



富捷科技

# Product Datasheet

## 产品规格说明书

FQL-L Series Automotive

Low-ohmic Low TCR Thick Film Chip Resistor

汽车级低阻低温漂厚膜片式电阻器

安徽省富捷电子科技有限公司

ANHUI FOJAN ELECTRONICS TECHNOLOGY CO., LTD

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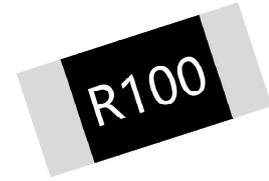
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## 汽车级低阻值低温漂厚膜片式电阻器

## Automotive Grade Low-ohmic Low TCR

## Thick Film Chip Resistor FQL-L Series



### 特点 (Features)

- 电性能稳定, 可靠度高 - Stable electrical capability and high Reliability
- 符合 RoHS 指令&无卤素要求 - Compliant with RoHS directive , Halogen free requirement
- 符合 汽车标准相关条款 - Compliant with AEC-Q200 standard

### 应用 (Application)

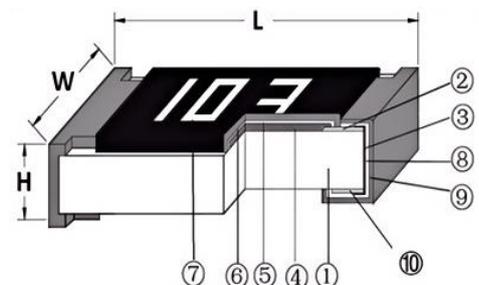
- 广泛应用于转换器、打印机设备、服务器板、电信及消费类电子、汽车类电子产品等领域。
- Converters, Printer equipment, Server board, Telecom, Consumer electronics and Car electronics etc.

### 产品料号 (Parts Number Explanation) 示例: FQL1206FR100TSL

F 公司	QL 产品别	1206 尺寸	F 公差	R100 字码	T 包装别	S 端电极	L 特殊码
FOJAN	<b>QL: Automotive</b>	0402	F:±1%	0402: No-Marking	T: 7 inch reel	S: Sn	Blank:
	<b>LowOhmic Low TCR</b>	0603	G:±2%	0603: 3-digits	Q:10 inch reel	C: Cu	none
	Others series refer to	0805	J:±5%	R10=100mR	R:13 inch reel	A: Au	
	Catalogue	1206		02Z=102mR	B: Bulk		
		1210		Others: 4-digits			
		2010		R100=100mR			
		2512		R500=500mR			
Company	Type	Size	Tolerance	Resistance	Packaging	Termination	Special Case

### 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 <sub>2</sub> O <sub>3</sub>
2	银电极 Conductive layer (Top)	银 Ag
3	侧电极 Side conductive layer	镍铬合金 NiCr
4	阻体层 Resistive layer	氧化钌 RuO <sub>2</sub>
5	内保护层 Inner protective layer	玻璃 Glass
6	外保护层 Outer Protective layer	环氧树脂 Epoxy
7	文字 Marking	环氧树脂 Epoxy
8	镍电极 Ni plating layer	镍 Ni
9	锡电极 Sn plating layer	锡 Sn
10	银电极 Conductive layer (Back)	银 Ag



■ 尺寸 (Dimension):

尺寸 Dimension							单位 (unit) : mm
型别 (Type)		L	W	H	T1	T2	
英制	公制						
0402	1005	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10	
0603	1608	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.25±0.15	
0805	2012	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	
1206	3216	3.10±0.10	1.60±0.10	0.55±0.10	0.45±0.20	0.45±0.20	
1210	3225	3.10±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20	
2010	5025	5.00±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20	
2512	6432	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.90±0.20	

■ 电气特性 (Electrical characteristics)

型别 Type	70°C 下额定功率 Rated Power at 70°C	最大工作电压 Max Working Voltage	最大过负荷电压 Max Overload Voltage	绝缘耐压 DWV
0402	1/16W	0.79A	1.97A	300V
0603	1/10W	2.23A	5.59A	300V
0805	1/8W	2.50A	6.25A	500V
1206	1/4W	3.53A	8.83A	500V
1210	1/2W	5.00A	12.50A	500V
2010	3/4W	6.12A	15.30A	500V
2512	1W	7.07A	17.67A	500V

