

# 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**  
**Phicomp**

Product specification – September 27, 2018 V.7



**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 =  $\pm 5\%$   
 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 & 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 & 4x standard power

**(6) RESISTANCE VALUE**

1  $\Omega \leq R \leq 1M \Omega$   
 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. 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)

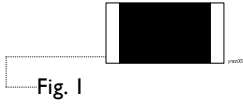
Resistance rule of global part number	
Resistance coding rule	Example
XRX	1R = 1 $\Omega$
(1 to 9.76 $\Omega$ )	1R5 = 1.5 $\Omega$ 9R76 = 9.76 $\Omega$
XXRX	10R = 10 $\Omega$
(10 to 97.6 $\Omega$ )	97R6 = 97.6 $\Omega$
XXXR	100R = 100 $\Omega$
(100 to 976 $\Omega$ )	
XKXX	1K = 1,000 $\Omega$
(1 to 9.76 K $\Omega$ )	9K76 = 9760 $\Omega$
XXKX	10K = 10,000 $\Omega$
(10 to 97.6 K $\Omega$ )	97K6 = 976,000 $\Omega$
XXXK	100K = 100,000 $\Omega$
(100 K $\Omega$ )	

**ORDERING EXAMPLE**

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

**MARKING**

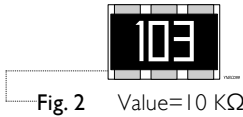
SR0402



No Marking

Fig. 1

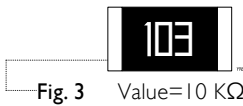
SR1218



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

Fig. 2 Value=10 KΩ

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”.

**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	-
1210	1/2	-	-	-
1218	1	-	-	-
2010	3/4	-	-	-
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**

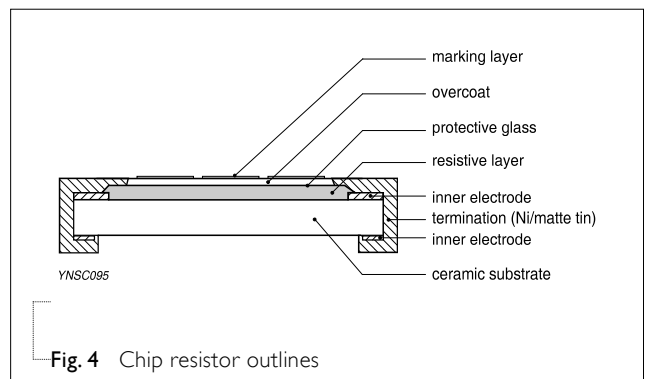


Fig. 4 Chip resistor outlines

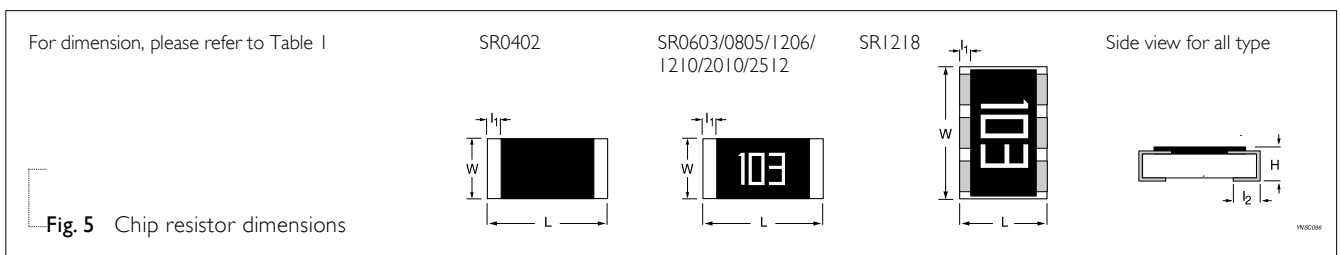
**Chip Resistor Surface Mount**

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% 1 Ω ≤ R ≤ 1M Ω	-55 °C to +155 °C	50 V	100 V	100 V	10 Ω < R ≤ 1M Ω ±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						
	3/4W						
SR1210	1/2W	200 V	400 V	500 V			
	3/4W						
SR1218	1W	200 V	400 V	500 V			
	1.5W						
SR2010	3/4W	200 V	400 V	500 V			
	1.5W						
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

