

# DATA SHEET

## SURGE CHIP RESISTORS

AUTOMOTIVE GRADE

SR series

1%, 0.5%

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**

D =  $\pm 0.5\%$

F =  $\pm 1\%$

**(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 & 4 x standard power

**(6) RESISTANCE VALUE**

$1\ \Omega \leq R \leq 1\text{M}\ \Omega$

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. 1K2, not 1K20.

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

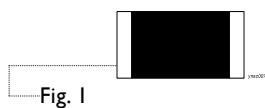
**(7) DEFAULT CODE**

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

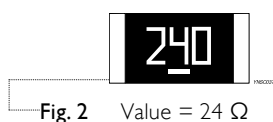
Resistance rule of global part number	
Resistance coding rule	Example
XXXX (1 to 9.76 $\Omega$ )	1R = 1 $\Omega$ 1R5 = 1.5 $\Omega$ 9R76 = 9.76 $\Omega$
XXRX (10 to 97.6 $\Omega$ )	10R = 10 $\Omega$ 97R6 = 97.6 $\Omega$
XXXR (100 to 976 $\Omega$ )	100R = 100 $\Omega$
XKXX (1 to 9.76 K $\Omega$ )	1K =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

**ORDERING EXAMPLE**

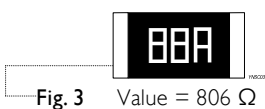
The ordering code for an SR0805 chip resistor, value 10 K $\Omega$  with  $\pm 5\%$  tolerance, supplied in 7-inch tape reel is: SR0805JR-0710KL.

**MARKING****SR0402**

No Marking

**SR0603**

1%, 0.5%, E24 exception values 10/11/13/15/20/75 of E24 series



1%, 0.5%, E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series

**SR0805 / SR1206 / SR1210 / SR1218 / SR2010 / SR2512**Both E-24 and E-96 series: 4 digits,  $\pm 0.5\%$  &  $\pm 1\%$ 

First three digits for significant figure and 4th digit for number of zeros

**NOTE**

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

**TAPING REEL & POWER**

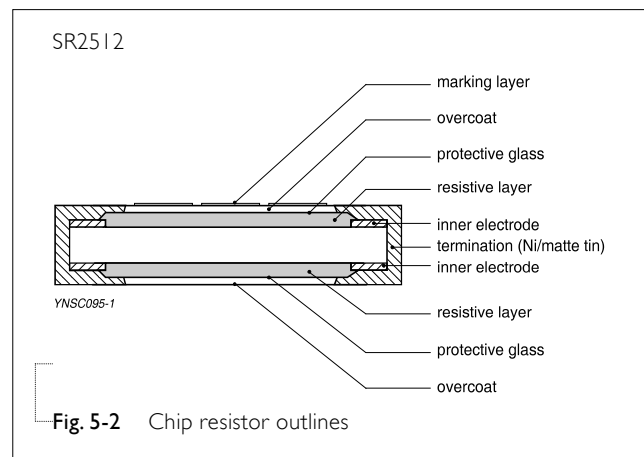
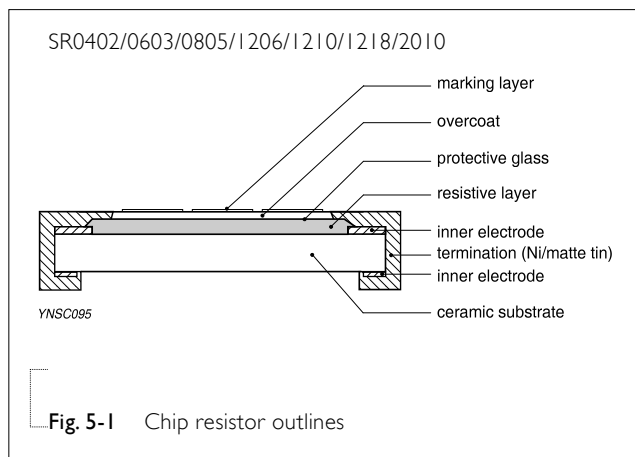
Table I

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.5.

