

APPROVAL SHEET

SR25_A, SR20_A

$\pm 1\%$, $\pm 5\%$

Thick Film Anti-Sulfur Chip Resistors

Size 2512, 2010

(Automotive & Anti-Sulfuration)

RoHS 2 Compliant with exemption 7C-I
Halogen free

FEATURE

1. High reliability and stability $\pm 1\%$
2. Sulfuration resistant by Oil 105°C soaked with 3.5% sulphur substance 500hrs
3. Automotive grade AEC Q-200 Qualified
4. 100% CCD inspection
5. RoHS 2 Compliant with exemption 7C-I and Halogen free products

APPLICATION

- Automotive application
- Consumer electrical equipment
- EDP, Computer application
- Telecom application

DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The extra protective metal film is added onto top side electrodes to protect termination from sulfuration. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to within tolerance by laser cutting of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (lead free) alloy.

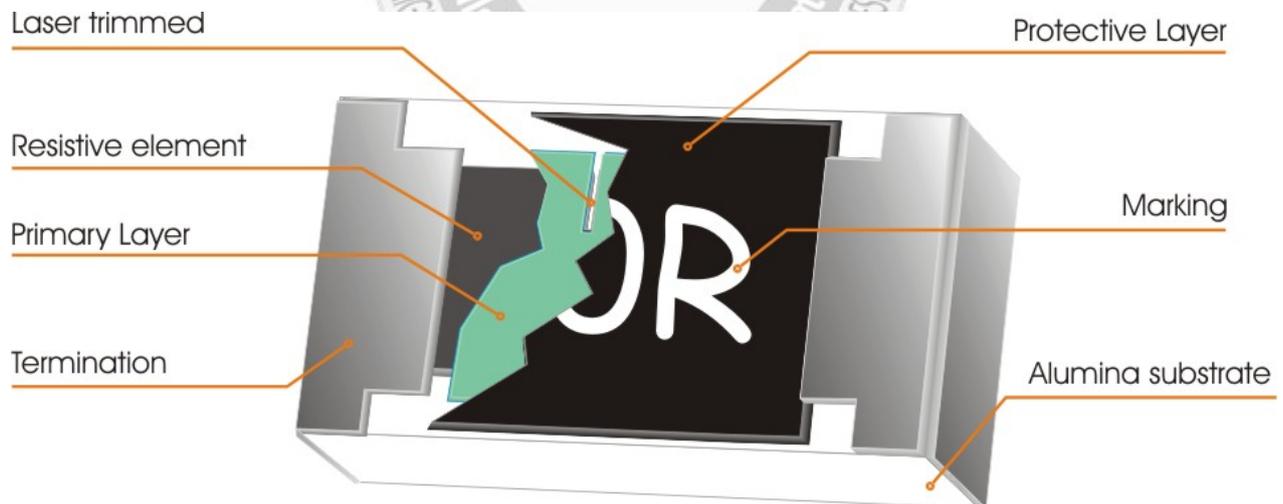


Fig 1. Construction of a Chip-R

QUICK REFERENCE DATA

Item	General Specification	
Series No.	SR25_A	SR20_A
Size code	2512(6432)	2010 (5025)
Resistance Range	1Ω~10MΩ	
Resistance Tolerance	± 1%, E96+E24 ± 5%, E24	
TCR (ppm/°C)	> 1MΩ ± 200 ppm/°C 10Ω ~ 1MΩ ± 100 ppm/°C < 10Ω ± 200 ppm/°C	
Max. dissipation @ T _{amb} =70°C	1 W	0.75 W
Max. Operation Voltage (DC or RMS)	250V	200V
Max. Overload Voltage (DC or RMS)	500V	400V
Operation temperature	-55 ~ +155°C	

Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see “IEC publication 60115-8”
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

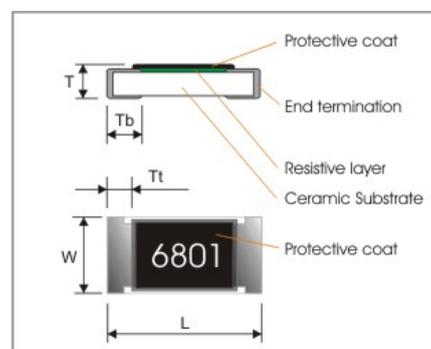
$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}} \text{ or Max. RCWV listed above, whichever is lower.}$$

