



富捷科技

Product Datasheet

产品规格说明书

FRM Series

Low Resistance Alloy Resistor

低阻值合金电阻器

安徽省富捷电子科技有限公司

ANHUI FOJAN ELECTRONICS TECHNOLOGY CO., LTD

安徽省马鞍山市郑蒲港新区金蒲电子产业园

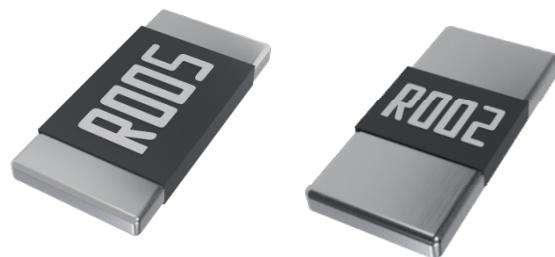
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低阻值合金电阻器

Low Resistance Alloy Resistor

FRM Series



■ 特点 (Features)

- 散热性能好
- 用于高功率耗散
- 用于电流检测的低电流, 高精度电阻
- 低电感
- 全合金材质
- 低温度系数
- 绝缘耐压: 500V DC
- 符合 AEC-Q200 可靠性测试
- 无铅, 符合 RoHS、Reach 要求
- Good performance for Heat Dissipation
- For High Power Dissipation
- Low Resistance and High Accuracy Resistor for Current Detection
- Low inductance
- All alloy material
- Low temperature coefficient
- Dielectric Withstanding Voltage: 500V DC
- Complies with AEC-Q200 reliability test
- Pb-free to Meet RoHS、Reach Requirements

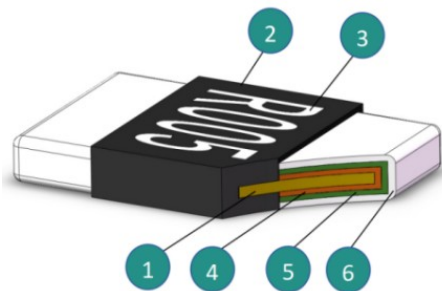
■ 应用 (Application)

- DC-DC 转换器, 电池组, 充电, 适配器
- 便携式仪器(PDA 和手机)
- 电压调节模块(VRM)
- 过流保护
- 电流检测
- 电源管理应用
- 开关电源
- DC-DC Converter, Battery Pack, Charge, Adaptor
- Portable Instruments (PDA and Cell Phone)
- Voltage Regulation Module (VRM)
- Over current protection
- Current sensing
- Power Management Applications
- Switching Power Supply

■ 产品料号 (Parts Number Explanation) 示例: FRM252WFR005TM

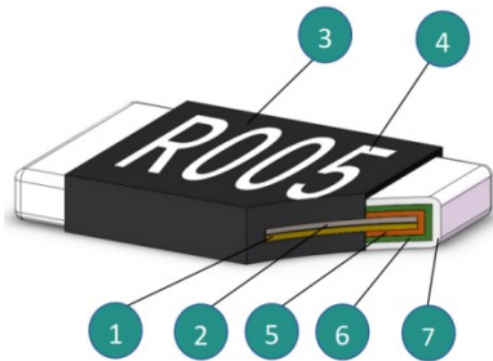
F 公司名	R 产品别	M 功能别	25 尺寸	2W 功率	F 公差	R005 字码	T 包装别	M 材质	特殊型
FOJAN	R:Resistor P:High power	M:Metal	08:0805 12:1206 20:2010 25:2512	05: 0.5W 1W: 1W 15: 1.5W 2W: 2W	F:±1% G:±2% J:±5%	R005=5mΩ R500=500mΩ R0005=0.5mΩ	T: 7 inch reel R:13 inch reel B: Bulk	M: Metal	Blank: none L: large electrode
Company	Type	Functional	Size	Power	Tolerance	Resistance	Packaging	Termination	Special Case

电阻结构 (Construction)



