

# **DATA SHEET**

**SURGE CHIP RESISTORS** 

AUTOMOTIVE GRADE SR series

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



YAGEO Phícomp



#### 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

(2) (3) (4) (5) (1)

#### (I) SIZE

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

#### (2) TOLERANCE

 $| = \pm 5\%$ 

 $K = \pm 10\%$ 

 $M = \pm 20\%$ 

# (3) PACKAGING TYPE

R = Paper taping reel

K = Embossed taping reel

# (4) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Based on spec.

#### (5) TAPING REEL

| 07 = 7 inch dia. Reel  | $7W = 7$ inch dia. Reel & $2 \times$ standard power |
|------------------------|---|
| 13 = 13 inch dia, Reel | $7T = 7$ inch dia. Reel & $3 \times$ standard power |

#### (6) RESISTANCE VALUE

 $1 \Omega \le R \le 100 K\Omega$ 

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. I K2, not I K20.

Detailed coding rules of resistance are shown in the table of "Resistance rule of global part number".

#### (7) DEFAULT CODE

 $(100 \text{ K}\Omega)$ 

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

#### number Resistance coding Example rule $IR = I \Omega$ XRXX $IR5 = 1.5 \Omega$ (1 to 9.76 $\Omega$ ) $9R76 = 9.76 \Omega$ $IOR = IO \Omega$ **XXRX** (10 to 97.6 $\Omega$ ) $97R6 = 97.6 \Omega$ **XXXR** $100R = 100 \Omega$ (100 to 976 $\Omega$ ) $IK = 1,000 \Omega$ XKXX(I to 9.76 K $\Omega$ ) $9K76 = 9760 \Omega$ $10K = 10,000 \Omega$ XXKX (10 to 97.6 K $\Omega$ ) $97K6 = 976,000 \Omega$ XXXK $100K = 100,000 \Omega$

Resistance rule of global part

#### **ORDERING EXAMPLE**

The ordering code for an SR0805 chip resistor, value  $10 \text{ K}\Omega$  with ±5% tolerance, supplied in 7-inch tape reel is: SR0805JR-0710KL.



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# MARKING

# SR0402

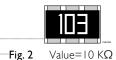


No Marking

**Chip Resistor Surface Mount** 

Fig. I

# SR1218



E-24 series: 3 digits

First two digits for significant figure and 3rd digit for number of zeros

# SR0603 / SR0805 / SR1206 / SR1210 / SR2010 / SR2512



E-24 series: 3 digits

First two digits for significant figure and 3rd digit for number of zeros

Fig. 3 Value=10 KΩ

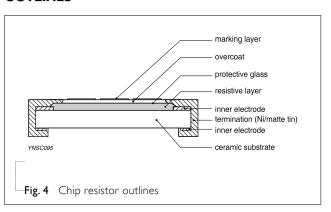
#### **NOTE**

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

#### 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**

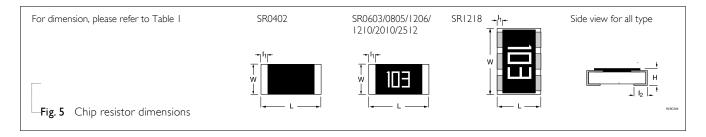


#### **DIMENSIONS**

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|-----------|-----|

| TYPE   | L (mm)     | W (mm)     | H (mm)     | I <sub>I</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  | 0.50±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 2

