

# 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



## 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 =  $\pm 0.5\%$

F =  $\pm 1\%$

J =  $\pm 5\%$

K =  $\pm 10\%$

M =  $\pm 20\%$

#### (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

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 & 4xstandard 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)

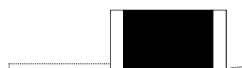
Resistance rule of global part number	
Resistance coding rule	Example
XXXX (1 to 9.76 $\Omega$ )	1R = 1 $\Omega$ 1R5 = 1.5 $\Omega$ 9R76 = 9.76 $\Omega$
XXRX (10 to 97.6 $\Omega$ )	10R = 10 $\Omega$ 97R6 = 97.6 $\Omega$
XXXR (100 to 976 $\Omega$ )	100R = 100 $\Omega$
XKXX (1 to 9.76 K $\Omega$ )	1K = 1,000 $\Omega$ 9K76 = 9760 $\Omega$
XXKX (10 to 97.6 K $\Omega$ )	10K = 10,000 $\Omega$ 97K6 = 97,600 $\Omega$
XXXX (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**

SR0201 / SR0402



No Marking

Fig. 1

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**

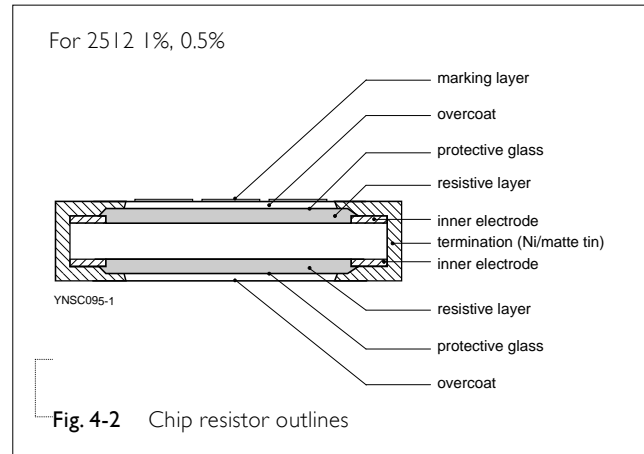
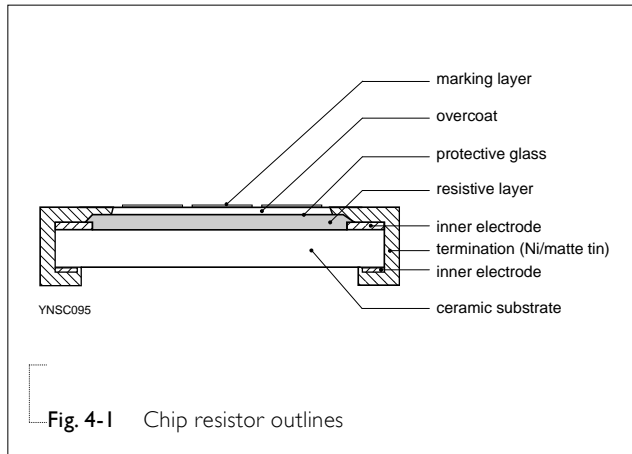
Table 1

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.

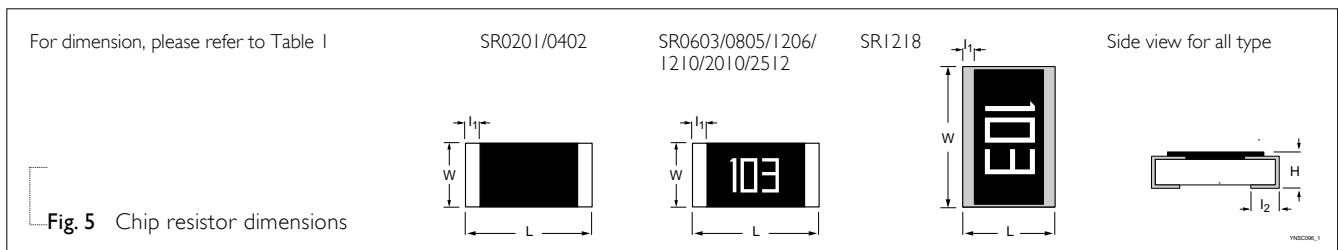
## OUTLINES



## 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	$3.10 \pm 0.10$	$1.60 \pm 0.10$	$0.55 \pm 0.10$	$0.45 \pm 0.20$	$0.45 \pm 0.20$
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	$5.00 \pm 0.10$	$2.50 \pm 0.15$	$0.55 \pm 0.10$	$0.55 \pm 0.15$	$0.55 \pm 0.20$
SR2512	$6.35 \pm 0.10$	$3.10 \pm 0.15$	$0.55 \pm 0.10$	$0.60 \pm 0.20$	$0.60 \pm 0.20$