型别 Type	阻值范围 Resistance Range (mΩ)
0805	1~25
1206	1~200
2010	1~100
2512	0.5~4

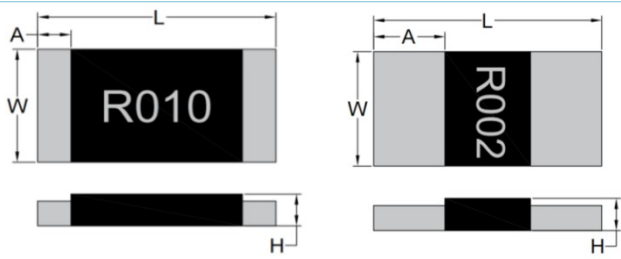
NO.	结构 construction	主要材料 Major material
1	合金材料 Alloy material	锰铜 CuMn
2	保护层 Epoxy Coating	环氧树脂 Epoxy
3	文字 Marking	环氧树脂 Epoxy
4	铜电极 Cu plating layer	铜 Cu
5	镍电极 Ni plating layer	镍 Ni
6	锡电极 Sn plating layer	锡 Tin



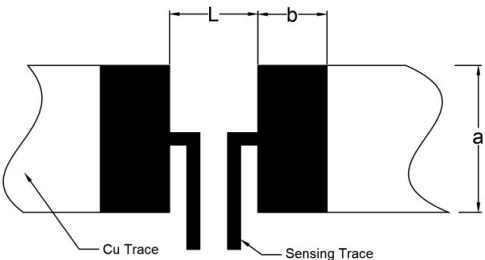
型别 Type	阻值范围 Resistance Range (mΩ)
2512	1~680

NO.	结构 construction	主要材料 Major material
1	合金材料 Alloy material	锰铜 CuMn
2	散热片 Heat sink	铝 Al
3	保护层 Epoxy Coating	环氧树脂 Epoxy
4	文字 Marking	环氧树脂 Epoxy
5	铜电极 Cu plating layer	铜 Cu
6	镍电极 Ni plating layer	镍 Ni
7	锡电极 Sn plating layer	锡 Tin

■ 尺寸 (Dimension)

尺寸 Dimension					单位 (unit) : mm
型别 (Type)	L	W	A	H	
0805	2.0±0.20	1.25±0.20	0.4±0.20	0.6±0.20	
0805-L	2.0±0.20	1.25±0.20	0.65±0.20	0.6±0.20	
1206	3.2±0.20	1.6±0.20	0.5±0.30	0.7±0.15	
1206-L	3.2±0.20	1.6±0.20	1.0±0.25	0.9±0.15	
2010	5.0±0.20	2.5±0.20	0.6±0.30	0.6±0.20	
2010-L	5.0±0.20	2.5±0.20	1.5±0.30	0.6±0.20	
2512	6.4±0.20	3.2±0.20	0.95±0.25	0.9±0.20	
2512-L	6.4±0.20	3.2±0.20	2.1±0.25	0.9±0.20	

■ 推荐焊盘尺寸 (Recommended Pad Dimension)

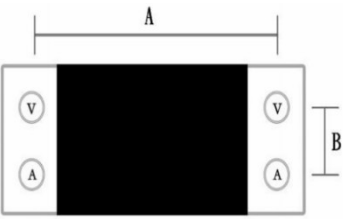
焊盘尺寸 Pad Dimension					单位 (unit) : mm
型别 (Type)	阻值范围 Resistance Range (mΩ)	a	b	L	
0805	2mΩ≤R≤25mΩ	1.4±0.1	1.2±0.1	0.7±0.1	
0805-L	1mΩ≤R<2mΩ	1.4±0.1	1.2±0.1	1.2±0.1	
1206	R≥1mΩ	1.8±0.1	1.7±0.1	1.6±0.1	
1206-L	R=1mΩ	1.8±0.1	2.3±0.1	1.0±0.1	
2010	1mΩ≤R≤100mΩ	3.4±0.2	1.5±0.2	3.5±0.2	
2010-L	1mΩ≤R≤3mΩ	3.4±0.2	1.5±0.2	2.0±0.2	
2512	1mΩ≤R≤680mΩ	4.0±0.1	2.1±0.1	4.1±0.1	
2512-L	0.5mΩ≤R≤4mΩ	4.0±0.1	3.1±0.1	1.3±0.1	

■ 电气特性 (Electrical characteristics)

