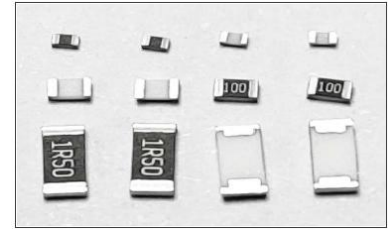


■抗硫化超低阻值厚膜片式固定电阻器

Anti-Sulfurated Low Ohmic Thick Film Chip Fixed Resistor



◆特征 Features

- * 电性能稳定, 可靠性高
Stable electrical capability, high reliability
- * 具有良好的抗硫化性能
With good sulfuration-resistant performance
- * 符合RoHS指令要求
Compliant with RoHS directive
- * 符合无卤素要求
Halogen free requirement
- * 潮敏等级: MSL1
MSL Class: MSL1

◆应用领域Application

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、LED灯驱动电源、便携式设备等。
Switching Power Supply, Over Current Protection in Audio Application, Voltage Regulation Module (VRM), DC-DC Converter, Charger, LED Lamp Devices, Portable Devices, etc.

◆型号表示法 Part Number

RH	S	—	06	M	R150	F	T	13						
产品代号 Product Code	额定功率代号 Power Rating Code		型号代号 Type Code		电阻温度系数代号 T.C.R Series Code		电阻值代号 Resistance Value Code		阻值误差精度代号 Resistance Tolerance Code		包装方式代号 Packing Style Code		卷盘方式代号 Reel Style Code	
抗硫化超低阻值厚膜片式固定电阻器 Anti-sulfurated Low Ohmic Thick Film Chip Fixed Resistor	代号 Code	额定功率系列 Power rating	代号 Code	型号 Type	型号 Type	代号 Code	T.C. R (ppm/℃)	单位Ω，小数点用R表示； 单位mΩ，小数点用M表示； Units:Ω Decimal point should be expressed by "R"; Units:mΩ Decimal Point should be expressed by'M' 例如Example： R080=0.080Ω R100=0.100Ω R047=0.047Ω 0603: V22=22mΩ R10=0.100Ω	代号 Code	误差精度 Tolerance	代号 Code	包装方法 Packing Style	代号 Code	卷盘方法 Reel Style
	0402	C	02	0402					F	±1%				
	0603	S	03	0603	M	±500	H		±3%	7英寸卷盘 7inch Reel				
	0805		05	0805										
	1206		06	1206										
	1210		1210	1210										
	2010		10	2010										
	2512	c	12	2512	Y	±1500	J		±5%	13英寸卷盘 13 inch Reel				
				0402										
				0603										
				0805										
				1206										
				1210										
				2010										
				2512										

注: 1、不同厂家的超低阻产品其工艺及技术参数可能会略有差异, 建议客户索样评估使用的可行性; 不同厂家的超低阻产品不建议直接替换使用, 我司不承担因直接替换使用而带来的经济损失。

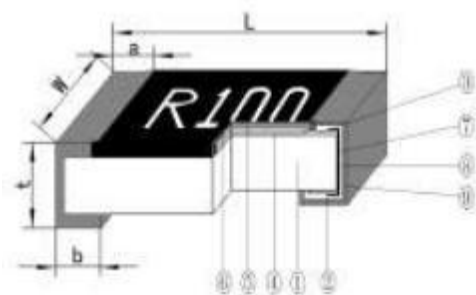
The process and technical parameters of ultra-low resistance products from different manufactures maybe slightly different, so it is suggested that customers ask for samples to evaluate the feasibility of use;

the ultra-low resistance products from different manufactures are not recommended to be replaced directly, and our company will not bear the economic losses caused by the direct replacement.

2、阻值≤50mΩ的超低阻产品, 建议客户首选合金电阻产品, 如果必须选用厚膜超低阻产品, 建议在选型时咨询原厂技术人员。

For the resistance value≤50mΩ, it is recommended that customer to use metal foil/metal strip chip resistor. If thick film ultra-low resistance products must be selected, please contact our customer service team for selection.

◆产品结构 Construction



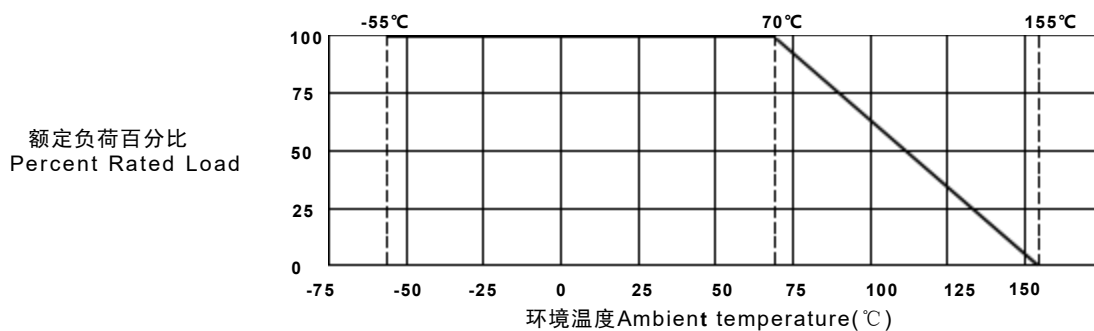
- ①陶瓷基板Ceramic Substrate
- ②背电极 Bottom Electrode
- ③面电极 Top Electrode
- ④电阻体Resistor Layer
- ⑤一次保护Primary Overcoat
- ⑥二次保护Secondary Overcoat
- ⑦端电极Edge Electrode
- ⑧中间电极Barrier Layer
- ⑨外部电极External Electrode

◆规格尺寸 Dimensions

型号Type	尺寸Dimensions(mm)				
	L	W	t	a	b
0402	1.00±0.05	0.50±0.05	0.30±0.05	0.25±0.10	0.25±0.10
0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
0805	2.00±0.10	1.25±0.15	0.55±0.10	0.35±0.20	0.40±0.20
1206	3.20±0.20	1.60 ±0.15	0.55±0.10	0.45±0.20	0.50±0.20
1210	3.20±0.20	2.50±0.20	0.55±0.10	0.45±0.20	0.50±0.20
2010	5.00±0.20	2.50±0.20	0.55±0.10	0.65±0.20	0.60±0.20
2512	6.30±0.20	3.20±0.20	0.55±0.10	0.80±0.20	0.60±0.20

◆产品特性曲线图Product Characteristic Curve

* 负荷下降曲线Derating Curve



使用温度范围:
Operating
Temperature Range:
-55℃~155℃

注：当电阻使用的环境温度超过70℃时，其额定负荷(额定功率)按上述曲线下降。

Note:For resistors operated in ambient over 70℃,rated load (rated power)shall be derated in accordance with the above figure.

