

■ 抗硫化车用厚膜晶片电阻器 Anti-Sulfuration Automotive Thick Chip Resistors



■ 应用 (Application)

- Industrial Equipent
- Power Application
- Networking Application
- High-end Computer & Multimedia Electronics in high sulfur environment
- Automotive electronics
- 工业设备
- 电源应用
- 网络应用
- 高硫环境下的高端计算机与多媒体电子
- 汽车电子

■ 特性 (Features)

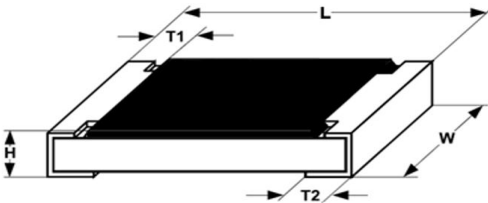
- AEC-Q200 qualified
- Superior resistance against sulfur containing atmosphere
- AEC-Q200合格
- 优异的抗硫性

■ 料号说明 (Parts Number Explanation)

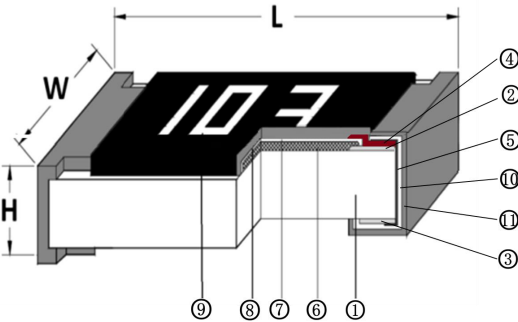
示例: Example: FRR0603J102TS

F 公司名	R 产品别	R 功能别	0603 型别	J 公差	102 字码	I 包装别	S 端电极	特殊型
FOJAN	R:Resistor	R: Anti-Sulfuration	0402 0603 0805 1206 1210 2010 1812 2512	F:±1% G:±2% J:±5% P: Jumper	±5%:E24 3-digits+blank 102=1KΩ 1R0=1Ω ±1%&Below: E24+E96: 4-digits 1001=1KΩ 1R00=1Ω	T: 7 inch reel Q:10 inch reel R:13 inch reel B:Bulk	S: Sn C: Cu A: Au	Blank: none
Company code	Type code	Functional code	Size code	Tolerance code	Resistance code	Packaging code	Termination code	Special code

尺寸 (Dimension)

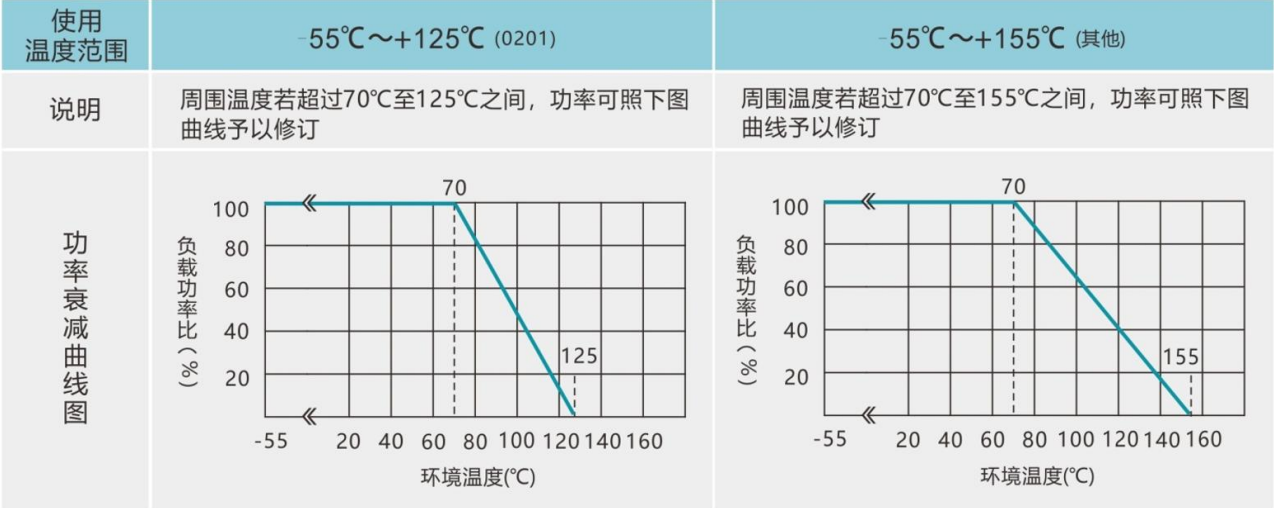
尺寸 dimension					
	单位 (unit) : mm				
型别 (Type)	L	W	H	T1	T2
0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
0603	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.25±0.15
0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
1206	3.10±0.10	1.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
1210	3.10±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20
2010	5.00±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20
1812	4.50±0.20	3.10±0.20	0.55±0.10	0.55±0.20	0.70±0.20
2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.90±0.20

