

DATA SHEET

AUTOMOTIVE GRADE SURGE CHIP RESISTORS

SR series

1%, 0.5%

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

RoHS compliant & Halogen free



YAGEO
Phicomp

Product specification – August 9, 2021 V.5



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 RC 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

$1\ \Omega \leq R \leq 1M\ \Omega$

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		Example
Resistance coding rule		
XRXX	(1 to 9.76 Ω)	IR = 1 Ω IR5 = 1.5 Ω 9R76 = 9.76 Ω
XXRX	(10 to 97.6 Ω)	10R = 10 Ω 97R6 = 97.6 Ω
XXXR	(100 to 976 Ω)	100R = 100 Ω
XKXX	(1 to 9.76 K Ω)	IK = 1,000 Ω 9K76 = 9760 Ω
XXKX	(10 to 97.6 K Ω)	10K = 10,000 Ω 97K6 = 97,600 Ω
XXXK	(100 K Ω)	100K = 100,000 Ω

ORDERING EXAMPLE

The ordering code for an SR0805 chip resistor, value 10 K Ω with $\pm 1\%$ tolerance, supplied in 7-inch tape reel is: SR0805FR-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".

Table I

TAPING REEL & POWER

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.5.

OUTLINES

SR0402/0603/0805/1206/1210/1218/2010

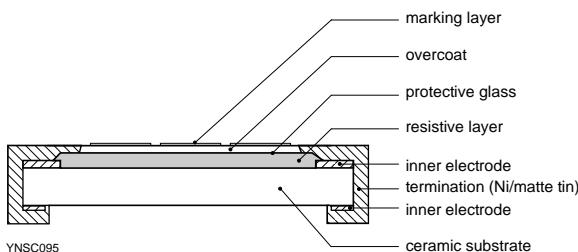


Fig. 5-1 Chip resistor outlines

SR2512

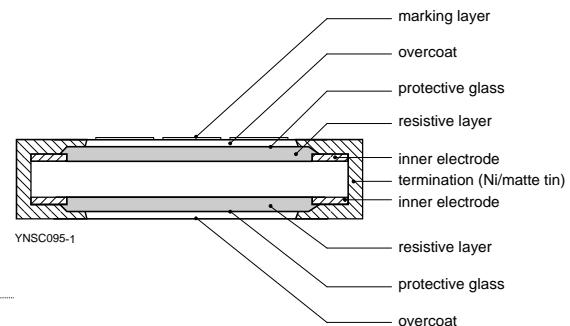


Fig. 5-2 Chip resistor outlines

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

For dimension, please refer to Table 1

SR0402

SR0603/0805/1206/
1210/2010/2512

SR1218

Side view for all type

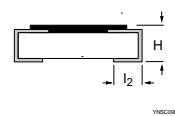
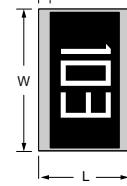
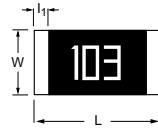
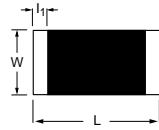


Fig. 5 Chip resistor dimensions

ELECTRICAL CHARACTERISTICS

Table 3

TYPE	POWER	RESISTANCE RANGE	CHARACTERISTICS			
			Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage
SR0402	1/16W					
	1/8W			50 V	100 V	100 V
	1/5W					
SR0603	1/10W					
	1/5W			75V	150V	150V
	1/4W					
SR0805	1/8 W					
	1/4W			150V	300V	300V
	1/3W					
	1/2W					
SR1206	1/4 W	E24/E96 0.5%, 1% 1 Ω ≤ R ≤ 1M Ω	-55 °C to +155 °C			
	1/2W			200 V	400 V	500 V
	3/4W					
SR1210	1W					
	1/2W			200 V	400 V	500 V
	1W					
SR1218	1W			200 V	400 V	500 V
	1.5W					
SR2010	3/4W			200 V	400 V	500 V
	1.25W					
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

- 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 $+155^{\circ}\text{C}$ **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

