

1 適用範圍:

- 1.1 本承認書適用於本公司生產的無鉛、無鹵素之RAA系列汽車用厚膜排列晶片電阻器。
- 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)



型別	尺寸 (參考 3.規格表)	回路數	電極構造	電阻值	容差	包裝型式(請參閱 IE-SP-054)
汽車用厚膜排列 晶片電阻器	02(0402)	2:2迴路 4:4迴路 8:8迴路	D:凸電極	3-碼 EX.10Ω=100 4.7Ω=4R7 JUMPER=000	D=± 0.5% F=± 1% G=± 2% J=± 5%	TH : 2 mm Pitch Carrier Tape 10000 pcs
				4-碼 EX. 10.2Ω=10R2 10KΩ=1002		

3 規格表:

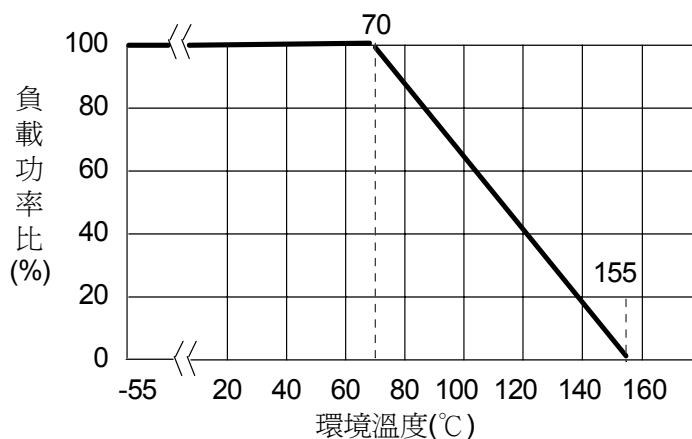
型別	額定 功率	最高 額定 電壓	最高 過負荷 電壓	T.C.R (ppm/℃) 溫度係數	阻值範圍			Number of Terminals 端子數	Number of Resistors 電阻數	JUMPER (0Ω) 額定電流	JUMPER (0Ω) 阻值
					D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	G(±2%)、J(±5%) E-24			J (±5%)	J (±5%)
RAA02-2D (0402)	$\frac{1}{16}$ W	25V	50V	±300	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	4	2	1A	50mΩ MAX.
				±200	-----	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$				
RAA03-2D (0603)	$\frac{1}{16}$ W	50V	100V	±200	-----	$10\Omega \leq R \leq 10M\Omega$	$1\Omega \leq R \leq 10M\Omega$	4	2	1A	50mΩ MAX.
RAA02-4D (0402)	$\frac{1}{16}$ W	25V	50V	±300	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	8	4	1A	50mΩ MAX.
				±200	-----	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$				
RAA03-4D (0603)	$\frac{1}{16}$ W	50V	100V	±200	$22\Omega \leq R \leq 470K\Omega$	$1\Omega \leq R \leq 10M\Omega$	$1\Omega \leq R \leq 10M\Omega$	8	4	1A	50mΩ MAX.
RAA02-8D (0402)	$\frac{1}{16}$ W	25V	50V	±250	-----	$10\Omega \leq R \leq 10M\Omega$	$1\Omega \leq R \leq 10M\Omega$	16	8	1A	50mΩ MAX.
使用溫度範圍				-55℃ ~ +155℃							

IE			QA	Sales	備註	發行管制章 DATA Center. Series No.60
制訂	審查	核准	會簽	會簽	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	

3.1 功率衰減曲線:

使用溫度範圍：- 55 ~ 155 °C

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。



3.2 額定電壓:

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。

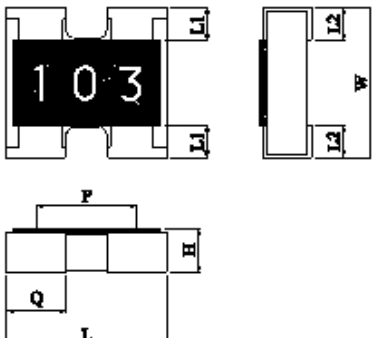
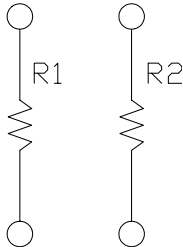
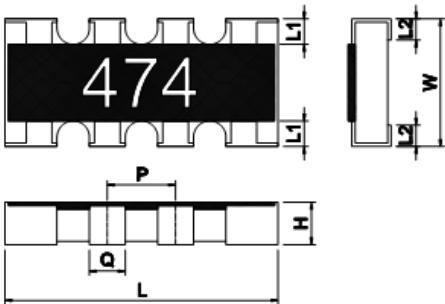
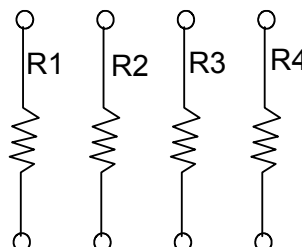
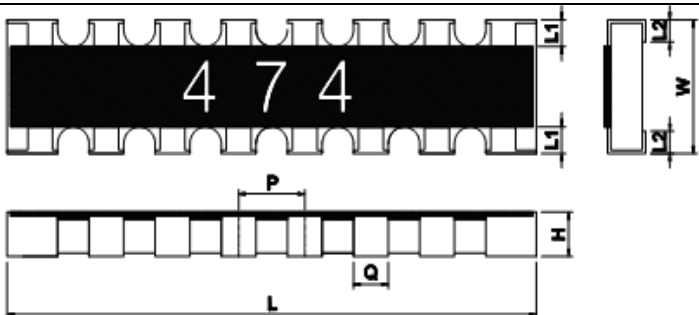
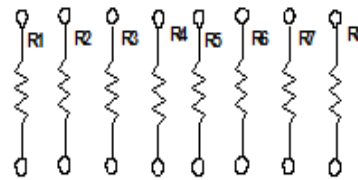
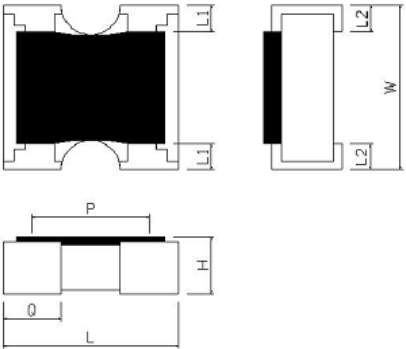
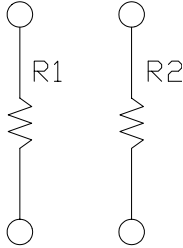
$$E = \sqrt{R \times P}$$

E=額定電壓(V)

P=額定功率(W)

R=公稱阻值(Ω)

4 尺寸: (mm)

RAA03-2D 	Circuits  $R1=R2$
RAA02-4D / RAA03-4D 	Circuits  $R1=R2=R3=R4$
RAA02-8D 	Circuits  $R1=R2=R3=R4=R5=R6=R7=R8$
RAA02-2D 	Circuits  $R1=R2$