电阻结构 (Construction)



NO.	结构 construction	主要材料 Major material
1	陶瓷基板 Ceramic substrate	三氧化二铝 Al ₂ O ₃
2	正电极/银钯 Top inner electrode	银/钯 Ag/Pd
3	背电极/银 Bottom inner electrode	银 Ag
4	树脂银 Resin silver	低温银 Ag
5	侧电极 Side conductive layer	镍铬合金 NiCr
6	阻体层 Resistive layer	氧化钌+玻璃 RuO ₂ + glass
7	内保护层 Inner protective layer	玻璃 Glass
8	外保护层 Outer Protective layer	环氧树脂 Epoxy
9	文字 Marking	环氧树脂 Epoxy
10	镍电极 Ni plating layer	镍 Ni
11	锡电极 Sn plating layer	锡 Matte Tin

功率衰减曲线 (Derating Curve)



阻值范围 (Resistance range)

型别 Type	阻值范围 Resistance Range		
	1%	2%	5%
0402	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
0603	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
0805	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
1206	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
1210	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
2010	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
1812	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ
2512	1Ω~10MΩ	1Ω~22MΩ	1Ω~22MΩ

如有非标准品的需求,请联系我们的业务部门 For non-standard parts, please contact our sales dept.

■ 电气特性 (Electrical characteristics)

型别 Type	0402	0603	0805	1206	1210	1812	2010	2512
绝缘耐压 Dielectric Withstanding Voltage	100V	100V	300V	500V	500V	500V	500V	500V
零欧姆阻值 ±5% Resistance Value of Jumper ±5%	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ	<50mΩ
零欧姆额定电流 Rated Current of Jumper	1A	1A	2A	2A	2A	2A	2A	2A
零欧姆电阻最大电流 Max Current of Jumper	2A	2A	5A	10A	10A	10A	10A	10A

■ 电性规格 (Standard Electrical Specifications)

型别 Type	额定功率 (Power Rating at 70℃)	最高工作电压 Max. RCWV	最大过负荷电压 Max. Overload Voltage	T.C.R. (PPM/℃)	阻值范围 Resistance Range
0402	1/16W	50V	100V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ
0603	1/10W	75V	150V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ
0805	1/8W	150V	300V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ
1206	1/4W	200V	400V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ
1210	1/2W	200V	500V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ
1812	3/4W	200V	500V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ
2010	3/4W	200V	500V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ

FRR-Series
Anti- Sulfuration Automotive Thick Film Chip Resistors
FRR 系列抗硫化车用厚膜晶片电阻器说明书



