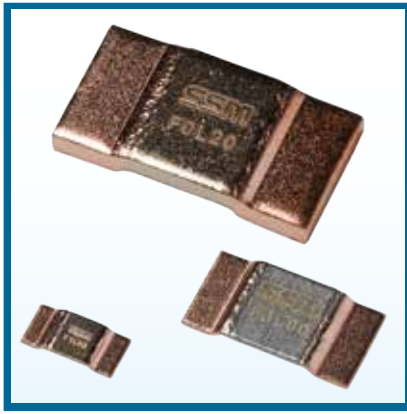




## High-Precision Low-TCR Alloy Current Sensing Resistors

### ■MSR series

AEC-Q200 Compliant

#### Features

- The MSR series is based on precision resistance alloy and welded with vacuum electron beam welding equipment to ensure its characteristics and reliability.
- Precision machining and uniform welding provide a minimum tolerance of  $\pm 0.5\%$  without trimming.
- The TCR achieves a minimum of 25ppm/ $^{\circ}\text{C}$  over a wide temperature range of  $-55^{\circ}\text{C}$  to  $170^{\circ}\text{C}$ .
- The "trim-free" technology avoids current loss and is free of hot spots.
- The thermoelectric power is extremely low and thermal fluctuations are minimized.

#### Applications

- Automotive Electronic
- Precision Power Supply
- Instrumentation
- Medical Equipment



### ◆Part numbering system

**MSRSF 2512 P - 5L00 - D 4P0**

Series code

Size : 2512, 3920, 5930

Temperature Coefficient of Resistance

Nominal resistance value

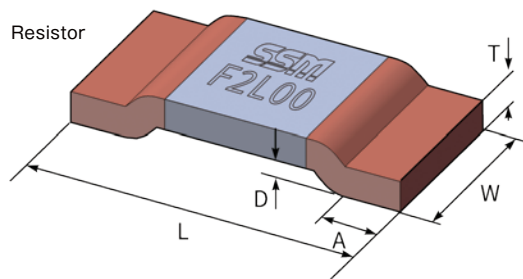
Resistance tolerance

Packaging : 4P0 (4,000)