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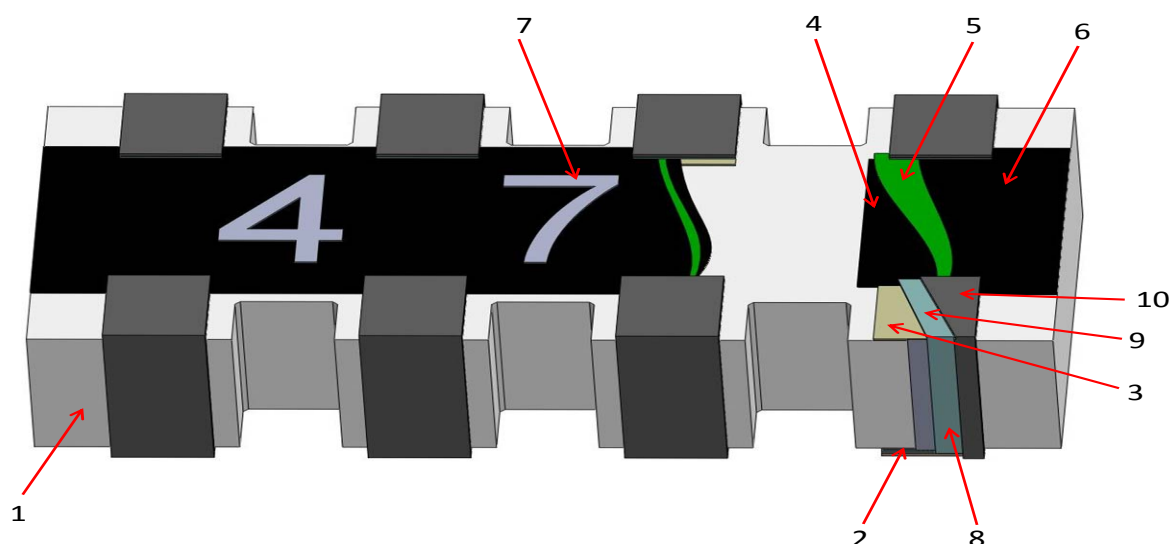
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Unit:mm

DIM TYPE	L	W	H	L1	L2	P	Q
RAA02-2D (0402)	1.00±0.10	1.00±0.10	0.30±0.05	0.15±0.10	0.25±0.10	(0.67)	0.33±0.10
RAA03-2D (0603)	1.60±0.15	1.60±0.15	0.45±0.10	0.30±0.15	0.30±0.15	(0.80)	0.60±0.10
RAA02-4D (0402)	2.00±0.10	1.00±0.10	0.40±0.10	0.20±0.10	0.25±0.10	(0.50)	0.30±0.10
RAA03-4D (0603)	3.20±0.20	1.60±0.15	0.50±0.10	0.30±0.15	0.30±0.15	(0.80)	0.50±0.10
RAA02-8D (0402)	4.00±0.20	1.60±0.10	0.40±0.10	0.30±0.15	0.30±0.10	(0.50)	0.25±0.10

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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Series No. 60