◆电性能参数Electrical Performance Parameters

型号 Type	70℃下额定功率 Rating Power at 70℃ (W)	阻值范围 Resistance Range
0402	C: 1/16	$0.1\Omega \leq R < 1\Omega$
0603	D: 1/10	$0.01\Omega \leq R < 1\Omega$
0805	E: 1/8	$0.01\Omega \leq R < 1\Omega$
1206	F: 1/4	$0.01\Omega \leq R < 1\Omega$
1210	R: 1/3	$0.01\Omega \leq R < 1\Omega$
2010	H: 3/4	$0.01\Omega \leq R < 1\Omega$
2512	J: 1	$0.01\Omega \leq R < 1\Omega$
注Note:	1、电压为直流或交流有效值。 Voltage of DC or AC RMS value. 2、 $E = \sqrt{P \times R}$ 或元件极限电压两者中的较小值。 $E = \sqrt{P \times R}$ or Limiting element voltage whichever is lower. E: 额定电压 Rated voltage (V) P: 额定功率 Rated power (W) R: 标称阻值 Normal resistance (Ω)	

型号 Type	阻值范围 Resistance Range			电阻温度系数 Temperature Coefficient of Resistance	
	$\pm 1\%$	$\pm 3\%$	$\pm 5\%$	T.C.R (PPM/℃)	代号 Code
0402	$0.1\Omega \leq R < 1\Omega$			± 500	M
0603	$0.01\Omega \leq R < 0.033\Omega$			± 1500	Y
	$0.033\Omega \leq R < 0.068\Omega$			± 1000	S
	$0.068\Omega \leq R < 0.1\Omega$			± 800	Q
	$0.1\Omega \leq R < 1\Omega$			± 500	M
0805 1206 1210 2010 2512	$0.01\Omega \leq R < 0.02\Omega$			± 1500	Y
	$0.02\Omega \leq R < 0.05\Omega$			± 1000	S
	$0.05\Omega \leq R < 0.1\Omega$			± 800	Q
	$0.1\Omega \leq R < 1\Omega$			± 500	M

◆可靠性测试方法 Reliability Test Method

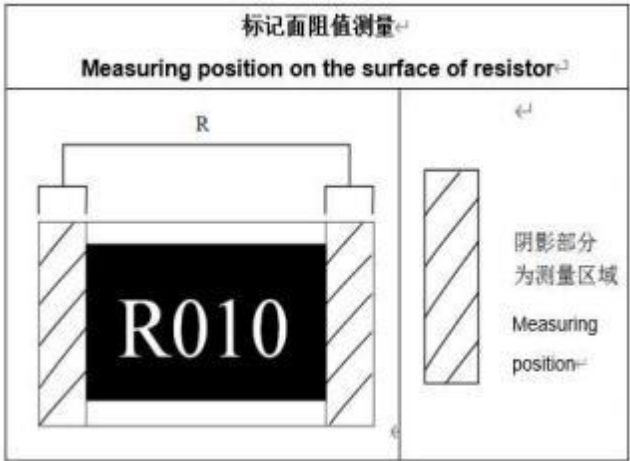
项目 Item	标准 Specifications	测试方法 (IEC60115-1) Test Methods(IEC 60115-1)
可焊性 Solderability	可焊面积 ≥95% 95% Cover Min	IEC60115-1 11.1 245℃±5℃ 锡槽, 保持3s±0.3s. Lead-free solder bath at 245℃±5℃ for 3s±0.3s.
耐焊接热 Resistance to Soldering Heat	无可见损伤 No mechanical damage $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$	IEC 60115-1 11.2 270℃±5℃ 锡槽, 保持10s ±1s. Lead-free solder bath at 270℃±5℃ for 10s ±1s.
基板弯曲试验 Substrate Bending Test	无可见损伤 No mechanical damage $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$	IEC 60115-1 9.8 弯曲距离(Bending distance): 0402、0603、0805:5mm; 1206、1210: 4mm; 2010、2512: 2mm 保持时间(Duration): 60s ±5s.
剪切力试验 Shear Test	外观无可见损伤 No mechanical damage	IEC 60115-1 9.7 施加力(Applying force): 0402、0603: 5N; 0805: 9N; 1206、1210: 25N; 2010、2512: 45N. 保持时间(Duration): 10s ±1s.
电阻温度系数 T.C.R	在规定值内 Within specified T.C.R	IEC 60115-1 6.2 +20℃/-55℃/+20℃/+125℃/+20℃
温度快速变化 Rapid Change of Temperature	无可见损伤 No mechanical damage $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$	IEC 60115-1 10.1 -55℃(30分钟)~常温(5分钟)~155℃(30分钟), 300个循环。 -55℃(30min)~normal temperature(5min)~155℃(30min), 300 cycles.
短时间过负载 Short Time Overload	无可见损伤 No mechanical damage 1%: $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$ 3%、5%: $\Delta R \leq \pm(2.0\%R + 0.5m\Omega)$	IEC 60115-1 8.1 2.5倍额定电压, 持续5秒。 2.5 times rated voltage for 5s.
高温高湿 Biased Humidity	无可见损伤 No mechanical damage $\Delta R \leq \pm(3.0\%R + 0.05\Omega)$	IEC 60115-1 4.37/MIL-STD-202 Method 103 温度: 85℃, 湿度85%RH的条件下施加10%额定功率(电流)下的电压值或元件极限电压(取最小值), 放置1000小时。 85℃/85%RH, apply 10% of operating power or limiting element voltage for 1000 hours.
稳态湿热 Damp Heat Steady State	无可见损伤 No mechanical damage 1%: $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$ 3%、5%: $\Delta R \leq \pm(2.0\%R + 0.5m\Omega)$	IEC60115-1 10.4 40℃±2℃, 93% ±3% RH, 1000小时, 额定电压, 通1.5小时/断0.5小时。 40℃±2℃, 93% ±3% RH, 1000 hours, rated voltage for 1.5h ON/0.5h OFF.
70℃耐久性 Endurance at 70℃	无可见损伤 No mechanical damage 1%: $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$ 3%、5%: $\Delta R \leq \pm(2.0\%R + 0.5m\Omega)$	IEC60115-1 7.1 70℃±2℃, 1000小时, 额定电压, 通1.5小时/断0.5小时。 70℃±2℃, 1000 hours, rated voltage for 1.5h ON/0.5h OFF,
上限类别温度耐久性 Endurance at Upper Category Temperature	无可见损伤 No mechanical damage 1%: $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$ 3%、5%: $\Delta R \leq \pm(2.0\%R + 0.5m\Omega)$	IEC 60115-1 7.3 155℃±2℃, 1000小时。 155℃±2℃, 1000 hours.
低温负载 Operation at Low Temperature	无可见损伤 No mechanical damage 1%: $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$ 3%、5%: $\Delta R \leq \pm(2.0\%R + 0.5m\Omega)$	IEC 60115-1 10.2 -55℃±5℃, 无负载1小时, 额定电压45分钟, 无负载15分钟。 -55℃±5℃, 1 hour without load, rated voltage for 45min, 15 minutes without load.
绝缘电阻 Insulation Resistance	1000MΩ Min	IEC 60115-1 12.1 在电极与基片间施加100V±15V直流电压, 保持1分钟, 然后测绝缘电阻值。 Apply DC 100V ±15V between substrate and terminations for 1 minute, then check insulation resistance.
耐电压 Voltage Proof	无击穿或飞弧 No breakdown or flashover	IEC60115-1 12.2 在电极与基片间以大约100V/s的速率施加有效值为最大过负荷电压的交流电压, 保持60s±5s。 Apply max. overload voltage of ACRMS at a rate of approximately 100V/s between substrate and terminations for 60s ±5s.
耐溶剂性 Component Solvent Resistance	标记清晰, 无可见损伤 Clearly marked, No mechanical damage	IEC 60115-1 11.3 异丙醇 (IPA), 23℃±5℃, 浸10小时。 Iso-propyl alcohol (IPA), 23℃±5℃, 10 hours.



