FOSAN TECHNOLOGY

富捷科技 FOJAN

Product Datasheet
产品规格说明书

FQL Series Low-ohmic Automotive Thick Film Chip Resistor

低阻车规厚膜片式电阻器

安徽省富捷电子科技有限公司
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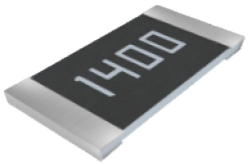
低阻车规厚膜片式电阻器
General Low-ohmic Automotive Thick Film Chip Resistor



■ 特点 (Features)

- 低阻值 -Low-ohmic
- 电性能稳定，可靠度高 - Stable electrical capability and high Reliability
- 符合 RoHS 指令和无卤素要求 - Compliant with RoHS directive and Halogen free requirement
- 具有优越的抗硫化性能 - With excellent Anti-sulfured performance
- 符合 汽车标准相关条款 -Compliant with AEC-Q200 standard

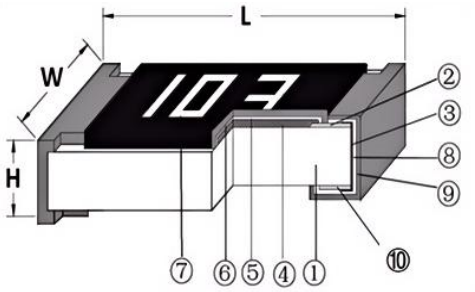
■ 应用 (Application)

- 广泛用于汽车开关电源、音响设备的过电流保护、电压调节器、电源转换器、充电器、 灯驱动电源、等。
- Widely used in Automotive Switching Power Supply, Over Current Protection in Audio Application, Voltage Regulation, Module(VRM), DC-DC Converter, Charger, LED Lamp Devices, , etc

■ 产品料号 (Parts Number Explanation) 示例: FQL1206FR100TS

F 公司	QL 产品别	1206 尺寸	F 公差	R100 字码	T 包装别	S 端电极	特殊码
FOJAN	**QL: General** **Low-ohmic** Others series refer to Catalogue	0402 0603 0805 1206 1210 1218 1812 2010 2512	F:±1% J:±5%	0603：3-digits R10=100mR R50=500mR 02Z=102mR 0805-2512： 4-digits R100=100mR R500=500mR	T: 7 inch reel Q:10 inch reel R:13 inch reel B:Bulk	S：Sn C：Cu A：Au	Blank： none
Company	Product Type	Size	Tolerance	Resistance	Packaging	Termination	Special Case

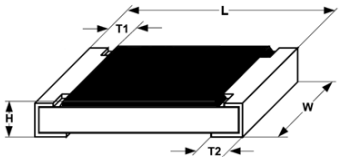
▪ 电阻结构（Construction）



NO.	结构 Construction	主要材料 Major material
1	陶瓷基板 Ceramic substrate	三氧化二铝 Al_2O_3
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_2
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	镍电极 Ni plating layer	镍 Ni
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
1218	3245	3.10±0.10	4.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
1812	4532	4.50±0.20	3.10±0.20	0.55±0.10	0.55±0.20	0.70±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	最大工作电流 Max Working Current	最大过负荷电流 Max Overload Current	绝缘耐压 Dielectric Withstanding Voltage
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
1812	3/4W	6.12A	15.30A	500V
2010	3/4W	6.12A	15.30A	500V
2512	1W	7.07A	17.67A	500V

备注（Remark）： 额定电压计算公式（The rated voltage is calculated by the following formula）：

E= $\sqrt{RP}$

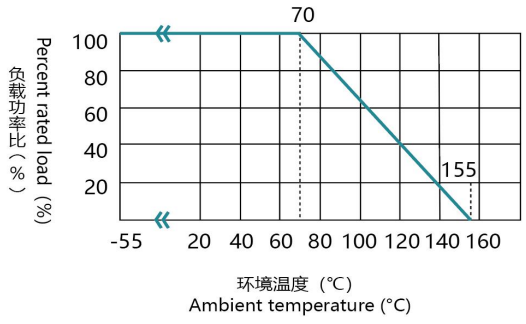
E：额定电压（Rated Voltage） (V)

P：额定功率（Rated Power ） (W)

R：电阻阻值（Resistance ） (ohm)

如果计算出的电压超过此型别的最大工作电压，则此型别的最大工作电压为此电阻的额定电压。
In case the value calculated by the formula exceed the maximum working voltage as above table 8, the maximum working voltage shall be regarded as rated voltage.

