                | 2.63 | 3.4  | 1.54 |
|  |                            | R005~R006               | 2.38 | 3.4  | 2.04 |
|  |                            | 6M5~R007                | 1.88 | 3.4  | 3.04 |
|  |                            | R008~R015               | 1.63 | 3.4  | 3.54 |
|  | <b>LRC10</b>               | 0M50                    | 2.61 | 2.89 | 0.60 |
|  |                            | 0M75                    | 2.49 | 2.89 | 0.80 |
|  |                            | R001                    | 2.29 | 2.89 | 0.95 |
|  |                            | R002                    | 1.99 | 2.89 | 1.55 |
|  |                            | R003                    | 1.49 | 2.89 | 2.55 |
|  |                            | R004~R005               | 2.29 | 2.89 | 0.95 |
|  |                            | R006~R008               | 1.99 | 2.89 | 1.55 |
|  |                            | R009~R010               | 1.74 | 2.89 | 2.05 |
|  |                            | <b>LRC06</b>            | 0M50 | 1.80 | 1.90 |
|  | 0M75                       |                         | 1.68 | 1.90 | 0.55 |
|  | R001                       |                         | 1.55 | 1.90 | 0.55 |
|  | 1M2                        |                         | 1.35 | 1.90 | 0.95 |
|  | 1M5                        |                         | 1.35 | 1.90 | 1.55 |
|  | R002~R003                  |                         | 1.05 | 1.90 | 1.55 |
|  | 3M5~R006                   |                         | 1.55 | 1.90 | 0.55 |
|  | R007~R009                  |                         | 1.35 | 1.90 | 0.95 |
|  | R010                       |                         | 1.05 | 1.90 | 1.55 |

● Note: No circuits between pads to avoid short circuit

## ▶ Reel & Tape

### Emboss Plastic Tape Specifications (LRC)



Emboss Plastic Tape Specifications

| Type     | Resistance (mΩ) | P0 (mm) | P1 (mm) | P2 (mm)  | ΦD0 (mm)  | ΦD1 (mm) | T (mm)   |
|----------|-----------------|---------|---------|----------|-----------|----------|----------|
| LRC06    | 0.5 - 10        | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | 1.55±0.05 | 1.0Min.  | 0.87±0.1 |
| LRC10    | 0.5 - 10        | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | 1.55±0.05 | 1.4Min.  | 0.85±0.1 |
| LRC12    | 0.50 - 0.75     | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | 1.55±0.05 | 1.4Min.. | 1.45±0.2 |
|          | 1 - 10          | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | 1.55±0.05 | 1.4Min.. | 0.81±0.1 |
| LR12 (G) | 0.50 - 15       | 4.0±0.1 | 4.0±0.1 | 2.0±0.05 | 1.55±0.05 | 1.4Min.  | 0.85±0.1 |

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

## Order Codes

### Order Codes (LRC)

| LRC       | 12                   |         | H                        |   | TR      |    | D            |   | R011             |   | G              |      |                    |             |                      |
|-----------|----------------------|---------|--------------------------|---|---------|----|--------------|---|------------------|---|----------------|------|--------------------|-------------|----------------------|
| Part Type | Dimensions (L×W)(mm) |         | Resistance Tolerance (%) |   | Package |    | TCR (PPM/°C) |   | Power Rating (W) |   | Resistance (Ω) |      | Protective Coating |             |                      |
|           | 12                   | 6.3×3.1 | EIA2512                  | J | ±5      | TR | Taping Reel  | D | ±50              |   | Standard       | 0m50 | 0.00050            |             | Black Coating        |
|           | 10                   | 5.1×2.5 | EIA2010                  | H | ±3      |    |              | W | ±75              | A | 1.5            | 0m75 | 0.00075            |             |                      |
|           | 06                   | 3.2×1.6 | EIA1206                  | F | ±1      |    |              | E | ±100             | S | 2              | 1m50 | 0.00150            | G           | Green Coating        |
|           |                      |         |                          |   |         |    |              | F | ±200             | R | 3              | R011 | 0.01100            | **2010/1206 | No coating / marking |
|           |                      |         |                          |   |         |    |              | K | ±150             | B | 2.5            | R002 | 0.00200            |             |                      |
|           |                      |         |                          |   |         |    |              |   |                  |   |                | R020 | 0.02000            |             |                      |

### Resistance codes example (3 Marking)

| Resistance | 0.39mΩ | 0.5mΩ | 0.75mΩ | 330mΩ | 5.1Ω |
|------------|--------|-------|--------|-------|------|
| Codes      | M39    | M50   | M75    | R33   | 5R1  |

### Resistance codes example (4 Marking)

| Resistance | 1mΩ  | 1.5mΩ | 2mΩ  | 7mΩ  | 10mΩ |
|------------|------|-------|------|------|------|
| Codes      | R001 | 1M50  | R002 | R007 | R010 |

# Four-terminal Kelvin Connected Resistors (LRD)

## ▶ Product Introduction

Token's open air 4-terminal kelvin connected resistors (LRD) tackle current sensing applications.

### Features :

- Low inductance.
- 4 leads for Kelvin connection.
- Decimal marked, silicone coated.
- Tinned copper terminal for easy soldering.
- Radial, self-supporting, design is ideal for PC board mounting.

### Applications :

- Surge/Pulse Applications.
- Current Sensing Application.
- Feed Back & Motor Control.
- High Precision Measurement Instrumentation.

Always preferred in current sense applications, Token's LRD Series range is available in the 1W, 3W, 5W, 7W and 10W packages, resistance values down to 0.001 ohm, with tolerances as tight as 0.50% and TCRs of 50ppm standard.

The 4 Lead Kelvin configurations enables current to be applied through two opposite terminals and a sensing voltage to be measured across the other two terminals, eliminating the resistance and temperature coefficient of the terminals for a more accurate current measurement.

With up to 10W power rating and TCRs as low as 50ppm/°C, the LRD 4-Lead Kelvin resistors deliver excellent performance, making them ideal for a variety of applications. The resistor is constructed using a low-resistance, low-inductance, high-impulse proprietary metal element that gives the device its extended power and temperature ratings.

Continually upgrading its current sense resistors to take advantage of modern technologies and manufacturing methods, Token is now able to offer complete ranges of products which meet the RoHS requirements and in addition to detailing these, the component selector also provides designers with a comprehensive selection of application notes.

The Open Air (LRD) Kelvin 4-terminal Resistor can be manufactured to custom length/width for use as a current shunt. Token will also produce outside these specifications to meet customer requirements. Contact us with your specific needs, or link to Token official website "[Current Sensing Resistors](http://www.token.com.tw)" for more information.

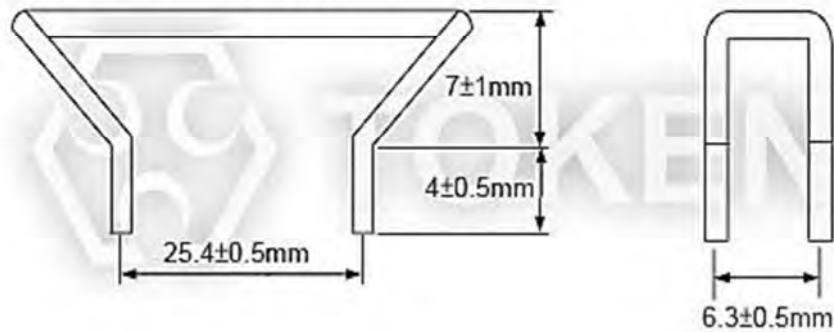


## LRD Spec. & Dim

### Specification & Dimensions (Unit: mm) (LRD)

| Type   | Rating Current | Resistance Range (mΩ) | Tolerance (%)                          | TCR (ppm/°C)  |
|--------|----------------|-----------------------|--|---|
| LRD-1  | 1A             | 1 ~ 10 mΩ             | D(±0.5%)<br>F(±1%)<br>G(±2%)<br>J(±5%) | ±10 ppm/°C<br>±20 ppm/°C<br>±25 ppm/°C<br>±50 ppm/°C<br>±100 ppm/°C |
| LRD-3  | 3A             | 1 ~ 10 mΩ             |  |   |
| LRD-5  | 5A             | 0.5 ~ 5 mΩ            |  |   |
| LRD-7  | 7A             | 0.3 ~ 3 mΩ            |  |   |
| LRD-10 | 10A            | 0.1 ~ 1 mΩ            |  |   |

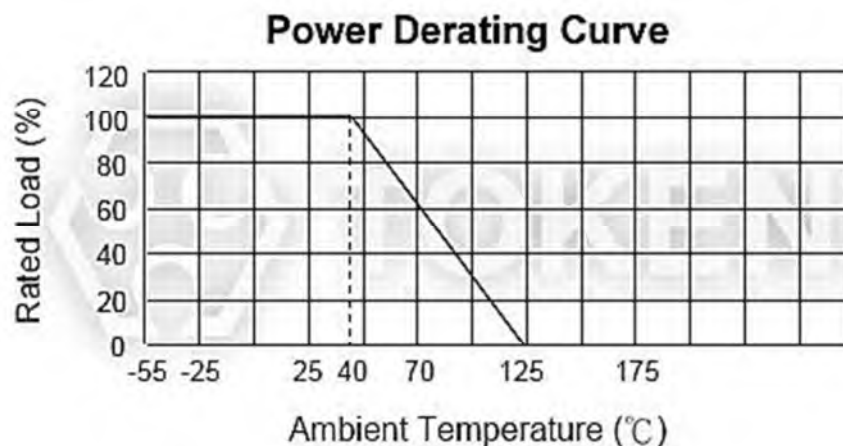
LRD Dimensions (Unit: mm)



4-Terminal Current Sensing Open Air (LRD) Dimensions

## Derating Curve

### Power Derating Curve (LRD)



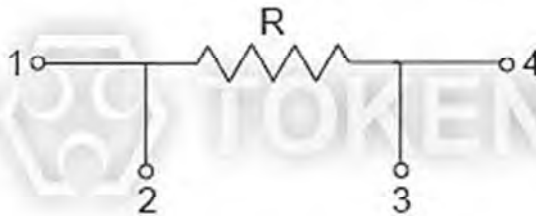
(LRD) Power Derating Curve

## Characteristics

### Characteristic Specification & 4-Lead Kelvin Connections (LRD)

| Test Items                  | Test Method                              | Specification                |
|-----------------------------|--|------------------------------|
| Operating Temperature Range |  | -55°C ~ 125°C                |
| Maximum Working Voltage     |  | (P40°C x R)/2                |
| Terminal Tensile Strength   | 50N, 10s                                 | $\Delta R \leq \pm 1.0\%R$   |
| Withstand Voltage           | 1000V, 1 Min.                            | No damage on the appearance. |
| Short Time Overload         | 5 times rated power, 5s                  | $\Delta R \leq \pm 4.0\%R$   |
| Thermal Shock               | -55°C ~ +125°C, 5 cycles, 30 Min..       | $\Delta R \leq \pm 5.0\%R$   |
| Load Life                   | 70°C, 1000h 1.5 hours on, 0.5 hours off. | $\Delta R \leq \pm 5.0\%R$   |

#### KELVIN ELECTRICAL CONNECTION:



Terminals 2 & 3 Current Traces.  
Terminals 1 & 4 Sense Traces.

4 Lead Kelvin Connections (LRD)

## Order Codes

### Order Codes (LRD)

| LRD         | - | 5             | R005                 | F           | P            |
|-------------|---|---------------|----------------------|-------------|--------------|
| Part Number |   | Rated Current | Resistance Value (Ω) | Tolerance % | Package-Code |
| LRD         |   | 1   1 A       | R005   0.005Ω        | D   ±0.5%   | P   Bulk     |
|             |   | 3   3 A       | R05   0.05Ω          | F   ±1%     |              |
|             |   | 5   5 A       | R1   0.1Ω            | G   ±2%     |              |
|             |   | 7   7 A       |                      | J   ±5%     |              |
|             |   | 10   10 A     |                      |             |              |



# 4-Terminal Current Sensing Resistor (LSQ)

## ► Product Introduction

**Token's Kelvin style (LSQ) family current sensing 4-terminal resistors handle high-wattage applications.**

### Features :

- Welded & fireproof construction.
- Superior anti-surge capability & Low TCR.
- Special inorganic potting construction provides high moisture resistance and thermal conductivity.
- 4 leads for Kelvin connection with extremely low resistance values.

### Applications :

- Automatic Test Equipment.
- Current Sensing Application.
- High Precision Instrumentation.
- Industrial, Medical and Military.
- Measurement Instrumentation.

Providing ultralow resistance values (to 0.01 ohm) for relatively high current requirements, new four-terminal cement filling resistor from Token combine the advantages of a Kelvin configuration with PC board mounting capability.

The Kelvin (or 4-terminal) configuration enables current to be applied through two opposite terminals and a sensing voltage to be measured across the other two terminals, eliminating the resistance and temperature coefficient of the terminals for a more accurate current measurement.

The 4 lead resistors are a new version of Token's (LSQ) Precision Current Sensing Family Resistors which was specially designed for use in a Kelvin method where a current is applied through two opposing leads and sensing voltage is measured across the other two leads. Token LSQ series is specifically designed for low resistance applications requiring the highest accuracy and temperature stability.

The advantages of Kelvin connection enable the resistance and temperature coefficient of the leads to be effectively eliminated. The need to connect to the leads at precise test points is eliminated, allowing for tighter tolerance on the end application. Also results in a lower temperature coefficient of resistance and lower self-heating drift which may be experienced on two-terminal resistor.

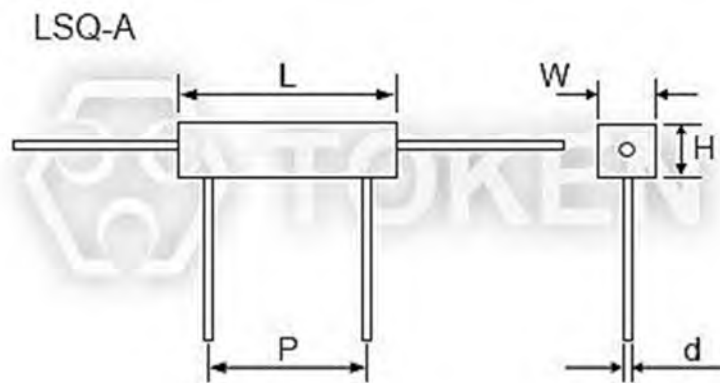
Token will also produce low ohmic resistor LSQ series outside these specifications to meet customer requirements. Contact us with your specific needs, or link to Token official website "[Current Sensing Resistors](http://www.token.com.tw)" for more information.



## ▶ LSQ-A Spec. & Dim

### Specification & Dimensions (Unit: mm) (LSQ-A) for Kelvin Connection

| Type     | Power (Watts) | Resistance Range ( $\Omega$ ) | Dimensions (Unit: mm) |           |           |           |             |
|----------|---------------|-------------------------------|-----------------------|-----------|-----------|-----------|-------------|
|          |               |                               | L                     | W $\pm$ 1 | H $\pm$ 1 | P $\pm$ 1 | d $\pm$ 0.5 |
| LSQ-A-3  | 3             | R01~R1                        | 22 $\pm$ 1.0          | 8         | 8         | 14        | 0.8         |
| LSQ-A-5  | 5             | R01~R1                        | 22 $\pm$ 1.5          | 9.5       | 9.5       | 14        | 0.8         |
| LSQ-A-7  | 7             | R01~R1                        | 35 $\pm$ 2.0          | 9.5       | 9.5       | 25        | 0.8         |
| LSQ-A-10 | 10            | R01~R1                        | 48 $\pm$ 2.0          | 9.5       | 9.5       | 36        | 0.8         |
| LSQ-A-15 | 15            | R01~R1                        | 48 $\pm$ 2.0          | 12.5      | 12.5      | 36        | 0.8         |

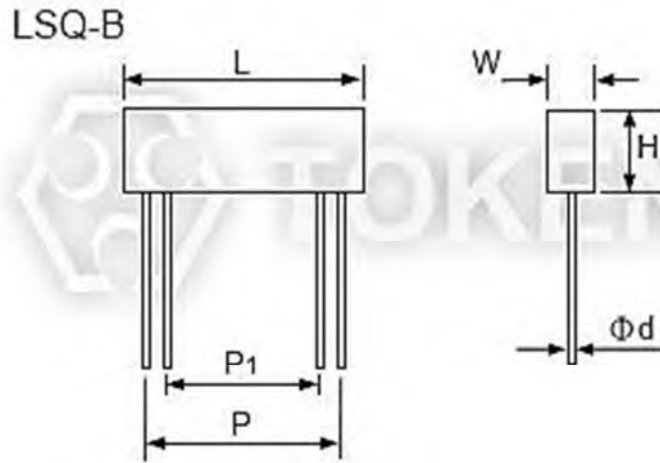


4-T Kelvin Sensing (LSQ-A) Dimensions

## ▶ LSQ-B Spec. & Dim

### Specification & Dimensions (Unit: mm) (LSQ-B) for Kelvin Connection

| Type    | Power (Watts) | Resistance Range ( $\Omega$ ) | Dimensions (Unit: mm) |           |           |           |                        |             |
|---------|---------------|-------------------------------|-----------------------|-----------|-----------|-----------|------------------------|-------------|
|         |               |                               | L $\pm$ 2             | W $\pm$ 1 | H $\pm$ 1 | P $\pm$ 1 | P <sub>1</sub> $\pm$ 1 | d $\pm$ 0.5 |
| LSQ-B-5 | 5             | R01~R1                        | 26                    | 5         | 10        | 20        | 12                     | 0.8         |

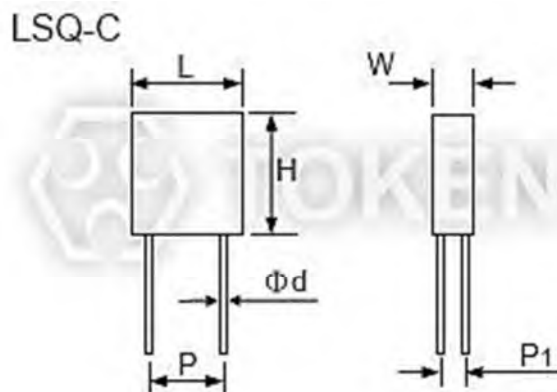


4 Terminal Sensing (LSQ-B) Dimensions

## ▶ LSQ-C Spec. & Dim

### Specification & Dimensions (Unit: mm) (LSQ-C) for Kelvin Connection

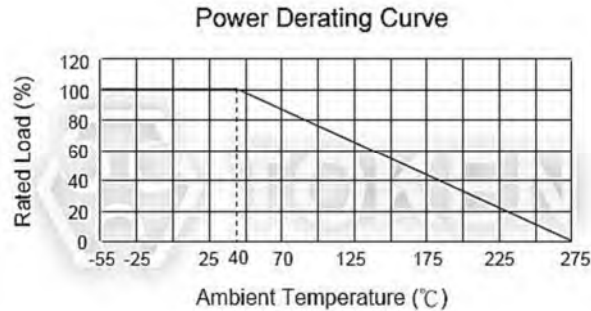
| Type     | Power (Watts) | Resistance Range ( $\Omega$ ) | Dimensions (Unit: mm) |           |           |           |                        |             |
|----------|---------------|-------------------------------|-----------------------|-----------|-----------|-----------|------------------------|-------------|
|          |               |                               | L $\pm$ 2             | W $\pm$ 1 | H $\pm$ 1 | P $\pm$ 1 | P <sub>1</sub> $\pm$ 1 | d $\pm$ 0.5 |
| LSQ-C-10 | 10            | R01~R1                        | 18                    | 10.5      | 20        | 12        | 5                      | 1.0         |



4-wire Sensing (LSQ-C) Dimensions

## ▶ Derating Curve

### Power Derating Curve (LSQ)



Power Derating Curve (LSQ)

## ▶ Characteristics

### Characteristic Specification (LSQ)

| Test Items                  | Test Method  | Specification   |
|-----------------------------|--|---|
| Resistance Tolerances       |  | D( $\pm 0.5\%$ ), F( $\pm 1\%$ ), G( $\pm 2\%$ ), J( $\pm 5\%$ )  |
| Temperature Coefficients    |  | $\pm 10$ ppm/ $^{\circ}\text{C}$ , $\pm 20$ ppm/ $^{\circ}\text{C}$ , $\pm 25$ ppm/ $^{\circ}\text{C}$ , $\pm 50$ ppm/ $^{\circ}\text{C}$ |
| Operating Temperature Range |  | $-55^{\circ}\text{C} \sim 275^{\circ}\text{C}$  |
| Maximum Working Voltage     |  | $(P/40^{\circ}\text{C} \times R)^{1/2}$   |
| Terminal Tensile Strength   | 50N, 10s   | $\Delta R \leq \pm 1.0\%R$  |
| Withstand Voltage           | 1000V, 1 Min.  | No damage on the appearance.  |
| Short Time Overload         | 5 times rated power, 5s  | $\Delta R \leq \pm 4.0\%R$  |
| Thermal Shock               | $-55^{\circ}\text{C} \sim +275^{\circ}\text{C}$ , 5 cycles, 30 Min.. | $\Delta R \leq \pm 5.0\%R$  |
| Load Life                   | $40^{\circ}\text{C}$ , 1000h 1.5 hours on, 0.5 hours off.            | $\Delta R \leq \pm 5.0\%R$  |

## ▶ Order Codes

### Order Codes (LSQ)

| LSQ-A       | - | 15           | R01                           | J             | P            |
|-------------|---|--------------|-------------------------------|---------------|--------------|
| Part Number |   | Rated Power  | Resistance Value ( $\Omega$ ) | Tolerance     | Package-Code |
| LSQ-A       |   | 3   3 Watt   | R01   0.01 $\Omega$           | J   $\pm 5\%$ | P   Bulk     |
| LSQ-B       |   | 5   5 Watt   | R05   0.05 $\Omega$           |               |              |
| LSQ-C       |   | 7   7 Watt   | R1   0.1 $\Omega$             |               |              |
|             |   | 10   10 Watt |                               |               |              |
|             |   | 15   15 Watt |                               |               |              |

# Power Low Resistance Resistor (BWL)

## ▶ Product Introduction

**Token's low resistance current sensing (BWL) resistor minimizes power consumption.**

### Features :

- Low inductance.
- Excellent load life stability.
- Low temperature coefficient.
- Cooler operation for high power to size ratio.
- Proprietary processing technique produces extremely low resistance values

### Applications :

- Switching and linear power supplies.
- Notebook power management.
- Power amplifiers.
- Instruments.

In response to demand for more energy efficient products, Token Electronics has expanded its current sensing series offering with the launch of the BWL series, its lowest resistance value resistor, to minimize power consumption.

The BWL series has been designed for current sensing in power electronic systems and the resistors are available in 0.5W to 10W power ratings, with a wide Ohmic range starting from as low as 0.005Ω.

Products in the economical, low-inductance BWL resistors are axial leads with high temperature mold compound, making them well-suited to the industry trend and are ideal for all types of current sensing applications including switching and linear power supplies, instruments and power amplifiers

In addition, the BWL series utilizes metal strip technology, essential for those involved in constructing devices and circuits for the detection of currents.

Token's BWL standard series is lead-free and RoHS compliant and can be a replacement for Vishay, IRC, KOA, Panasonic current sense resistor with more competitive price and short lead time. Contact us with your specific needs. Or link to our official website "[Current Sensing Resistors](#)" to get more information.

### Material:

- Encapsulation: High temperature mold compound.
- BWL metal strip technology utilizes manganin.
- Element: Self-supporting nickel-chrome alloy.
- Terminals: Tinned copper.

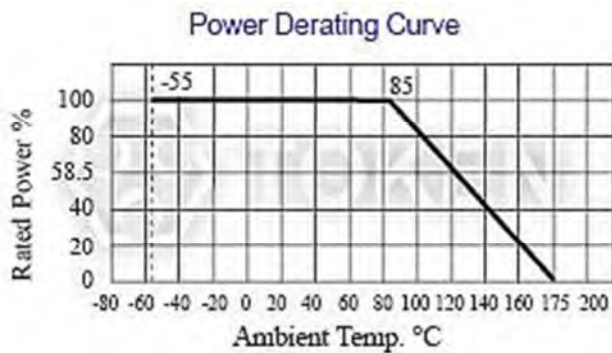




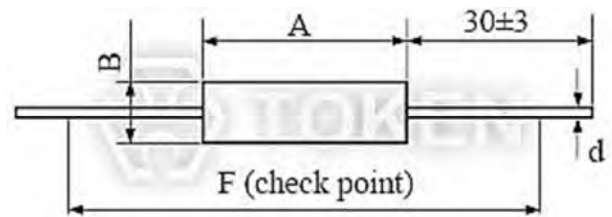
## ► Technical Specifications & Dimensions

### Technical Specifications & Dimensions (BWL)

| Type    | Rated Watts at 25°C (W) | Resistance Range (Ω) |     | Tolerance         | Dimensions (Unit: mm) |         |     |      |
|---------|-------------------------|----------------------|-----|-------------------|-----------------------|---------|-----|------|
|         |                         | Min                  | Max |                   | A±0.25                | ΦB±0.25 | Φd  | F    |
| BWL-0.5 | 0.5                     | 0.01                 | 1   | ±1%<br>±2%<br>±5% | 7.0                   | 3.0     | 0.6 | 27.0 |
| BWL-1   | 1.0                     | 0.005                | 2   |                   | 11.0                  | 3.0     | 0.6 | 31.0 |
| BWL-3   | 3.0                     | 0.005                | 2   |                   | 15.0                  | 5.2     | 0.8 | 35.0 |
| BWL-4   | 4.0                     | 0.005                | 5   |                   | 18.0                  | 6.5     | 0.8 | 38.0 |
| BWL-5   | 5.0                     | 0.005                | 1   |                   | 24.0                  | 8.4     | 1.0 | 44.0 |
| BWL-10  | 10.0                    | 0.01                 | 1   |                   | 46.5                  | 10.0    | 1.0 | 66.0 |



(BWL) Power Derating Curve



## ► Electrical Performance

### Electrical Performance (BWL)

| Test Items                      | Test Conditions                  | Specifications             |
|---------------------------------|----------------------------------|----------------------------|
| Operating Temp. Range           |                                  | -55°C ~ 175°C              |
| Insulation Resistance           | 500V                             | >1GΩ                       |
| Dielectric Withstanding Voltage | 500V AC 1 Min.                   | $\Delta R \leq \pm 0.1\%R$ |
| Load Life                       | 70°C on~off cycle 1000 Hrs.      | $\Delta R \leq \pm 1\%R$   |
| Moisture-Proof Load Life        | 40°C 95% RH on~off cycle 21 Hrs. | $\Delta R \leq \pm 0.2\%R$ |
| Resistance to soldering heat    | 350°C, 3.5s                      | $\Delta R \leq \pm 0.1\%R$ |
| Solderability                   | 235±5°C, 5s(solder bath method)  | IEC68-2-20(1968)           |

## Order Codes

### Order Codes (BWL)

| BWL         | - | 1W               | R01                     | F                        | P       |
|-------------|---|------------------|-------------------------|--------------------------|---------|
| Part Number |   | Power Rating (W) | Resistance ( $\Omega$ ) | Resistance Tolerance (%) | Package |
|             |   | 0.5W 0.5         | R01 0.01                | F $\pm 1$                | P Bulk  |
|             |   | 1W 1.0           | 0R1 0.1                 | G $\pm 2$                |         |
|             |   | 3W 3.0           | 1R 1                    | J $\pm 5$                |         |
|             |   | 4W 4.0           |                         |                          |         |
|             |   | 5W 5.0           |                         |                          |         |
|             |   | 10W 10.0         |                         |                          |         |

# Low Ohmic Resistor (LRA)

## Product Introduction

### Open Air Low Ohmic Resistors (LRA) Feature Longer Thermal Path.

#### Features :

- Radial leads.
- Non-inductance.
- Solderable Copper Leads.
- Lead (Pb)-free and RoHS compliant.
- $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$ ,  $\pm 10\%$  standard tolerance.
- High stability bare metal element open air style.

#### Applications :

- Automotive, Feedback System.
- Residual Battery Power Detection.
- CPU Drive Control, Power Tool Motor controls.
- Power Supply Shunt, Current Detective, and Current Sensing.
- Inverter and Switching Power Supplies
- High power AC/DC detection.

Token's current sense LRA open air resistors are expected to gain wide acceptance in the worldwide market as a result of increased thermal management capabilities.

The LRA series is designed for applications requiring the transfer of heat away from circuits and solder joints. Available in 0.5W, 1W, and 1.5W rating, the resistor is being specified for current sensing, feedback, current detective, supper low inductance, as well as surge and pulse applications.



The hot spot on the LRA open-air resistor is approximately 0.2 degrees higher than on a typical metal strip chip resistor. This results in an increased thermal path for the LRA, reducing heat transfer into the solder joints and circuits.

The flameproof LRA low resistance value resistors are constructed of a wire resistive element with welded copper leads to prevent solder wicking, which can change the device's resistance value in the circuit by as much as 30%. Because of this, the device is ideal for thermally harsh environments,

including automotive and aerospace applications, as well as enclosed poorly ventilated circuits in applications such as laptop computers.

The LRA Open Air Series feature a reduced pitch, or spacing between the leads on the circuit board (with a corresponding increase in the board mounted profile), when compared to the standard Token LRB Series devices.

The LRA resistors are rated for 1W or 1.5W at 70°C, with resistance values from 0.1Ω to 0.003Ω and tolerances down to ±1%. Operating temperature range is -50°C to 300°C. The LRA Series is available in bulk packaging in 200 increments.

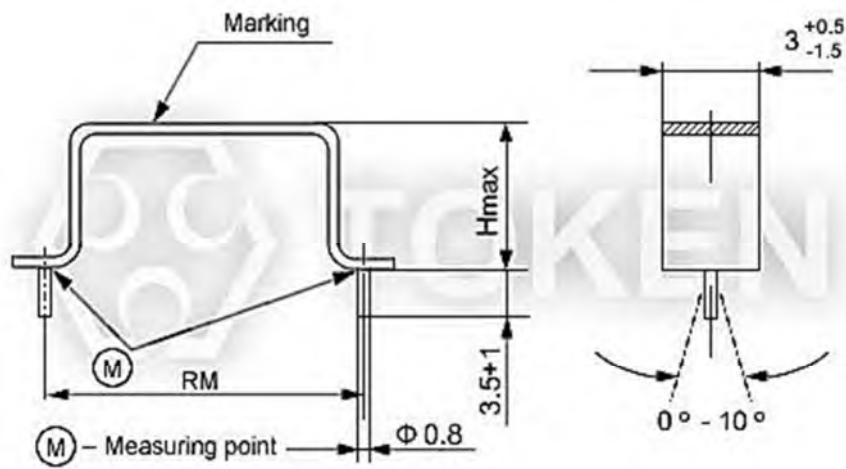
Token will also produce devices outside these specifications to meet customer requirements. A lead-free RoHS-compliant version is available, as is a non-inductive version for high frequency applications. Contact us with your specific needs, or link to Token official website “[Current Sensing Resistors](#)” for more information.



## ► Dimensions

### Dimensions (Unit: mm) (LRA)

| Type       | H Max. (Unit: mm) | RM (Unit: mm) |
|------------|-------------------|---------------|
| LRA350-009 | 6.5               | 10            |
| LRA351-009 | 10.5              |               |
| LRA352-009 | 17.0              |               |
| LRA351-010 | 8.0               | 15            |
| LRA352-010 | 14.5              |               |
| LRA352-010 | 16.1±1.0          | 14.5±1.0      |
| LRA352-010 | 17.1±1.0          | 14.5±1.0      |
| LRA352-011 | 12.0              | 20            |



Low Ohmic Open Air (LRA) Dimensions

#### Construction:

- 1. The resistive elements consist of a flat metal-band.
- 2. Spot welded Cu-terminals ensure high stability of contacts.
- 3. Thus, this construction results in a non-inductive of both high stability and overload capacity.

## Characteristics

### Characteristic Specification (LRA)

| Type  | LRA                     | 350-009  | 351-009<br>351-010 | 352-009<br>352-010<br>352-011 |
|---|-------------------------|--|--------------------|-------------------------------|
| Power rating P70  | W                       | 0.5  | 1.0                | 1.5                           |
| Resistance range  | Ω                       | R003~R051  | R004~R068          | R006~R10                      |
| E-series  |                         | E24≥R010   |                    |                               |
| Tolerances  | %                       | ±1, ±2, ±5, ±10  |                    |                               |
| Temperature coefficient                                   | PPM                     | ±25~±100   |                    |                               |
| Max. Cont. working voltage                                | VRMS                    | $\sqrt{P70 * R}$ For all styles                        |                    |                               |
| Insulation voltage (1Min..)                               | VRMS                    | Non insulated  |                    |                               |
| Insulation resistance                                     | Ω                       | Non insulated  |                    |                               |
| Derating, linear  | °C                      | 70~300(0W)   |                    |                               |
| Climatic category   |                         | 55/200/56  |                    |                               |
| Temperature range   | °C                      | -50~300  |                    |                               |
| Thermal resistance  | KW-1                    | 200  | 100                | 70                            |
| Failure rate (Total, V <sub>0Max.</sub> , 60% conf. lev.) | 10-9 * h-1              | Ca.10, Depends on value                                |                    |                               |
| Endurance (P70, 70,1000h)                                 | $[\frac{\Delta R}{R}]%$ | ±3.0   |                    |                               |
| Damp heat, steady state(40°C,93% r.h.,56d)                | $[\frac{\Delta R}{R}]%$ | ±0.5   |                    |                               |
| Climatic sequence   | $[\frac{\Delta R}{R}]%$ | ±0.5   |                    |                               |
| Terminal strength   | $[\frac{\Delta R}{R}]%$ | ±0.5   |                    |                               |
| Terminal tensile strength                                 | N                       | 30   |                    |                               |
| Resistance to soldering heat ( 260°C,10s )                | $[\frac{\Delta R}{R}]%$ | ±0.2 typ.  |                    |                               |
| Solder ability  | s                       | 2.5 Flow time, solder globule test<br>IEC 60068-2-20-T |                    |                               |
| Making  |                         | Value imprinted  |                    |                               |



## ► Packing Specification

### Packing Specification (LRA)

| Type                     | Package | Pieces | Pack.-Code |
|--------------------------|---------|--------|------------|
| LRA350-009               | Bulk    | 200pcs | Bulk       |
| LRA351-009<br>LRA351-010 | Bulk    | 200pcs | Bulk       |
| LRA352-010<br>LRA352-011 | Bulk    | 200pcs | Bulk       |

## ► Order Codes

### Order Codes (LRA)

| LRA351-009  | R024                          |                | J             |            | P           |      |
|-------------|-------------------------------|----------------|---------------|------------|-------------|------|
| Part Number | Resistance Value ( $\Omega$ ) |                | Tolerance (%) |            | Pack. -Code |      |
|             | R020                          | 0.020 $\Omega$ | F             | $\pm 1\%$  | P           | Bulk |
|             | R022                          | 0.022 $\Omega$ | G             | $\pm 2\%$  |             |      |
|             | R024                          | 0.024 $\Omega$ | J             | $\pm 5\%$  |             |      |
|             | R100                          | 0.100 $\Omega$ | K             | $\pm 10\%$ |             |      |

# Metal Strip Chip High Power Low Ohmic Resistor (LRP)

## ► Product Introduction

Things go better with Token (LRP) high power metal strip resistors.

### Features :

- Customized Resistance Available.
- Low TCR  $\pm 50\text{PPM}/^\circ\text{C}$ ,  $\pm 75\text{PPM}/^\circ\text{C}$ .
- High power rating from 1 Watts to 3 Watts
- Low resistance values from  $7\text{m}\Omega$  to  $100\text{m}\Omega$ .
- Without Laser Trimmed with very low inductance.

### Applications :

- For NB power management.
- For MB power management.
- For Monitor power management.
- SWPS: DC-DC converter, Charger, Adaptor.

(LRP) Low ohm metal strip resistors from Token Electronics offer a wide range of high-power current sensing applications including power management of NB, MB and monitor, automotive, shunts and power amplifiers, DC-DC converter and charger, test & measurement instruments, linear power supplies and switching.

(LRP) Design for applications that require high power handling (Up to 3W) and low resistance values from  $7\text{m}\Omega$  to  $100\text{m}\Omega$  and come with a range of advantages including a wide temperature range and a varied choice of wide range package sizes 2512 with high current capability.

Token (LRP) is aiming for very high power-to-footprint size ratio, excellent frequency response and very low inductance in a solid metal nickel-chrome or manganese-copper alloy resistive element with Low TCR  $\pm 50\text{PPM}/^\circ\text{C}$ . Also, (LRP) is ideal for all types of voltage division, current sensing and pulse applications.

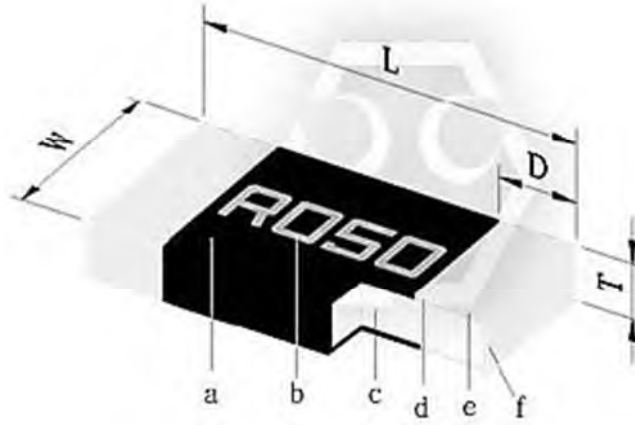
For more power metal strip chip low ohm resistors, please link to Token official website "[Current Sense Resistors](#)". Contact us with your specific needs.



## Construction & Dimensions

### Dimensions Chip 2512 (LRP)

| Type  | Size (Inch) | L(mm)     | W(mm)     | T(mm)     | D(mm)     |
|-------|-------------|-----------|-----------|-----------|-----------|
| LRP12 | 2512        | 6.40±0.25 | 3.20±0.25 | 0.70±0.20 | 0.90±0.30 |



Chip 2512 Dimensions (LRP)

### Construction (LRP)

| a        | b       | c           | d                  | e             | f              |
|----------|---------|-------------|--------------------|---------------|----------------|
| Overcoat | Marking | Alloy Plate | Internal Electrode | Barrier Layer | Solder Plating |

- Notice: TOKEN is capable of manufacturing the optional spec based on customer's requirement.

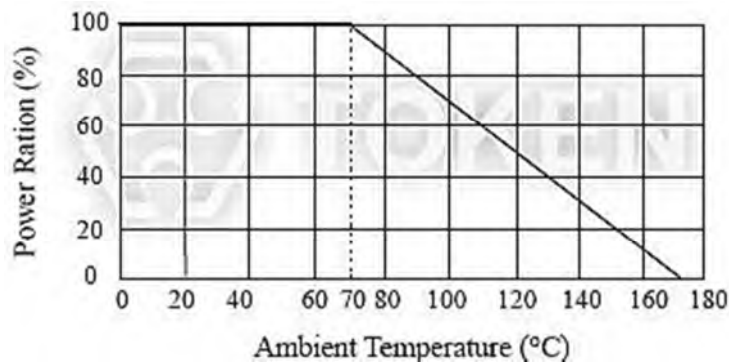
## Electrical Specification

### Electrical Specifications Chip 2512 (LRP)

| Type         | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (± %) | Resistance (mΩ)  | TCR (±PPM/°C) |
|--------------|----------------------|-----------------------|----------------------------|--|---------------|
| LRP12 (2512) | 1W, 2W, 3W           | -55°C ~ +170°C        | ±0.5%, ±1%, ±5%            | 15, 18, 20, 22, 25, 30, 33, 35, 39, 40, 47, 50, 60, 68, 70, 75, 80, 82, 90, 91, 100                  | ±50           |
|              |                      |                       |                            | 7, 8, 9, 10, 12, 15, 18, 20, 22, 25, 30, 33, 35, 39, 40, 47, 50, 60, 68, 70, 75, 80, 82, 90, 91, 100 | ±75           |

- Operating Current  $I = \sqrt{P/R}$  Operating Voltage  $V = \sqrt{P * R}$  or Max. Operating voltage whichever is lower.
- Token is capable of manufacturing the optional spec based on customer's requirement.

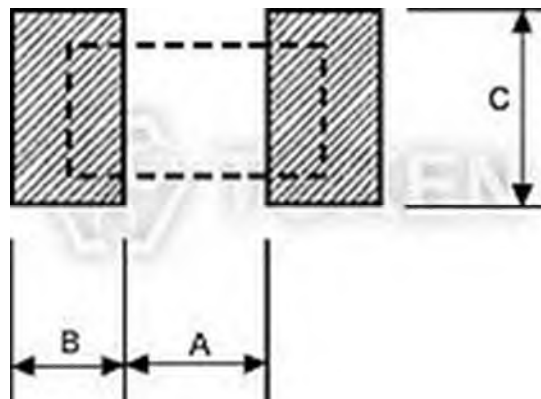
### Derating Curve (LRP)



(LRP) Power Derating Curve

### Recommend Land Pattern (LRP)

| Type  | A (mm) | B (mm) | C (mm) |
|-------|--------|--------|--------|
| LRP12 | 4.00   | 2.00   | 3.50   |



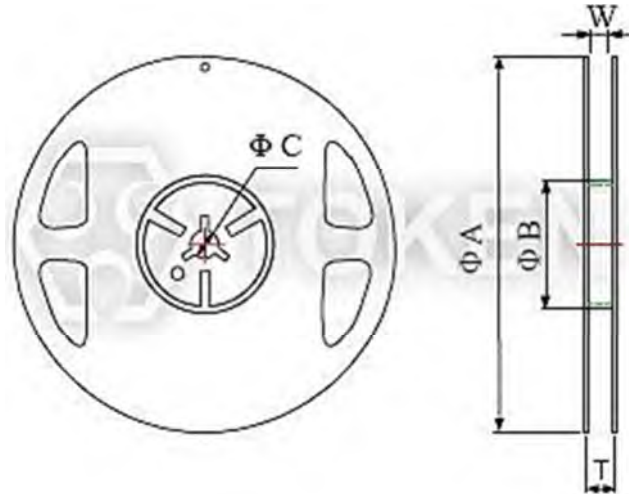
Recommend Land Pattern

- FR4 copper board, 100µm of copper pad thickness.

