Innovative Service Around the Globe YAGEO

# DATA SHEET

## SURGE CHIP RESISTORS

SR series

20%, 10%, 5%

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

**RoHS compliant & Halogen free**

YAGEO Phycomp

Product specification – July 22, 2019 V.8



## 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 1
- 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

13 = 13 inch dia. Reel

47 = 7 inch dia. Reel & 4xstandard power

7W = 7 inch dia. Reel & 2 x standard power

7T = 7 inch dia. Reel & 3 x standard 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 rule of global part number

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



Fig. 1 No Marking

SR1218

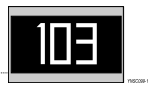



Fig. 2 Value=10 KΩ

E-24 series: 3 digits
First two digits for significant figure and 3rd digit for number of zeros

SR0603 / SR0805 / SR1206 / SR1210 / SR2010 / SR2512




Fig. 3 Value=10 KΩ

E-24 series: 3 digits
First two digits for significant figure and 3rd digit for number of zeros

**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**

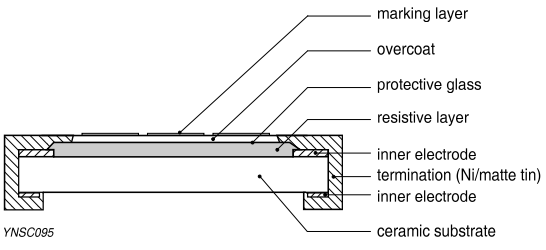



Fig. 4 Chip resistor outlines

## DIMENSIONS

Table 2

| TYPE | L (mm) | W (mm) | H (mm) | $I_1$ (mm) | $I_2$ (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 |

For dimension, please refer to Table 1

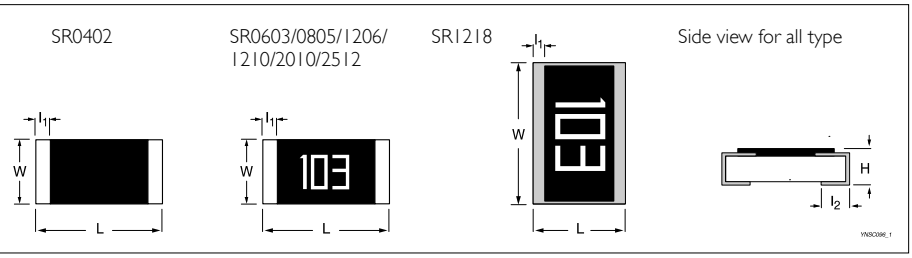



**Fig. 5** Chip resistor dimensions

## 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<br>1/8W<br>1/5W | E24 5%, 10%, 20%<br>1 Ω ≤ R ≤ 1M Ω | –55 °C to +155 °C | 50 V | 100 V | 100 V | 10Ω < R ≤ 1MΩ<br>±100 ppm/°C<br><br>1Ω ≤ R ≤ 10Ω<br>±200 ppm/°C |
| SR0603 | 1/10W<br>1/5W<br>1/4W | | | 75V | 150V | 150V | |
| SR0805 | 1/8 W<br>1/4W<br>1/3W<br>1/2W | | | 150V | 300V | 300V | |
| SR1206 | 1/4 W<br>1/2W<br>3/4W<br>1W | | | 200 V | 400 V | 500 V | |
| SR1210 | 1/2W<br>1W | | | 200 V | 400 V | 500 V | |
| SR1218 | 1W<br>1.5W | | | 200 V | 400 V | 500 V | |
| SR2010 | 3/4W<br>1.25W | | | 200 V | 400 V | 500 V | |
| SR2512 | 1 W<br>2W | | | 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 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**

1. 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

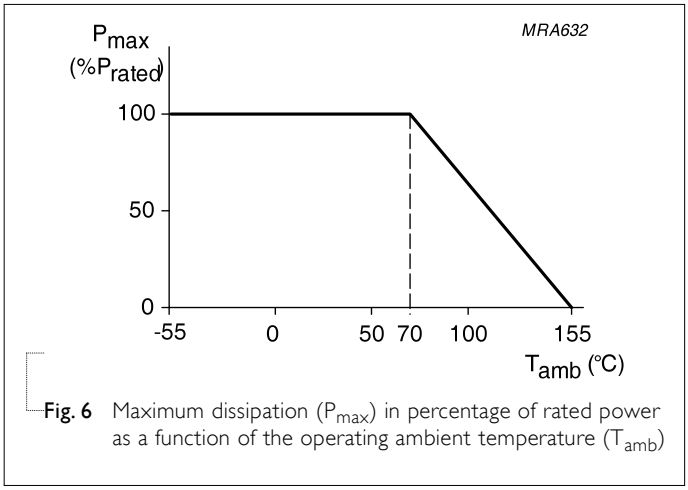



Fig. 6 Maximum dissipation ($P_{max}$) in percentage of rated power as a function of the operating ambient temperature ($T_{amb}$)

### 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)

## PULSE LOAD BEHAVIOR

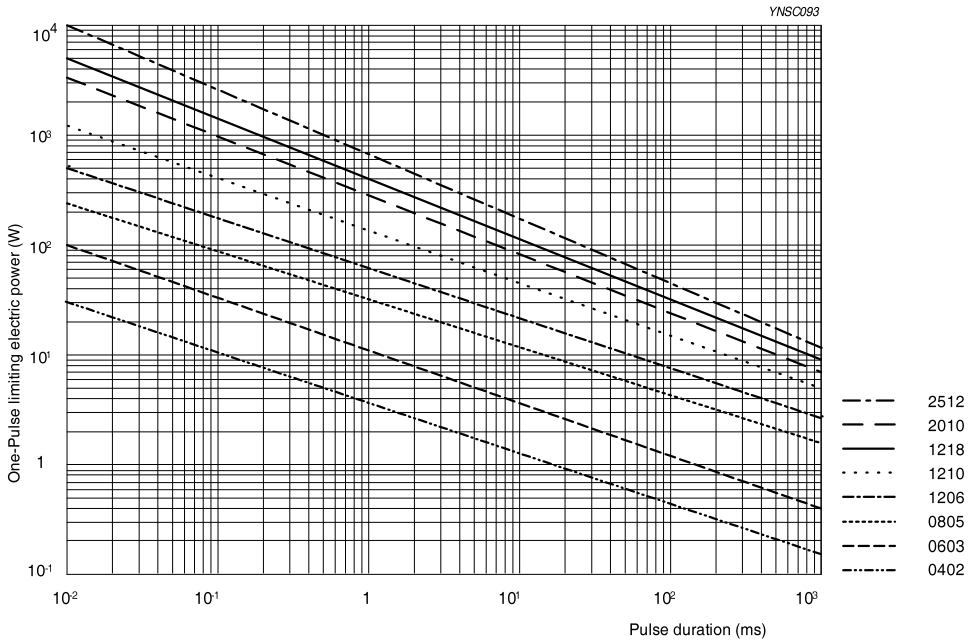



Fig. 7 Pulse-Load behavior

## 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>**Formula:**<br>$T.C.R= \frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6$ (ppm/°C)<br>Where<br>$t_1$= +25 °C or specified room temperature<br>$t_2$= –55 °C or +125 °C test temperature<br>$R_1$=resistance at reference temperature in ohms<br>$R_2$=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<br>at room temperature | ±(2.0%+0.05 Ω) |
| High Temperature 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.<br>RCWV 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>**Bending for 0402: 5mm**<br>**0603 & 0805: 3mm**<br>**1206 and above: 2mm**<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 10Ω < R ≤ 1MΩ from ± 200 ppm/°C to ± 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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