|          |       |                                      | CHARACTERISTICS                |                            |                             |                                       |   |
|----------|-------|--------------------------------------|--------------------------------|----------------------------|-----------------------------|---------------------------------------|---|
| TYPE     | POWER | RESISTANCE RANGE                     | Operating<br>Temperature Range | Max.<br>Working<br>Voltage | Max.<br>Overload<br>Voltage | Dielectric<br>Withstanding<br>Voltage | Temperature<br>Coefficient of<br>Resistance |
| SR0402   | 1/16W |                                      |                                | 50 V                       | 100 V                       | 100 V                                 |   |
| 3110 102 | 1/8   |                                      |                                | 30 V                       | 100 V                       | 100 V                                 |   |
|          | 1/10W |                                      |                                |                            |                             |                                       |   |
| SR0603   | 1/5W  |                                      |                                | 75V                        | 150V                        | 150V                                  |   |
|          | 1/4W  |                                      |                                |                            |                             |                                       |   |
|          | 1/8 W |                                      | -55 °C to +155 °C <sub>-</sub> |                            |                             |                                       |   |
| SR0805   | 1/4W  |                                      |                                | 150V                       | 300V                        | 300V                                  |   |
|          | 1/3W  | E24 5%, 10%, 20%<br>I Ω ≤ R ≤ 100 KΩ |                                |                            |                             |                                       | ±200 ppm/°C                                 |
|          | 1/4 W | 1 22 2 1/ 2 100 1/22                 |                                |                            |                             |                                       |   |
| SR I 206 | 1/2W  |                                      |                                | 200 V                      | 400 V                       | 500 V                                 |   |
|          | 3/4W  |                                      |                                |                            |                             |                                       |   |
| SR1210   | 1/2W  |                                      | <del>-</del>                   | 200 V                      | 400 V                       | 500 V                                 |   |
| SR1218   | IW    |                                      |                                | 200 V                      | 400 V                       | 500 V                                 |   |
| SR2010   | 3/4 W |                                      | <del>-</del>                   | 200 V                      | 400 V                       | 500 V                                 |   |
| SR2512   | I W   |                                      | <del>-</del>                   | 200 V                      | 400 V                       | 500 V                                 |   |

# FOOTPRINT AND SOLDERING PROFILES

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

# PACKING STYLE AND PACKAGING QUANTITY

Table 3 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".



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# **FUNCTIONAL DESCRIPTION**

# **OPERATING TEMPERATURE RANGE**

Range: -55 °C to +155 °C

# **POWER RATING**

Each type rated power at 70 °C: SR0402: 07 = 1/16W; 7W = 1/8W

SR0603: 07 = 1/10W; 7W = 1/5W; 7T=1/4W

SR0805: 07 = 1/8W; 7W = 1/4W; 7T=1/3W

SR1206: 07 = 1/4W; 7W = 1/2W; 7T=3/4W

SR1210: 07 = 1/2W

SR1218: 07 = IW

SR2010: 07 = 3/4W

SR2512: 07 = IW

#### **RATED VOLTAGE**

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

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

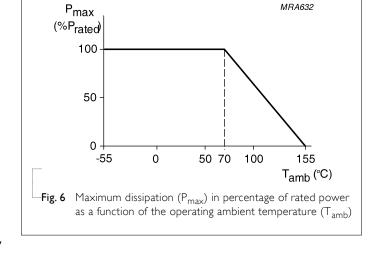
Where

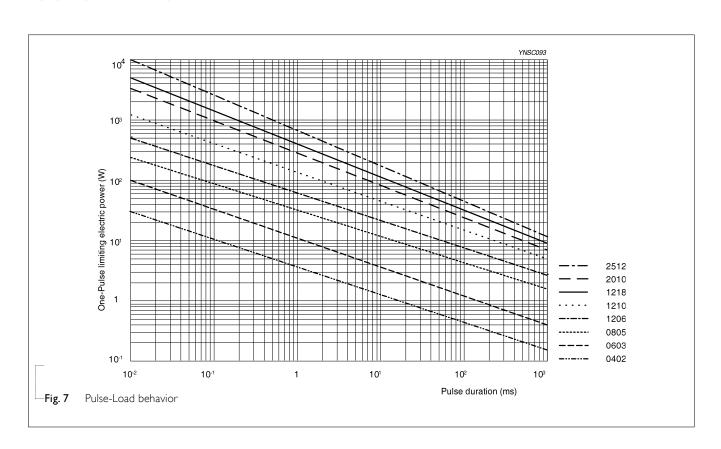
V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