## ▶ Reel & Tape

### Packing Quantity & Reel Specifications (LRP)

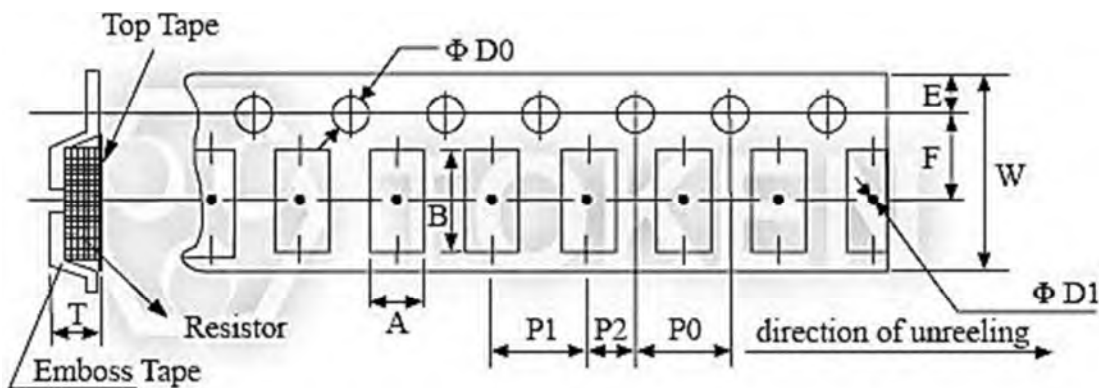
| Type  | Packaging Quantity | Tape Width | Reel Diameter | ΦA (mm)   | ΦB (mm)  | ΦC (mm)  | W (mm)   | T (mm)   |
|-------|--------------------|------------|---------------|-----------|----------|----------|----------|----------|
| LRP12 | Embossed 4,000 pcs | 12 mm      | 7 inch        | 178.0±1.5 | 60.0±1.0 | 13.0±0.5 | 13.0±1.0 | 15.5±0.5 |



Reel Specifications Dimensions

### Emboss Plastic Tape Specifications (LRP)

| Type  | A (mm)    | B (mm)    | W (mm)    | E (mm)    | F (mm)   | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | ΦD <sub>1</sub> (mm) | T        |
|-------|-----------|-----------|-----------|-----------|----------|---------------------|---------------------|---------------------|----------------------|----------------------|----------|
| LRP12 | 3.50±0.10 | 6.70±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.0±0.10            | 4.0±0.10            | 2.0±0.05            | 1.50±0.10            | 1.50±0.25            | 1.2±0.15 |



Low Ohm Metal Strip (LRP) Emboss Plastic Tape Specifications

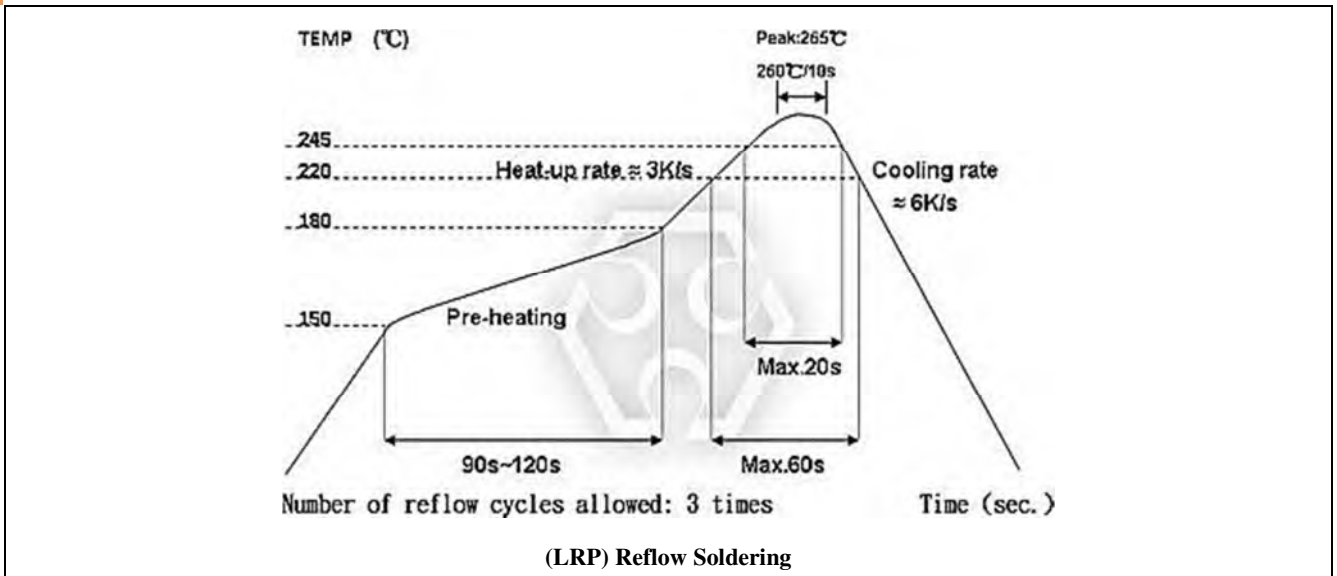
**Notice:**

1. The cumulative tolerance of 10 sprocket hole pitch is ±0.2mm.
2. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
3. A & B measured 0.3mm 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.



## ▶ Reflow Soldering

### Soldering Condition (Reflow soldering only) (LRP)



- Time of IR reflow soldering at maximum temperature point 260°C : 10s
- Time of soldering iron at maximum temperature point 410°C : 5s

## Environmental Characteristics

### Environmental Characteristics (LRP)

| Item   | Requirement       | Test Method   |
|--|-------------------|---|
| Thermal Shock                                  | ±1%               | IEC-60115-1 4.19<br>JIS-C-5201-1 4.19<br>-55°C ~ 155°C, 5 cycles  |
| Short Time Overload                            | ±1%               | IEC60115-1 4.13<br>JIS-C-5201-1 4.13<br>5*rated power for 5 seconds                                     |
| Low Temperature Storage                        | ±1%               | IEC-60115-1 4.23.4<br>JIS-C-5201-1 4.23.4<br>at -55°C for 1000 hrs                                      |
| Biased Humidity                                | ±1%               | MIL-STD-202 Method 103<br>1000 hrs 85°C/85% RH 10% of operating power                                   |
| Bending Strength                               | ±1%               | IEC-60115-1 4.33<br>JIS-C-5201-1 4.33<br>Bending width 2mm once for 5 seconds                           |
| Endurance                                      | ±1%               | IEC60115-1 4.25<br>JIS-C-5201-1 4.25.1<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" |
| Dry Heat                                       | ±1%               | IEC60115-1 4.23.2<br>JIS-C-5201-1 4.23.2<br>at +170°C for 1000 hrs                                      |
| Resistance to Soldering Heat                   | ±0.5%             | IEC-60115-1 4.18<br>JIS-C-5201-1 4.18<br>260±5°C, for 10 seconds  |
| Insulation Resistance                          | >100MΩ            | IEC60115-1 4.6<br>JIS-C-5201-1 4.13<br>100V DC for 1 minute   |
| Solderability                                  | 95% Min. coverage | IEC-60115-1 4.17<br>JIS-C-5201-1 4.17<br>245±5°C for 3 seconds  |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.          | IEC60115-1 4.8<br>JIS-C-5201-1 4.8<br>-55°C ~+125°C. (25°C is the reference temperature)                |

- Rated continuous Working Voltage (RCWV) =  $\sqrt{\text{Power Rating} \times \text{Resistance Value } (\Omega)}$  or Max. Operating voltage whichever is lower.
- Storage Temperature: 25±3°C; Humidity < 80%RH;



## Order Codes

### Order Codes (LRP)

| LRP          | 12                   | F       | TR      | D    | S            | R050        |                 |     |                |      |         |       |            |
|--------------|----------------------|---------|---------|------|--------------|-------------|-----------------|-----|----------------|------|---------|-------|------------|
| Product Type | Dimensions (L×W)(mm) |         | Package |      | TCR (PPM/°C) |             | Power Rating(W) |     | Resistance (Ω) |      | Marking |       |            |
|              | 12                   | EIA2512 | D       | ±0.5 | TR           | Taping Reel | D               | ±50 | T              | 1    | R015    | 0.015 | No Marking |
|              |                      |         |         |      |              |             |                 |     |                |      |         |       |            |
|              |                      | F       |         |      | ±1           | W           | ±75             | S   | 2              | R050 | 0.05    |       |            |
|              |                      | J       |         |      | ±5           |             |                 | R   | 3              |      |         |       |            |



# 4 Kelvin Current Sense Resistor (LPS)

## ► Product Introduction

Token's low value 4 lead kelvin current sensing (LPS) resistors family offers a variety of possibilities for current shunts.

### Features :

- Radial leads.
- Non-inductance.
- Solderable Copper Leads.
- Lead (Pb)-free and RoHS compliant.
- $\pm 2\%$ ,  $\pm 5\%$ ,  $\pm 10\%$  standard tolerance.
- High stability bare metal element open air resistor.

### Applications :

- Automotive, Feedback System.
- Residual Battery Power Detection.
- CPU Drive Control, Power Tool Motor controls.
- Power Supply Shunt, Current Detective, and Current Sensing.
- Inverter and Switching Power Supplies
- High power AC/DC detection.

The (LPS) family for shunt is expected to gain wide acceptance in the worldwide market as a result of offering a variety of possibilities.

The U-shaped semi-customized LPS family for direct board mounting is specified for precision current sensing, feedback, current detective, supper low inductance, as well as surge and pulse applications. LPS family Available in very low ohm ( $0.002\Omega \sim 0.05\Omega$ ) and high power ( $1W \sim 5W$ ).

The dimension of the semi-customized final unit is designed in accordance with the application requirements of resistance value and required power rating. Token's LPS series can be manufactured with 2 or 4 solder tags (terminals). The LPS type B with 2 solder tags (1 pin on each side) is a standard part of LPS series and type A with 4 terminals (2 pin on each side) is used either for Kelvin connections or for high current applications. Depending from the alloy material's thickness, one terminal contact on each side can carry up to 50A ( $A \text{ (Current)} = (W \text{ (Power)}/\Omega \text{ (Resistance)})^{1/2}$ ), so a 4-terminal part can carry 100A (ask Token factory).

Operating temperature range is  $-50^{\circ}\text{C}$  to  $300^{\circ}\text{C}$  with tolerances  $\pm 2\%$ ,  $\pm 5\%$ , and  $\pm 10\%$ .

Token will also produce low value current sense resistor LPS series outside these specifications to meet customer requirements. Contact us with your specific needs, or link to Token official website "[Current Sensing Resistors](#)" for more information.

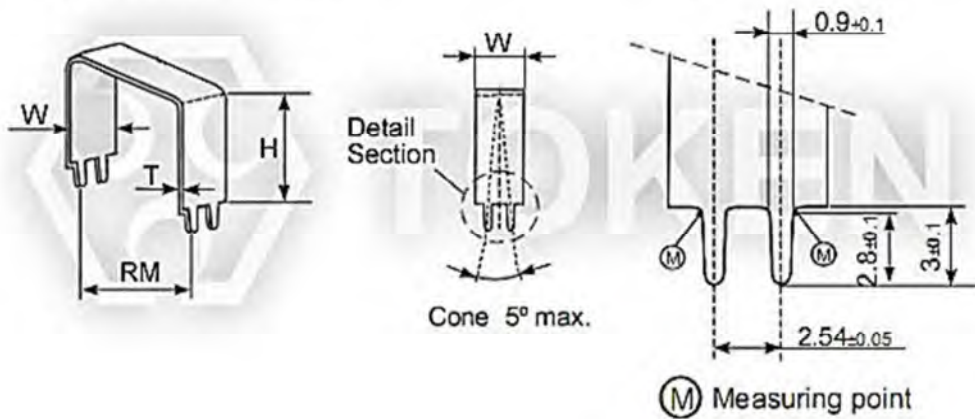


## Dimensions

### Dimensions (Unit: mm) Open Air 4-T & 2-T (LPS)

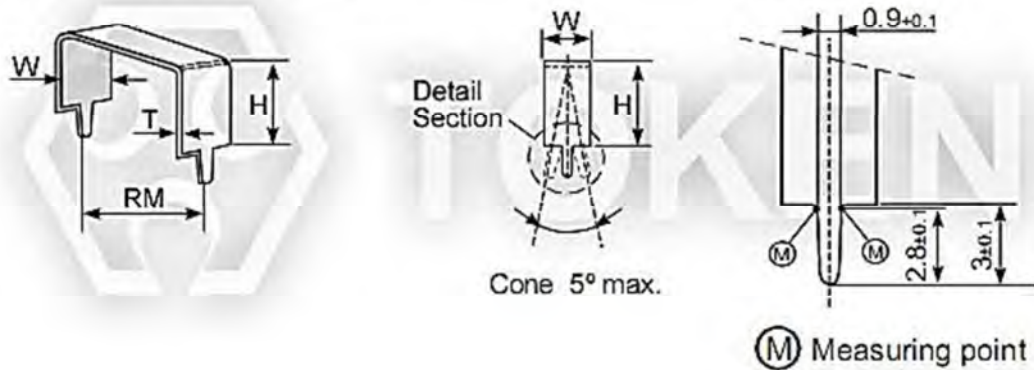
| Type       | Power (Watts) | Resistance Range ( $\Omega$ ) | RM (mm) | H (mm) Max. |
|------------|---------------|-------------------------------|---------|-------------|
| LPS359-008 | 1             | R005~R05                      | 5 ~ 30  | 20.0        |
| LPS359-009 | 2             | R005~R02                      |         |             |
| LPS359-010 | 3             | R003~R01                      |         |             |
| LPS359-011 | 5             | R002~R005                     |         |             |

Type A - 4 Terminals



Semi-customized (LPS) Dimensions Type A - Four Terminal for Kelvin Connection

Type B - Two Terminals



Semi-customized (LPS) Dimensions Type B - Open Air Low Value Two Terminal Resistor

**Construction:**

- 1. W, T and H depend on material, resistance value and required power rating.
- 2. RM: 5~30 mm, preferably in 5 mm-steps. Special varieties on request.
- 3. M: Measuring point.



## Characteristics

### Characteristic Specification (LPS)

| Test Items   | Specification                                    |
|--|--|
| Resistance range                                   | R002~R05   |
| Tolerances   | ±2%, ±5%, ±10%                                   |
| Temperature coefficient                            | Upon request                                     |
| Insulation voltage                                 | Non insulated                                    |
| Insulation resistance                              | Non insulated                                    |
| Derating, linear                                   | 70~300°C (0W)                                    |
| Climatic category                                  | 55/155/21  |
| Temperature range                                  | -50~300°C  |
| Endurance (P70, 70°C, 1000 Hrs.)                   | $\Delta R \leq \pm 2\% R$                        |
| Damp heat, steady state (40°C, 93% r.h., 56d)      | $\Delta R \leq \pm 2\% R$                        |
| Climatic sequence                                  | $\Delta R \leq \pm 0.5\% R$                      |
| Terminal strength                                  | None   |
| Terminal tensile strength                          | None   |
| Resistance to soldering heat (350°C, 3.5s)         | $\Delta R \leq \pm 0.5\% R$ typ.                 |
| Solderability (Solder bath method 235±5°C, 2±0.5s) | Good tinning (≥ 90 % covered), no visible damage |

## Order Codes

### Order Codes (LPS)

| LPS359-008  | B             | 3           | R024 | J                    | P     |               |     |             |      |
|-------------|---------------|-------------|------|----------------------|-------|---------------|-----|-------------|------|
| Part Number | Terminal Type | Rated Power |      | Resistance Value (Ω) |       | Tolerance (%) |     | Pack. -Code |      |
| LPS359-008  | A 4 Terminals | 1           | 1 W  | R002                 | 0.002 | G             | ±2  | P           | Bulk |
| LPS359-009  | B 2 Terminals | 2           | 2 W  | R010                 | 0.010 | J             | ±5  |             |      |
| LPS359-010  |               | 3           | 3 W  | R022                 | 0.022 | K             | ±10 |             |      |
| LPS359-011  |               | 5           | 5 W  | R050                 | 0.050 |               |     |             |      |

# Metal Strip Low Ohm Power Chip Resistor (LRM)

## ► Product Introduction

### Build Token (LRM) Power Low Ohmic Metal Strip resistors into your Design

#### Features :

- Low TCR down to  $\pm 75\text{PPM}/^\circ\text{C}$ .
- Low resistance values from  $1\text{m}\Omega$  to  $100\text{m}\Omega$ .
- High power rating from 1/8 Watts to 3 Watts
- Wide range package sizes 0805, 1206, 2010, and 2512.

#### Applications :

- For NB power management.
- For MB power management.
- For Monitor power management.
- SWPS: DC-DC converter, Charger, Adaptor.

(LRM) Low ohm Power Metal Strip resistors from Token Electronics offer a wide range of high-power current sensing applications including power DC-DC converter and charger, management of NB, MB and monitor, test & measurement instruments, linear power supplies and switching, automotive, shunts and power amplifiers.

(LRM) Design for applications that require a wide range power handling from 1/8W up to 3W and low resistance values from  $1\text{m}\Omega$  to  $100\text{m}\Omega$  and come with a range of advantages including a wide temperature range and a varied choice of wide range package sizes 0805, 1206, 2010, and 2512 with high current capability.

Token (LRM) is aiming for very high power-to-footprint size ratio, excellent frequency response and very low inductance in a solid metal nickel-chrome or manganese-copper allow resistive element with Low TCR  $\pm 75\text{PPM}/^\circ\text{C}$ . Also, ideal for all types of voltage division, current sensing and pulse applications.

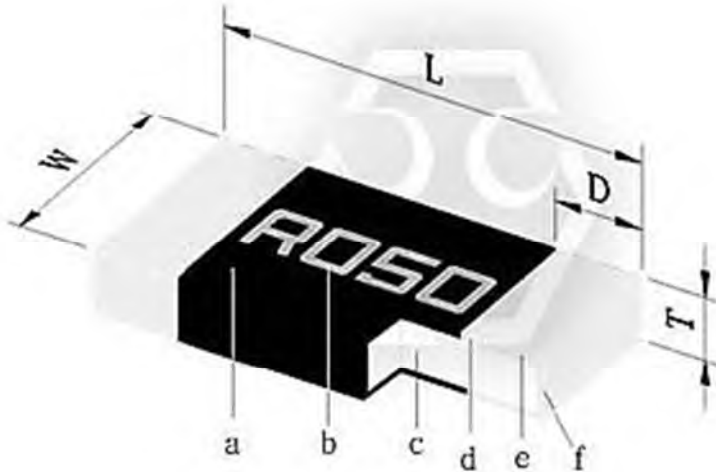
For more power metal strip chip low ohm resistors, please link to Token official website "[Current Sense Resistors](#)". Contact us with your specific needs.



## ► Construction & Dimensions

### Construction (LRM)

| a                  | b       | c           | d                       | e                  | f                   |
|--------------------|---------|-------------|-------------------------|--------------------|---------------------|
| Overcoat (molding) | Marking | Alloy Plate | Internal Electrode (Cu) | Barrier Layer (Ni) | Solder Plating (Sn) |

**Power Metal Strip Dimensions (LRM)**

### Dimensions Chip (LRM)

| Part No.      | Resistance (mΩ)           | Material | L (mm)    | W (mm)    | T (mm)    | D (mm)    | Weight(g)<br>1000pcs |
|---------------|---------------------------|----------|-----------|-----------|-----------|-----------|----------------------|
| LRM05*TE****M | 5, 9, 10, 20              | MnCu     | 2.00±0.10 | 1.25±0.10 | 0.60±0.20 | 0.40±0.20 | 15.00                |
| LRM06*TFR001M | 1                         | MnCu     | 3.20±0.20 | 1.60±0.20 | 0.75±0.20 | 1.10±0.30 | 18.00                |
| LRM06*T****M  | 2 ~ 30                    | MnCu     | 3.20±0.20 | 1.60±0.20 | 0.60±0.20 | 0.50±0.30 | 18.00                |
| LRM10*T****   | 5, 6, 10, 15, 20          | NiCu     | 5.00±0.20 | 2.50±0.20 | 0.60±0.20 | 0.60±0.30 | 40.50                |
| LRM12*T****M  | 0.5, 0.75                 | MnCu     | 6.40±0.20 | 3.20±0.20 | 0.60±0.20 | 2.60±0.20 | 90.90                |
| LRM12*T****M  | 5, 10, 20, 25, 30, 40, 50 | MnCu     | 6.40±0.20 | 3.20±0.20 | 0.60±0.20 | 0.90±0.20 | 90.90                |
| LRM12*T****M  | 4 ~ 50                    | NiCu     | 6.40±0.20 | 3.20±0.20 | 0.60±0.20 | 0.90±0.20 | 90.90                |
| LRM12*T****   | 1, 1.5, 2, 3              | NiCu     | 6.40±0.20 | 3.20±0.20 | 0.60±0.20 | 2.0±0.20  | 90.90                |
| LRM12*T****   | 2, 3, 4                   | NiCu     | 6.40±0.20 | 3.20±0.20 | 0.70±0.20 | 2.0±0.20  | 90.90                |
| LRM12*T****   | 10 ~ 100                  | NiCu     | 6.40±0.20 | 3.20±0.20 | 0.70±0.20 | 0.90±0.20 | 90.90                |

● Notice: TOKEN is capable of manufacturing the optional spec based on customer's requirement.

## Electrical Specification

### MnCu Material - Electrical Specifications (LRM)

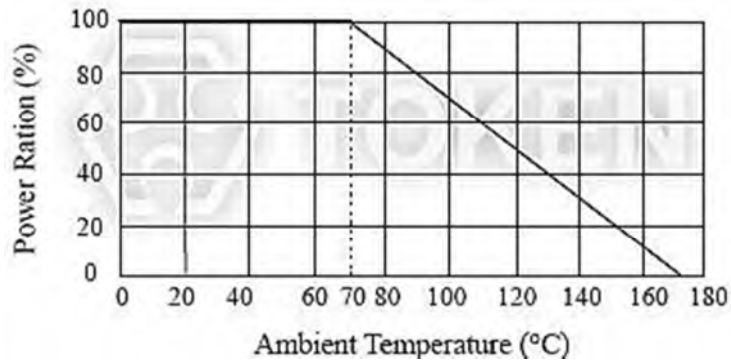
| Type         | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (± %) | Resistance (mΩ)            | TCR (±PPM/°C) |
|--------------|----------------------|-----------------------|----------------------------|----------------------------|---------------|
| LRM05 (0805) | 1/8W, 1/4W, 1/2W     | -55°C ~ +170°C        | ±1%, ±5%                   | 5, 9, 10, 20               | ±100          |
| LRM06 (1206) | 1/4W, 1/2W, 1W       |                       |                            | 1                          | ±200          |
|              |                      |                       |                            | 2, 3, 4, 5, 6, 7, 8, 9, 10 | ±100          |
|              |                      |                       |                            | 12, 14, 15, 20, 22, 25, 30 | ±75           |
| LRM12 (2512) | 1W, 2W               |                       |                            | 0.5, 0.75                  | ±200          |
|              | 1W                   |                       |                            | 5, 10                      | ±100          |
|              |                      |                       |                            | 20, 25, 30, 40, 50         | ±75           |

### NiCu Material - Electrical Specifications (LRM)

| Type         | Power Rating at 70°C | Operating Temp. Range | Resistance Tolerance (± %) | Resistance (mΩ)  | TCR (±PPM/°C) |
|--------------|----------------------|-----------------------|----------------------------|--|---------------|
| LRM10 (2010) | 1/2W, 3/4W, 1W, 1.5W | -55°C ~ +170°C        | ±1%, ±5%                   | 5, 6, 10   | ±100          |
| LRM12 (2512) | 1W, 2W               |                       |                            | 15, 20   | ±75           |
|              |                      |                       |                            | 1, 1.5   | ±275          |
|              |                      |                       |                            | 2, 3, 4, 5, 6, 7, 8, 10  | ±100          |
|              |                      |                       |                            | 12, 15, 18, 20, 25, 30, 33, 35, 40, 50                           | ±75           |
|              |                      |                       |                            | 2, 3, 4, 10, 12, 15, 18, 20, 25, 30, 39, 40, 50, 60, 70, 80, 100 | ±75           |

- Operating Current  $I = \sqrt{P/R}$ , Operating Voltage  $V = \sqrt{P * R}$  or Max. Operating voltage whichever is lower.
- Optional specifications can be required.

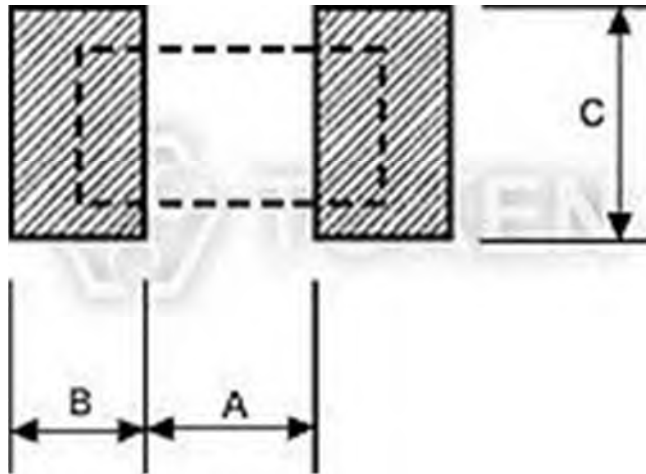
## Derating Curve (LRM)



(LRM) Power Derating Curve

## Recommend Land Pattern (LRM)

| Type                | A ±0.2(mm) | B ±0.2(mm) | C ±0.2(mm) |
|---------------------|------------|------------|------------|
| LRM05               | 1.20       | 1.15       | 1.40       |
| LRM06 (1mΩ)         | 1.00       | 2.30       | 1.80       |
| LRM06 (2mΩ ~ 30mΩ)  | 1.60       | 1.70       | 1.80       |
| LRM10               | 3.50       | 1.50       | 3.40       |
| LRM12 (0.5mΩ ~ 3mΩ) | 1.30       | 3.10       | 4.00       |
| LRM12 (4mΩ ~ 100mΩ) | 4.10       | 2.10       | 4.00       |



Recommend Land Pattern

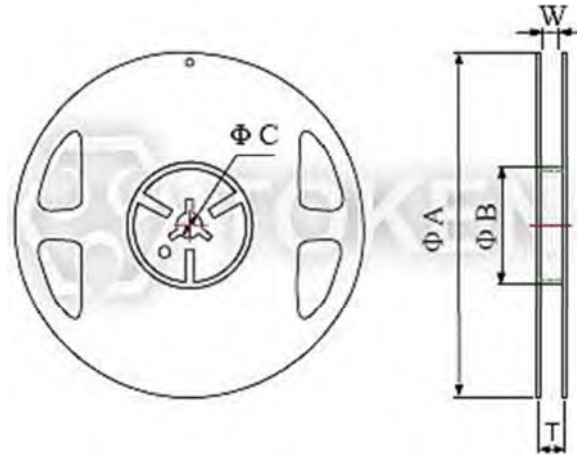
- \*FR4 copper board, 100μm of copper pad thickness



## ▶ Reel & Tape

### Packing Quantity & Reel Specifications (LRM)

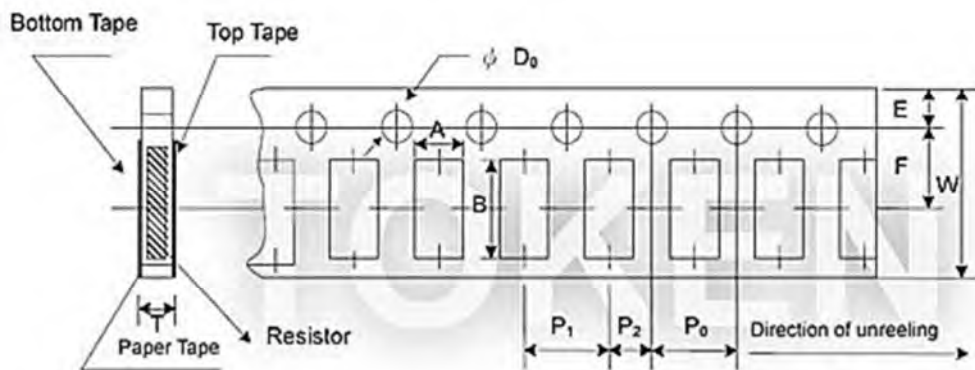
| Type  | Packaging Quantity | Tape Width | Reel Diameter | ΦA (mm)    | ΦB (mm)  | ΦC (mm)  | W (mm)   | T (mm)   |
|-------|--------------------|------------|---------------|------------|----------|----------|----------|----------|
| LRM05 | Paper 5,000 pcs    | 8 mm       | 7 inch        | 178.0±2.0  | 60.0±1.0 | 13.0±1.0 | 9.0±1.0  | 11.4±1.0 |
| LRM06 | Paper 5,000 pcs    | 8 mm       | 7 inch        | 178.0±2.0  | 60.0±1.0 | 13.0±1.0 | 9.0±1.0  | 11.5±1.0 |
| LRM10 | Embossed 4,000 pcs | 12 mm      | 7 inch        | 178.0±2.0  | 60.0±1.0 | 13.0±1.0 | 13.0±1.0 | 15.5±1.0 |
| LRM12 | Embossed 4,000 pcs | 12 mm      | 7 inch        | 180.0+0/-3 | 60.0±1.0 | 13.0±1.0 | 13.0±1.0 | 15.4±2.0 |



Reel Dimensions

### Paper Tape Specifications (LRM)

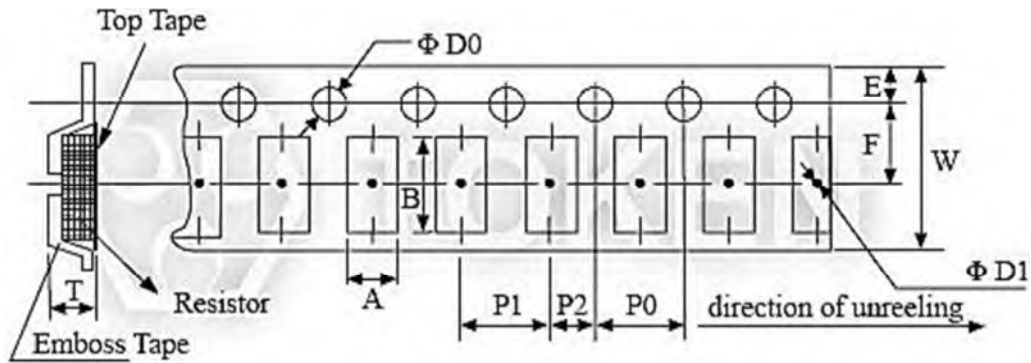
| Type  | A (mm)    | B (mm)    | W (mm)    | E (mm)    | F (mm)    | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | T         |
|-------|-----------|-----------|-----------|-----------|-----------|---------------------|---------------------|---------------------|----------------------|-----------|
| LRM05 | 1.60±0.15 | 2.40±0.20 | 8.00±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1/-0          | 0.84±0.10 |
| LRM06 | 2.00±0.15 | 3.60±0.20 | 8.00±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1/-0          | 0.84±0.10 |



(LRM) Paper Tape Specifications

## Emboss Plastic Tape Specifications (LRM)

| Type  | A (mm)    | B (mm)    | W (mm)    | E (mm)    | F (mm)   | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | ΦD <sub>1</sub> (mm) | T         |
|-------|-----------|-----------|-----------|-----------|----------|---------------------|---------------------|---------------------|----------------------|----------------------|-----------|
| LRM10 | 2.80±0.20 | 5.30±0.20 | 12.0±0.20 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1, -0         | 1.50±0.25            | 0.85±0.15 |
| LRM12 | 3.60±0.20 | 6.90±0.20 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1, -0         | 1.50±0.25            | 0.85±0.15 |
| LRM12 | 3.60±0.20 | 6.90±0.20 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1, -0         | 1.50±0.25            | 1.20±0.15 |



(LRM) Emboss Plastic Tape Specifications

- 1. The cumulative tolerance of 10 sprocket whole pitch is  $\pm 0.2\text{mm}$ .
- 2. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
- 3. A & B measured 0.3mm 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.

## ► Environmental Characteristics

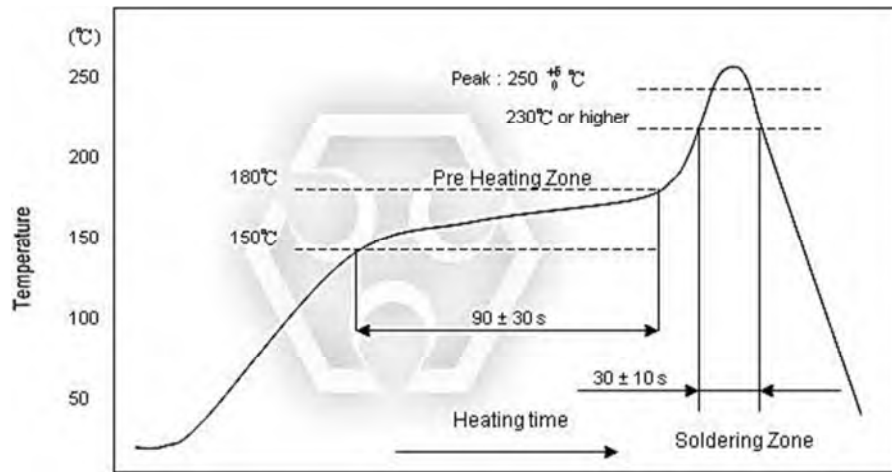
### Environmental Characteristics (LRM)

| Item  | Requirement   | Test Method   |
|---|---|---|
| <b>Thermal Shock</b>                                  | 0805, 2010: $\pm 0.5\%$<br>1206, 2512: $\pm 1\%$                  | JIS-C-5201-1 4.19<br>IEC-60115-1 4.19<br>-55°C ~ 155°C, 300 cycles, 15min per extreme condition                               |
| <b>Short Time Overload</b>                            | 0805, 2010, 2512: $\pm 0.5\%$<br>1206: $\pm 1\%$                  | IEC60115-1 4.13<br>JIS-C-5201-1 4.13<br>5*rated power for 5 seconds   |
| <b>Low Temperature Storage</b>                        | 0805, 2010, 2512: $\pm 0.5\%$<br>1206: $\pm 1\%$                  | IEC-60115-1 4.23.4<br>JIS-C-5201-1 4.23.4<br>at -55°C for 1000 hrs  |
| <b>Damp Heat no Load</b>                              | 2512 0.5mΩ, 0.75mΩ, 1206: $\pm 0.5\%$<br>Other sizes: $\pm 1.0\%$ | IEC60115-1 4.24.2.1a<br>JIS-C-5201-1 4.24.2.1a<br>85°C, 85%RH, 1000 hrs   |
| <b>Bending Strength</b>                               | $\pm 1\%$   | IEC-60115-1 4.33<br>JIS-C-5201-1 4.33<br>Bending width 2mm once for 5 seconds   |
| <b>Endurance</b>                                      | $\pm 1\%$   | IEC60115-1 4.25<br>JIS-C-5201-1 4.25.1<br>70 $\pm$ 2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"                 |
| <b>Dry Heat</b>                                       | $\pm 1\%$   | IEC60115-1 4.23.2<br>JIS-C-5201-1 4.23.2<br>at +170°C for 1000 hrs  |
| <b>Resistance to Soldering Heat</b>                   | $\pm 0.5\%$   | IEC-60115-1 4.18<br>JIS-C-5201-1 4.18<br>0805, 2010: 260 $\pm$ 5°C for 10 seconds<br>1206, 2512: 260 $\pm$ 5°C for 20 seconds |
| <b>Insulation Resistance</b>                          | >100MΩ  | IEC60115-1 4.6<br>JIS-C-5201-1 4.13<br>100V DC for 1 minute   |
| <b>Solderability</b>                                  | 95% Min. coverage   | IEC-60115-1 4.17<br>JIS-C-5201-1 4.17<br>245 $\pm$ 5°C for 3 seconds  |
| <b>Temperature Coefficient of Resistance (T.C.R.)</b> | As Spec.  | IEC60115-1 4.8<br>JIS-C-5201-1 4.8<br>-55°C ~ +125°C. (25°C is the reference temperature)                                     |

- Rated continuous Working Voltage (RCWV) =  $\sqrt{\text{Power Rating} \times \text{Resistance Value } (\Omega)}$  or Max. Operating voltage whichever is lower.
- Storage Temperature: 25 $\pm$ 3°C; Humidity < 80%RH;

## ▶ Reflow soldering

### | Soldering Condition (Reflow soldering only) (LRM)



(LRM) Reflow Soldering

## ▶ Order Codes

### | Order Codes (LRM)

| LRM          | 12                   | F       | TR      | D  | S            | R050        |                 |     |                |     |         |       |      |               |
|--------------|----------------------|---------|---------|----|--------------|-------------|-----------------|-----|----------------|-----|---------|-------|------|---------------|
| Product Type | Dimensions (L×W)(mm) |         | Package |    | TCR (PPM/°C) |             | Power Rating(W) |     | Resistance (Ω) |     | Marking |       |      |               |
|              | 05                   | EIA0805 | F       | ±1 | TR           | Taping Reel | W               | ±75 | W              | 1/8 | R015    | 0.015 | N    | No Marking    |
| 06           | EIA1206              | G       |         |    |              |             | ±2              | E   | ±100           | V   | 1/4     | R050  | 0.05 | M             |
|              | 10                   | EIA2010 | J       | ±5 | F            | ±200        | O               | 1/3 | R500           | 0.5 |         |       |      |               |
|              | 12                   | EIA2512 |         |    | 3            | ±275        | U               | 1/2 |                |     |         |       |      | NiCu Material |
|              |                      |         |         |    |              |             | Q               | 3/4 |                |     |         |       |      |               |
|              |                      |         |         |    |              |             | T               | 1   |                |     |         |       |      |               |
|              |                      |         |         |    |              |             | A               | 1.5 |                |     |         |       |      |               |
|              |                      |         |         |    |              |             | S               | 2   |                |     |         |       |      |               |
|              |                      |         |         |    |              |             | R               | 3   |                |     |         |       |      |               |



# Open Air Resistors (OAR)

## ► Product Introduction

Token's "tight pitch" version of its open air metal element current sense resistor (OAR) need less PCB space.

### Features :

- High stability open-air style.
- Precision alloys resistive element.
- Lead (Pb)-free and RoHS compliant.
- Standard tolerance  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$ .
- Low inductance. Solderable copper leads (60/40).
- Radial leads, low resistance value  $0.05\Omega \sim 0.005\Omega$ .

### Applications :

- CPU Drive Control.
- Power Tool Motor controls.
- Automotive, Feedback System.
- Power Supply Shunt, Current Detective.
- Inverter and Switching Power Supplies.
- Residual Battery Power Detection, and Current Sensing.

In response to requests from power electronics design engineers with the means to squeeze more current-sensing capability into crowded power supply designs, Token Electronics has developed a "tight pitch" version of its open air metal element current sensing resistor with ratings as high as 5W in a reduced PC board footprint and longer thermal path.

Designated the OAR Series, these through-hole devices offer a high current, flameproof alternative to conventional axial devices and flat chips for current-sense circuits where PC board space is at a premium. The open air resistor's footprint is reduced by extending the height of the device above the board, thus keeping the resistor element's "hot spot" safely off the PC board and providing for increased air circulation under it, which in turn provides increased heat dissipation and cooler operation.

The OAR devices with increased height improve cooling efficiency, and because many power supply designs are already tightly-packed at the PC board level, the additional height does not create any profile issues. The OAR series feature a reduced pitch, or spacing between the leads on the circuit board with a corresponding increase in the board mounted profile.

The OAR low resistance value resistors are power rated for 1W, 2W, 3W, or 5W at  $85^{\circ}\text{C}$ , with resistance values from  $0.05\Omega$  to  $0.005\Omega$ , with tolerances down to  $\pm 1\%$ . They feature TCRs as low as  $\pm 50\text{ppm}/^{\circ}\text{C}$  and inductance values in the single-digit nano henry range (10 nH Max.). Operating temperature range is  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . The flameproof OAR resistors are constructed of a wire resistive element with welded copper leads to prevent solder wicking, which can change the device's resistance value in the circuit by as much as 30%.

The Low Ohmic Value Current Sense (OAR) Resistor is available in bulk packaging and is RoHS compliant and lead free. For non-standard technical requirements and special applications, please contact us with your specific needs, or link to Token official website "[Current Sensing Resistors](http://www.token.com.tw)" for more information.

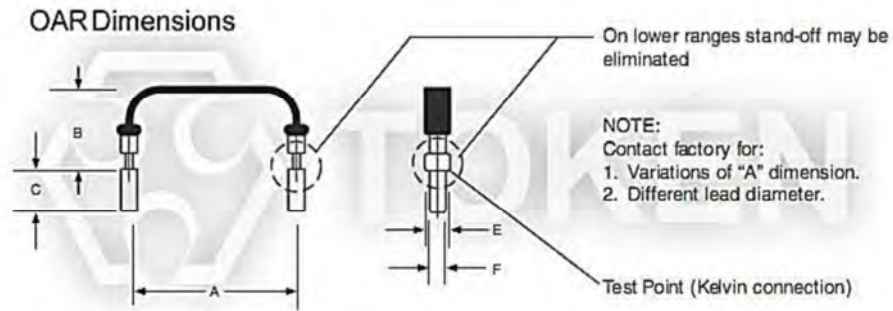




## ► OAR Dimensions

### Dimensions (Unit: mm) (OAR)

| Type  | Dimensions (Unit: mm) |     |       |       |       |
|-------|-----------------------|-----|-------|-------|-------|
|       | A±1                   | B±3 | C±0.8 | E±0.3 | F±0.1 |
| OAR-1 | 10                    | 10  | 3.5   | 1.6   | 1.0   |
| OAR-2 | 15                    | 15  | 3.5   | 1.6   | 1.0   |
| OAR-3 | 20                    | 20  | 3.5   | 1.6   | 1.0   |
| OAR-5 | 20                    | 20  | 3.5   | 1.6   | 1.0   |



Open Air Current Sensing (OAR) Resistor Dimensions

## ► Specification

### Specification (OAR)

| Type  | Power Rating @ 85°C (W) | Resistance Range (mΩ) | Tolerance (±%)    | Temperature Coefficient TCR (ppm/°C) | Inductance (nH) |
|-------|-------------------------|-----------------------|-------------------|--------------------------------------|-----------------|
| OAR-1 | 1                       | R005~R05              | ±1%<br>±2%<br>±5% | ±50                                  | 10 Max.         |
| OAR-2 | 2                       | R005~R05              |                   |                                      |                 |
| OAR-3 | 3                       | R005~R05              |                   |                                      |                 |
| OAR-5 | 5                       | R005~R01              |                   |                                      |                 |

## ► Characteristics

### Characteristic Specification (OAR)

| Test Items            | Test Method                     | Specification      |
|-----------------------|---------------------------------|--------------------|
| Load Life             | 1000 hours @ 25°C               | $\Delta R/R < 1\%$ |
| Moisture Test         | no load for 1000 hours          | $\Delta R/R < 1\%$ |
| Temperature Cycling   | -40°C to +125°C for 1000 cycles | $\Delta R/R < 1\%$ |
| Operating Temperature |                                 | -40°C to +125°C    |

## ► Order Codes

### Order Codes (OAR)

| OAR         | - | 1               | R01                  | J             | P            |
|-------------|---|-----------------|----------------------|---------------|--------------|
| Part Number |   | Rated power (W) | Resistance Value (Ω) | Tolerance (%) | Package-Code |
| OAR         |   | 1   1 W         | R005   0.005Ω        | F   ±1%       | P   Bulk     |
|             |   | 2   2 W         | R01   0.01Ω          | G   ±2%       |              |
|             |   | 3   3 W         | R05   0.05Ω          | J   ±5%       |              |
|             |   | 5   5 W         |                      |               |              |

# Low Ohmic Open Air Resistor (LRB)

## ► Product Introduction

**Token's open-air, low inductance, low ohmic resistor is alternative current shunts.**

### Features :

- Low inductance.
- High stability open-air style.
- Precision alloys resistive element.
- Lead (Pb)-free and RoHS compliant.
- Standard tolerance  $\pm 3\%$ ,  $\pm 5\%$ ,  $\pm 10\%$ .
- Radial leads, low resistance value  $2\text{ m}\Omega \sim 50\text{ m}\Omega$ .

### Applications :

- CPU Drive Control.
- Automotive, Feedback System.
- Residual Battery Power Detection, and Current Sensing.
- Power Supply Shunt, Current Detective.
- Inverter and Switching Power Supplies.
- Power Tool Motor controls.

Developed for current sensing and shunt applications, Token's LRB series of bare element resistors have a precision alloys (Ni-Cu) element welded construction. Built-in stand-offs and standard spacing makes for easy mounting.

The bare metal element design allows for maximum cooling via airflow, forcing less heat into the PCB. The flameproof construction offers values down to  $2\text{m}\Omega$  with low inductance. Customer can specify resistance range designed to satisfy challenging and specific technical requirements.

These factors make the LRB Series an outstanding choice for all types of high current power supplies and power applications requiring a robust part that is impervious to most environmental stresses. The device is ideal for current limited, current balance, and sampling sense in power supplier. It takes on the capability of high overload, and the function easily welding and non-inductance as well.

The Open Air (LRB) Low Ohmic Value Resistor is available in bulk packaging and is RoHS compliant and lead free. For non-standard technical requirements and special applications, please contact us with your specific needs, or link to Token official website "[Current Sensing Resistors](#)" for more information.

