

# DATA SHEET

## AUTOMOTIVE GRADE SURGE CHIP RESISTORS (LEAD FREE)

SR\_P series

0.5%, 1%, 5%, 10%, 20%

sizes 0201/0402/0603/0805/1206



## SCOPE

This specification describes SR0201 to SR1206 chip resistors made by thick film process.

## APPLICATIONS

- Total lead free without RoHS exemption
- Telecommunications
- Power supplies
- Car electronics

## FEATURES

- AEC-Q200 qualified
- Superior to RC series in pulse withstanding voltage and surge withstanding voltage.
- MSL class: MSL 1
- Halogen free epoxy
- 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 P  
(1) (2) (3) (4) (5) (6) (7)

#### (1) SIZE

0201/ 0402/ 0603/ 0805/ 1206

#### (2) TOLERANCE

D =  $\pm 0.5\%$

F =  $\pm 1\%$

J =  $\pm 5\%$

K =  $\pm 10\%$

M =  $\pm 20\%$

#### (3) PACKAGING TYPE

R = Paper 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

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. 1K20, not 1K20.

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

#### (7) DEFAULT CODE

Letter P is lead free (without RoHS exemption).

Resistance rule of global part number	
Resistance coding rule	Example
XRXX (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 = 97,600 $\Omega$
XXXXK (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-0710KP.

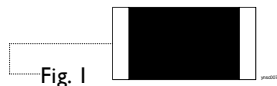
**MARKING****SR0201/ 0402**

Fig. 1

No Marking

**SR0603**

Fig. 2

Value = 24  $\Omega$ 

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



Fig. 3

Value = 806  $\Omega$ 

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

**SR0805 /1206**

Fig. 4

Value = 10 K  $\Omega$ 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**

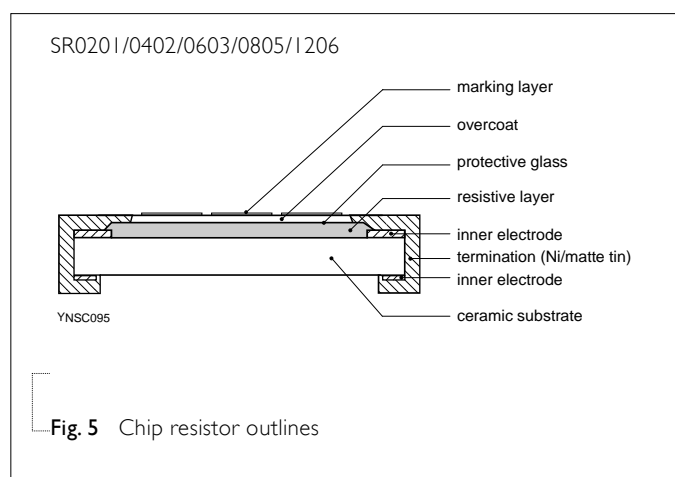
Table I

TYPE	POWER, W (P70)			
	CODING			
	07	7W	7T	47
0201	1/20	1/10	-	1/5
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	-

## 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.

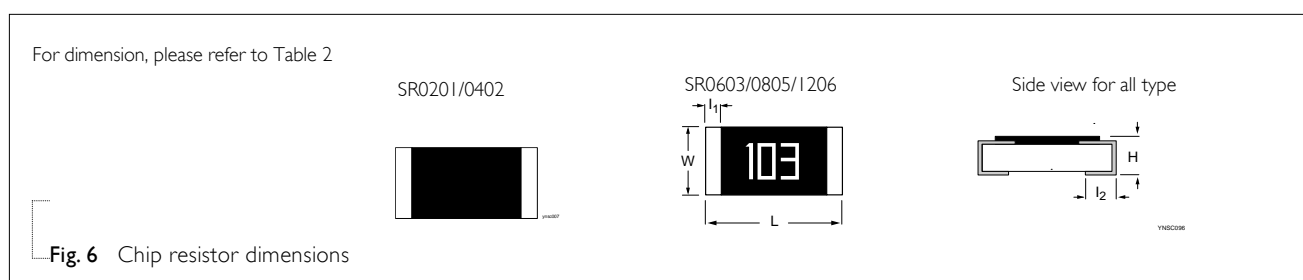
## OUTLINES



## DIMENSIONS

Table 2

TYPE	L (mm)	W (mm)	H (mm)	$l_1$ (mm)	$l_2$ (mm)
SR0201	$0.60 \pm 0.03$	$0.30 \pm 0.03$	$0.23 \pm 0.03$	$0.12 \pm 0.05$	$0.15 \pm 0.05$
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	$3.10 \pm 0.10$	$1.60 \pm 0.10$	$0.55 \pm 0.10$	$0.45 \pm 0.20$	$0.45 \pm 0.20$