型别 Type	额定功率 Power Rating at P70 (W)	T.C.R. (PPM/ °C)	阻值范围 Resistance Range (mΩ)	精度 Tolerance (%)	额定电流 Rated Current (A)	最大过载电流 Max overload Current (A)	使用温度范围 Operating Temperatur e (°C)
0805	0.125、0.25	±50	2~25	±0.5%,±1%, ±2%, ±5%	11	25	-55°C~170°C
0805-L	0.5	±50	1~2	±0.5%,±1%, ±2%, ±5%	22	50	-55°C~170°C
1206	0.5	±50	101~200	±0.5%,±1%, ±2%, ±5%	2	5	-55°C~170°C
1206	1	±50	1~100	±0.5%,±1%, ±2%, ±5%	31	70	-55°C~170°C
1206-L	1	±50	1	±0.5%,±1%, ±2%, ±5%	31	70	-55°C~170°C
2010	1.5	±50	1~100	±0.5%,±1%, ±2%, ±5%	38	86	-55°C~170°C
2010-L	1.5	±50	1~3	±0.5%,±1%, ±2%, ±5%	38	86	-55°C~170°C
2512	2	±50	1~680	±0.5%,±1%, ±2%, ±5%	63	141	-55°C~170°C
2512-L	2	±50	0.5~4	±0.5%,±1%, ±2%, ±5%	63	141	-55°C~170°C

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.

■ 阻值量测点 (Resistance measurement point)

	型别 Type	A	B
	0805	1.6±0.2	0.65±0.2
	1206	2.6±0.25	0.9±0.25
	2010	4.5±0.25	1.7±0.25
	2512	5.6±0.25	2.0±0.25

开尔文四线法检测, 测试点位于产品底部 Kelvin Four-terminal sensing, The test point is located at the bottom of the product.

■ 印字标识 (Marking)

The resistance value of the product is expressed in two ways:

- The decimal point of Ω is indicated by the character "R".
- Using "m" to indicate the decimal point of m Ω .

E.g.,

R001=1m Ω ; R050=50m Ω ;

0m50=0.5m Ω ; 2m50=2.5m Ω ;

002=2m Ω (0805)

010=10m Ω (0805)

产品阻值使用两种方式表示:

- 以 "R" 字指示 Ω 的小数点的位置
- 以 "m" 字指示 m Ω 的小数点的位置

例:

R001=1m Ω ; R050=50m Ω ;

0m50=0.5m Ω ; 2m50=2.5m Ω ;

002=2m Ω (0805)

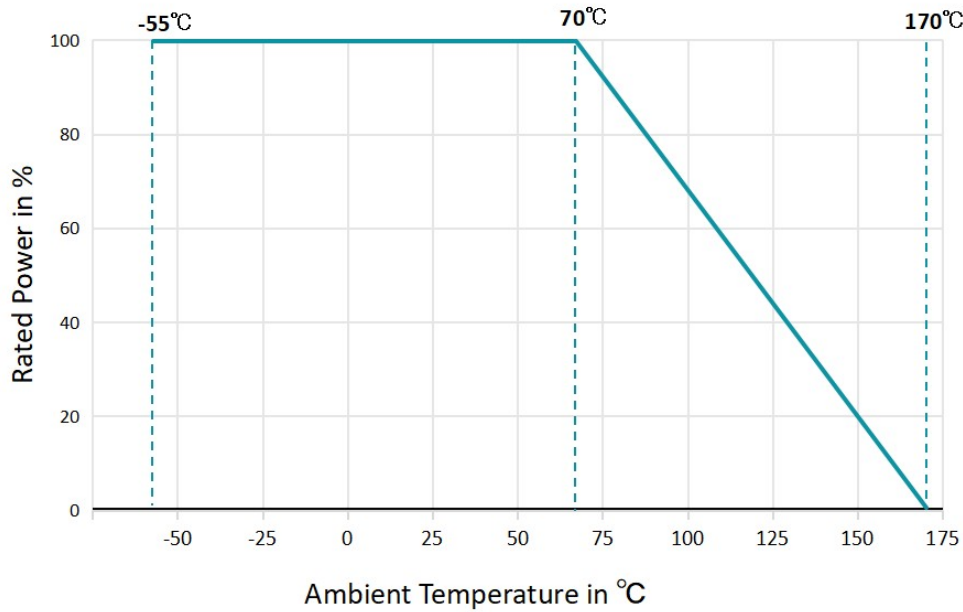
010=10m Ω (0805)

■ 性能 (Performance)