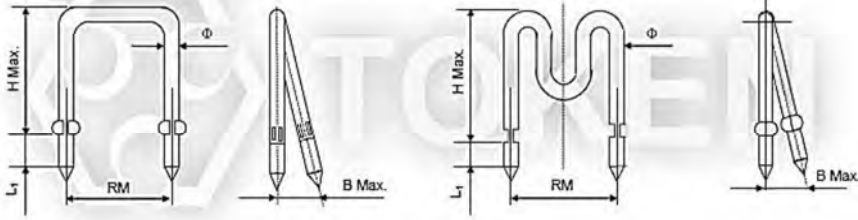


## LRB Dimensions

### Dimensions (Unit: mm) (LRB)

| RM (mm) | H Max. (mm) | B Max. (mm) | Ø (mm) | L1 (mm) |
|---------|-------------|-------------|--------|---------|
| 5 ~ 50  | 20          | 1           | 5 ~ 29 | 3±0.5   |

LRB Dimensions (Unit: mm)



Current Sensing Open Air Resistors (LRB) Dimensions

## Specification

### Specification (LRB)

| Type   | Diameter Ø (mm) | Rated Current (A) | Resistance Range (mΩ) | Tolerance (%)               | Temperature Coefficient (ppm/°C) | Temperature Range (°C) |
|--------|-----------------|-------------------|-----------------------|-----------------------------|----------------------------------|------------------------|
| LRB-05 | 0.5             | 2.5               | 20~50                 | ±3%(H)<br>±5%(J)<br>±10%(K) | ±50 ~ ±100                       | -55 ~ +85              |
| LRB-06 | 0.6             | 3.0               | 20~50                 |                             |                                  |                        |
| LRB-07 | 0.7             | 4.0               | 20~50                 |                             |                                  |                        |
| LRB-08 | 0.8             | 4.5               | 20~50                 |                             |                                  |                        |
| LRB-09 | 0.9             | 5.0               | 10~50                 |                             |                                  |                        |
| LRB-10 | 1.0             | 5.5               | 10~30                 |                             |                                  |                        |
| LRB-11 | 1.1             | 6.0               | 5~20                  |                             |                                  |                        |
| LRB-12 | 1.2             | 7.0               | 5~20                  |                             |                                  |                        |
| LRB-13 | 1.3             | 7.5               | 5~20                  |                             |                                  |                        |
| LRB-14 | 1.4             | 8.0               | 5~20                  |                             |                                  |                        |
| LRB-15 | 1.5             | 9.0               | 5~20                  |                             |                                  |                        |
| LRB-16 | 1.6             | 9.5               | 5~15                  |                             |                                  |                        |
| LRB-18 | 1.8             | 11                | 3~10                  |                             |                                  |                        |
| LRB-20 | 2.0             | 12                | 2~8                   |                             |                                  |                        |
| LRB-23 | 2.3             | 14                | 2~8                   |                             |                                  |                        |
| LRB-25 | 2.5             | 17                | 2~5                   |                             |                                  |                        |
| LRB-29 | 2.9             | 21                | 2~5                   |                             |                                  |                        |

## Order Codes

### Order Codes (LRB)

| LRB         | - | 08          | 05                  | R005                 | K           | P            |
|-------------|---|-------------|---------------------|----------------------|-------------|--------------|
| Part Number |   | Diameter Ø  | Leads Pitch RM (mm) | Resistance Value (Ω) | Tolerance % | Package-Code |
| LRB         |   | 05   0.5 mm | 05   5 mm           | R005   0.005Ω        | H   ±3%     | P   Bulk     |
|             |   | 06   0.6 mm | 10   10 mm          | R02   0.02Ω          | J   ±5%     |              |
|             |   | 07   0.7 mm | 15   15 mm          | R05   0.05Ω          | K   ±10%    |              |
|             |   | 08   0.8 mm | 20   20 mm          |                      |             |              |
|             |   | 09   0.9 mm | 25   25 mm          |                      |             |              |
|             |   | 10   1.0 mm | 30   30 mm          |                      |             |              |
|             |   | 11   1.1 mm | 35   35 mm          |                      |             |              |
|             |   | 12   1.2 mm | 40   40 mm          |                      |             |              |
|             |   | 13   1.3 mm | 45   45 mm          |                      |             |              |
|             |   | 14   1.4 mm | 50   50 mm          |                      |             |              |
|             |   | 15   1.5 mm |                     |                      |             |              |
|             |   | 16   1.6 mm |                     |                      |             |              |
|             |   | 17   1.7 mm |                     |                      |             |              |
|             |   | 18   1.8 mm |                     |                      |             |              |
|             |   | 20   2.0 mm |                     |                      |             |              |
|             |   | 23   2.3 mm |                     |                      |             |              |
|             |   | 25   2.5 mm |                     |                      |             |              |
|             |   | 29   2.9 mm |                     |                      |             |              |



# Current Shunts Resistors (FL)

## ► Product Introduction

**Token's Current Shunt Resistors (FL) for high-current applications aid precision measurement.**

Current shunts are low resistance precision resistors used to measure AC or DC electrical currents by the voltage drop those currents create across the resistance. Sometimes called an ammeter shunt, it is a type of current sensor.

A wide range of precision shunts, designed for use with kilowatt-hour meters and other high-current applications where a high level of accuracy is required, is now available from Token Electronics.



The interchangeable shunts (FL) are used to multiply the measuring range of measuring instrument and designed for PCB and bus bar mounting, are manufactured from electron beam welded copper and manganin, and have low temperature coefficients. Featuring low inductance values, shunts FL series can handle permanent currents of up to 10000A at voltage 75 mV.

FLQ-54 type shunt is made of precision alloy board. Its copper terminals spot welded by silver alloy ensure extremely high electric capability. The construction provides a kind of excellent stability and high overloaded ability non-inductive resistor, applied widely as current limited, current balance or sampling sense in communication system, electric equipment and auto-controlling electrical circuit.

The FL Series is available in bulk packaging and is RoHS compliant and lead free. For non-standard technical requirements and special applications, please contact us with your specific needs, or link to Token official website "[Current Sensing Resistors](http://www.token.com.tw)" for more information.

**Power Rating:** Watts (W) = Current ( $I^2$ ) × Resistance Value (R)

- Because current shunt is resistor and dissipate heat from the current flowing through them, when they get hot.
- Since that heat can change their resistance and even permanently damage the shunt, so it is often given a power rating or a derating factor.
- In practice current shunt is often rated to be used continuously at only 2/3 of their "rated current".
- The heat produced is power measured in Watts (W).

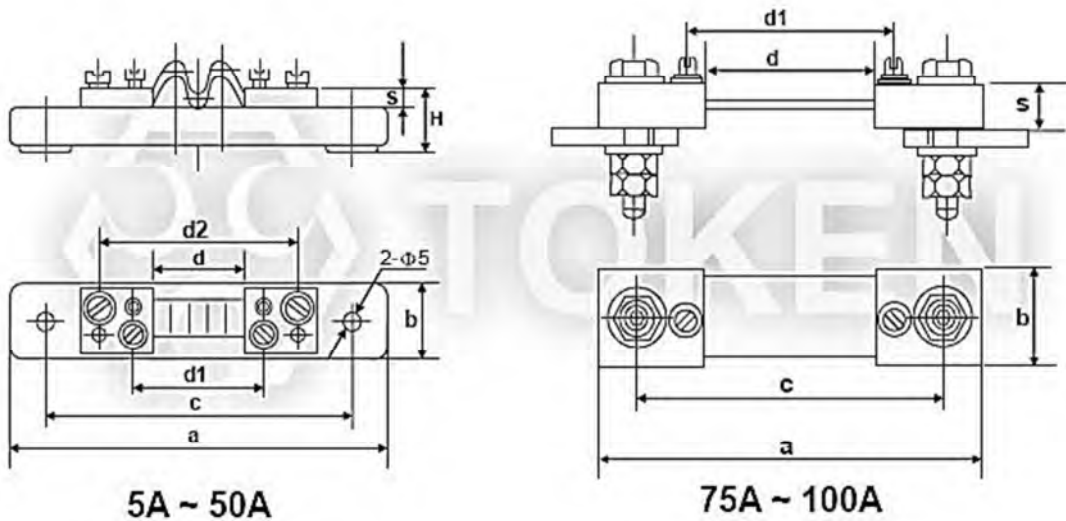
**Calculate Current:** Current (I) = Voltage (V) / Resistance Value (R)

- By inserting a current shunt into a circuit whose current you want to measure your can find the current by measuring the voltage drop across the shunt.
- Then knowing the resistance of the current shunt you can calculate the current using Ohm's law.

## ► FL-2 (5A-10000A)

### Dimensions (5A-100A, Unit: mm) (FL-2)

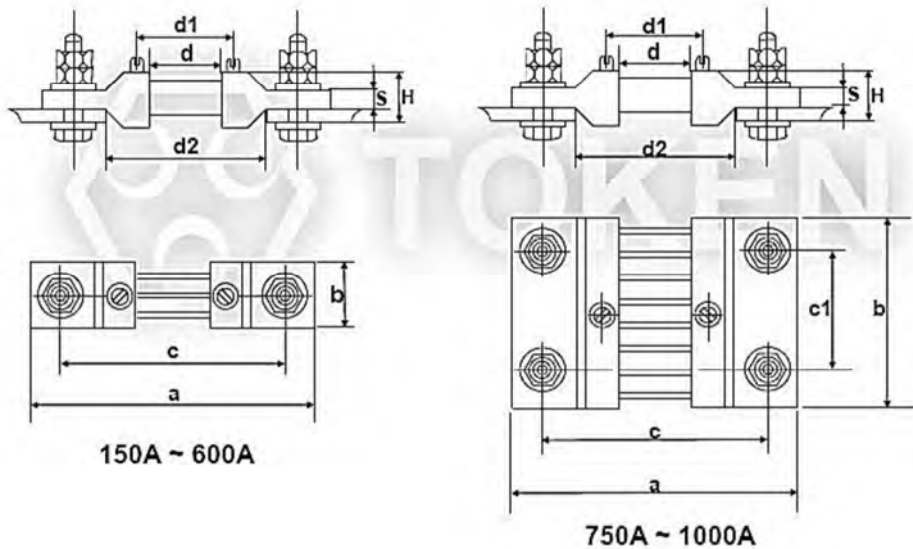
| Rating Current (A) | Dimensions (Unit: mm) |     |    |    |    |    |    |    |    |    | High Current Bolt (mm)-PC (Option) | Shunt Voltage Bolt (mm)-PC (Option) |
|--------------------|-----------------------|-----|----|----|----|----|----|----|----|----|------------------------------------|-------------------------------------|
|                    | a                     | c   | b  | c1 | c2 | H  | S  | d  | d1 | d2 |                                    |                                     |
| 5                  | 120                   | 100 | 20 |    |    | 15 | 5  | 30 | 42 | 60 | M5x6-2                             | M5x6-2                              |
| 10                 | 120                   | 100 | 20 |    |    | 15 | 5  | 30 | 42 | 60 | M5x6-2                             |                                     |
| 15                 | 120                   | 100 | 20 |    |    | 15 | 5  | 30 | 42 | 60 | M5x6-2                             |                                     |
| 20                 | 120                   | 100 | 20 |    |    | 15 | 5  | 30 | 42 | 60 | M5x6-2                             |                                     |
| 30                 | 120                   | 100 | 20 |    |    | 15 | 5  | 30 | 42 | 60 | M5x6-2                             |                                     |
| 50                 | 120                   | 100 | 20 |    |    | 15 | 5  | 30 | 42 | 60 | M5x6-2                             |                                     |
| 75                 | 104                   | 85  | 22 |    |    | 22 | 10 | 40 | 53 |    | M8x35-2                            |                                     |
| 100                | 104                   | 85  | 22 |    |    | 22 | 10 | 40 | 53 |    | M8x35-2                            |                                     |



FL-2 Type (5A-100A) Shunt

## ► Dimensions (150A-1000A, Unit: mm) (FL-2)

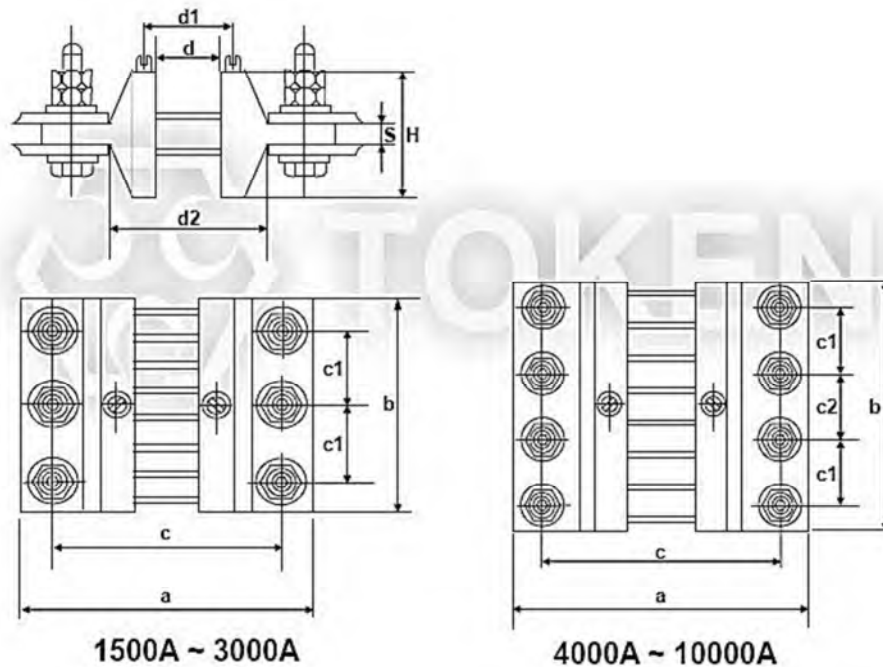
| Rating Current (A) | Dimensions (Unit: mm) |     |    |    |    |    |   |    |    |    | High Current Bolt (mm)-PC (Option) | Shunt Voltage Bolt (mm)-PC (Option) |
|--------------------|-----------------------|-----|----|----|----|----|---|----|----|----|------------------------------------|-------------------------------------|
|                    | a                     | c   | b  | c1 | c2 | H  | S | d  | d1 | d2 |                                    |                                     |
| 150                | 116                   | 85  | 22 |    |    | 22 | 6 | 30 | 39 | 54 | M8x35-2                            | M5x6-2                              |
| 200                | 116                   | 85  | 22 |    |    | 22 | 6 | 30 | 39 | 54 | M8x35-2                            |                                     |
| 250                | 126                   | 100 | 26 |    |    | 22 | 6 | 40 | 49 | 64 | M10x35-2                           |                                     |
| 300                | 126                   | 100 | 26 |    |    | 22 | 6 | 40 | 49 | 64 | M10x35-2                           |                                     |
| 400                | 126                   | 100 | 38 |    |    | 22 | 6 | 40 | 49 | 64 | M10x35-2                           |                                     |
| 500                | 126                   | 100 | 45 |    |    | 22 | 6 | 40 | 49 | 64 | M10x35-2                           |                                     |
| 600                | 126                   | 100 | 62 |    |    | 22 | 6 | 40 | 49 | 64 | M10x35-2                           |                                     |
| 750                | 126                   | 100 | 76 | 50 |    | 22 | 6 | 40 | 49 | 64 | M10x35-4                           |                                     |
| 1000               | 126                   | 100 | 95 | 50 |    | 22 | 6 | 40 | 49 | 64 | M10x35-4                           |                                     |



FL-2 Type (150A-1000A) Shunt

## ► Dimensions (1500A-10000A, Unit: mm) (FL-2)

| Rating Current (A) | Dimensions (Unit: mm) |     |     |      |      |     |    |    |    |    | High Current Bolt (mm)-PC (Option) | Shunt Voltage Bolt (mm)-PC (Option) |
|--------------------|-----------------------|-----|-----|------|------|-----|----|----|----|----|------------------------------------|-------------------------------------|
|                    | a                     | c   | b   | c1   | c2   | H   | S  | d  | d1 | d2 |                                    |                                     |
| 1500               | 190                   | 160 | 95  | 50   |      | 100 | 6  | 40 | 52 | 64 | M12x60-4                           | M5x6-2                              |
| 2000               | 190                   | 160 | 95  | 50   |      | 100 | 6  | 40 | 52 | 64 | M12x60-4                           |                                     |
| 2500               | 190                   | 160 | 110 | 50   |      | 100 | 13 | 40 | 52 | 84 | M12x60-4                           |                                     |
| 3000               | 190                   | 160 | 145 | 2-50 |      | 100 | 13 | 40 | 52 | 84 | M12x60-6                           |                                     |
| 4000               | 190                   | 160 | 195 | 2-50 | 55   | 100 | 13 | 40 | 52 | 84 | M16x80-8                           |                                     |
| 5000               | 284                   | 220 | 195 | 2-50 | 55   | 150 | 18 | 40 | 52 | 88 | M16x80-8                           |                                     |
| 6000               | 284                   | 220 | 210 | 2-50 | 80   | 150 | 18 | 40 | 52 | 88 | M16x80-8                           |                                     |
| 7500               | 290                   | 220 | 320 | 3-50 | 2-60 | 150 | 18 | 40 | 52 | 88 | M16x80-12                          |                                     |
| 10000              | 290                   | 220 | 400 | 3-50 | 2-90 | 150 | 18 | 40 | 52 | 88 | M16x80-12                          |                                     |



FL-2 Type (1500A-10000A) Shunt

## ▶ FL-13 (30A-75A)

### Dimensions (30A-75A, Unit: mm) (FL-13)

| Voltage (mV) | Rating Current (A) | Dimensions (Unit: mm) |    |    | Mounting size (mm) |      |
|--------------|--------------------|-----------------------|----|----|--------------------|------|
|              |                    | L                     | B  | H  | C                  | Bolt |
| 75mV         | 30A                | 100                   | 20 | 21 | 85                 | M5   |
| 75mV         | 50A                | 130                   | 14 | 30 | 85                 | M8   |
| 75mV         | 75A                | 130                   | 14 | 30 | 85                 | M8   |



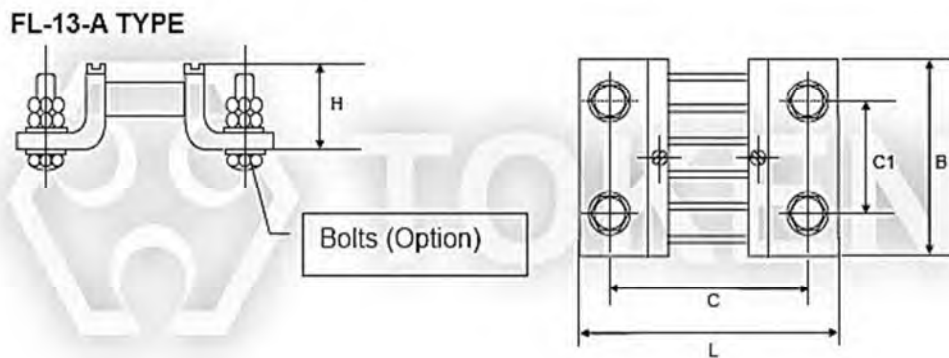
FL-13 Type (30A-75A) Shunt



## ► FL-13-A (100A-1000A)

### Dimensions (100A-1000A, Unit: mm) (FL-13-A)

| Voltage (mV) | Rating Current (A) | Dimensions (Unit: mm) |    |    | Mounting size (mm) |    |      |
|--------------|--------------------|-----------------------|----|----|--------------------|----|------|
|              |                    | L                     | B  | H  | C                  | C1 | Bolt |
| 75mV         | 100A               | 130                   | 14 | 30 | 85                 |    | M8   |
| 75mV         | 200A               | 130                   | 24 | 30 | 85                 |    | M10  |
| 75mV         | 300A               | 130                   | 30 | 30 | 100                |    | M10  |
| 75mV         | 400A               | 130                   | 42 | 30 | 100                |    | M10  |
| 75mV         | 500A               | 130                   | 52 | 30 | 100                |    | M10  |
| 75mV         | 600A               | 130                   | 60 | 30 | 100                | 50 | M10  |
| 75mV         | 750A               | 130                   | 77 | 30 | 100                | 50 | M10  |
| 75mV         | 1000A              | 130                   | 95 | 30 | 100                |    | M10  |

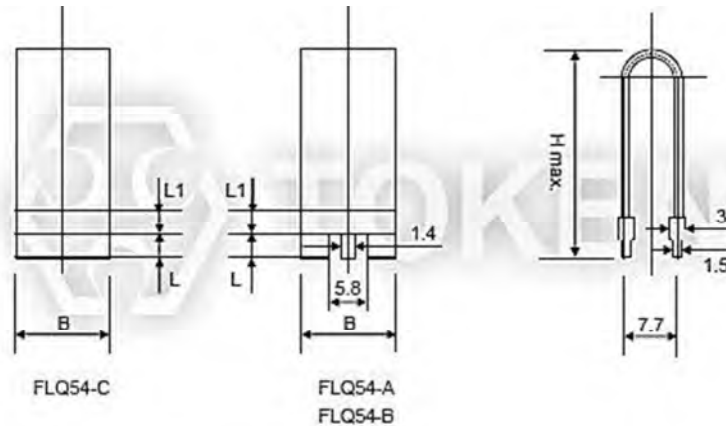


FL-13-A Type (100A-1000A) Shunt

## ► FLQ54 (30A-100A)

### Dimensions (30A-100A, Unit: mm) (FLQ54)

| Type    | Dimensions (Unit: mm) |    |   |                | Style of terminal |
|---------|-----------------------|----|---|----------------|-------------------|
|         | H KHz.                | B  | L | L <sub>1</sub> |                   |
| FLQ54-A | 37                    | 18 | 3 | 3              | 6                 |
| FLQ54-B | 60                    | 30 | 5 | 5              | 6                 |
| FLQ54-C | 32                    | 15 | 3 | 3              | 2                 |



FLQ54 Type (30A-100A) Shunt

### Technical Specifications (30A-100A) (FLQ54)

| Type    | Rated Current (A) | Rated Voltage Drop (mV) | Nominal Resistance (mΩ) | Accuracy Class | Temperature Range (°C) | Temperature Coefficient (ppm/°C) |
|---------|-------------------|-------------------------|-------------------------|----------------|------------------------|----------------------------------|
| FLQ54-A | 30                | 50                      | 1.6667                  | 0.5            | -55 ~ +85              | ±25                              |
| FLQ54-A | 50                | 50                      | 1.0000                  |                |                        |                                  |
| FLQ54-A | 60                | 50                      | 0.8333                  |                |                        |                                  |
| FLQ54-B | 60                | 50                      | 0.8333                  |                |                        |                                  |
| FLQ54-B | 75                | 50                      | 0.6667                  |                |                        |                                  |
| FLQ54-B | 100               | 50                      | 0.5000                  |                |                        |                                  |
| FLQ54-C | 30                | 45                      | 1.5000                  |                |                        |                                  |
| FLQ54-C | 60                | 45                      | 0.7500                  |                |                        |                                  |

## ► Characteristics

### Characteristic Specification (FL-2, FL-13, FL-13-A)

| Test Items                             | Specification   |
|--|---|
| Rated Voltage Drop                     | 50mV, 60mV, 75mV, 100mV.  |
| Accuracy Class                         | 0.5% for 5~4000 A; 1% for 5000~6000 A   |
| Over Rating Capacity                   | 120% of rated current for 2 hours.  |
| Ambient Conditions                     | Temperature: -40~+60°C; relative humidity: ≤95% 35°C  |
| Giving Out Heat When Loaded            | Not be more than 80°C at rated current of below 50A.; not be more than 120°C at rated current of 50A and over 50A.                              |
| Capacity to Withstand Mechanical Force | It is capable of withstanding the transport bumping at acceleration of 70m/S <sup>2</sup> and shock frequency of 80-120 times/Min. for 5 hours. |

## ► Order Codes

### Order Codes (FL)

| FL-2        | - | 5A                 |       | 50mV              |        | F                  |       | P            |      |
|-------------|---|--------------------|-------|-------------------|--------|--------------------|-------|--------------|------|
| Part Number |   | Rating Current (A) |       | Voltage Drop (mV) |        | Accuracy Class (%) |       | Package-Code |      |
| FL-2        |   | 5A                 | 5 A   | 50mV              | 50 mV  |                    |       | P            | Bulk |
| FL-13       |   | 10A                | 10 A  | 60mV              | 60 mV  | F                  | ±1%   |              |      |
| FL-13-A     |   | 200A               | 200 A | 75mV              | 75 mV  | D                  | ±0.5% |              |      |
| FLQ54-A     |   | 750A               | 750 A | 100mV             | 100 mV |                    |       |              |      |
| FLQ54-B     |   |                    |       |                   |        |                    |       |              |      |
| FLQ54-C     |   |                    |       |                   |        |                    |       |              |      |

# 4-Terminal Connection Kelvin Current Sensing Chips (LRF)

## ► Product Introduction

**A key current sensing technology of 4-terminal Kelvin resistor (LRF) to construct vehicles for road, rail, sea, air and space.**

### Features :

- 4-Terminal Kelvin design, Durable with all-welded construction.
- Solid metal strip nickel-chrome or manganese-copper alloy resistive element.
- Ideal for all types of current sensing, voltage division and pulse applications.
- Proprietary processing technique produces extremely low resistance values.
- Over Coating : molding Compound UL-94 grade.

### Applications :

- Automotive: Electronic controls (engine and transmission controls, audio electronics, climate controls, anti-lock brakes, etc.).
- Computer: Power management / safety, DC/DC converter, VRMs, Li-Ion battery management.
- Telecommunications: Power management in cell phones.
- Industrial: Instrumentation, inverter air conditioning.

Token extends its surface-mount current sensing series with (LRF). This 4-terminal connection Kelvin chip resistor derivative in 1/2 watt and 1 watt package sizes. TCR down to 150ppm and enables tight tolerances down to 1% for increased measurement accuracy. Token LRF0612 combines tight tolerance and low TCR with extremely low resistance values down to 0.5mΩ in the compact 0612 case size.

Employing the same Ni-Cu or Mn-Cu resistive element this product affords the user an added advantage of a built in 4-terminal design with 2 larger electrodes for current management and 2 smaller electrodes for voltage measurement. This results in a pulse tolerant, tight tolerance resistor in the 0612 package size that maintains the superior electrical characteristics of the surface-mount construction.

With its 4-terminal construction, the device reduces system errors while eliminating the need for system calibration. Also, LRF's low resistance value minimises excess power dissipation while its tight tolerance and low TCR improve circuit accuracy by reducing measurement error or eliminating the need for calibration during manufacturing or in the field, which reduces costs and/or improves end product performance.

The LRF0612 is suitable for all types of voltage division, current sensing, and pulse applications in power management for cell phones; VRMs for laptops, DC/DC converters for servers, and Li-Ion battery management and safety; industrial instrumentation; and automotive electronic control such as audio, transmission, anti-lock brakes, engine, and climate controls.

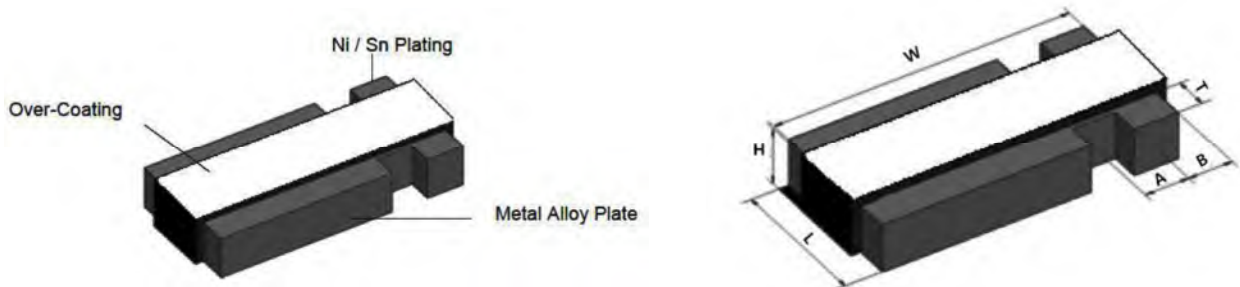
Like all current sensing chip resistors, LRF0612 features an all-welded construction that contributes to its superior electrical performance. A proprietary processing technique produces extremely low resistance values ranging from 0.5mΩ to 5mΩ, with tight tolerances of 1%, 2% and 5%. The device is lead-free, RoHS-compliant, and Token Green. For non-standard technical requirements and special applications, contact us with your specific needs. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)".



## Construction & Dimensions

### Dimensions Unit: mm (LRF)

| Type    | Power Rating at 70 °C (W) | Resistance Range (mΩ) | L±0.2 (mm) | W±0.25 (mm) | H±0.2 (mm) | T±0.25 (mm) | A±0.13 (mm) | B±0.13 (mm) |
|---------|---------------------------|-----------------------|------------|-------------|------------|-------------|-------------|-------------|
| LRF0612 | 1/2                       | 0.5~5                 | 1.65       | 3.05        | 0.65       | 0.4         | 0.51        | 0.51        |
| LRF0612 | 1                         | 0.5~5                 | 1.65       | 3.05        | 0.65       | 0.4         | 0.51        | 0.51        |

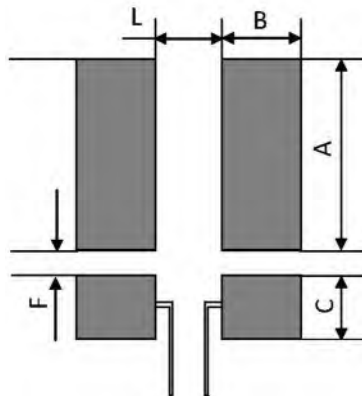


(LRF) Kelvin Current Sensing Chips Dimensions (Unit: mm)

## Electrical Specifications

### Recommend Land Pattern (LRF)

| Type    | Maximum Power Rating (Watts: W) | Resistance Range (mΩ) | Dimensions (mm ± 0.1) |     |     |     |     |
|---------|---------------------------------|-----------------------|-----------------------|-----|-----|-----|-----|
|         |                                 |                       | A                     | B   | C   | L   | F   |
| LRF0612 | 1/2W, 1W                        | 0.5 ~ 5               | 2.3                   | 1.0 | 0.8 | 0.7 | 0.4 |



4-Terminal Connection Kelvin Recommend Land Pattern (LRF)

- \* Remark: Copper foil minimum thickness of PCB: 3oz

### Electrical Characteristics (LRF)

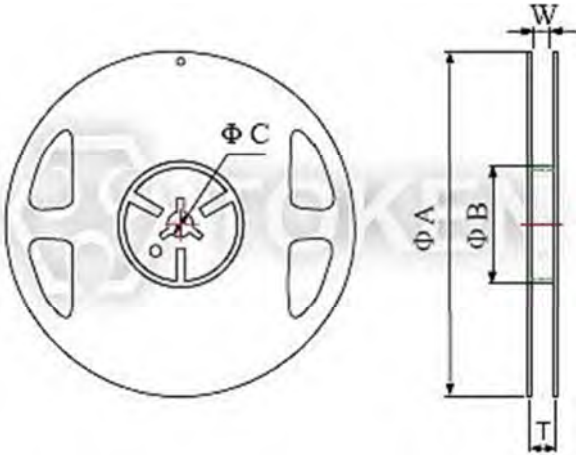
| Type    | Power Rating at 70 °C | Maximum working voltage (V) | Resistance Range (mΩ) | TCR (ppm/°C) | Tolerance (%) | Operating Temperature Range |
|---------|-----------------------|-----------------------------|-----------------------|--------------|---------------|-----------------------------|
| LRF0612 | 1/2W, 1W              | (P x R)1/2                  | 0.5mΩ ≤ R ≤ 3mΩ       | ±200         | ±1%, ±2%, ±5% | -55°C ~ +170°C              |
|         |                       |                             | 3mΩ ≤ R ≤ 5mΩ         | ±150         |               |                             |



## ▶ Reel & Type

### Packing Quantity & Reel Specifications (LRF)

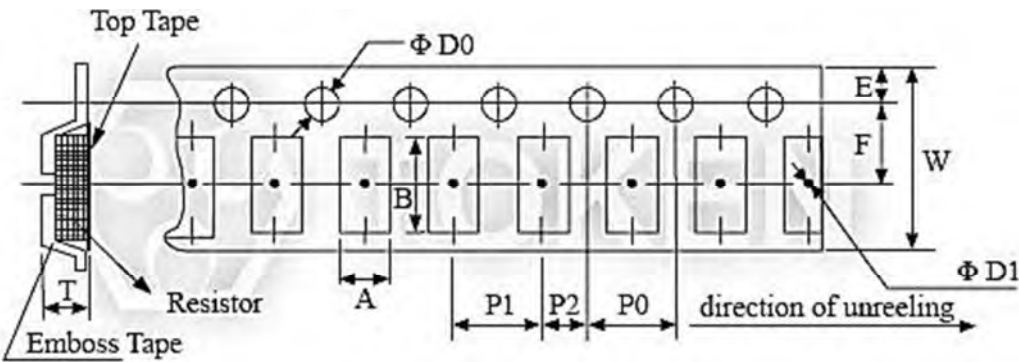
| Type    | Packaging Quantity | Tape Width | Reel Diameter | ΦA (mm)   | ΦB (mm)  | ΦC (mm)  | W (mm)  | T (mm) |
|---------|--------------------|------------|---------------|-----------|----------|----------|---------|--------|
| LRF0612 | 4,000 pcs          | 8 mm       | 7 inch        | 178.5±2.5 | 60.0±1.0 | 13.0±1.0 | 9.0±1.0 | 11.5±1 |



Reel Specifications Dimensions

### Emboss Plastic Tape Specifications (LRF)

| Type    | A (mm)    | B (mm)    | W (mm)    | E (mm)    | F (mm)   | P0 (mm)  | P1 (mm)  | P2 (mm)  | ΦD0 (mm)  | ΦD1 (mm)  | T (mm)   |
|---------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|----------|
| LRF0612 | 3.50±0.10 | 6.70±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.0±0.10 | 4.0±0.10 | 2.0±0.05 | 1.50±0.10 | 1.50±0.25 | 1.2±0.15 |

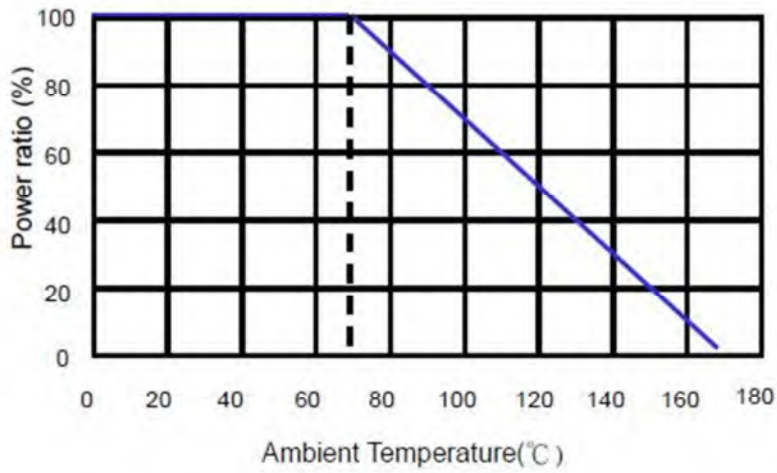


Low Ohm 4-Terminal Connection (LRF) Emboss Plastic Tape Specifications

- Notice :
  1. The cumulative tolerance of 10 sprocket hole pitch is ±0.2mm.
  2. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
  3. A & B measured 0.3mm 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.

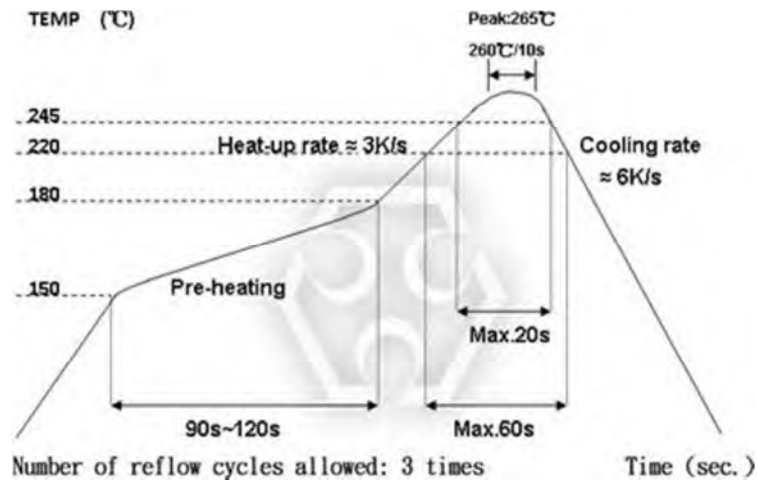
## Derating & Reflow

### Derating Curve



Kelvin Current Sensing Chips (LRF) - Derating Curve

### Reflow Condition



4-Terminal Current Chips (LRF) - Reflow Soldering (IR)

## Environmental Characteristics

### Environmental Characteristics (LRF)

| Item   | Requirement       | Test Method   |
|--|-------------------|---|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.          | IEC60115-1 4.8<br>JIS-C-5201-1 4.8<br>-55°C ~+125°C, 25°C is the reference temperature.                 |
| Short Time Overload                            | ±1%               | IEC60115-1 4.13<br>JIS-C-5201-1 4.13<br>5*rated power for 5 seconds.                                    |
| Insulation Resistance                          | >100MΩ            | IEC60115-1 4.6<br>JIS C 5201-1 4.6<br>100V DC for 1 minute  |
| Endurance                                      | ±2.0%             | IEC60115-1 4.25<br>JIS-C-5201-1 4.25.1<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" |
| Moisture no Load                               | ±1%               | IEC60115-1 4.24.2.1a<br>JIS-C-5201-1 4.24.2.1a<br>85°C, 85%RH, 1000 Hrs.                                |
| High Temperature Exposure                      | ±2.0%             | IEC60115-1 4.23.2<br>JIS-C-5201-1 4.23.2<br>At +170°C for 1000 Hrs.                                     |
| Low Temperature Storage                        | ±1%               | IEC60115-1 4.23.4<br>JIS C 5201-1 4.23.4<br>At -55°C for 1000 Hrs.                                      |
| Bending Strength                               | ±1%               | IEC-60115-1 4.33<br>JIS-C-5201-1 4.33<br>Bending width 2mm once for 5 seconds.                          |
| Solderability                                  | 95% Min. coverage | IEC-60115-1 4.17<br>JIS-C-5201-1 4.17<br>245±5°C for 2±0.5 seconds.                                     |
| Resistance to Soldering Heat                   | ±0.5%             | IEC-60115-1 4.18<br>JIS-C-5201-1 4.18<br>260±5°C for 10±1 sec 2 cycles.                                 |
| Thermal Shock                                  | ±1%               | IEC-60115-1 4.19<br>JIS-C-5201-1 4.19<br>-55°C ~ 150°C, 300 cycles, 15min per extreme condition.        |

## Order Codes

### Order Codes (LRE)

| LRF         | 0612                  |           | F                        | TR |         | F           | T            | 0m75 |                  | M    |                       |         |         |               |  |
|-------------|-----------------------|-----------|--------------------------|----|---------|-------------|--------------|------|------------------|------|-----------------------|---------|---------|---------------|--|
| Part Number | Dimensions (L×W) (mm) |           | Resistance Tolerance (%) |    | Package |             | TCR (PPM/°C) |      | Power Rating (W) |      | Resistance (Ω)<br>Ex: |         | Marking |               |  |
|             | 0612                  | 1.65*3.05 | J                        | ±5 | TR      | Taping Reel | K            | ±150 | U                | 0.5W | 0m50                  | 0.00050 | M       | MnCu Material |  |
|             |                       |           | G                        | ±2 |         |             | F            | ±200 | T                | 1W   | 0m75                  | 0.00075 |         | NiCu Material |  |
|             |                       |           | F                        | ±1 |         |             |              |      |                  |      | 1m50                  | 0.00150 |         |               |  |
|             |                       |           |                          |    |         |             |              |      |                  |      | R005                  | 0.00500 |         |               |  |



# AEC-Q200 Metal Alloy High Power Resistors (LREA)

## ► Product Introduction

### Token AEC-Q200 High Power Current Sensing Chips (LREA) Compliant for your Automotive & Transportation Solutions.

#### Features :

- Wide range package sizes 1206/2512/2725/4527.
- High power rating up to 5 Watts, Low TCR down to  $\pm 50$  ppm/ $^{\circ}\text{C}$ .
- Resistance values from 0.25m $\Omega$  to 1 $\Omega$ , Customized resistance available.
- AEC-Q200 Compliance, RoHS compliant and Halogen free.

#### Construction :

- The resistive layer is covered with a protective coat, and two external end terminations are added.
- Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the metal alloy.
- Wrap-around terminations have an electroplated nickel barrier and pure Tin (lead free) or matte-tin finish, ensuring excellent "leach" resistance properties and solderability.

#### Applications :

- Power Management for NB, MB, Monitor.
- SWPS DC-DC Converter, Charger, Adaptor, Power Supplies, shunts.
- Electric Vehicles, Automatic and Continuously Variable Transmission systems.
- Hard Disk Drives: Solid-state hard drives (SSD), Solid-state hybrid drives (SSHDD).

Token electronics AEC-Q200 current sensing resistor (LREA) offer excellent stability, high power, small size, excellent heat dissipation and high solder-joint reliability which make them excellent for design into Electric Vehicles, Hybrid Electric Vehicles, Automatic and Continuously Variable Transmission systems and other vehicle power applications.

Power metal alloy strip current sense surface-mount resistors (LREA) provide superior performance in high temperature applications with a wide range of package sizes in 1206/2512/2725/4527 and choice of resistance values from 0.25 m $\Omega$  to 1 $\Omega$ . The (LREA) resistors deliver overload capabilities equivalent to wirewound devices with high power handling (Up to 5W) and temperature coefficients as low as  $\pm 50$  ppm/ $^{\circ}\text{C}$ .

AEC-Q200 (LREA) current-sensing chip resistors are qualified for automotive systems to provide engineers additional assurance that they are designing in a robust and reliable component. The device is optimized for electronic controls, including chassis, driver information electronics, engine, and climate controls and ideal for all types of pulse and current sensing applications including linear power supplies and switching, instruments, power amplifiers and shunts.

To maximise energy conversion efficiency and reduce power consumption, current sense resistors ought to be from the lowest ohmic value, the highest pulse and surge possible. Token Current-sensing (LREA) resistors allow control circuitry to watch the level of current in a circuit by converting current into a voltage that can be monitored with exceptional efficiency such as typical applications in modern battery-operated equipment.

Token electronics delivers the right chip for your low range, current-sense applications. For standard parts please link to High Power Low Value Current Sensing Chip Resistors (LRE) Metal Strip. For more detailed product information and data sheets or to discuss your specific requirements please contact Token electronics.

