1 Scope:

1.1 This specification is applicable to lead-free and halogen-free RSTA series anti-sulfurated automotive thick film chip resistors.
1.2 Superior Sulfur resistant capability (Refer to ASTM-B-809-95&EIA977 sulfur vapor test).
1.3 Lead-free products refer to termination lead-free which meets RoHS requirement. However, Pb contained in glass material is exempted by RoHS directive.
1.4 This product is for automotive electronic application.
1.5 AEC-Q200 qualified ,grade 1.
1.6 RSTA0201 AEC-Q200 qualified, grade 1.
Other Types AEC-Q200 qualified, grade 0.

2 Explanation Of Part Number:

(EX)

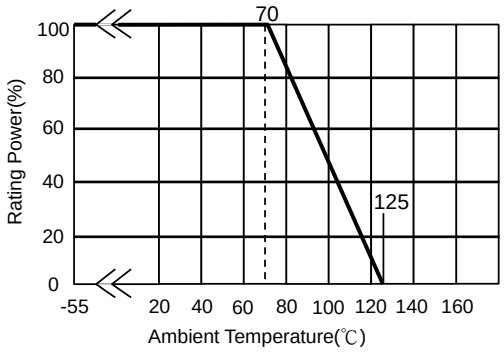
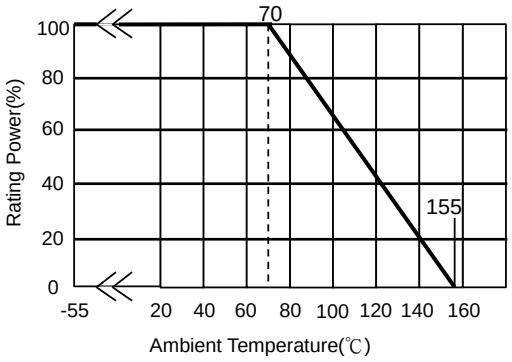
RSTA **0805** **T** **1002** **F**

Type	Size	Packaging	Nominal Resistance		Resistance Tolerance
RSTA series anti-sulfurated automotive thick film chip resistors	0201 0402 0603 0805 1206 1210 2010 2512	T :Taping Type	5% (3-Digit)	EX. 10Ω=100 4.7Ω=4R7 JUMPER=000	D=± 0.5% J=± 5% F=± 1%
			0.5% 1% (4-Digit)	EX. 10.2Ω=10R2 10KΩ=1002 JUMPER=0000	

3 General Specifications:

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm / ℃)	Resistance Range		JUMPER (0Ω) Rated Current		JUMPER (0Ω) Resistance Value	
					D(±0.5%) E-24、E-96	J(±5%)、F(±1%) E-24、E-96	J(±5%)	F(±1%)	J(±5%)	F(±1%)
RSTA (0201)	1/20W	25V	50V	-200 +400	1Ω≦R＜10Ω	1Ω≦R＜10Ω	0.5A	0.5A	100mΩ MAX	50mΩ MAX
				±200	10Ω≦R≦10MΩ	10Ω≦R＜10MΩ				
RSTA (0402)	1/16W	50V	100V	±200	------	1Ω≦R＜10Ω	1A	1.5A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜22MΩ				
RSTA (0603)	1/10W	75V	150V	±200	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1A	2A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜22MΩ				
RSTA (0805)	1/8W	150V	300V	±200	1Ω≦R＜10Ω	1Ω≦R＜10Ω	2A	2.5A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜27MΩ				
RSTA (1206)	1/4W	200V	400V	±200	1Ω≦R＜10Ω	1Ω≦R＜10Ω	2A	3.5A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜27MΩ				
RSTA (1210)	1/2W	200V	400V	±200	1Ω≦R＜10Ω	1Ω≦R＜10Ω	2A	4A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜27MΩ				
RSTA (2010)	3/4W	200V	400V	±200	1Ω≦R＜10Ω	1Ω≦R＜10Ω	2A	5A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜20MΩ				
RSTA (2512)	1W	200V	400V	±200	1Ω≦R＜10Ω	1Ω≦R＜10Ω	2A	7A	100mΩ MAX	50mΩ MAX
				±100	10Ω≦R≦1MΩ	10Ω≦R＜20MΩ				
Operating Temperature Range				-55℃ ~ +155℃(0201：－55℃ ~ ＋125℃)						

