

# DATA SHEET

## SURGE CHIP RESISTORS

SR series  
20%, 10%, 5%  
sizes 0402/0603/0805/1206/1210/1218/2010/2512  
RoHS compliant & Halogen free



**SCOPE**

This specification describes SR0402 to SR2512 chip resistors with lead-free terminations made by thick film process.

**APPLICATIONS**

- Telecommunications
- Power supplies
- Car electronics

**FEATURES**

- AEC-Q200 qualified
- Superior to SR series in pulse withstanding voltage and surge withstanding voltage.
- MSL class: MSL I
- Halogen free epoxy
- RoHS compliant
  - Products with lead-free terminations meet RoHS requirements
  - Pb-glass contained in electrodes, resistor element and glass are exempted by RoHS
- Reduce environmentally hazardous waste
- High component and equipment reliability

**ORDERING INFORMATION - GLOBAL PART NUMBER**

Part number is identified by the series name, size, tolerance, packaging type, temperature coefficient, taping reel and resistance value.

**GLOBAL PART NUMBER**

**SR XXXX X X X XX XXXX L**  
 (1) (2) (3) (4) (5) (6) (7)

**(1) SIZE**

0402 / 0603 / 0805 / 1206 / 1210 / 1218 / 2010 / 2512

**(2) TOLERANCE**

J = ±5%  
 K = ±10%  
 M = ±20%

**(3) PACKAGING TYPE**

R = Paper taping reel                      K = Embossed taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

- = Based on spec.

**(5) TAPING REEL & POWER**

07 = 7 inch dia. Reel      7W = 7 inch dia. Reel & 2 x standard power  
 13 = 13 inch dia. Reel      7T = 7 inch dia. Reel & 3 x standard power  
 47 = 7 inch dia. Reel & 4xstandard power

**(6) RESISTANCE VALUE**

1 Ω ≤ R ≤ 1M Ω  
 There are 2~4 digits indicated the resistance value. Letter R/K/M is decimal point, no need to mention the last zero after R/K/M, e.g. 1K2, not 1K20.  
 Detailed coding rules of resistance are shown in the table of "Resistance rule of global part number".

**(7) DEFAULT CODE**

Letter L is the system default code for ordering only. (Note)

| Resistance coding rule  | Example                                  |
|-------------------------|--|
| XXXX<br>(1 to 9.76 Ω)   | 1R = 1 Ω<br>1R5 = 1.5 Ω<br>9R76 = 9.76 Ω |
| XXRX<br>(10 to 97.6 Ω)  | 10R = 10 Ω<br>97R6 = 97.6 Ω              |
| XXXR<br>(100 to 976 Ω)  | 100R = 100 Ω                             |
| XKXX<br>(1 to 9.76 KΩ)  | 1K = 1,000 Ω<br>9K76 = 9760 Ω            |
| XXKX<br>(10 to 97.6 KΩ) | 10K = 10,000 Ω<br>97K6 = 976,000 Ω       |
| XXXXK<br>(100 KΩ)       | 100K = 100,000 Ω                         |

**ORDERING EXAMPLE**

The ordering code for an SR0805 chip resistor, value 10 KΩ with ±5% tolerance, supplied in 7-inch tape reel is: SR0805JR-0710KL.

**MARKING**

SR0402



SR1218



SR0603 / SR0805 / SR1206 / SR1210 / SR2010 / SR2512



**NOTE**

For further marking information, please refer to data sheet “Chip resistors marking”.

**TAPING REEL & POWER**

Table 1

| TYPE | POWER, W (P70) |      |     |     |
|------|----------------|------|-----|-----|
|      | CODING         |      |     |     |
|      | 07             | 7W   | 7T  | 47  |
| 0402 | 1/16           | 1/8  | 1/5 | -   |
| 0603 | 1/10           | 1/5  | 1/4 | -   |
| 0805 | 1/8            | 1/4  | 1/3 | 1/2 |
| 1206 | 1/4            | 1/2  | 3/4 | 1   |
| 1210 | 1/2            | 1    | -   | -   |
| 1218 | 1              | 1.5  | -   | -   |
| 2010 | 3/4            | 1.25 | -   | -   |
| 2512 | 1              | 2    | -   | -   |

**CONSTRUCTION**

The resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a lead-free glass. The composition of the glaze is adjusted to give the approximately required resistance value. The whole element is covered by a protective overcoat. The top of overcoat is marked with the resistance value. Finally, the two external terminations (Ni/matte tin) are added, as shown in Fig.4.