Or link to

Token





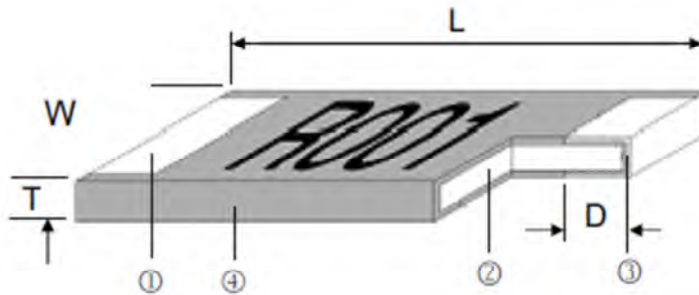
---

official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## Dimensions

### Metal Alloy Chip (LREA) Construction & Dimensions



|   |                        |
|---|------------------------|
| 1 | Solder Plating (Sn)    |
| 2 | Alloy Plate            |
| 3 | Barrier Layer (Cu, Ni) |
| 4 | Overcoat               |

Metal Alloy AEC-Q200 Chip (LREA) Construction & Dimensions

| Type     | Power Rating at 70°C (W) | Resistance Range (mΩ) | Dimensions (Unit: mm) |             |             |             |
|----------|--------------------------|-----------------------|-----------------------|-------------|-------------|-------------|
|          |                          |                       | L                     | W           | T           | D           |
| LREA1206 | 1                        | 1.0~2.0               | 3.200±0.254           | 1.650±0.254 | 0.670±0.254 | 0.508±0.254 |
|          |                          | 3.0~100.0             | 3.200±0.254           | 1.650±0.254 | 0.490±0.254 | 0.508±0.254 |
| LREA2512 | 2                        | 0.5~1.0               | 6.350±0.254           | 3.050±0.254 | 0.670±0.254 | 2.200±0.254 |
|          |                          | 1.5                   |                       |             | 2.000±0.254 |             |
|          |                          | 2.0                   |                       |             | 1.400±0.254 |             |
|          |                          | 2.5~100.0             |                       |             | 1.100±0.254 |             |
|          |                          | 101.0~450.0           |                       |             | 0.610±0.254 | 0.850±0.254 |
|          | 3                        | 0.5~1.0               |                       |             | 2.200±0.254 |             |
|          |                          | 1.5                   |                       |             | 2.000±0.254 |             |
|          |                          | 2.0                   |                       |             | 1.400±0.254 |             |
|          |                          | 2.5~50.0              |                       |             | 1.100±0.254 |             |
|          |                          | 51.0~100.0            |                       |             | 0.740±0.254 | 1.100±0.254 |
| LREA2725 | 4                        | 0.25                  | 6.800±0.254           | 6.350±0.254 | 0.820±0.254 | 2.300±0.254 |
|          |                          | 0.5                   |                       |             | 0.690±0.254 |             |
|          |                          | 1                     |                       |             | 0.690±0.254 | 1.800±0.254 |
|          |                          | 1.5~3.0               |                       |             | 0.610±0.254 |             |
|          |                          | 501.0~680.0           |                       |             | 0.770±0.254 | 2.000±0.254 |
| LREA4527 | 3                        | 681.0m~1.0R           | 11.300±0.500          | 6.600±0.500 | 0.690±0.254 | 2.000±0.254 |
|          |                          | 1.0                   |                       |             | 0.790±0.254 | 3.000±0.254 |
|          | 5                        | 1.5                   |                       |             | 0.840±0.254 | 2.000±0.254 |
|          |                          | 2.0~500.0             |                       |             | 0.840±0.254 |             |
|          |                          |                       |                       |             | 0.840±0.254 |             |

## Electrical Specifications

### AEC-Q200 Chip Resistors (LREA) Electrical Specifications

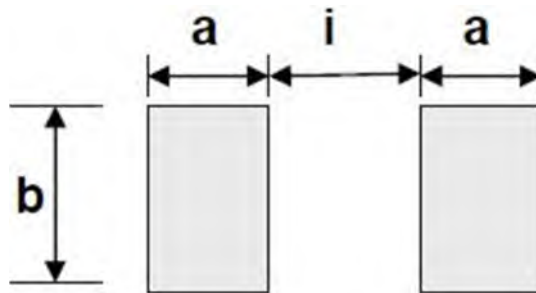
| Type     | Max. Rating Power (W) | Max. Rating Current (A)* | Max. Overload Current (A) | Resistance Range (mΩ)* |                                 | TCR (ppm/°C) | Operating Temperature (°C) |
|----------|-----------------------|--------------------------|---------------------------|------------------------|---------------------------------|--------------|----------------------------|
|          |                       |                          |                           | D (±0.5%)              | F (±1%);<br>G (±2%);<br>J (±5%) |              |                            |
| LREA1206 | 1                     | 31.62                    | 54.77                     | 7.0~100.0              | 1.0~100.0                       | ±50          | -55~+170°C                 |
| LREA2512 | 2                     | 63.25                    | 141.42                    | 7.0~450.0              | 0.5~450.0                       |              |                            |
|          | 3                     | 77.46                    | 134.16                    | 7.0~100.0              | 0.5~100.0                       |              |                            |
| LREA2725 | 4                     | 126.49                   | 252.98                    | --                     | 0.25~3.0                        |              |                            |
| LREA4527 | 3                     | 2.45                     | 4.24                      | 501m~1.0R              | 501m~1.0R                       |              |                            |
|          | 5                     | 70.71                    | 122.47                    | 7.0~500.0              | 1.0~500.0                       |              |                            |

- Note: Rating Current  $I = \sqrt{(P/R)}$  or Max. Rating Current whichever is lower.  
Special tolerance and range of resistance are under requested.

## Land Pattern

### Recommend Land Pattern (LREA)

| Type     | Maximum Power Rating (Watts) | Resistance Range (mΩ) | Dimensions (Unit: mm) |      |      |
|----------|------------------------------|-----------------------|-----------------------|------|------|
|          |                              |                       | a                     | b    | i    |
| LREA1206 | 1.0                          | 1.0 ~ 100.0           | 1.60                  | 2.18 | 0.66 |
| LREA2512 | 2.0 & 3.0                    | 0.5 ~ 1.5             | 3.05                  | 3.68 | 1.27 |
|          |                              | 2.0 ~ 3.5             | 2.11                  | 3.68 | 3.18 |
|          |                              | 3.6 ~ 450.0           | 1.90                  | 3.68 | 3.50 |
| LREA2725 | 4.0                          | 0.25 ~ 0.5            | 3.18                  | 6.86 | 1.32 |
|          |                              | 1.0 ~ 3.0             | 2.34                  | 6.86 | 3.00 |
| LREA4527 | 3.0 & 5.0                    | 1.0 ~ 3.0             | 4.50                  | 8.74 | 4.50 |
|          |                              | 3.5 ~ 100.0           | 3.40                  | 8.74 | 6.43 |
|          |                              | 101.0m ~ 1R           | 2.93                  | 8.74 | 7.63 |

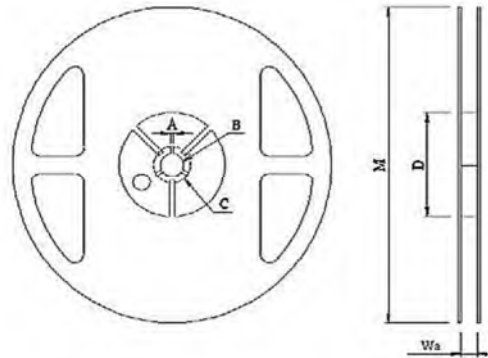


AEC-Q200 Recommend Land Pattern (LREA) Dimensions

## ▶ Reel & Type

### Reel Specifications (LREA)

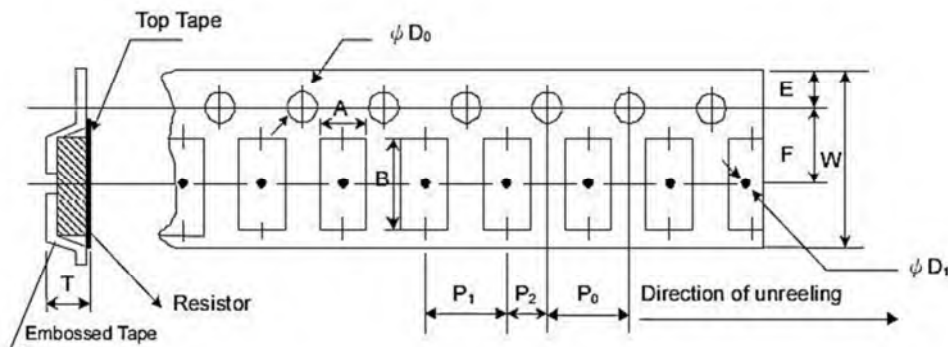
| Reel Type / Tape   | W          | M         | A         | B          | C          | D          |
|--|------------|-----------|-----------|------------|------------|------------|
| 7" reel for 8 mm embossed<br>(LREA0805 & 1206 series only) | 12.00± 0.5 | 178 ± 1.0 | 2.0 ± 0.5 | 13.2 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |
| 7" reel for 12 mm embossed                                 | 16.2 ± 0.5 | 178 ± 1.0 | 2.5 ± 0.5 | 13.5 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |
| 7" reel for 24 mm embossed (LREA4527 series only)          | 24.4 +2/-0 | 178 ± 1.0 | 2.0 ± 0.5 | 13.2 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |



Reel Specifications Dimensions

### Emboss Plastic Tape Specifications (LREA)

| Type     | A±0.1 | B±0.1 | W±0.3 | E±0.1 | F±0.1 | P0±0.1 | P1±0.3 | P2±0.1 | ΦD0±0.05 | ΦD1±0.1 | T±0.1 |
|----------|-------|-------|-------|-------|-------|--------|--------|--------|----------|---------|-------|
| LREA1206 | 2.03  | 3.55  | 8.0   | 1.75  | 3.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.00    | 0.70  |
| LREA2512 | 3.50  | 6.75  | 12.0  | 1.75  | 5.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.55    | 0.90  |
| LREA2725 | 6.81  | 7.16  | 12.0  | 1.75  | 5.5   | 4.0    | 8.0    | 2.0    | 1.55     | 1.55    | 1.05  |
| LREA4527 | 7.38  | 12.0  | 24.0  | 1.75  | 11.5  | 4.0    | 12.0   | 2.0    | 1.55     | 1.55    | 1.05  |



Low Ohm Metal Strip (LREA) Emboss Plastic Tape Specifications

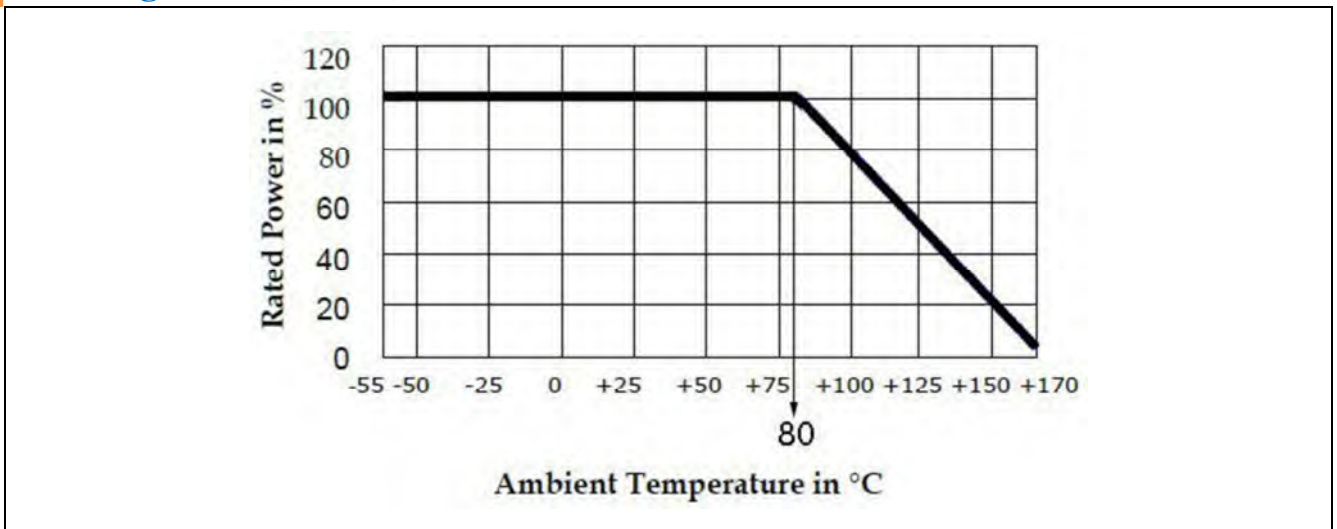
- The cumulative tolerance of 10 sprockets hole pitch is ± 0.2mm.
- Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
- A & B measured 0.3mm from the bottom of the packet
- T measured at a point on the inside bottom of the packet to the top surface of the carrier.
- Pocket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

## Packaging Quantity (LREA)

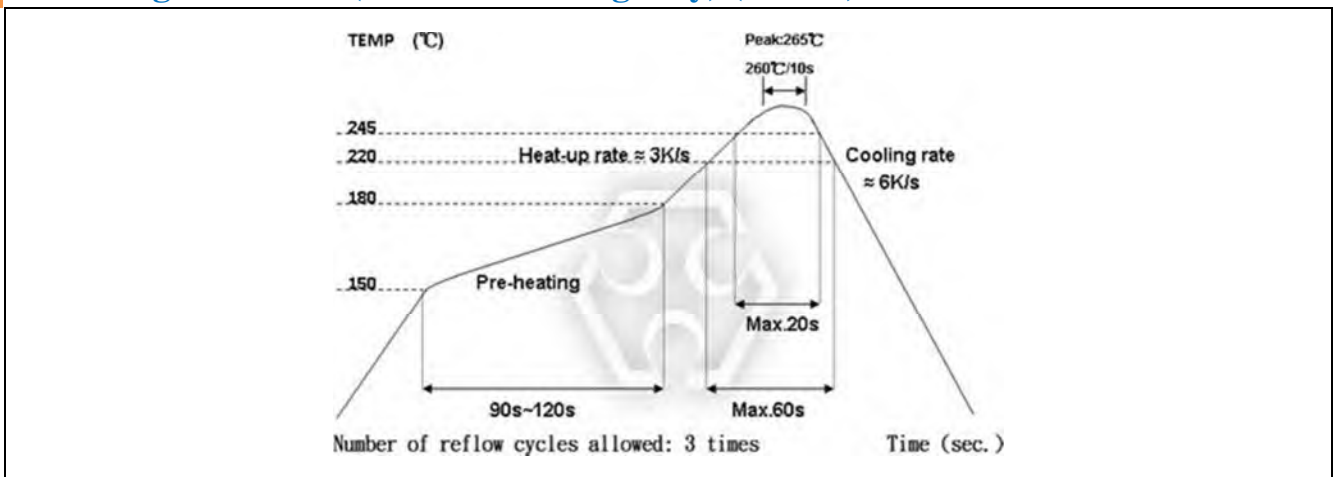
| Type     | Tape Width             | Diameter  | Piece/Reel |
|----------|------------------------|-----------|------------|
| LREA1206 | 8 mm/embossed plastic  | 178 mm/7" | 5,000      |
| LREA2512 | 12 mm/embossed plastic | 178 mm/7" | 4,000      |
| LREA2725 | 12 mm/embossed plastic | 178 mm/7" | 2,000      |
| LREA4527 | 24 mm/embossed plastic | 178 mm/7" | 1,000      |

## Derating & Soldering Condition

### Derating Curve (LREA)



### Soldering Condition (Reflow soldering only) (LREA)





## Environmental Characteristics

### Environmental Characteristics (LREA)

| Item   | Requirement  | Test Method  |       |          |
|--|--|--|-------|----------|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.   | JIS C 5201-1 4.8 +25/+150°C  |       |          |
| Short Time Overload                            | LREA4527: $\Delta R/R_0 \leq \pm 2.0\%$<br>The others: $\Delta R/R_0 \leq \pm 0.5\%$ | JIS C 5201-1 4.13 Rating power duration: 5secs.                                  |       |          |
|  |  | Type   | Power | Multiple |
|  |  | LREA1206   | 1.0W  | 3 times  |
|  |  | LREA2512   | 2.0W  | 5 times  |
|  |  | LREA2512   | 3.0W  | 3 times  |
|  |  | LREA2725   | 4.0W  | 4 times  |
| LREA4527                                       | 3.0W, 5.0W   | 3 times  |       |          |
| Solderability                                  | 95% Min. coverage  | JIS-C5201-1 4.17 245±5°C for 3 seconds   |       |          |
| Resistance to Soldering Heat                   | $\Delta R/R_0 \leq \pm 0.5\%$  | JIS-C5201-1 4.18 260±5°C for 10 seconds  |       |          |
| Temperature Cycling                            | $\Delta R/R_0 \leq \pm 0.5\%$  | JIS-C5201-1 4.19 -55°C ~ 150°C, 1000 cycles                                      |       |          |
| High Temperature Exposure (Storage)            | LREA4527: $\Delta R/R_0 \leq \pm 2.0\%$<br>The others: $\Delta R/R_0 \leq \pm 1.0\%$ | JIS-C5201-1 4.23.2 +170°C for 1000 Hrs.  |       |          |
| Bias Humidity                                  | $\Delta R/R_0 \leq \pm 0.5\%$  | JIS-C5201-1 4.24 +85°C/85%RH for 1,000Hrs. with 1.5Hrs "ON", 0.5Hr "OFF".        |       |          |
| Load Life                                      | LREA4527: $\Delta R/R_0 \leq \pm 2.0\%$<br>The others: $\Delta R/R_0 \leq \pm 1.0\%$ | JIS-C5201-1 4.25 80±2°C, RCWV for 1000 Hrs. with 1.5 Hrs. "ON" and 0.5 Hr. "OFF" |       |          |

## Order Codes

### Order Codes (LREA)

| LREA        | 2725                 |            | F                        |      | TR      |             | D            |      | 4                |   | R010                  |         |
|-------------|----------------------|------------|--------------------------|------|---------|-------------|--------------|------|------------------|---|-----------------------|---------|
| Part Number | Dimensions (L×W)(mm) |            | Resistance Tolerance (%) |      | Package |             | TCR (PPM/°C) |      | Power Rating (W) |   | Resistance (Ω)<br>Ex: |         |
| LREA        | 1206                 | 3.20*1.65  | J                        | ±5   | TR      | Taping Reel | D            | ±50  | T                | 1 | 0m50                  | 0.00050 |
|             | 2512                 | 6.35*3.05  | G                        | ±2   |         |             | W            | ±75  | S                | 5 | 0m75                  | 0.00075 |
|             | 2725                 | 6.80*6.35  | F                        | ±1   |         |             | E            | ±100 | R                | 3 | 1m50                  | 0.00150 |
|             | 4527                 | 11.30*6.60 | D                        | ±0.5 |         |             | K            | ±150 | 4                | 4 | R002                  | 0.00200 |
|             |                      |            |                          |      |         |             | F            | ±200 | 5                | 5 | R010                  | 0.01000 |
|             |                      |            |                          |      |         |             |              |      |                  |   | R100                  | 0.10000 |

# Metal Strip Low Value Chip Resistors (LRE)

## ► Product Introduction

Token (LRE) Metal Strip Chips offer exclusive technology features and benefits for current-sensing.

### Features :

- High power rating up to 5 Watts. Low TCR down to  $\pm 50$  ppm/ $^{\circ}$ C.
- Resistance values from 0.25m to 1 Ohm. Customized resistance available.
- Wide range package sizes 0805/1206/2010/2512/2725/2728/2817/4527.

### Applications :

- Power Management for NB, MB, Monitor.
- SWPS DC-DC Converter, Charger, Adaptor, Power Supplies.
- Hard Disk Drives: Solid-state hard drives (SSD), Solid-state hybrid drives (SSHD).

### Construction :

- The resistive layer is covered with a protective coat, and two external end terminations are added.
- Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the metal alloy.
- Wrap-around terminations have an electroplated nickel barrier and pure Tin (lead free) or matte-tin finish, ensuring excellent "leach" resistance properties and solderability.

For current sensing applications, metal strip (metal alloy) resistors provide a more robust technology than thick film and thin film devices. Both thin film and thick film resistor technologies need a ceramic substrate for support.

Power Metal Strip technologies are quite different from thick film or thin film technologies since it is an exciting-metal welded construction that's thick enough to become self-supporting (there's no substrate). It's because the big current transporting mass of the bulk alloy, which supplies greater surge capacity. The ability of power handling capacity offers greater power rating and/or extended really low resistance ranges.

In fast electrical transients such as mechanical switch closures or battery plug-in, the pulse capability of the resistor is limited to the amount of heat energy that causes a temperature rise in the resistor element. The more massive resistor element of the power metal strip device will have less temperature rise for the same pulse energy, which translates to superior pulse withstanding capability.

Unlike other manufacturers of metal element current sense resistors, Token (LRE) metal strip chip resistors design for applications that require high power handling (Up to 5W) and low resistance values from 0.25m $\Omega$  to 1 $\Omega$  at  $\pm 50$  ppm/ $^{\circ}$ C ; and come with a range of advantages including a wide temperature range and a varied choice of wide range package sizes 0805/1206/2010/2512/2725/2728/2817/4527 with high current capability.

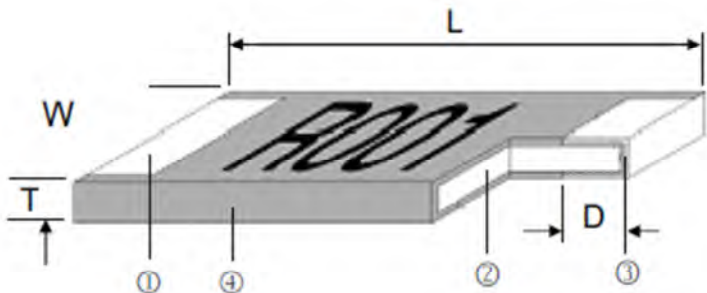
Token (LRE) series enable a wide range of design options and flexibility allows designers to specify the resistance value and tolerance that their circuits require, instead of designing their circuits to the resistance values available. At the same time, Token electronics also offers AEC-Q200 Automotive Grade (LREA) specifications by extending (LRE) series for vehicle applications such as electronic controls (anti-lock brakes, audio electronics, engine and transmission controls, climate controls, etc.).

Token electronics delivers the right chip for your low range, current-sense applications. For more detailed product information and data sheets or to discuss your specific requirements please contact Token electronics. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## ► Dimensions

### Metal Strip Chip (LRE) Construction & Dimensions

|  |   |                        |
|--|---|------------------------|
|  <p style="text-align: center;">Metal Alloy AEC-Q200 Chip (LRE) Construction &amp; Dimensions</p> | 1 | Solder Plating (Sn)    |
|  | 2 | Alloy Plate            |
|  | 3 | Barrier Layer (Cu, Ni) |
|  | 4 | Overcoat               |

| Type    | Power Rating at 70°C (W) | Resistance Range (mΩ) | Dimensions (Unit: mm) |             |             |             |             |             |
|---------|--------------------------|-----------------------|-----------------------|-------------|-------------|-------------|-------------|-------------|
|         |                          |                       | L                     | W           | T           | D           |             |             |
| LRE0805 | 0.75                     | 3.0 ~ 100.0           | 2.100±0.254           | 1.500±0.254 | 0.320±0.254 | 0.400±0.254 |             |             |
|         | 1.0                      | 3.0 ~ 10.0            |                       |             |             |             |             |             |
| LRE1206 | 0.5                      | 51.0 ~ 100.0          | 3.200±0.254           | 1.650±0.254 | 0.300±0.254 | 0.508±0.254 |             |             |
|         | 0.75                     | 21.0 ~ 50.0           |                       |             | 0.390±0.254 |             |             |             |
|         | 1.0                      | 1.0~2.0               |                       |             | 0.670±0.254 |             |             |             |
|         |                          | 3.0~100.0             |                       |             | 0.490±0.254 |             |             |             |
|         | 1.5                      | 1.0~2.0               |                       |             | 0.670±0.254 |             |             |             |
|         |                          | 3.0~100.0             |                       |             | 0.490±0.254 |             |             |             |
| LRE2010 | 0.75                     | 71.0~100.0            | 5.100±0.254           | 2.400±0.254 | 0.310±0.254 | 0.840±0.254 |             |             |
|         | 1                        | 31.0~70.0             |                       |             | 0.460±0.254 |             |             |             |
|         | 1.5                      | 1.0~2.0               |                       |             | 0.670±0.254 |             |             |             |
|         |                          | 2.5~30.0              |                       |             | 0.460±0.254 |             |             |             |
|         |                          | 31.0~100.0            |                       |             | 0.590±0.254 |             |             |             |
| LRE2512 | 1                        | 0.5~1.0               | 6.350±0.254           | 3.050±0.254 | 0.670±0.254 | 2.200±0.254 |             |             |
|         |                          | 1.5                   |                       |             | 2.000±0.254 |             |             |             |
|         |                          | 2.0                   |                       |             | 1.400±0.254 |             |             |             |
|         |                          | 2.5~100.0             |                       |             | 1.100±0.254 |             |             |             |
|         |                          | 101.0~680.0           |                       |             | 0.850±0.254 |             |             |             |
|         | 2                        | 0.5~1.0               |                       |             | 0.670±0.254 | 2.200±0.254 |             |             |
|         |                          | 1.5                   |                       |             | 2.000±0.254 |             |             |             |
|         |                          | 2.0                   |                       |             | 1.400±0.254 |             |             |             |
|         |                          | 2.5~100.0             |                       |             | 1.100±0.254 |             |             |             |
|         |                          | 101.0~450.0           |                       |             | 0.850±0.254 |             |             |             |
|         | 3                        | 0.5~1.0               |                       |             | 6.350±0.254 | 3.050±0.254 | 0.670±0.254 | 2.200±0.254 |
|         |                          | 1.5                   |                       |             |             |             |             | 2.000±0.254 |
|         |                          | 2.0                   |                       |             |             |             |             | 1.400±0.254 |

| Type    | Power Rating at 70°C (W) | Resistance Range (mΩ) | Dimensions (Unit: mm) |             |             |             |
|---------|--------------------------|-----------------------|-----------------------|-------------|-------------|-------------|
|         |                          |                       | L                     | W           | T           | D           |
|         |                          | 2.5~50.0              |                       |             |             | 1.100±0.254 |
|         |                          | 51.0~100.0            |                       |             | 0.740±0.254 |             |
| LRE2725 | 4                        | 0.25                  | 6.800±0.254           | 6.350±0.254 | 0.820±0.254 | 2.300±0.254 |
|         |                          | 0.5                   |                       |             | 0.690±0.254 |             |
|         |                          | 1                     |                       |             | 0.690±0.254 | 1.800±0.254 |
|         |                          | 1.5~3.0               |                       |             | 0.610±0.254 |             |
| LRE2728 | 4                        | 4.0~50.0              | 6.600±0.254           | 6.700±0.254 | 0.720±0.254 | 1.200±0.254 |
|         |                          | 51.0~450.0            |                       |             | 0.840±0.254 |             |
|         |                          | 451.0~600.0           |                       |             | 0.770±0.254 |             |
| LRE2817 | 3                        | 1.0                   | 7.300±0.254           | 4.400±0.254 | 0.690±0.254 | 1.800±0.254 |
|         |                          | 2.0~30.0              |                       |             | 0.610±0.254 |             |
|         |                          | 31.0~100.0            |                       |             | 0.720±0.254 | 1.500±0.254 |
|         |                          | 101.0~130.0           |                       |             | 0.770±0.254 |             |
|         |                          | 131.0~200.0           |                       |             | 0.690±0.254 |             |
| LRE4527 | 3                        | 501.0~680.0           | 11.300±0.500          | 6.600±0.500 | 0.770±0.254 | 2.000±0.254 |
|         |                          | 681.0m~1.0R           |                       |             | 0.690±0.254 |             |
|         | 5                        | 1.0                   |                       |             | 0.790±0.254 | 3.000±0.254 |
|         |                          | 1.5                   |                       |             | 0.840±0.254 | 2.000±0.254 |
|         |                          | 2.0~500.0             |                       |             | 0.840±0.254 |             |



## ► Electrical Specifications

### Current Sensing Metal Strip Chip (LRE) Electrical Specifications

| Type    | Max. Rating Power (W) | Max. Rating Current (A)* | Max. Overload Current (A) | Resistance Range (mΩ)* |                                 | TCR (ppm/°C) | Operating Temperature (°C) |
|---------|-----------------------|--------------------------|---------------------------|------------------------|---------------------------------|--------------|----------------------------|
|         |                       |                          |                           | D (±0.5%)              | F (±1%);<br>G (±2%);<br>J (±5%) |              |                            |
| LRE0805 | 0.75                  | 15.81                    | 31.62                     | 10.0~100.0             | 3.0~100.0                       | ±50          | -55~+170°C                 |
|         | 1                     | 18.26                    | 36.51                     | 10.0                   | 3.0~10.0                        |              |                            |
| LRE1206 | 0.50                  | 3.13                     | 6.26                      | 51.0~100.0             | 51.0~100.0                      |              |                            |
|         | 0.75                  | 5.98                     | 11.95                     | 21.0~50.0              | 21.0~50.0                       |              |                            |
|         | 1                     | 31.62                    | 63.25                     | 7.0~100.0              | 1.0~100.0                       |              |                            |
| LRE2010 | 1.5                   | 38.73                    | 67.08                     | 7.0~100.0              | 1.0~100.0                       |              |                            |
|         | 0.75                  | 3.25                     | 7.27                      | 71.0~100.0             | 71.0~100.0                      |              |                            |
|         | 1                     | 5.68                     | 12.70                     | 31.0~70.0              | 31.0~70.0                       |              |                            |
| LRE2512 | 1.5                   | 38.73                    | 77.46                     | 7.0~100.0              | 1.0~100.0                       |              |                            |
|         | 1                     | 44.72                    | 100.00                    | 7.0~680.0              | 0.5~680.0                       |              |                            |
|         | 2                     | 63.25                    | 141.42                    | 7.0~450.0              | 0.5~450.0                       |              |                            |
| LRE2725 | 3                     | 77.46                    | 134.16                    | 7.0~100.0              | 0.5~100.0                       |              |                            |
|         | 4                     | 126.49                   | 252.98                    | --                     | 0.25~3.0                        |              |                            |
| LRE2728 | 4                     | 31.62                    | 54.77                     | 7.0~600.0              | 4.0~600.0                       |              |                            |
| LRE2817 | 3                     | 54.77                    | 109.54                    | 7.0~200.0              | 1.0~200.0                       |              |                            |
| LRE4527 | 3                     | 2.45                     | 4.24                      | 501m~1.0R              | 501m~1.0R                       |              |                            |
|         | 5                     | 70.71                    | 122.47                    | 7.0~500.0              | 1.0~500.0                       |              |                            |

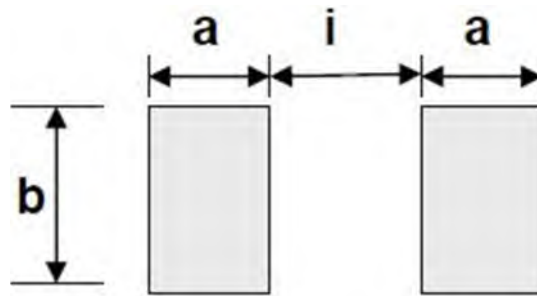
- Note: Rating Current  $I = \sqrt{(P/R)}$  or Max. Rating Current whichever is lower.  
Special tolerance and range of resistance are under requested.



## Land Pattern

### Metal Strip Chip (LRE) Recommend Land Pattern

| Type    | Maximum Power Rating (Watts) | Resistance Range (mΩ) | Dimensions (mm) |      |      |
|---------|------------------------------|-----------------------|-----------------|------|------|
|         |                              |                       | a               | b    | i    |
| LRE0805 | 0.75                         | 3.0 ~ 100.0           | 1.80            | 2.18 | 0.66 |
|         | 1.0                          | 3.0 ~ 10.0            | 1.80            | 2.18 | 0.66 |
| LRE1206 | 0.5 & 0.75 & 1.0 & 1.5       | 1.0 ~ 100.0           | 1.60            | 2.18 | 0.66 |
| LRE2010 | 0.75 & 1.0 & 1.5             | 1.0 ~ 3.0             | 2.89            | 2.92 | 1.22 |
|         |                              | 3.1 ~ 100.0           | 2.29            | 2.92 | 2.41 |
| LRE2512 | 1.0 & 2.0 & 3.0              | 0.5 ~ 1.5             | 3.05            | 3.68 | 1.27 |
|         |                              | 2.0 ~ 3.5             | 2.11            | 3.68 | 3.18 |
|         |                              | 3.6 ~ 680.0           | 1.90            | 3.68 | 3.50 |
| LRE2725 | 4.0                          | 0.25 ~ 0.5            | 3.18            | 6.86 | 1.32 |
|         | 4.0                          | 1.0 ~ 3.0             | 2.34            | 6.86 | 3.00 |
| LRE2728 | 4.0                          | 4.0 ~ 600.0           | 2.75            | 7.82 | 3.51 |
| LRE2817 | 3.0                          | 1.0 ~ 3.0             | 2.75            | 7.82 | 3.51 |
|         | 3.0                          | 3.5 ~ 200.0           | 2.45            | 7.82 | 3.11 |
| LRE4527 | 3.0 & 5.0                    | 1.0 ~ 3.0             | 4.50            | 8.74 | 4.50 |
|         |                              | 3.5 ~ 100.0           | 3.4             | 8.74 | 6.43 |
|         |                              | 101.0m ~ 1R           | 2.93            | 8.74 | 7.63 |

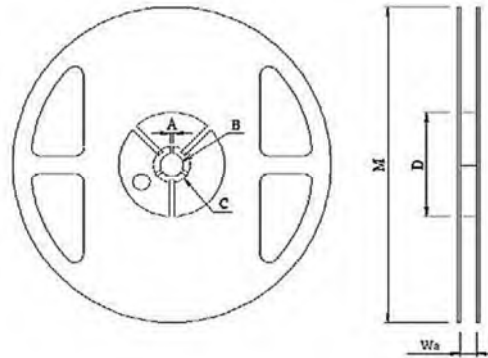


Metal Strip Chip (LRE) Recommend Land Pattern

## Reel & Type

### Reel Specifications (LRE) Unit: mm

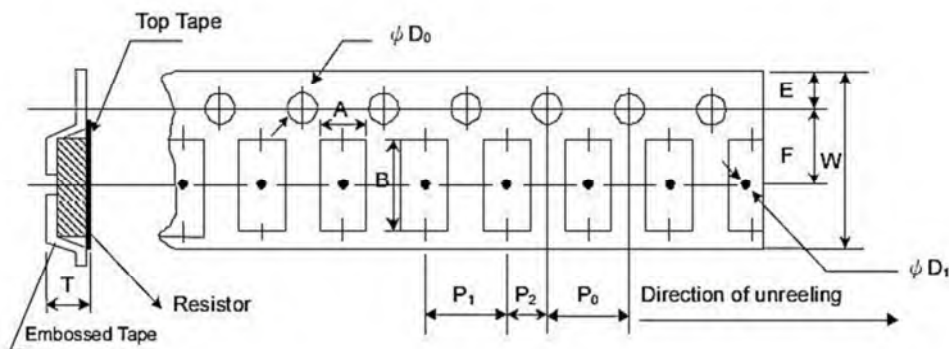
| Reel Type / Tape   | W          | M         | A         | B          | C          | D          |
|--|------------|-----------|-----------|------------|------------|------------|
| 7" reel for 8 mm embossed<br>(LREA0805 & 1206 series only) | 12.00± 0.5 | 178 ± 1.0 | 2.0 ± 0.5 | 13.2 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |
| 7" reel for 12 mm embossed                                 | 16.2 ± 0.5 | 178 ± 1.0 | 2.5 ± 0.5 | 13.5 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |
| 7" reel for 24 mm embossed (LREA4527 series only)          | 24.4 +2/-0 | 178 ± 1.0 | 2.0 ± 0.5 | 13.2 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |



Reel Specifications Dimensions

### Emboss Plastic Tape Specifications (LRE)

| Type    | A±0.1 | B±0.1 | W±0.3 | E±0.1 | F±0.1 | P0±0.1 | P1±0.3 | P2±0.1 | ΦD0±0.05 | ΦD1±0.1 | T±0.1 |
|---------|-------|-------|-------|-------|-------|--------|--------|--------|----------|---------|-------|
| LRE0805 | 1.70  | 2.45  | 8.0   | 1.75  | 3.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.00    | 0.50  |
| LRE1206 | 2.03  | 3.55  | 8.0   | 1.75  | 3.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.00    | 0.70  |
| LRE2010 | 2.85  | 5.55  | 12.0  | 1.75  | 5.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.55    | 0.82  |
| LRE2512 | 3.50  | 6.75  | 12.0  | 1.75  | 5.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.55    | 0.90  |
| LRE2725 | 6.81  | 7.16  | 12.0  | 1.75  | 5.5   | 4.0    | 8.0    | 2.0    | 1.55     | 1.55    | 1.05  |
| LRE2728 | 7.10  | 7.05  | 12.0  | 1.75  | 5.5   | 4.0    | 8.0    | 2.0    | 1.55     | 1.55    | 0.95  |
| LRE2817 | 4.60  | 7.50  | 12.0  | 1.75  | 5.5   | 4.0    | 8.0    | 2.0    | 1.55     | 1.55    | 1.20  |
| LRE4527 | 7.38  | 12.0  | 24.0  | 1.75  | 11.5  | 4.0    | 12.0   | 2.0    | 1.55     | 1.55    | 1.05  |



Low Ohm Metal Strip (LRE) Emboss Plastic Tape Specifications

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

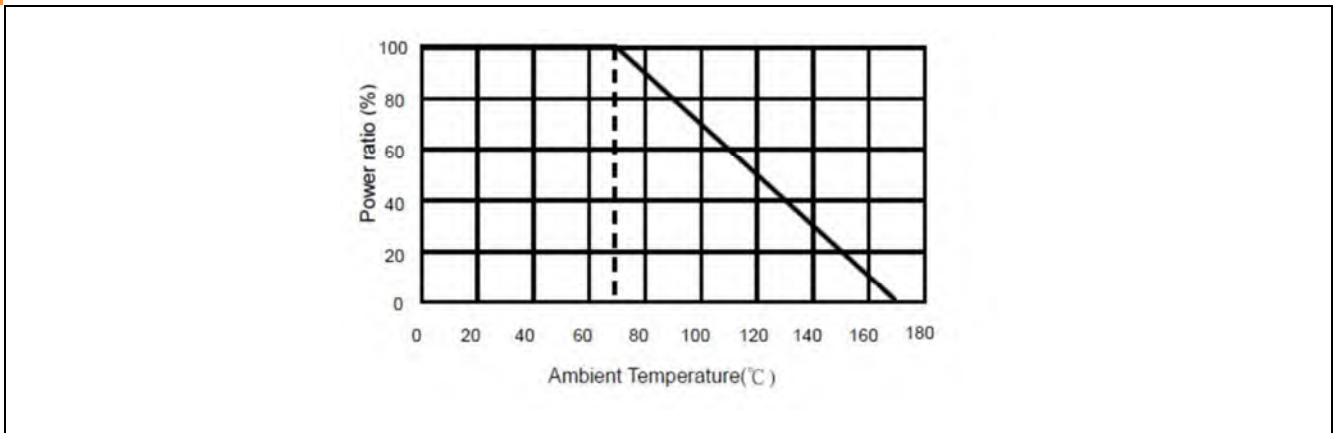
## Packaging Quantity (LRE)

| Type    | Tape Width             | Diameter  | Pieces/Reel |
|---------|------------------------|-----------|-------------|
| LRE0805 | 8 mm/embossed plastic  | 178 mm/7" | 5,000       |
| LRE1206 | 8 mm/embossed plastic  | 178 mm/7" | 5,000       |
| LRE2010 | 12 mm/embossed plastic | 178 mm/7" | 4,000       |
| LRE2512 | 12 mm/embossed plastic | 178 mm/7" | 4,000       |
| LRE2725 | 12 mm/embossed plastic | 178 mm/7" | 2,000       |
| LRE2728 | 12 mm/embossed plastic | 178 mm/7" | 2,000       |
| LRE2817 | 12 mm/embossed plastic | 178 mm/7" | 1,000       |
| LRE4527 | 24 mm/embossed plastic | 178 mm/7" | 1,000       |

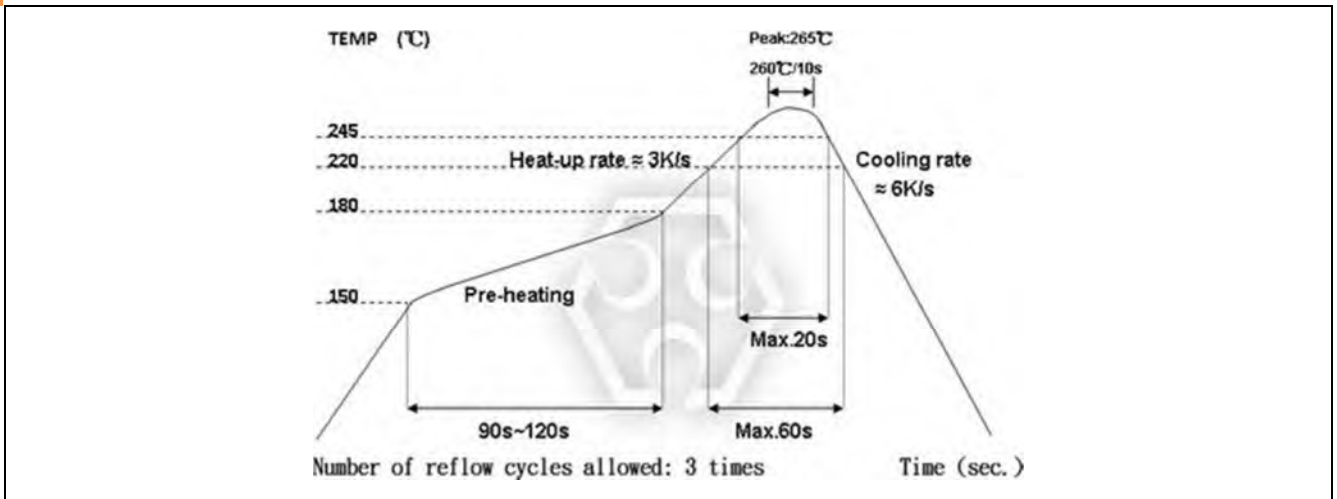


## ▶ Derating & Soldering Condition

### Derating Curve (LRE)



### Soldering Condition (Reflow soldering only) (LRE)



## Environmental Characteristics

### Environmental Characteristics (LRE)

| Item   | Requirement  | Test Method  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|--|--|--|-------------------|----------|----------|---------|-------------|---------|---------|-------------------|---------|---------|------|---------|---------|-------------|---------|---------|------|---------|---------|------------------|---------|---------|------|---------|---------|------|---------|---------|------|---------|---------|------------|---------|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.   | JIS C 5201-1 4.8 +25/+125°C  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| Short Time Overload                            | LRE4527: $\Delta R/R_0 \leq \pm 2.0\%$ The others: $\Delta R/R_0 \leq \pm 0.5\%$ | JIS C 5201-1 4.13 Rating power duration: 5secs.  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | <table border="1"> <thead> <tr> <th>Type</th> <th>Power</th> <th>Multiple</th> </tr> </thead> <tbody> <tr> <td>LRE0805</td> <td>0.75W, 1.0W</td> <td>4 times</td> </tr> <tr> <td>LRE1206</td> <td>0.5W, 0.75W, 1.0W</td> <td>4 times</td> </tr> <tr> <td>LRE1206</td> <td>1.5W</td> <td>3 times</td> </tr> <tr> <td>LRE2010</td> <td>0.75W, 1.0W</td> <td>5 times</td> </tr> <tr> <td>LRE2010</td> <td>1.5W</td> <td>4 times</td> </tr> <tr> <td>LRE2512</td> <td>1.0W, 2.0W, 3.0W</td> <td>5 times</td> </tr> <tr> <td>LRE2725</td> <td>4.0W</td> <td>4 times</td> </tr> <tr> <td>LRE2728</td> <td>4.0W</td> <td>3 times</td> </tr> <tr> <td>LRE2817</td> <td>3.0W</td> <td>4 times</td> </tr> <tr> <td>LRE4527</td> <td>3.0W, 5.0W</td> <td>3 times</td> </tr> </tbody> </table> | Type              | Power    | Multiple | LRE0805 | 0.75W, 1.0W | 4 times | LRE1206 | 0.5W, 0.75W, 1.0W | 4 times | LRE1206 | 1.5W | 3 times | LRE2010 | 0.75W, 1.0W | 5 times | LRE2010 | 1.5W | 4 times | LRE2512 | 1.0W, 2.0W, 3.0W | 5 times | LRE2725 | 4.0W | 4 times | LRE2728 | 4.0W | 3 times | LRE2817 | 3.0W | 4 times | LRE4527 | 3.0W, 5.0W | 3 times |
|  |  | Type   | Power             | Multiple |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE0805  | 0.75W, 1.0W       | 4 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE1206  | 0.5W, 0.75W, 1.0W | 4 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE1206  | 1.5W              | 3 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE2010  | 0.75W, 1.0W       | 5 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE2010  | 1.5W              | 4 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE2512  | 1.0W, 2.0W, 3.0W  | 5 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
|  |  | LRE2725  | 4.0W              | 4 times  |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| LRE2728  | 4.0W   | 3 times  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| LRE2817  | 3.0W   | 4 times  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| LRE4527  | 3.0W, 5.0W   | 3 times  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| Solderability                                  | 95% Min. coverage  | JIS-C5201-1 4.17 245±5°C for 3 seconds   |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| Resistance to Soldering Heat                   | $\Delta R/R_0 \leq \pm 0.5\%$  | JIS-C5201-1 4.18 260±5°C for 10 seconds  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| Temperature Cycling                            | $\Delta R/R_0 \leq \pm 0.5\%$  | JIS-C5201-1 4.19 -55°C ~ 150°C, 100 cycles   |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| Bias Humidity                                  | $\Delta R/R_0 \leq \pm 0.5\%$  | JIS-C5201-1 4.24 +85°C/85%RH for 1,000Hrs. with 1.5Hrs "ON", 0.5Hr "OFF".  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| High Temperature Exposure (Storage)            | LRE4527: $\Delta R/R_0 \leq \pm 2.0\%$ The others: $\Delta R/R_0 \leq \pm 1.0\%$ | JIS-C5201-1 4.23.2 +170°C for 1000 Hrs.  |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |
| Load Life                                      | LRE4527: $\Delta R/R_0 \leq \pm 2.0\%$ The others: $\Delta R/R_0 \leq \pm 1.0\%$ | JIS-C5201-1 4.25 70±2°C, RCWV for 1000 Hrs. with 1.5 Hrs. "ON" and 0.5 Hr. "OFF"   |                   |          |          |         |             |         |         |                   |         |         |      |         |         |             |         |         |      |         |         |                  |         |         |      |         |         |      |         |         |      |         |         |            |         |

## Order Codes

### Order Codes (LRE)

| LRE         | 2728                  | F          | TR                       | D    | 4       | R010        |              |                  |                    |       |         |         |                                      |
|-------------|-----------------------|------------|--------------------------|------|---------|-------------|--------------|------------------|--------------------|-------|---------|---------|--------------------------------------|
| Part Number | Dimensions (L×W) (mm) |            | Resistance Tolerance (%) |      | Package |             | TCR (PPM/°C) | Power Rating (W) | Resistance (Ω) Ex: |       | Marking |         |                                      |
|             | 0805                  | 2.10*1.50  | J                        | ±5   | TR      | Taping Reel | D            | ±50              | U                  | 0.5W  | 0m50    | 0.00050 | *0805<br>Black Coating<br>No Marking |
|             | 1206                  | 3.20*1.65  | G                        | ±2   |         |             | W            | ±75              | Q                  | 0.75W | 0m75    | 0.00075 |                                      |
|             | 2010                  | 5.10*2.40  | F                        | ±1   |         |             | E            | ±100             | T                  | 1W    | 1m50    | 0.00150 |                                      |
|             | 2512                  | 6.35*3.05  | D                        | ±0.5 |         |             | K            | ±150             | A                  | 1.5W  | R002    | 0.00200 |                                      |
|             | 2725                  | 6.80*6.35  |                          |      |         |             | F            | ±200             | S                  | 2W    | R010    | 0.01000 |                                      |
|             | 2728                  | 6.60*6.70  |                          |      |         |             |              |                  | R                  | 3W    | R100    | 0.10000 |                                      |
|             | 2817                  | 7.30*4.40  |                          |      |         |             |              |                  | 4                  | 4W    |         |         |                                      |
|             | 4527                  | 11.30*6.60 |                          |      |         |             |              |                  | 5                  | 5W    |         |         |                                      |

● Note: There is no marking on 0805 series.