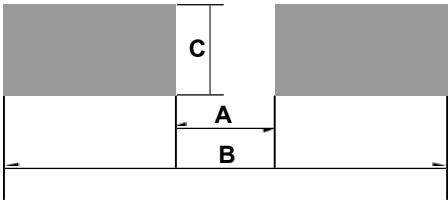
◆可靠性测试方法Reliability Test Method

项目 Item	标准 Specifications	测试方法 (IEC60115-1) TestMethods(IEC 60115-1)
抗硫化性能 Sulfuration- Resistant	无可见损伤 No mechanical damage $\Delta R \leq \pm(5.0\%R + 0.5m\Omega)$	方法一 Method one: 油浴, 恒温: $105^{\circ}\text{C} \pm 3^{\circ}\text{C}$, 放置时间: 1000小时。 Soaked in industrial oil with sulfur substance contained $105^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 1000 hours.
	无可见损伤 No mechanical damage $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$	方法二 Method two: ASTM-B-809-95: 把待测电阻放置在饱和硫蒸气内, 温度: $60^{\circ}\text{C} \pm 3^{\circ}\text{C}$, 湿度: 91%RH ~93%RH, 放置时间: 1500小时。 ASTM-B-809-95: Place the resistor to be measured in saturated sulfur vapor, Temperature: $60^{\circ}\text{C} \pm 3^{\circ}\text{C}$, humidity: 91%RH ~93%RH, 1500 hours.
	无可见损伤 No mechanical damage $\Delta R \leq \pm(1.0\%R + 0.5m\Omega)$	方法三 Method three: EIA-977 硫磺熏蒸, 恒温: $105^{\circ}\text{C} \pm 3^{\circ}\text{C}$, 放置时间: 1500小时。 Sulfur fumigation, constant temperature: $105^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 1500 hours.

◆阻值标准测量位置Standard Measuring Position for Resistance Value



◆推荐焊盘尺寸Recommend Solder Pad Size



单位 unit: mm

厚膜电阻 Thick Film Resistor			
型号Type	A	B	C
0402	0.45	1.45	0.60
0603	0.80	2.50	0.95
0805	1.05	3.25	1.40
1206	1.90	4.50	1.75
1210	2.00	4.60	2.70
2010	3.50	6.50	2.70
2512	4.80	7.80	3.40

注：电阻焊接后，电阻值可能因焊盘面积、焊盘间距、焊锡量的差别而发生变化。顾客在设计电路及选型时，必须充分而全面的考虑及评判适用性。
After soldering, the resistance value may change due to the difference of pad area, pad spacing and solder quantity. When designing circuits and selecting models, customers must comprehensively consider and evaluate the applicability.

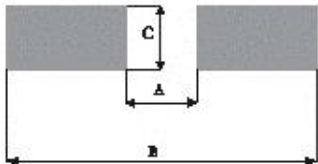
◆包装Packaging

包装方式见附录 Packaging can refer to the Appendix.

附录 Appendix I

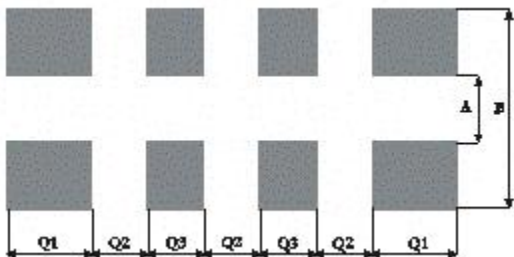
◆推荐焊盘尺寸 Recommend Solder Pad Size

* 片式固定电阻器 Chip fixed resistor 单位 unit: mm



厚膜电阻及薄膜电阻 Thick Film Resistor and Thin Film Resistor			
型号 Type	A	B	C
01005	0.17±0.03	0.60±0.03	0.22±0.03
0201	0.23±0.05	0.84±0.05	0.38±0.05
0402	0.45±0.05	1.45±0.05	0.60±0.05
0603	0.80±0.05	2.50±0.05	0.95±0.05
0805	1.05±0.1	3.25±0.1	1.40±0.1
1206	1.90±0.1	4.50±0.1	1.75±0.1
1210	2.00±0.1	4.60±0.1	2.70±0.1
2010	3.50±0.1	6.50±0.1	2.70±0.1
2512(1W、1.5W)	4.80±0.1	7.80±0.1	3.40±0.1
2512(2W)	2.70±0.1	7.80±0.1	3.60±0.1
0508	0.60±0.1	2.20±0.1	2.00±0.1
0612	0.60±0.1	2.90±0.1	3.30±0.1
1225	1.40±0.1	4.50±0.1	6.40±0.1

* 厚膜片式网络电阻器 Thick film chip network resistor



单位 unit: mm

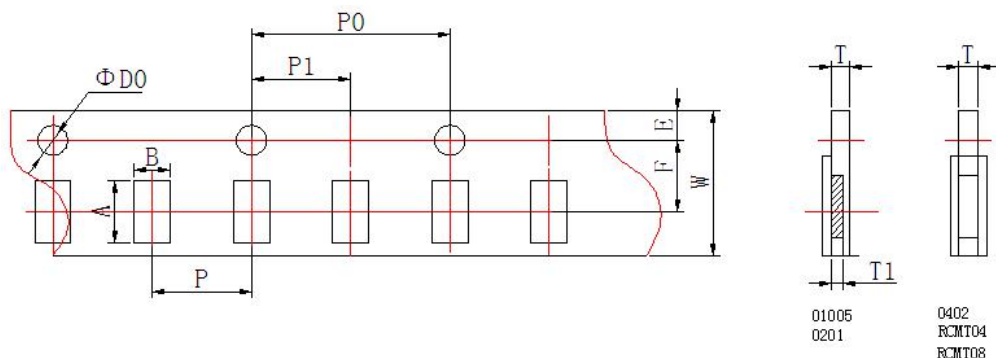
型号 Type	A	B	Q1	Q2	Q3
2R01	0.30±0.05	0.90±0.05	0.30±0.05	0.20±0.05	---
4R01	0.30±0.05	0.90±0.05	0.20±0.05	0.20±0.05	0.20±0.05
2R02	0.35±0.05	1.25±0.05	0.65±0.05	0.20±0.05	0.30±0.05
4R02	0.38±0.05	1.60±0.05	0.40±0.05	0.20±0.05	---
4R03	0.80±0.05	2.70±0.05	0.60±0.05	0.40±0.05	0.40±0.05
备注 Remarks	1、2R01型号包含including:RC-MY04、RCMY04、RH-MY04、RHMY04 2、4R01型号包含including:RC-MY08、RCMY08、RH-MY08、RHMY08 3、2R02型号包含including:RC-MT04、RCMT04、RH-MT04、RHMT04 4、4R02型号包含including:RC-MT08、RCMT08、RH-MT08、RHMT08 5、4R03型号包含including:RC-ML08、RCML08、RH-ML08、RHML08 6、上述型号说明适用于附录中所有型号。 The above description applies to all types in the appendix.				

