1 適用範圍:

1.1 本承認書適用於本公司所生產的無鉛、無鹵素之RAT系列汽車用厚膜晶片電阻器。

1.2 本公司之無鉛產品意指符合RoHS要求的端電極無鉛，而存在於電阻層玻璃材料中的鉛是符合RoHS的鉛排外條款。

1.3 符合AEC-Q200 測試規範

2 型別名稱:

(例)

RAT **02** **100** **J** **TH**

型別	尺寸 (參考 3.規格表)	電阻值		容差	包裝型式 (請參閱 IE-SP-054)
汽車用 厚膜晶片電阻器	02(0402)	3-碼	EX. 10Ω=100 4.7Ω=4R7 JUMPER=000	B =± 0.1% D=± 0.5% F=± 1% G=± 2% J=± 5%	TH：2 mm Pitch Carrier Tape 10000 pcs . . . . . BA：散裝(盒裝)
		4-碼	EX. 10.2Ω=10R2 10KΩ=1002		

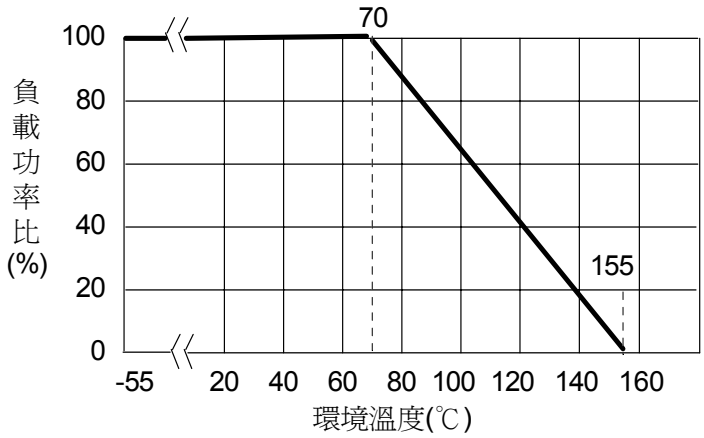
3 規格表:

型別	額定功率	最高額定電壓	最高過負荷電壓	T.C.R (ppm/℃) 溫度係數	阻值範圍				JUMPER (0Ω) 額定電流	JUMPER (0Ω) 阻值
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	G(±2%)、J(±5%) E-24	J (±5%)	J (±5%)
RAT02 (0402)	1/16 W	50V	100V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦22MΩ	10Ω≦R≦22MΩ	1A	50mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
RAT03 (0603)	1/10 W	75V	150V	±100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦22MΩ	10Ω≦R≦22MΩ	1A	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
RAT05 (0805)	1/8 W	150V	300V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦27MΩ	10Ω≦R≦27MΩ	2A	50mΩ MAX.
				±200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
RAT06 (1206)	1/4 W	200V	400V	±100	10Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦27MΩ	10Ω≦R≦27MΩ	2A	50mΩ MAX.
				±200	3Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
RAT12 (1210)	1/2 W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦27MΩ	10Ω≦R≦27MΩ	2A	50mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
RAT20 (2010)	3/4 W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	10Ω≦R≦20MΩ	2A	50mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
RAT25 (2512)	1W	200V	400V	±100	100Ω≦R≦1MΩ	10Ω≦R≦10MΩ	10Ω≦R≦20MΩ	10Ω≦R≦20MΩ	2A	50mΩ MAX.
				±200	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
使用溫度範圍				-55℃ ~ +155℃						

3.1 功率衰減曲線:

使用溫度範圍：- 55 ～ 155 ℃

周圍溫度若超過70℃至155℃之間，功率可照下圖曲線予以修定之。



3.2 額定電壓或額定電流:

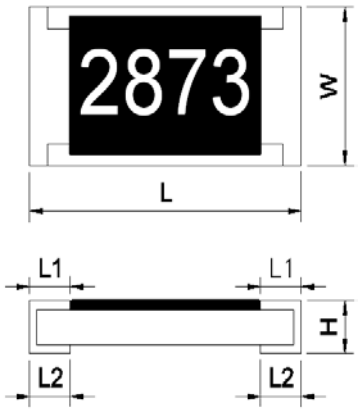
額定電壓:對於額定功率之直流或交流(商用週率有效值rms.)電壓。

可用下列公式求得，但求得之值若超過規格表內之最高電壓時，則以最高額定電壓為其額定電壓。

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

E=額定電壓(V)
P=額定功率(W)
R=公稱阻值(Ω)