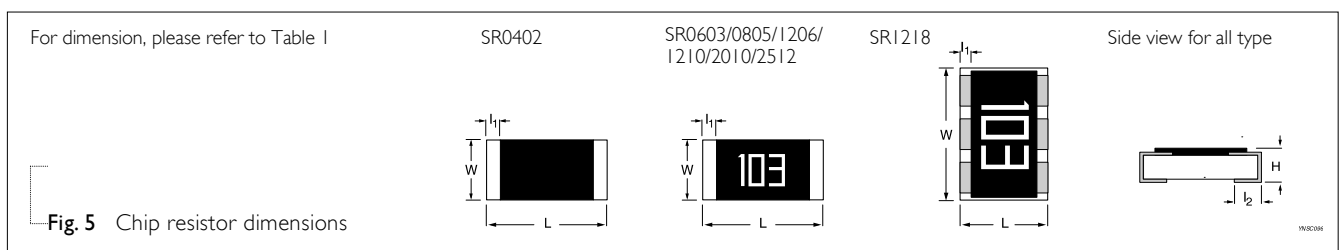
## OUTLINES



## DIMENSIONS

Table 2

TYPE	L (mm)	W (mm)	H (mm)	$l_1$ (mm)	$l_2$ (mm)
SR0402	$1.00 \pm 0.05$	$0.50 \pm 0.05$	$0.35 \pm 0.05$	$0.20 \pm 0.10$	$0.25 \pm 0.10$
SR0603	$1.60 \pm 0.10$	$0.80 \pm 0.10$	$0.45 \pm 0.10$	$0.25 \pm 0.15$	$0.25 \pm 0.15$
SR0805	$2.00 \pm 0.10$	$1.25 \pm 0.10$	$0.50 \pm 0.10$	$0.35 \pm 0.20$	$0.35 \pm 0.20$
SR1206	$3.10 \pm 0.10$	$1.60 \pm 0.10$	$0.55 \pm 0.10$	$0.45 \pm 0.20$	$0.40 \pm 0.20$
SR1210	$3.10 \pm 0.10$	$2.60 \pm 0.15$	$0.55 \pm 0.10$	$0.45 \pm 0.15$	$0.50 \pm 0.20$
SR1218	$3.10 \pm 0.10$	$4.60 \pm 0.10$	$0.55 \pm 0.10$	$0.45 \pm 0.20$	$0.40 \pm 0.20$
SR2010	$5.00 \pm 0.10$	$2.50 \pm 0.15$	$0.55 \pm 0.10$	$0.55 \pm 0.15$	$0.50 \pm 0.20$
SR2512	$6.35 \pm 0.10$	$3.10 \pm 0.15$	$0.55 \pm 0.10$	$0.60 \pm 0.20$	$0.50 \pm 0.20$



**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/E96 0.5%, 1% 1 Ω ≤ R ≤ 1M Ω	−55 °C to +155 °C	50 V	100 V	100 V	10Ω < R ≤ 1MΩ ±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						
	1/2W						
SR1206	1/4 W			200 V	400 V	500 V	1Ω ≤ R ≤ 10Ω ±200 ppm/°C
	1/2W						
	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:

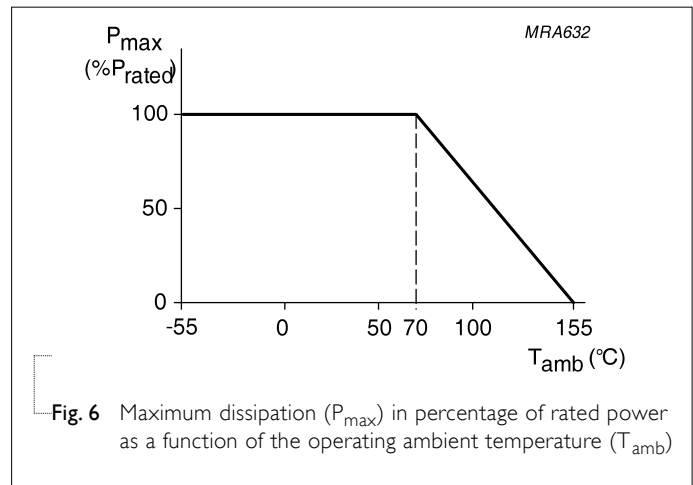
$$V = \sqrt{P \times R}$$

Where

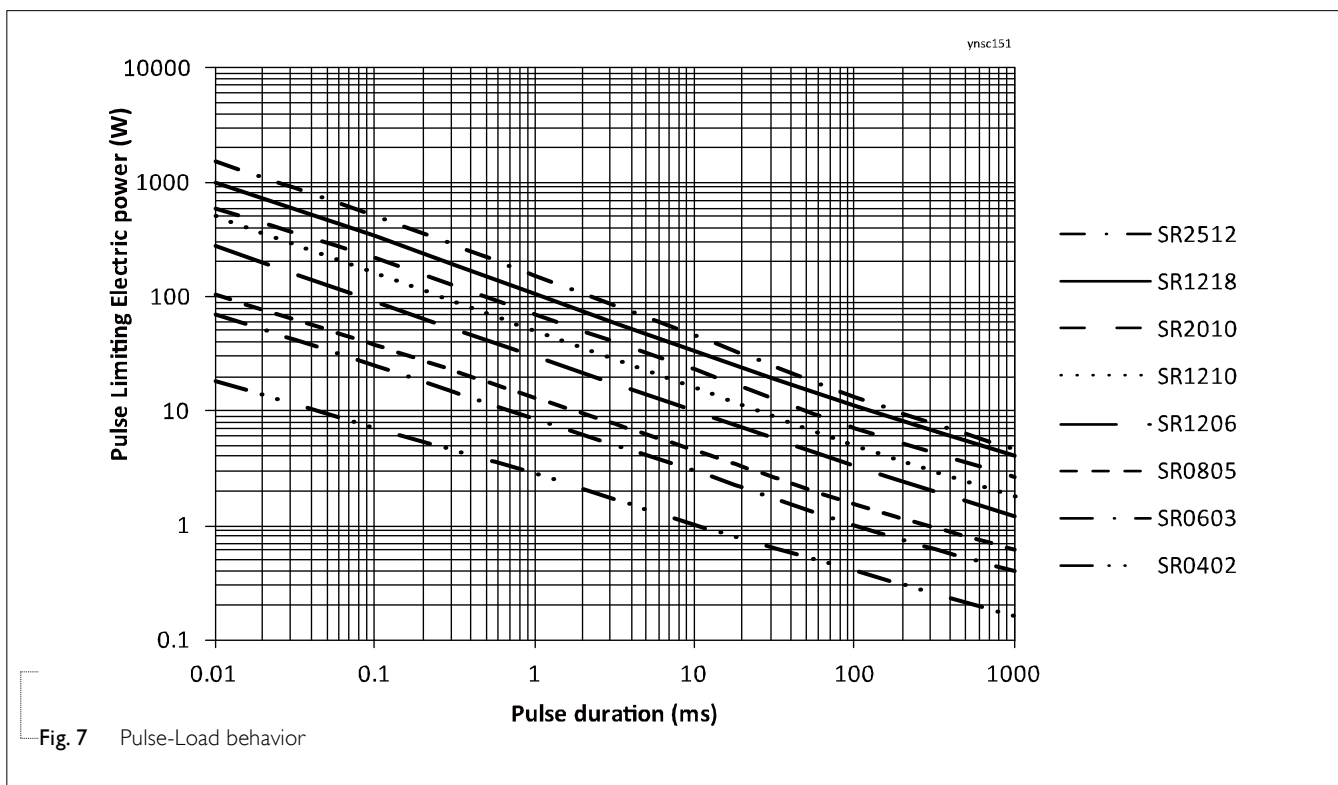
V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value ( $\Omega$ )



### 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	±(2.0%+0.05 Ω)
Humidity	IEC 60115-1 4.24.2	Steady state for 1,000 hours at 40 °C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	±(3.0%+0.05 Ω)
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	±(2.0%+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)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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 3	Sep. 27, 2018		- Extend resistance range of 0402 ~ 2512 to 1Mohm - Tighten TCR of all sizes for for $10\Omega < R \leq 1M\Omega$ from $\pm 200$ ppm/°C to $\pm 100$ ppm/°C - Add SR1210, SR1218, SR2010 7W (double power)
Version 2	Oct. 02, 2017	-	- Add SR0402 7T (triple power), SR0805 47 (quadruple power), SR2512 7W (double power)
Version 1	Nov. 11, 2016	-	- Update 7T power for 1206
Version 0	Dec. 01, 2015	-	- New product datasheet

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"The reimbursement is limited to the value of the products."