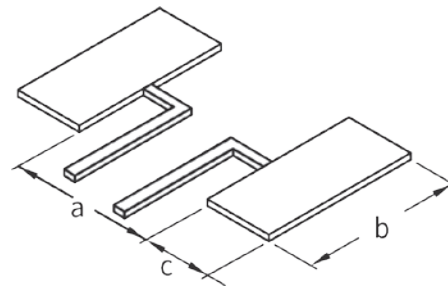
### ◆Electrical Specification

| Series | Size inch.<br>(mm) | Resistance<br>Value | Power  | Max.<br>Current | Operating<br>Temperature | TCR<br>(20°C/R <sub>ref</sub> ) | Tolerance                 | Thermal<br>Resistance | PKG.       |            |
|--------|--------------------|---------------------|--------|-----------------|--------------------------|---------------------------------|---------------------------|-----------------------|------------|------------|
| MSRSF  | 2512<br>(6432)     | 3 mΩ                | 4 W    | 36 A            | -55~170 °C               | ±25 ppm/°C                      | ± 0.5 %<br>± 1 %<br>± 5 % | 19.7 °C/W             | 4,000 pcs. |            |
|        |                    | 5 mΩ                | 2.5 W  | 22 A            |                          |                                 |                           | 31.1 °C/W             |            |            |
|        | 3920<br>(10052)    | 1 mΩ                | 8 W    | 89 A            |                          |                                 |                           | 7.8 °C/W              | 2,000 pcs. |            |
|        |                    | 2 mΩ                | 6 W    | 55 A            |                          |                                 |                           | 15.4 °C/W             |            |            |
|        |                    | 3 mΩ                | 5 W    | 41 A            |                          |                                 |                           | 23 °C/W               |            |            |
|        |                    | 4 mΩ                | 6 W    | 32 A            |                          |                                 |                           | 31.1 °C/W             |            |            |
|        |                    | 5 mΩ                | 5 W    | 25 A            |                          |                                 |                           | 38.4 °C/W             |            |            |
|        |                    | 5930<br>(15078)     | 1 mΩ   | 10 W            |                          |                                 |                           | 100 A                 |            | 6.4 °C/W   |
|        | 2 mΩ               |                     | 10 W   | 63 A            |                          |                                 |                           | 12.6 °C/W             |            |            |
|        | 3 mΩ               |                     | 10 W   | 45 A            |                          |                                 |                           | 19.1 °C/W             |            |            |
|        | MSRPF              | 2512<br>(6432)      | 1.5 mΩ | 5 W             |                          |                                 |                           | 57 A                  |            | -55~170 °C |
| 2 mΩ   |                    |                     | 5 W    | 50 A            | 13.4 °C/W                |                                 |                           |                       |            |            |
| 3 mΩ   |                    |                     | 4 W    | 36 A            | 19.8 °C/W                |                                 |                           |                       |            |            |
| 4 mΩ   |                    |                     | 3 W    | 27 A            | 26.9 °C/W                |                                 |                           |                       |            |            |
| 5 mΩ   |                    |                     | 2.5 W  | 22 A            | 33.6 °C/W                |                                 |                           |                       |            |            |
| MSREK  | 2512<br>(6432)     | 2 mΩ                | 5 W    | 50 A            | -55~170 °C               | ±100 ppm/°C                     | ± 0.5 %<br>± 1 %<br>± 5 % | 13.2 °C/W             | 4,000 pcs. |            |
|        |                    | 3 mΩ                | 4 W    | 36 A            |                          |                                 |                           | 19.8 °C/W             |            |            |
|        |                    | 4 mΩ                | 3 W    | 27 A            |                          |                                 |                           | 24.3 °C/W             |            |            |
|        |                    | 5 mΩ                | 2.5 W  | 22 A            |                          |                                 |                           | 31.1 °C/W             |            |            |
| MSREM  | 2512<br>(6432)     | 0.3 mΩ              | 6 W    | 140 A           | -55~170 °C               | ±200 ppm/°C                     | ± 0.5 %<br>± 1 %<br>± 5 % | 4.1 °C/W              | 4,000 pcs. |            |
|        |                    | 0.5 mΩ              | 6 W    | 109 A           |                          |                                 |                           | 5.1 °C/W              |            |            |
|        |                    | 1 mΩ                | 6 W    | 77 A            |                          |                                 |                           | 11.1 °C/W             |            |            |
| MSRPK  | 3920<br>(10052)    | 1 mΩ                | 8 W    | 89 A            | -55~170 °C               | ±50 pm/°C                       | ± 0.5 %<br>± 1 %<br>± 5 % | 7.6 °C/W              | 2,000 pcs. |            |
|        |                    | 2 mΩ                | 6 W    | 54 A            |                          |                                 |                           | 15.4 °C/W             |            |            |
|        |                    | 3 mΩ                | 5 W    | 40 A            |                          |                                 |                           | 23.1 °C/W             |            |            |
|        |                    | 4 mΩ                | 4 W    | 30 A            |                          |                                 |                           | 28.9 °C/W             |            |            |
|        |                    | 5 mΩ                | 3 W    | 24 A            |                          |                                 |                           | 36.5 °C/W             |            |            |
| MSRPM  | 3920<br>(10052)    | 0.2 mΩ              | 12 W   | 244 A           | -55~170 °C               | ±150 ppm/°C                     | ± 0.5 %<br>± 1 %<br>± 5 % | 3.6 °C/W              | 2,000 pcs. |            |
|        |                    | 0.3 mΩ              | 10 W   | 182 A           |                          | 3.8 °C/W                        |                           |                       |            |            |
|        |                    | 0.5 mΩ              | 9 W    | 134 A           |                          | 6.3 °C/W                        |                           |                       |            |            |
|        |                    | 1 mΩ                | 8 W    | 89 A            |                          | 12.6 °C/W                       |                           |                       |            |            |
|        | 5930<br>(15078)    | 0.2 mΩ              | 15 W   | 273 A           |                          | ±100 ppm/°C                     |                           | ± 1 %                 |            | 2.6 °C/W   |
|        |                    | 0.5 mΩ              | 10 W   | 142 A           |                          |                                 |                           | ± 5 %                 |            | 6.5 °C/W   |
|        |                    | 0.8 mΩ              | 9 W    | 105 A           |                          |                                 |                           | 9.3 °C/W              |            |            |
|        |                    | 1 mΩ                | 9 W    | 94 A            |                          |                                 |                           | 11.4 °C/W             |            |            |