# Metal Alloy Zero Ohm Jumper Chips (LRJ)

## ► Product Introduction

### New Performance Requirements for True Metal Alloy Zero Ohm Jumper Chip Resistor in High Power Applications.

#### Features :

- High current application with Low profile.
- Ultra-Low resistance values, 0.2 mΩ Max.
- operating temperature range -55°C ~+150°C.
- Wide range package sizes 1206, 2512, 2817, 2725, and 4527.

#### Applications :

- Electrical tools, Power Management
- NB, Mobil Device, Server, Portable Devices
- Automotive, Industrial, Consumer Electronics, Electric Instrument

A zero ohm resistor is often called SMD jumper resistors, milli-ohm resistor, or zero ohm link resistors which are designed to link to circuits to together just like any other wire.

Token's true metal alloy strip zero ohm resistors (LRJ) make options with a lot less space and cost than DIP switches and jumper headers. These high current metal alloy jumper resistor chips (LRJ) SMT series, designed to replace zero ohm resistors without changing board designs or layouts. The devices could also be applied in high power applications to replace jumper wire for better stability or buried copper coin PCB for cost saving.



Five jumpers for the different resistor chip sizes are provided a wide range of standard dimensions 1206, 2512, 2817, 2725, and 4527 to make ease of designs along with footprint template compatibility. Token (LRJ) SMD metal alloy current jumper resistors designed for applications that require high power handling (Up to 5W) with resistance < 0.2mΩ at operating temperature range -55°C ~+150°C. (LRJ). These new products are distinctively suited as true zero ohm resistor replacements.

Token (LRJ) resistor chip jumpers manufactured from metal alloy plate and designed to deliver a extremely low impedance and profile circuit linkage as a zero ohm resistor. Chip jumpers are packaged on tape and reel for compatibility with most vacuum or mechanical pick and place assembly systems. These (LRJ) SMD devices are also suitable for high current, high-density PCB packages on power and aluminum backplanes.

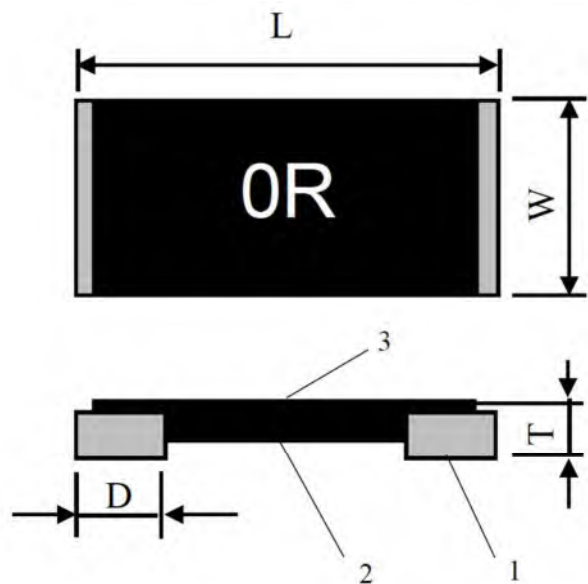
Some circuit boards are designed with multiple functions and configurations in one design. Often these functions and configurations can't coexist in single circuit because they will conflict with each other. To this end, more and more designers use (LRJ) resistor SMD jumpers for single side PCB that has no through-hole but for double-sided PCB. An application is used as a dummy, when through-holes for a not- yet- designed- resistor are prepared by way of precaution, and the holes are short-circuited after all.

Token electronics delivers the right chip for your low range, current-sense applications. For more detailed product information and data sheets or to discuss your specific requirements please contact Token electronics. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)".



## ► Dimensions

### Zero Ohm Resistors (LRJ) Construction & Dimensions

|   |   |                     |
|---|---|---------------------|
|  | 1 | Solder Plating (Sn) |
|   | 2 | Alloy Plate         |
|   | 3 | Overcoat            |

Zero Ohm Jumper link Resistors (LRJ) Construction & Dimensions

| Type    | Power Rating at 70°C(W) | Dimensions (Unit: mm) |             |             |             |
|---------|-------------------------|-----------------------|-------------|-------------|-------------|
|         |                         | L                     | W           | T           | D           |
| LRJ1206 | 1                       | 3.200±0.254           | 1.650±0.254 | 0.670±0.254 | 0.508±0.254 |
| LRJ2512 | 2                       | 6.350±0.254           | 3.050±0.254 | 0.670±0.254 | 1.100±0.254 |
| LRJ2817 | 3                       | 7.100±0.254           | 4.200±0.254 | 0.770±0.254 | 1.500±0.254 |
| LRJ2725 | 4                       | 6.800±0.254           | 6.350±0.254 | 0.770±0.254 | 1.800±0.254 |
| LRJ4527 | 5                       | 11.300±0.500          | 6.600±0.500 | 0.770±0.254 | 2.000±0.254 |

## Electrical Specifications

### Zero Ohm Chip Resistors (LRJ) Electrical Specifications

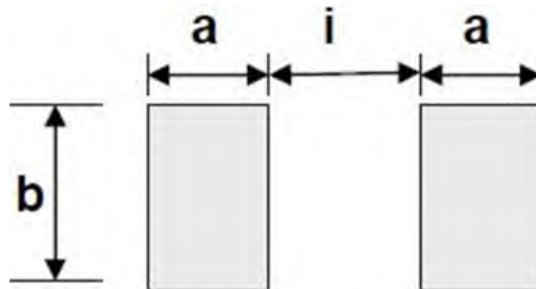
| Type    | Power Rating at 70°C | Max. Rating Current (A)* | Resistance (mΩ) | Operating Temperature °C |
|---------|----------------------|--------------------------|-----------------|--------------------------|
| LRJ1206 | 1                    | 70.7                     | < 0.2           | -55~+150°C               |
| LRJ2512 | 2                    | 100                      | < 0.2           |                          |
| LRJ2817 | 3                    | 122                      | < 0.2           |                          |
| LRJ2725 | 4                    | 140                      | < 0.2           |                          |
| LRJ4527 | 5                    | 158                      | < 0.2           |                          |

● Note: Rating Current  $I = \sqrt{P/R}$  or Max. Rating Current whichever is lower.

Special tolerance and range of resistance are under requested. **Land Pattern**

### Zero Ohm Chips (LRJ) Recommend Land Pattern

| Type    | Maximum Power Rating (Watts) | Dimensions (Unit: mm) |      |      |
|---------|------------------------------|-----------------------|------|------|
|         |                              | a                     | b    | i    |
| LRJ1206 | 1                            | 1.00                  | 1.90 | 1.40 |
| LRJ2512 | 2                            | 2.11                  | 3.68 | 3.18 |
| LRJ2817 | 3                            | 2.45                  | 4.60 | 3.11 |
| LRJ2725 | 4                            | 2.34                  | 6.86 | 3.00 |
| LRJ4527 | 5                            | 3.40                  | 8.74 | 6.43 |

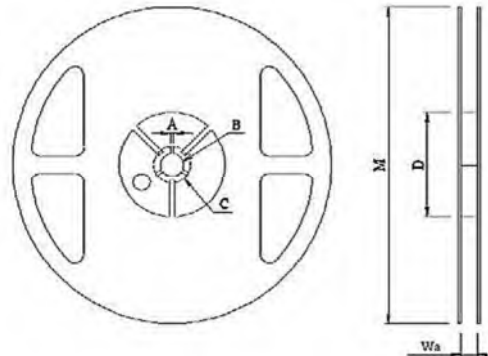


Zero Ohm Chips (LRJ) Recommend Land Pattern

## ▶ Reel & Type

### Reel Specifications (LRJ) (Unit: mm)

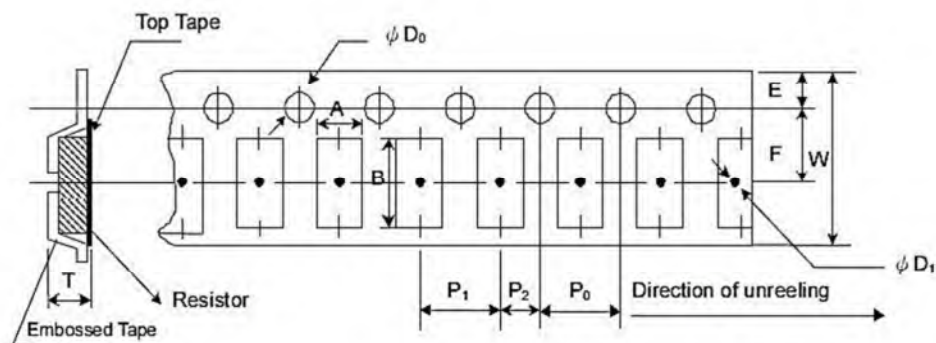
| Reel Type / Tape                                     | W          | M         | A         | B          | C          | D          |
|--|------------|-----------|-----------|------------|------------|------------|
| 7" reel for 8 mm embossed (LRJ1206 series only)      | 12.00± 0.5 | 178 ± 1.0 | 2.0 ± 0.5 | 13.2 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |
| 7" reel for 12 mm embossed LRJ2512, LRJ2725, LRJ2817 | 16.2 ± 0.5 | 178 ± 1.0 | 2.5 ± 0.5 | 13.5 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |
| 7" reel for 24 mm embossed (LRJ4527 series only)     | 24.4 +2/-0 | 178 ± 1.0 | 2.0 ± 0.5 | 13.2 ± 0.5 | 17.7 ± 0.5 | 60.0 ± 0.5 |



Reel Specifications Dimensions

### Emboss Plastic Tape Specifications (LRJ) (Unit: mm)

| Type    | A±0.1 | B±0.1 | W±0.3 | E±0.1 | F±0.1 | P0±0.1 | P1±0.3 | P2±0.1 | ΦD0±0.05 | ΦD1±0.1 | T±0.1 |
|---------|-------|-------|-------|-------|-------|--------|--------|--------|----------|---------|-------|
| LRJ1206 | 2.03  | 3.55  | 8.0   | 1.75  | 3.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.00    | 1.00  |
| LRJ2512 | 3.50  | 6.75  | 12.0  | 1.75  | 5.5   | 4.0    | 4.0    | 2.0    | 1.55     | 1.55    | 0.90  |
| LRJ2725 | 6.81  | 7.16  | 12.0  | 1.75  | 5.5   | 4.0    | 8.0    | 2.0    | 1.55     | 1.55    | 1.05  |
| LRJ2817 | 4.60  | 7.50  | 12.0  | 1.75  | 5.5   | 4.0    | 8.0    | 2.0    | 1.55     | 1.55    | 1.20  |
| LRJ4527 | 7.38  | 12.0  | 24.0  | 1.75  | 11.5  | 4.0    | 12.0   | 2.0    | 1.55     | 1.55    | 1.05  |



Emboss Plastic Tape Specifications (Unit: mm)

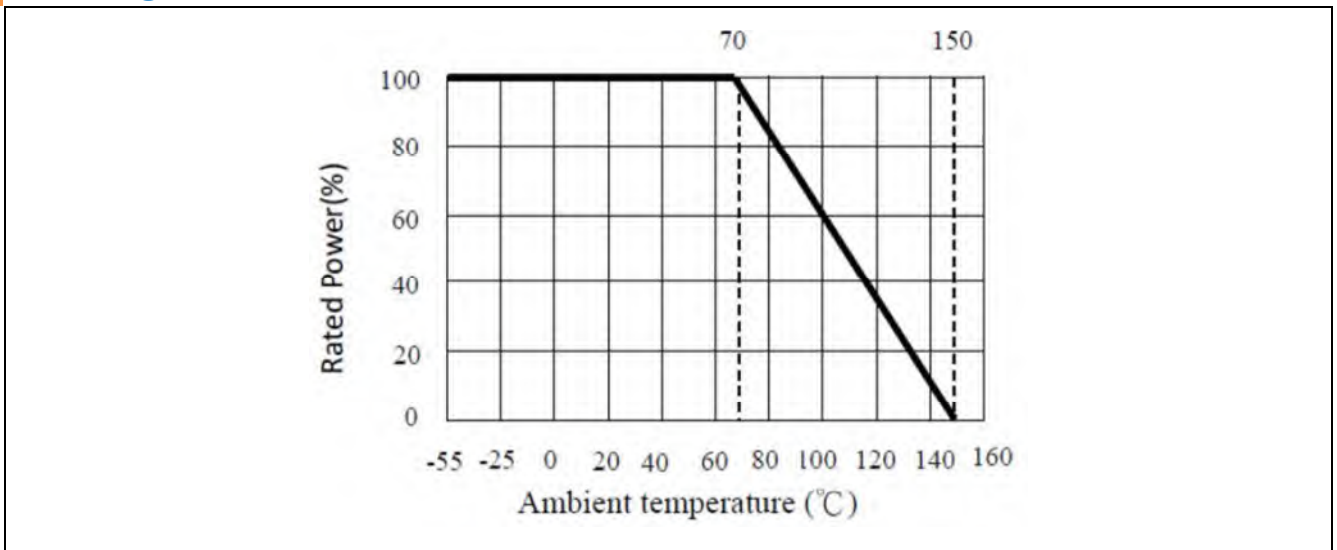
- The cumulative tolerance of 10 sprockets hole pitch is ± 0.2mm.
- Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
- A & B measured 0.3mm from the bottom of the packet
- T measured at a point on the inside bottom of the packet to the top surface of the carrier.
- Pocket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

## Packaging Quantity (LRJ)

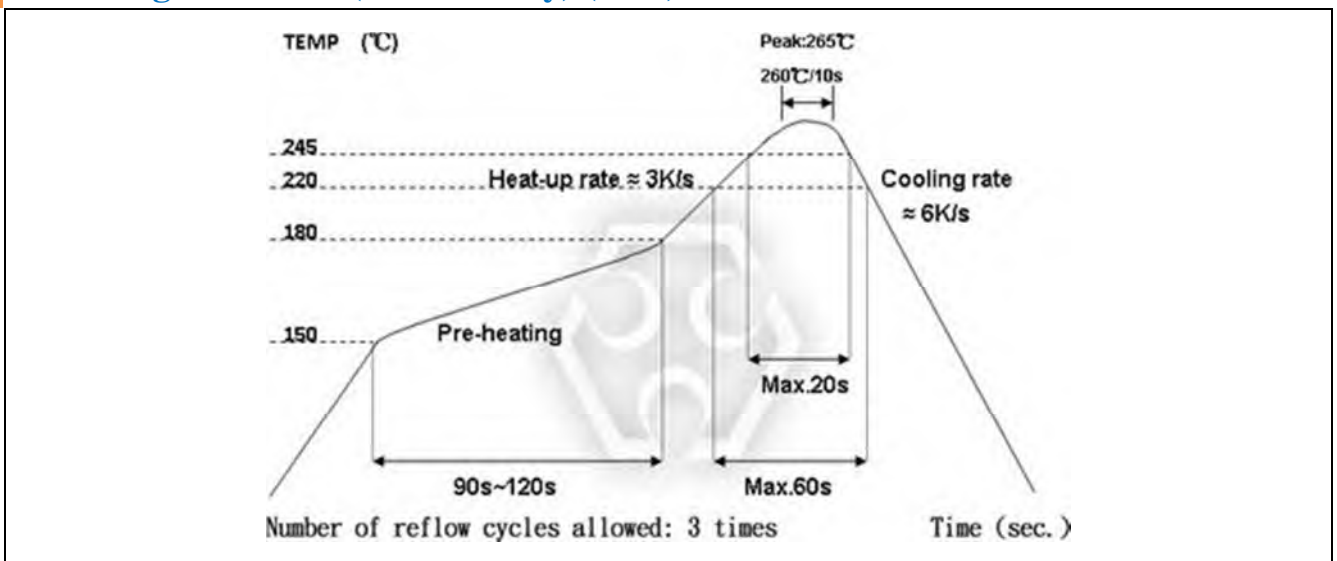
| Type    | Tape Width             | Diameter  | Piece/Reel |
|---------|------------------------|-----------|------------|
| LRJ1206 | 8 mm/embossed plastic  | 178 mm/7" | 5,000      |
| LRJ2512 | 12 mm/embossed plastic | 178 mm/7" | 4,000      |
| LRJ2725 | 12 mm/embossed plastic | 178 mm/7" | 2,000      |
| LRJ2817 | 12 mm/embossed plastic | 178 mm/7" | 1,000      |
| LRJ4527 | 24 mm/embossed plastic | 178 mm/7" | 1,000      |

## Derating & Soldering Condition

### Derating Curve (LRJ)



### Soldering Condition (Reflow Only) (LRJ)





## Environmental Characteristics

### Environmental Characteristics (LRJ)

| Item                                | Requirement                | Test Method  |
|-------------------------------------|----------------------------|--|
| Short Time Overload                 | $\leq 0.2 \text{ m}\Omega$ | JIS C 5201-1 4.13<br>4 times rated power duration: 5secs.  |
| Load Life                           | $\leq 0.2 \text{ m}\Omega$ | JIS-C5201-1 4.25<br>70 $\pm$ 2 $^{\circ}$ C, RCWV for 1000 Hrs. with 1.5 Hrs. "ON" and 0.5 Hr. "OFF" |
| Bias Humidity                       | $\leq 0.2 \text{ m}\Omega$ | JIS-C5201-1 4.24<br>+85 $^{\circ}$ C /85%RH for 1,000Hrs. with 1.5Hrs "ON", 0.5Hr "OFF".             |
| High Temperature Exposure (Storage) | $\leq 0.2 \text{ m}\Omega$ | JIS-C5201-1 4.23.2<br>+150 $^{\circ}$ C for 1000 Hrs.  |
| Solderability                       | 95% Min. coverage          | JIS-C5201-1 4.17<br>245 $\pm$ 5 $^{\circ}$ C for 3 seconds   |
| Temperature Cycling                 | $\leq 0.2 \text{ m}\Omega$ | JIS-C5201-1 4.19<br>-55 $^{\circ}$ C ~ 150 $^{\circ}$ C, 100 cycles                                  |

## Order Codes

### Order Codes (LREA)

| LRJ         | 1206  | TR               | T  | R000                           |
|-------------|---|------------------|--|--------------------------------|
| Part Number | Dimensions (LxW)(mm)  | Package          | Power Rating (W)                               | Resistance ( $\Omega$ )<br>Ex: |
| LRJ         |   | TR   Taping Reel | T   1W<br>S   5W<br>R   3W<br>4   4W<br>5   5W | R000   < 0.20m $\Omega$        |
|             | 1206   3.20*1.65<br>2512   6.35*3.05<br>2817   7.10*4.20<br>2725   6.80*6.35<br>4527   11.30*6.60 |                  |  |                                |

# Electron Beam Welding Shunts (FLW)

## ► Product Introduction

**Electron Beam Welded Shunts (FLW) serves precision measurement and battery applications in a new age.**

### Features :

- High precision, Low TCR (Temperature Coefficient of Resistance Value).
- Low resistance, low inductance, Low watt loss, and Long-term stability.
- High power electron beam welding technology

### Applications :

- Electric power distribution, battery management frequency convertors, load test.
- Applied for current limiting, current balance or sampling test of power supply.
- Applied for functional low inductance power supply applications.

Increasing pressure from the international produce higher-quality competition at lower prices In a shorter period of time resulting in the use of specialized process, whenever possible to detect an advantage. Adapting this philosophy to electron beam welding (EBW), Token Electronics announced the release of a new and enhanced bus bar shunt of blade terminal in (FLW) series producing by the new generation of load-lock machines fulfilling all these requirements in the area of EB welding.

This is a new Bus-Bar Battery Shunt resistor that has rated voltage drop 75 mV capability with 1.5 mΩ to 0.075 mΩ. Specifically, it is possible to output 75 mV from the voltage terminal with a current from 50 A to 1000 A with precision  $\pm 0.5\%$  and  $\pm 1\%$  tolerance in option.

(FLW) large current shunt resistor is using complete electron beam welding technology, ease assembly, mechanically strong, vibration resistance, and reliable operation in long term. Featuring low inductance values, shunts (FLW) is suitable for energy meters Invertors, AC/DC convertors, UPS, battery management, frequency convertors, and power modules low inductance applications.

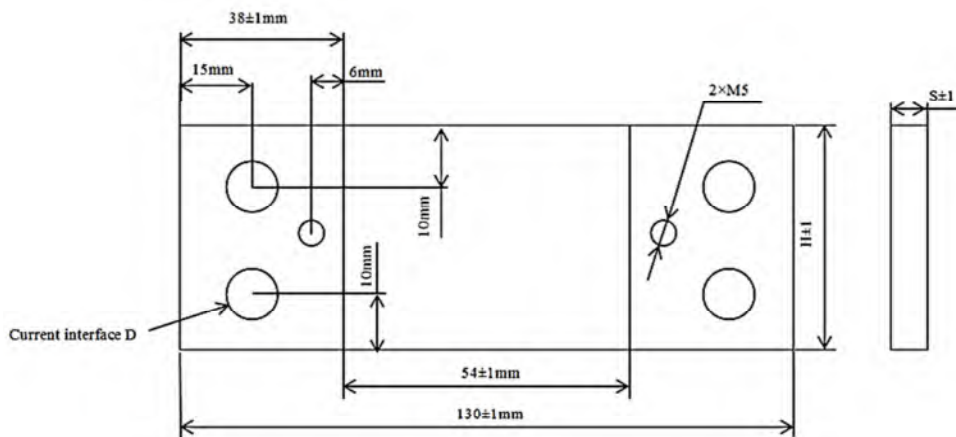
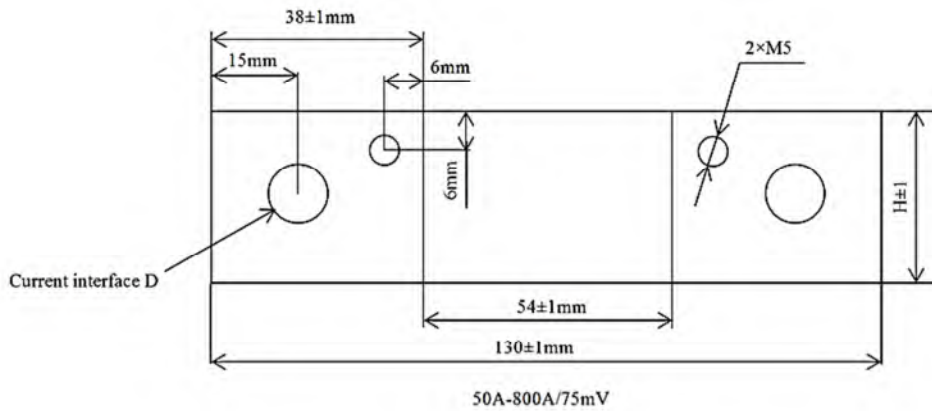
The shape and size of these (FLW) series can be customised and is available in bulk packaging with RoHS compliant and lead free. Token engineers will work together with the client to create designs and develop products to meet their specific needs. For non-standard technical requirements and special applications, contact us with your specific needs., or link to Token official website "[Current Sensing Resistors](http://www.token.com.tw)" for more information.



## Dimensions & Electrical Specifications

### Dimensions (Unit: mm) & Electrical Specifications

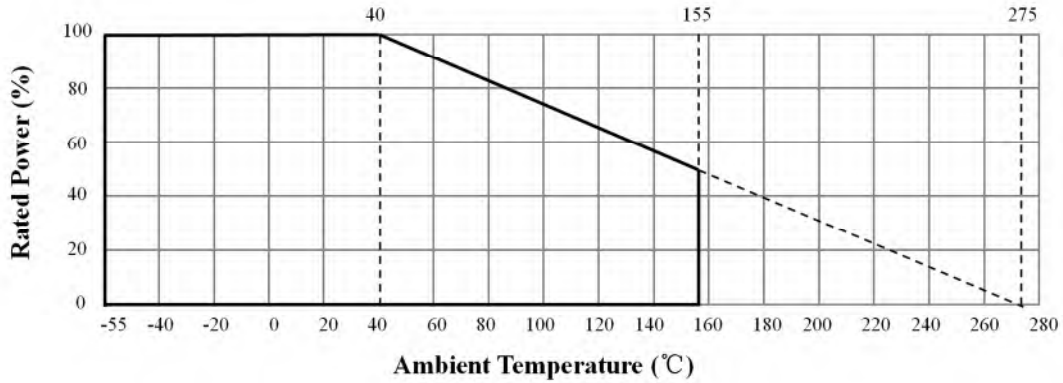
| Type | Rated Current (A) | Normal Resistance (mΩ) | Rated Voltage Drop (mV) | Tolerance Range (%) | T.C.R. (X10 <sup>-6</sup> ) | Dimensions (mm) |      |         |
|------|-------------------|------------------------|-------------------------|---------------------|-----------------------------|-----------------|------|---------|
|      |                   |                        |                         |                     |                             | S               | H    | ΦD      |
| FLW  | 50                | 1.5                    | 75                      | ± 0.5(D)<br>± 1(F)  | ± 20<br>± 50                | 1.5             | 9    | Φ6.5x2  |
|      | 100               | 0.75                   |                         |                     |                             | 2.0             | 16.5 |         |
|      | 150               | 0.5                    |                         |                     |                             | 2.5             | 20   |         |
|      | 200               | 0.375                  |                         |                     |                             | 2.5             | 26   | Φ8.5x2  |
|      | 300               | 0.25                   |                         |                     |                             | 3.2             | 30   |         |
|      | 400               | 0.1875                 |                         |                     |                             | 4.0             | 33   |         |
|      | 500               | 0.15                   |                         |                     |                             | 5.0             | 33   | Φ10.5x2 |
|      | 600               | 0.125                  |                         |                     |                             | 6.0             | 33   |         |
|      | 700               | 0.1014                 |                         |                     |                             | 6.0             | 40   |         |
|      | 800               | 0.0938                 |                         |                     |                             | 6.5             | 40   | Φ10.5x4 |
|      | 900               | 0.0833                 |                         |                     |                             | 6.5             | 45   |         |
|      | 1000              | 0.075                  |                         |                     |                             | 6.5             | 50   |         |



Electron Beam Welding Precision Shunt Dimensions (Unit: mm)

## Derating Curve

### Derating Curve (FLW)



## Environmental Characs.

### Characteristic Specification (FLW)

| Test Items                     | Specifications             | Test Conditions                         |
|--------------------------------|----------------------------|---|
| Short time overload            | $\leq \pm(1\%+0.05\Omega)$ | 10P <sub>R</sub> 、5S                    |
| Shock                          | $\leq \pm(1\%+0.05\Omega)$ | 1000m/S <sup>2</sup> 、6mS               |
| Vibration                      | $\leq \pm(1\%+0.05\Omega)$ | 10-1000Hz、0.75mm、98m/S <sup>2</sup>     |
| Durability at room temperature | $\leq \pm(2\%+0.05\Omega)$ | 25 <sup>°C</sup> 、P <sub>R</sub> 、1000h |

## Order Codes

### Order Codes (FL)

| FLW         | - | 50A                | 75mV              | F                  | p            |
|-------------|---|--------------------|-------------------|--------------------|--------------|
| Part Number |   | Rating Current (A) | Voltage Drop (mV) | Accuracy Class (%) | Package-Code |
| FLW         |   | 50A   50A          | 75mV   75 mV      | F   ±1%            | P   Bulk     |
|             |   | 100A   100A        |                   | D   ±0.5%          |              |
|             |   | 700A   700 A       |                   |                    |              |
|             |   | 1000A   1000 A     |                   |                    |              |

# High Power Chip Current Sensing Resistor Shunts (LRS)

## ▶ Product Introduction

The advanced alloy shunt technology of TOKEN (LRS) spells out the high-power current sensing resistor.

### Features :

- Resistance down to 0.1mΩ to 6mΩ.
- TCR down to  $\pm 20\text{ppm}/^\circ\text{C}$  and  $\pm 50\text{ppm}/^\circ\text{C}$ .
- Sustain high temperature, lead-free and RoHS compliant.
- Welded construction, air cooling, Strong stability of circuit.
- Tolerance  $\pm 1\%$ ,  $\pm 2\%$ , and  $\pm 5\%$ . Rated Power 3W, 5W, 6W, and 7W.

### Applications :

- Frequency converters.
- Automatic control power supply.
- Power modules. Communication system.
- Current sensor for power hybrid applications.
- High current applications for the automotive market.

Design of Bare Open Surface Mounting Chip Alloy allows air flow to achieve maximum cooling effect, so that PCB retains less heat. Welding flame protection structure feature provides 20ppm TCR temperature coefficient, low inductance. These characteristics make LRS an excellent choice for all high-power power supply and power applications that are not impacted by most environmental stresses.

For the development of high current applications for automated control and sensing power supplies, the TOKEN current sensing chip shunt (LRS) uses Manganese Copper (Manganin), Kama Alloy (KAMAR NiCr20AlSi), and Ferro Chrome Aluminum Alloy (FeCrAl) which featuring antioxidant and high temperature resistant thermal corrosion properties as alloy welding structure. Standard surface mounting spacing design is suitable for reflow welding and automatic mounting machine applications.

Designed specifically for high current applications LRS, the power can reach 3W, 5W, 6W, and 7W. The range of ultra-low resistance is from 0.1mΩ to 6mΩ. There are many options in selecting precision tolerances ( $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$ ). Two types of chip dimensions are available: standard size 2512, 3920, and 5930; special size 3921, 4026, 4527, and 5931. TOKEN realizes small size, high power design, lower cost and higher performance current sensing shunts.

LRS provides embossed tape packaging, size 2512 1Kpcs per reel, 3920 2.5Kpcs per reel, 5930 2Kpcs per reel, products meet RoHS standards and lead-free requirements. Customers can specify resistance, size and specifications to meet the design challenges and specific technical requirements. Please contact TOKEN Business Department for the latest product information. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.

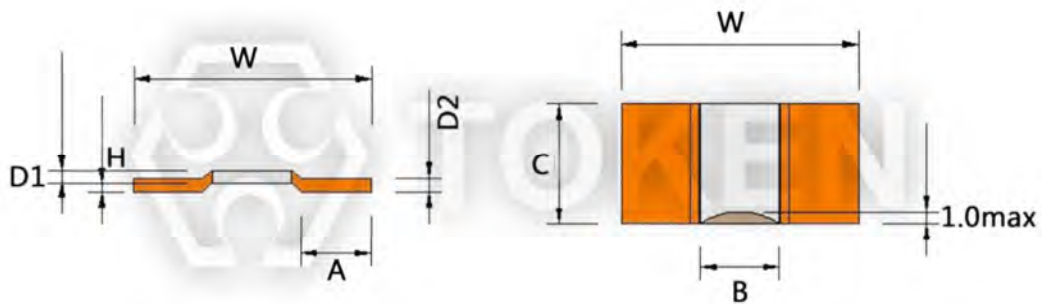




## LRS - M/K Dim.

### LRS - M/K Standard Size (Unit : mm)

| Type | Power (W) | Material | Size | B (mm)  | W (mm)  | A (mm)  | C (mm)  | H (mm)  | D1 (mm) | D2 (mm) | Resistance Value (mΩ) |
|------|-----------|----------|------|---------|---------|---------|---------|---------|---------|---------|-----------------------|
| LRS  | 3         | M        | 2512 | 3.0±0.3 | 6.3±0.2 | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 1.5     | 1.5     | 0.3                   |
|      |           |          |      |         |         |         |         |         | 0.88    | 0.88    | 0.5                   |
|      |           |          |      |         |         |         |         |         | 0.5     | 0.5     | 1                     |
|      |           | K        |      |         |         |         |         |         | 1.31    | 1.31    | 1                     |
|      |           |          |      |         |         |         |         |         | 0.65    | 0.65    | 2                     |
|      |           |          |      |         |         |         |         |         | 0.43    | 0.43    | 3                     |
|      | 5         | M        | 3920 | 4.5±0.3 | 10±0.2  | 2.2±0.2 | 5.1±0.4 | 0.5±0.1 | 1.5     | 1.5     | 0.2                   |
|      |           |          |      |         |         |         |         |         | 1.37    | 1.37    | 0.3                   |
|      |           |          |      |         |         |         |         |         | 0.83    | 0.83    | 0.5                   |
|      |           | K        |      |         |         |         |         |         | 0.4     | 0.4     | 1                     |
|      |           |          |      |         |         |         |         |         | 1.16    | 1.16    | 1                     |
|      |           |          |      |         |         |         |         |         | 0.37    | 0.37    | 3                     |
|      | 7         | M        | 5930 | 5.0±0.3 | 15±0.3  | 4.2±0.3 | 7.6±0.4 | 0.5±0.1 | 1.5     | 1.5     | 0.2                   |
|      |           |          |      |         |         |         |         |         | 0.75    | 0.75    | 0.4                   |
|      |           |          |      |         |         |         |         |         | 0.6     | 0.6     | 0.5                   |
|      |           | K        |      |         |         |         |         |         | 0.41    | 0.41    | 0.75                  |
|      |           |          |      |         |         |         |         |         | 0.86    | 0.86    | 1                     |
|      |           |          |      |         |         |         |         |         | 0.4     | 0.4     | 2                     |
|      |           |          |      |         |         |         |         | 0.29    | 0.29    | 3       |                       |



Alloy Shunt Resistors (LRS) - M/K Series Dimensions

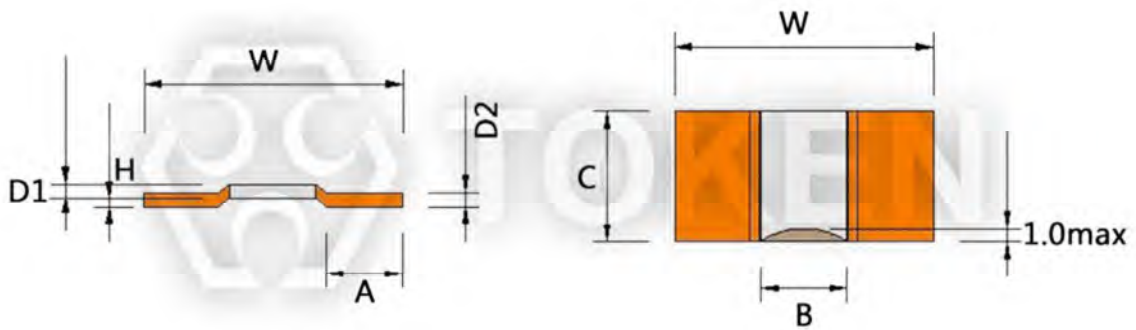
### LRS - M/K Special Size (Unit : mm)

| Type | Power (W) | Material | Size | B (mm)  | W (mm)   | A (mm)  | C (mm)  | H (mm)  | Resistance Value (mΩ) |
|------|-----------|----------|------|---------|----------|---------|---------|---------|-----------------------|
| LRS  | 5         | M        | 3921 | 4.5±0.3 | 10±0.2   | 2.2±0.2 | 5.2±0.3 | 0.5±0.1 | 0.2 ~ 5               |
|      | 5         | K        | 3921 | 4.5±0.3 | 10±0.2   | 2.2±0.2 | 5.2±0.3 | 0.5±0.1 | 0.2 ~ 5               |
|      | 6         | M        | 4026 | 4.5±0.3 | 10±0.2   | 2.2±0.2 | 6.6±0.4 | 0.5±0.1 | 0.2 ~ 3               |
|      | 6         | K        | 4026 | 4.5±0.3 | 10±0.2   | 2.2±0.2 | 6.6±0.4 | 0.5±0.1 | 0.2 ~ 3               |
|      | 6         | M        | 4527 | 4.5±0.3 | 11.5±0.2 | 3.0±0.3 | 6.9±0.4 | 0.5±0.1 | 0.4 ~ 3               |
|      | 6         | K        | 4527 | 4.5±0.3 | 11.5±0.2 | 3.0±0.3 | 6.9±0.4 | 0.5±0.1 | 0.4 ~ 3               |
|      | 7         | M        | 5931 | 5.0±0.3 | 15±0.3   | 4.2±0.3 | 7.8±0.4 | 0.5±0.1 | 0.1 ~ 0.75            |
|      | 7         | K        | 5931 | 5.0±0.3 | 15±0.3   | 4.2±0.3 | 7.8±0.4 | 0.5±0.1 | 1 ~ 3                 |

## ► LRS - F Dim.

### LRS - F Dimensions (Unit : mm)

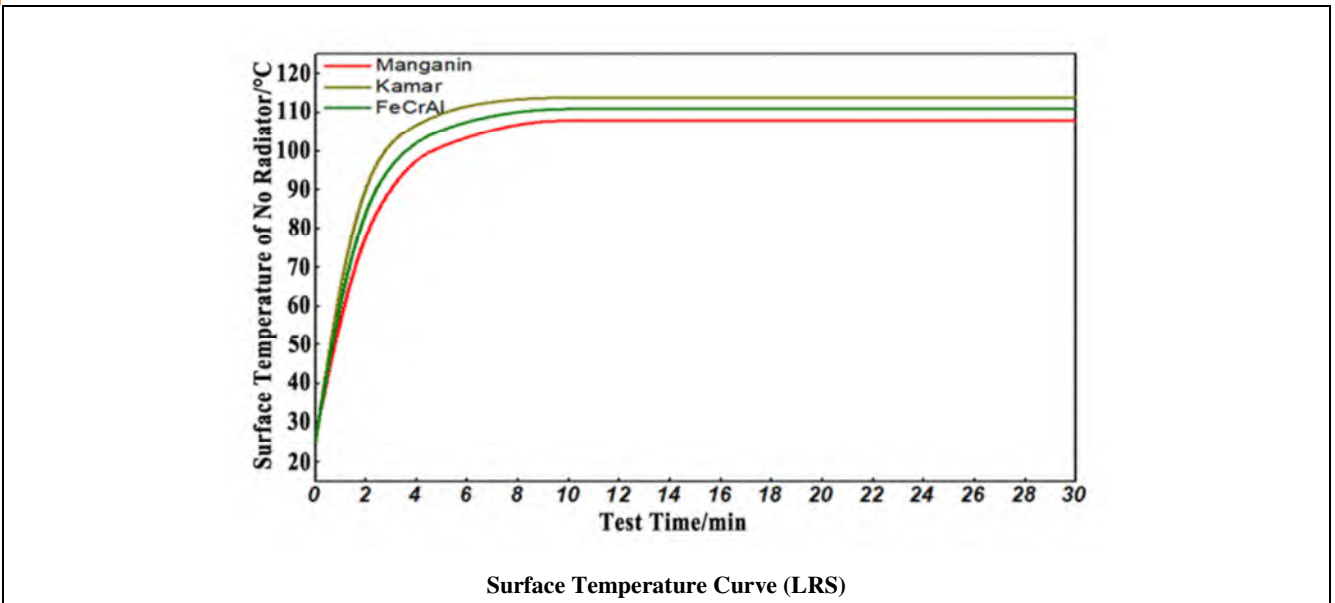
| Type | Power (W) | Material | Size | B (mm)  | W (mm)   | A (mm)  | C (mm)  | H (mm)  | D1 (mm) | D2 (mm) | Resistance Value (mΩ) |
|------|-----------|----------|------|---------|----------|---------|---------|---------|---------|---------|-----------------------|
| LRS  | 3         | F        | 2512 | 3.0±0.3 | 6.3±0.2  | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 1.4     | 1.4     | 1                     |
|      |           |          |      | 3.0±0.3 | 6.3±0.2  | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 0.7     | 0.7     | 2                     |
|      |           |          |      | 3.0±0.3 | 6.3±0.2  | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 3       | 0.47    | 0.47                  |
|      |           |          |      | 3.0±0.3 | 6.3±0.2  | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 0.35    | 0.35    | 4                     |
|      |           |          |      | 3.0±0.3 | 6.3±0.2  | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 0.28    | 0.28    | 5                     |
|      |           |          |      | 3.0±0.3 | 6.3±0.2  | 1.2±0.2 | 3.1±0.3 | 0.5±0.1 | 0.24    | 0.24    | 6                     |
|      | 5         | F        | 3920 | 4.5±0.3 | 10.0±0.2 | 2.2±0.2 | 5.1±0.4 | 0.5±0.1 | 1.28    | 1.28    | 1                     |
|      |           |          |      | 4.5±0.3 | 10.0±0.2 | 2.2±0.2 | 5.1±0.4 | 0.5±0.1 | 0.64    | 0.64    | 2                     |
|      |           |          |      | 4.5±0.3 | 10.0±0.2 | 2.2±0.2 | 5.1±0.4 | 0.5±0.1 | 0.43    | 0.43    | 3                     |
|      |           |          |      | 4.5±0.3 | 10.0±0.2 | 2.2±0.2 | 5.1±0.4 | 0.5±0.1 | 0.32    | 0.32    | 4                     |
|      |           |          |      | 4.5±0.3 | 10.0±0.2 | 2.2±0.2 | 5.1±0.4 | 0.5±0.1 | 0.26    | 0.26    | 5                     |
|      | 7         | F        | 5930 | 5.0±0.3 | 15±0.3   | 4.2±0.3 | 7.6±0.4 | 0.5±0.1 | 0.96    | 0.96    | 1                     |
|      |           |          |      | 5.0±0.3 | 15±0.3   | 4.2±0.3 | 7.6±0.4 | 0.5±0.1 | 0.48    | 0.48    | 2                     |
|      |           |          |      | 5.0±0.3 | 15±0.3   | 4.2±0.3 | 7.6±0.4 | 0.5±0.1 | 0.32    | 0.32    | 3                     |
|      |           |          |      | 5.0±0.3 | 15±0.3   | 4.2±0.3 | 7.6±0.4 | 0.5±0.1 | 0.24    | 0.24    | 4                     |



Current Sensing Power Shunts (LRS) - F Series Dimensions

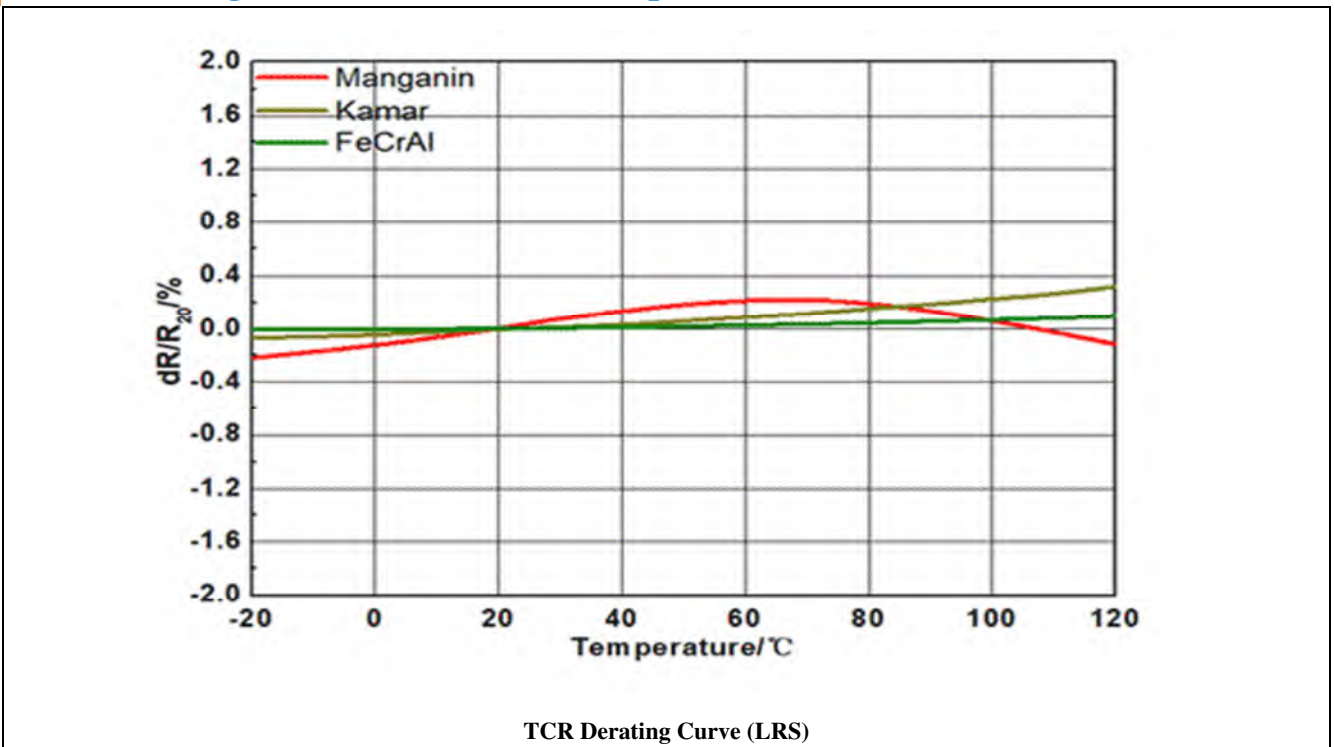
## ► Technical Specifications

### Surface Temperature Curve LRS - Technical Specifications



● Note : The surface temperature test board is made of aluminium substrate.