RALEC 旺詮	RAA 汽車用厚膜排列晶片電阻器規格標準書	文件編號	IE-SP-072
		版本日期	2015/06/08
		頁次	5/9

6 信賴性實驗項目：

Item 項目	Conditions 條件	Specifications規格	
		Resistors	Jumper
High Temperature Exposure (Storage)	Put the specimens in the chamber with temperature of $125\pm3^{\circ}\text{C}$ for 1000 hours. Then take them out to stabilize in room temperature for $24\pm2\text{hr}$ or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.5%、1% : $\Delta R=\pm(1.0\%+0.05\Omega)$ 2. 2%、5% : $\Delta R=\pm(2.0\%+0.10\Omega)$ 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°C to 155°C for 5 minutes and total 1000 cycles. Then take them out to stabilize in room temperature for $24\pm2\text{hr}$ or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.5%、1% : $\Delta R=\pm(1.0\%+0.05\Omega)$ 2. 2%、5% : $\Delta R=\pm(2.0\%+0.05\Omega)$ No mechanical damage.	Refer to item 3. general specifications
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 $24\pm2\text{hr}$ or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.5%、1% : $\Delta R=\pm(0.5\%+0.05\Omega)$ 2. 2%、5% : $\Delta R=\pm(2.0\%+0.05\Omega)$ No mechanical damage.	Refer to item 3. general specifications
Biased Humidity	Solder the specimens on the test PCB and put them into the constant temperature humidity chamber with $85\pm2^{\circ}\text{C}$ and $85\pm5\%\text{RH}$. 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 $24\pm2\text{hr}$ or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.5%、1% : $\Delta R=\pm(0.5\%+0.05\Omega)$ 2. 2%、5% : $\Delta R=\pm(2.0\%+0.10\Omega)$ No mechanical damage, short or burning out phenomenon.	Refer to item 3. general specifications
Operational Life	Solder the specimens on the test PCB and Put them in the chamber with temperature of $125\pm3^{\circ}\text{C}$ and load the rated voltage for 1000 hours. Then take them out to stabilize in room temperature for $24\pm2\text{hr}$ or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	1. 0.5%、1% : $\Delta R=\pm(0.5\%+0.05\Omega)$ 2. 2%、5% : $\Delta R=\pm(2.0\%+0.10\Omega)$ No mechanical damage, short or burning out phenomenon.	Refer to item 3. general specifications
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 $25\pm5^{\circ}\text{C}$ for $3+0.5/-0$ minutes, then rinse with water and stabilize for 48 hrs or more, and measure of its resistance variance rate. Experiment evidence: AEC-Q200	$\Delta R=\pm(0.5\%+0.05\Omega)$ No mechanical damage, peel-off of G2 overcoat & marking or Leaching problem.	Refer to item 3. general specifications
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 : $260\pm5^{\circ}\text{C}$ Soldering duration : $10\pm1\text{sec}$. Experiment evidence AEC-Q200	$\Delta R\%=\pm(1.0\%+0.05\Omega)$ No cosmetic defect on terminal or peeling off of side end.	Refer to item 3. general specifications

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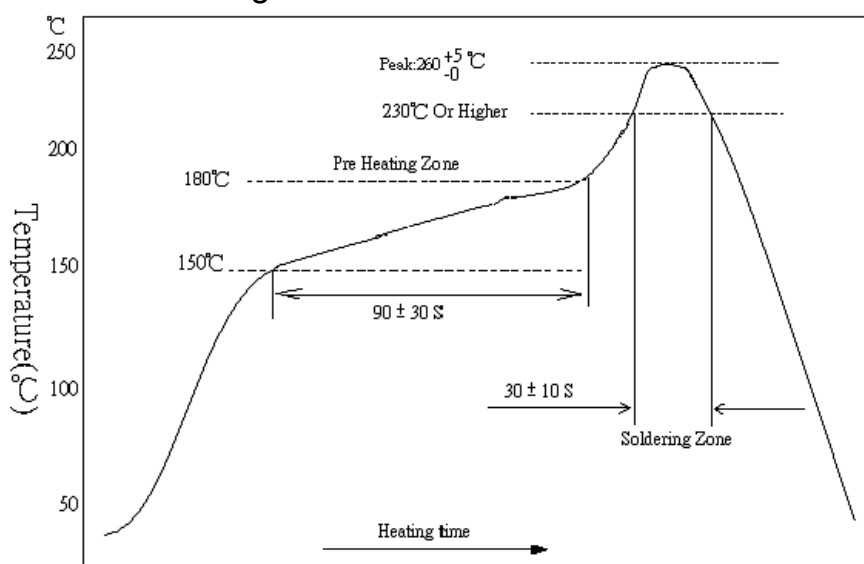
Item 項目	Conditions 條件	Specifications規格									
		Resistors	Jumper								
Thermal Shock	Solder the specimens on the test PCB and put them into the Thermal Shock Test Chamber with the temperature of -55℃ for 15min and +125℃ for 15min, which is specified as 1 cycle and total 300 cycles needed. Then take out the specimens to stabilize for 24±2hr or more and measured of its resistance variance rate. <table><tr><th colspan="2">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	Test condition		The lowest Temp	-55±5℃	The highest Temp	125±5℃	Dwell time	15min	1. 1% : ΔR=±(0.5%+0.05Ω) 2. 2%、5% : Δ R=± (1.0%+0.05Ω)	Refer to item 3. general specifications
Test condition											
The lowest Temp	-55±5℃										
The highest Temp	125±5℃										
Dwell time	15min										
ESD	Put the specimens on the test fixture and two discharges (2KV DC) shall be applied to each PUT, one with a positive polarity and one 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	1. 1% : ΔR=±(2.0%+0.05Ω) 2. 2%、5% : ΔR=±(3.0%+0.10Ω)	Refer to item 3. general specifications								
Solderability	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	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 measure of its resistance variance rate in load. Bending depth (D)=5mm Experiment evidence: AEC-Q200	ΔR=±(1.0%+0.05Ω)	Refer to item 3. general specifications								
		No mechanical damage, peeling off of side end or chip crack.									