■ 功率衰减曲线 (Derating Curve)

使用温度范围 Temperature usage range	-55°C~+155°C
说明 Describe	周围温度若超过 70°C至 155°C之间, 功率可照下图曲线予以修订 If the ambient temperature exceeds 70°C to 155°C, the power can be revised according to the curve in the following figure
功率衰减曲线图 Power Attenuation Curvee	

■ 温度系数 (Temperature Coefficient)

型别 Type	阻值范围 Resistance Range	产品精度和温漂系数 (ppm/°C) Resistance Tolerance and TCR (ppm/°C)		
		±1%	±2%	±5%
0402	100mΩ≤R < 500mΩ	±300	±300	±300
	500mΩ≤R < 1Ω	±200	±200	±200
0603	100mΩ≤R < 500mΩ	±300	±300	±300
	500mΩ≤R < 1Ω	±200	±200	±200
0805	50mΩ≤R < 68mΩ	±150	±150	±150
	68mΩ≤R < 1Ω	±100	±100	±100
1206	50mΩ≤R < 68mΩ	±150	±150	±150
	68mΩ≤R < 1Ω	±100	±100	±100
1210	50mΩ≤R < 1Ω	±100	±100	±100
2010	50mΩ≤R < 1Ω	±100	±100	±100
2512	50mΩ≤R < 1Ω	±100	±100	±100

■ 性能 (Performance)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
温度系数 Temperature Coefficient	JIS C 5201 4.8	$TCR = (R - R_0) / (t - t_0) R_0 \times 10^6 (\text{ppm})$ R0: 电阻在室温下的阻值 (resistance at room temperature) R: 电阻在 125°C或-55°C下的阻值 (resistance at 125°C or -55°C) t0: 室温 (room temperature) t: 测试温度 (test temperature 125°C or -55°C)	As SEPC
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%: ±(1.0%+0.05Ω) 5%: ±(2.0%+0.05Ω)
高温储存 High Temperature Exposure	AEC-Q200 TEST3 MIL-STD-202 METHOD 108	125°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. Unpowered. Measurement at 24±4 hours °C after test conclusion	±(1.00%+0.05Ω)
温度循环 Temperature Cycling	AEC-Q200 TEST 4 JESD22 METHOD JA-104	-55 ~ + 155, °C °C 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 °C °C after test conclusion. 30min maximum dwell time at each temperature extreme. 1min. maximum transition time.	±(2.00% +0.05Ω)