■ 功率衰减曲线 (Derating Curve)

使用温度范围 Temperature usage range	-55℃~+155℃
说明 Describe	周围温度若超过 70℃至 155℃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 Curve	

▪ 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	0.1Ω≤R＜0.5Ω	±800	±800	±800
	0.5Ω≤R＜0.91Ω	±400	±400	±400
0603/0805 1206/1210 1812/2010/2512	0.05Ω≤R＜0.1Ω	±1200	±1200	±1200
	0.1Ω≤R＜0.5Ω	±800	±800	±800
	0.5Ω≤R＜0.91Ω	±400	±400	±400

▪ 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 ×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 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.	0.5%/1%:±(1.0%+0.05Ω) 5%：±(2.0%+0.05Ω)
高温储存 High Temperature Exposure	AEC-Q200 TEST 3 MIL-STD-202 METHOD 108	125℃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 ℃ after test conclusion	±(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)
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.	0.5%/1%:±(1.0%+0.05Ω) 5%：±(2.0%+0.05Ω)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
耐湿特性 Humidity	MIL-STD-202 METHOD 103 AEC-Q200 7	加载 10%额定功率，85℃/85%RH，持续通电 $1000^{+24}/_{-0}$H,试验结束 24±4 小时后进行测试 Load 10% of operating power，1000 hours 85℃ /85%RH. Measurement at 24±4 hours after test conclusion.	0.5%/1%：±(1.0%+0.05Ω) 5%：±(2.0%+0.05Ω)
负荷寿命 Load life	MIL-STD-202 METHOD 108 AEC-Q200 8	电阻放入恒温箱中，温度 125±2℃，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±2℃ temperature, ON TIME:1.5H，OFF TIME:0.5H，and applied rated voltage for 1000 $^{+24}/_{-0}$H. Measure the variation of resistance.	0.5%/1%：±(1.0%+0.05Ω) 5%：±(2.0%+0.05Ω)
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)
绝缘电阻 Insulation resistance	JIS C 5201 4.6 IEC60115-1-4.6	电阻本体上加载绝缘耐压 60±5 秒，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 IEC60115-1-4.7	电阻本体上加载绝缘耐压 60±5 秒。 Applied the dielectric withstanding voltage on the center of body for60±5seconds.	无击穿、飞弧可见机械性损伤 No evidence of flash over, mechanical damage arcing or insulation breakdown
端子强度 Terminal Strength	AEC-Q200 TEST 11 MIL-STD 202 METHOD 211	04020.5kgf；0603:1.0kgf；其他规格：2.0kgf 施加推力，维持 60±1 秒 0402:0.5kgf, 0603：1.0kgf；Other：2.0kgf ；60±1 seconds；	无破损 No Broken
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	±(3.0%+0.05Ω)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
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; 1206 以上的尺寸弯曲 2+0.2/0 mm; 量测试验前后阻值变化率 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)
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 No Marking fall off and broken
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) 1000hrs Method 1: steam sulfur powder test (with saturated potassium nitrate) at 105℃ with humidity and heat (1000hrs)	±(3.0% +0.05Ω) Max

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

1.0402 因本体太小，本体上无字码标示

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

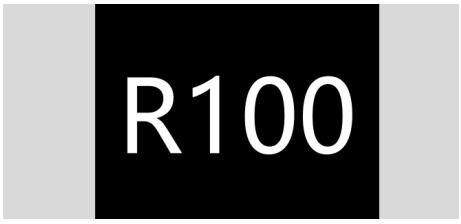
2.0603 规格（1%&5%）（0603Type）：3 字码（3-digits）