## ELECTRICAL CHARACTERISTICS

Table 3

TYPE	POWER	RESISTANCE RANGE	CHARACTERISTICS				Temperature Coefficient of Resistance	
			Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage		
SR0201	1/20W	E24 5%, 10%, 20% $1\Omega \leq R \leq 1M\Omega$ E24/E96 0.5%, 1% $1\Omega \leq R \leq 1M\Omega$	-55 °C to +155 °C	25V	50V	50V	$1\Omega \leq R \leq 10\Omega$ -100~+350ppm°C $10\Omega < R \leq 1M\Omega$ $\pm 200 \text{ ppm}^\circ\text{C}$	
	1/10W							
	1/5W							
SR0402	1/16W			75V	100V	100V		
	1/8W							
	1/5W							
SR0603	1/10W			75V	150V	150V		
	1/5W							
	1/4W							
	1/8W							
SR0805	1/4W			150V	300V	300V	$1\Omega \leq R \leq 10\Omega$ $\pm 200 \text{ ppm}^\circ\text{C}$ $10\Omega < R \leq 1M\Omega$ $\pm 100 \text{ ppm}^\circ\text{C}$	
	1/3W							
	1/2W							
	1/4W							
SR1206	1/2W			200 V	400 V	500V		
	3/4W							

## 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	SR0201/0402	SR0603/0805/1206
Paper taping reel (R)	7" (178 mm)	10,000	5,000

## 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:

SR0201: 1/20W, 1/10W, 1/5W

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

**RATED VOLTAGE**

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

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

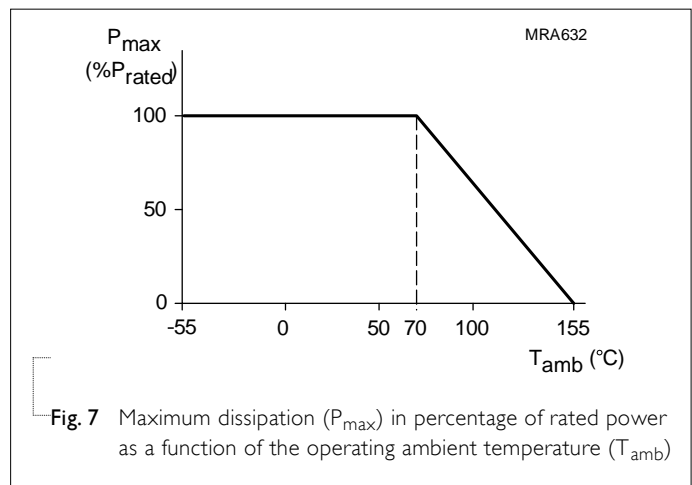
or max. working voltage whichever is less

