

# **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

(1) (2) (3) (4) (5) (6) (7

### (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 & POWER

07 = 7 inch dia. Reel 7W = 7 inch dia. Reel &  $2 \times$  standard power

13 = 13 inch dia. Reel  $3 \times 3$  standard power

47 = 7 inch dia. Reel & 4xstandard power

### (6) RESISTANCE VALUE

### $|\Omega \le R \le |M\Omega|$

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

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

number Resistance coding rule	Example
XRXX (1 to 9.76 Ω)	IR = I Ω IR5 = I.5 Ω 9R76 = 9.76 Ω
XXRX (10 to 97.6 Ω)	10R = 10 Ω 97R6 = 97.6 Ω
XXXR (100 to 976 <b>Ω)</b>	100R = 100 Ω
XKXX (1 to 9.76 KΩ)	IK = I,000 Ω 9K76 = 9760 Ω
XXKX (10 to 97.6 KΩ)	$10K = 10,000 \Omega$ 97K6= 976,000 Ω
XXXK (100 KΩ)	100Κ = 100,000 Ω

Resistance rule of global part

### 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. 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

### NOTE

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

### TAPING REEL & POWER

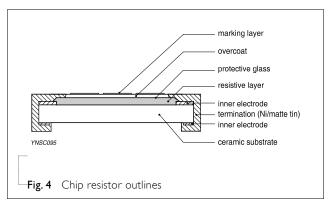
-Table I

		F	POWER, W (P70)		
TYPE			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.

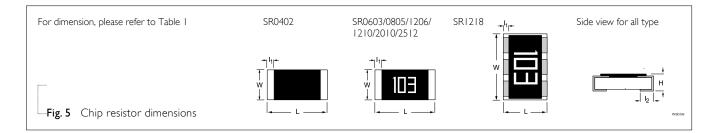
## **OUTLINES**



### **DIMENSIONS**

Table 2

TYPE	L (mm)	W (mm)	H (mm)	I <sub>1</sub> (mm)	l <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

			CHARACTERISTICS				
TYPE	POWER	resistance range	Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance
	1/16W						
SR0402	I/8W			50 V	100 V	100 V	
	1/5W						
	1/10W						
SR0603	I/5W			75V	150V	150V	
-	1/4W						
	I/8 W						
SR0805	1/4W			150V	300V	300V	$10\Omega < R \le IM\Omega$ $\pm 100 \text{ ppm/°C}$ $I\Omega \le R \le I0\Omega$
	1/3W						
-	1/2W	E24 5%, 10%, 20%		200 V	400 V	500 V	
CD 1204	1/4 W	$I \Omega \leq R \leq IM \Omega$	–55 °C to +155 °C				
SR1206	1/2W						
-	3/4W						±200 ppm/°C
SR1210	1/2W			200 V	400 V	500 V	
-	3/4W						
SR1218	- IW			200 V	400 V	500 V	
	1.5W						
SR2010	3/4W			200 V	400 V	500 V	
	1.5W						
SR2512	I 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: I/16W, I/8W, I/5W SR0603: 1/10W, 1/5W, 1/4W SR0805: I/8W, I/4W, I/3W, I/2W

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

SR1210: 1/2W, 3/4W SR1218: IW, 1.5W SR2010: 3/4W, 1.5W SR2512: IW, 2W

### **RATED VOLTAGE**

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

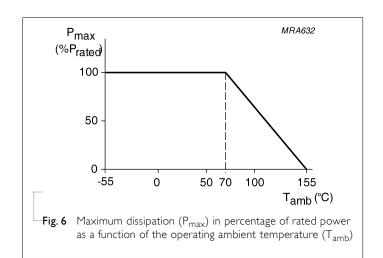
$$V = \sqrt{(P \times R)}$$

#### Where

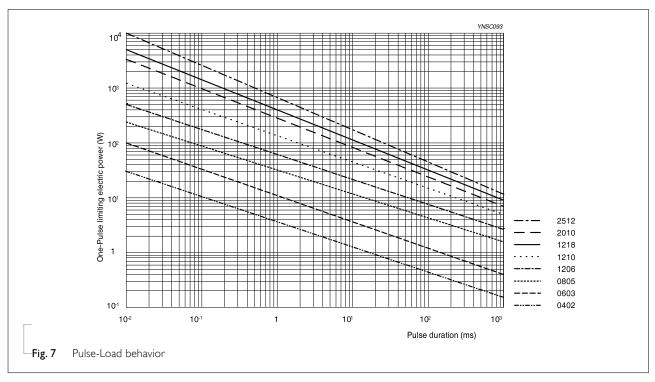
V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

 $R = Resistance value (\Omega)$ 



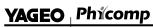
### **PULSE LOAD BEHAVIOR**



### TESTS AND REQUIREMENTS

Table 5 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	
		$R_1$ =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 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	



Product specification

7 8

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

Life	IEC 60115-1 4.25.1	1,000 hours at 70±2 °C, RCWV applied for 1.5	±(3.0%+0.05 Ω)
	MIL-STD-202 Method 108	hours on, 0.5 hour off, still-air required	
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 1 cycle per hour, with 1,000 cycles.	±(1.0%+0.05 Ω)
		Devices mounted	
Solderability	LCTD 000		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
- Wetting	J-STD-002	Electrical Test not required Magnification 50X	Well tinned (≥95% covered) No visible damage
		SMD conditions:	140 VISIDIE Galflage
		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	±(1.0%+0.05 Ω)
		PCB (FR4)  Bending for 0402: 5mm  0603 & 0805: 3mm  1206 and above: 2mm	
		Holding time: minimum 60 seconds	

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### **Chip Resistor Surface Mount**

SR SERIES

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

### REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
			- Extend resistance range of 0402 ~ 2512 to IMohm,
Version 7	Sep. 27, 2018	-	- Tighten TCR of all sizes for $10\Omega < R \leq IM\Omega$ from $\pm$ 200 ppm/°C to $\pm$ 100 ppm/°C
			- 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, 20	C - 01 2015		- Update SR0603 Dielectric Withstanding Voltage to 150V
	Sep. 01, 2015	-	- Update 7T power for 0603/0805 & 7W for 1210
Version 3	Jul. 31, 2015	-	- Comply with AEC-Q200 standard
		06, 2014 -	- Add SR0402/0603/1210
Version 2	jan. 06, 2014		- 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	-	-

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