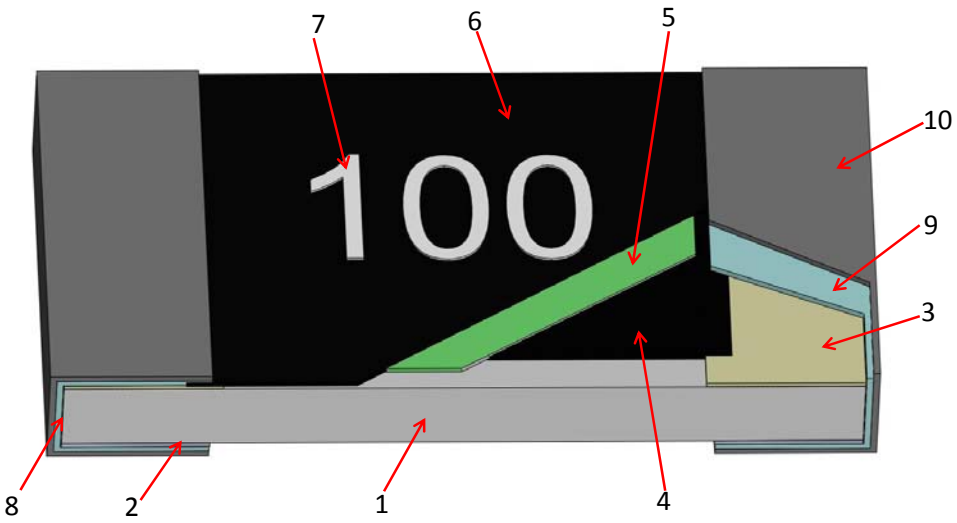
4 尺寸:



Unit:mm

Type \ Dimensions / Size Code		L	W	H	L1	L2
RAT02	0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
RAT03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
RAT05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
RAT06	1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
RAT12	1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
RAT20	2010	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20
RAT25	2512	6.30±0.20	3.20±0.20	0.55±0.10	0.60±0.20	0.60±0.20

5 結構圖:



1	陶瓷基板	Ceramic substrate	6	2nd 保護層	2nd Protective coating
2	背面內部電極	Bottom inner electrode	7	字碼	Marking
3	正面內部電極	Top inner electrode	8	側面內部電極	Terminal inner electrode
4	電阻層	Resistive layer	9	Ni 層電鍍	Ni plating
5	1st 保護層	1st Protective coating	10	Sn 層電鍍	Sn plating

6 信賴性試驗項目：

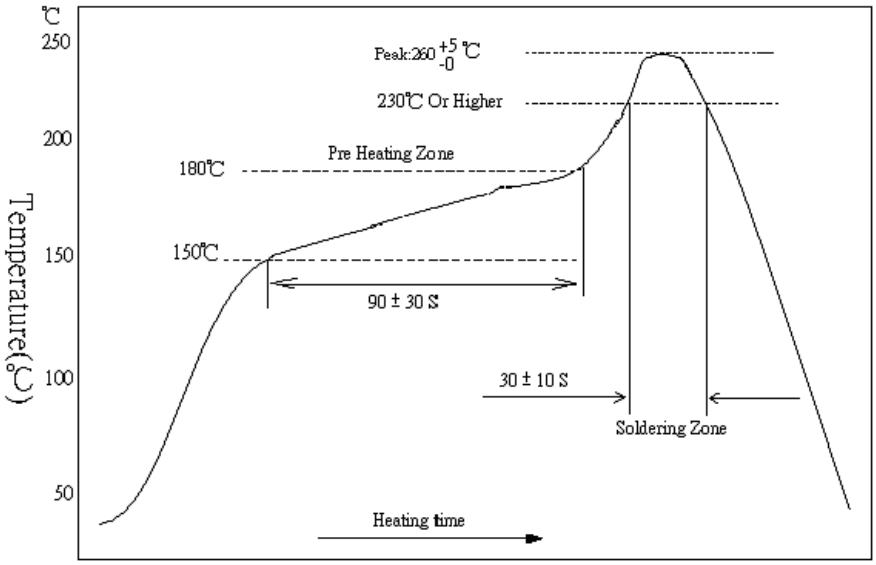
Item 項目	Conditions 條件	Specifications規格 Resistors	Jumper
High Temperature Exposure (Storage	Put the specimens in the chamber with temperature of 125±3℃ for 1000 hours. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： △R=±(1.0%+0.05Ω) 2、2%、5%： △R=±(2.0%+0.10Ω)	Refer to item 3. general specifications
		No mechanical damage.	
Temperature Cycling	Put the specimens in the High & low temperature test chamber with temperature varies from -55℃ to 155℃ for 5 minutes and total 1000 cycles. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： △R=±(1.0%+0.05Ω) 2、2%、5%： △R=±(2.0%+0.05Ω)	Refer to item 3. general specification
		No mechanical damage.	
Moisture Resistance	reference to the temperature、humidity and duration specified in test method 7a, the specimens are put into the constant temperature humidity chamber to test for total 10 cycles (240hr) without load. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： △R=±(0.5%+0.05Ω) 2、2%、5%： △R=± (2.0%+0.05Ω)	Refer to item 3. general specification
		No mechanical damage.	
Biased Humidity	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±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： △ R=±(0.5%+0.05Ω) 2、2%、5%： △R=±(2.0%+0.10Ω)	Refer to item 3. general specification
		No mechanical damage, short or burning-out phenomenon.	
Operational Life	Solder the specimens on the test PCB and Put them in the chamber with temperature of 125±3℃ and load the rated voltage for 1000 hours. Then take them out to stabilize in room temperature for 24±2hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%：: △R=±(0.5%+0.05Ω) 2、2%、5%： △R=±(2.0%+0.10Ω)	Refer to item 3. general specification
		No mechanical damage, short or burning-out phenomenon.	
Physical Dimension	Measure of chip size (L、W、H) by size measuring tool. Measure of conductor size with the high-power microscope Experiment evidence: AEC-Q200	Refer to Datasheet item 4 Dimension	
Resistance to Solvents	Take the specimens to be immersed into the isopropyl alcohol of 25±5℃ for 3+0.5/-0 minutes, then rinse with water and stabilize for 48 hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	△R=±(0.5%+0.05Ω)	Refer to item 3. general specification.
		No mechanical damage, peel-off of G2 overcoat & marking or Leaching problem.	
Resistance to Soldering Heat	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	△R%=±(1.0%+0.05Ω)	Refer to item 3. general specification.
		No cosmetic defect on terminal or peel-off of side end.	

