

RALEC 旺詮	RAT 汽車用厚膜晶片電阻器 規格標準書	文件編號	IE-SP-070
		版本日期	2017/10/24
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## 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	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	01(0201) 02(0402) 03(0603) 05(0805) 06(1206) 12(1210) 20(2010) 25(2512)	3-碼	EX. 10Ω=100 4.7Ω=4R7 JUMPER=000	B = ± 0.1% D = ± 0.5% F = ± 1% G = ± 2% J = ± 5%	Q1 : 1 mm Pitch Carrier Tape 20000 pcs QE : 1 mm Pitch Carrier Tape 150000 pcs TH : 2 mm Pitch Carrier Tape 10000 pcs H0 : 2 mm Pitch Carrier Tape 15000 pcs H1 : 2 mm Pitch Carrier Tape 20000 pcs H2 : 2 mm Pitch Carrier Tape 20000 pcs H3 : 2 mm Pitch Carrier Tape 30000 pcs H4 : 2 mm Pitch Carrier Tape 40000 pcs H5 : 2 mm Pitch Carrier Tape 50000 pcs H6 : 2 mm Pitch Carrier Tape 60000 pcs TP : 4 mm Pitch Carrier Tape 5000 pcs P2 : 4 mm Pitch Carrier Tape 10000 pcs P3 : 4 mm Pitch Carrier Tape 15000 pcs P4 : 4 mm Pitch Carrier Tape 20000 pcs TE : 4 mm Pitch Carrier Tape 4000 pcs E6 : 8 mm Pitch Carrier Tape 2000 pcs BA : 散裝(盒裝)
		4-碼	EX. 10.2Ω=10R2 10KΩ=1002		

IE			QA	Sales	備註 非發行管制文件 自行注意版本更新 非經允許，禁止自行影印文件	發行管制章 DATA Center.  Series No. <b>60</b>
制訂	審查	核准	會簽	會簽		

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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/°C) 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%)	F (±1%)	J (±5%)	F (±1%)
RAT01 (0201)	$\frac{1}{20}$ W	25V	50V	-200 +400	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	0.5A	---	50mΩ MAX	---
				±200	$47\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$					
RAT02 (0402)	$\frac{1}{16}$ W	50V	100V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 22M\Omega$	$10\Omega \leq R \leq 22M\Omega$	1A	---	50mΩ MAX.	---
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RAT03 (0603)	$\frac{1}{10}$ W	75V	150V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 22M\Omega$	$10\Omega \leq R \leq 22M\Omega$	1A	---	50mΩ MAX.	---
				±200	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RAT05 (0805)	$\frac{1}{8}$ W	150V	300V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 27M\Omega$	$10\Omega \leq R \leq 27M\Omega$	2A	2.5A	50mΩ MAX.	20mΩ MAX.
				±200	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RAT06 (1206)	$\frac{1}{4}$ W	200V	400V	±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 27M\Omega$	$10\Omega \leq R \leq 27M\Omega$	2A	3.5A	50mΩ MAX.	20mΩ MAX.
				±200	$3\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RAT12 (1210)	$\frac{1}{2}$ W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 27M\Omega$	$10\Omega \leq R \leq 27M\Omega$	2A	4A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RAT20 (2010)	$\frac{3}{4}$ W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	$10\Omega \leq R \leq 20M\Omega$	2A	5A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RAT25 (2512)	1W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	$10\Omega \leq R \leq 20M\Omega$	2A	7A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
使用溫度範圍				-55°C ~ +155°C (0201:-55°C ~ +125°C)								

3.1 功率衰減曲線：

型別	RAT01 (0201)	其它
使用溫度範圍	-55°C ~ +125°C	-55°C ~ +155°C
說明	周圍溫度若超過70°C至125°C之間，功率可照下圖曲線予以修定之。	周圍溫度若超過70°C至155°C之間，功率可照下圖曲線予以修定之。
功率衰減曲線圖		

備註	非 發 行 管 制 文 件 自 行 注 意 版 本 更 新	發行管制章 DATA Center.
	非經允許，禁止自行影印文件	Series No. 60

### 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。

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

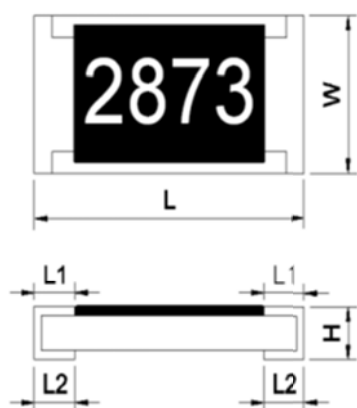
E=額定電壓(V)

P=額定功率(W)

R=公稱阻值(Ω)

### 4 尺寸:

Unit:mm



Dimension		L	W	H	L1	L2
Type	Size Code					
RAT01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
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