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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	$\Delta R = \pm(1.0\% + 0.05\Omega)$ No mechanical damage or peeling off of side end.	Refer to item 3. general specifications
Sulfuration Test	Put the tested resistor in saturated vapor, at a temperature of $60 \pm 2^\circ\text{C}$, humidity of 91~93% RH for 1000hrs. Refer to ASTM-B-809-95	$\Delta R = \pm(1.0\% + 0.05\Omega)$	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 $260^{+5}_{-0}^\circ\text{C}$,10秒。

7.2 烙鐵焊錫方法: $350 \pm 10^\circ\text{C}$ 3秒之內。

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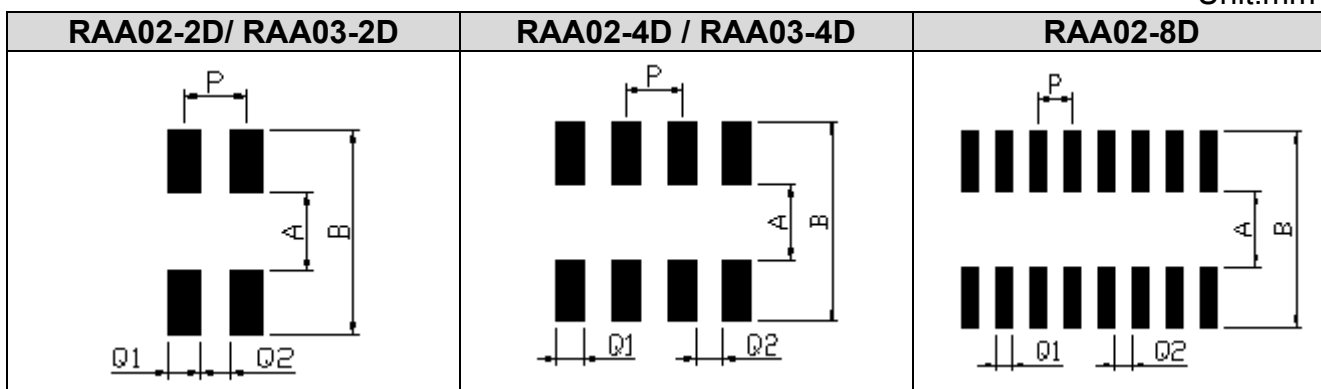
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8 建議 Land Pattern Design (For Reflow Soldering) :

Unit:mm



DIM TYPE	A	B	P	Q1	Q2
RAA02-2D	0.50	2.00	0.67	0.33	0.34
RAA03-2D	1.00	2.60	0.80	0.40	0.40
RAA02-4D	0.50	2.00	0.50	0.28	0.22
RAA03-4D	1.00	2.60	0.80	0.40	0.40
RAA02-8D	1.00	2.60	0.50	0.25	0.25

9 鍍層厚度:

9.1 鎳層(Ni)厚度: $\geq 2 \mu m$

9.2 純錫層(Tin): $\geq 3 \mu m$

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 儲存期限:

11.1 在儲存環境 $25 \pm 5^{\circ}C$ 、 $60 \pm 15\%$ 之條件下可儲存二年。

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12 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

13 附件:

13.1 文件修訂記錄表 (QA-QR-027)

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