### TCR Derating Curve LRS - Technical Specifications



● Note : The surface temperature test board is made of aluminium substrate.

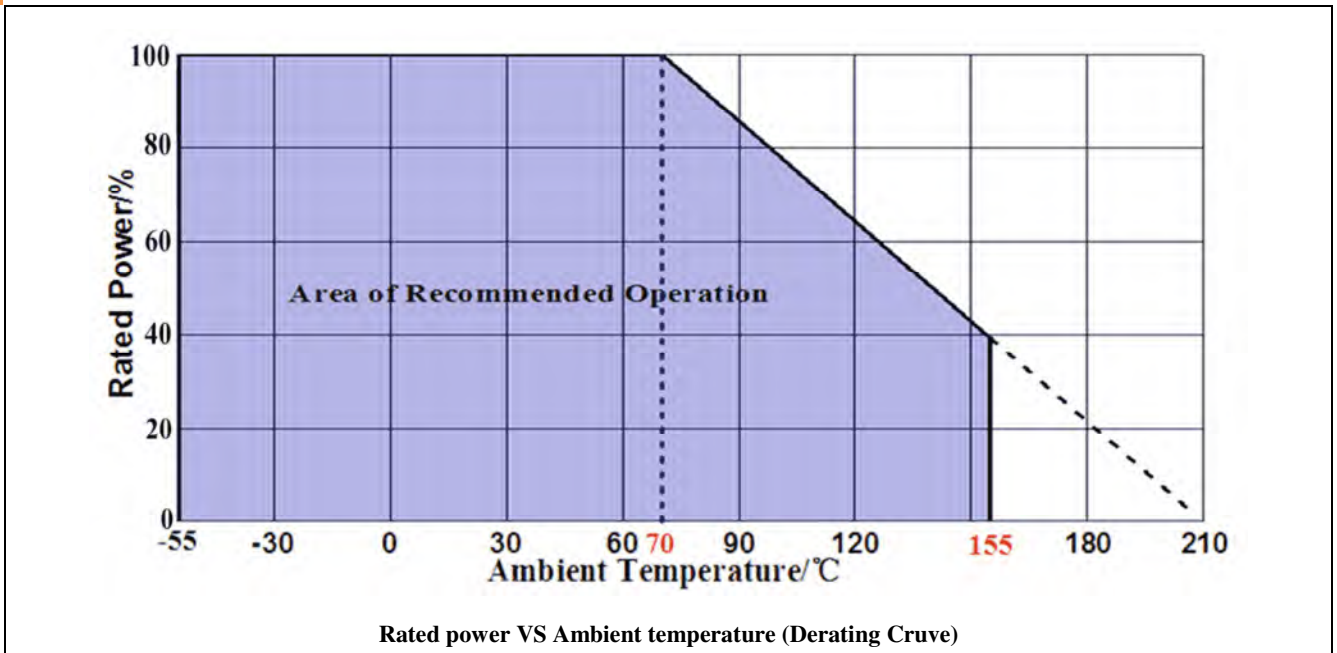
## ► Environmental Characteristics

### LRS - Environmental Characteristics

| Items                        | Requirement              | Test Methods   |
|------------------------------|--------------------------|--|
| Temperature Cycling          | ±0.5%                    | JESD22<br>1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test conclusion.  |
| High Temperature Exposure    | ±0.5%                    | MIL-STD-202<br>1000hrs. @T=125°C. Unpowered. Measurement at 24±2 hours after test conclusion.  |
| Moisture Resistance          | ±0.5%                    | MIL-STD-202<br>t=24 hrs/cycle. Measurement at 24±2 hours after test conclusion.<br>Note: Steps 7a & 7b not required. Unpowered.  |
| Biased Humidity              | ±0.5%                    | MIL-STD-202<br>1000hrs 85°C/85% RH. Measurement at 24±2 hours after test conclusion.<br>Note: Specified conditions: 10% of operating power.  |
| Operational Life             | ±0.5%                    | MIL-STD-202<br>Condition D Steady State TA=125°C at rated power. Measurement at 24±2 hours after test conclusion.  |
| Solderability                | 95% Coverage<br>Minimum. | J-STD-002C<br>245°C±5°C, 5s+0.5s/-0.   |
| Resistance to Soldering Heat | ±0.5%                    | MIL-STD-202<br>260°C±5°C, 10s±1s. Measurement at 24±2 hours after test conclusion.   |
| Short Time Overload          | ±0.5%                    | MIL-STD-202<br>5 × Rated power for 5s. Measurement at 24±2 hours after test conclusion.  |
| Thermal Shock                | ±1%                      | MIL-STD-202<br>-55°C/+125°C, 300 Cycles. Maximum transfer time 20s, Dwell time 15Min..   |
| Vibration                    | ±0.5%                    | MIL-STD-202<br>5g's for 20 Min., 12 cycles each of 3 orientations.<br>Note: Use 8"X5" PCB .031" thick 7" secure points on one long side and secure points at corners of opposite sides which parts mounted with in 2 from any secure point. Test from 10-2000 Hz. Measurement at 24±2 hours after test conclusion. |

## ▶ Derating Curve

### Power Derating Curve (LRS)

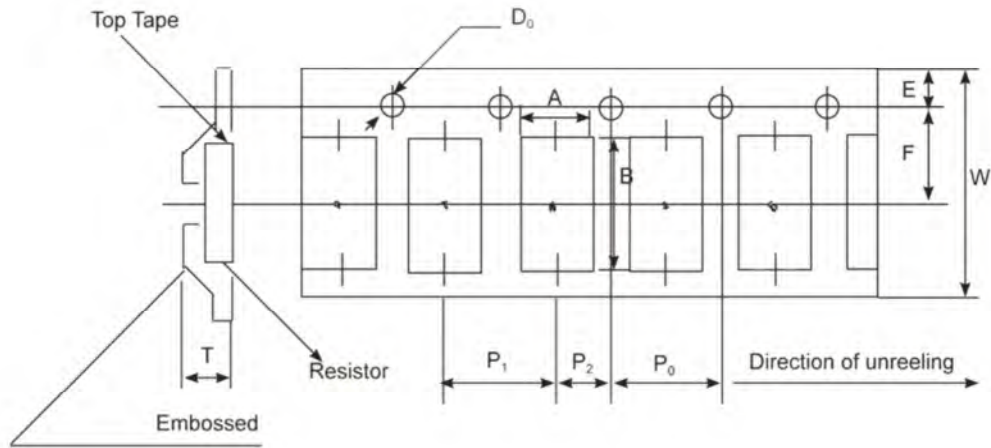




## ► Packaging

### LRS - Packaging

| Size | A (mm) | B (mm) | W (mm) | E (mm) | F (mm) | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | D <sub>0</sub> (mm) | T (mm) | Quantity (EA)/ Pieces |
|------|--------|--------|--------|--------|--------|---------------------|---------------------|---------------------|---------------------|--------|-----------------------|
| 2512 | 4.3    | 7.6    | 16     | 1.55   | 7.5    | 3.85                | 7.7                 | 7.7                 | 1.5                 | 1.7    | 1000                  |
| 3920 | 6.0    | 11     | 24     | 1.55   | 11.2   | 6                   | 12                  | 12                  | 1.5                 | 2.0    | 2500                  |
| 5930 | 8.6    | 16     | 24     | 1.55   | 10.8   | 6                   | 12                  | 12                  | 1.5                 | 2.4    | 2000                  |



LRS - Embossed Plastic Tape Specifications

## Order Codes

### Large Current Sensing Chip Resistor Shunts LRS - Order Code

| LRS         | 3         |    | M        |          | 0m30                    |                 | J             |         |
|-------------|-----------|----|----------|----------|-------------------------|-----------------|---------------|---------|
| Part Number | Power (W) |    | Material |          | Resistance ( $\Omega$ ) |                 | Tolerance (%) |         |
| LRS         | 3         | 3W | F        | FeCrAl   | 0m10                    | 0.0001 $\Omega$ | J             | $\pm 5$ |
|             | 5         | 5W | M        | Manganin | 0m30                    | 0.0003 $\Omega$ | G             | $\pm 2$ |
|             | 7         | 7W | K        | Kamar    | R001                    | 0.001 $\Omega$  | F             | $\pm 1$ |
|             |           |    |          |          | R004                    | 0.004 $\Omega$  |               |         |
|             |           |    |          |          | R005                    | 0.005 $\Omega$  |               |         |

# Alloy Sampling Shunt Current Sensing Resistors (FLU)

## ► Product Introduction

"Stamping type" (FLU) precision sampling resistor provides up to 7W power and a TCR as low as 40ppm.

### Features :

- Tolerance  $\pm 1\%$ ,  $\pm 2\%$  and  $\pm 5\%$ .
- Low resistance 0.1m $\Omega$  to 10m $\Omega$ .
- Rated Power 1W ~ 7W with low inductance.
- Sustain high temperature.

### Applications :

- Power Electronic.Home Appliance.
- Current Sensing.Communication System.
- Automotive electronics.Drive technology.

Achieving the best detection results in the smallest space is one of the most common requirements of electronic design engineers for circuit systems. This is the advantage of the Token Electronics' stamping sampling shunt resistor technology.

Stamping type shunt resistor is also known as current detection alloy resistor, current sensing resistor, sampling shunts, current induction shunts.

The sampling resistance is divided into current sampling and voltage sampling. For current sampling, a resistor with smaller resistance value is connected in series, while for voltage sampling, a resistor with larger resistance value is connected in parallel. The function of sampling resistance is to convert current into voltage signal for current measurement. In the actual circuit, it is connected in series with the load resistor.

Designated the (FLU) through-hole devices offer a high current, flameproof alternative to conventional axial devices and flat chips for current-sense circuits where PC board space is at a premium. The open air resistor's footprint is reduced by extending the height of the device above the board, thus keeping the resistor element's "hot spot" safely off the PC board and providing for increased air circulation under it, which in turn provides increased heat dissipation and cooler operation. The structure adopts advanced alloy stamping and features high temperature resistance with low inductance.

The (FLU) offers a higher current load than conventional axial resistors and SMD resistors, with a wide range pitch of radial pins to choose from. Its rated power can be up to 1W ~7W, temperature coefficient as low as  $\pm 40\text{ppm}/^\circ\text{C}$ , resistance tolerance accuracy  $\pm 1\%$ ,  $\pm 2\%$ , and  $\pm 5\%$ , resistance range as low as 0.1m $\Omega$  to 10m $\Omega$ .

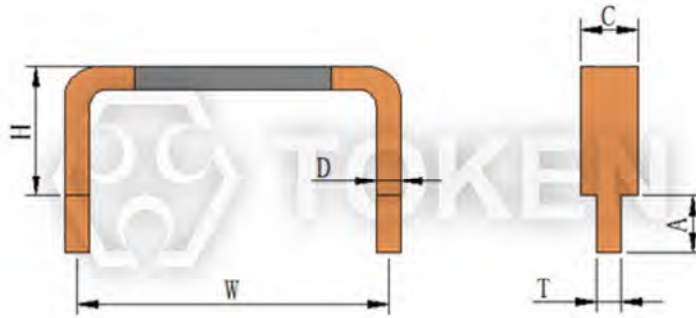
The Low Ohmic Alloy Shunts (FLU) are available in bulk packaging and is RoHS compliant and lead free. For non-standard technical requirements and special applications, contact us with your specific needs.Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## Dimensions

### Dimensions - FLU (Unit : mm)

| Resistance (mΩ) | W (mm) | C (mm) | D (mm) | H (mm) | A (mm) | T (mm)             |
|-----------------|--------|--------|--------|--------|--------|--------------------|
| 0.1~10          | 5~30   | 10~35  | 0.3~3  | 5~30   | 4±0.2  | 1.0±0.2<br>1.5±0.2 |

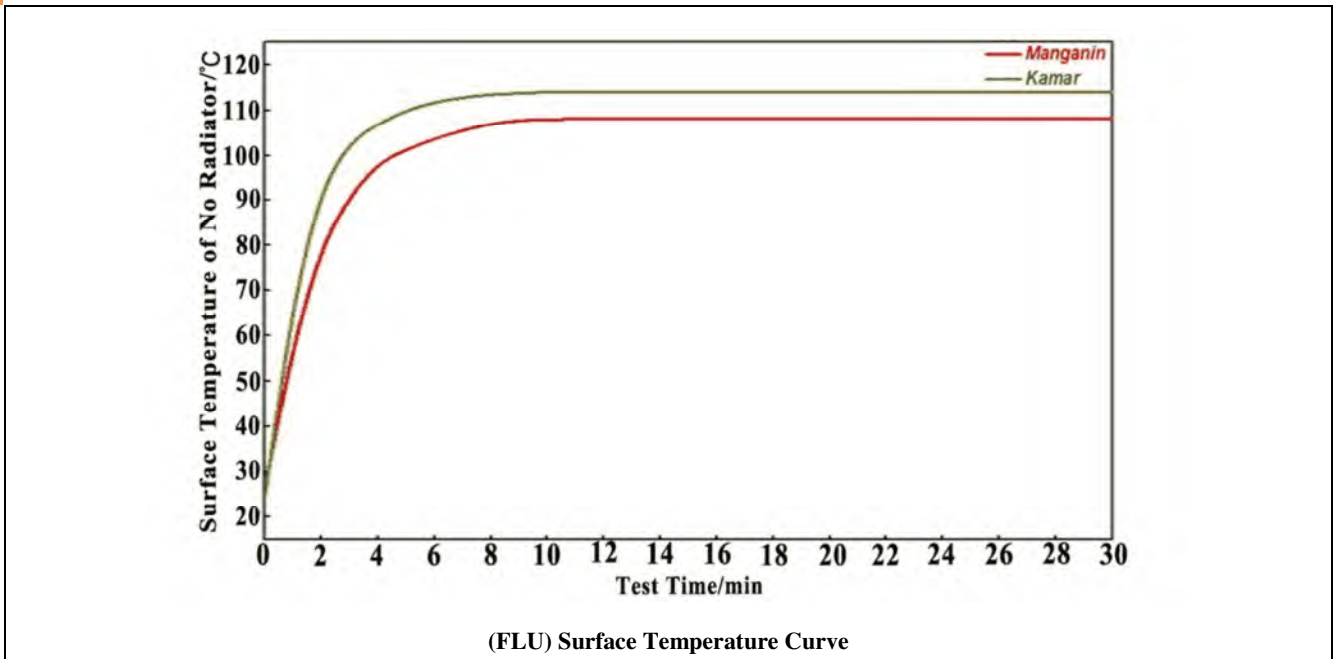


Alloy Current Sensing Resistors (FLU) Dimensions

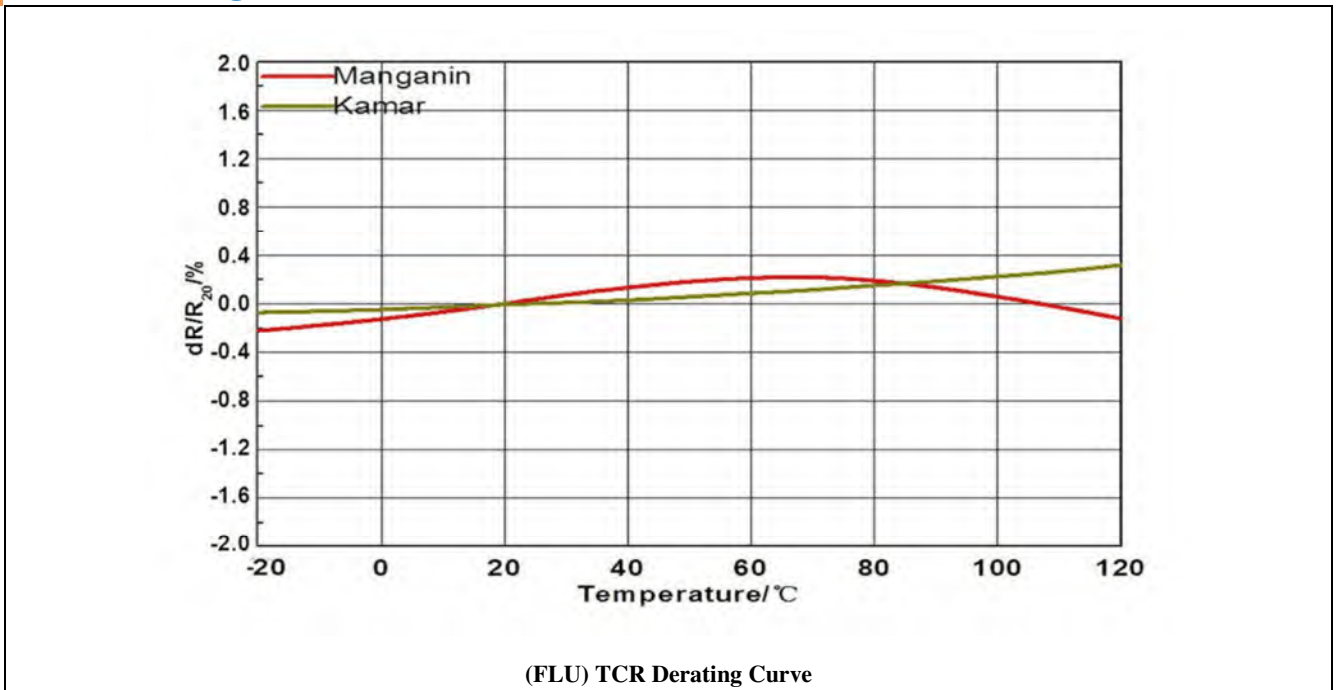
- Note: For non-standard dimensions of pins (A and T), Pitch (W), and Height (H) and variations of Rated current can be on request.

## Technical Specifications

### Surface Temperature Curve - FLU



### TCR Derating Curve - FLU





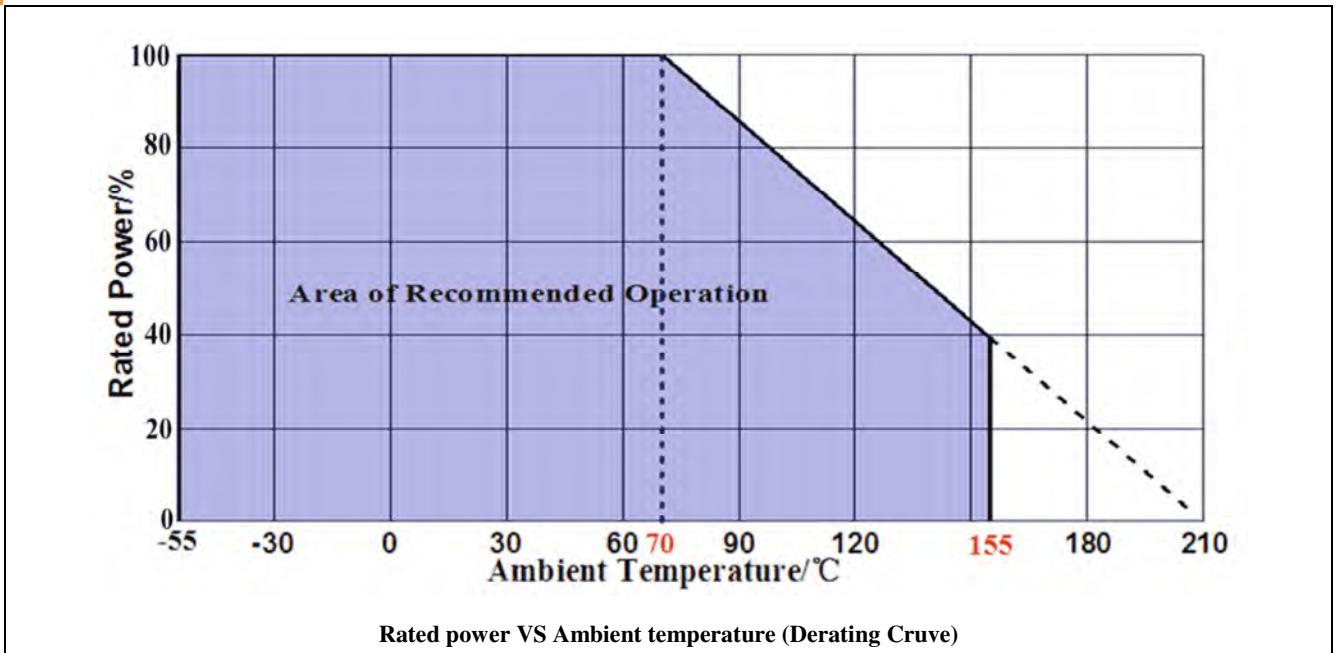
## ► Environmental Characteristics

### Environmental Characteristics - FLU

| Items                               | Methods  | Requirement              |
|-------------------------------------|--|--------------------------|
| <b>Temperature Cycling</b>          | MIL-STD-202<br>1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after.   | ±0.5%                    |
| <b>High Temperature</b>             | MIL-STD-202<br>1000hrs. @T=125°. Unpowered. Measurement at 24±2 hours after.   | ±0.5%                    |
| <b>Moisture Resistance</b>          | MIL-STD-202<br>t=24 hrs/cycle.<br>Note:Steps 7a & 7b not required. Measurement at 24±2 hours after.  | ±0.5%                    |
| <b>Biased Humidity</b>              | MIL-STD-202<br>1000hrs 85°C/85% RH.<br>Note: Specified conditions: 10% of operating power. Measurement at 24±2 hours after.  | ±0.5%                    |
| <b>Operational Life</b>             | MIL-STD-202<br>Condition D Steady State TA=125°C at rated power. Measurement at 24±2 hours after.  | ±0.5%                    |
| <b>Solderability</b>                | J-STD-002C<br>245°C ±5°C, 5s+0.5s/-0.  | 95% Coverage<br>Minimum. |
| <b>Vibration</b>                    | MIL-STD-202<br>5g's for 20 Min., 12 cycles each of 3 orientations.<br>Note: Use 8"X5" PCB. 031" thick 7" secure points on one long side and secure points at corners of opposite sides which parts mounted within 2" from any secure point. Test from 10-2000 Hz. Measurement at 24±2 hours after test conclusion. | ±0.5%                    |
| <b>Resistance to Soldering Heat</b> | MIL-STD-202<br>260°C ±5°C, 10s±1s. Measurement at 24±2 hours after test conclusion.  | ±0.5%                    |
| <b>Short Time Overload</b>          | MIL-STD-202<br>5 × Rated power for 5s. Measurement at 24±2 hours after test conclusion.  | ±0.5%                    |
| <b>Thermal Shock</b>                | MIL-STD-202<br>-55°C/+125°C, 300 Cycles, Maximum transfer time 20s Dwell.  | ±1%                      |

## ▶ Derating Curve

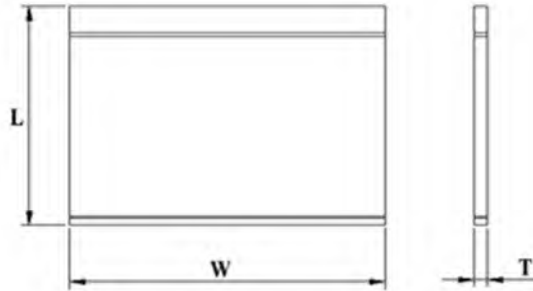
### Derating Curve - FLU



## ► Packaging

### FLU - Internal Package

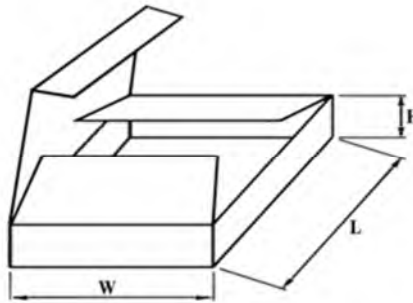
| Type | L/mm | W/mm | T/mm |
|------|------|------|------|
| P1   | 130  | 130  | 0.2  |
| P2   | 160  | 160  | 0.2  |
| P3   | 210  | 150  | 0.1  |



Internal Package (FLU)

### FLU - External Package

| Type | L/mm | W/mm | H/mm |
|------|------|------|------|
| B1   | 170  | 120  | 50   |
| B2   | 240  | 180  | 115  |
| B3   | 230  | 170  | 200  |
| B4   | 250  | 250  | 250  |
| B5   | 300  | 300  | 300  |



External Package (FLU)

## Order Codes

### Alloy Current Sensing Resistors (FLU) Order Code

| FLU         | 5         |      | 0m10                    |                  | F             |         |
|-------------|-----------|------|-------------------------|------------------|---------------|---------|
| Part Number | Pitch (W) |      | Resistance ( $\Omega$ ) |                  | Tolerance (%) |         |
| FLU         | 5         | 5mm  | 0m10                    | 0.00010 $\Omega$ | J             | $\pm 5$ |
|             | 15        | 15mm | 0m50                    | 0.00050 $\Omega$ | G             | $\pm 2$ |
|             | 30        | 30mm | R005                    | 0.00500 $\Omega$ | F             | $\pm 1$ |
|             |           |      | R010                    | 0.01000 $\Omega$ |               |         |

- Note: Plating, tin dipping, or size, please can be required.



# Four-terminal Alloy Shunt Resistors (FLH)

## ▶ Product Introduction

Four-terminal Alloy Shunt Resistors (FLH) tackle current sensing applications with TCR 20ppm.

### Features :

- Resistance values down to 0.0003Ω.
- TCR down to  $\pm 20\text{ppm}/^\circ\text{C}$  and  $\pm 50\text{ppm}/^\circ\text{C}$ .
- Low inductance. RoHS compliant and Lead-free.
- Tolerance  $\pm 1\%$ ,  $\pm 2\%$  and  $\pm 5\%$ . Rated Power 3 Watts.

### Applications :

- Current Sensing, Drive technology.
- Automotive electronics, Power Electronic.
- Communication System, Home Appliance.

Token FLH open four-pin alloy shunt series, also known as four-lead sampling shunt, current sensing resistor, or four-pin sampling resistor.

Kelvin four-terminal resistors are used to ensure that the current acts on two opposite terminals and to measure the detection voltage of the other two terminals, thereby reducing the influence of resistance and temperature coefficient between terminals and obtaining more accurate current measurements.

Four-lead alloy shunt FLH adopts U-shaped design and high-pulse special alloy element structure, which can improve the power of the resistor and expand the operating temperature range. It has the characteristics of low resistance, low inductance and high reliability. The temperature coefficient is lower than that of 20 ppm/C, which provides excellent performance and is suitable for various applications.



Token FLH devices always preferred in current sense applications, standard rated power 3W is available packages, resistance values down to 0.0003Ω, with tolerances as tight as  $\pm 1\%$ ,  $\pm 2\%$ , and  $\pm 5\%$  with low-inductance 10 nH. TCR is as low as  $\pm 20\text{ppm}/^\circ\text{C}$  and  $\pm 50\text{ppm}/^\circ\text{C}$  with high-impulse proprietary metal element that gives the device its extended power and temperature ratings.

With modern technology and production methods, we continuously upgrade production equipment, provide complete low resistance current detection resistor products, and all aspects of current sensing shunt product information and application information. The products meet RoHS requirements.

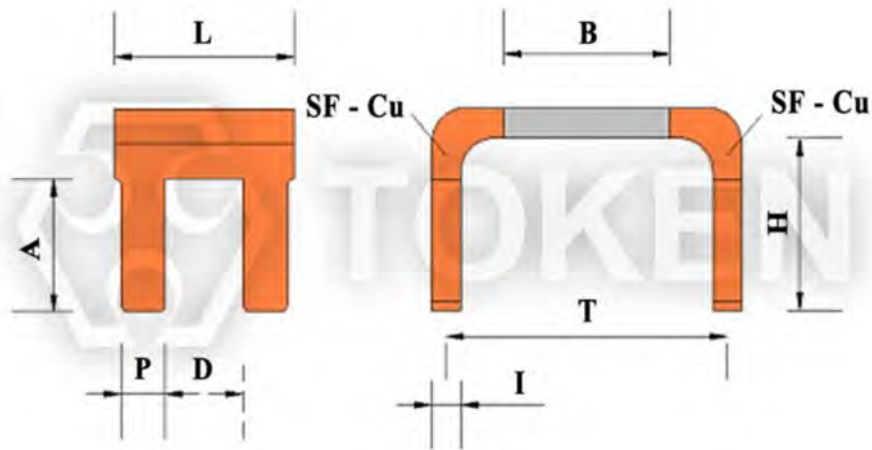
FLH series as current divider and current detection resistor products can be customized according to customers' needs. For special resistance value and latest product information, contact us with your specific needs. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## ► Dimensions

### Alloy Shunt Resistors (FLH) Dimensions (Unit:mm)

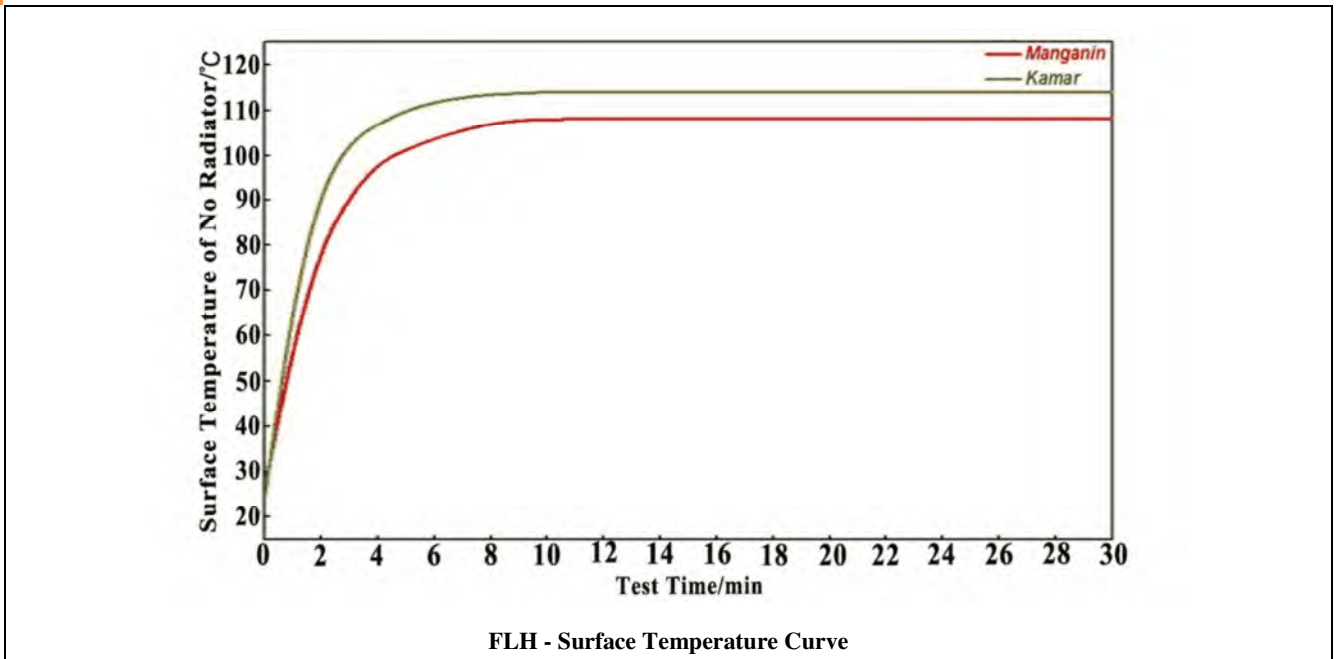
| Type       | B (mm)  | W (mm)  | L (mm)  | A (mm)  | P (mm)  | H (mm)  | D (mm)  | I (mm)   |
|------------|---------|---------|---------|---------|---------|---------|---------|----------|
| FLH-M-0m30 | 5.0±0.3 | 8.3±0.3 | 5.3±0.3 | 3.8±0.5 | 1.3±0.3 | 5.0±1.0 | 1.8±0.3 | 1.43±0.3 |
| FLH-M-0m50 | 5.0±0.3 | 8.3±0.3 | 5.3±0.3 | 3.8±0.5 | 1.3±0.3 | 5.0±1.0 | 1.8±0.3 | 0.86±0.3 |
| FLH-M-R001 | 5.0±0.3 | 8.3±0.3 | 5.3±0.3 | 3.8±0.5 | 1.3±0.3 | 5.0±1.0 | 1.8±0.3 | 0.44±0.3 |
| FLH-M-R002 | 5.0±0.3 | 8.3±0.3 | 5.3±0.3 | 3.8±0.5 | 1.3±0.3 | 5.0±1.0 | 1.8±0.3 | 0.63±0.3 |
| FLH-M-R003 | 5.0±0.3 | 8.3±0.3 | 5.3±0.3 | 3.8±0.5 | 1.3±0.3 | 5.0±1.0 | 1.8±0.3 | 0.43±0.3 |



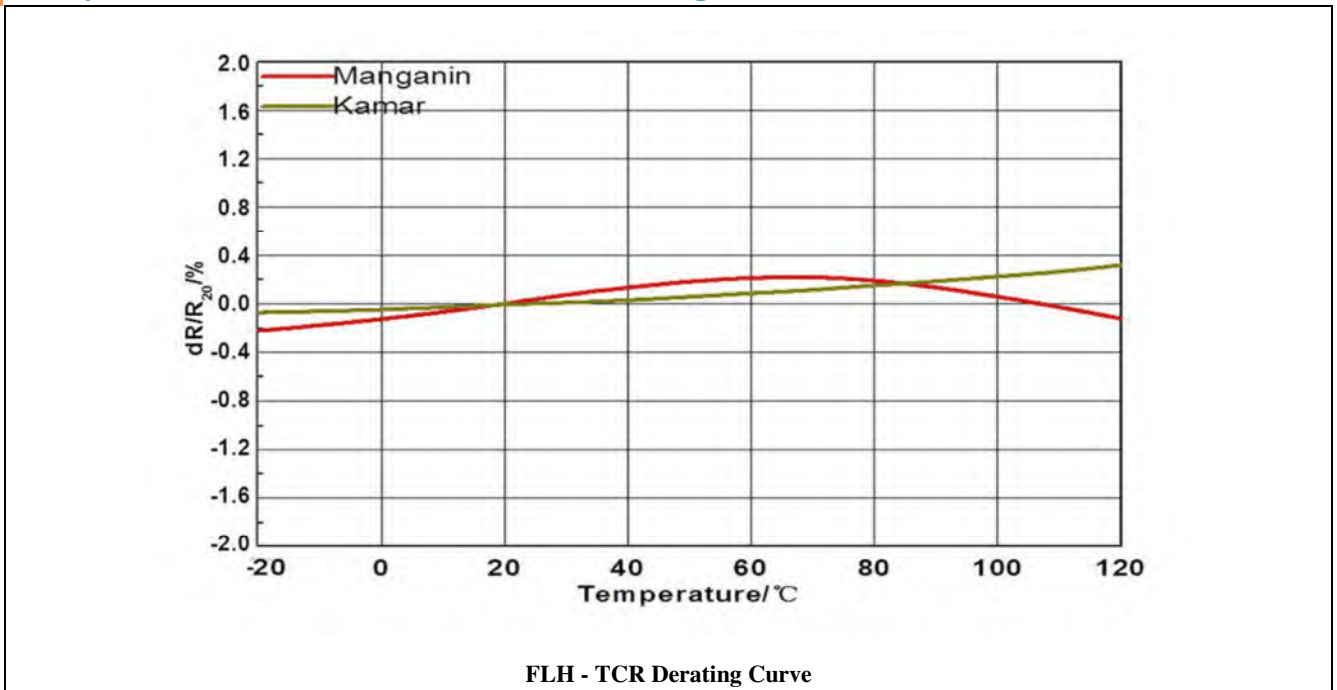
Alloy Shunt Resistors (FLH) - Dimensions

## Technical Specifications

### Alloy Shunt Resistors (FLH) Surface Temperature Curve



### Alloy Shunt Resistors (FLH) TCR Derating Curve



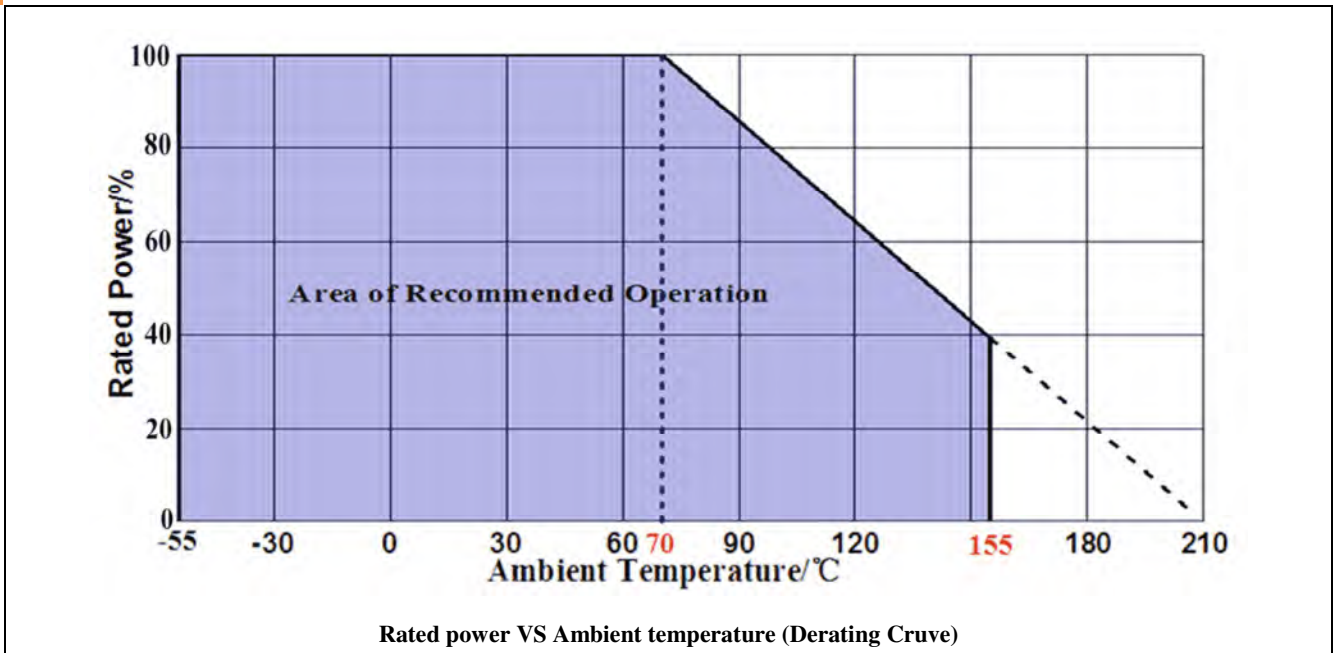
## ► Environmental Characteristics

### Alloy Shunt Resistors (FLH) Environmental Characteristics

| Items                        | Requirement           | Test Methods  |
|------------------------------|-----------------------|---|
| Temperature Cycling          | ±0.5%                 | JESD22<br>1000 Cycles(-55°C to +125°C). Measurement at 24±2 hours after test conclusion.  |
| High Temperature Exposure    | ±0.5%                 | MIL-STD-202<br>1000hrs. @T=125°C. Unpowered. Measurement at 24±2 hours after test conclusion.   |
| Moisture Resistor            | ±0.5%                 | MIL-STD-202<br>t = 24 hrs/cycle. Steps 7a & 7b not required. Unpowered. Measurement at 24±2 hours after test conclusion.  |
| Biased Humidity              | ±0.5%                 | MIL-STD-202<br>1000hrs 85°C/85% RH.<br>Note: Specified conditions: 10% of operating power. Measurement at 24±2 hours after test conclusion.   |
| Operational Life             | ±0.5%                 | MIL-STD-202<br>Condition D Steady State TA=125°C at rated power. Measurement at 24±2 hours after test conclusion.   |
| Solderability                | 95% Coverage Minimum. | J-STD-002C 245±5°C, 5s+0.5s/-0.   |
| Vibration                    | ±0.5%                 | MIL-STD-202<br>5g's for 20 Min., 12 cycles each of 3 orientations.<br>Note: Use 8"X5" PCB. 0.031" thick 7" secure points on one long side and secure points at corners of opposite sides which parts mounted within 2 from any secure point. Test from 10-2000 Hz. Measurement at 24±2 hours after test conclusion. |
| Resistance to Soldering Heat | ±0.5%                 | MIL-STD-202<br>260±5°C, 10s±1s. Measurement at 24±2 hours after test conclusion.  |
| Short Time Overload          | ±0.5%                 | MIL-STD-202<br>55×Rated power for 5s. Measurement at 24±2 hours after test conclusion.  |
| Thermal Shock                | ±1%                   | MIL-STD-202<br>-55°C/+125°C, 300 Cycles. Maximum transfer time 20s, Dwell time 15Min..  |

## ▶ Derating Curve

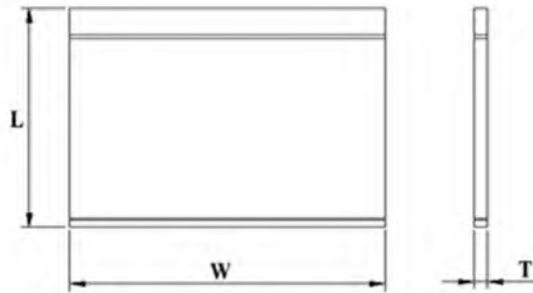
### Alloy Shunt Resistors (FLH) Derating Curve



## ► Packaging

### Alloy Shunt Resistors (FLH) Internal Package

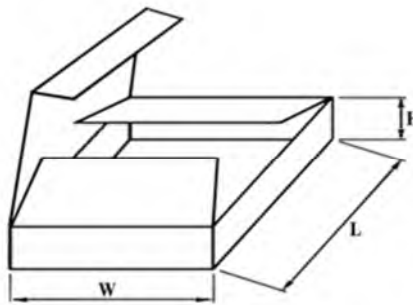
| Type | L/mm | W/mm | T/mm |
|------|------|------|------|
| P1   | 130  | 130  | 0.2  |
| P2   | 160  | 160  | 0.2  |
| P3   | 210  | 150  | 0.1  |



FLH - Internal Package

### Alloy Shunt Resistors (FLH) External Package

| Type | L/mm | W/mm | H/mm |
|------|------|------|------|
| B1   | 170  | 120  | 50   |
| B2   | 240  | 180  | 115  |
| B3   | 230  | 170  | 200  |
| B4   | 250  | 250  | 250  |
| B5   | 300  | 300  | 300  |



FLH - External Package



## Order Codes

### Alloy Current Sensing Resistors (FLU) Order Code

| FLH         | M        |          | 0m30                    |                 | F             |         |
|-------------|----------|----------|-------------------------|-----------------|---------------|---------|
| Part Number | Material |          | Resistance ( $\Omega$ ) |                 | Tolerance (%) |         |
| M           | M        | Manganin | 0m30                    | 0.0003 $\Omega$ | J             | $\pm 5$ |
| FLH         | K        | Kamar    | R001                    | 0.001 $\Omega$  | G             | $\pm 2$ |
|             |          |          | R003                    | 0.003 $\Omega$  | F             | $\pm 1$ |



# Chip Alloy Current Shunt Resistors (FLM)

## ► Product Introduction

SMD alloy shunt resistance FLM is a key current sensing technology for future vehicle construction.