**OUTLINES**



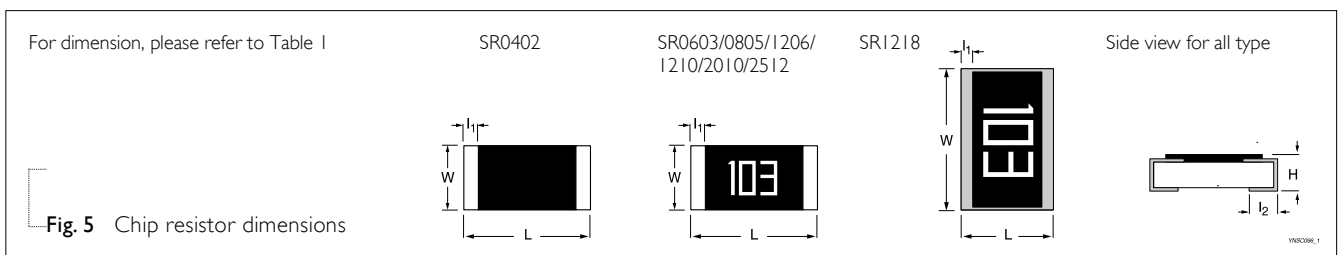
**Chip Resistor Surface Mount**

SR SERIES **0402/0603/0805/1206/1210/1218/2010/2512**

**DIMENSIONS**

Table 2

| TYPE   | L (mm)    | W (mm)    | H (mm)    | I <sub>1</sub> (mm) | I <sub>2</sub> (mm) |
|--------|-----------|-----------|-----------|---------------------|---------------------|
| SR0402 | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10           | 0.25±0.10           |
| SR0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.25±0.15           | 0.25±0.15           |
| SR0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20           | 0.35±0.20           |
| SR1206 | 3.10±0.10 | 1.60±0.10 | 0.55±0.10 | 0.45±0.20           | 0.40±0.20           |
| SR1210 | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.45±0.15           | 0.50±0.20           |
| SR1218 | 3.10±0.10 | 4.60±0.10 | 0.55±0.10 | 0.45±0.20           | 0.40±0.20           |
| SR2010 | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.55±0.15           | 0.50±0.20           |
| SR2512 | 6.35±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.20           | 0.50±0.20           |



**ELECTRICAL CHARACTERISTICS**

Table 3

| TYPE   | POWER | RESISTANCE RANGE                   | CHARACTERISTICS             |                      |                       |                                 |                                       |
|--------|-------|------------------------------------|-----------------------------|----------------------|-----------------------|---------------------------------|---------------------------------------|
|        |       |                                    | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | Temperature Coefficient of Resistance |
| SR0402 | 1/16W | E24 5%, 10%, 20%<br>1 Ω ≤ R ≤ 1M Ω | -55 °C to +155 °C           | 50 V                 | 100 V                 | 100 V                           | 10 Ω < R ≤ 1M Ω<br>±100 ppm/°C        |
|        | 1/8W  |                                    |                             |                      |                       |                                 |                                       |
|        | 1/5W  |                                    |                             |                      |                       |                                 |                                       |
| SR0603 | 1/10W |                                    |                             | 75V                  | 150V                  | 150V                            |                                       |
|        | 1/5W  |                                    |                             |                      |                       |                                 |                                       |
|        | 1/4W  |                                    |                             |                      |                       |                                 |                                       |
| SR0805 | 1/8 W |                                    |                             | 150V                 | 300V                  | 300V                            |                                       |
|        | 1/4W  |                                    |                             |                      |                       |                                 |                                       |
|        | 1/3W  |                                    |                             |                      |                       |                                 |                                       |
| SR1206 | 1/2W  |                                    |                             | 200 V                | 400 V                 | 500 V                           |                                       |
|        | 1/4 W |                                    |                             |                      |                       |                                 |                                       |
|        | 1/2W  |                                    |                             |                      |                       |                                 |                                       |
|        | 3/4W  |                                    |                             |                      |                       |                                 |                                       |
| SR1210 | 1W    | 200 V                              | 400 V                       | 500 V                |                       |                                 |                                       |
|        | 1/2W  |                                    |                             |                      |                       |                                 |                                       |
| SR1218 | 1W    | 200 V                              | 400 V                       | 500 V                |                       |                                 |                                       |
|        | 1.5W  |                                    |                             |                      |                       |                                 |                                       |
| SR2010 | 3/4W  | 200 V                              | 400 V                       | 500 V                |                       |                                 |                                       |
|        | 1.25W |                                    |                             |                      |                       |                                 |                                       |
| SR2512 | 1 W   | 200 V                              | 400 V                       | 500 V                |                       |                                 |                                       |
|        | 2W    |                                    |                             |                      |                       |                                 |                                       |