◆包装 Packaging

* 纸带编带 Paper Taping

适用于01005、0201、0402、2R01、4R01、2R02、4R02:

For 01005、0201、0402、2R01、4R01、2R02、4R02:



单位unit: mm

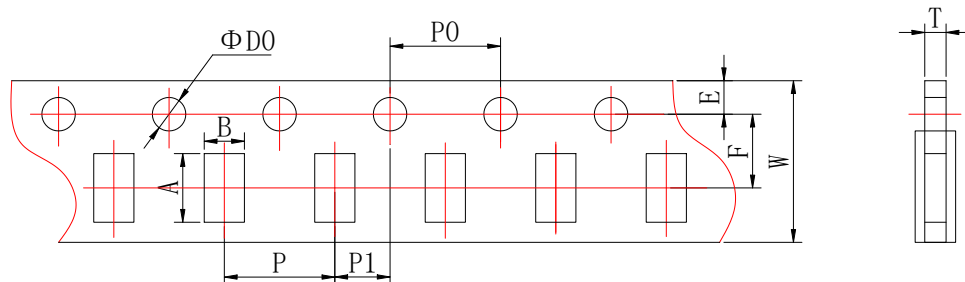
型号Type	A	B	W	F	E
01005	0.45±0.02	0.25±0.02	8.00±0.02	3.50±0.05	1.75±0.05
0201	0.70±0.10	0.40±0.10	8.00±0.20	3.50±0.05	1.75±0.10
0402	1.15±0.10	0.65±0.10	8.00±0.20	3.50±0.05	1.75±0.10
2R01	0.97±0.05	0.77±0.05	8.00±0.20	3.50±0.05	1.75±0.10
4R01	1.57±0.05	0.77±0.05	8.00±0.20	3.50±0.05	1.75±0.10
2R02	1.45±0.10	1.20±0.10	8.00±0.20	3.50±0.05	1.75±0.10
4R02	2.20±0.10	1.20±0.10	8.00±0.20	3.50±0.05	1.75±0.10

单位unit: mm

型号Type	P	P0	P1	ΦD0	T1	T
01005	2.00±0.05	4.00±0.10	2.00±0.05	1.55±0.02	0.17±0.02	0.31±0.02
0201	2.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	0.28±0.04	0.42±0.05
0402	2.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	/	0.44±0.05
2R01	2.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	/	0.60±0.10
4R01	2.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	/	0.60±0.10
2R02	2.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	/	0.60±0.10
4R02	2.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	/	0.60±0.10

适用于0603、0805、0508、1206、0612、1210、4R03:

For 0603、0805、0508、1206、0612、1210、4R03:



单位unit: mm

型号Type	A	B	W	F	E
0603	1.80±0.10	1.05±0.10	8.00±0.20	3.50±0.05	1.75±0.10
0805	2.30±0.10	1.50±0.10	8.00±0.20	3.50±0.05	1.75±0.10
0508	2.30±0.10	1.50±0.10	8.00±0.20	3.50±0.05	1.75±0.10
1206	3.50±0.20	1.90±0.20	8.00±0.20	3.50±0.05	1.75±0.10
0612	3.50±0.20	1.90±0.20	8.00±0.20	3.50±0.05	1.75±0.10
1210	3.50±0.20	2.80±0.20	8.00±0.20	3.50±0.05	1.75±0.10
4R03	3.50±0.20	1.90±0.20	8.00±0.20	3.50±0.05	1.75±0.10

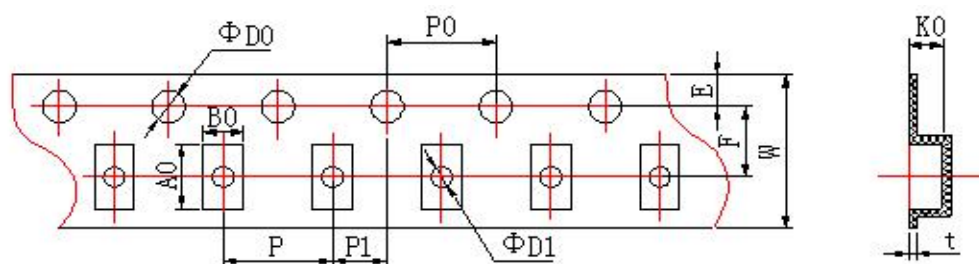
单位unit: mm

型号Type	P	P0	P1	ΦD0	T	
					厚膜电阻及薄膜电阻 Thick Film Resistor and Thin Film Resistor	合金片式固定电 阻 Metal Foil resistor
0603	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.60±0.10	0.75±0.10
0805	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10	0.95±0.10
0508	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10	0.95±0.10
1206	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10	0.95±0.10
0612	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10	0.95±0.10
1210	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10	---
4R03	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10	---

***塑料带编带 Embossed Taping**

适用于2010、2512、1225:

For 2010、2512、1225:



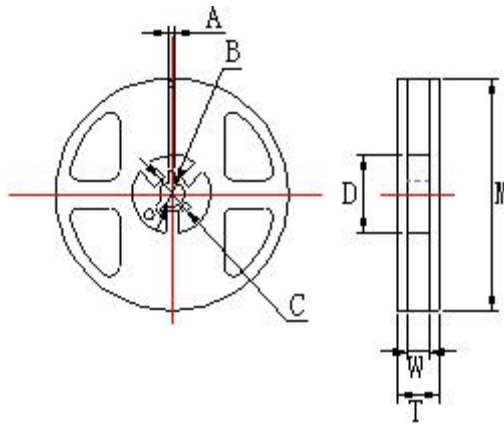
单位unit: mm

型号Type	A0	B0	W	F	E	t
2010	5.50±0.15	2.82±0.15	12.00±0.10	5.50±0.10	1.75±0.10	0.25±0.05
2512	6.78±0.15	3.45±0.15	12.00±0.10	5.50±0.10	1.75±0.10	0.25±0.05
1225	6.78±0.15	3.45±0.15	12.00±0.10	5.50±0.10	1.75±0.10	0.25±0.05