Test Items 测试项目	Reference 依据标准	Conditions of Test 测试条件	Test Limits 测试结果
Temperature Coefficient of Resistance 温度系数	AEC-Q200 TEST 19 IEC 60115-1 4.8	Measuring points -55°C and +125°C, reference point +20°C 测量点-55°C和+125°C, 参考点+20°C	见图表
High Temperature Exposure (Storage) 高温存储	AEC-Q200-REV D-Test 3 MIL-STD202 Method 108	T=170°C, 1000hrs, Measurement at 24hrs after test conclusion. 170°C, 1000 小时, 测试结束后 24 小时测量。	$\Delta R \leq \pm 1\%$
Low Temperature Exposure (Storage) 低温存储	IEC60115-1 4.25	T=-55°C, 1000 hours, Measurement at 24hrs after test conclusion. -55°C, 1000 小时, 测试结束后 24 小时测量。	$\Delta R \leq \pm 0.5\%$
Temperature Cycling 温度循环	AEC-Q200-REV D-Test 4 JESD22 Method JA-104	1000 Cycle (-55°C to 125°C) Measurement at 24hrs after test conclusion. 1000 次循环 (-55°C至 125°C) 测试结束后 24 小时进行测量。	$\Delta R \leq \pm 0.5\%$
Short time overload 短时过载	IEC60115-1 4.13	5 X rated power for 5s 5 倍额定功率, 5 秒	$\Delta R \leq \pm 0.5\%$
Moisture Resistance 耐湿性	AEC-Q200-REV D-Test 6 MIL-STD-202 Method 106	T=24 hours / Cycle, 10 Cycles. Notes: Steps 7a& 7b not required. 施加 T=24 小时/周期, 零功率, 方法中 7a 和 7b 不做要求	$\Delta R \leq \pm 1\%$
Biased Humidity 高温高湿	AEC-Q200-REV D-Test 7 MIL-STD-202 Method 103	10% Rated power at 85°C, RH:85%, 1000Hrs, Measurement at 24hrs after test conclusion. 10%额定功率, 85°C, 相对湿度: 85%, 1000 小时, 测试结束后 24 小时测量。	$\Delta R \leq \pm 0.5\%$