2512	1W	200V	500V	±200	1Ω~10Ω
					10 MΩ~22 MΩ
				±100	10Ω~10MΩ

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性能 (Performance Specifications)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
短时间过负荷 Short-time overload	JIS C 5201 4.13	加载 2.5 倍的额定电压, 时间 5 秒后测量试验前后的阻值变化率。 Applied 2.5 times of rated voltage for 5 second. Measure the variation of resistance.	±(1.00% +0.05Ω)
温度系数 Temperature Coefficient	JIS C 5201 4.8	TCR= (R-R ₀) / (t-t ₀) R ₀ ×10 ⁶ (ppm) R0 电阻在室温下的阻值(resistance at room temperature) R 电阻在 125℃或-55℃下的阻值(resistance at 125℃ or -55℃) t0 室温(room temperature) t 测试温度 (test temperature 125℃ or -55℃)	As Spec
焊锡性 Solderability	AEC-Q200 TEST 18 J-STD-002	用于引脚型和表面贴装型元件, 不需要电气测试. 放大倍数 50 倍。 测试条件: 表面贴装型: a)方法 B, 干热@155℃,4 小时,@235℃,3±0.5 秒 b)方法 B, 蒸煮 8 小时, @235℃,3±0.5 秒 For pin and surface-mount components, no electrical testing required. Magnification 50 times.Test conditions: Surface mount type: a) Method B: dry heat @155℃,4 hours, @235℃,3±0.5 seconds b) Method B: cook for 8 hours at @235℃,3±0.5 seconds	> 95%面积上锡 (> 95% coverage)
抗焊锡热 Resist to soldering heat	AEC-Q200 TEST 15 MIL-STD-202 METHOD 210	沾助焊剂后浸入锡炉, 锡炉温度 260±5℃, 时间 10±0.5 秒, 测量试验前后的阻值变化率。 Dip the terminal in a flux and then dip into a soldering bath at 260±5℃ for 10±0.5sec. Measure the variation of resistance.	±(1.00% +0.05Ω)

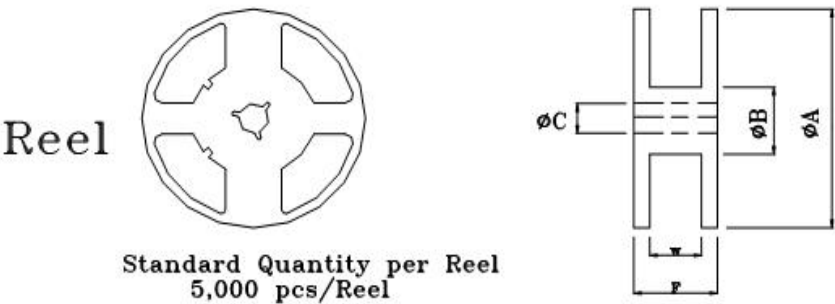
内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
绝缘电阻 Insulation resistance	JIS C 5201 4.6	电阻本体上加载绝缘耐压 60±5 秒后，测量绝缘阻抗。 Applied the dielectric withstanding voltage on the center of body for 60±5seconds. Then measure insulation resistance.	>10GΩ
绝缘耐压 Dielectric withstanding voltage	JIS C 5201 4.7	电阻本体上加载绝缘耐压 60±5 秒。 Applied the dielectric withstanding voltage on the center of body for 60±5seconds.	无击穿、飞弧及可见机械性损伤 No evidence of flashover, mechanical damage arcing or insulation breakdown
端子弯曲 Terminal bending	AEC-Q200 TEST 21 AEC-Q200-005	电阻焊接在测试板上进行弯折,弯折保持时间 20±1 秒, 1206(含)以下的尺寸弯曲 5+0.2/0 mm; 1210 以上的尺寸弯曲 2+0.2/0 mm; 量测试前后阻值变化率 Specimen shall be mounted on test board, then bend the board and maintained for 20±1s. the distance of bending is 5+0.2/0 mm for resistors which size no larger than 1206 or 2+0.2/0 mm which size larger than 1206. Measure the variation of resistance.	±(1.00% +0.05Ω)