单位unit: mm

型号Type	P	P0	P1	ΦD0	ΦD1	K0	
						厚膜电阻及薄膜电阻 Thick Film Resistor and Thin Film Resistor	合金片式固定电阻 Metal Foil resistor
2010	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10/-0	1.50±0.10	0.84±0.10	0.84±0.10
2512	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10/-0	1.50±0.10	0.81±0.10	1.00±0.10
1225	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10/-0	1.50±0.10	0.81±0.10	1.00±0.10

* 卷盘 Reel



单位unit: mm

卷盘尺寸 Reel Type	型号Type	M	W	T	A	B	C	D
7英寸 7inch dia.Reel	01005、0201 0402、0603 0805、1206 1210、2R01 4R01、2R02 4R02、4R03 0508、0612	178±2.0	9.5±1.0	12.5±1.5	2.0±0.5	13.0±0.5	21.0±0.5	58.0±2.0
	2010、2512	178±2.0	13.0±0.5	15.5±1.5	2.0±0.5	13.0±0.5	21.0±0.5	57.0±2.0
	1225	178±2.0	13.0±0.5	15.5±1.5	2.0±0.5	13.0±0.5	21.0±0.5	57.0±2.0
13英寸 13 inch dia.Reel	0201、0402 0603、0805 1206	330±2.0	9.5±1.0	13.4±1.0	2.0±0.5	13.0±0.5	21.0±0.5	100.0±1.0

◆ 编带包装能力 Taping Ability

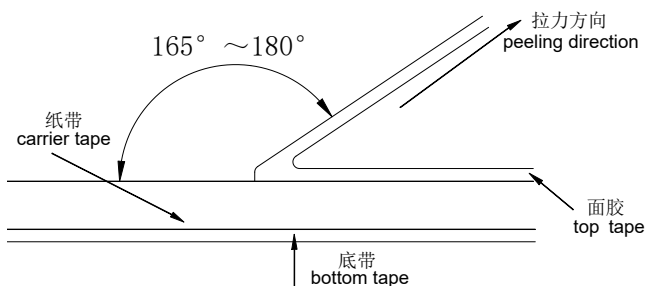
面带拉力 Top tape peel strength

面带拉力强度未11g~70g (0.1N~0.7N) , 速度: 300mm/min, 经下列试验后不允许有破裂断带现象。

Peel strength is 11g~70g (0.1N~0.7N),with speed of 300mm/min,and should not have flash and

tear after peeling.

测试方法 Test method:



电阻松动自如，无粘面胶带、底胶带现象。

Resistor is free, no sticking to top tape and bottom tape.

电阻易从纸带中取出，且晶片孔无机械损伤。

Resistor is easy to take out from carrier tape and chip hole have no mechanical damage.

◆包装数量 Packaging Quantity

包装方法 Packaging style	7英寸 7inch dia.Reel					13英寸 13 inch dia.Reel	
型号 Type	01005	0201	0402、2R01 2R02、4R01 4R02	0603、0805 1206、1210 4R03、0508 0612	2010、2512 、1225	0201、 0402	0603、0805、 1206
数量 Quantity (pcs)	20000	15000	10000	5000	4000	50000	20000

◆IEC E-24、E-96系列电阻值代码对照表 IEC E-24、E-96 Series Resistance Cross-reference List

* E-24 系列 E-24 series ($\times 10^n \Omega$)

(单位 unit: 0.001 Ω 、0.01 Ω 、0.1 Ω 、1 Ω 、10 Ω 、100 Ω 、1k Ω 、10k Ω 、100k Ω 、1M Ω 、10M Ω 、100M Ω 、1000M Ω)

表一 Table One:

1.0	1.5	2.2	3.3	4.7	6.8
1.1	1.6	2.4	3.6	5.1	7.5
1.2	1.8	2.7	3.9	5.6	8.2
1.3	2.0	3.0	4.3	6.2	9.1

* E-96系列 E-96 series ($\times 10^n \Omega$)

(单位 unit: 0.001 Ω 、0.01 Ω 、0.1 Ω 、1 Ω 、10 Ω 、100 Ω 、1k Ω 、10k Ω 、100k Ω 、1M Ω 、10M Ω 、100M Ω 、1000M Ω)

表二 Table Two:

1.00	1.33	1.78	2.37	3.16	4.22	5.62	7.50
1.02	1.37	1.82	2.43	3.24	4.32	5.76	7.68
1.05	1.40	1.87	2.49	3.32	4.42	5.90	7.87
1.07	1.43	1.91	2.55	3.40	4.53	6.04	8.06
1.10	1.47	1.96	2.61	3.48	4.64	6.19	8.25
1.13	1.50	2.00	2.67	3.57	4.75	6.34	8.45
1.15	1.54	2.05	2.74	3.65	4.87	6.49	8.66
1.18	1.58	2.10	2.80	3.74	4.99	6.65	8.87
1.21	1.62	2.15	2.87	3.83	5.11	6.81	9.09
1.24	1.65	2.21	2.94	3.92	5.23	6.98	9.31
1.27	1.69	2.26	3.01	4.02	5.36	7.15	9.53
1.30	1.74	2.32	3.09	4.12	5.49	7.32	9.76

* E-96系列0603型号《乘数代码对照表》及《电阻值代码对照表》

E-96 series(0603)《multiplied Cross-reference List》And《Resistance Cross-reference List》

表三 Table Three:

乘数multiplied	$\times 10^0$	$\times 10^1$	$\times 10^2$	$\times 10^3$	$\times 10^4$	$\times 10^5$	$\times 10^6$	$\times 10^7$	$\times 10^{-1}$	$\times 10^{-2}$	$\times 10^{-2}$	$\times 10^{-3}$
代码code	A	B	C	D	E	F	G	H	X	Y	Y	Z

表四 Table Four:

代号 code	E-96系列电阻 E-96 resistance	代号 code	E-96系列电阻 E-96 resistance	代号 code	E-96系列电阻 E-96 resistance	代号 code	E-96系列电阻 E-96 resistance
01	100	25	178	49	316	73	562
02	102	26	182	50	324	74	576
03	105	27	187	51	332	75	590
04	107	28	191	52	340	76	604
05	110	29	196	53	348	77	619
06	113	30	200	54	357	78	634
07	115	31	205	55	365	79	649
08	118	32	210	56	374	80	665
09	121	33	215	57	383	81	681
10	124	34	221	58	392	82	698
11	127	35	226	59	402	83	715
12	130	36	232	60	412	84	732
13	133	37	237	61	422	85	750
14	137	38	243	62	432	86	768
15	140	39	249	63	442	87	787
16	143	40	255	64	453	88	806
17	147	41	261	65	464	89	825
18	150	42	267	66	475	90	845
19	154	43	274	67	487	91	866
20	158	44	280	68	499	92	887
21	162	45	287	69	511	93	909
22	165	46	294	70	523	94	931
23	169	47	301	71	536	95	953
24	174	48	309	72	549	96	976

◆厚膜电阻阻值代码及标记规则

Description for Resistance Value Code and Marking of Thick Film Chip Resistor

* 阻值代码 Resistance Value Code

所有厚膜电阻的阻值代码与其标记是相对的。

All the resistance value code of thick film chip resistor is corresponding with the marking.