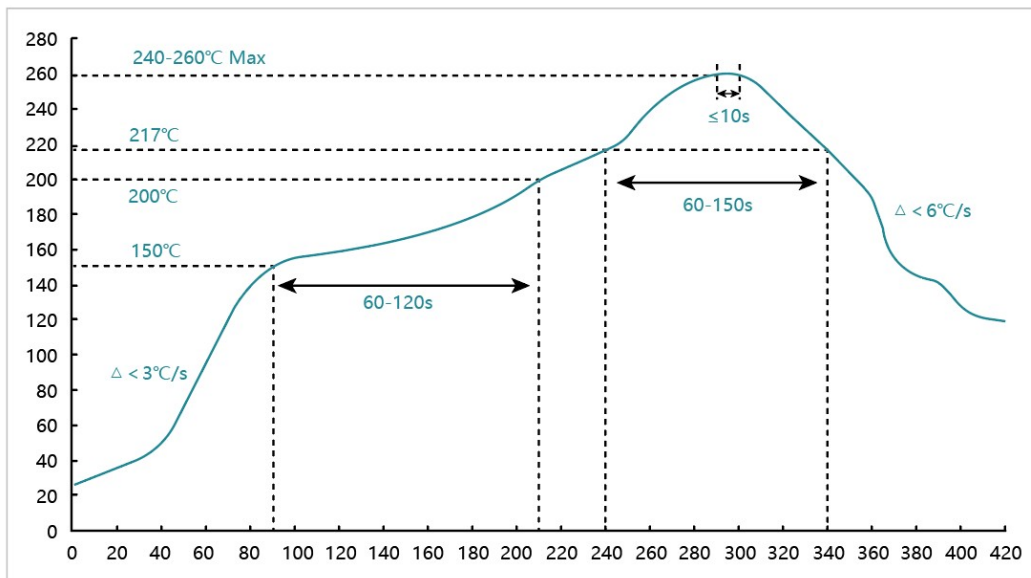
Load Life 负载寿命	AEC-Q200-REV D-Test 8 MIL-STD-202 Method 108	1000 h at +70 °C, 1.5 h "ON" , 0.5 h "OFF" , Measurement at 24hrs after test conclusion. 1000 小时, +70 °C, 1.5 小时"开启", 0.5 小时"关闭", 测试结束后 24 小时测量。	$\Delta R \leq \pm 1\%$
Resistance to Solvents 耐溶剂性	AEC-Q200-REV D-Test 12 MIL-STD-202 Method 215	Dip in solvent for 3 minutes and wipe 10 times, three cycles of three solvents, rinse and dry at room temperature. 浸入溶剂三分钟后擦十次, 三种溶剂三个循环, 清洗后 室温干燥	Markings are clear, no visible damage 标志清晰, 无可 见损伤
Resistance to Soldering Heat 耐焊接热	AEC-Q200-REV D-Test 15 MIL-STD-202 Method 210	T=260 $\pm$ 5°C solder, 10 $\pm$ 1 sec dwell 260 $\pm$ 5°C 焊接, 停留 10 $\pm$ 1 秒。	$\Delta R \leq \pm 0.5\%$
Mechanical Shock 机械冲击	AEC-Q200-REV D-Test 13 MIL-STD-202 Method 213	100g's, Normal duration is 6ms, half sine shock pulse 正半弦波, 峰值加速度 100g's, 脉冲持续 6ms, 三轴六向各 3 次。	$\Delta R \leq \pm 0.5\%$
Resistance to vibration 抗震性	AEC-Q200-REV D-Test 14 MIL-STD-202 Method 204	5g's for 20min. 12cycles, 10-2000Hz 10-2000Hz, 5g's, 20 分钟一个循环, X.Y.Z 三个方向各 12 个循环	$\Delta R \leq \pm 0.5\%$
Board Flex 板弯曲试验	AEC-Q200-REV D-Test 21 AEC-Q200-005	Min 2mm deflection , 60sec. 2mm, 保持时间 60s	$\Delta R \leq \pm 0.5\%$
Thermal Shock 冷热冲击	AEC-Q200-REV D-Test 16 MIL-STD-202 Method 107	-55°C/+155°C. Note: Number of cycles required-1000, Maximum transfer time-20 seconds, Dwell time-15 minutes. -55°C, 15 分钟~常温<20 秒~+155°C, 15 分钟, 1000 个 循环	$\Delta R \leq \pm 1\%$
ESD Test 静电放电测试	AEC-Q200-REV D-Test 17 AEC-Q200-002 or ISO/DIS 10605	a: Direct Contact (Dc): $\pm 6kV$; b: Air Discharge (AD): +12kv, +16k, +25kV; a: 直接接触 (DC): $\pm 6kV$; b: 空气放电 (AD): +12kV、+16k、+25kV;	$\Delta R \leq \pm 1\%$
Solderability 可焊性	AEC-Q200-REV D-Test 18 J-STD-002	Dip the terminal in a flux and then dip into a soldering bath at 245 $\pm$ 5°C for 3 $\pm$ 0.5sec 沾助焊剂后浸入锡炉, 锡炉温度 245 $\pm$ 5°C, 时间 3 $\pm$ 0.5 秒。	> 95% area covered > 95% 面积上锡

■ 功率衰减曲线 (Derating Curve)