**FOOTPRINT AND SOLDERING PROFILES**

Recommended footprint and soldering profiles, please refer to data sheet “Chip resistors mounting”.

**PACKING STYLE AND PACKAGING QUANTITY**

Table 4 Packing style and packaging quantity

| PACKING STYLE            | REEL DIMENSION | SR0402 | SR0603/0805/1206 | SR1210 | SR1218/2010/2512 |
|--------------------------|----------------|--------|------------------|--------|------------------|
| Paper taping reel (R)    | 7" (178 mm)    | 10,000 | 5,000            | 5,000  | ---              |
|                          | 13" (330 mm)   | 50,000 | 20,000           | 20,000 | ---              |
| Embossed taping reel (K) | 7" (178 mm)    | ---    | ---              | ---    | 4,000            |

**NOTE**

I. For paper/embossed tape and reel specification/dimensions, please refer to data sheet “Chip resistors packing”.

**FUNCTIONAL DESCRIPTION**

**OPERATING TEMPERATURE RANGE**

Range: -55 °C to +155 °C

**POWER RATING**

Each type rated power at 70 °C:

SR0402: 1/16W, 1/8W, 1/5W

SR0603: 1/10W, 1/5W, 1/4W

SR0805: 1/8W, 1/4W, 1/3W, 1/2W

SR1206: 1/4W, 1/2W, 3/4W, 1W

SR1210: 1/2W, 1W

SR1218: 1W, 1.5W

SR2010: 3/4W, 1.25W

SR2512: 1W, 2W

**RATED VOLTAGE**

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$$V = \sqrt{P \times R}$$

Where

V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value (Ω)

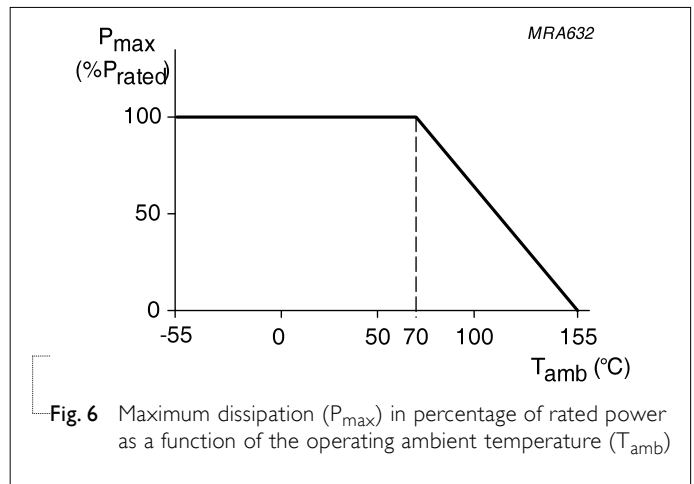


Fig. 6 Maximum dissipation (P<sub>max</sub>) in percentage of rated power as a function of the operating ambient temperature (T<sub>amb</sub>)