備

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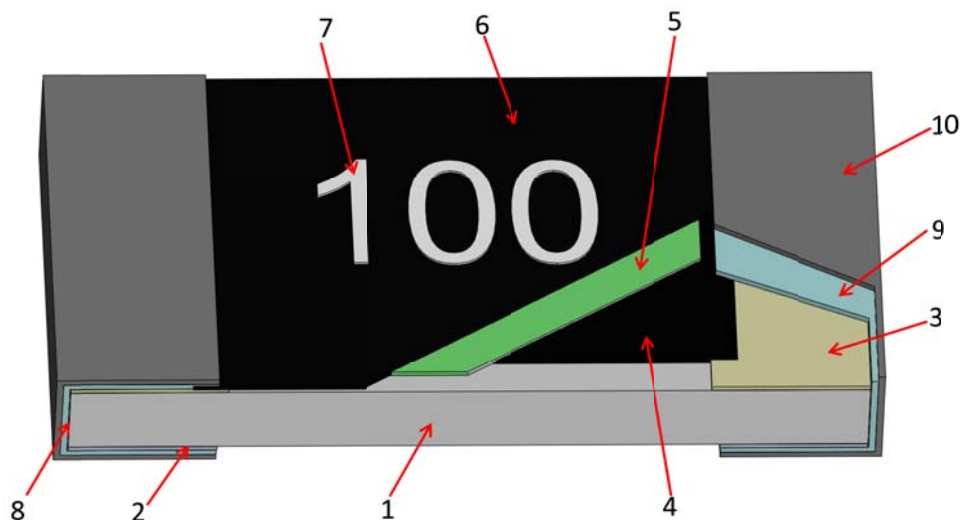
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5 結構圖：



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

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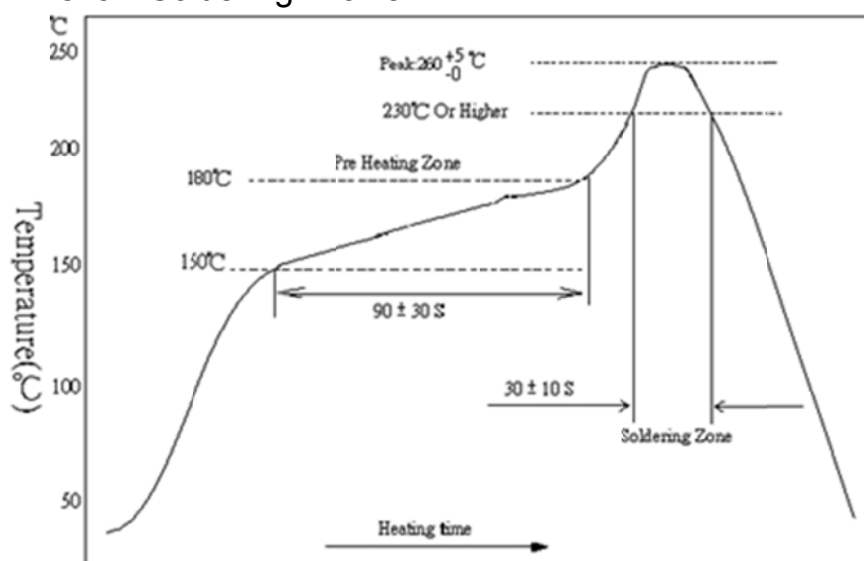
6 信賴性試驗項目：																														
Item 項目	Conditions 條件	Specifications規格																												
		Resistors	Jumper																											
High Temperature Exposure (Storage)	Put the specimens in the chamber with temperature of 155±3℃ for 1000 hours. Then take them out to stabilize in room temperature for 24±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： ΔR=±1.0% 2、2%、5%： ΔR=±2.0% No mechanical damage.	Refer to item 3. general specifications																											
Temperature Cycling	Put the specimens in the High & low temperature test chamber with temperature varies from -55℃ to 125℃ for 5 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	ΔR=±2.0% No mechanical damage.	Refer to item 3. general specification																											
Short Time Overload	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><td>型別</td><td>RAT01 (0201)</td><td>RAT02 (0402)</td><td>RAT03 (0603)</td><td>RAT05 (0805)</td><td>RAT06 (1206)</td><td>RAT12 (1210)</td><td>RAT20 (2010)</td><td>RAT25 (2512)</td></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>---</td><td>---</td><td>---</td><td>6.25A</td><td>8.75A</td><td>10A</td><td>12.5A</td><td>17.5A</td></tr></table> Refer to JIS-C5201-1 4.13	型別	RAT01 (0201)	RAT02 (0402)	RAT03 (0603)	RAT05 (0805)	RAT06 (1206)	RAT12 (1210)	RAT20 (2010)	RAT25 (2512)	±5%	1.25A	2.5A	2.5A	5A	5A	5A	5A	5A	±1%	---	---	---	6.25A	8.75A	10A	12.5A	17.5A	1、0.1%、0.5%、1%： ΔR=±1.0% 2、2%、5%： ΔR=±2.0% No evidence of mechanical damage. No short or burned on the appearance.	Refer to item 3. general specification
型別	RAT01 (0201)	RAT02 (0402)	RAT03 (0603)	RAT05 (0805)	RAT06 (1206)	RAT12 (1210)	RAT20 (2010)	RAT25 (2512)																						
±5%	1.25A	2.5A	2.5A	5A	5A	5A	5A	5A																						
±1%	---	---	---	6.25A	8.75A	10A	12.5A	17.5A																						
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±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： ΔR=±2.0% 2、2%、5%： ΔR=±3.0% No mechanical damage, short or burning-out phenomenon.	Refer to item 3. general specification																											
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±4hr or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1、0.1%、0.5%、1%： ΔR=±2.0% 2、2%、5%： ΔR=±3.0% No mechanical damage, short or burning-out phenomenon.	Refer to item 3. general specification																											
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	ΔR=±1.0% No cosmetic defect on terminal or peel-off of side end.	Refer to item 3. general specification.																											
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 2000Ω and 150pF respectively. Experiment evidence AEC-Q200	ΔR=±3.0% No mechanical damage, short or burning-out phenomenon.	Refer to item 3. general specification																											