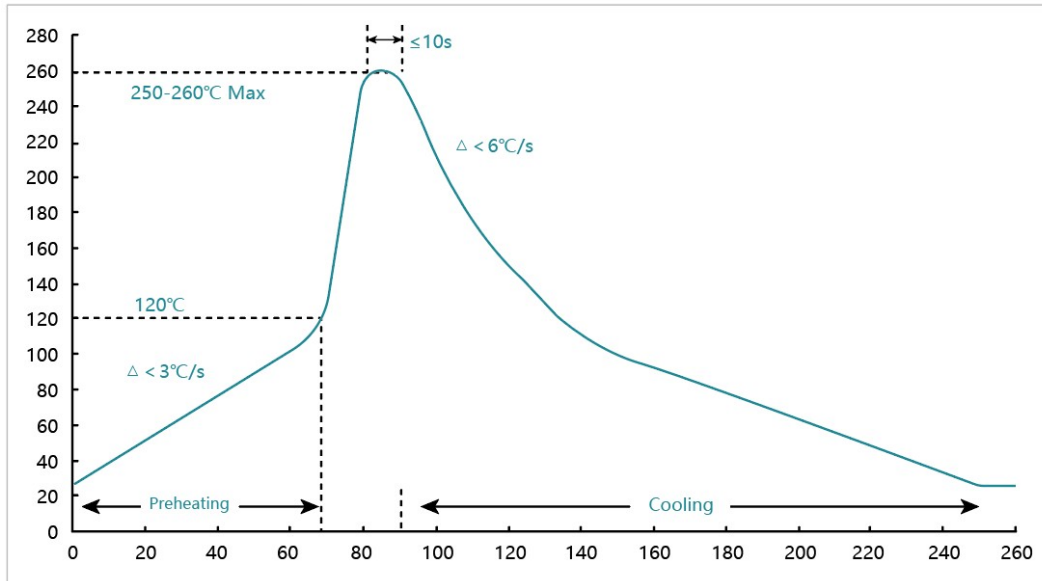


■ 焊接 (soldering)

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



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

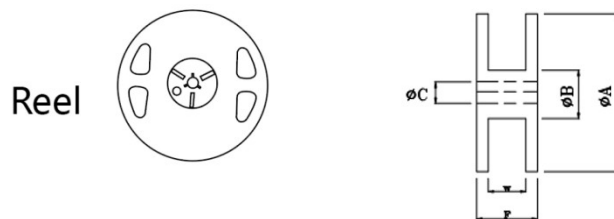


- 手工焊温度 (hand soldering temperature)

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

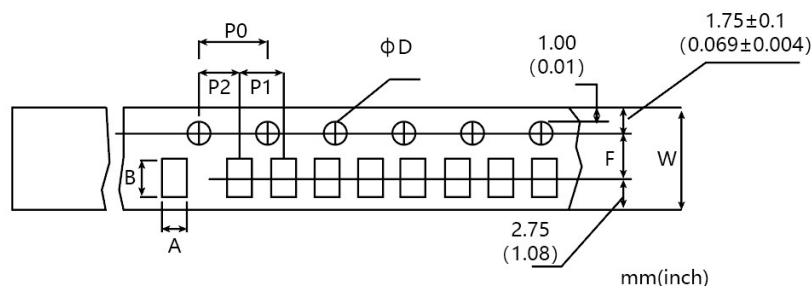
■ 包装规格 (Tapping Specification)



- 卷盘尺寸 (Reel dimension)

Type	Size		Unit	A	B	C	F	W
0805	7"	5K/Reel	mm	178±2.0	60.0±1.0	13.0±1.0	11.4±1.0	9.00±1.0
1206	7"	5K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	15.4±1.0	9.00±0.5
2010	7"	4K/Reel	mm	178±2.0	60.0±1.0	13.5±1.0	15.4±1.0	13.8±1.0
2512	7"	4K/Reel	mm	178±2.0	80.0±1.0	13.5±1.0	15.4±2.0	13.0±1.0

-包装尺寸 (packing dimension)



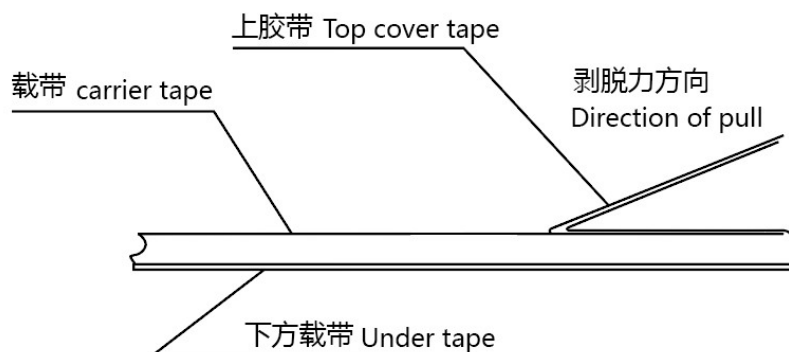
Unit: mm

Type	A	B	D	F	P0	P1	P2	W
0805	1.60±0.15	2.40 ±0.2	1.50±0.10	3.5 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00±0.10	8.0±0.20
1206	2.00±0.20	3.60±0.20	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.0±0.20
2010	2.8±0.2	5.3±0.2	1.50±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10
2512	3.60±0.20	6.90±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

■ 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)



■ 合金电阻器使用说明 (Alloy 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_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 $25\pm 5^\circ\text{C}$ Temperature: $25\pm 5^\circ\text{C}$
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.



■ 修订履历 (Revision History)

[illegible]