温度循环 Temperature Cycling	AEC-Q200 TEST 4 JESD22 METHOD JA-104	-55℃~+ 155℃, 循环 1000 次, 在每一个极限温度持续时间不超过 30 分钟, 且温度转换时间不超过 1 分钟, 试验结束 24±4 小时后进行测试. 1000 Cycles (-55℃ to +155℃) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme. 1min. maximum transition time.	±(2.00% +0.05Ω)
耐湿特性 Humidity	AEC-Q200 TEST 7 MIL-STD-202 METHOD 103	加载 10%额定功率, 85℃/85%RH, 持续通电 1000H,试验结束 24±4 小时后进行测试 1000 hours 85℃/85%RH. Note: Specified conditions: 10% of operating power. Measurement at 24±4 hours after test conclusion.	±(2.00% +0.05Ω)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
负荷寿命 Load life	AEC-Q200 TEST 8 MIL-STD-202 METHOD 108	电阻放入恒温箱中, 温度 $125\pm 2^{\circ}\text{C}$, ON TIME:1.5H, OFF TIME:0.5H, 通电额定电压 $1000^{+24}/_{-0}$ 小时, 量测试验前后阻值变化率. Put the specimen in a chamber at $125\pm 2^{\circ}\text{C}$ temperature, ON TIME:1.5H, OFF TIME:0.5H, and applied rated voltage for $1000^{+24}/_{-0}$ H. Measure the variation of resistance.	$\pm(2.00\% + 0.05\Omega)$
温湿循环 Moisture resistance	AEC-Q200 TEST 6 MIL-STD-202 METHOD 106	$25^{\circ}\text{C}\sim 65^{\circ}\text{C}, 90\sim 100\%\text{RH}$, 2.5 小时; 65°C $90\sim 100\%\text{RH}$, 3 小时; $65^{\circ}\text{C}\sim 25^{\circ}\text{C}, 80\sim 100\%\text{RH}$, 2.5 小时, 10 个循环, 试验结束 24 ± 4 小时后进行测试. $25^{\circ}\text{C}\sim 65^{\circ}\text{C}, 90\sim 100\%\text{RH}$, 2.5H; 65°C $90\sim 100\%\text{RH}$, 3H; $65^{\circ}\text{C}\sim 25^{\circ}\text{C}$ $80\sim 100\%\text{RH}$, 2.5H, 10 cycles, Measurement at 24 ± 4 hours after test conclusion.	$\pm(2.00\% + 0.05\Omega)$
高温储存 High Temperature Exposure(Storage)	AEC-Q200 TEST 3 MIL-STD-202 METHOD 108	155°C 下放置 1000h, 不加载功率, 试验结束 24 ± 4 小时后进行测试. 1000 hrs. @ $T=155^{\circ}\text{C}$. Unpowered. Measurement at 24 ± 4 hours after test conclusion	$\pm(1.00\% + 0.05\Omega)$
端子强度 Terminal Strength	AEC-Q200 TEST 11 MIL-STD 202 METHOD 211	0402:0.5kgf; 0603:1.0kgf; 其他规格: 2.0kgf施加推力, 维持 60 ± 1 sec 0402:0.5kgf, 0603: 1.0kgf; Other: 2.0kgf ; 60 ± 1 seconds;	无破损
耐溶剂性 Resistance to Solvents	AEC-Q200 TEST 12 MIL-STD 202 METHOD 215	注意: 添加水性洗涤化学品-OKEM Clean或等效物。请勿使用违禁溶剂 Note: Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.	标示无脱落、损伤
ESD 试验 ESD test	AEC-Q200 TEST 17 AEC-Q200-002	加载规定静电电压2次/间隔1秒, 0402规格:0.5KV, 0603规格:1KV, 其它规格2KV. 0402: 0.5KV, 0603: 1.0KV, Other:2KV, 2times/1s	$\pm(3.0\% + 0.05\Omega)$