## 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
SR0201	1/20W	E24/E96 0.5%, 1% E24 5%, 10%, 20%  for 0402, 0603, 0805, 1206, 2010   <					

**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**

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, 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

**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)

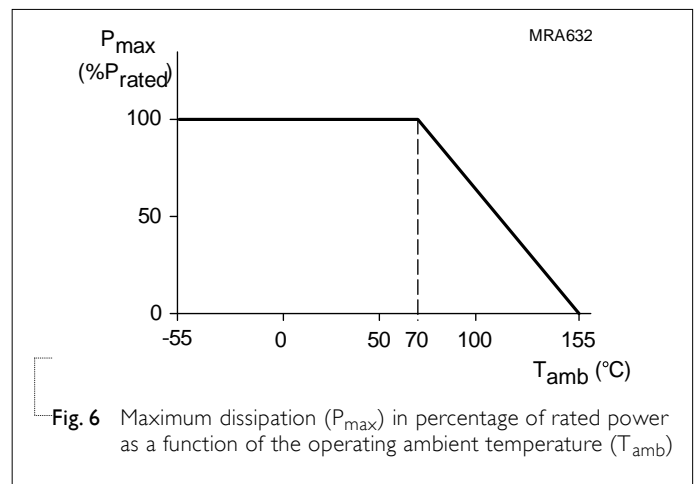


Fig. 6 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

## Pulse load Behavior

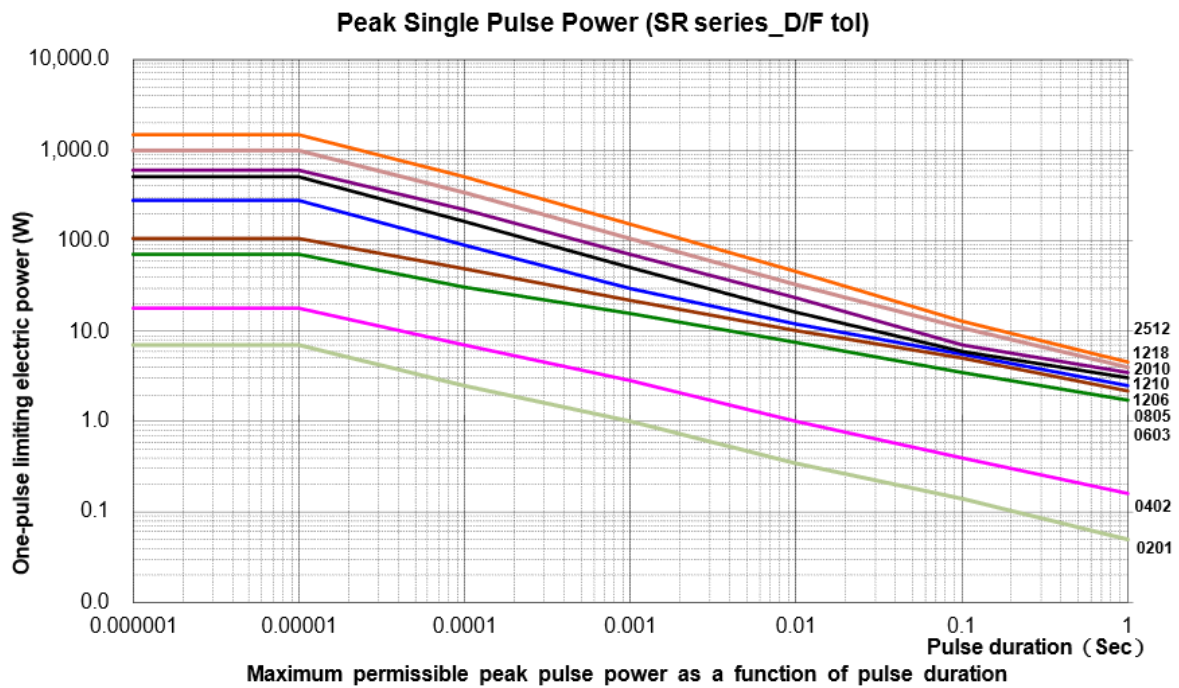