3.1 Power Derating Curve:

Type	RSTA (0201)	Other
Operating Temperature Range	−55℃ ~ +125℃	−55℃ ~ +155℃
Explain	If the ambient temperature exceeds 70 degrees centigrade to 125 degrees centigrade, the power can be modified by the curve as below.	If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below.
Figure		

3.2 Voltage Rating or Current Rating:

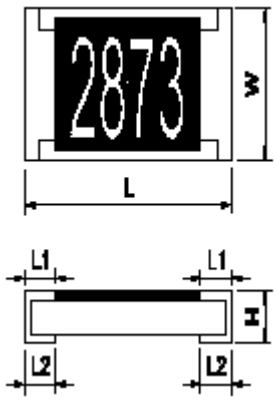
Rated Voltage: DC voltage or AC voltage (rms) based on the rated power.
The voltage can be calculated by the following formula. If the calculated value exceeds the Max. voltage specified in the Table 3.1, the Max. voltage rating is set as the voltage rating.

$$E=\sqrt{R\times P}$$

E= Voltage rating (V)
P= Power rating (W)
R= Nominal resistance(Ω)

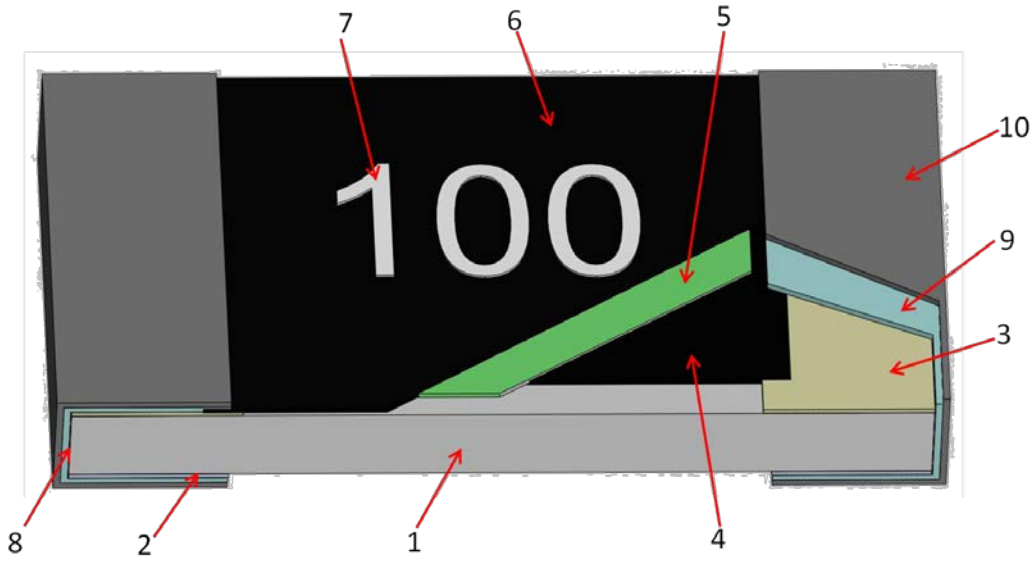
4 Dimensions:

Unit:mm



Type \ Dimension / Size Code		L	W	H	L1	L2
RSTA	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
RSTA	0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
RSTA	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
RSTA	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
RSTA	1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.20
RSTA	1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
RSTA	2010	5.00±0.20	2.50±0.20	0.60±0.10	0.65±0.20	0.65±0.20
RSTA	2512	6.30±0.20	3.20±0.20	0.60±0.10	0.65±0.20	0.65±0.20

5 Structure Graph:



1	Ceramic substrate	6	2nd Protective coating
2	Bottom inner electrode	7	Marking
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1st Protective coating	10	Sn plating

6 Reliability Test:

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>High Temperature Exposure (Storage)</td><td>Put the specimens in the chamber with temperature of 155±3℃ for 1000 hours. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate.

Experiment evidence: AEC-Q200</td><td>0.5%、1%：△R=±1.0%
5%：△R=±2.0%</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="3">No mechanical damage.</td></tr>
<tr><td>Temperature Cycling</td><td>Put the specimens in the High & low temperature test chamber with temperature varies from -55℃ to 125℃ for 15 minutes and total 1000 cycles. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate.

Experiment evidence: AEC-Q200</td><td>△R%=±2.0%</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="3">No mechanical damage</td></tr>
<tr><td>Biased Humidity</td><td>Solder the specimens on the test PCB and put them into the constant temperature humidity chamber with 85±2℃ and 85±5%RH. Then apply the test voltage that calculates based on the 10% of rated power for 1000hrs. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate.

