Innovative Service Around the Globe YAGEO

DATA SHEET

AUTOMOTIVE GRADE SURGE CHIP RESISTORS

SR series

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

sizes 0201/0402/0603/0805/1206/1210/1218/2010/2512

RoHS compliant & Halogen free

YAGEO

Product specification – August 31, 2023 V.11

SCOPE

This specification describes SR0201 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

0201 / 0402 / 0603 / 0805 / 1206 / 1210 / 1218 / 2010 / 2512

(2) TOLERANCE

D = ± 0.5%
F = ± 1%
J = ±5%
K = ±10%
M = ±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 & Standard power
13 = 13 inch dia. Reel
47 = 7 inch dia. Reel & 4xstandard power
7W = 7 inch dia. Reel & 2 x standard power
7T = 7 inch dia. Reel & 3 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 ±5% tolerance, supplied in 7-inch tape reel is: SR0805JR-0710KL.

MARKING

SR0201 / SR0402

Fig. 1

No Marking

SR1218

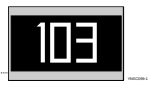

Fig. 2 Value=10 KΩ

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".

TAPING REEL & POWER

Table 1

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	1/3
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.4.

OUTLINES

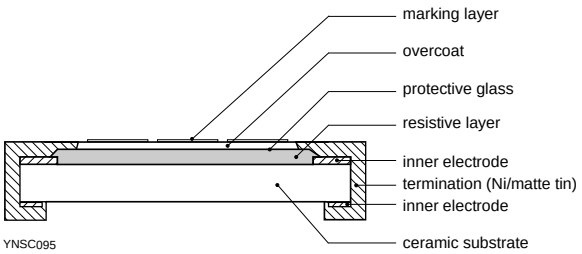

Fig. 4-1 Chip resistor outlines

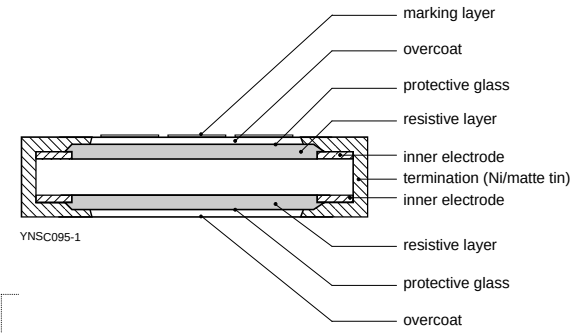

Fig. 4-2 Chip resistor outlines

DIMENSIONS

Table 2

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
SR0201	0.60±0.03	0.30±0.03	0.23±0.03	0.12±0.05	0.15±0.05
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	0.45±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	0.55±0.20
SR2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.60±0.20