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FQL-L 系列低温漂低阻厚膜片式电阻器规格书



内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
温湿循环 Moisture resistance	MIL-STD-202 METHOD 106	25°C~65°C,90% ~ 100%RH, 2.5 小时; 65°C 90% ~ 100%RH, 3 小时; 65°C~25°C,80%~ 100%RH,2.5 小时, 10 个循环, 试验结束 24±4 小 时后进行测试。 25°C~65°C,90% ~ 100%RH, 2.5H; 65°C 90% ~100%RH, 3H; 65°C~25°C 80% ~ 100%RH, 2.5H, 10 cycles, Measurement at 24±4 hours after test conclusion.	1%:±(1.0%+0.05Ω) 5%:±(2.0%+0.05Ω)
焊锡性 Solderability	JIS C 5201 4.17	沾助焊剂后浸入锡炉, 锡炉温度 245±5°C, 3±0.5 秒。 Dip the terminal in a flux and then dip into a soldering bath at 245±5°C for 3±0.5sec.	> 95%面积上锡 (>95% coverage)
抗焊锡热 Resist to soldering heat	JIS C 5201 4.18	沾助焊剂后浸入锡炉, 锡炉温度 260±5°C, 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°C for 10±0.5sec. Measure the variation of resistance.	±(1.00% +0.05Ω)
绝缘电阻 Insulation resistance	JIS C 5201 4.6	电阻本体上加绝缘耐压 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	电阻本体上加绝缘耐压 60±5 秒。 Applied the dielectric withstanding voltage on the center of body for60±5seconds.	无击穿、飞溅及可见机械 性损伤 No evidence of flash over, mechanical damage arcing or insulation breakdown
温湿循环 Moisture resistance	MIL-STD-202 METHOD 106	25°C~65°C,90% ~ 100%RH, 2.5 小时; 65°C 90% ~ 100%RH, 3 小时; 65°C~25°C,80% ~ 100%RH,2.5 小时, 10 个循环, 试验结束 24±4 小时后进行测试。 25°C~65°C,90% ~ 100%RH, 2.5H; 65°C 90% ~ 100%RH, 3H; 65°C~25°C 80% ~ 100%RH, 2.5H, 10 cycles, Measurement at 24±4 hours after test conclusion.	1%:±(1.0%+0.05Ω) 5%:±(2.0%+0.05Ω)
耐湿特性 Humidity	MIL-STD-202 METHOD 103 AEC-Q200 TEST 7	电阻放入恒温恒湿箱, 加载 10%额定功率, 85°C /85%RH, 持续通电 1000+24/-0H, 试验结束 24±4 小时后进行测试 Put the specimen in a chamber Load 10% of operating power,1000 hours 85°C/85%RH. Measurement at 24±4 hours after test conclusion.	1%:±(1.0%+0.05Ω) 5%:±(2.0%+0.05Ω)
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.	标识无脱落、损伤 No Marking fall off and broken

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
负荷寿命 Load life	MIL-STD-202 METHOD 108 AEC-Q200 TEST 8	电阻放入恒温箱中，温度 $125\pm 2^{\circ}\text{C}$ ，加载 45%额定功率 ON TIME:1.5H，OFF TIME:0.5H，通电 $1000+24/-0\text{H}$ ，试验结束 $24\pm 4$ 小时后进行测试 Put the specimen in a chamber at $125\pm 2^{\circ}\text{C}$ temperature, Load 45% rated power ON TIME:1.5H, OFF TIME:0.5H, and applied for $1000+24/-0\text{H}$ . Measurement at $24\pm 4$ hours after test conclusion.	$1\%:\pm(1.0\%+0.05\Omega)$ $5\%:\pm(2.0\%+0.05\Omega)$
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 $20\pm 1$ 秒，1206 (含) 以下的尺寸弯曲 $5+0.2/0$ mm; 1206 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 $20\pm 1\text{s}$ . 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. 测试板 (test board) 压头 (jig)  待测物 Specimen 测试基板 Testing printed circuit board 测试支架 Supporting jig 基板原位置 Position before bend 压头 Jig 印刷电路板 Testing printed circuit board Distance of bending	$\pm(1.00\% + 0.05\Omega)$

### ■ 本体标识 (Marking on the Resistor's Body)

1.0402 因本体太小，本体上无字码标识

For 0402 size, no marking on the body due to the small size of the resistor

2.0603 规格 (1%&5%) (0603Type) : 3 字码 (3-digits)



R10=100mΩ

3.0805/1206/1210/2010/2512/1812 规格 (1%&5%) : 4 字码  
0805/1206/1210/2010/2512/1812type(1%&5%):4-digits