## ◆ Dimensions



Solder Pad



Not following the recommended solder pad design can seriously affect the temperature coefficient measurement results and current sensing accuracy!

## ◆ Electrical Specification

| Series | Size inch.<br>(mm) | Resistance<br>Value | Unit:mm  |          |         |           |          |         |          |          |
|--------|--------------------|---------------------|----------|----------|---------|-----------|----------|---------|----------|----------|
|        |                    |                     | L        | W        | A       | T         | D        | a       | b        | c        |
| MSRSF  | 2512<br>(6432)     | 3 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.45±0.2  | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 5 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.27±0.15 | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        | 3920<br>(10052)    | 1 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 1.3±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 2 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.65±0.2  | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 3 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.45±0.2  | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 4 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.33±0.15 | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 5 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.27±0.15 | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        | 5930<br>(15078)    | 1 mΩ                | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 1.05±0.2  | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |
|        |                    | 2 mΩ                | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 0.53±0.2  | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |
|        |                    | 3 mΩ                | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 0.35±0.2  | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |
| MSRPF  | 2512<br>(6432)     | 1.5 mΩ              | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.90±0.2  | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 2 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.65±0.2  | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 3 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.45±0.2  | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 4 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.33±0.15 | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 5 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.27±0.15 | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
| MSREK  | 2512<br>(6432)     | 2 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.6±0.2   | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 3 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.4±0.2   | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 4 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.33±0.15 | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 5 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.25±0.15 | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
| MSREM  | 2512<br>(6432)     | 0.3 mΩ              | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 1.0±0.2   | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 0.5 mΩ              | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.9±0.2   | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
|        |                    | 1 mΩ                | 6.3±0.3  | 3.0±0.3  | 1.3±0.3 | 0.4±0.15  | 0.35±0.2 | 3.9±0.2 | 3.4±0.25 | 1.8±0.25 |
| MSRPF  | 3920<br>(10052)    | 1 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 1.3±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 2 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.6±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 3 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.4±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 4 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.33±0.15 | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 5 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.25±0.15 | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
| MSRPF  | 3920<br>(10052)    | 0.2 mΩ              | 10.0±0.3 | 5.2±0.3  | 1.8±0.3 | 1.4±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 0.3 mΩ              | 10.0±0.3 | 5.2±0.3  | 1.8±0.3 | 1.3±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 0.5 mΩ              | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.8±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        |                    | 1 mΩ                | 10.0±0.3 | 5.2±0.3  | 2.0±0.3 | 0.4±0.2   | 0.5±0.2  | 5.6±0.1 | 6.2±0.2  | 2.7±0.2  |
|        | 5930<br>(15078)    | 0.2 mΩ              | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 1.6±0.2   | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |
|        |                    | 0.5 mΩ              | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 0.65±0.2  | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |
|        |                    | 0.8 mΩ              | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 0.47±0.2  | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |
|        |                    | 1 mΩ                | 15.0±0.3 | 7.75±0.3 | 3.8±0.3 | 0.38±0.2  | 0.5±0.2  | 5.6±0.1 | 8.75±0.2 | 5.2±0.2  |