Experiment evidence: AEC-Q200</td><td>0.5%、1%：△R%=±2.0%
5%：△R%=±3.0%</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="3">No mechanical damage, short or burning-out phenomenon.</td></tr>
<tr><td>Operational Life</td><td>Solder the specimens on the test PCB and Put them in the chamber with temperature of 125±3℃ and load the voltage for 1000 hours. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate.
Note: The input voltage shall refer to the power derating curve (referring to Table.3.1)

Experiment evidence: AEC-Q200</td><td>0.5%、1%：△R%=±2.0%
5%：△R%=±3.0%</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="3">No mechanical damage, short or burning-out phenomenon.</td></tr>
<tr><td rowspan="2">Short Time Overload</td><td>Applied 2.5 times rated voltage for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Rated voltage refer to item 3. general specifications) Jumper :
Applied Maximum overload current
<table>
<tr><th>型别
Jumper</th><th>RSTA (0201)</th><th>RSTA (0402)</th><th>RSTA (0603)</th><th>RSTA (0805)</th><th>RSTA (1206)</th><th>RSTA (1210)</th><th>RSTA (2010)</th><th>RSTA (2512)</th></tr>
<tr><td>±5%</td><td>1.25A</td><td>2.5A</td><td>2.5A</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td></tr>
<tr><td>±1%</td><td>1.25A</td><td>3.75A</td><td>5.0A</td><td>6.25A</td><td>8.75A</td><td>10.0A</td><td>12.5A</td><td>17.5A</td></tr>
</table>
Refer to JIS-C5201-1 4.13</td><td>0.5%、1%：△R%=±1.0%
5%：△R%=±2.0%</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="3">No mechanical damage, peel-off of side end or chip crack.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>The specimens are fully immersed into the Pb-free solder pot, then take them out to stabilize for 1 hour or more and measure of its resistance variance rate.
Temp of solder pot：260±5℃
Soldering duration：10±1sec.

Experiment evidence AEC-Q200</td><td>△R=±1.0%</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="3">No cosmetic defect on terminal or peel-off of side end</td></tr>
</table>

Item	Conditions	Specifications	
		Resistors	Jumper
ESD	Put the specimens on the test fixture and two (2)discharges (2KVDC) shall be applied to each PUT, one (1) with a positive polarity and one (1) with a negative polarity. Afterwards, the specimens stabilize for 30min or more and measure of its resistance variance rate. The test is performed with direct contact and regular discharge mode. The resistor and capacitor used on the spearhead is 2000Ωand 150pF respectively. Experiment evidence AEC-Q200	△R%=±3.0%	Refer to item 3. general specifications
		No mechanical damage, short or burning-out phenomenon.	
Solderability	**Test method:** **Test item 1 (solder pot test): Method B** Precondition: The specimens are subjected to 155℃ dry bake for 4hrs±15min. The specimens are immersed into the flux first, then fully immersed into the solder pot, at a temperature of 235± 5℃ for 5+0/-0.5 sec. Then rinse with water and observe the soldering coverage under the microscope. **Test item 2 (Leaching test): Method D** The specimens are immersed into the flux first, then fully immersed into the solder pot, at a temperature of 260±5℃ for 30+0/-0.5 sec. Then rinse with water and observe the soldering coverage under the microscope. Experiment evidence AEC-Q200	1.Solderingcoverage over 95% 2.At the edge of terminal, the object underneath (e.g. white ceramic) shall not expose.	
Electrical Characterization	$TCR(ppm/℃)=\frac{(R2-R1)}{R1(T2-T1)}\times 10^6$ R1: Resistance at room temperature (Ω) R2: Resistance at -55℃or +125℃(Ω) T1: Room temperature (℃) T2: Temperature -55℃or +125℃	Refer to item 3. general specifications	NA
Board Flex (Bending Test)	Solder the specimens on the test PCB and put the PCBA onto the Bending Tester. Add force at the central part of PCB, and the duration of the applied forces shall be 60 (+ 5) Sec. Measure of its resistance variance rate in load. Bending depth (D) : 0402 0603 0805=5mm 0201 1206 1210=3mm 2010 2512=2mm Experiment evidence: AEC-Q200	△R=±1.0%	Refer to item 3. general specifications
		No mechanical damage, peel-off of side end or chip crack.	
Sulfuration Test	Put the tested resistor in sulfur vapor, at a temperature of 105±2℃for 750hrs Refer to ASTM-B-809-95&EIA977	△R=±4.0%	Refer to item 3. general specifications