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
抗硫化实验 Sulfuration test	ASTM-B-809-95	方法一：温度105℃，湿热蒸硫粉试验（加饱和硝酸钾）750hrs 方法二：切削油:硫粉=96.5:3.5，温度105℃，100H; 预处理：前后先经历3次回流焊+100次温冲 Method 1: steam sulfur powder test (with saturated potassium nitrate) at 105℃ with humidity and heat (750hrs) Method 2: cutting oil: sulfur powder =96.5:3.5, temperature 105℃, 100H; Pretreatment: before and after three reflow soldering +100 thermal shock	±(3.0% +0.05Ω) Max

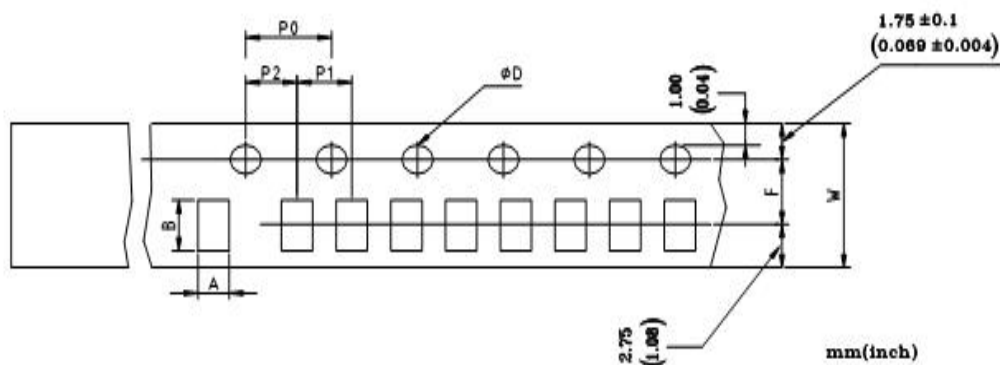
■ 包装规格 (Tapping Specification)

-卷盘尺寸 (Reel dimension)



Type	Size		Unit	A	B	C	F	W
0402	7"	10K/Reel 15K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
0402	13"	40K/50K Reel	mm	330±2.0	100.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
0603/0805/1206/1210	7"	5K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
0603/0805/1206	10"	10K/Reel	mm	254±2.0	100.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
0603/0805/1206	13"	20K/Reel	mm	330±2.0	100.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
1812/2010/2512	7"	4K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	15.4±1.0	13.0±0.3

-包装尺寸 (packing dimension)



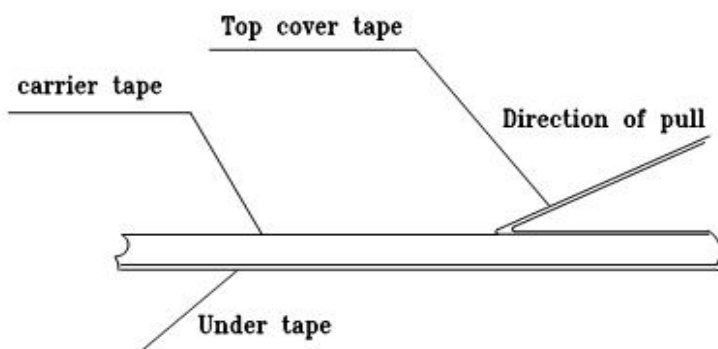
Unit: mm

Dimensions	A	B	D	F	P0	P1	P2	W
0402	0.65±0.10	1.15±0.10	1.50± ^{0.1} _{0.0}	3.50±0.05	4.00±0.10	2.00±0.10	2.00±0.05	8.00±0.20
0603	1.10±0.10	1.90±0.10	1.50± ^{0.1} _{0.0}	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20
0805	1.65±0.20	2.40±0.20	1.50± ^{0.1} _{0.0}	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20
1206	1.90±0.20	3.50±0.20	1.50± ^{0.1} _{0.0}	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20
1210	2.80±0.20	3.50±0.20	1.50± ^{0.1} _{0.0}	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20
2010	2.90±0.10	5.30±0.10	1.50± ^{0.1} _{0.0}	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10
2512	3.40±0.10	6.60±0.10	1.50± ^{0.1} _{0.0}	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10

■ 上胶带剥离力测试 (Peel force of top cover tape)

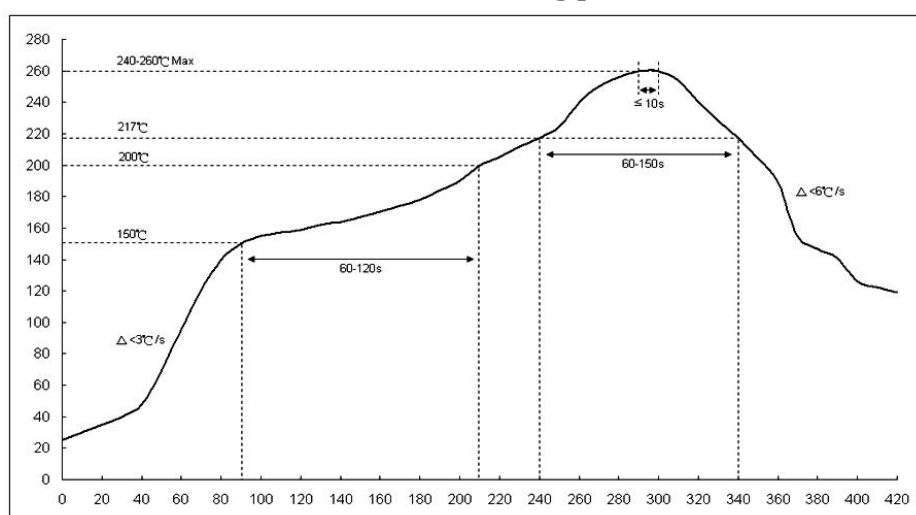
上胶带以 200mm/分钟的速度，沿 165~180 度角的方向进行剥离，如下图所示。纸带的剥离力范围为 10g~70g; 载带的剥离力范围为 30~100g。