SR1210: 1/2W, 3/4W

SR1218: 1W, 1.5W

SR2010: 3/4W, 1.5W

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)

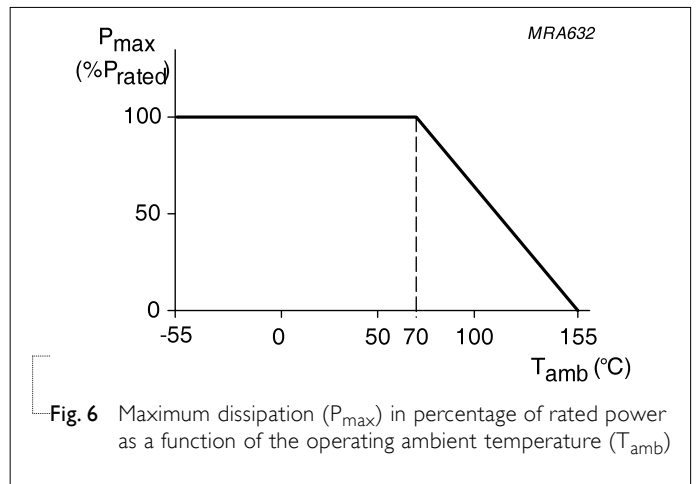


Fig. 6 Maximum dissipation (P<sub>max</sub>) in percentage of rated power as a function of the operating ambient temperature (T<sub>amb</sub>)