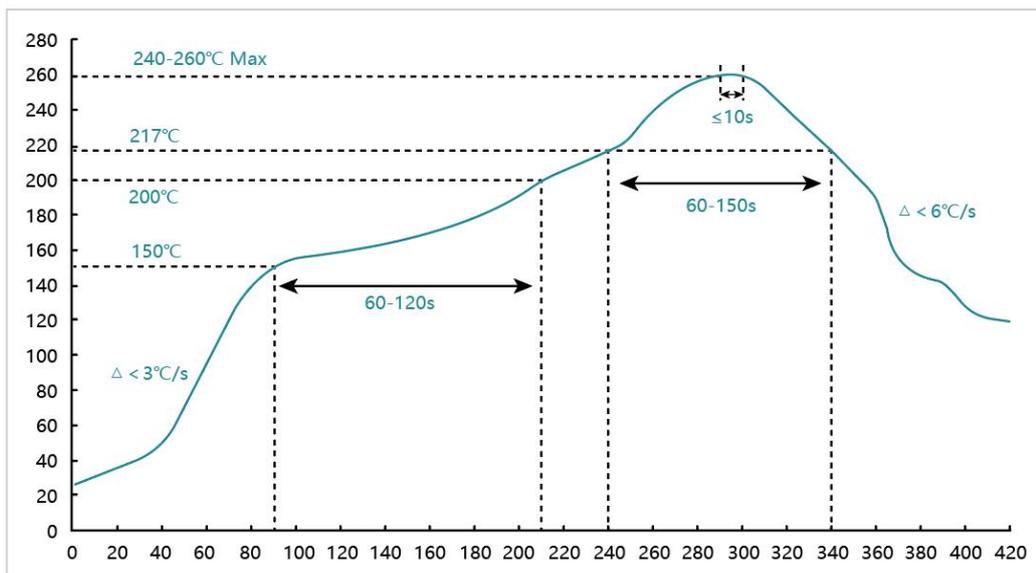
R100=100mΩ



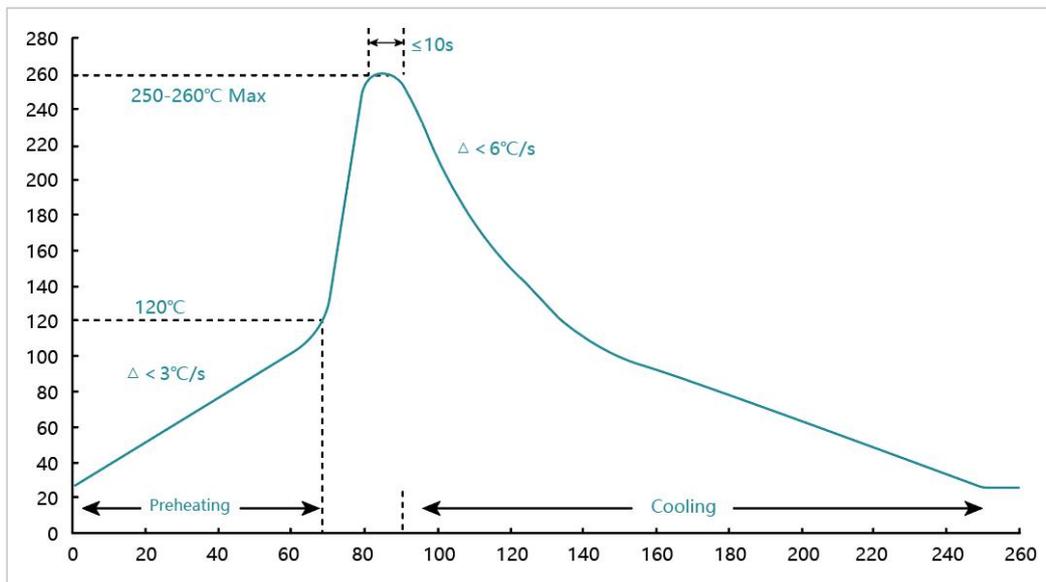
R102=102mΩ

### ■ 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)

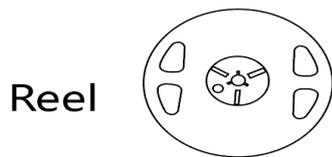


- 手工焊温度 (hand soldering temperature)

烙铁温度  $350 \pm 10^{\circ}\text{C}$  3 秒之内, 避免烙铁接触电阻本体

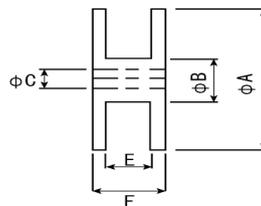
The iron temperature is  $350 \pm 10^{\circ}\text{C}$ , hand soldering time less than 3S. Avoid solder iron tip direct touch the components body

■ 包装规格 (Tapping Specification)



Reel

Standard Quantity per Reel  
5000 pcs/Reel



- 卷盘尺寸 (Reel dimension)