 $R = Resistance value (\Omega)$ 

#### **PULSE LOAD BEHAVIOR**





Product specification

# TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

| TEST                         | TEST METHOD                                  | PROCEDURE  | REQUIREMENTS      |
|------------------------------|--|--|-------------------|
| Temperature Coefficient of   | MIL-STD-202 Method 304                       | At +25/–55 °C and +25/+125 °C  | Refer to table 2  |
| Resistance (T.C.R.)          |  | Formula:   |                   |
|                              |  | T.C.R= $\frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6 \text{ (ppm/°C)}$                                     |                   |
|                              |  | Where $t_1$ = +25 °C or specified room temperature   |                   |
|                              |  | $t_2$ = -55 °C or +125 °C test temperature   |                   |
|                              |  | R <sub>I</sub> =resistance at reference temperature in ohms  |                   |
|                              |  | R <sub>2</sub> =resistance at test temperature in ohms   |                   |
| 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<br>Exposure | IEC 60068-2-2                                | 1,000 hours at $T_A$ = 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.   | ±(3.0%+0.05 Ω)    |
|                              |  | RCWV applied for 1.5 hours on and 0.5 hour off   |                   |
| 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                | IEC 60115-1 4.18                             | Condition B, no pre-heat of samples  | ±(1.0%+0.05 Ω)    |
| Soldering Heat               | MIL-STD- 202 Method 210                      | Lead-free solder, 260 $\pm$ 5 °C, 10 $\pm$ 1 seconds immersion time                                    | No visible damage |
|                              |  | Procedure 2 for SMD: devices fluxed and cleaned with isopropanol                                       |                   |
| Temperature Cycling          | JESD22-A104C                                 | -55/+125 °C for I cycle per hour, with I,000 cycles. Devices mounted                                   | ±(1.0%+0.05 Ω)    |



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|---|---|
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 Chip Resistor Surface Mount
 SR
 SERIES
 0402/0603/0805/1206/1210/1218/2010/2512

| TEST          | TEST METHOD      | PROCEDURE   | REQUIREMENTS                |
|---------------|------------------|---|-----------------------------|
| Solderability |                  |   |                             |
| - Wetting     | J-STD-002        | Electrical Test not required Magnification 50X                                  | Well tinned (≥95% covered)  |
|               |                  | SMD conditions:   | No visible damage           |
|               |                  | Immerse the specimen into the solder pot at $245\pm3$ °C for $2\pm0.5$ seconds. |                             |
|               |                  |   |                             |
| Board Flex    | IEC 60115-1 4.33 | Chips mounted on a 90mm glass epoxy resin                                       | $\pm (1.0\% + 0.05 \Omega)$ |
|               |                  | PCB (FR4)   |                             |
|               |                  | Bending for 0402: 5mm<br>0603 & 0805: 3mm<br>1206 and above: 2mm                |                             |
|               |                  | Holding time: minimum 60 seconds  |                             |
|               |                  |   |                             |
|               |                  |   |                             |

# REVISION HISTORY

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION  |
|-----------|---------------|---------------------|--|
| Version 5 | Nov.11, 2016  | -                   | - Update 7T power for 1206   |
| Version 4 | Sep. 01, 2015 | -                   | - Update SR0603 Dielectric Withstanding Voltage to 150V                              |
|           |               |                     | - 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   |
|           |               |                     | - Update electrical characteristic   |
| Version I | Mar 18, 2011  | -                   | - Change to dual brand datasheet that describes SR0805 to SR2512 with RoHS compliant |
|           |               |                     | - Define global part number  |
| Version 0 | Oct 19, 2004  | -                   | -  |

<sup>&</sup>quot;The reimbursement is limited to the value of the products."



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