Innovative Service Around the Globe YAGEO

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 Phycomp

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 1
- 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 = ±0.5%

F = ±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

13 = 13 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 Ω ≤ R ≤ 1M Ω

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
XRXX (1 to 9.76 Ω)	1R = 1 Ω 1R5 = 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 KΩ)	1K = 1,000 Ω 9K76 = 9760 Ω
XXKX (10 to 97.6 KΩ)	10K = 10,000 Ω 97K6= 97,600 Ω
XXXK (100 KΩ)	100K = 100,000 Ω

ORDERING EXAMPLE

The ordering code for an SR0805 chip resistor, value 10 KΩ with ±1% tolerance, supplied in 7-inch tape reel is: SR0805FR-0710KL.

MARKING

SR0402

Fig. 1

No Marking

SR1218

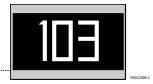

Fig. 2 Value=10 KΩ

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

SR0603 / SR0805 / SR1206 / SR1210 / SR2010 / SR2512

Fig. 3 Value=10 KΩ

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".

Table 1

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

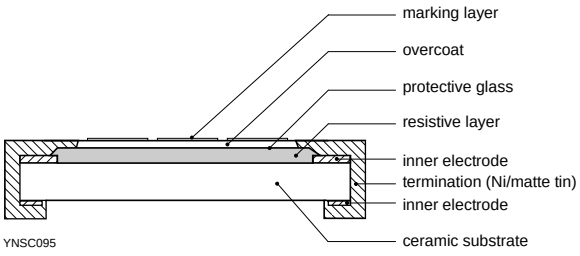

Fig. 5-1 Chip resistor outlines

SR2512

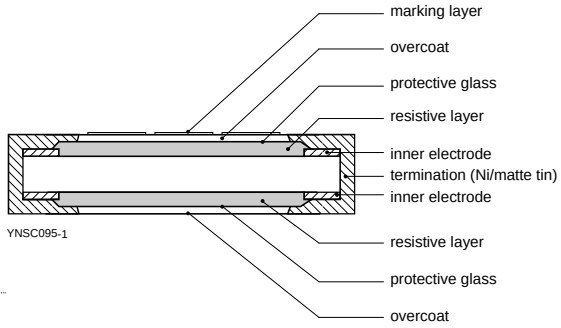

Fig. 5-2 Chip resistor outlines

DIMENSIONS

Table 2

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (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

For dimension, please refer to Table 1

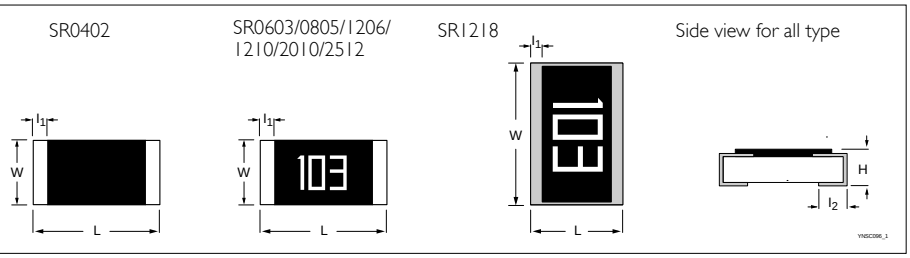

Fig. 5 Chip resistor dimensions

ELECTRICAL CHARACTERISTICS

Table 3

TYPE	POWER	RESISTANCE RANGE	CHARACTERISTICS				
			Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	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 1Ω ≤ R ≤ 10Ω ±200 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	
	1/2W						
	3/4W						
	1W						
SR1210	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

1. 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, 1W
SR1210: 1/2W, 1W
SR1218: 1W, 1.5W
SR2010: 3/4W, 1.25W
SR2512: 1W, 2W