R10=100mΩ

02Z=102mΩ

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

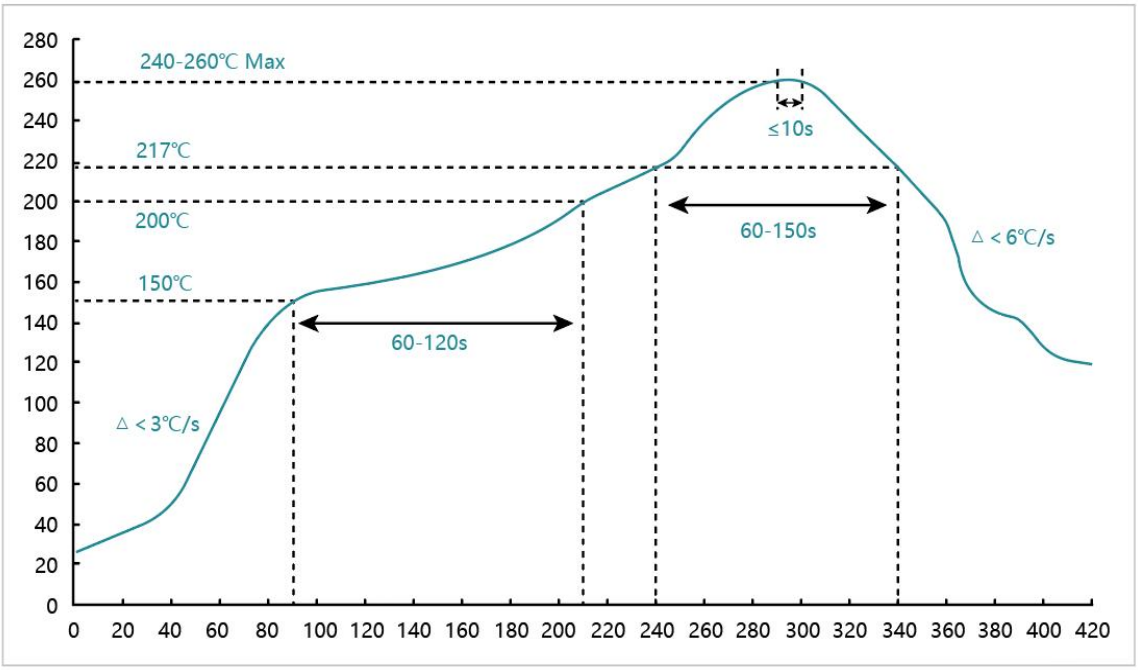
R102=102mΩ

▪ 0603±1% E96 系列电阻值代码 Standard E96 Series Resistance Value Code for 0603 ±1% Marking

