

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)

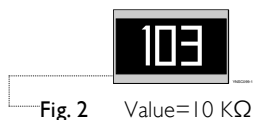
| Resistance rule of global part number | |
|---------------------------------------|---|
| Resistance coding rule | Example |
| XXXX (1 to 9.76 Ω) | 1R = 1 Ω 1R5 = 1.5 Ω 9R76 = 9.76 Ω |
| XXRX (10 to 97.6 Ω) | 10R = 10 Ω 97R6 = 97.6 Ω |
| XXXR (100 to 976 Ω) | 100R = 100 Ω |
| XKXX (1 to 9.76 K Ω) | 1K = 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 $\pm 5\%$ tolerance, supplied in 7-inch tape reel is: SR0805JR-0710KL.

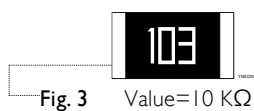
MARKING**SR0201 / SR0402**

No Marking

SR1218

E-24 series: 3 digits

First two digits for significant figure and 3rd digit for number of zeros

SR0603 / SR0805 / SR1206 / SR1210 / SR2010 / SR2512

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

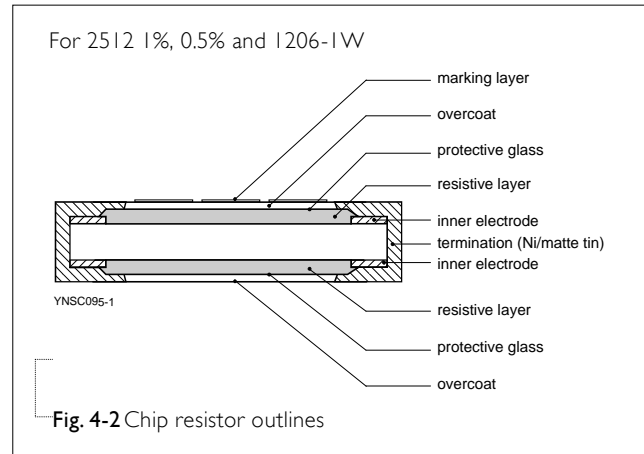
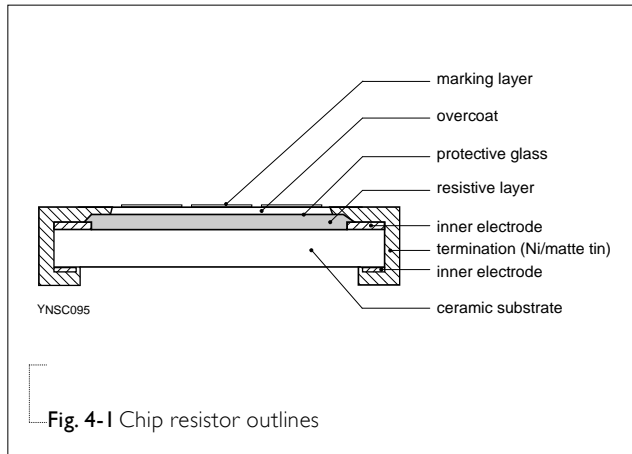
Table 1

| 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.

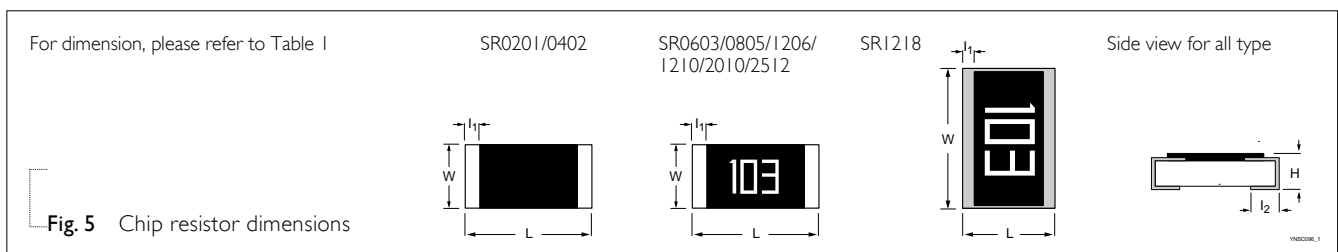
OUTLINES



DIMENSIONS

Table 2

| TYPE | L (mm) | W (mm) | H (mm) | l_1 (mm) | l_2 (mm) |
|--------|-----------------|-----------------|-----------------|-----------------|-----------------|
| SR0201 | 0.60 ± 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 |