Metal Alloy Current Sensing Resistors

MSR series

## ◆ Part Number information

|                                                             |   |   |   |                      |   |   |   |                                                                                 |   |   |   |                              |   |   |   |                              |   |                                      |  |
|-------------------------------------------------------------|---|---|---|----------------------|---|---|---|---------------------------------------------------------------------------------|---|---|---|------------------------------|---|---|---|------------------------------|---|--------------------------------------|--|
| M                                                           | S | R | S | F                    | 2 | 5 | 1 | 2                                                                               | P | 5 | L | 0                            | 0 | F | 4 | P                            | 0 |                                      |  |
| Series<br>(4 digits)                                        |   |   |   | Size<br>(4 digits)   |   |   |   | TCR<br>(1 digits)                                                               |   |   |   | Resistance<br>(4 digits)     |   |   |   | Tolerance<br>(1 digits)      |   | Quantity<br>(3 digits)               |  |
| MSRSF<br>MSRPF<br>MSREK<br>MSREM<br>MSRPF<br>MSRPF<br>MSRPF |   |   |   | 2512<br>3920<br>5930 |   |   |   | P:±25 ppm/°C<br>Q:±50 ppm/°C<br>R:±100 ppm/°C<br>E:±150 ppm/°C<br>S:±200 ppm/°C |   |   |   | 5L00 = 5 mΩ<br>0L50 = 0.5 mΩ |   |   |   | D:±0.5 %<br>F:±1 %<br>J:±5 % |   | 2P0 = 2,000 pcs.<br>4P0 = 4,000 pcs. |  |

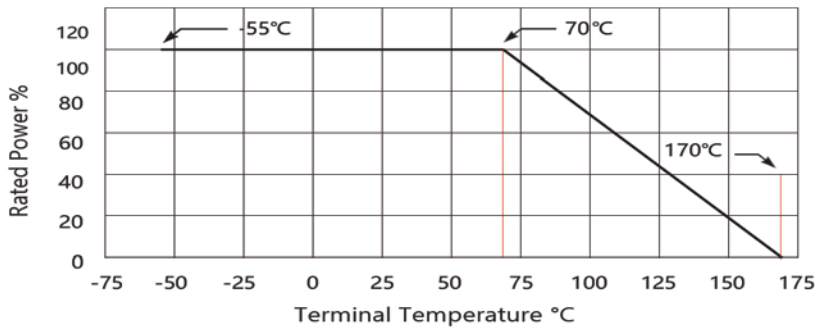
# High-Precision Low-TCR Alloy Current Sensing Resistors