7 Plating Thickness:

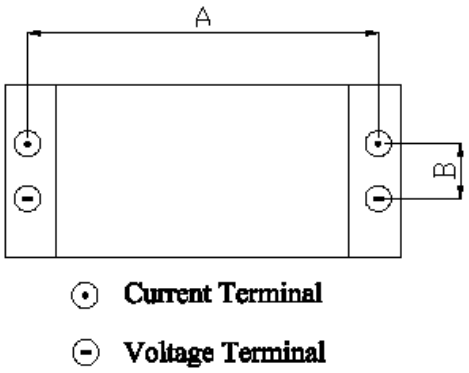
7.1 Ni:≧2μm

7.2 Sn(Tin):≧3μm

7.3 Sn(Tin):Matte Sn

8 Measurement Point:

Measure from bottom electrodes



Unit : mm

TYPE \ DIM	A	B
RSTA0201	0.44±0.05	0.22±0.05
RSTA0402	0.80±0.05	0.24±0.05
RSTA0603	1.35±0.05	0.35±0.05
RSTA0805	1.80±0.05	0.35±0.05
RSTA1206	2.90±0.05	0.35±0.05
RSTA1210	2.90±0.05	0.35±0.05
RSTA2010	4.50±0.05	1.15±0.05
RSTA2512	5.90±0.05	1.60±0.05

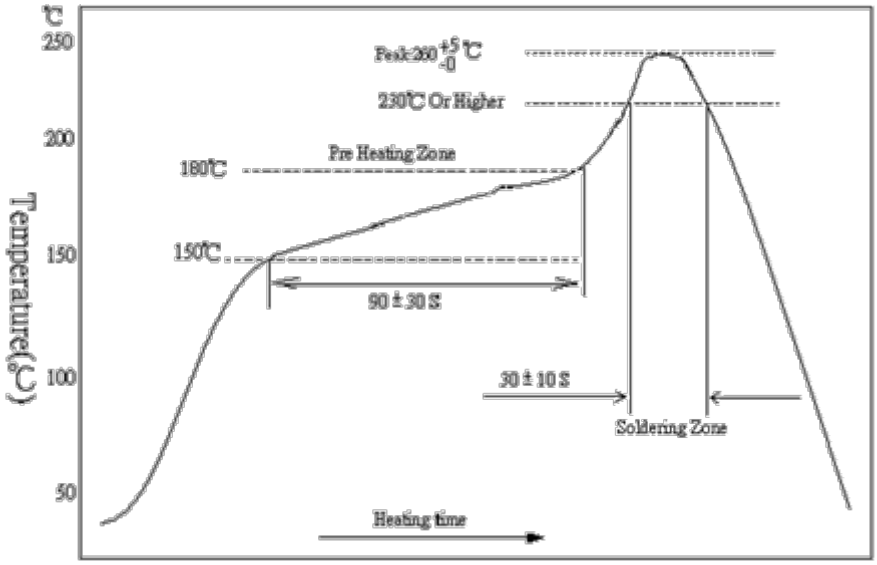
9 Rule of package empty quantity:

9.1 Empty quantity for each reel is not allowed to exceed 0.1% of the whole quantity, and continuous 2pcs (included) empty are also unallowed.

10 Technical application notes (This is for recommendation, please customer perform adjustment according to actual application):

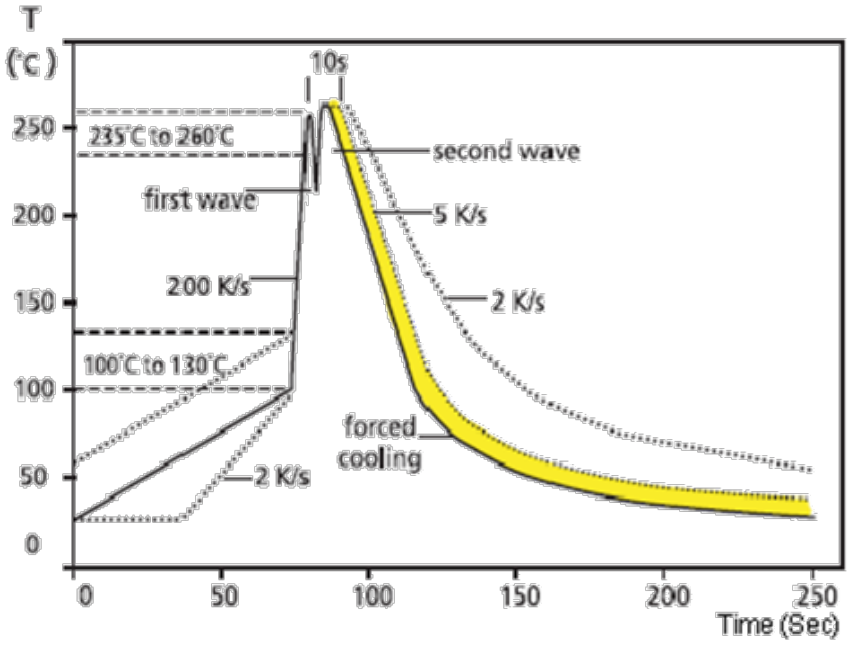
10.1 Recommend Soldering Method:

10.1.1 Lead Free IR-Reflow Soldering Profile (MEET J-STD-020D)



Remark: The peak temperature of soldering heat is 260 +5/-0 ℃ for 10 seconds

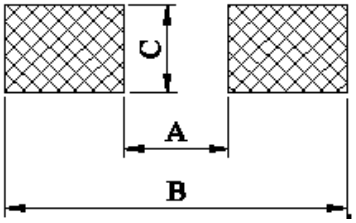
10.1.2 Lead Free Double-Wave Soldering Profile. (This applies to 0603 and above size products)



10.1.3 Soldering Iron: temperature 350℃±10℃ , dwell time shall be less than 3 sec.

10.2 Recommend Land Pattern Design (For Reflow Soldering)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.



Unit:mm

DIM / TYPE	A	B	C
RSTA0201	0.3	1.0	0.4
RSTA0402	0.5	1.5	0.6
RSTA0603	0.8	2.1	0.9
RSTA0805	1.2	3.0	1.3
RSTA1206	2.2	4.2	1.6
RSTA1210	2.2	4.2	2.8
RSTA2010	3.5	6.1	2.8
RSTA2512	3.8	8.0	3.5

10.3 Automobile Electronic Application:

This specification is for automobile electronic use. RALEC will take no responsibility if any damage, cost or loss occurs when the product has been used in any special circumstances:

(a) Information, entertainment, navigation, audio control units;
(b) Comfortable door, window, seat control unit;
(c) Internal lighting control unit.

10.4 Environment Precautions:

If consumer intends to use our company product in special environment or condition (including but not limited to those mentioned below), then will need to make individual recognition of product features and reliability accordingly:

(a) Used in high temperature and humidity environment;
(b) Exposed to sea breeze or other corrosive gas, such as Cl2、H2S、NH3、SO2 and NO2;
(c) Used in non-verified liquids including water, oil, chemical and organic solvents;
(d) Using non-verified resin or other coating material to seal or coat our Company product;
(e) After soldering, it is necessary to use water-soluble detergents to clean residual solder fluxes, even though no-clean fluxes are recommended.

10.5 Momentary Overload Precautions:

The product might be out of function when momentary overloaded. Please make sure to avoid momentary overloading while using and preserving.

10.6 Operation and Processing Precautions:

(a) Avoid damage to the edge of resistor and protective layer caused by mechanical stress;

(b) Handle with care when printing circuit board (PCB) is divided or fixed on support body, because bending of printing circuit board (PCB) mounting will make mechanical stress for resistors;

(c) Make sure the power rating is under the limit when using the resistor. When power rating is over the limit, the resister will be overloaded. There might be machinery damage due to the climbing temperature;

(d) If the resister will be exposed under massive impact load (shock wave) in a short period of time, the working environment must be set up well before use;

(e) Please make evaluation and confirmation when the product is well used in your company and have a through consideration of its fail-safe design to ensure the system safety.

11 Stock period:

11.1 The temperature condition must be controlled at 25±5℃, the R.H. must be controlled at 60±15%. The stock can maintain quality level in two years.

11.2 Please avoid the mentioned harsh environment below when storing to ensure product performance and its' weldability. Places exposed to sea breeze or other corrosive gas, such as Cl2、H2S、NH3、SO2 and NO2.

11.3 When the product is moved and stored, please ensure the correct orientation of the box. Do not drop or squeeze the box. Otherwise, the electrode or the body of the product may be damaged.

12 The carton packaged for electronic-information products is made by the symbol as follows: (For china)

	
Marking for control of pollution cause by electronic-information products	Marking for package recovery

13 Attachments:

13.1 Document Revise Record (QA-QR-027)

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