RATED VOLTAGE

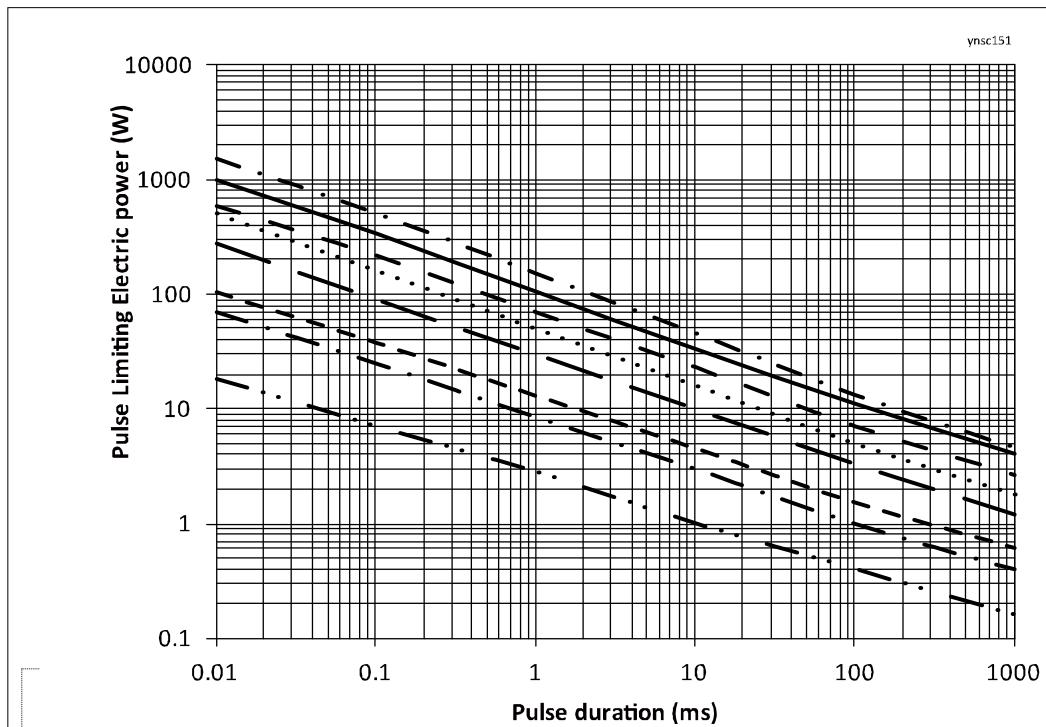
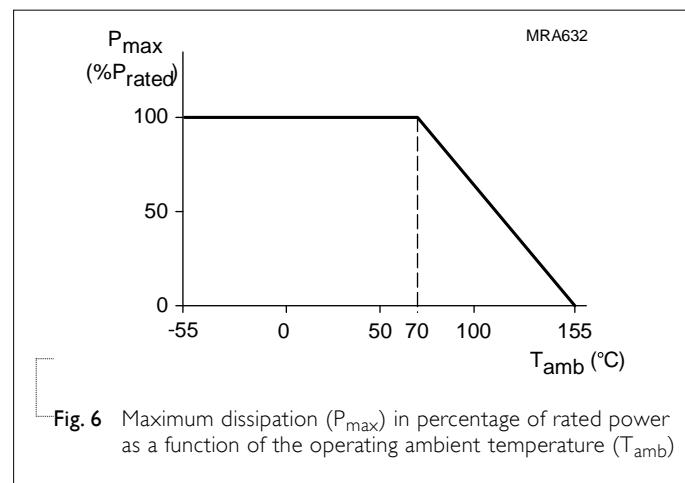
The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

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

Where

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

P = Rated power (W)

R = Resistance value (Ω)**PULSE LOAD BEHAVIOR**

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 $T_A = 155$ °C, unpowered	$\pm(2.0\%+0.05\Omega)$
Moisture Resistance	AEC-Q200 Test 6 MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	$\pm(0.5\%+0.05\Omega)$
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	1,000 hours; 85 °C / 85% RH 10% of operating power Measurement at 24 ± 4 hours after test conclusion.	$\pm(1.0\%+0.05\Omega)$
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at 125 °C, derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	$\pm(2.0\%+0.05\Omega)$
Resistance to Soldering Heat	AEC-Q200 Test 15 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	$\pm(1\%+0.05\Omega)$ No visible damage
Thermal Shock	AEC-Q200 Test 16 MIL-STD-202 Method 107	-55/+125 °C Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	$\pm(0.5\%+0.05\Omega)$
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, $I_{pos.} + I_{neg.}$ discharges 0201: 500V 0402/0603: 1KV 0805 and above: 2KV	$\pm(3.0\%+0.05\Omega)$



TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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 °C dry heat, dipping at 235±3 °C for 5±0.5 seconds. (b) Method B, steam aging 8 hours, dipping at 215±3 °C for 5±0.5 seconds. (c) Method D, steam aging 8 hours, dipping at 260±3 °C for 30±0.5 seconds.	Well tinned (≥95% covered) No visible damage
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm 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	±(1.0%+0.05Ω)
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/-55 °C and +25/+125 °C	Refer to table 2
		Formula: $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$	
		Where $t_1 = +25 \text{ °C}$ or specified room temperature $t_2 = -55 \text{ °C}$ or +125 °C test temperature R_1 = resistance at reference temperature in ohms R_2 = 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%+0.05Ω)



REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 5	Aug. 09, 2021	-	- Upgrade to Automotive Grade
Version 4	Jul. 22, 2019	-	- Update power rating - Extend resistance range of 0402 ~ 2512 to 1Mohm
Version 3	Sep. 27, 2018	-	- Tighten TCR of all sizes for for $10\Omega < R \leq 1M\Omega$ from $\pm 200 \text{ ppm}/^\circ\text{C}$ to $\pm 100 \text{ ppm}/^\circ\text{C}$ - 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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