備註	非發行管制文件 自行注意版本更新	發行管制章 DATA Center.
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Item 項目	Conditions 條件	Specifications規格	
		Resistors	Jumper
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.Soldering coverage over 95% 2.At the edge of terminal, the object underneath (e.g. white ceramic) shall not expose.	
Electrical Characterization	$TCR \text{ (ppm / } ^\circ\text{C)} = \frac{(R2 - R1)}{R1 (T2 - T1)} \times 10^6$ 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	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)=5mm Experiment evidence: AEC-Q200	ΔR=±1.0%  No mechanical damage, peel-off of side end or chip crack.	Refer to item 3. general specification
備註	非發行管制文件 自行注意版本更新		發行管制章 DATA Center.
	非經允許，禁止自行影印文件		Series No. 60

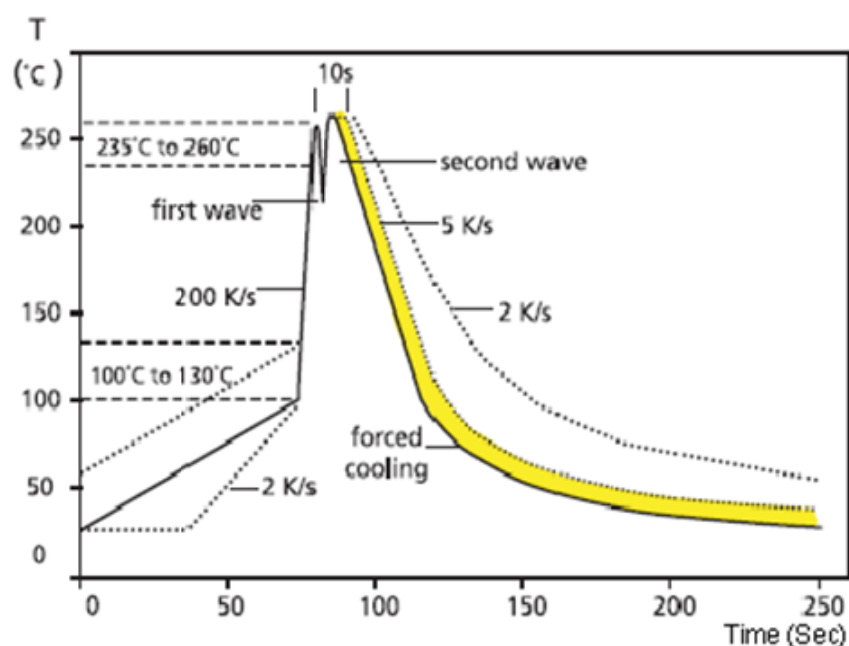
### 7 建議焊錫條件:

#### 7.1 Lead Free IR Reflow Soldering Profile



備註:零件最高耐溫260 +5/-0 °C,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°C 3秒之內。

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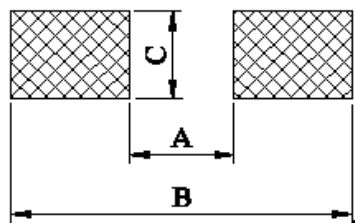
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## 8 建議 Land Pattern Design (For Reflow Soldering) :

Unit:mm



DIM TYPE	A	B	C
RAT01	0.3	1.0	0.4
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 鍍層厚度： $\geq 2 \mu m$ 9.2 純錫： $\geq 3 \mu m$ 

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	Unit : mm		
	DIM TYPE	A	B
	RAT01	0.44±0.05	0.22±0.05
	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

● Current Terminal

⊖ Voltage Terminal



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## 12 儲存期限：

12.1 在儲存環境 $25\pm 5^{\circ}\text{C}$ 、 $60\pm 15\%$ 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)

備 註	非 發 行 管 制 文 件 自 行 注 意 版 本 更 新	發行管制章 DATA Center.
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