### Features :

- Inductance less than 10 nH, Lead-free and RoHS compliant.
- Rated Power 4W ~ 7W. Tolerance  $\pm 1\%$ ,  $\pm 2\%$  and  $\pm 5\%$ .
- TCR down to  $\pm 20\text{ppm}/^\circ\text{C}$  and  $\pm 50\text{ppm}/^\circ\text{C}$ .
- Resistance values down to  $0.0002\Omega$ .

### Applications :

- Power modules, Communication system.
- Current sensor for power hybrid applications.
- High current applications for the automotive market.
- Frequency converters, Automatic control power supply.

Token Electronics equipped with (FLM) alloy shunt on its current sensing surface mount devices. It adopts the design of folding terminals outward and inward. Nickel-copper or manganese-copper alloy stamping is used to maintain the superior electrical characteristics of the surface mounting structure. It has the characteristics of pulse resistance and high precision.

Unlike other manufacturers of metal alloy current detection resistors, Token metal alloy power chips (FLM) have a number of advantages. Power can reach 4W, 5W, and 7W. The temperature coefficient TCR (20 - 50) ppm, tolerance accuracy 1%, 2%, and 5%, is used to improve the measurement accuracy. The resistance value is as low as  $0.0002\Omega$ , which is the first choice for high-end current sensing and sampling applications.

The (FLM) device is applicable to all types of voltage dividers, current detection and pulse applications in power management, such as sensors and transducers; VRM for notebook computers, DC/DC converters for servers, management and safety of lithium ion batteries; industrial instrumentation; and high current applications in the automotive market, such as audio, transmission, anti-lock braking, and engines.

Token Electronics adopts modern technology and production methods, constantly upgrades production equipment, provides complete low resistance current detection components, and all aspects of current sensing shunt product and application information.

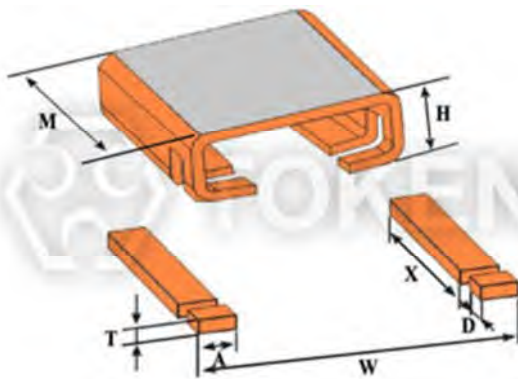
The (FLM) device is available in bulk packaging and is RoHS compliant and lead free. For non-standard technical requirements and special applications, contact us with your specific needs. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)".



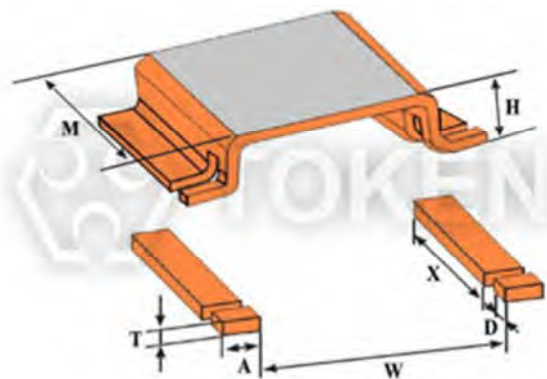
## ► Dimensions

### Metal Alloy Power Shunts (FLM) Dimensions (Unit:mm)

| Type       | Power (W) | M (mm)  | W (mm)   | H (mm)  | X (mm)  | D (mm)   | A (mm)  | T (mm)   |
|------------|-----------|---------|----------|---------|---------|----------|---------|----------|
| FLM-M-0m20 | 5         | 6.6±0.3 | 6.9±0.3  | 3.0±0.5 | 4.8±0.3 | 0.90±0.3 | 2.5±0.3 | 0.7±0.3  |
| FLM-M-0m30 | 5         | 6.6±0.3 | 6.9±0.3  | 3.0±0.5 | 4.8±0.3 | 0.90±0.3 | 2.5±0.3 | 1.12±0.3 |
| FLM-M-0m50 | 5         | 6.6±0.3 | 6.9±0.3  | 3.0±0.3 | 4.8±0.3 | 0.90±0.3 | 2.5±0.3 | 0.66±0.3 |
| FLM-M-R001 | 5         | 6.6±0.3 | 6.9±0.3  | 3.0±0.3 | 4.8±0.3 | 0.90±0.3 | 2.5±0.3 | 0.33±0.3 |
| FLM-K-R002 | 5         | 6.6±0.3 | 6.9±0.3  | 3.0±0.3 | 4.8±0.3 | 0.90±0.3 | 2.5±0.3 | 0.50±0.3 |
| FLM-K-R003 | 4         | 6.6±0.3 | 6.9±0.3  | 3.0±0.3 | 4.8±0.3 | 0.90±0.3 | 2.5±0.3 | 0.34±0.3 |
| FLM-K-R005 | 4         | 3.9±0.3 | 6.9±0.3  | 3.0±0.3 | 2.0±0.3 | 0.34±0.3 | 2.5±0.3 | 0.34±0.3 |
| FLM-K-R010 | 7         | 6.1±0.3 | 15.9±0.3 | 3.0±0.3 | 4.2±0.3 | 0.90±0.3 | 2.5±0.3 | 0.30±0.3 |



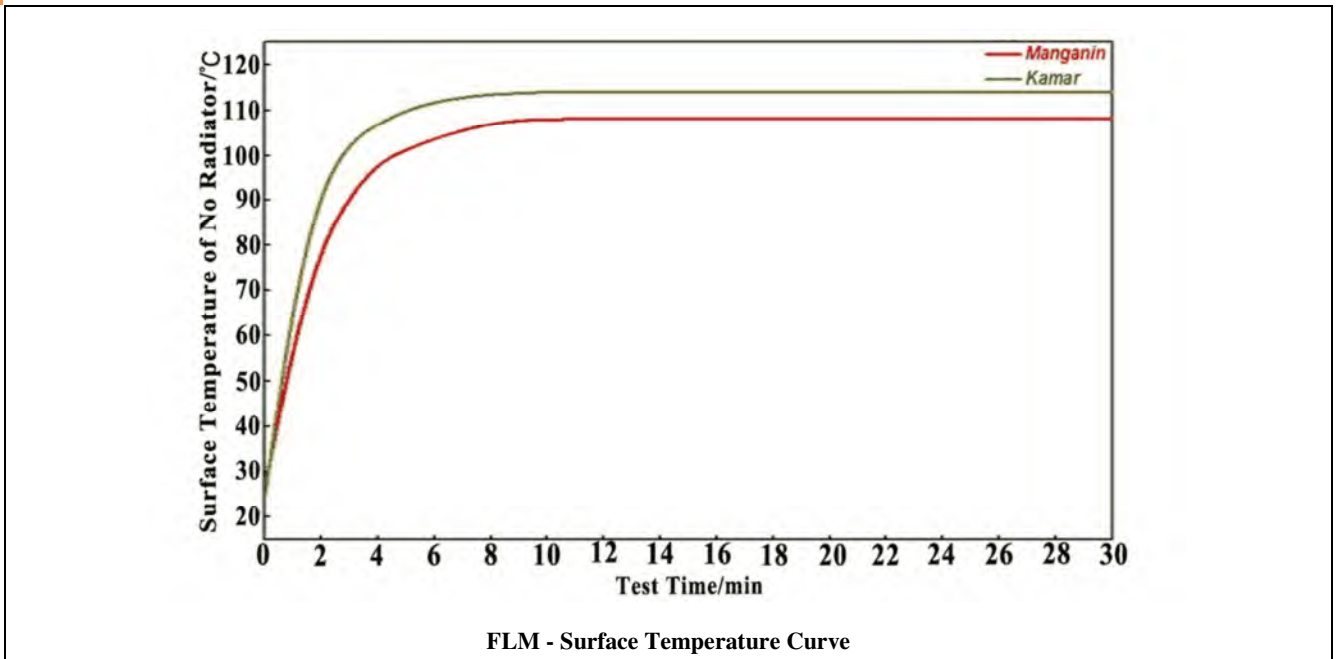
Alloy Shunt Resistors FLM - Inward Fold (n)



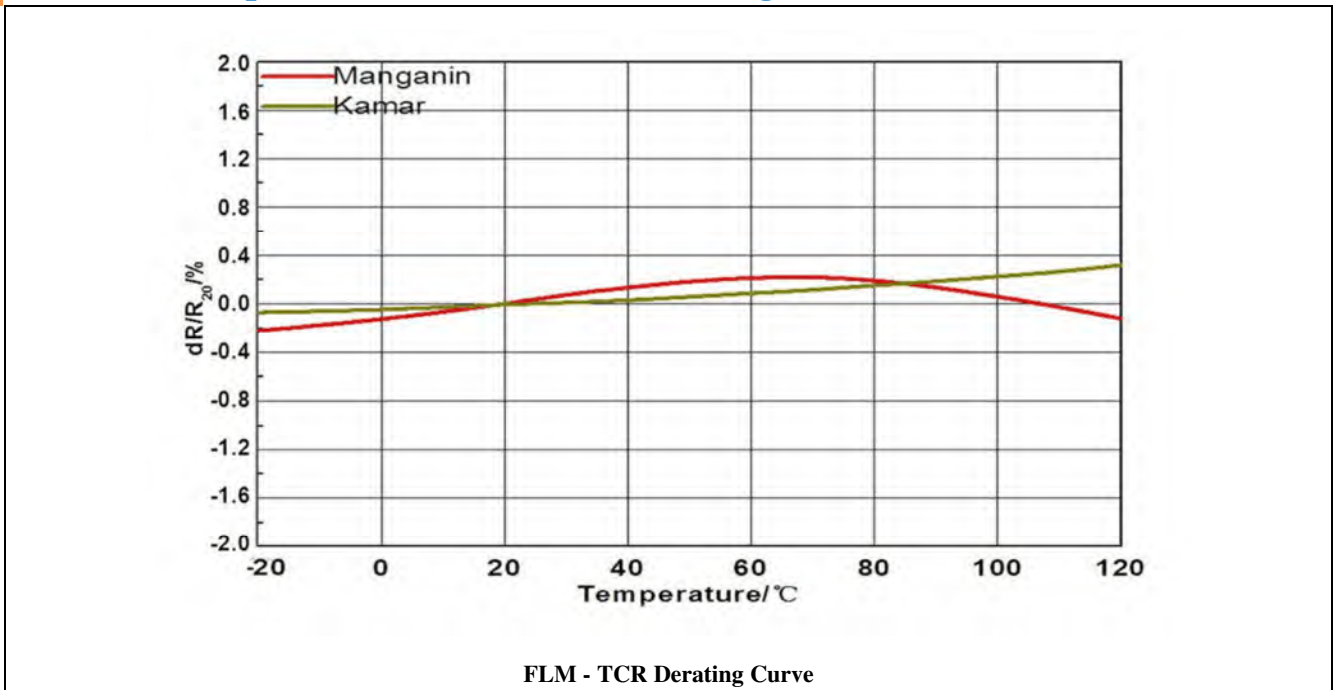
Alloy Shunt Resistors FLM - Outward Fold (y)

## Technical Specifications

### Current Shunts (FLM) Surface Temperature Curve



### Low Ohm Chip Resistors (FLM) TCR Derating Curve



## ► Environmental Characteristics

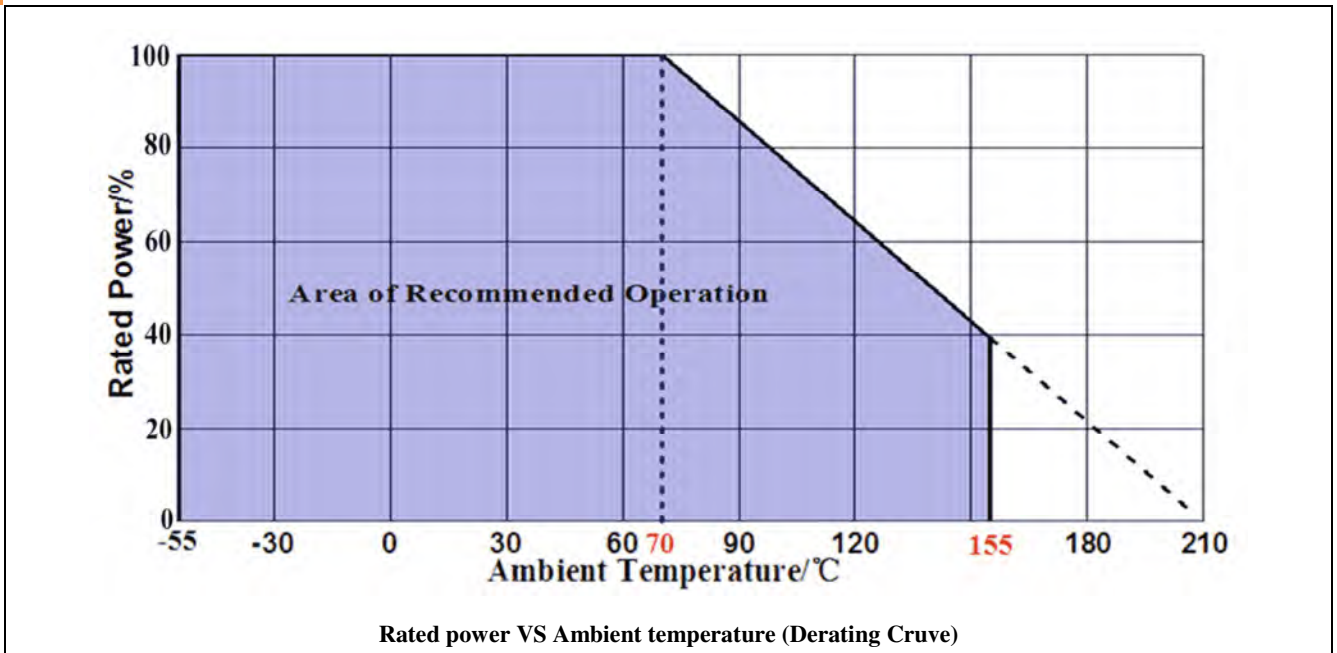
### Alloy Shunt Resistors (FLM) Environmental Characteristics

| Items                        | Requirement           | Test Methods   |
|------------------------------|-----------------------|--|
| Temperature Cycling          | ±0.5%                 | JESD22<br>1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test conclusion.  |
| High Temperature Exposure    | ±0.5%                 | MIL-STD-202<br>1000hrs. @T=125°C .Unpowered. Measurement at 24±2 hours after test conclusion.  |
| Moisture Resistance          | ±0.5%                 | MIL-STD-202<br>t=24hrs/cycle.Note:Steps 7a & 7b not required. Unpowered. Measurement at 24±2 hours after test conclusion.  |
| Biased Humidity              | ±0.5%                 | MIL-STD-202<br>1000hrs 85°C/85%RH.Note: Specified conditions: 10% of operating power. Measurement at 24±2 hours after test conclusion.   |
| Operational Life             | ±0.5%                 | MIL-STD-202<br>Condition D Steady State TA=125°C at rated power. Measurement at 24±2 hours after test conclusion.  |
| Solderability                | 95% Coverage Minimum. | J-STD-002C<br>245°C ±5°C , 5s+0.5s/-0.   |
| Resistance to Soldering Heat | ±0.5%                 | MIL-STD-202<br>260°C ±5°C , 10s±1s. Measurement at 24±2 hours after test conclusion.   |
| Short Time Overload          | ±0.5%                 | MIL-STD-202<br>5×Rated power for 5s. Measurement at 24±2 hours after test conclusion.  |
| Thermal Shock                | ±1%                   | MIL-STD-202<br>-55°C/+125°C , 300 Cycles.Maximumtransfer time 20s, Dwell time 15Min..  |
| Vibration                    | ±0.5%                 | MIL-STD-202<br>5g's for 20 Min., 12 cycles each of 3 orientations.<br>Note: Use 8"X5" PCB .031" thick 7" secure points on one long side and secure points at corners of opposite sides which parts mounted within 2 from any secure point. Test from 10-2000 Hz.Measurement at 24±2 hours after test conclusion. |



## ▶ Derating Curve

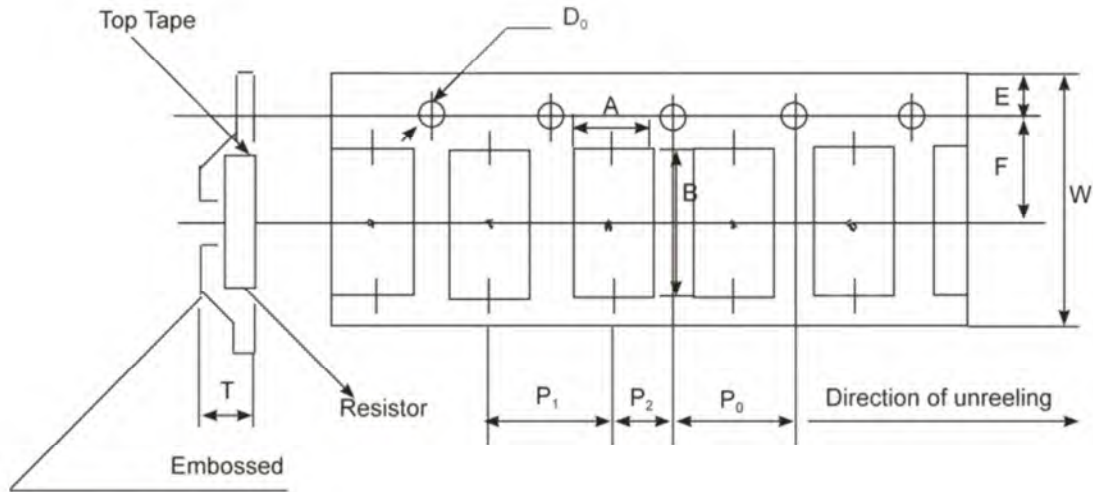
### Current Shunts (FLM) Derating Curve



## ► Packaging

### Alloy Shunt Resistors (FLM) Packaging

| Type | A/mm | B/mm | W/mm | E/mm | F/mm | P <sub>0</sub> /mm | P <sub>1</sub> /mm | P <sub>2</sub> /mm | D <sub>0</sub> /mm | T/mm | Quantity(EA)/pieces |
|------|------|------|------|------|------|--------------------|--------------------|--------------------|--------------------|------|---------------------|
| In   | 7.5  | 8    | 16   | 1.75 | 7.35 | 6                  | 12                 | 12                 | 1.5                | 3.8  | 3000                |
| Out  | 7.3  | 12.1 | 24   | 1.75 | 12.2 | 6                  | 12                 | 12                 | 1.5                | 3.5  | 1000                |



FLM - Embossed Plastic Tape Specifications

## Order Codes

### SMD Alloy Current Shunt Resistors (FLM) Order Code

| FLM         | 5         |    | M        |          | 0m20                    |                 | F             |         | y     |              |
|-------------|-----------|----|----------|----------|-------------------------|-----------------|---------------|---------|-------|--------------|
| Part Number | Power (W) |    | Material |          | Resistance ( $\Omega$ ) |                 | Tolerance (%) |         | Shape |              |
| FLM         | 4         | 4W | M        | Manganin | 0m20                    | 0.0002 $\Omega$ | J             | $\pm 5$ | y     | outward Fold |
|             | 5         | 5W | K        | Kamar    | 0m50                    | 0.0005 $\Omega$ | G             | $\pm 2$ | n     | Intward Fold |
|             | 7         | 7W |          |          | R001                    | 0.001 $\Omega$  | F             | $\pm 1$ |       |              |
|             |           |    |          |          | R002                    | 0.002 $\Omega$  |               |         |       |              |
|             |           |    |          |          | R010                    | 0.01 $\Omega$   |               |         |       |              |



# Large Current Sense Resistor Power Shunts (FLP)

## ► Product Introduction

Token's Metal Plate Shunt Resistor (FLP) serves high-current precision measurement applications.

### Features :

- Inductance less than 10 nH, Lead-free and RoHS compliant.
- Tolerance  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$ . Resistance values down to  $0.00005\Omega$ .
- Overcurrent capacity 100A ~ 600A, Rated Power 3W ~ 70W.
- TCR down to  $\pm 50\text{ppm}/^\circ\text{C}$  and  $\pm 100\text{ppm}/^\circ\text{C}$ .

### Applications :

- Power Electronic, Home Appliance.
- Current Sensing, Drive technology.
- Automotive electronics, Communication System.

Token Electronics provides a wide range of precise shunts designed for high current applications requiring high precision, such as instruments, power supplies, watt-hour meters, automotive control systems, etc.

As one of current sensing resistors, metal plate alloy shunt resistors are precise low resistance which are often used in AC or DC voltage measurement. They are also called ammeter shunts.

The FLP shunt is composed of precise manganese kamar alloy plate, which is easy to weld and ensures the electrical performance of the welding joint. Strong structure provides high reliability, low inductance, and high load capacity. It is widely used in current limiting circuits such as communication systems, electronic machines, automatic control power supply, and current sharing or sampling detection.

Metal Plate FLP shunts can withstand higher current load than traditional resistors and surface mount resistors. Its power can reach 3W~70W, temperature coefficient  $\pm 50\text{ppm}/^\circ\text{C}$ ,  $\pm 100\text{ppm}/^\circ\text{C}$ , inductance is less than 10 nH, resistance is as low as  $0.00005\Omega$ , tolerance accuracy  $\pm 1\%$ ,  $\pm 2\%$ , and  $\pm 5\%$ , and overcurrent capacity can reach 100A~600A.

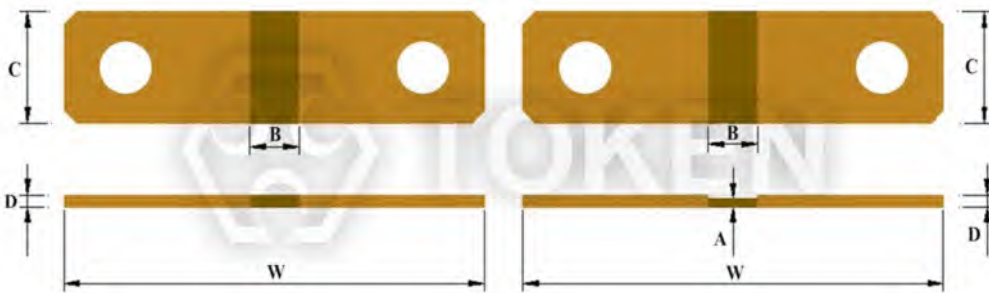
Token provides bulk FLP series, which meets the lead-free and RoHS compliant. It can be customized according to customer's needs and provide customers with lower resistance series current sensing shunt resistors. Special resistance, size, specifications, and latest product information, please contact our Business Department. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## ► Dimensions

### Power Shunts (FLP) Dimensions (Unit: mm)

| Type       | * Over current / A | W (mm) | B (mm)  | C (mm) | D (mm)   | A (mm)   |
|------------|--------------------|--------|---------|--------|----------|----------|
| FLP-M-0m05 | 600                | 85±0.5 | 4.5±0.2 | 18±0.5 | 3±0.1    | 2.15±0.1 |
| FLP-M-0m10 | 600                | 84±0.5 | 10±0.2  | 20±0.5 | 3±0.1    | 2.3±0.1  |
| FLP-M-0m10 | 400                | 35±0.5 | 5±0.2   | 15±0.5 | 1.5±0.1  | -        |
| FLP-M-0m20 | 600                | 50±0.5 | 10±0.2  | 10±0.5 | 3±0.1    | 2.3±0.1  |
| FLP-M-0m50 | 150                | 35±0.5 | 8±0.2   | 15±0.5 | 0.47±0.1 | -        |
| FLP-M-R001 | 100                | 35±0.5 | 12±0.2  | 15±0.5 | 0.35±0.1 | -        |
| FLP-K-R002 | 150                | 35±0.5 | 14±0.2  | 15±0.5 | 0.62±0.1 | -        |
| FLP-K-R004 | 100                | 35±0.5 | 14±0.2  | 15±0.5 | 0.31±0.1 | -        |



FLP - Power Shunts Dimensions

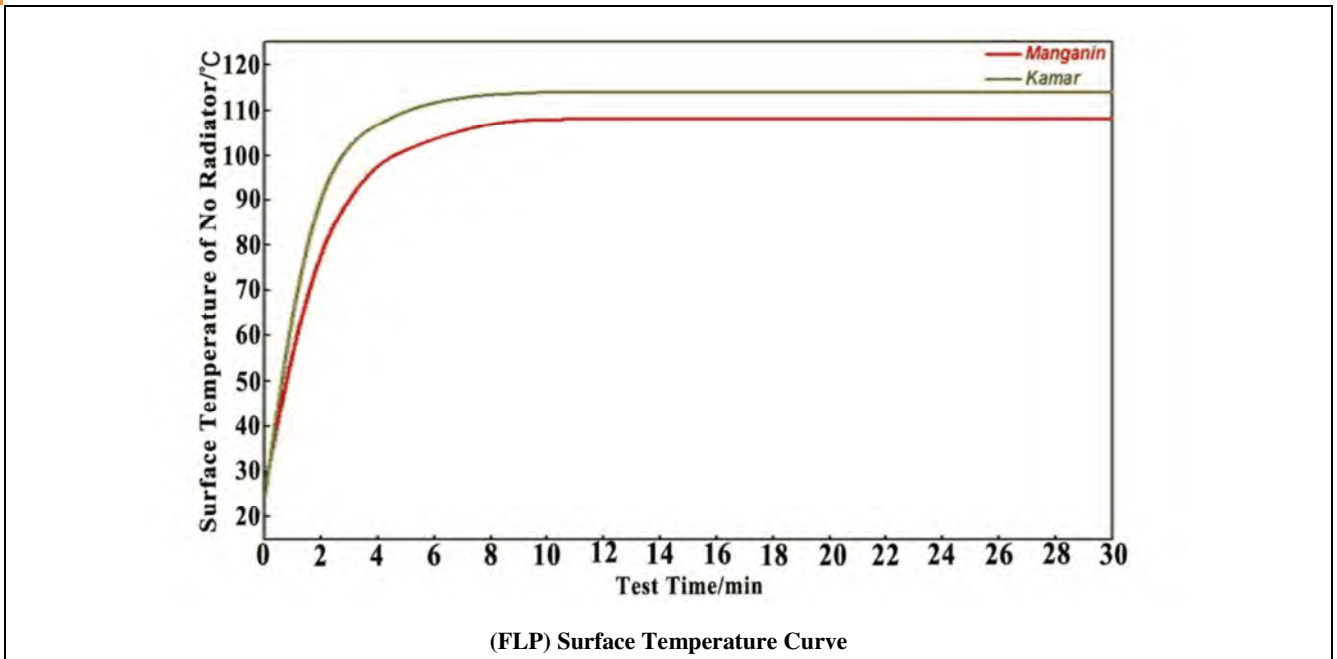
\* Remark:

- Overcurrent is the current exceeds the rated current.
- Circuit currents larger than the rated load current of the circuit conductor are all overcurrent including overload current and short circuit current.
- The difference is that the overcurrent before the circuit insulation damage is called overload current, and the overcurrent after the insulation damage is called short-circuit current.

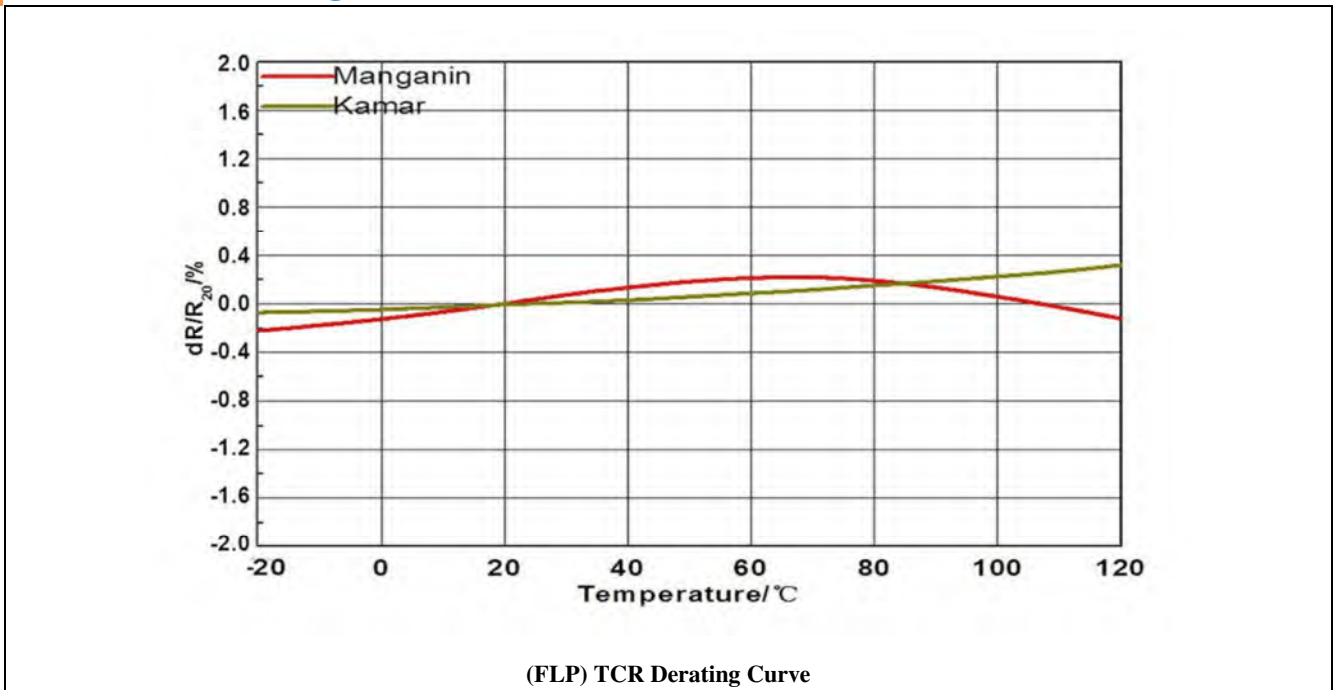


## Technical Specifications

### FLP - Surface Temperature Curve



### FLP - TCR Derating Curve



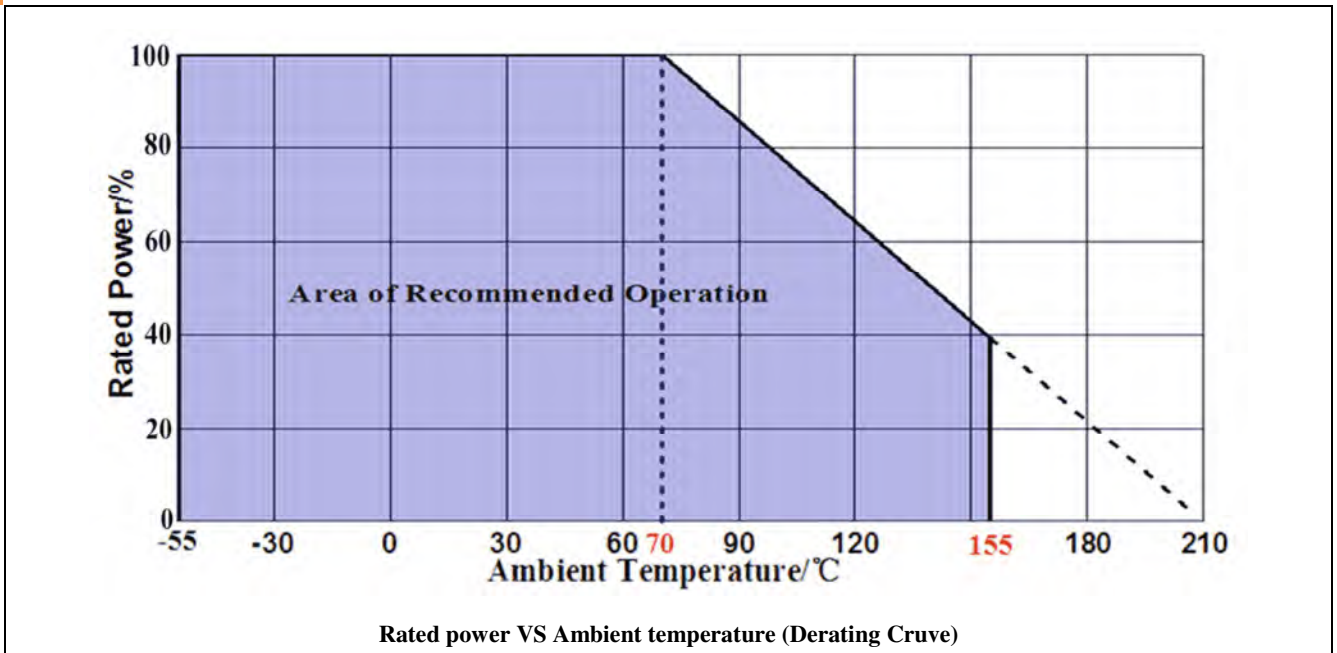
## ► Environmental Characteristics

### Shunt Resistors (FLP) Environmental Characteristics

| Items                        | Requirement              | Test Methods  |
|------------------------------|--------------------------|---|
| Temperature Cycling          | ±0.5%                    | JESD22<br>1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test.  |
| High Temperature Exposure    | ±0.5%                    | MIL-STD-202<br>1000hrs. @T=125°C. Unpowered. Measurement at 24±2 hours after test.  |
| Moisture Resistance          | ±0.5%                    | MIL-STD-202<br>t=24hrs/cycle.<br>Note: Steps 7a & 7b not required. Unpowered. Measurement at 24±2 hours after test.   |
| Biased Humidity              | ±0.5%                    | MIL-STD-202<br>1000hrs 85°C/85% RH.<br>Note: Specified conditions: 10% of operating power. Measurement at 24±2 hours after test.  |
| Operational Life             | ±0.5%                    | MIL-STD-202<br>Condition D Steady State TA=125°C at rated power. Measurement at 24±2 hours after test.  |
| Solderability                | 95% Coverage<br>Minimum. | J-STD-002C<br>245°C ±5°C, 5s+0.5s/-0.   |
| Resistance to Soldering Heat | ±0.5%                    | MIL-STD-202<br>260°C ±5°C, 10s±1s. Measurement at 24±2 hours after test.  |
| Short Time Overload          | ±0.5%                    | MIL-STD-202<br>5 × Rated power for 5s. Measurement at 24±2 hours after test.  |
| Thermal Shock                | ±1%                      | MIL-STD-202<br>-55°C/+125°C, 300 Cycles. Maximum transfer time 20s, Dwell time 15Min..  |
| Vibration                    | ±0.5%                    | MIL-STD-202<br>5g's for 20 Min., 12 cycles each of 3 orientations.<br>Note: Use 8"X5" PCB .031" thick 7" secure points on one long side and secure points at corners of opposite sides which parts mounted within 2 from any secure point. Test from (10-2000)Hz. Measurement at 24±2 hours after test. |

## ▶ Derating Curve

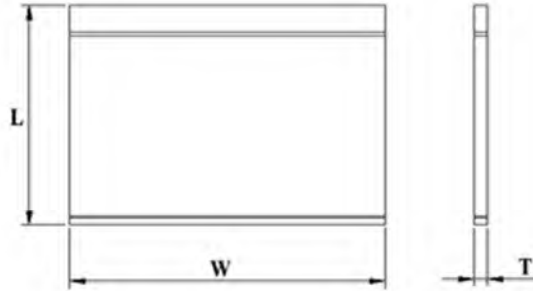
### Shunt Resistors (FLP) Derating Curve



## ► Packaging

### Large Current Shunts (FLP) Internal Package

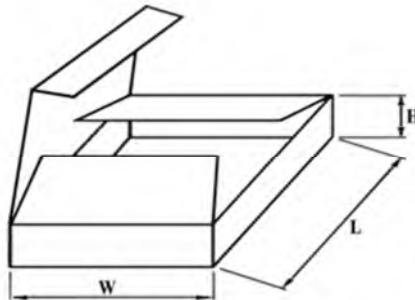
| Type | L/mm | W/mm | T/mm |
|------|------|------|------|
| P1   | 130  | 130  | 0.2  |
| P2   | 160  | 160  | 0.2  |
| P3   | 210  | 150  | 0.1  |



FLP - Internal Package

### Large Current Shunts (FLP) External Package

| Type | L/mm | W/mm | H/mm |
|------|------|------|------|
| B1   | 170  | 120  | 50   |
| B2   | 240  | 180  | 115  |
| B3   | 230  | 170  | 200  |
| B4   | 250  | 250  | 250  |
| B5   | 300  | 300  | 300  |



FLP - External Package

## Order Codes

### Metal Plate Large Current Sense Power Shunts (FLP) - Order Code

| FLP         | 600              |       | M        |          | 0m20                    |                  | F             |         |
|-------------|------------------|-------|----------|----------|-------------------------|------------------|---------------|---------|
| Part Number | Over Current (A) |       | Material |          | Resistance ( $\Omega$ ) |                  | Tolerance (%) |         |
| FLP         | 100              | 100 A | M        | Manganin | 0m05                    | 0.00005 $\Omega$ | J             | $\pm 5$ |
|             | 150              | 150 A | K        | Kamar    | 0m20                    | 0.0002 $\Omega$  | G             | $\pm 2$ |
|             | 400              | 400 A |          |          | 0m50                    | 0.0005 $\Omega$  | F             | $\pm 1$ |
|             | 600              | 600 A |          |          | R001                    | 0.001 $\Omega$   |               |         |
|             |                  |       |          |          | R004                    | 0.004 $\Omega$   |               |         |

- Note: Plating, tin dipping, or size, please can be required.





# SMD Large Current Weld Precision Resistor Shunts (LRN)

## ► Product Introduction

Surface mounted high current shunt, low TCR 20PPM (LRN) is the first choice for high power circuit design.

### Features :

- Air cooling, Strong stability of circuit.
- Tolerance  $\pm 1\%$ ,  $\pm 2\%$ , and  $\pm 5\%$ . Rated Power 4W and 7W.
- Reflow Soldering applicable. lead-free and RoHS compliant.
- TCR down to  $\pm 20\text{ppm}/^\circ\text{C}$  and  $\pm 50\text{ppm}/^\circ\text{C}$ . Resistance down to  $0.0005\Omega$ .

### Applications :

- Communication system.
- Power modules · Frequency converters.
- Current sensor for power hybrid applications.
- High current applications for the automotive market.

For the development of current detection and shunting applications, TOKEN's high current shunt (LRN) adopts the welding structure of Manganin and KAMAR (NiCr20AlSi) precision resistance alloys. The spacing standard design makes it easy for surface mounting, reflow soldering, and suitable for current sensing and shunting applications.

Open bare alloy element design allows air flow to achieve maximum cooling effect, so that PCB retains less heat. The design of flame protection structure provides  $0.0005\Omega$  low resistance and low inductance. These factors make ruggedness (LRN) an excellent choice for all high current power supply and power applications that are not affected by most environmental stresses.

Specially designed for applications requiring high power processing (LRN). The power is 4W and 7W. The ultra-low resistance ranges from  $0.5\text{m}\Omega$  to  $30\text{m}\Omega$ . There are various tolerance selection advantages ( $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$ ), size 4312, and 4320. To achieve compact size and miniaturization, design a smaller, lower cost, higher performance, high power circuit terminal product design.

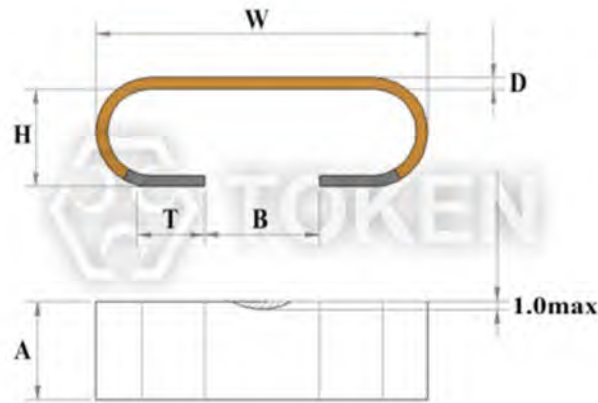
Provide packing with Embossed Plastic Tape, size 4312 2Kpcs per reel, 4320 2Kpcs per reel, products meet the lead-free and RoHS standards. Customers can specify resistance, size and specifications to meet the design challenges and specific technical requirements. Please contact TOKEN Business Department for the latest product information. Or link to Token official website "[Current Sense Resistors](http://www.token.com.tw)". Contact us with your specific needs.