Where

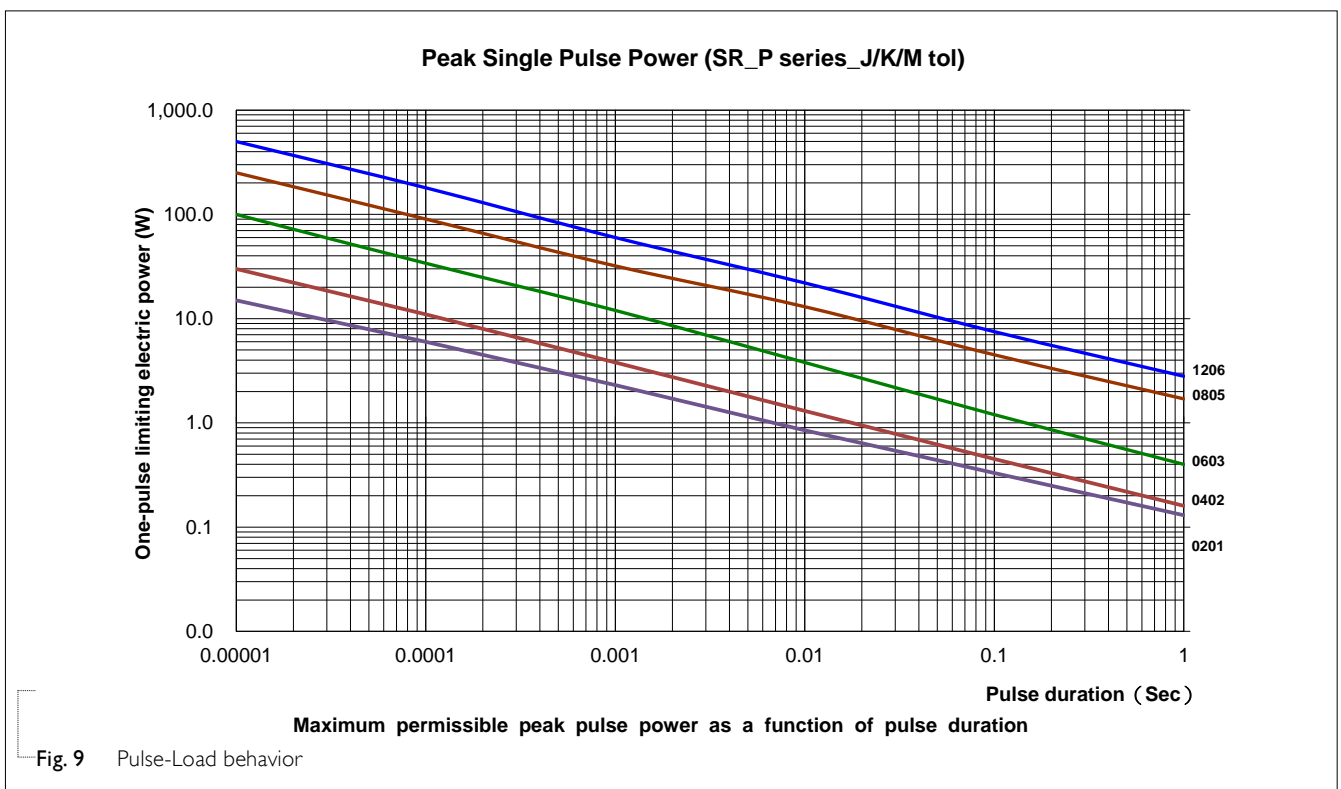
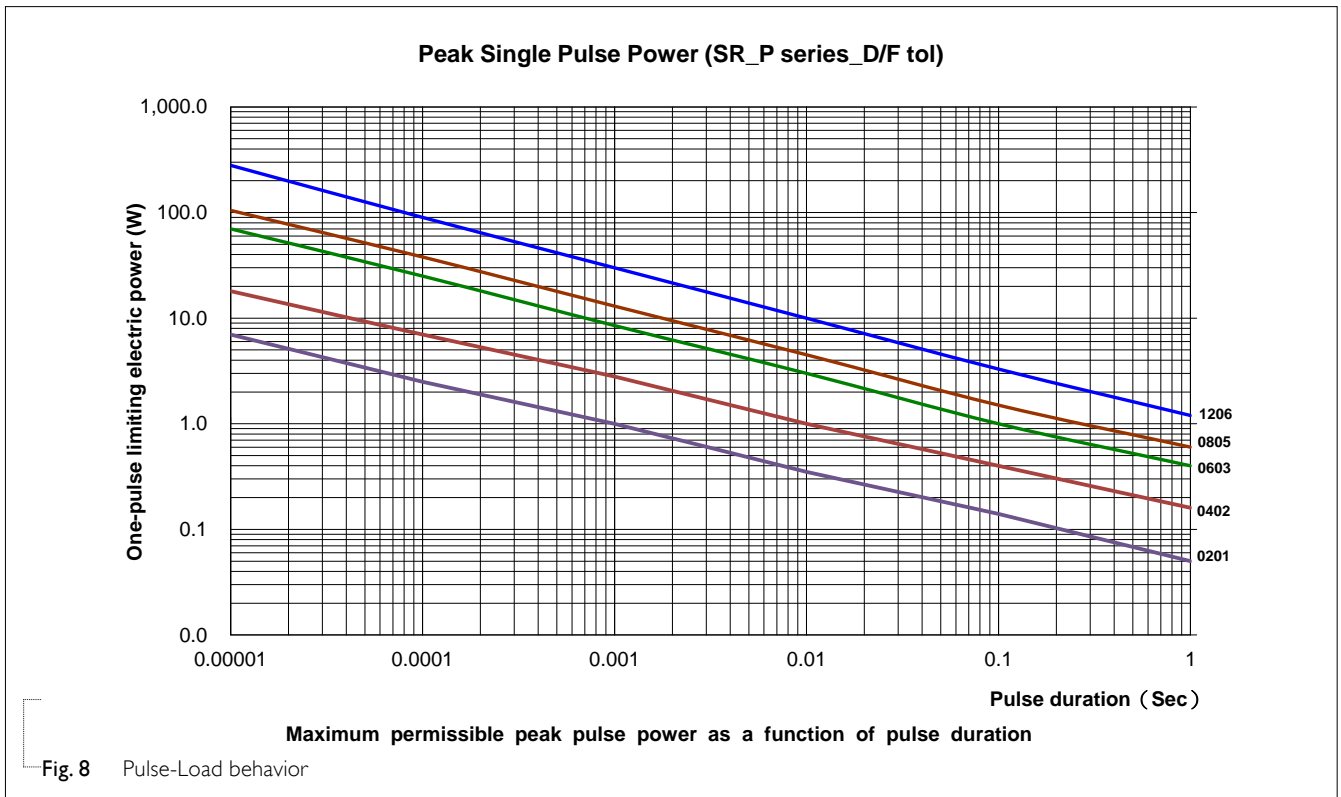
V = Continuous rated DC or AC (rms) working voltage (V)