* 标记 Marking

* E-24系列（0603、 $\geq \pm 5\%$ ）：采用三位数字表示，前二位表示电阻值有效数字，第三位表示乘以10的次方数。

E-24 series: Express resistance value on the glass side with three digits, the first two digits should be significant and the third one denotes number of zeros.

例For example



30K Ω



33 Ω

*E-24系列 (0603、 $\leq \pm 1\%$)：在三位数字标记下方增加下横线识别。

E-24 series(0603、 $\leq \pm 1\%$): One short bar under marking letter.

例For example:

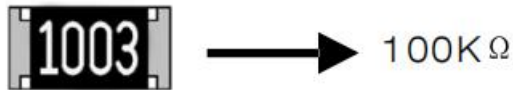


*E-96系列和E-24系列 (0508、0805、0612、1206、1225、1210、2010、2512、 $\pm 1\%$ & $\pm 0.5\%$)：

▲采用四位数字表示，前三位表示电阻值有效数字，第四位表示乘以10的次方数。

E-96 series & E-24 series (0508、0805、0612、1206、1225、1210、2010、2512、 $\pm 1\%$ & $\pm 0.5\%$): Express the resistance value with four digits, the first three digits are significant figures and the fourth de notes the number of zeros.

例For example:

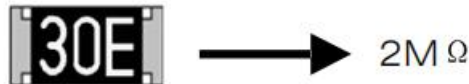


*E-96系列 (0603、 $\leq \pm 1\%$)：

▲采用三位代码表示，前两位表示E-96系列阻值代码，后一位字母表示乘数代码（见表三和表四）。

Express the resistance value with three code, the first two digit code denote the resistance of E-96 series, and the third code of letter denote the multiplier (see the table three and four).

例For example:



*小数点以“R”表示 The decimal point should be expressed by “R” .

例For example:



*跨接电阻以“0”表示 The jumper should be expressed by “0”

例For example:



* ≤ 0402 产品不作标记：For the chip resistor (≤ 0402) , there is no mark on the glass side.

例For example:



*非IEC标准系列的电阻值标记表示方法：一般以最接近IEC E24系列标称阻值的标记表示方法。

For the resistance values which don't belong to IEC serial, use the resistance of IEC serial which is most close to the required resistance of non-IEC serial for replacement.

*客户对标记有特殊要求时，则按照协商的结果印刷标记。

To get agreement by both party if the customers have special requirements for the marking.

◆薄膜电阻阻值代码及标记规则

Description for Resistance Value Code and Marking of Thin of Thin Film Chip Resistor

* 阻值代码 Resistance Value Code

所有薄膜电阻全尺寸统一采用四位数阻值代码表示。

All resistance value code of thin film chip resistor used four digits.

例Example

TD03G4701BT

四位数代号表示，如：4701=4.7K Ω ；1R50=1.5 Ω

To use four digits codes represent resistance value,

例Example 4701=4.7K Ω 1R50=1.5 Ω

* 标记 Marking

*当阻值同时存在于E24和E96系列时，优先采用E96系列。

When resistance value belongs to E24 as well as E96 series, we suggest preferentially use E96 series.

例Example 10K=1002, \neq 103

* \geq 0805产品标记For the chip resistor (\geq 0805) :

▲采用四位数字表示，前三位表示电阻值有效数字，第四位表示10 的次方数。

Express the resistance value with four digits, the first three digits are significant figures and the fourth denotes the number of zeros.

例Example

 \rightarrow 100K Ω


*0603标记 Marking for 0603 Size Resistor

▲0603-E96系列：采用三位代码表示，前二位表示E-96系列阻值代码，后一位字母表示乘数代码（见表三和表四）；

Express the resistance value with three code, the first two digit code denote the resistance of E-

96 series, and the third code of letter denote the multiplier (see the table three and four).

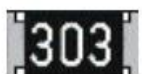
例Example

 \rightarrow 2M Ω

▲0603-E24系列：采用三位数字表示，前二位表示电阻值有效数字，第三位表示10 的次方数。


Express the resistance value on the glass side with three digits, the first two digits should be significant and the third denote number of zeros.

例Example

 \rightarrow 30K Ω

*▲小数点以“R”表示 The decimal point should be expressed by“R”.

例Example

 \rightarrow 5.6 Ω

* \leq 0402 产品：不作标记 For the chip resistor (\leq 0402), there is no mark on the glass side.

例Example



◆电流检测电阻阻值代码及标记规则

Description for resistance Value Code and Marking of Current Sensing Thick Film Chip Resistor

* 阻值代码 Resistance Value Code

所有电流检测电阻全尺寸统一采用四位数阻值代码表示。

All resistance value code of current sensing thick film chip resistor used four digits.

例Example

RBF03MR010FT

____ 四位数代号表示，如：R010=10mΩ；30M1=30.1mΩ

To use four digits codes represent resistance value,

例Example R010=10mΩ；30M1=30.1mΩ

* 标记 Marking

*E-24和E-96系列（0508、0805、0612、1206、1225、1210、2010、2512， $\leq \pm 5\%$ ）：采用四位标记代码。

For（0508、0805、0612、1206、1225、1210、2010、2512， $\leq \pm 5\%$ ），when resistance value belongs to E24 and E96 series, we suggest preferentially use four digits.

标记代码 Mark Code	阻值范围 Resistance Value	示例 Sample
R00×	$1\text{m}\Omega \leq R \leq 9\text{m}\Omega$	R005=5mΩ
R0×	$10\text{m}\Omega \leq R \leq 99\text{m}\Omega$	R033=33mΩ
R×	$100\text{m}\Omega \leq R \leq 999\text{m}\Omega$	R100=100mΩ
×	$1\text{m}\Omega < R < 10\text{m}\Omega$ （包含小数点后两位有效数字） (Contains two significant digits after the decimal point.)	5M10=5.1mΩ
×	$10\text{m}\Omega < R < 100\text{m}\Omega$ （包含小数点后一位数字） (Contains one significant digit after the decimal point.)	30M1=30.1mΩ

*E-24和E-96系列（0603， $\leq \pm 5\%$ ）：采用三位标记代码。

For the chip resistor (0603, $\leq \pm 5\%$), when resistance value belongs to E024 and E96 series, we suggest preferentially use three digits.

标记代码 Mark Code	阻值范围 Resistance Value	示例 Sample
V0×	$1\text{m}\Omega \leq R \leq 9\text{m}\Omega$	V05=5mΩ
V×	$10\text{m}\Omega \leq R \leq 99\text{m}\Omega$	V33=33mΩ
R×	$100\text{m}\Omega \leq R \leq 999\text{m}\Omega$	R100=100mΩ
×	$1\text{m}\Omega < R < 10\text{m}\Omega$ （包含小数点后一位有效数字） (Contains one significant digit after the decimal point.)	5M10=5.1mΩ

* ≤ 0402 产品不印刷标记。

For the chip resistor (≤ 0402), there is no mark on the glass side.