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% 1 Ω ≤ R ≤ 1M Ω | -55 °C to +155 °C | 25 V | 50 V | 50 V | 1 Ω ≤ R < 10Ω -100~+350ppm°C 10Ω ≤ R ≤ 1MΩ ± 200 ppm°C | |
| | 1/10W | | | | | | | |
| | 1/5W | | | | | | | |
| SR0402 | 1/16W | | | 75 V | 100 V | 100 V | | |
| | 1/8W | | | | | | | |
| | 1/5W | | | | | | | |
| SR0603 | 1/10W | | | 150V | 300V | 300V | | |
| | 1/5W | | | | | | | |
| | 1/4W | | | | | | | |
| | 1/3W | | | | | | | |
| SR0805 | 1/8 W | | | 500V | 1000V | 1000V | | 10Ω ≤ R ≤ 1MΩ ±100 ppm/°C |
| | 1/4W | | | | | | | |
| | 1/3W | | | | | | | |
| | 1/2W | | | | | | | |
| SR1206 | 1/4 W | | | 200 V | 400 V | 500 V | | |
| | 1/2W | | | | | | | |
| | 3/4W | | | | | | | |
| SR1210 | 1W | | | 200 V | 400 V | 500 V | | |
| | 1/2W | | | | | | | |
| | 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 | | | 500 V | 1000 V | 1000 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 | 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

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)