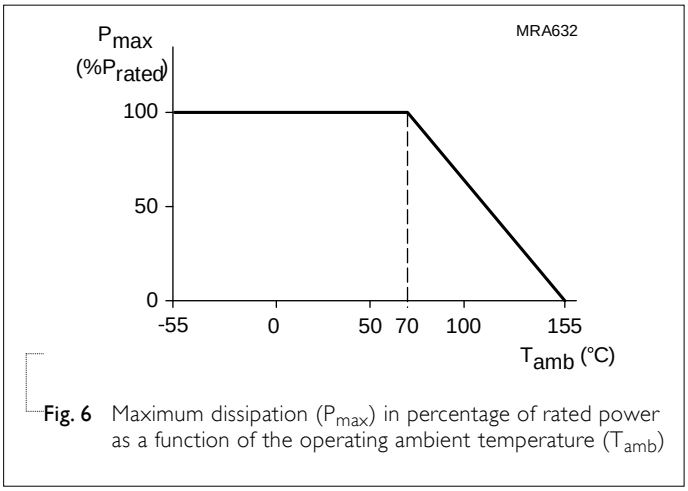

Fig. 6 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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

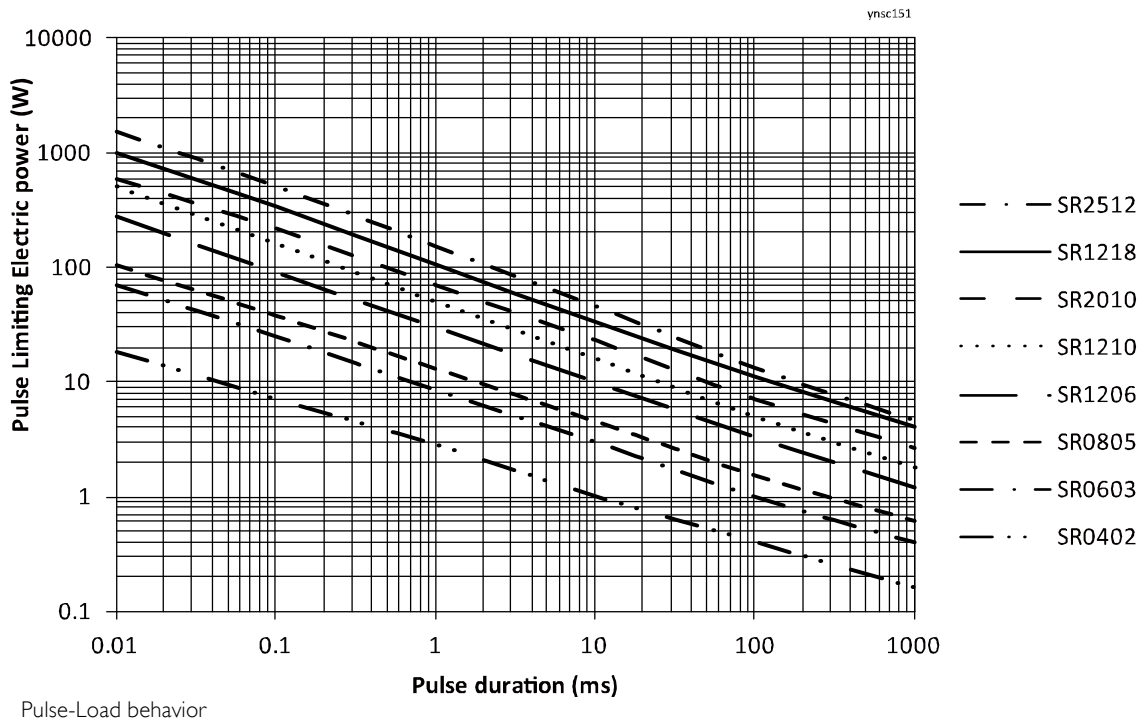

Fig. 7 Pulse-Load behavior

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	±(2.0%+0.05Ω)
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	±(0.5%+0.05Ω)
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.	±(1.0%+0.05Ω)
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	±(2.0%+0.05Ω)
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	±(1%+0.05Ω) 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	±(0.5%+0.05Ω)
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, $1_{pos.}$ + $1_{neg.}$ discharges 0201: 500V 0402/0603: 1KV 0805 and above: 2KV	±(3.0%+0.05Ω)

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 Formula: $T.C.R= \frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6$ (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 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
Version 3	Sep. 27, 2018	-	- Extend resistance range of 0402 ~ 2512 to 1Mohm - Tighten TCR of all sizes for for 10Ω < R ≤ 1MΩ from ± 200 ppm/°C to ± 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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