## MSR series

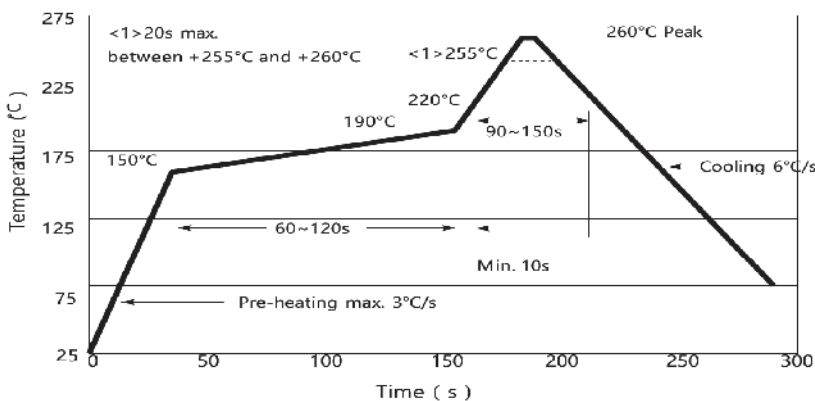
### Performance

| Test                      | Test Method                                                                                                                     | Standards                                  | Typical                                    | Max.                      |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------|---------------------------|
| High Temperature Storage  | 1000h@+170°C, unpowered                                                                                                         | AEC-Q200 TEST 3<br>MIL-STD-202 Method 108  | $\Delta R \pm \leq 0.5\%$                  | $\Delta R \leq \pm 1.0\%$ |
| Thermal Shock             | -55°C, 15min~ambient temperature<br><20s~+155°C, 15min, 1000 cycles                                                             | AEC-Q200 TEST 16<br>MIL-STD-202 Method 107 | $\Delta R \leq \pm 0.1\%$                  | $\Delta R \leq \pm 0.5\%$ |
| Bias Humidity             | +85°C, 85%RH, powered no less than<br>10% rated power for1000h                                                                  | AEC-Q200 TEST 7<br>MIL-STD-202 Method 103  | $\Delta R \leq \pm 0.2\%$                  | $\Delta R \leq \pm 0.5\%$ |
| Load Life                 | 2000h @ +70°C, rated power, 90min on,<br>30min off +70°C refers to terminal temperature                                         | AEC-Q200 TEST 8<br>MIL-STD-202 Method 108  | $\Delta R \leq \pm 0.5\%$                  | $\Delta R \leq \pm 1.0\%$ |
| Resistance to Solvent     | Immerse in solvent for 3 min and wipe 10 times.<br>Three cycles of three solvents.<br>Dry at ambient temperature after cleaning | AEC-Q200 TEST 12<br>MIL-STD-202 Method 215 | Clear marking.<br>No visible damage        |                           |
| Mechanical Shock          | Half Sine Wave, peak acceleration 100g's, pulse duration 6ms,<br>3 times in each of six directions, on three different axes     | AEC-Q200 TEST 13<br>MIL-STD-202 Method 213 | $\Delta R \leq \pm 0.01\%$                 | $\Delta R \leq \pm 0.2\%$ |
| Vibration                 | 10-2KHz, 5g's, 20min/cycle,<br>12 cycles in each directions of X Y Z                                                            | AEC-Q200 TEST 14<br>MIL-STD-202 Method 204 | $\Delta R \leq \pm 0.01\%$                 | $\Delta R \leq \pm 0.2\%$ |
| Resistance to Solder Heat | 260°C tin bath for 10s                                                                                                          | AEC-Q200 TEST 15<br>MIL-STD-202 Method 210 | $\Delta R \leq \pm 0.2\%$                  | $\Delta R \leq \pm 0.5\%$ |
| Solderability             | 245°C tin bath for 3s                                                                                                           | AEC-Q200 TEST 18<br>IEC 60115-1 4.17       | No visible damage.<br>95% minimum coverage |                           |
| TCR                       | 55°C and +170°C, +20d Ref.                                                                                                      | AEC-Q200 TEST 19<br>IEC 60115-1 4.8        | Within the<br>nominal TCR                  | $\Delta R \leq \pm 1.0\%$ |
| Substrate Bending         | 2mm. Duration: 60s.                                                                                                             | AEC-Q200 TEST 21<br>AEC-Q200-005           | $\Delta R \pm \leq 0.5\%$                  | $\Delta R \leq \pm 0.5\%$ |
| Short Time Overload       | 5x rated voltage, 5s                                                                                                            | IEC 60115-1 4.13                           | $\Delta R \pm \leq 0.5\%$                  | $\Delta R \leq \pm 0.5\%$ |
| Low Temperature Storage   | -55°C for 96h, unpowered                                                                                                        | IEC 60068-2-1                              | $\Delta R \pm \leq 0.5\%$                  | $\Delta R \leq \pm 0.5\%$ |
| Moisture Resistance       | Apply T=24 h/cycle, zero power,<br>method 7a and 7b are not required                                                            | MIL-STD-202 Method 106                     | $\Delta R \pm \leq 0.5\%$                  | $\Delta R \leq \pm 0.5\%$ |

### Derating Curve

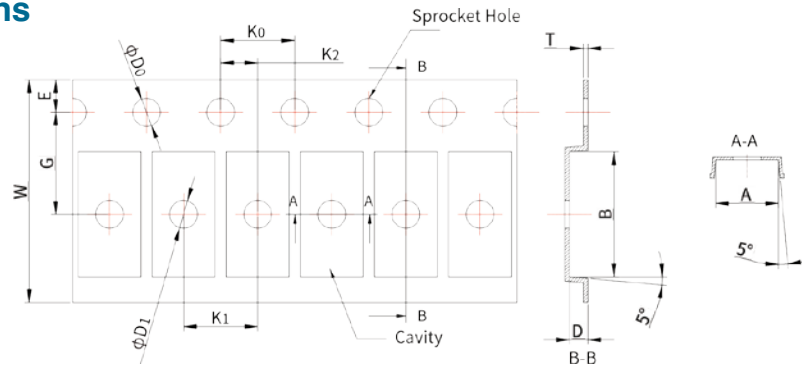


### Reflow Soldering Profile



Resistor Surface Temperature:  
Pre-Heat: +150°C+190°C,60~120sec.  
Reflow: Above +220°C,90~150sec.  
Applicable Solder Composition: Sn-Ag-Cu