## Dimensions

### Chip Weld Shunts LRN - Dimension Specifications (Unit:mm)

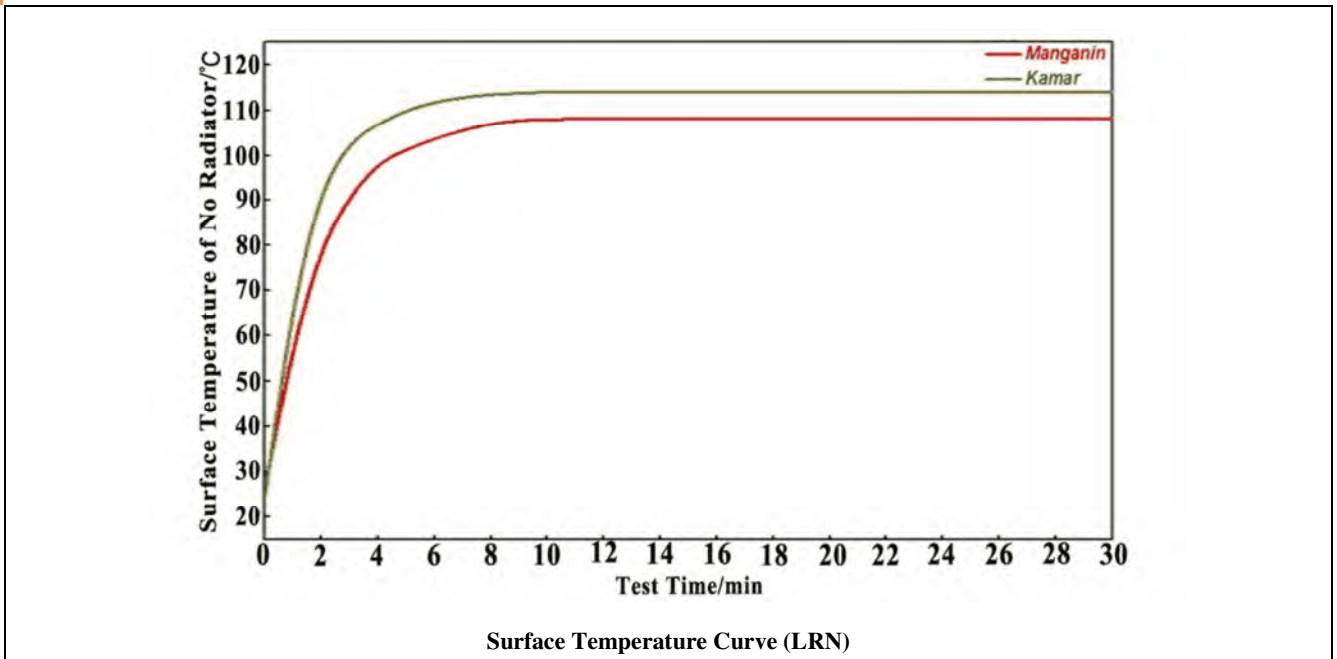
| Type | Power (W) | Material | Size | Resistance (mΩ) | D (mm)    | H (mm)  | B (mm)  | W (mm) | T (mm)  | A (mm)  |
|------|-----------|----------|------|-----------------|-----------|---------|---------|--------|---------|---------|
| LRN  | 4         | M        | 4312 | 2               | 0.59±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 3.1±0.3 |
|      |           |          |      | 3               | 0.39±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 3.1±0.3 |
|      |           |          |      | 5               | 0.40±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 3.1±0.3 |
|      |           | K        | 4312 | 10              | 0.62±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 3.1±0.3 |
|      |           |          |      | 20              | 0.62±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 3.1±0.3 |
|      |           |          |      | 30              | 0.25±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 3.1±0.3 |
|      | 7         | M        | 4320 | 0.5             | 0.74±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 6.1±0.4 |
|      |           |          |      | 1               | 0.37±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 6.1±0.4 |
|      |           |          |      | 5               | 0.20±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 6.1±0.4 |
|      |           | K        | 4320 | 5               | 0.62±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 6.1±0.4 |
|      |           |          |      | 10              | 0.30±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 6.1±0.4 |
|      |           |          |      | 15              | 0.20±0.05 | 3.1±0.3 | 4.2±0.5 | 11±0.5 | 2.8±0.3 | 6.1±0.4 |



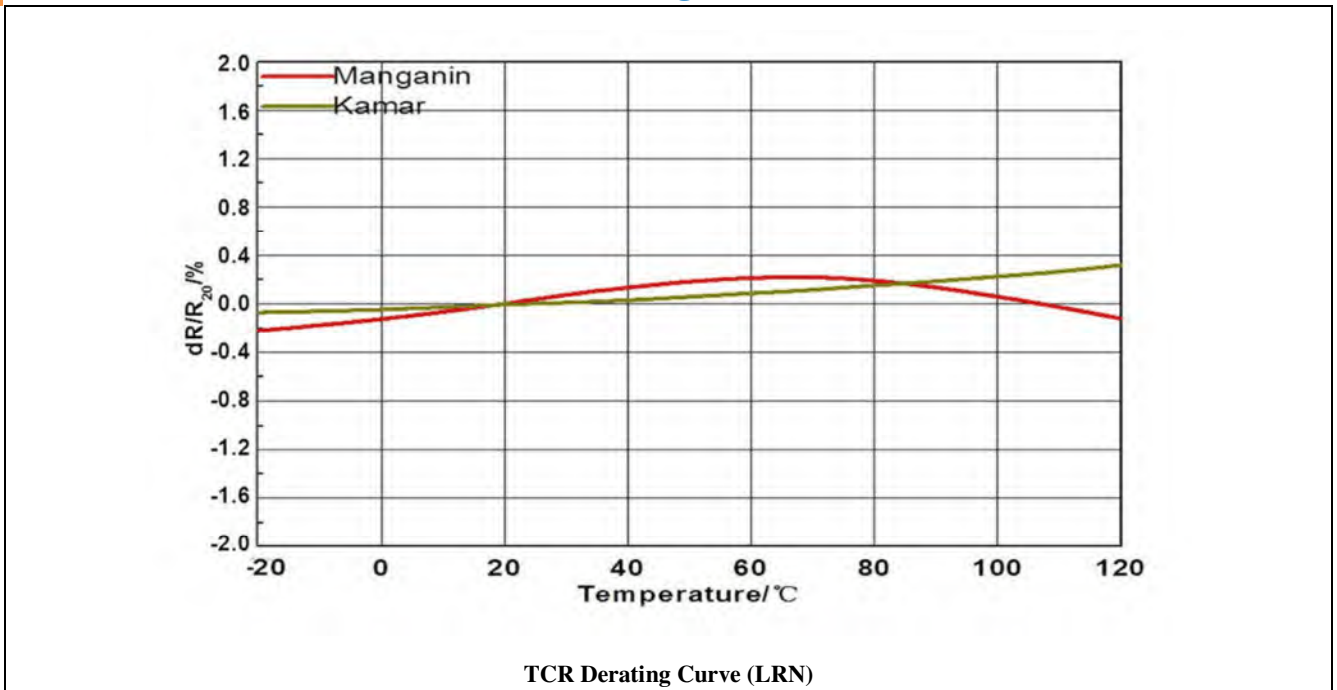
Chip Weld Shunts LRN - Dimensions (Unit:mm)

## Technical Specifications

### Chip Weld Resistors LRN - Surface Temperature Curve



### SMD Weld Resistors LRN - TCR Derating Curve



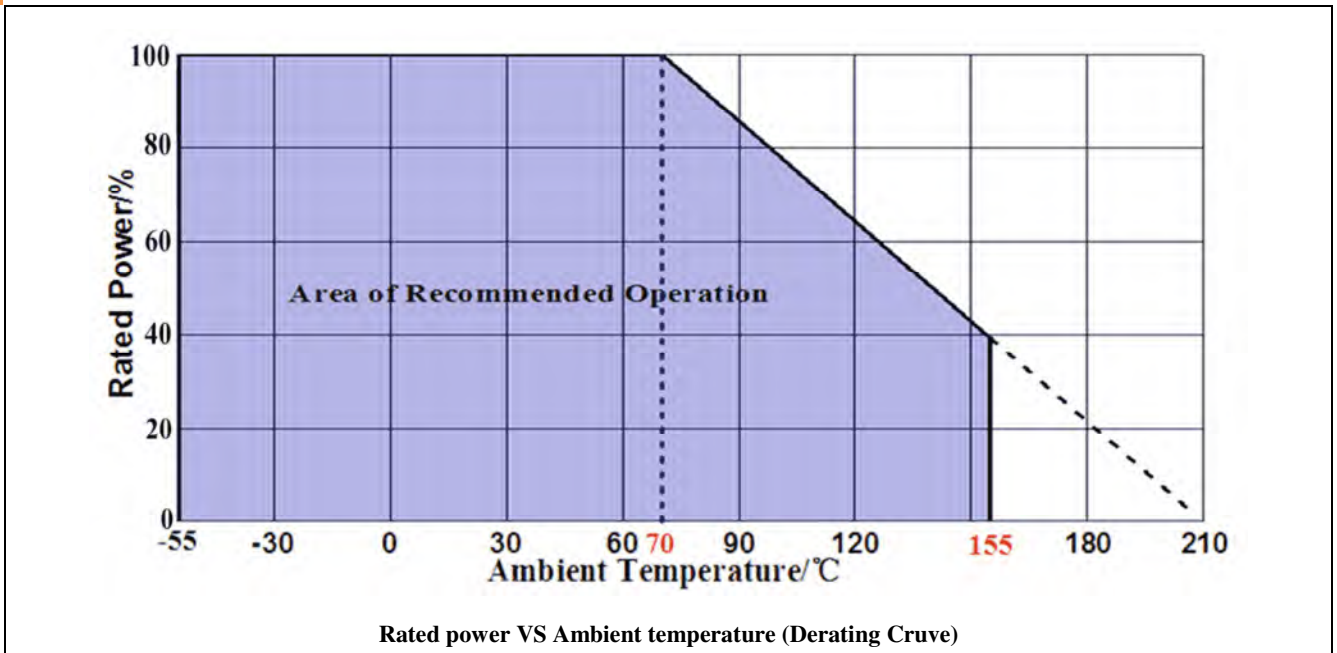
## Environmental Characteristics

### SMD Weld Resistor LRN - Environmental Characteristics

| Items                        | Requirement           | Test Methods  |
|------------------------------|-----------------------|---|
| Temperature Cycling          | ±0.5%                 | JESD22<br>1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test conclusion.   |
| High Temperature Exposure    | ±0.5%                 | MIL-STD-202<br>1000hrs. @T=125°C. Unpowered. Measurement at 24±2 hours after test conclusion.   |
| Moisture Resistance          | ±0.5%                 | MIL-STD-202<br>t=24 hrs/cycle.<br>Note: Steps 7a & 7b not required. Unpowered. Measurement at 24±2 hours after test conclusion.   |
| Biased Humidity              | ±0.5%                 | MIL-STD-202<br>1000hrs 85°C/85% RH.<br>Note: Specified conditions: 10% of operating power.<br>Measurement at 24±2 hours after test conclusion.  |
| Operational Life             | ±0.5%                 | MIL-STD-202<br>Condition D Steady State TA=125°C at rated power. Measurement at 24±2 hours after test conclusion.   |
| Solderability                | 95% Coverage Minimum. | J-STD-002C<br>245°C ±5°C, 5s+0.5s/-0.   |
| Resistance to Soldering Heat | ±0.5%                 | MIL-STD-202<br>260°C ±5°C, 10s±1s. Measurement at 24±2 hours after test conclusion.   |
| Short Time Overload          | ±0.5%                 | MIL-STD-202<br>5 × Rated power for 5s. Measurement at 24±2 hours after test conclusion.   |
| Thermal Shock                | ±1%                   | MIL-STD-202<br>-55°C/+125°C, 300 Cycles. Maximum transfer time 20s, Dwell time 15Min..  |
| Vibration                    | ±0.5%                 | MIL-STD-202<br>5g's for 20 Min., 12 cycles each of 3 orientations.<br>Note: Use 8"X5" PCB .031" thick 7" secure points on one long side and secure points at corners of opposite sides which parts mounted within 2 from any secure point. Test from 10-2000 Hz. Measurement at 24±2 hours after test conclusion. |

## ▶ Derating Curve

### LRN - Derating Curve

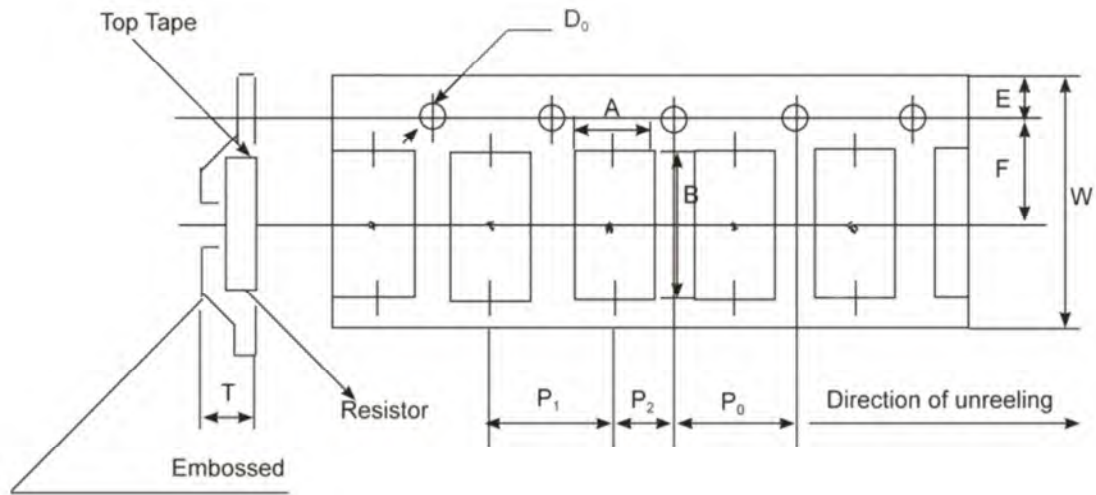




## ► Packaging

### LRN - Packaging

| Size | A/mm | B/mm | W/mm | E/mm | F/mm | P <sub>0</sub> /mm | P <sub>1</sub> /mm | P <sub>2</sub> /mm | D <sub>0</sub> /mm | T/mm | Quantity (EA) / pieces |
|------|------|------|------|------|------|--------------------|--------------------|--------------------|--------------------|------|------------------------|
| 4312 | 4.3  | 12.5 | 24   | 1.55 | 7.5  | 6                  | 12                 | 12                 | 1.50               | 3.8  | 2000                   |
| 4320 | 7    | 12.5 | 24   | 1.55 | 11.2 | 6                  | 12                 | 12                 | 1.50               | 3.8  | 1000                   |



LRN - Embossed Plastic Tape Specifications

## Order Codes

### SMD Large Current Weld Precision Shunts LRN - Order Code

| LRN         | 4         |    | M        |          | R003                    |                 | J             |         |
|-------------|-----------|----|----------|----------|-------------------------|-----------------|---------------|---------|
| Part Number | Power (W) |    | Material |          | Resistance ( $\Omega$ ) |                 | Tolerance (%) |         |
| LRN         | 4         | 4W | M        | Manganin | 0m50                    | 0.0005 $\Omega$ | J             | $\pm 5$ |
|             | 7         | 7W | K        | Kamar    | R002                    | 0.002 $\Omega$  | G             | $\pm 2$ |
|             |           |    |          |          | R003                    | 0.003 $\Omega$  | F             | $\pm 1$ |
|             |           |    |          |          | R010                    | 0.01 $\Omega$   |               |         |
|             |           |    |          |          | R030                    | 0.03 $\Omega$   |               |         |



# Current Sensing Metal Chip Resistors (CSM)

## ▶ Product Introduction

### New Ultra-low Ohmic Chip Resistors for Current Detection in power electronic systems.

#### Features :

- RoHs compliant and halogen free.
- High precision current sensing and voltage division.
- High power rating in small size. Excellent long term stability.
- Metal foil construction low Resistance TCR/Inductance/EMF (only for MnCu).

#### Applications :

- Charger, Measuring instrument. Switching Power Supply.
- Battery Management System. Power Management Applications.
- DC-DC Converter, Adaptor, Voltage Regulation Module (VRM).
- Battery Pack, Over Current Protection in Audio Applications.

Current sense resistors are a rapidly evolving technology that focuses on regulating and monitoring power from the power supply to the end equipment.

In addition, current sensing resistors based on Token (CSM) metal alloys are capable of handling higher inrush currents, have better TCR capability, and generally do not suffer from differences in thermal expansion from the PCB. Metal alloy based resistors are a cost-effective solution compared to competing technologies including Hall effect sensors, magnetoresistive sensors and current transformers.

Token (CSM) provides high performance and reliability over the entire operating temperature range, with a small enclosure size and high power rating compared to standard current sense resistors. Resistance value starts at 1mΩ and goes to 700mΩ, applications include switches and DC-DC converters, battery packs, chargers, adapters, overcurrent protection in audio applications, power management applications, LED drivers, motor control, electric Tools and power amplifiers.

Ultra low resistance metal chip resistors (CSM) are SMD devices designed for current sensing circuits in power electronics systems. The metal alloy construction ensures high reliability and high performance with a very low and stable TCR (50ppm, 75ppm, 100ppm) value. The small chip size provides high power ratings from 0.5W to 5W and operates from -55°C to +155°C temperature. Accuracy tolerances are ±0.5% and ±1%.

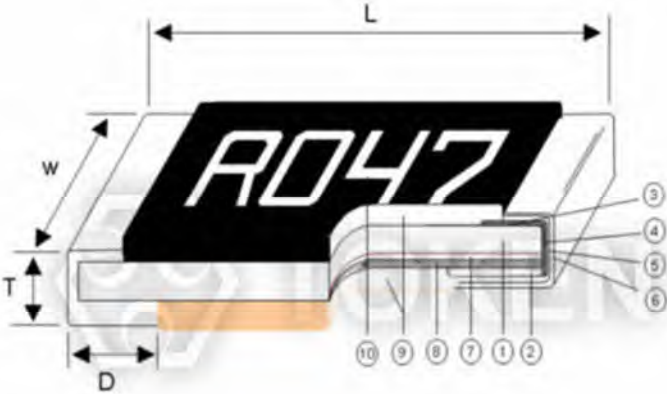
There are many options of popular industry sizes: 0603, 0805, 1206, 2010, 2512, 3921, 4527, 0508, 0612, 0815, 1225, and 2139. 5K pcs per reel in smaller sizes 0603, 0805, 1206, 0508, and 0612. 4K pcs per reel for 2010, 2512, 0815, and 1225. 2K pcs per reel for 2139.

Ultra-low ohmic chip resistors (CSM) for current detection meet RoHS standards and lead-free requirements, please link to Token official website "[Current Sense Resistors](#)". Contact us with your specific needs.



## ► Dimensions

### CSM - Construction & Dimensions

|  |                          |                       | ①                     | Alumina Substrate | ⑥         | External Electrode |
|---|--------------------------|-----------------------|-----------------------|-------------------|-----------|--------------------|
|   |                          |                       | ②                     | Bottom Electrode  | ⑦         | Adhesive           |
| <p style="text-align: center;">Surface Mount (CSM) Construction</p>               |                          |                       | ③                     | Top Electrode     | ⑧         | Resistor Layer     |
|   |                          |                       | ④                     | Edge Electrode    | ⑨         | Primary Overcoat   |
|   |                          |                       | ⑤                     | Barrier Layer     | ⑩         | Marking            |
| Type  | Power Rating at 70°C (W) | Resistance Range (mΩ) | Dimensions (Unit: mm) |                   |           |                    |
|   |                          |                       | L                     | W                 | T         | D                  |
| CSM0603   | 0.5                      | 5                     | 1.60±0.25             | 0.80±0.25         | 0.65±0.20 | 0.50±0.20          |
|   |                          | 6~100                 |                       |                   |           | 0.40±0.20          |
| CSM0805   | 0.75                     | 4~270                 | 2.00±0.25             | 1.20±0.25         | 0.65±0.20 | 0.50±0.20          |
| CSM1206   | 1                        | 4~700                 | 3.20±0.25             | 1.60±0.25         | 0.65±0.20 | 0.68±0.30          |
| CSM2010   | 1.5                      | 2~3                   | 5.08±0.25             | 2.54±0.25         | 0.65±0.20 | 2.10±0.30          |
|   |                          | 4~500                 |                       |                   |           | 0.70±0.30          |
| CSM2512   | 2                        | 2                     | 6.40±0.30             | 3.20±0.30         | 0.75±0.20 | 1.65±0.30          |
|   |                          | 3                     |                       |                   |           | 1.65±0.30          |
|   |                          | 4~560                 |                       |                   |           | 1.05±0.30          |
| CSM3921   | 4                        | 10~50                 | 11.10±0.30            | 5.10±0.30         | 0.65±0.30 | 2.36±0.30          |
| CSM4527   | 5                        | 10~50                 | 11.60±1.0             | 7.10±1.0          | 0.65±0.30 | 2.70±0.40          |
| CSM0508   | 1                        | 1~100                 | 1.35±0.20             | 2.10±0.20         | 0.65±0.20 | 0.43±0.20          |
| CSM0612   | 1.5                      | 1                     | 1.60±0.25             | 3.20±0.25         | 0.65±0.20 | 0.50±0.30          |
|   |                          | 2~100                 |                       |                   |           | 0.40±0.20          |
| CSM0815   | 2                        | 1~20                  | 2.20±0.20             | 3.80±0.20         | 0.65±0.20 | 0.61±0.20          |
| CSM1225   | 3                        | 1~100                 | 3.20±0.30             | 6.40±0.30         | 0.65±0.20 | 0.60±0.20          |
| CSM2139   | 5                        | 1~100                 | 5.10±0.40             | 11.10±0.30        | 0.65±0.30 | 0.90±0.30          |

## Electrical Characteristics

### CSM - Electrical Characteristics

| Type    | Max. Rating Power (W) | Max. Rating Current (A)* | Max. Overload Current (A) | Resistance Range (mΩ)* |         | TCR (ppm/°C) | Material            |
|---------|-----------------------|--------------------------|---------------------------|------------------------|---------|--------------|---------------------|
|         |                       |                          |                           | D (±0.5%)              | F (±1%) |              |                     |
| CSM0603 | 0.5                   | 10                       | 15.81                     | -                      | 5~9     | ±75          | R005~R049: MnCu     |
|         |                       | 7.07                     | 11.18                     | 10~100                 |         | ±50          | R050~R100: Cu Alloy |
| CSM0805 | 0.75                  | 13.69                    | 21.65                     | -                      | 4~9     | ±75          | R004~R049: MnCu     |
|         |                       | 8.66                     | 13.69                     | 10~270                 |         | ±50          | R050~R270: Cu Alloy |
| CSM1206 | 1                     | 15.81                    | 25                        | -                      | 4~9     | ±75          | R004~R049: MnCu     |
|         |                       | 10                       | 15.81                     | 10~700                 |         | ±50          | R050~R700: Cu Alloy |
| CSM2010 | 1.5                   | 27.38                    | 43.30                     | -                      | 2~9     | ±100         | R002~R500: Cu Alloy |
|         |                       | 12.24                    | 19.36                     | 10~500                 |         | ±50          |                     |
| CSM2512 | 2                     | 31.62                    | 50                        | -                      | 2~9     | ±75          | R002~R049: MnCu     |
|         |                       | 14.14                    | 22.36                     | 10~560                 |         | ±50          | R050~R560: Cu Alloy |
| CSM3921 | 4                     | 20                       | 31.62                     | 10~50                  |         | ±50          | R010~R050: Cu Alloy |
| CSM4527 | 5                     | 22.36                    | 35.35                     | 10~50                  |         | ±50          | R010~R050: Cu Alloy |
| CSM0508 | 1                     | 31.62                    | 50                        | -                      | 1~9     | ±100         | R001~R009: MnCu     |
|         |                       | 10                       | 15.81                     | 10~100                 |         | ±50          | R010~R100: Cu Alloy |
| CSM0612 | 1.5                   | 38.72                    | 61.23                     | -                      | 1~9     | ±100         | R001~R009: MnCu     |
|         |                       | 12.24                    | 19.36                     | 10~100                 |         | ±50          | R010~R100: Cu Alloy |
| CSM0815 | 2                     | 44.72                    | 70.71                     | -                      | 1~9     | ±100         | R001~R020: Cu Alloy |
|         |                       | 14.14                    | 22.36                     | 10~20                  |         | ±50          |                     |
| CSM1225 | 3                     | 54.77                    | 86.60                     | -                      | 1~9     | ±100         | R001~R020: MnCu     |
|         |                       | 17.32                    | 27.38                     | 10~100                 |         | ±50          | R021~R100: Cu Alloy |
| CSM2139 | 5                     | 111.80                   | 70.71                     | -                      | 1~9     | ±100         | R001~R020: MnCu     |
|         |                       | 22.36                    | 35.35                     | 10~100                 |         | ±50          | R021~R100: Cu Alloy |

\* Operating Temperature -55°C ~ +155°C





## ► Environmental Characteristics

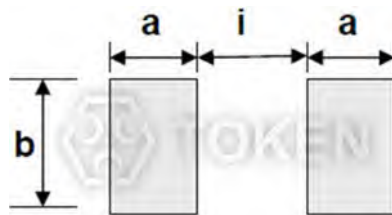
### CSM - Environmental Characteristics

| Item  | Specification      | Test Method  |
|---|--------------------|--|
| Temperature Coefficient of Resistance (T.C.R) | As Spec.           | JIS-C-5201-1 4.8<br>IEC-60115-1 4.8<br>-55°C ~ +125°C, 25°C is the reference temperature.  |
| Short Time Overload                           | ±(1.0% + 0.5mΩ)    | JIS-C-5201-1 4.13<br>IEC 60115-1 4.13<br>RCWV*2.5 or Max Overloading Voltage 5sec.   |
| Solderability                                 | 95% Min. coverage. | JIS-C-5201-1 4.17<br>IEC-60115-1 4.17<br>245±5°C for 3 seconds.  |
| Resistance to Soldering Heat                  | ±(1.0% + 0.5mΩ)    | JIS-C-5201-1 4.18<br>IEC-60115-1 4.18<br>260±5°C for 10 seconds.   |
| Temperature Cycling                           | ±(1.0% + 0.5mΩ)    | JIS-C-5201-1 4.19<br>IEC-60115-1 4.19<br>-55°C to +155°C, 100 cycles.  |
| Dry Heat                                      | ±(1.0% + 0.5mΩ)    | JIS-C-5201-1 4.23<br>IEC-60115-1 4.23.2<br>At +155°C for 1000 Hrs.   |
| Damp Heat with Load                           | ±(2.0% + 0.5mΩ)    | JIS-C-5201-1 4.24<br>IEC-60115-1 4.24<br>40±2°C, 90~95% R.H., load with rated current for 1000 Hrs. with 1.5 Hrs. "ON" and 0.5 Hrs. "OFF". |
| Endurance                                     | ±(2.0% + 0.5mΩ)    | JIS-C-5201-1 4.25<br>IEC-60115-1 4.25.1<br>70±2°C, load with rated current for 1000 Hrs. with 1.5 Hrs. "ON" and 0.5 Hrs. "OFF".            |
| Bending Strength                              | ±(1.0% + 0.5mΩ)    | JIS-C-5201-1 4.33<br>IEC-60115-1 4.33<br>Bending once for 5 seconds with 2mm .   |

## Derating Curve

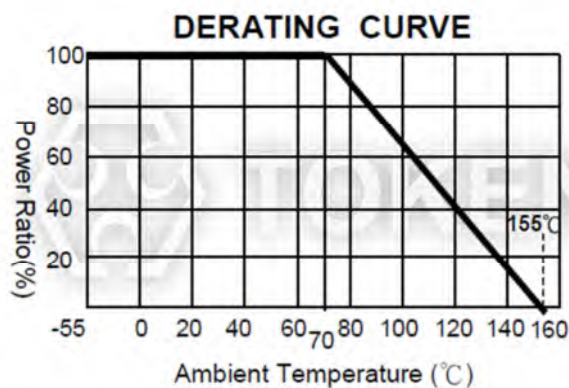
### CSM - Recommend Land Pattern

| Type    | Maximum Power Rating (Watts) | Resistance Range (mΩ) | Dimensions (mm) |       |      |
|---------|------------------------------|-----------------------|-----------------|-------|------|
|         |                              |                       | a               | b     | i    |
| CSM0603 | 0.5                          | 5                     | 1.35            | 0.92  | 0.50 |
|         |                              | 6~100                 | 1.30            | 0.92  | 0.60 |
| CSM0805 | 0.75                         | 4~270                 | 1.40            | 1.44  | 0.80 |
| CSM1206 | 1                            | 4~700                 | 1.80            | 1.84  | 1.20 |
| CSM2010 | 1.5                          | 2~3                   | 3.65            | 2.88  | 0.70 |
|         |                              | 4~500                 | 2.65            | 2.88  | 2.70 |
| CSM2512 | 2                            | 2~3                   | 3.85            | 3.57  | 1.60 |
|         |                              | 4~560                 | 3.10            | 3.57  | 3.10 |
| CSM3921 | 4                            | 10~50                 | 4.50            | 5.75  | 5.00 |
| CSM4527 | 5                            | 10~50                 | 4.65            | 8.05  | 5.20 |
| CSM0508 | 1                            | 1~100                 | 1.10            | 2.30  | 0.60 |
| CSM0612 | 1.5                          | 1                     | 1.35            | 3.68  | 0.50 |
|         |                              | 2~100                 | 1.30            | 3.68  | 0.60 |
| CSM0815 | 2                            | 1~20                  | 2.40            | 4.26  | 0.70 |
| CSM1225 | 3                            | 1~100                 | 2.35            | 7.25  | 1.40 |
| CSM2139 | 5                            | 1~100                 | 2.80            | 12.65 | 2.40 |



(CSM) Recommend Land Pattern

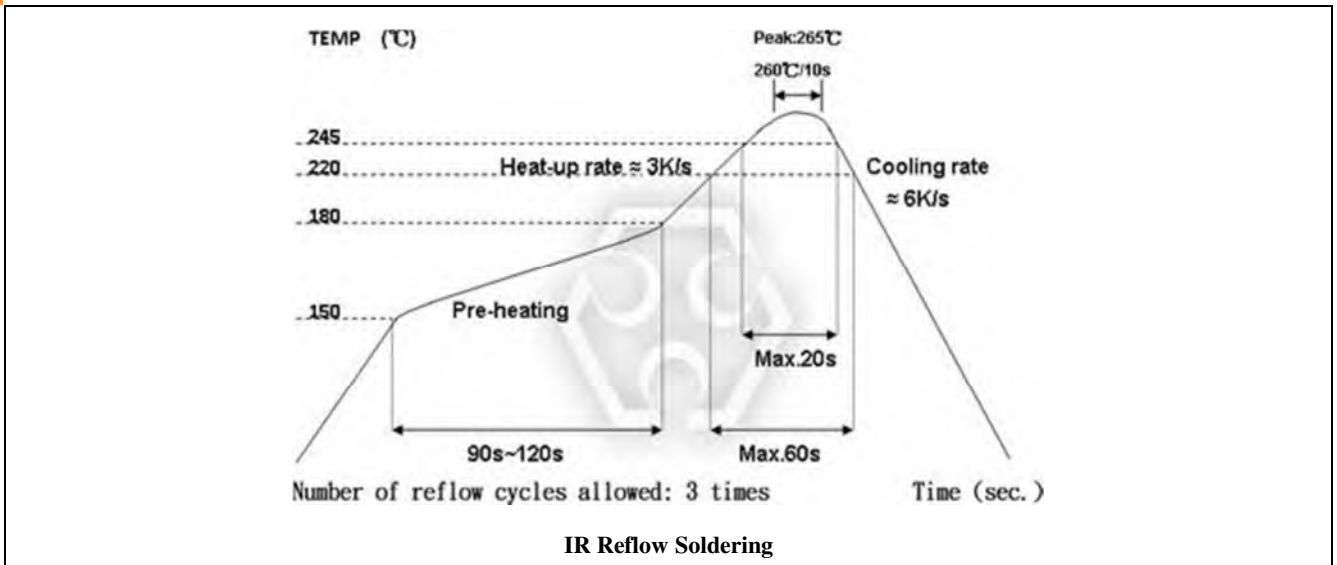
### CSM - Derating Curve



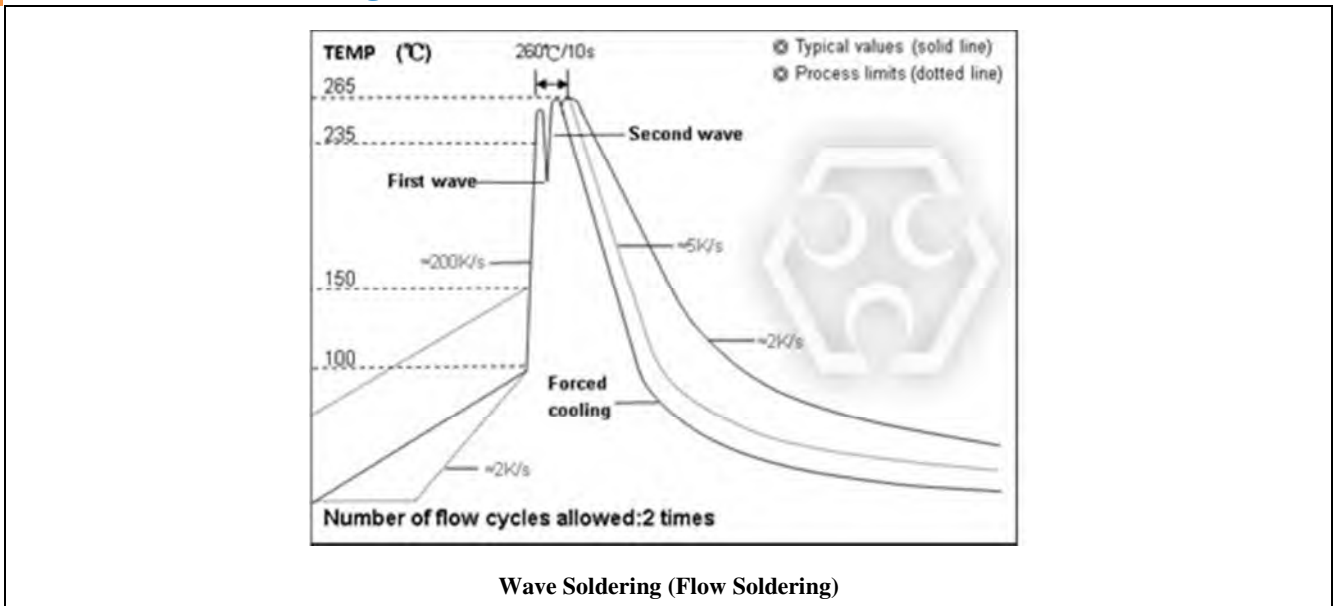
Rated power VS Ambient temperature (Power Derating Curve)

## Soldering

### CSM - Reflow Soldering



### CSM - Wave Soldering



**Remark :**

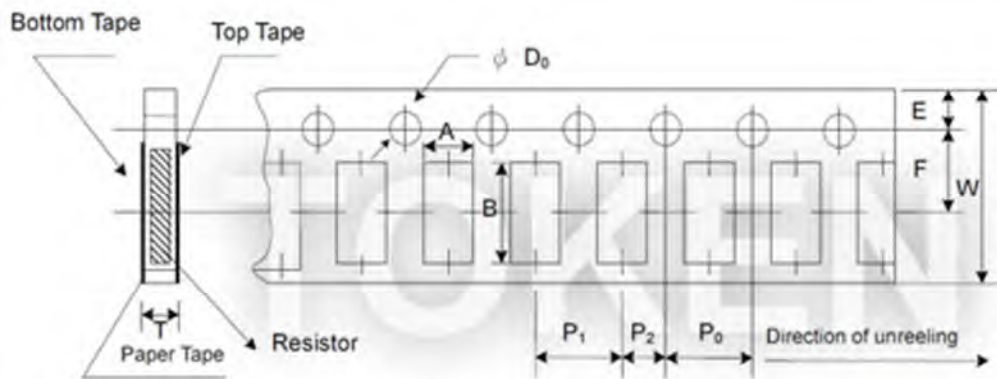
- Time of IR reflow soldering at maximum temperature point 260°C :10s.
- Time of wave soldering at maximum temperature point 260°C :10s.
- Time of soldering iron at maximum temperature point 410°C :5s.



## ► Packaging

### CSM - Paper Tape Specifications

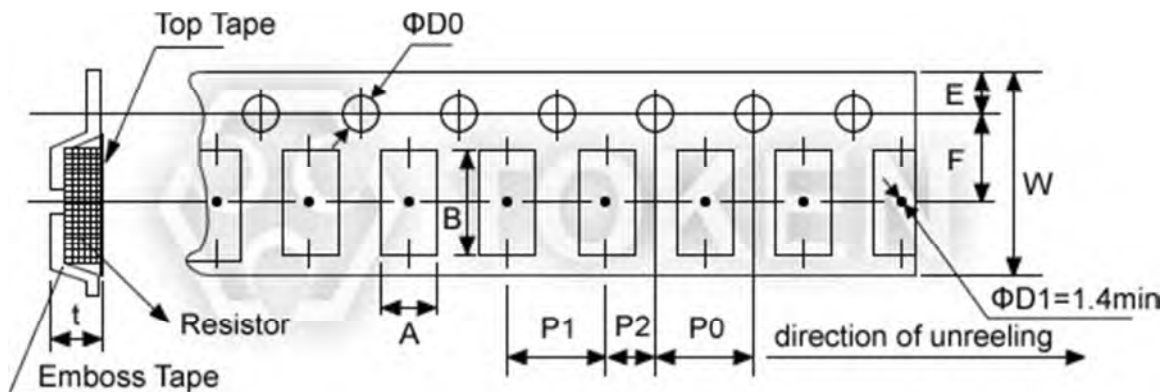
| Type    | A(mm)     | B(mm)     | W(mm)     | E(mm)     | F(mm)     | P0(mm)   | P1(mm)    | P2(mm)    | ΦD0(mm)     | T(mm)     |
|---------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-------------|-----------|
| CSM0603 | 1.18±0.20 | 1.98±0.20 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.75±0.20 |
| CSM0805 | 1.68±0.20 | 2.38±0.20 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.87±0.20 |
| CSM0508 | 1.68±0.20 | 2.38±0.20 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.87±0.20 |
| CSM1206 | 2.05±0.20 | 3.65±0.20 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.87±0.20 |
| CSM0612 | 2.05±0.20 | 3.65±0.20 | 8.00±0.30 | 1.75±0.10 | 3.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.87±0.20 |



Paper Tape Specifications

### Embossed Plastic Tape Specifications

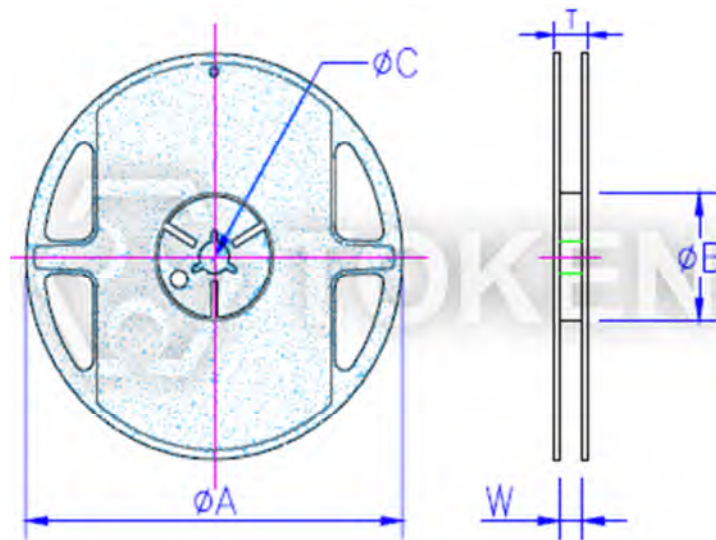
| Type    | A(mm)     | B(mm)     | W(mm)     | E(mm)     | F(mm)     | P0(mm)   | P1(mm)    | P2(mm)    | ΦD0(mm)     | T(mm)     |
|---------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-------------|-----------|
| CSM1508 | 2.40±0.20 | 4.10±0.20 | 12.0±0.30 | 1.75±0.10 | 5.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.75±0.20 |
| CSM2010 | 2.85±0.20 | 5.45±0.20 | 12.0±0.30 | 1.75±0.10 | 5.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.80±0.20 |
| CSM2512 | 3.40±0.20 | 6.75±0.20 | 12.0±0.30 | 1.75±0.10 | 5.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 1.00±0.20 |
| CSM1225 | 3.40±0.20 | 6.75±0.20 | 12.0±0.30 | 1.75±0.10 | 5.50±0.10 | 4.0±0.10 | 4.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 1.00±0.20 |
| CSM3921 | 5.50±0.20 | 11.5±0.20 | 24.0±0.30 | 1.75±0.10 | 11.5±0.10 | 4.0±0.10 | 8.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.90±0.20 |
| CSM2139 | 5.50±0.20 | 11.5±0.20 | 24.0±0.30 | 1.75±0.10 | 11.5±0.10 | 4.0±0.10 | 8.00±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.90±0.20 |
| CSM4527 | 7.50±0.20 | 12.0±0.20 | 24.0±0.30 | 1.75±0.10 | 11.5±0.10 | 4.0±0.10 | 12.0±0.10 | 2.00±0.10 | 1.50+0.1,-0 | 0.90±0.20 |



Paper Tape Specifications

## Reel Specifications and Packaging Quantity

| Type    | Packaging Quantity | Tape width | Reel Diameter | ΦA(mm)  | ΦB(mm) | ΦC(mm)   | W(mm)    | T(mm)    |
|---------|--------------------|------------|---------------|---------|--------|----------|----------|----------|
| CSM0603 | 5000Pcs            | 8mm        | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 9.0±1.0  | 11.4±1.0 |
| CSM0805 | 5000Pcs            | 8mm        | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 9.0±1.0  | 11.4±1.0 |
| CSM1206 | 5000Pcs            | 8mm        | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 9.0±1.0  | 11.4±1.0 |
| CSM2010 | 4000Pcs            | 12mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 13.0±1.0 | 15.5±1.0 |
| CSM2512 | 4000Pcs            | 12mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 13.0±1.0 | 15.5±1.0 |
| CSM3921 | 2000Pcs            | 24mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 24.5±1.0 | 26.5±1.0 |
| CSM4527 | 1000Pcs            | 24mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 24.5±1.0 | 26.5±1.0 |
| CSM0508 | 5000Pcs            | 8mm        | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 9.0±1.0  | 11.4±1.0 |
| CSM0612 | 5000Pcs            | 8mm        | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 9.0±1.0  | 11.4±1.0 |
| CSM0815 | 4000Pcs            | 12mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 13.0±1.0 | 15.5±1.0 |
| CSM1225 | 4000Pcs            | 12mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 13.0±1.0 | 15.5±1.0 |
| CSM2139 | 2000Pcs            | 24mm       | 7inch         | 178±5.0 | 60±2.0 | 13.0±1.0 | 24.5±1.0 | 26.5±1.0 |



Reel Dimensions



## Order Codes

### Order Codes (CSM)

| CSM          | 0603                 |            | F                        | TR      |             | D             | U               | R015 |                | M |          |  |
|--------------|----------------------|------------|--------------------------|---------|-------------|---------------|-----------------|------|----------------|---|----------|--|
| Product Type | Dimensions (L×W)(mm) |            | Resistance Tolerance (%) | Package |             | TCR (PPM/°C)  | Power Rating(W) |      | Resistance (Ω) |   | Marking  |  |
| CSM          |                      |            | D ±0.5%                  | TR      | Taping Reel | D ±50 PPM/°C  | W 1/8W          | R015 | 0.015Ω         | M | MnCu     |  |
|              | 0805                 | 2.00x1.20  | F ±1%                    |         |             | W ±75 PPM/°C  | V 1/4W          | R050 | 0.05Ω          | C | Cu Alloy |  |
|              | 1206                 | 3.20x1.60  |                          |         |             | E ±100 PPM/°C | O 1/3W          | R010 | 0.01Ω          |   |          |  |
|              | 2010                 | 5.08x2.54  |                          |         |             |               | U 1/2W          |      |                |   |          |  |
|              | 2512                 | 6.40x3.20  |                          |         |             |               | Q 3/4W          |      |                |   |          |  |
|              | 3921                 | 11.10x5.10 |                          |         |             |               | T 1W            |      |                |   |          |  |
|              | 4527                 | 11.60x7.10 |                          |         |             |               | A 1.5W          |      |                |   |          |  |
|              | 0508                 | 1.35x2.10  |                          |         |             |               | S 2W            |      |                |   |          |  |
|              | 0612                 | 1.60x3.20  |                          |         |             |               | R 3W            |      |                |   |          |  |
|              | 0815                 | 2.20x3.80  |                          |         |             |               | 4 4W            |      |                |   |          |  |
|              | 1225                 | 3.20x6.40  |                          |         |             |               | 5 5W            |      |                |   |          |  |
|              | 2139                 | 5.10x11.10 |                          |         |             |               |                 |      |                |   |          |  |



## General Information

### Applications of Current Detecting Components

Token's TCS and CS Series unique form factor provides automotive designers with several advantages. Both TCS and CS Series are ideal for applications involving window lift motors, fuel pump systems, seat belt pretensioners, and pulsewidth modulator feedback.

The wider resistive element and lower resistance enables higher current to pass through the device. Token's LRC ultra low ohmic metal strip chip series provides the inherent ability to flex slightly and offers stress relief during extreme temperature cycling on typical or metal substrates. This LRC series is suitable for switch power supply applications (DC-DC Converter, Charger, Adaptor) and power management of monitor.

The open air design of bare element resistor LRA and LRB Series provide a far cooler operation by allowing more air flow under the resistive element to keep excess heat from being transmitted to the PC board. They are suitable for high power AC/DC detection of power supply circuit.

Token axial moulded BWL series provides power rating up to 10 watts and lower resistance  $0.005\Omega$ , is ideal for all types of current sensing applications including switching and linear power supplies, instruments and power amplifiers..

### Your Current Options - Token Current Sense

As the world becomes more and more technology-driven, the uses for current sensing components will continue to increase. The need for even lower resistance value ranges is already becoming evident, as is the need for these resistors to handle more power. The industry-wide trend is the emergence of smaller and smaller products.

Token Electronics offers a wide variety of current sensing products from the industry to military standards, such as current sense in Thin-Film / Thick-Film Technology, Bare Element Resistors, and Open Air Shunts. This enables Token to present an astounding number of possible solutions for any circuit design needs.

### Cross reference - Current-Sensing Chips

| Token                            | Yageo  | Vishay              | Rohm    | KOA           | Cyntec  | TT/IRC              | Susumu  | Features       |
|----------------------------------|--------|---------------------|---------|---------------|---------|---------------------|---------|----------------|
| CS                               | RL/PT  | D..LR/<br>CRCW,RCWE | UCR     | SR73/<br>UR73 | RLT     | LRC,<br>LRF,<br>LVC | RLT     | Thick<br>Film  |
| LRC, LRP, LRM,<br>LRE, LREA, CSM | PR/PE  | WSL/WSLP            | PMR/PML | TLR           | RLT     | ULR,<br>LVC         | KRL, RL | Metal<br>Alloy |
| CS02                             | PT0402 | RCWE0402            | UCR01   | SR731E        | RLT0510 | LVC0402             | RLT0510 | Thick<br>Film  |
| CSM, LRE, LREA                   | PE0603 | WSL0603             | PMR03   | -             | RL0816  | -                   | -       | Metal<br>Foil  |
| CSM, LRE, LREA                   | PE0805 | WSL0805             | PMR10   | -             | RL1220  | -                   | -       | Metal<br>Foil  |
| CSM, LRE, LREA                   | PE4527 | WSR2/3/5            | -       | SL2/<br>SLN2  | -       | -                   | -       | Metal<br>Alloy |