The top cover tape is pulled at a speed of 200 mm/min with the angle between the tape during peel and the direction of unreeling maintained at 165 to 180 degree as following picture. The peel force of paper carrier tape shall be 0.1N to 0.7N(10 to 70 g), the peel force of plastic carrier tape shall be 0.3N to 1N (30 to 100 g)

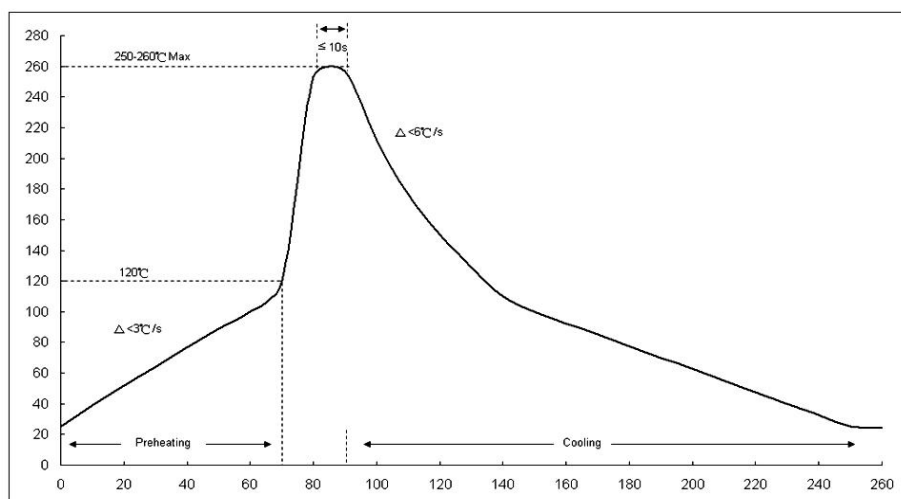


■ 焊接 (soldering)

- 建议回流焊曲线 (Recommend reflow soldering profile)



- 建议波峰焊曲线 (Recommend wave soldering profile)



-手工焊温度 (hand soldering temperature)

烙鐵溫度 350±10°C 3 秒之內 · 避免烙鐵接觸電阻本體

The iron temperature is 350±10°C, hand soldering time less than 3S. Avoid solder iron tip direct touch the components body

■ 厚膜电阻器使用说明 (Chip Resistor Instructions for use)

- 本产品在以下特殊环境下应用，性能可能会收到影响 (Application of the products in a special environment can deteriorate product performance) :

1. 高温;

High temperature

2. 有海风或腐蚀性气体，包括氯气，硫化氢，氨气，二氧化硫，二氧化氮等;

Near the sea ,or corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , and NO_2 , etc;

3. 各种类型的液体，包括水，油，化学品，有机溶剂的使用;

Unverified liquids, such as water, oil, chemical or organic solvent;

4. 在用树脂或其他涂层材料密封产品的情况下使用;

Unverified resin or paint to cover products;

5. 焊接后使用不洁焊剂或使用水或水溶性清洁剂清洗产品

Products should be washed with soluble cleaner even if non cleaning flux.

- 储存 / 搬运条件 (STORAGE / CARRY CONDITIONS)

6. 储存温度 25±5°C

Temperature: 25±5°C

7. 湿度 30~70%RH

Humidity: 30~70%RH

8. 储存期限: 先进先出, 2 年

Storage life: 2years FIFO

9. 存放和搬运时，请保持盒子的正确方向。严禁跌落在箱体上，否则可能损坏产品电极或本体

Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall on the box. otherwise the product electrode or body may be damaged.