Fig. 7-1 Pulse-Load behavior

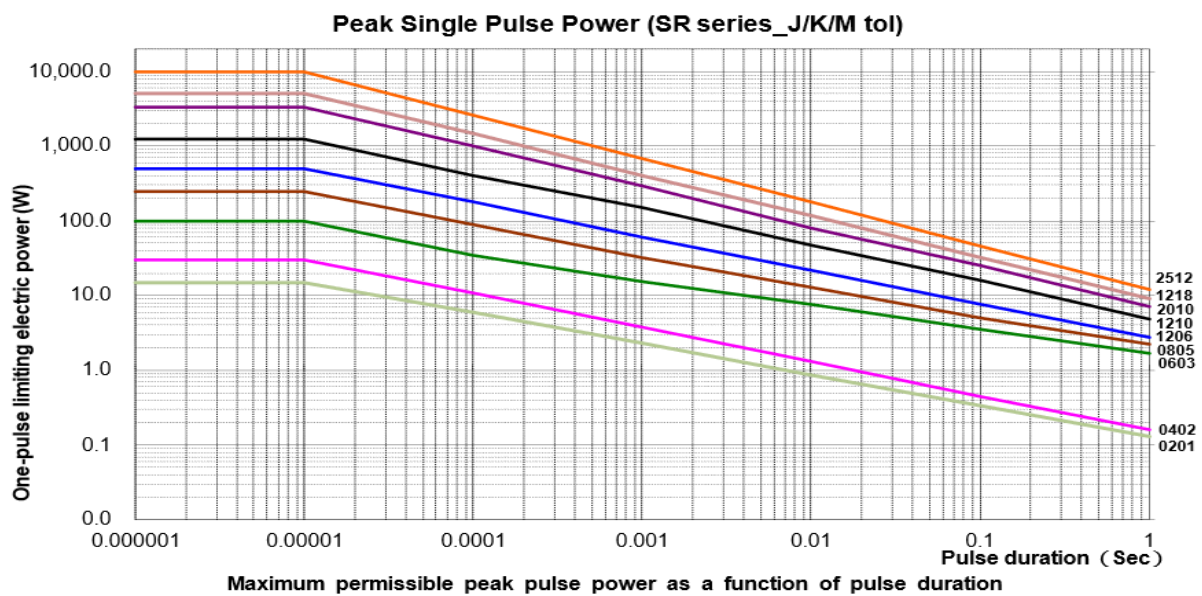


Fig. 7-2 Pulse-Load behavior

## Pulse load Behavior

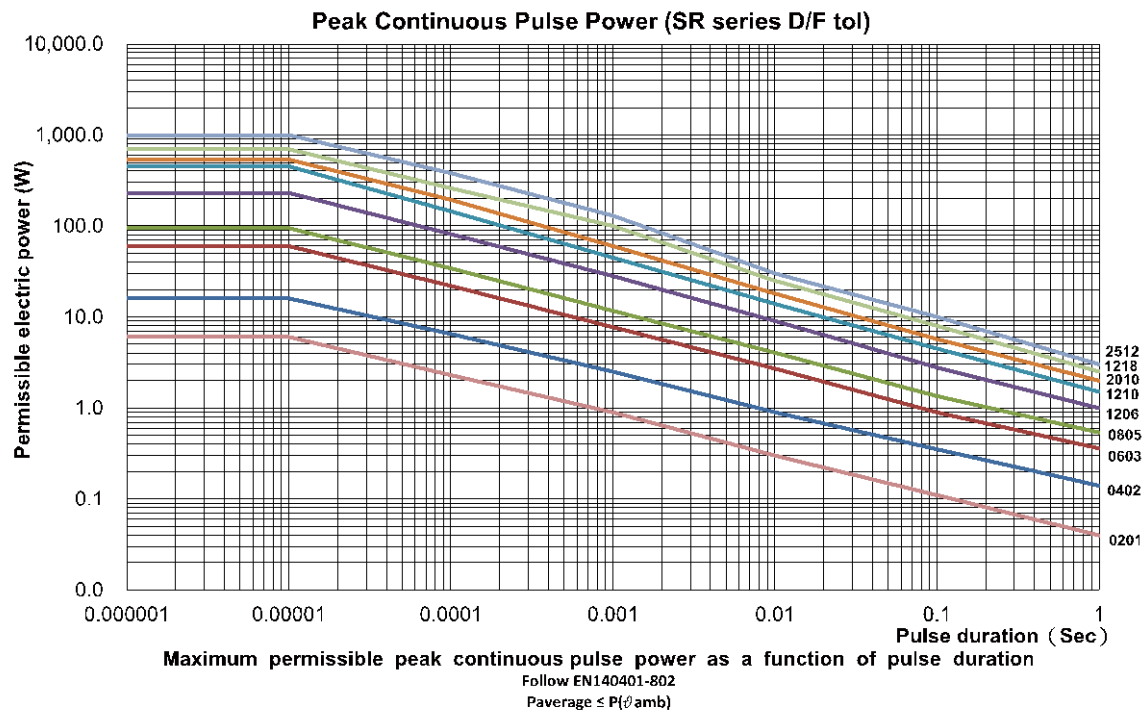


Fig. 7-3 Pulse-Load behavior

Pulse-SR001

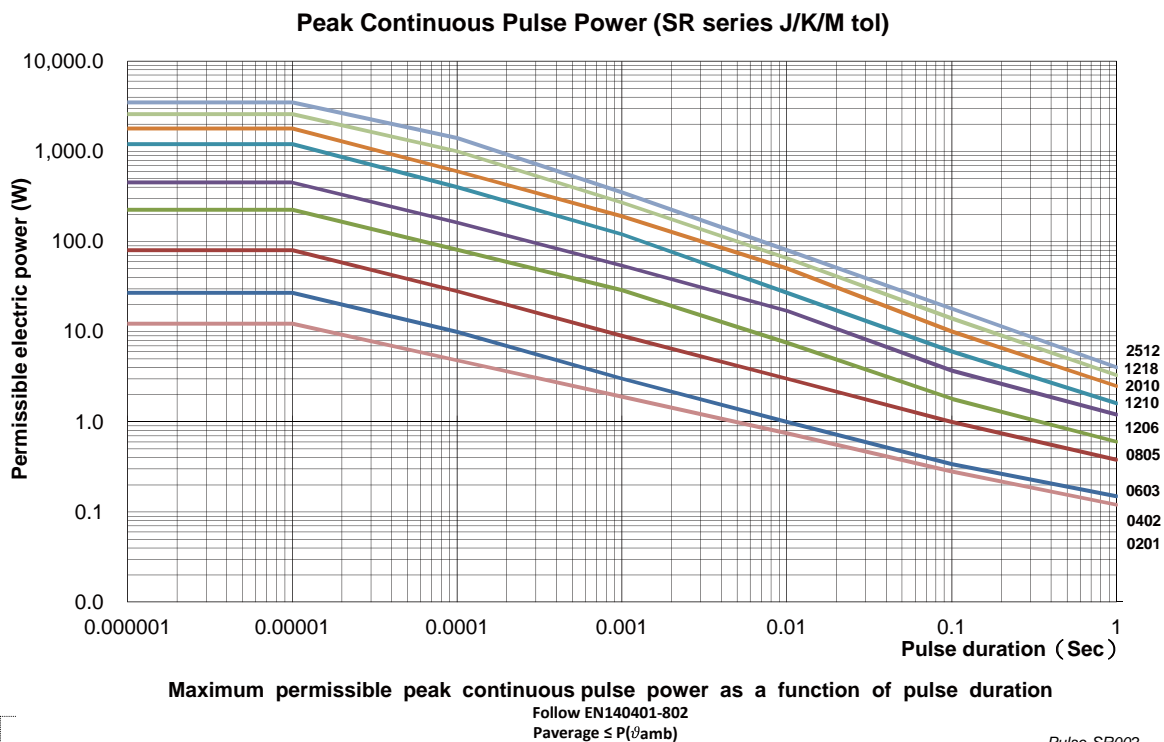


Fig. 7-4 Pulse-Load behavior

Pulse-SR002



**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 $t_1 = +25 \text{ °C}$ 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	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 14	Feb. 14, 2025	-	- Extend resistance range of 0402,0603,0805,1206,2010 to 10Mohm.
Version 13	Jul. 23, 2024	-	- Upgrade the working voltage of 1206 and 1210 to 500V
Version 12	Apr. 23, 2024	-	- Add continuous pulse curve
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
Version 9	Aug. 04, 2021	-	Upgrade the working voltage of 0805 to 500V
			I2 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 $10\Omega < R \leq 1M\Omega$ from $\pm 200$ ppm/°C to $\pm 100$ 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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