<table>
<tr><th rowspan="2">Item
項目</th><th rowspan="2">Conditions
條件</th><th colspan="2">Specifications規格</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Thermal Shock</td><td>Solder the specimens on the test PCB and put them into the Thermal Shock Test Chamber with the temperature of -55℃ for 15min and +125℃ for 15min, which is specified as 1 cycle and total 300 cycles needed. Then take out the specimens to stabilize for 24±2hr or more and measured of its resistance variance rate.
<table><tr><th></th><th>Test condition</th></tr><tr><td>The lowest Temp</td><td>-55±5℃</td></tr><tr><td>The highest Temp</td><td>125±5℃</td></tr><tr><td>Dwell time</td><td>15min</td></tr></table>Experiment evidence AEC-Q200</td><td>1、0.1%、0.5%、1%：
△R=±(0.5%+0.05Ω)
2、2%、5%：
△ R=± (1.0%+0.05Ω)</td><td>Refer to item 3. general specification</td></tr>
<tr><td>ESD</td><td>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 2000Ω and 150pF respectively.
Experiment evidence AEC-Q200</td><td>1、0.1%、0.5%、1%：
△R=±(2.0%+0.05Ω)
2、2%、5%：
△R=±(3.0%+0.10Ω)
No mechanical damage, short or burning-out phenomenon.</td><td>Refer to item 3. general specification</td></tr>
<tr><td>Solderability</td><td>Put the specimens in the apparatus of PCT, at a temperature of 105℃, humidity of 100% RH, and air pressure of 1.22× 105 Pa for a duration of 8 hours. Then leave the specimens in room temperature for 2 hours.
Test method:
Test item 1 (solder pot test): Method A
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 120±5sec. Then rinse with water and observe the soldering coverage under the microscope.
Experiment evidence AEC-Q200</td><td colspan="2">1.Soldering coverage over 95%
2.At the edge of terminal, the object underneath (e.g. white ceramic) shall not expose.</td></tr>
<tr><td>Electrical Characterization</td><td>$TCR\ (ppm/℃) = \frac{(R2-R1)}{R1(T2-T1)} \times 10^6$
R1: Resistance at room temperature (Ω)
R2: Resistance at -55℃ or +125℃(Ω)
T1: Room temperature (℃)
T2: Temperature -55℃ or +125℃
Experiment evidence: AEC-Q200</td><td>Refer to item 3. general specifications</td><td>NA</td></tr>
<tr><td>Board Flex (Bending Test)</td><td>Solder the specimens on the test PCB and put the PCBA onto the Bending Tester. Add force at the central part of PCB, and measure of its resistance variance rate in load.
Bending depth
(D)=5mm
Experiment evidence: AEC-Q200</td><td>△ R=±(1.0%+0.05Ω)
No mechanical damage, peel-off of side end or chip crack.</td><td>Refer to item 3. general specification</td></tr>
</table>

Item 項目	Conditions 條件	Specifications規格	
		Resistors	Jumper
Terminal Strength (SMD)	Solder the specimens on the test PCB and put them on the fixture. Then 1.8Kgf pushing force is applied with the test probe (diameter as R0.5) on the board and hold for 60sec, and measure of resistance variance rate in load. Experiment evidence: AEC-Q200	∆ R=±(1.0%+0.05Ω)	Refer to item 3. general specification
		No mechanical damage or peel-off of side end.	
Sulfuration Test	Put the tested resistor in saturated vapor, at a temperature of 60±2℃, humidity of 91~93% RH for 1000hrs. Refer to ASTM-B-809-95	∆ R=±(1.0%+0.05Ω)	Refer to item 3. general specifications