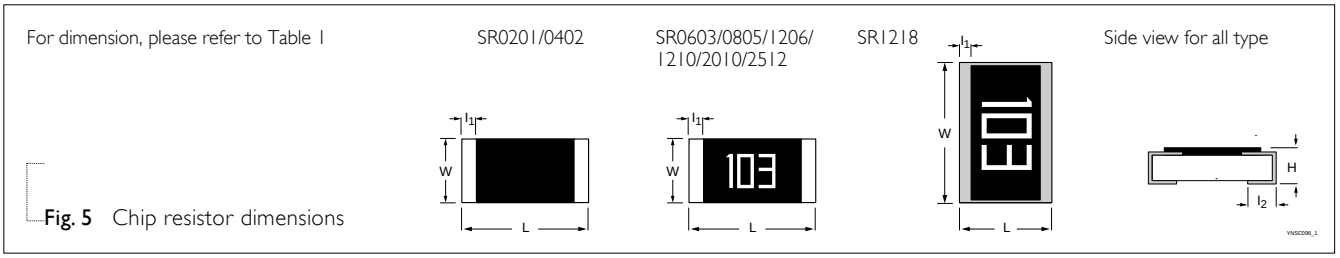

Fig. 5 Chip resistor dimensions

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
SR0201	1/20W 1/10W 1/5W	E24/E96 0.5%, 1% E24 5%, 10%, 20% 1 Ω ≤ R ≤ 1M Ω	–55 °C to +155 °C	25 V	50 V	50 V	1Ω ≤ R < 10Ω -100~+350 ppm°C 10Ω ≤ R ≤ 1MΩ ± 200 ppm°C
SR0402	1/16W 1/8W 1/5W			75 V	100 V	100 V	
SR0603	1/10W 1/5W 1/4W 1/3W			150V	300V	300V	
SR0805	1/8 W 1/4W 1/3W 1/2W			500V	1000V	1000V	10Ω ≤ R ≤ 1MΩ ±100 ppm/ °C
SR1206	1/4 W 1/2W 3/4W 1W			200 V	400 V	500 V	1Ω ≤ R < 10Ω ±200 ppm/ °C
SR1210	1/2W 1W			200 V	400 V	500 V	
SR1218	1W 1.5W			200 V	400 V	500 V	
SR2010	3/4W 1.25W			200 V	400 V	500 V	
SR2512	1 W 2W			500 V	1000 V	1000 V	

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	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:
SR0201: 1/20W, 1/10W, 1/5W
SR0402: 1/16W, 1/8W, 1/5W
SR0603: 1/10W, 1/5W, 1/4W, 1/3W
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

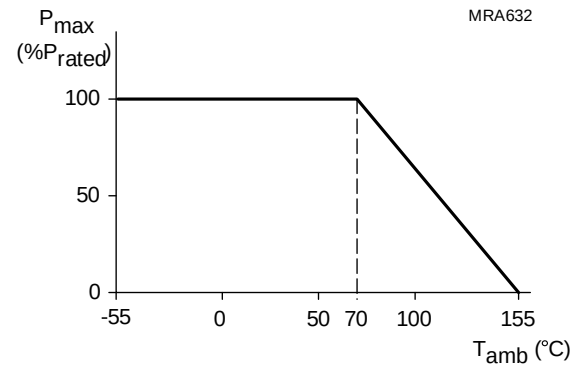

Fig. 6 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

RATED VOLTAGE

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

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

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 (Ω)