**PULSE LOAD BEHAVIOR**

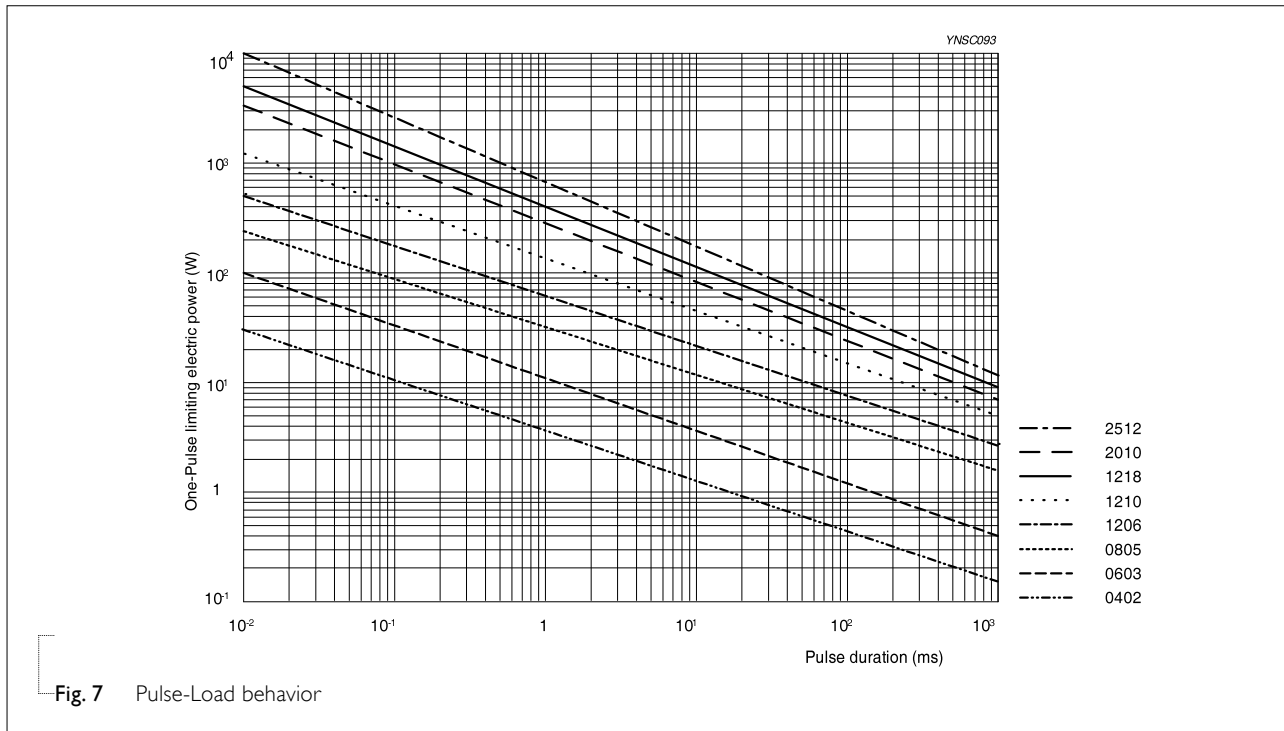


Fig. 7 Pulse-Load behavior

**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  Formula: $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ Where t <sub>1</sub> = +25 °C or specified room temperature t <sub>2</sub> = -55 °C or +125 °C test temperature R <sub>1</sub> = resistance at reference temperature in ohms 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 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 MIL-STD- 202 Method 210	Condition B, no pre-heat of samples Lead-free solder, 260±5 °C, 10±1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(1.0%+0.05 Ω) No visible damage
Temperature Cycling	JESD22-A104C	-55/+125 °C for 1 cycle per hour, with 1,000 cycles. Devices mounted	±(1.0%+0.05 Ω)
Solderability - Wetting	J-STD-002	Electrical Test not required Magnification 50X SMD conditions: Immerse the specimen into the solder pot at 245±3°C for 2±0.5 seconds.	Well tinned (≥95% covered) No visible damage
Board Flex	IEC 60115-1 4.33	Chips mounted on a 90mm glass epoxy resin PCB (FR4) <b>Bending for 0402: 5mm</b> <b>0603 &amp; 0805: 3mm</b> <b>1206 and above: 2mm</b> Holding time: minimum 60 seconds	±(1.0%+0.05 Ω)

**REVISION HISTORY**

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 7	Sep. 27, 2018	-	<ul style="list-style-type: none"> <li>- Extend resistance range of 0402 ~ 2512 to 1Mohm,</li> <li>- Tighten TCR of all sizes for <math>10\Omega &lt; R \leq 1M\Omega</math> from <math>\pm 200</math> ppm/°C to <math>\pm 100</math> ppm/°C</li> <li>- Add SR1210, SR1218, SR2010 7W (double power)</li> </ul>
Version 6	Oct. 02, 2017	-	<ul style="list-style-type: none"> <li>- Add SR0402 7T (triple power), SR0805 47 (quadruple power), SR2512 7W (double power)</li> </ul>
Version 5	Nov.11, 2016	-	<ul style="list-style-type: none"> <li>- Update 7T power for 1206</li> </ul>
Version 4	Sep. 01, 2015	-	<ul style="list-style-type: none"> <li>- Update SR0603 Dielectric Withstanding Voltage to 150V</li> <li>- Update 7T power for 0603/0805 &amp; 7W for 1210</li> </ul>
Version 3	Jul. 31, 2015	-	<ul style="list-style-type: none"> <li>- Comply with AEC-Q200 standard</li> </ul>
Version 2	Jan. 06, 2014	-	<ul style="list-style-type: none"> <li>- Add SR0402/0603/1210</li> <li>- Update electrical characteristic</li> </ul>
Version 1	Mar 18, 2011	-	<ul style="list-style-type: none"> <li>- Change to dual brand datasheet that describes SR0805 to SR2512 with RoHS compliant</li> <li>- Define global part number</li> </ul>
Version 0	Oct 19, 2004	-	-

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