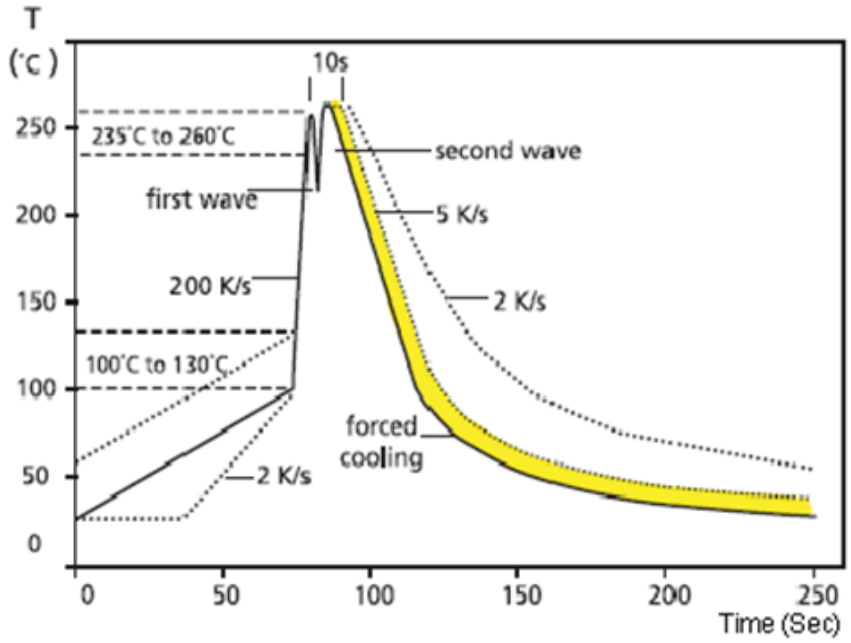
7 建議焊錫條件:

7.1 Lead Free IR Reflow Soldering Profile



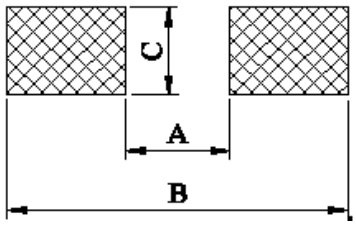
備註:零件最高耐溫260 +5/-0 ℃,10秒。

7.2 Lead Free Double-Wave Soldering Profile(適用0603(含)以上之產品)



7.3 烙鐵焊錫方法:350±10℃ 3秒之內。

8 建議 Land Pattern Design (For Reflow Soldering)：



Unit:mm

TYPE \ DIM	A	B	C
RAT02	0.5	1.5	0.6
RAT03	0.8	2.1	0.9
RAT05	1.2	3.0	1.3
RAT06	2.2	4.2	1.6
RAT12	2.2	4.2	2.8
RAT20	3.5	6.1	2.8
RAT25	3.8	8.0	3.5

9 鍍層厚度：

9.1 鎳層厚度:≧2μm

9.2 純錫:≧3μm

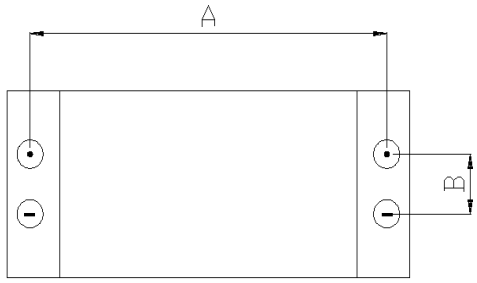
9.3 電鍍純錫為霧錫

10 包裝空料數規定:

10.1 每一Reel空料數未超過該捲總數0.1%及連續2顆(含)以上時，是被允許的。

11 阻值測試包裝標準量測位置：

背面電極量測



⊙ Current Terminal

⊖ Voltage Terminal

Unit : mm

TYPE \ DIM	A	B
RAT02	0.80±0.05	0.24±0.05
RAT03	1.35±0.05	0.35±0.05
RAT05	1.80±0.05	0.35±0.05
RAT06	2.90±0.05	0.35±0.05
RAT12	2.90±0.05	0.35±0.05
RAT20	4.50±0.05	1.15±0.05
RAT25	5.90±0.05	1.60±0.05

12 儲存期限:

12.1 在儲存環境25±5℃、60±15%之條件下可儲存二年。

13 電子信息產品標示外箱上以下列標籤進行標示:(外銷中國大陸)

	
電子信息產品污染控制標誌	包裝回收標誌

14 附件:

14.1 文件修訂記錄表　　(QA-QR-027)