## ◆Tape Specifications



## ◆Electrical Specification

| Series | Size (mm)    | Resistance Value | Unit:mm  |           |         |         |          |          |          |          |           |           |          |           |
|--------|--------------|------------------|----------|-----------|---------|---------|----------|----------|----------|----------|-----------|-----------|----------|-----------|
|        |              |                  | A        | B         | φDO     | φD1     | K0       | K1       | K2       | E        | G         | W         | D        | T         |
| MSRSF  | 2512 (6432)  | 3 mΩ             | 3.20±0.1 | 6.60±0.1  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.2 | 0.90±0.1 | 0.23±0.05 |
|        |              | 5 mΩ             | 3.20±0.1 | 6.50±0.1  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.2 | 0.73±0.1 | 0.23±0.05 |
|        | 3920 (10052) | 1 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 2.1±0.1  | 0.3±0.05  |
|        |              | 2 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 1.5±0.1  | 0.3±0.05  |
|        |              | 3 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 1.5±0.1  | 0.3±0.05  |
|        |              | 4 mΩ             | 5.65±0.2 | 10.41±0.2 | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 1.14±0.1 | 0.4±0.05  |
|        |              | 5 mΩ             | 5.65±0.2 | 10.41±0.2 | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 1.14±0.1 | 0.4±0.05  |
|        | 5930 (15078) | 1 mΩ             | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 4.0±0.1  | 2.0±0.1  | 1.75±0.1 | 11.5±0.05 | 24.0±0.3  | 1.9±0.1  | 0.3±0.05  |
|        |              | 2 mΩ             | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 4.0±0.1  | 2.0±0.1  | 1.75±0.1 | 11.5±0.05 | 24.0±0.3  | 1.3±0.1  | 0.3±0.05  |
|        |              | 3 mΩ             | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 4.0±0.1  | 2.0±0.1  | 1.75±0.1 | 11.5±0.05 | 24.0±0.3  | 1.3±0.1  | 0.3±0.05  |
| MSRPF  | 2512 (6432)  | 1.5 mΩ           | 3.30±0.2 | 6.60±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 1.50±0.1 | 0.25±0.05 |
|        |              | 2 mΩ             | 3.40±0.2 | 6.75±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 1.00±0.1 | 0.23±0.05 |
|        |              | 3 mΩ             | 3.30±0.2 | 6.60±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 0.90±0.1 | 0.23±0.05 |
|        |              | 4 mΩ             | 3.20±0.2 | 6.50±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 0.73±0.1 | 0.23±0.05 |
|        |              | 5 mΩ             | 3.20±0.2 | 6.50±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 0.73±0.1 | 0.23±0.05 |
| MSREK  | 2512 (6432)  | 2 mΩ             | 3.40±0.2 | 6.75±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.2 | 1.00±0.1 | 0.23±0.05 |
|        |              | 3 mΩ             | 3.30±0.2 | 6.60±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.2 | 0.90±0.1 | 0.23±0.05 |
|        |              | 4 mΩ             | 3.20±0.2 | 6.50±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.2 | 0.73±0.1 | 0.23±0.05 |
|        |              | 5 mΩ             | 3.20±0.2 | 6.50±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.2 | 0.73±0.1 | 0.23±0.05 |
| MSREM  | 2512 (6432)  | 0.3 mΩ           | 3.30±0.2 | 6.60±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 1.50±0.1 | 0.25±0.05 |