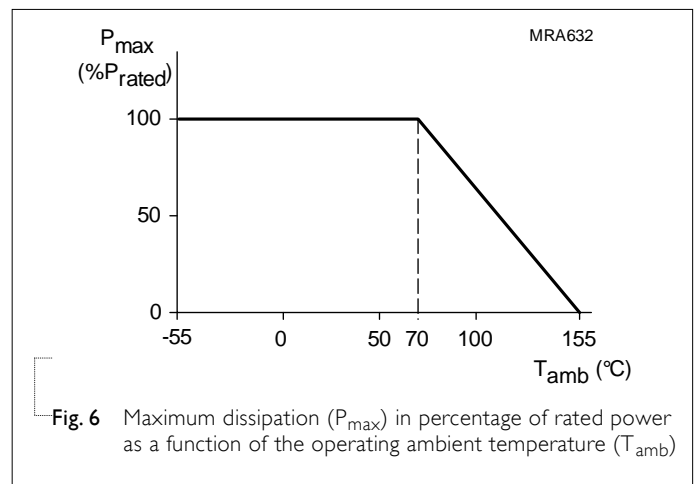
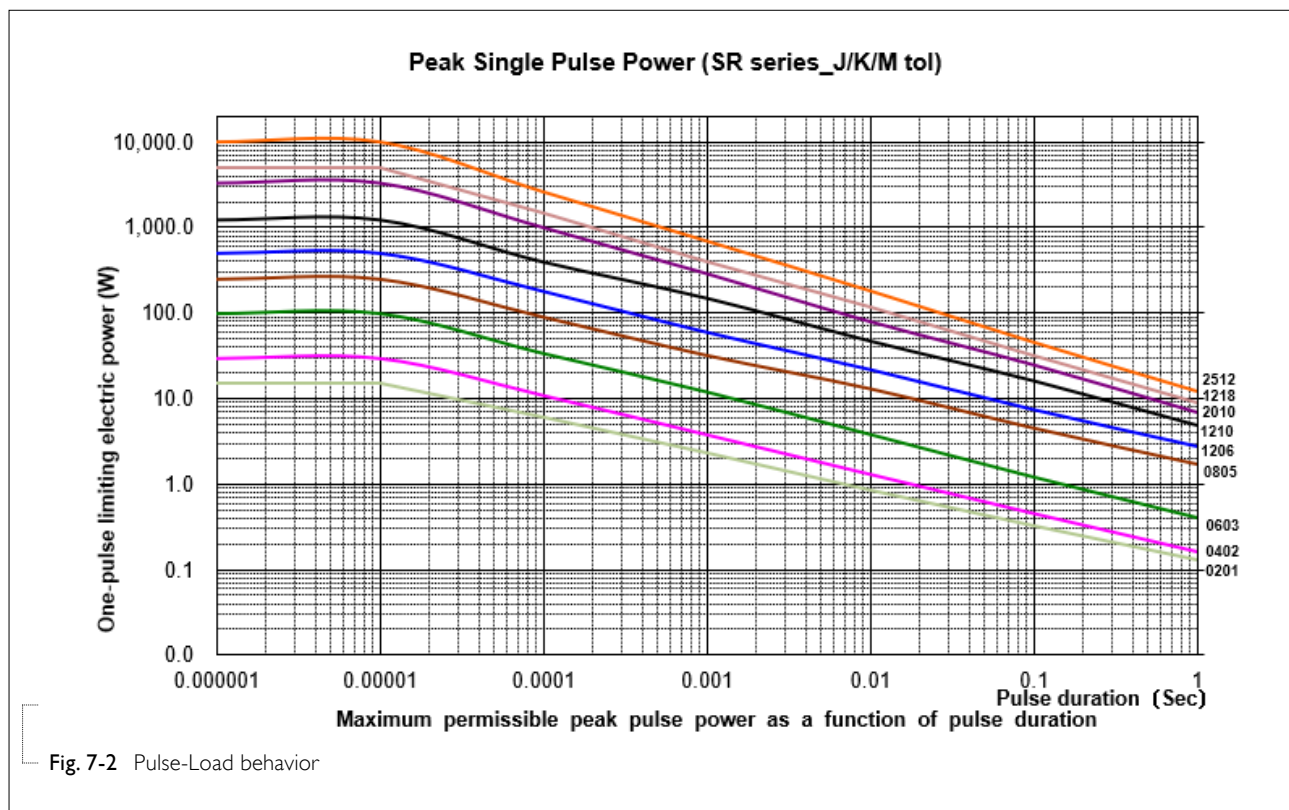
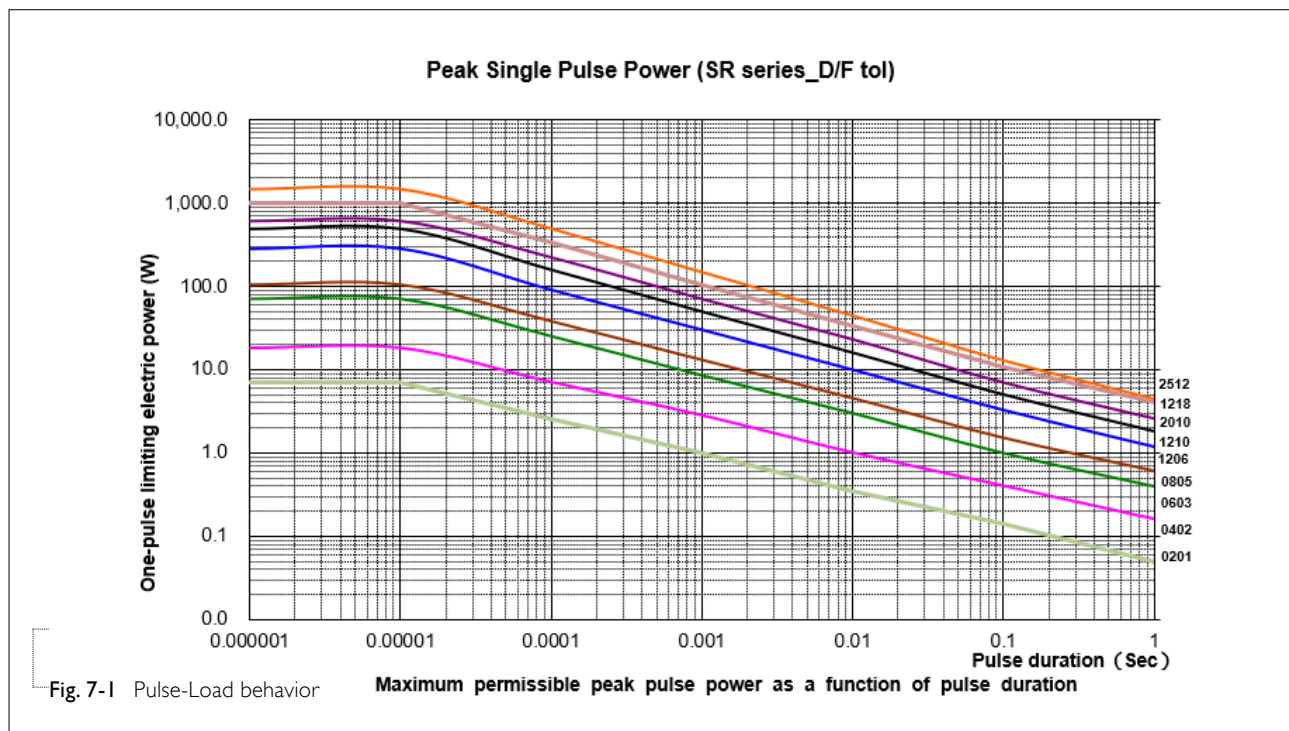


Fig. 6 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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 (method 106F), 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 ± 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 ± 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 ± 0.5 seconds. (b) Method B, steam aging 8 hours, dipping at $215\pm 3\text{ }^{\circ}\text{C}$ for 5 ± 0.5 seconds. (c) Method D, steam aging 8 hours, dipping at $260\pm 3\text{ }^{\circ}\text{C}$ for 30 ± 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 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 | 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 11 | Aug. 31, 2023 | - | - Upgrade the working voltage of 2512 to 500V - Merge F/D tol Add size 0201 |
| Version 10 | Aug. 02, 2022 | - | Upgrade the working voltage of 0402 to 75V Upgrade the working voltage of 0603 to 150V 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 1M Ω , - Tighten TCR of all sizes for 10 Ω < R \leq 1M Ω from \pm 200 ppm/ $^{\circ}$ C to \pm 100 ppm/ $^{\circ}$ 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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