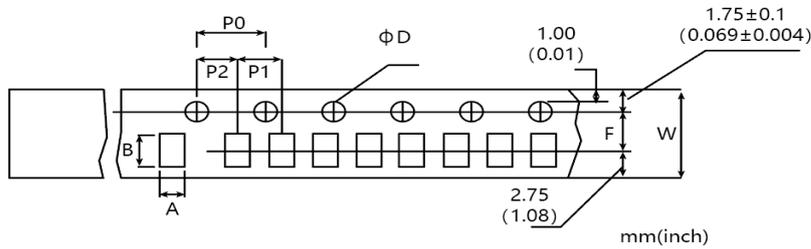
Type	Size	Unit	A	B	C	F	W	
0402	7"	10K/Reel	mm	$178 \pm 2.0$	$60.0 \pm 1.0$	$13.5 \pm 0.5$	$11.4 \pm 0.1$	$9.00 \pm 0.3$
0402	13"	40K/50K Reel	mm	$330 \pm 2.0$	$100.0 \pm 1.0$	$13.5 \pm 0.5$	$11.4 \pm 0.1$	$9.00 \pm 0.3$
0603/0805/1206	7"	5K/Reel	mm	$178 \pm 2.0$	$60.0 \pm 1.0$	$13.5 \pm 0.5$	$11.4 \pm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

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- 包装尺寸 (packing dimension)

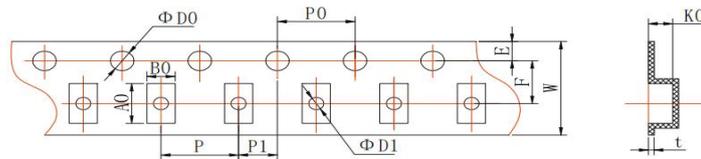
纸带编带 Paper Taping



Unit: mm

Dim	A	B	D	F	P0	P1	P2	W	T
0402	0.65±0.10	1.15±0.10	1.50±0.10	3.50±0.05	4.00±0.10	2.00±0.10	2.00±0.05	8.00±0.20	0.42±0.03
0603	1.10±0.10	1.90±0.10	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.60±0.03
0805	1.65±0.20	2.40±0.20	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.75±0.05
1206	1.90±0.20	3.50±0.20	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.75±0.05

塑料带编带 Embossed Taping



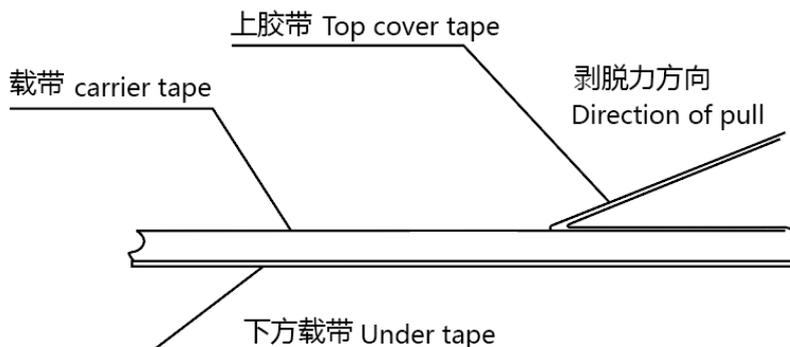
Unit: mm

Dim	B0	A0	D0	F	P0	P	P1	W	K0
2010	2.75±0.10	5.40±0.10	1.50±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10	0.75±0.10
2512	3.35±0.10	6.70±0.10	1.50±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10	0.75±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 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)



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

本产品以下特殊环境下应用，性能可能会受到影响：

(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<sub>2</sub>,H<sub>2</sub>S,NH<sub>3</sub>,SO<sub>2</sub>,and NO<sub>2</sub>,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,chenical 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 cheaner even if non cleaning flux.

## - 储存 / 搬运条件 (Storage / Carry conditions)

1. 储存温度 25±5°C                      Temperature: 25±5°C
2. 湿度 30%~70%RH                      Humidity: 30%~70%RH
3. 储存期限: 先进先出, 2年              Storage life: 2years FIFO
4. 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.