Pulse load Behavior

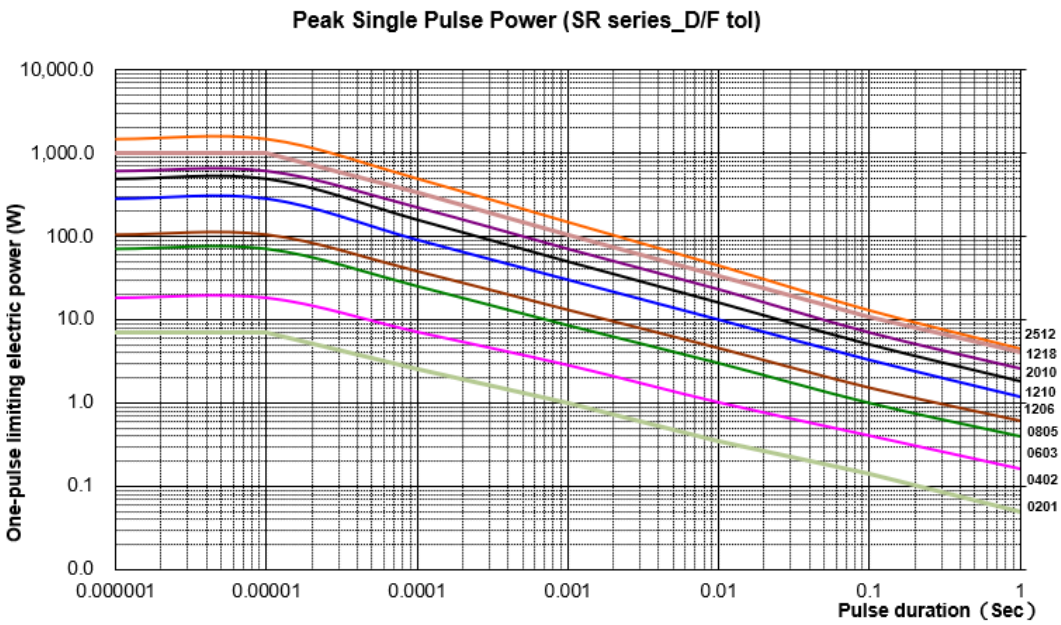

Fig. 7-1 Pulse-Load behavior

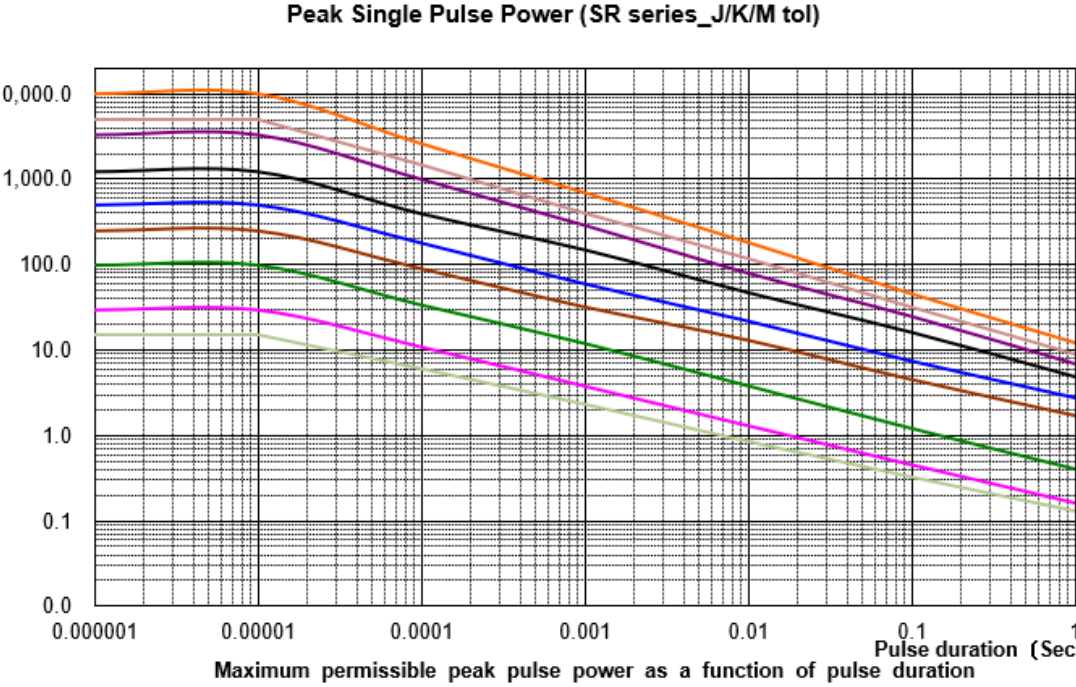

Fig. 7-2 Pulse-Load behavior

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) for D/F tol ±(3.0%+0.05Ω) 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 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	±(0.5%+0.05Ω) for D/F tol ±(2.0%+0.05Ω) for others
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) for D/F tol ±(3.0%+0.05Ω) for others
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) for D/F tol ±(3.0%+0.05Ω) 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±5 °C, 10±1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(1.0%+0.05Ω) No visible damage
Thermal Shock	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) for D/F tol ±(1.0%+0.05Ω) for others
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)
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

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	±(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: $T.C.R= \frac{R_2-R_1}{R_1(t_{2S}-t_1)} \times 10^6$ (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 8.1	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 11	Aug. 31, 2023	-	- Upgrade the working voltage of 2512 to 500V
Version 10	Aug. 02, 2022	-	- Merge F/D tol Add size 0201 Upgrade the working voltage of 0402 to 75V Upgrade the working voltage of 0603 to 150V Upgrade the working voltage of 0805 to 500V l2 dimension updated, for size 1206, size 2010, size 2512
Version 9	Aug. 04, 2021	-	- Upgrade to Automotive Grade
Version 8	Jul. 22, 2019	-	- Update power rating
Version 7	Sep. 27, 2018	-	- Extend resistance range of 0402 ~ 2512 to 1Mohm, - Tighten TCR of all sizes for 10Ω < R ≤ 1MΩ from ± 200 ppm/°C to ± 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, 2015	-	- Update SR0603 Dielectric Withstanding Voltage to 150V - Update 7T power for 0603/0805 & 7W for 1210
Version 3	Jul. 31, 2015	-	- Comply with AEC-Q200 standard
Version 2	Jan. 06, 2014	-	- Add SR0402/0603/1210 - Update electrical characteristic
Version 1	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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