**PULSE LOAD BEHAVIOR**



Fig. 7 Pulse-Load behavior

**TESTS AND REQUIREMENTS**

Table 5 Test condition, procedure and requirements

| TEST   | TEST METHOD            | PROCEDURE  | REQUIREMENTS     |
|--|------------------------|--|------------------|
| Temperature Coefficient of Resistance (T.C.R.) | MIL-STD-202 Method 304 | At +25/-55 °C and +25/+125 °C<br><br>Formula:<br>$T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$<br>Where<br>t <sub>1</sub> = +25 °C or specified room temperature<br>t <sub>2</sub> = -55 °C or +125 °C test temperature<br>R <sub>1</sub> = resistance at reference temperature in ohms<br>R <sub>2</sub> = resistance at test temperature in ohms | Refer to table 2 |
| Short Time Overload                            | IEC60115-1 4.13        | 2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature   | ±(2.0%+0.05 Ω)   |
| High Temperature Exposure                      | IEC 60068-2-2          | 1,000 hours at T <sub>A</sub> = 155 °C ±5 °C, unpowered  | ±(3.0%+0.05 Ω)   |
| Humidity                                       | IEC 60115-1 4.24.2     | Steady state for 1,000 hours at 40 °C / 95% R.H. RCWW applied for 1.5 hours on and 0.5 hour off  | ±(3.0%+0.05 Ω)   |

| TEST                         | TEST METHOD                                  | PROCEDURE  | REQUIREMENTS                                    |
|------------------------------|--|--|---|
| Life                         | IEC 60115-1 4.25.1<br>MIL-STD-202 Method 108 | 1,000 hours at 70±2 °C, RCWV applied for 1.5 hours on, 0.5 hour off, still-air required  | ±(3.0%+0.05 Ω)                                  |
| Resistance to Soldering Heat | IEC 60115-1 4.18<br>MIL-STD- 202 Method 210  | Condition B, no pre-heat of samples<br>Lead-free solder, 260±5 °C, 10±1 seconds immersion time<br>Procedure 2 for SMD: devices fluxed and cleaned with isopropanol                   | ±(1.0%+0.05 Ω)<br>No visible damage             |
| Temperature Cycling          | JESD22-A104C                                 | -55/+125 °C for 1 cycle per hour, with 1,000 cycles.<br>Devices mounted  | ±(1.0%+0.05 Ω)                                  |
| Solderability<br>- Wetting   | J-STD-002                                    | Electrical Test not required Magnification 50X<br>SMD conditions:<br>Immerse the specimen into the solder pot at 245±3°C for 2±0.5 seconds.  | Well tinned (≥95% covered)<br>No visible damage |
| Board Flex                   | IEC 60115-1 4.33                             | Chips mounted on a 90mm glass epoxy resin PCB (FR4)<br><b>Bending for 0402: 5mm</b><br><b>0603 &amp; 0805: 3mm</b><br><b>1206 and above: 2mm</b><br>Holding time: minimum 60 seconds | ±(1.0%+0.05 Ω)                                  |

**REVISION HISTORY**

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION   |
|-----------|---------------|---------------------|---|
| Version 8 | Jul. 22, 2019 | -                   | - Update power rating   |
| Version 7 | Sep. 27, 2018 | -                   | - Extend resistance range of 0402 ~ 2512 to 1Mohm,<br>- Tighten TCR of all sizes for $10\Omega < R \leq 1M\Omega$ from $\pm 200$ ppm/°C to $\pm 100$ ppm/°C<br>- Add SR1210, SR1218, SR2010 7W (double power) |
| Version 6 | Oct. 02, 2017 | -                   | - Add SR0402 7T (triple power), SR0805 47 (quadruple power), SR2512 7W (double power)   |
| Version 5 | Nov.11, 2016  | -                   | - Update 7T power for 1206  |
| Version 4 | Sep. 01, 2015 | -                   | - Update SR0603 Dielectric Withstanding Voltage to 150V<br>- Update 7T power for 0603/0805 & 7W for 1210  |
| Version 3 | Jul. 31, 2015 | -                   | - Comply with AEC-Q200 standard   |
| Version 2 | Jan. 06, 2014 | -                   | - Add SR0402/0603/1210<br>- Update electrical characteristic  |
| Version 1 | Mar 18, 2011  | -                   | - Change to dual brand datasheet that describes SR0805 to SR2512 with RoHS compliant<br>- Define global part number   |
| Version 0 | Oct 19, 2004  | -                   | -   |

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