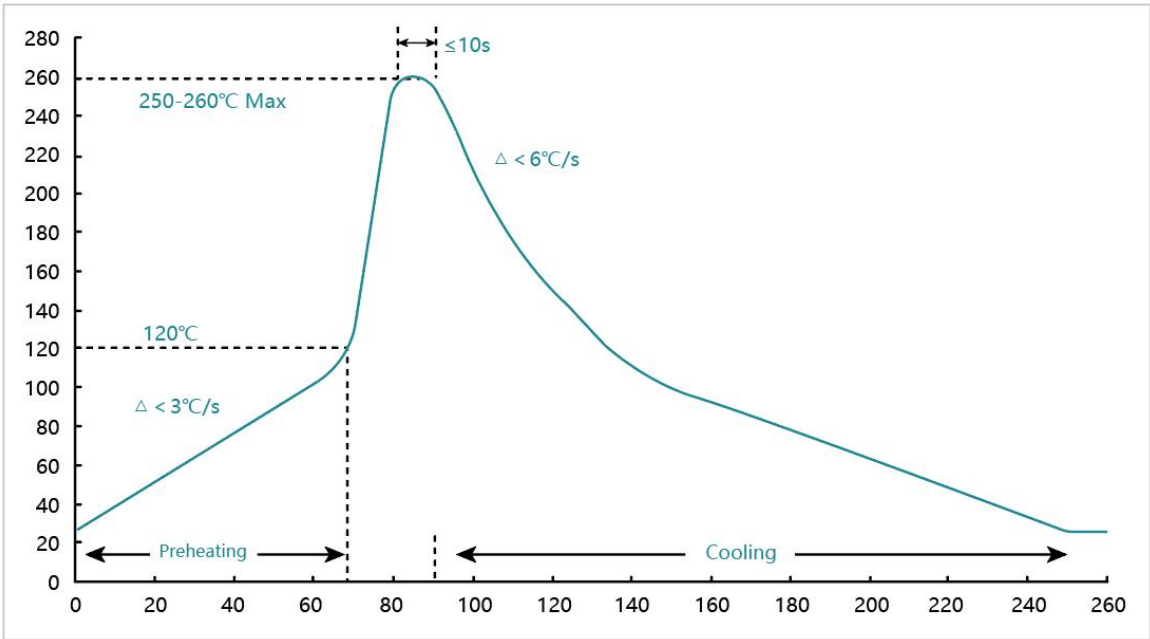
代码 Code	阻值 Value	代码 Code	阻值 Value	代码 Code	阻值 Value	代码 Code	阻值 Value	代码 Code	阻值 Value	代码 Code	阻值 Value
102 mR	**02Z**	158 mR	**20 Z**	232 mR	**36 Z**	332 mR	**51 Z**	475 mR	**66 Z**	681 mR	**81 Z**
105 mR	**03 Z**	162 mR	**21 Z**	237 mR	**37 Z**	340 mR	**52 Z**	487 mR	**67 Z**	698 mR	**82 Z**
107 mR	**04 Z**	165 mR	**22 Z**	243 mR	**38 Z**	348 mR	**53 Z**	499 mR	**68 Z**	715 mR	**83 Z**
113 mR	**06 Z**	169 mR	**23 Z**	249 mR	**39 Z**	357 mR	**54 Z**	511 mR	**69 Z**	732 mR	**84 Z**
115 mR	**07 Z**	174 mR	**24 Z**	255 mR	**40 Z**	365 mR	**55 Z**	523 mR	**70 Z**	768 mR	**86 Z**
118 mR	**08 Z**	178 mR	**25 Z**	261 mR	**41 Z**	374 mR	**56 Z**	536 mR	**71 Z**	787 mR	**87 Z**
121 mR	**09 Z**	182 mR	**26 Z**	267 mR	**42 Z**	383 mR	**57 Z**	549 mR	**72 Z**	806 mR	**88 Z**
124 mR	**10 Z**	187 mR	**27 Z**	274 mR	**43 Z**	392 mR	**58 Z**	562 mR	**73 Z**	825 mR	**89 Z**
127 mR	**11 Z**	191 mR	**28 Z**	280 mR	**44 Z**	402 mR	**59 Z**	576 mR	**74 Z**	845 mR	**90 Z**
133 mR	**13 Z**	196 mR	**29 Z**	287 mR	**45 Z**	412 mR	**60 Z**	590 mR	**75 Z**	866 mR	**91 Z**
137 mR	**14 Z**	205 mR	**31 Z**	294 mR	**46 Z**	422 mR	**61 Z**	604 mR	**76 Z**	887 mR	**92 Z**
140 mR	**15 Z**	210 mR	**32 Z**	301 mR	**47 Z**	432 mR	**62 Z**	619 mR	**77 Z**	909 mR	**93 Z**
143 mR	**16 Z**	215 mR	**33 Z**	309 mR	**48 Z**	442 mR	**63 Z**	634 mR	**78 Z**	931 mR	**94 Z**
147 mR	**17 Z**	221 mR	**34 Z**	316 mR	**49 Z**	453 mR	**64 Z**	649 mR	**79 Z**	953 mR	**95 Z**
154 mR	**19 Z**	226 mR	**35 Z**	324 mR	**50 Z**	464 mR	**65 Z**	665 mR	**80 Z**	976 mR	**96 Z**