*非IEC标准系列的电阻标记表示方法：一般以最接近IEC E24系列标称阻值的标记表示方法。

For the resistance values which don't belong to IEC serial, use the resistance of IEC serial which is most close to the required resistance of non-IEC serial for replacement.

*客户对标记有特殊要求时，则按照协商的结果印刷标记。

To get agreement by both party if there special requirement for the marking.

◆片式电阻器使用说明 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：

- 1、在各种类型的液体，包括水、油、化学品、有机溶剂的使用。
- 2、在户外直接暴露在阳光的地方，或在灰尘多的地方使用。
- 3、在产品暴露的地方，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。
- 4、在产品暴露于静电或电磁波的地方使用。
- 5、在产生热量的部件、塑料线，或其他易燃物品附近使用。
- 6、在用树脂或其他涂层材料密封产品的情况下使用。
- 7、焊接后使用不洁焊料或使用水或水溶性清洗剂清洗产品。
- 8、片状电阻器的基材是氧化铝。由于和安装基板的热膨胀系数不同，在反复施加提供热循环等热应力时，接合部的焊锡（焊锡部）有时会发生裂纹。如果环境温度反复发生很大的变动，并且载荷反复进行ON/OFF，则需要注意龟裂的发生。因热应力而发生的龟裂，取决于所安装的焊盘的大小、焊锡量、安装基板的散热性等，因此在环境温度有很大的变化或者载荷NO/OFF的条件下使用时，请充分注意以进行设计。

* Application of the products in a special environment can deteriorate product performance:

- 1、Use in various types of liquid, including water, oils, chemicals, and organic solvents.
- 2、Use outdoors where the products are exposed to direct sunlight, or in dusty places.
- 3、Use in places where the products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂ etc.
- 4、Use in places where the products are exposed to static electricity or electromagnetic waves.
- 5、Use in proximity to heat-producing components, plastic cords, or other flammable items.
- 6、Use involving sealing or coating the products with resin or other coating materials.
- 7、Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering.
- 8、The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stresses like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

◆储存方法 Storage Conditions

温度5℃~30℃，相对湿度30%RH~70%RH。建议在符合上述储存条件下十二个月内使用。

T: 5℃~30℃, RH: 30%RH~70%RH. The products are suggested to be used within twelve months when received, and the storage condition mentioned above should be followed.

◆产品使用注意事项

- 1、避免采用超过正常额定功率的功率，超过额定功率的稳态负载条件下可能会对产品性能和可靠性产生负面影响。
- 2、用镊子拿起产品时要小心，有可能会将保护或电阻体夹碎。
- 3、手动安装产品时，烙铁头勿触碰产品。
- 4、用于车载设备、医疗设备、航空设备以及其他涉及人身安全、或可能引起重大损失的设备上时，请务必事先与我公司联系。这些产品在这类用途中出现故障或失灵可能导致人身事故或严重损坏。

◆Precautions on use of products

- 1、Avoid applying power exceeding normal rated power, exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 2、Be careful when pick up the products with tweezers. There may be a care that the overcoat and / or the body can be chipped.
- 3、Soldering tip shall not touch the product when install product manually.

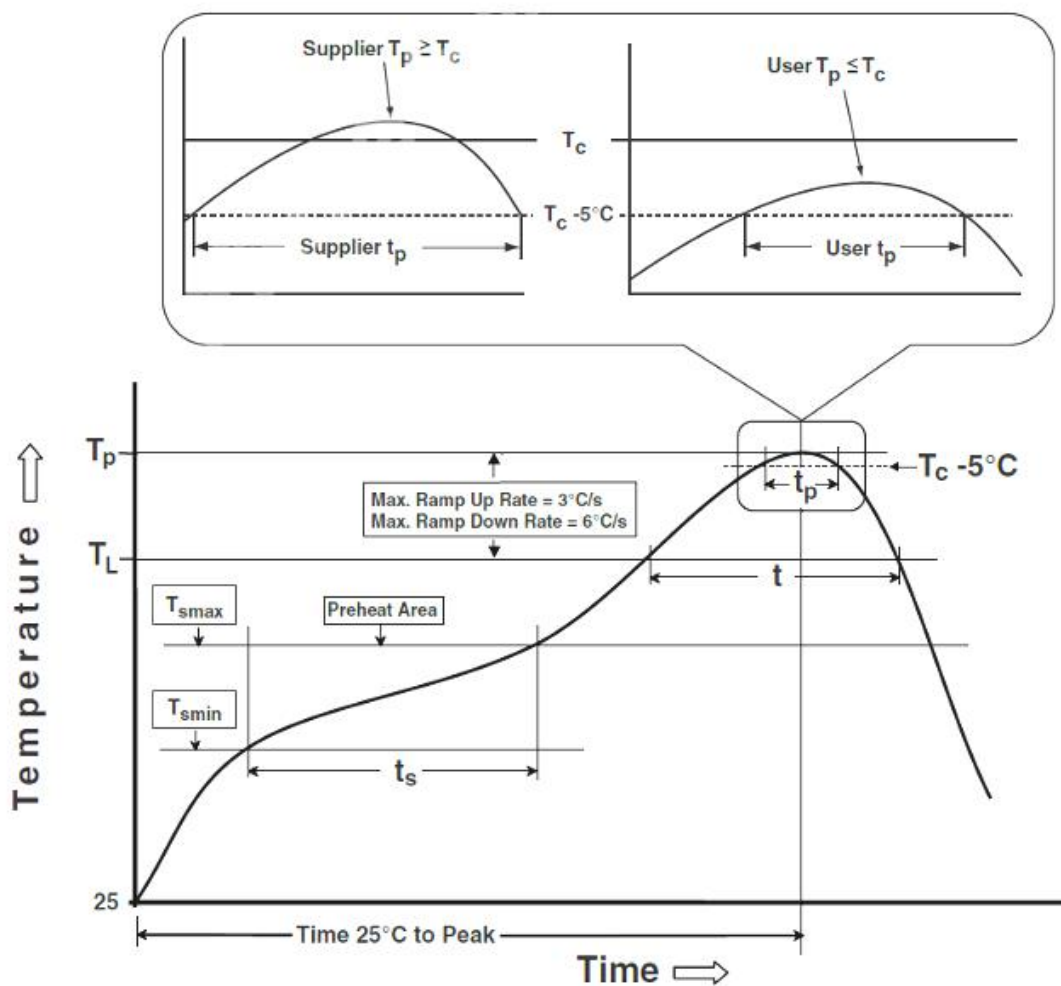
4、Contact our sales representatives before you use our products for applications including automotive, medical equipment and aerospace equipment. Malfunction or failure of the products in such applications may cause loss of human life or serious damage.