|        |              | 0.5 mΩ           | 3.30±0.2 | 6.60±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 1.50±0.1 | 0.25±0.05 |
|        |              | 1 mΩ             | 3.30±0.2 | 6.60±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 4.00±0.1 | 2.00±0.1 | 1.75±0.1 | 5.50±0.05 | 12.00±0.3 | 0.9±0.1  | 0.25±0.05 |
| MSRPF  | 3920 (10052) | 1 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 8.0±0.1  | 2.0±0.1  | 1.75±0.1 | 7.5±0.1   | 16.0±0.3  | 2.1±0.1  | 0.3±0.05  |
|        |              | 2 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 8.0±0.1  | 2.0±0.1  | 1.75±0.1 | 7.5±0.1   | 16.0±0.3  | 1.5±0.1  | 0.3±0.05  |
|        |              | 3 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 8.0±0.1  | 2.0±0.1  | 1.75±0.1 | 7.5±0.1   | 16.0±0.3  | 1.5±0.1  | 0.3±0.05  |
|        |              | 4 mΩ             | 5.65±0.2 | 10.41±0.2 | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 8.0±0.1  | 2.0±0.1  | 1.75±0.1 | 7.5±0.1   | 16.0±0.3  | 1.14±0.1 | 0.4±0.05  |
|        |              | 5 mΩ             | 5.65±0.2 | 10.41±0.2 | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 8.0±0.1  | 2.0±0.1  | 1.75±0.1 | 7.5±0.1   | 16.0±0.3  | 1.14±0.1 | 0.4±0.05  |
| MSRPF  | 3920 (10052) | 0.2 mΩ           | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 2.7±0.1  | 0.3±0.05  |
|        |              | 0.3 mΩ           | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 2.7±0.1  | 0.3±0.05  |
|        |              | 0.5 mΩ           | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 1.5±0.1  | 0.3±0.05  |
|        |              | 1 mΩ             | 5.5±0.2  | 10.5±0.2  | 1.5±0.1 | 1.5±0.1 | 4.00±0.1 | 8.00±0.1 | 2.00±0.1 | 1.75±0.1 | 7.50±0.1  | 16.00±0.3 | 1.5±0.1  | 0.3±0.05  |
|        | 5930 (15078) | 0.2 mΩ           | 8.03±0.2 | 15.6±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 12.0±0.1 | 2.0±0.1  | 1.75±0.1 | 11.5±0.1  | 24.0±0.3  | 2.35±0.1 | 0.3±0.05  |
|        |              | 0.5 mΩ           | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 12.0±0.1 | 2.0±0.1  | 1.75±0.1 | 11.5±0.1  | 24.0±0.3  | 1.3±0.1  | 0.3±0.05  |
|        |              | 0.8 mΩ           | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 12.0±0.1 | 2.0±0.1  | 1.75±0.1 | 11.5±0.1  | 24.0±0.3  | 1.3±0.1  | 0.3±0.05  |
|        |              | 1 mΩ             | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 12.0±0.1 | 2.0±0.1  | 1.75±0.1 | 11.5±0.1  | 24.0±0.3  | 1.3±0.1  | 0.3±0.05  |
|        |              | 1 mΩ             | 8.05±0.2 | 15.3±0.2  | 1.5±0.1 | 1.5±0.1 | 4.0±0.1  | 12.0±0.1 | 2.0±0.1  | 1.75±0.1 | 11.5±0.1  | 24.0±0.3  | 1.3±0.1  | 0.3±0.05  |

Metal Alloy Current Sensing Resistors

MSR series

| Series | Unit:mm   |          |               |           |       |       |
|--------|-----------|----------|---------------|-----------|-------|-------|
|        | Size (mm) | A        | φB            | φC        | φD    | φE    |
| MSRSF  | 2512      | 1.5 Min. | 13.0+0.5/-0.2 | 20.2 Min. | 330±2 | 100±2 |
| MSRPF  |           |          |               |           |       |       |
| MSREK  | 3920      | 1.5 Min. | 13.0+0.5/-0.2 | 20.2 Min. | 330±2 | 100±2 |
| MSREM  | 5930      |          |               |           |       |       |
| MSRPF  |           |          |               |           |       |       |
| MSRPM  |           |          |               |           |       |       |