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
High Temperature Exposure	AEC-Q200 Test 3 MIL-STD-202 Method 108	1,000 hours at $T_A = 155\text{ }^{\circ}\text{C}$ , unpowered	$\pm(2.0\%+0.05\Omega)$ for D/F tol $\pm(3.0\%+0.05\Omega)$ for others
Moisture Resistance	MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8 hours, 3 cycles / 24 hours for 10d. with $25\text{ }^{\circ}\text{C}$ / $65\text{ }^{\circ}\text{C}$ 95% R.H, without steps 7a & 7b, unpowered	$\pm(0.5\%+0.05\Omega)$ for D/F tol $\pm(2.0\%+0.05\Omega)$ for others
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	1,000 hours; $85\text{ }^{\circ}\text{C}$ / 85% RH 10% of operating power Measurement at $24\pm 4$ hours after test conclusion.	$\pm(1.0\%+0.05\Omega)$ for D/F tol $\pm(3.0\%+0.05\Omega)$ for others
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at $125\text{ }^{\circ}\text{C}$ , derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	$\pm(2.0\%+0.05\Omega)$ for D/F tol $\pm(3.0\%+0.05\Omega)$ for others
Resistance to Soldering Heat	AEC-Q200 Test 15 MIL-STD-202 Method 210	Condition B, no pre-heat of samples Lead-free solder, $260\pm 5\text{ }^{\circ}\text{C}$ , $10\pm 1$ seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	$\pm(1.0\%+0.05\Omega)$ No visible damage
Thermal Shock	MIL-STD-202 Method 107	$-55/+125\text{ }^{\circ}\text{C}$ Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	$\pm(0.5\%+0.05\Omega)$ for D/F tol $\pm(1.0\%+0.05\Omega)$ for others
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, $I_{\text{pos.}} + I_{\text{neg.}}$ discharges 0201: 500V 0402/0603: 1KV 0805 and above: 2KV	$\pm(3.0\%+0.05\Omega)$
Solderability - Wetting	AEC-Q200 Test 18 J-STD-002	Electrical Test not required Magnification 50X SMD conditions: (a) Method B, aging 4 hours at $155\text{ }^{\circ}\text{C}$ dry heat, dipping at $235\pm 3\text{ }^{\circ}\text{C}$ for $5\pm 0.5$ seconds. (b) Method B, steam aging 8 hours, dipping at $215\pm 3\text{ }^{\circ}\text{C}$ for $5\pm 0.5$ seconds. (c) Method D, steam aging 8 hours, dipping at $260\pm 3\text{ }^{\circ}\text{C}$ for $30\pm 0.5$ seconds.	Well tinned ( $\geq 95\%$ covered) No visible damage



TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 100mm x 40mm glass epoxy resin PCB (FR4) Bending for 0201/0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm Holding time: minimum 60 seconds	$\pm(1.0\%+0.05\Omega)$
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/-55 °C and +25/+125 °C <b>Formula:</b> $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ 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 $R_2$ = resistance at test temperature in ohms	Refer to table 2
Short Time Overload	IEC60115-1 8.1	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature	$\pm(2.0\%+0.05\Omega)$

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 1	Jan. 20, 2022	-	- Add size 0201
Version 0	Feb. 03, 2021	-	- New product datasheet

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