◆焊接Soldering

- 回流焊要求：器件回流焊要求满足J-STD-020无铅回流焊，具体要求如下：

Reflow soldering requirements: The device reflow soldering requirements meet the J-STD-020

lead-free reflow soldering. The specific requirements are as follows:



*升温速率 (Ramp-up rate (TL-TP)) : $>3^\circ\text{C/s}$

*降温速率 (Ramp-down rate (TP-TL)) : $\leq 6^\circ\text{C/s}$

*预热温度 (Preheat/soak) : $150^\circ\text{C} - 200^\circ\text{C}$ (T_{smin} to T_{smax}) : 60-120s

*液相线 217°C 以上时间 Time above 217°C of liquid phase (TL) : 60-150s.

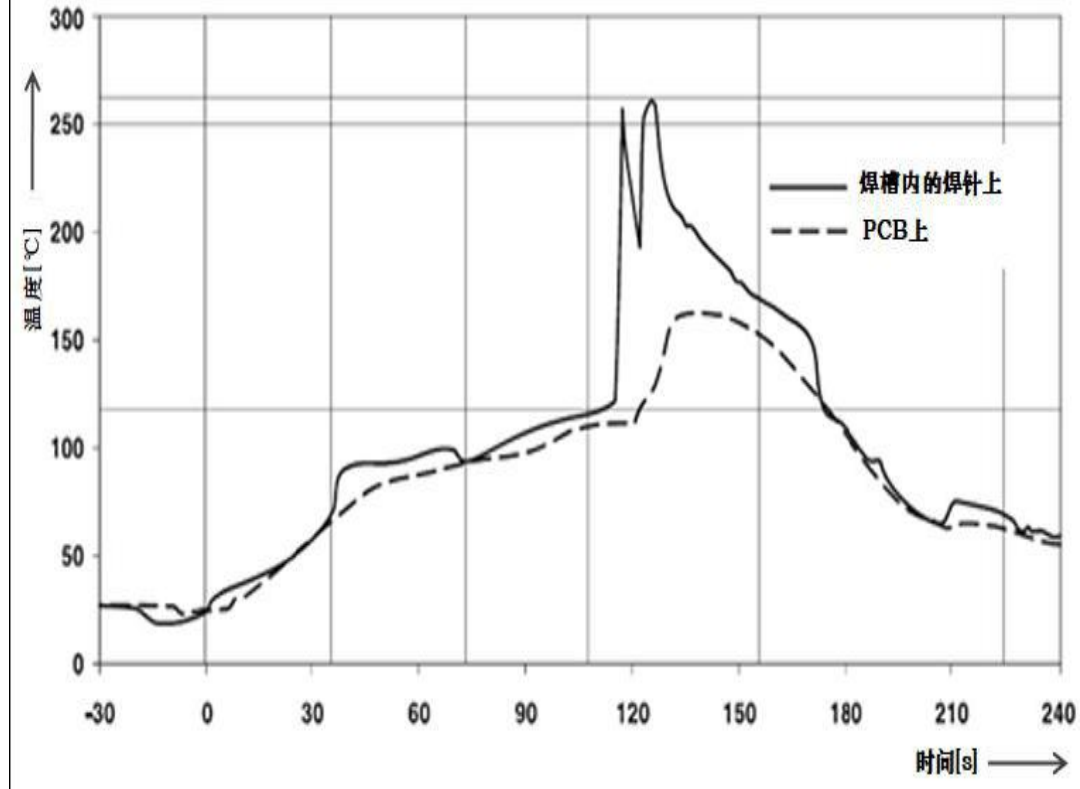
* T_c 最高温度 Maximum temperature of T_c : 260°C

*最长焊接时间 Maximum welding time: 8min max.

*峰值温度 $T_p = T_c - 5^\circ\text{C}$ 以内的时间 T_p Time t_p within the range where peak temperature $T_p = T_c - 5^\circ\text{C}$: 30s

*产品至少可承受回流焊次数: 3次 Minimum number of reflow soldering cycles the product can withstand: 3 times

● 波峰焊的要求 Requirements for wave welding



*预热温度要求时间 Preheating temperature requirement: 130 -160 time: 60-90s

*插装元器件引脚在260°C焊料槽中至少停留10s (Sn93.5-Ag3.0-Cu0.5)
The pins of the plug-in components stay in the 260 solder channel for 10s.

* 推荐的焊膏类型 Recommended solder alloy: 96.5Sn-3.0Ag-0.5Cu

◆ 修订履历 Revision History

版本 Version	日期Date	修订内容Revision Content	修订人Reviser
I 9.0	2026-01-04	-新增硫化试验测试方法 Add test method of sulfuration-resistant test. -附录：修改回流焊曲线和波峰焊曲线。 Appendix: Modify the requirements for the reflow soldering profile and the wave solder profile.	唐文宣 WenXuan Tang
I8.0	2025-10-24	-修改可靠性测试方法部分试验方法的引用条款。 Modify the reference clauses of test methods in the section on reliability test methods. -增加高温高湿测试条件以及判定标准。 Add the high temperature and humidity test conditions and judgment standards.	唐文宣 Wenxuan Tang
V7.0	2025-09-04	-附录：修改储存方法。 - Appendix: Modify the storage conditions.	刘瀚阳 Hanyang Liu
V6.0	2023-12-18	-修改“额定值”格式。Revise the format of Ratings. -特性:修改短时间过负载、稳态湿热、70℃℃耐久性试验项目的试验方法。 Characteristics: revise the test method of the short time overload,damp heat steady state,endurance at 70'C test items. -特点:增加潮敏等级MSL1Features:add the MSL1 -品名构成:增加13寸卷盘代号, 删除+2%、110%、+20%精度 Part number: add 13inch reel code,delete tolerance of +2%、+10%.+20%. -附录:增加13寸卷盘编带尺寸;增加0508、0612、1225包装、阻值代码及标记规则 Appendix: add the dimensions of 13 inch reel; Add the parameters of 0508、0612、1225.	方 敏Min Fang 卢振强 Zhenqiang Lu
V5.0	2023-02-20	-附录:增加RH-MY04, RH-MY08产品编带包装参数。 Appendix: Add the taping parameters of RH-MYO4, RH-MYO8. -附录:修改0201,0402,0603,0805编带包装A,B,T参数。 Appendix: Modify the taping parameters A,B,T of 0201,0402,0603,0805.	卢振强 Zhenqiang Lu
V4.0	2022-06-09	-修改产品标记由数码体改为手写体。 Modify the product marking from digital to handwritten.	杜建业 Jianye Du
V3.0	2022-02-25	-附录中“包装数量”:修改0201尺寸为15K包装数量。 Revise the quantity of 0201 15Kpcs to Packaging Quantity.	杜建业 Jianye Du
V2.0	2021-08-13	-增加“应用领域” Add the application. -附录中“推荐焊盘尺寸”:增加偏差值。 Add the tolerance to Recommend Solder Pad Size.	卢振强 Zhenqiang Lu
V2020.1.0	2021-02-24	-删除 E-24系列 客户特殊要求标记说明 Delete marking instructions for special requirements of customers	杜建业 Jianye Du
V2020.0	2020-06-23	-原版 The original version.	吴晓玲 Xiaoling Wu

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