▪ 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)

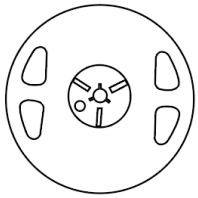
烙铁温度 350±10℃ 3 秒之内，避免烙铁接触电阻本体

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

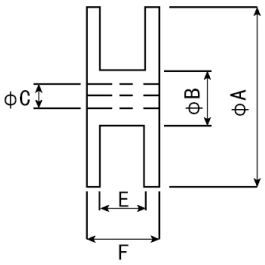
■ 包装规格（Tapping Specification）

-卷盘尺寸（Reel dimension）

Reel



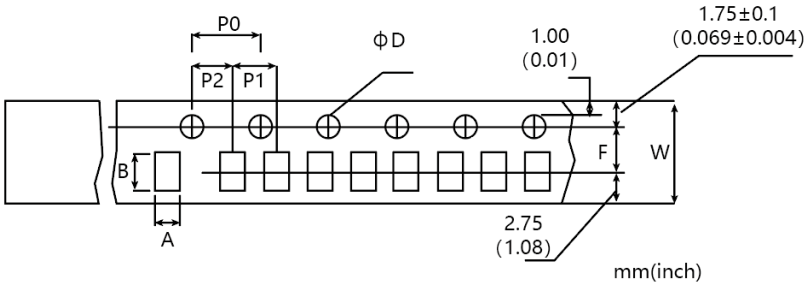
Standard Quantity per Reel
5000 pcs/Reel



Type	Size		Unit	A	B	C	F	W
0402	7″	10K/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
1218/1812/2010/2512	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）

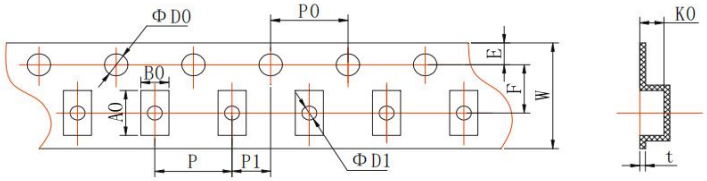
纸带编带 Paper Taping



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
1210	2.80±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



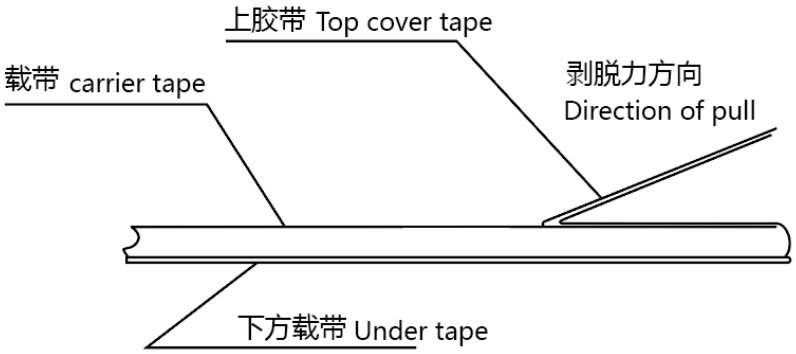
Unit: mm

Dim	B0	A0	D0	F	P0	P	P1	W	K0
1218	2.80±0.20	4.60±0.20	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
1812	3.52±0.10	5.10±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	0.78±0.10
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）

本产品在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_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,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℃ Temperature：25±5℃
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.

修订履历 (Revision History)

版本 Version	修订日期 Revision Date	修订内容 Revision Description	版本确认 Version Checked
FJ-JS-3001-V1.0	2020.12.01	原版 The original version	魏效振 Xiaozhen Wei
FJ-JS-3001-V2.0	2025.01.01	版本及格式修订 Version and format revision	魏效振 Xiaozhen Wei