For Jumper (0Ω) :

Item	General Specification	
Series No.	SR25_A	SR20_A
Size code	2512(6432)	2010 (5025)
Resistance Range	Max. 50mR	Max. 50mR
TCR (ppm/°C)	TCR is not applicable for Jumper product	
Max. dissipation @ T _{amb} =70°C	1 W	0.75 W
Rated Current	4.5 A	3.2 A
Peak Current	11 A	8 A
Operating Temperature	-55 ~ 155°C	-55 ~ 155°C

DIMENSIONS (unit : mm)

Series No.	SR25_A	SR20_A
L	6.40±0.20	5.00±0.20
W	3.20±0.20	2.50±0.20
T	0.60±0.10	0.55±0.10
T _b	0.90±0.25	0.60±0.25
T _t	0.85±0.25	0.65±0.25



CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

SR20	X	1003	F	T	L	A
Automotive code SR25 : 2512 SR20 : 2010	Type code X : ±1%, 10-1M ±5%, 1-10M W : ±1%, <10, >1M	Resistance code ±5%, E24: 2 significant digits followed by no. of zeros and a blank 220Ω = 221_ ("_" means a blank) ±1%, E24+E96: 3 significant digits followed by no. of zeros 102Ω = 1020 37.4KΩ = 3742	Tolerance F : ±1% J : ±5% P : Jumper	Packaging code T : 7" Reeled taping Q : 10" Reeled taping G : 13" Reeled taping B : Bulk	Termination code L = Sn base (lead free)	Special code A = Anti-sulfur by Oil 105°C soaked with 3.5% sulphur 500hrs

* Anti-Sulfur test conditions: Oil 105°C soaked with 3.5% sulphur substance 500hrs, acceptance criteria: +/-1.0%.\

* 100% CCD visual inspection to guarantee visual quality.

MARKING

Each resistor is marked with a four-digit code on the protective coating to designate the nominal resistance value ±5%, ±1% tolerance.

Size	±5%	±1%
2512, 2010	4-digits marking	4-digits marking

Example

RESISTANCE	Jumper (0Ω)	10Ω	12Ω	100Ω	6800Ω	47000Ω
4-digit marking	0000	10R0	12R0	1000	6801	4702

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24 & E96 series for resistors with a tolerance of $\pm 0.5\%$, $\pm 0.1\%$. The values of the E24/E96 series are in accordance with "IEC publication 60063"

Derating

The power that the resistor can dissipate depends on the operating temperature; see Fig.2

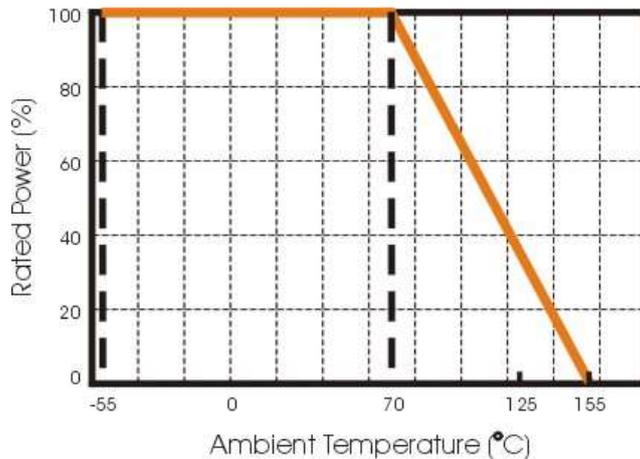


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature

MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

Storage and Handling Conditions:

1. Products are recommended to be used up within two years since operation date as ensured shelf life. Check solderability in case shelf life extension is needed.
2. To store products with following condition:
 - Temperature :5 to 40°C
 - Humidity :20 to 70% relative humidity
3. Caution:
 - a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid.
It may cause oxidation of electrode, which easily be resulted in poor soldering.
 - b. To store products on the shelf and avoid exposure to moisture.
 - c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

SOLDERING CONDITION follows J-STD-020D

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds.

Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.

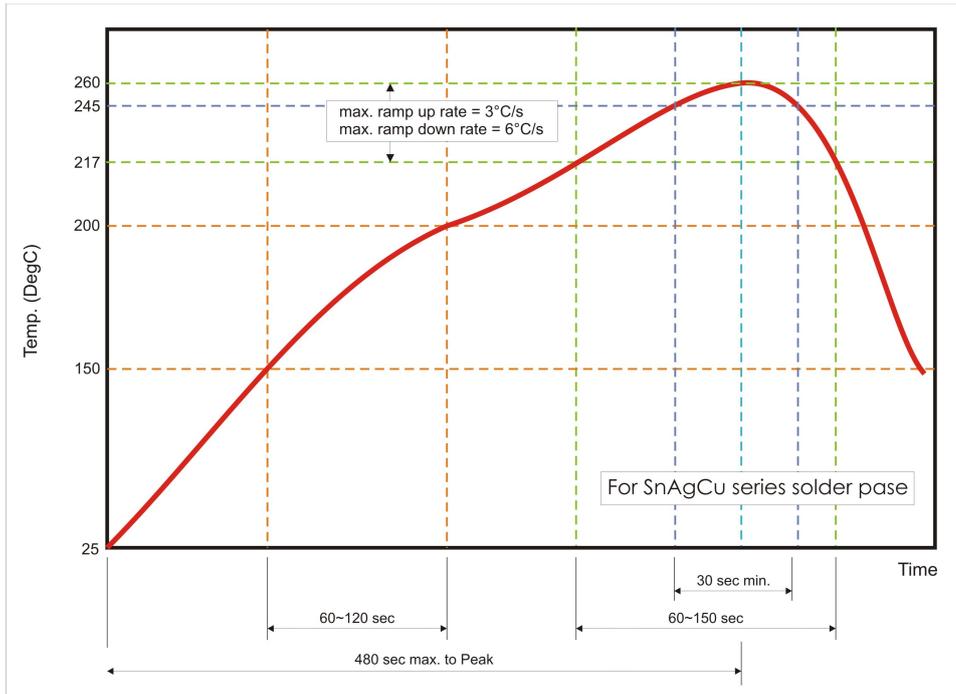


Fig 3. Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

TEST AND REQUIREMENTS

Essentially all tests are carried out according to the schedule of IEC publication 115-8, category **LCT/UCT/56**(rated temperature range : **L**ower **C**ategory **T**emperature, **U**pper **C**ategory **T**emperature; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ and JIS.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to IEC 60068-1, sub-clause 5.3. Unless otherwise specified, the following value supplied :

Temperature: 15°C to 35°C.

Relative humidity: 45% to 75%.

Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

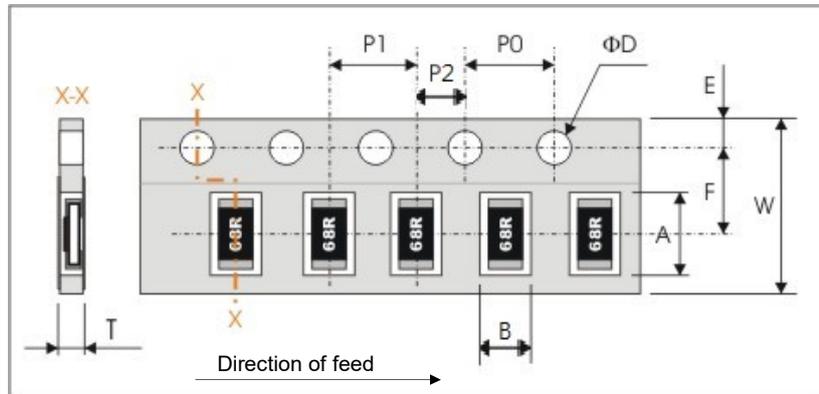
All soldering tests are performed with mildly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
High Temperature Exposure (Storage) MIL-STD-202 method 108	1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Temperature cycling JESD22 method JA-104	1000 cycles, -55°C ~ +155°C, dwell time 30min maximum.	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
Moisture Resistance MIL-STD-202 method 106	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
Bias Humidity MIL-STD-202 method 103	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Operational Life MIL-STD-202 method 108	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
External Visual MIL-STD-883 method 2009	Electrical test not required. Inspect device construction, marking and workmanship	No visual damage and refer WTC marking code.	
Physical Dimension JESD22 method JB-100	Verify physical dimensions(L, W, T, Tb, Tt)	Within the specified tolerance for WTC.	
Short Time Overload (STOL) JISC5201-1: 1998 Clause 4.13	Permanent resistance change after a 5 second application of a voltage 2.5 times the rated voltage or max. overload voltage, whichever is less	ΔR/R max. ±(2.0%+0.1Ω) No visible damage	<50mΩ
Resistance to soldering heat (R.S.H) MIL-STD-202 method 210	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270°C ±5°C	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
Thermal shock MIL-STD-202 method 107	Test -55 to 155°C / dwell time 15min/ Max transfer time 20sec 300cycles	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
ESD AEC-Q200-002	Test contact 1KV	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Solderability J-STD-002	a) Bake the sample for 155°C dwell time 4hrs/ solder dipping 235°C / 5sec. b) Steam the sample dwell time 8 hour/ solder dipping 215°C / 5sec c) Steam the sample dwell time 8 hour/ solder dipping 260°C / 7sec	95% coverage min., good tinning No visible damage	
Electrical Characteristics JISC5201-1: 1998 Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ t ₁ : 20°C+5°C-1°C R ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature	Within the specified tolerance Refer to "QUICK REFERENCE DATA"	
Board Flex AEC-Q200-005	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 2mm for 60sec	ΔR/R max. ±(1.0%+0.05Ω). No visible damage	<50mΩ
Terminal strength AEC-Q200-006	Pressurizing force: 1.8Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations	
Resistance to Solvents MIL-STD-202 Method 215	Solvent is Isopropyl alcohol, immersion 3mins at 25°C and brush 10 strokes with a toothbrush with a handle made of a non-reactive material (wet bristle),immersion and brush 3 times and then air blow dry	No superficial defect on marking, encapsulation, coating, appearance. Electrical characteristics within products specification and tolerance. Inspect at 3X max. for marking, inspect at 10X for part damage	
Mechanical Shock MIL-STD-202 method 213	Test ½ Sine Pulse/ 1500g peak/ normal duration: 6ms/ Velocity: 15.4ft/sec. Three shocks in each direction, total 18 shocks	Within the specified tolerance No visible damage	<50mΩ
Vibration MIL-STD-202 method 204	Test 5g's for 20min., 12 cycles each of 3 orientations	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Sulfuration test	Oil 105°C soaked with 3.5% Sulfur substance, 500hrs	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ

PACKAGING

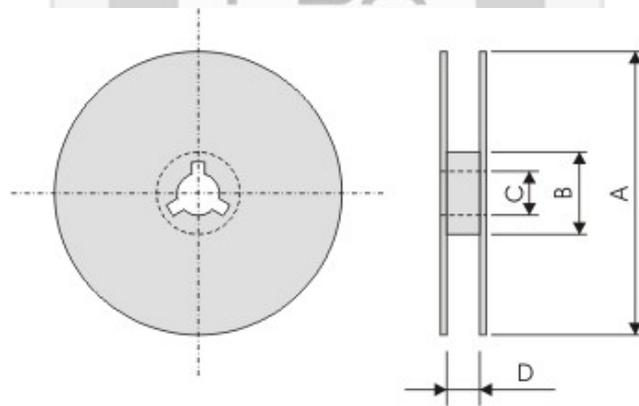
Tape specifications (unit :mm)



Series No.	A	B	W	F	E
SR25	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
SR20	5.50±0.20	2.80±0.20			

Series No.	P1	P0	P2	ΦD	T
SR25	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	MAX1.2
SR20					

Reel dimensions (unit :mm)



Symbol	A	B	C	D
7" Reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	12.4±1.0
10" Reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	14.0±0.2
13" Reel	Φ330.0±2.0	Φ100.0±1.0	13.0±0.2	14.0±0.2

Taping quantity

2512, 2010 by plastic tape taping 4,000 pcs per 7" reel; 8,000pcs per 10" reel; 16,000pcs per 13" reel.