

■车规薄膜片式固定电阻器 - AT0612

Thin Film Chip Fixed Resistor Automotive Grade - AT0612

◆特征 Features

- * 符合 AEC-Q200 汽车标准相关条款
Compliant with AEC-Q200 standard
- * 具有抗硫化性能
With good anti-sulfuration performance
- * 符合 RoHS 指令要求
Compliant with RoHS directive
- * 符合无卤素要求
Halogen free requirement
- * 特殊钝化材料, 具备良好的耐湿性、耐腐蚀性、高可靠性
Using special passivation material, and has good moisture resistance, corrosion resistance, high reliability.
- * 适应再流焊与波峰焊
Suit for re-flow and wave soldering.
- * 潮敏等级:MSL 1
MSL Class:MSL 1



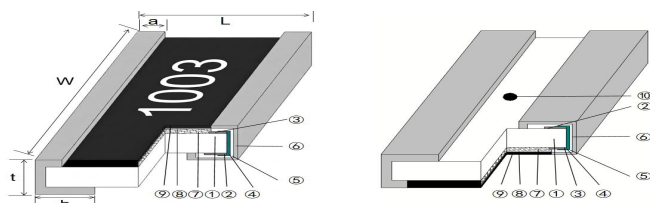
◆应用领域 Application

- * 汽车电子、医学仪器、测试/测量设备、打印设备、自动设备控制器、转换器、通讯设备等。
Automotive electronics, Medical Equipment, Test/Measurement Equipment, Printer Equipment, Automatic Equipment Controller, Converters, Communication Device, etc.

◆型号表示法 Part Number

AT	J		0612		G		1003	F	T		G		
产品代号 Product Code	额定功率代号 Power Rating Code		封装尺寸 Dimension		电阻温度系数代号 T.C.R. Code		电阻值代号 Resistance Value Code	电阻精度代号 Resistance Tolerance Code	包装方式代号 Packaging Style Code		无铅化等级代号 Lead-free Level Code		
车规薄膜片式固定电阻器 Thin Film Chip Fixed Resistor Automotive Grade	代号 Code	额定功率 Power Rating	代号 Code	型号 Type	代号 Code	T.C.R (PPM/℃)	统一采用四位数：前三位表示有效数字，第四位表示有效数字后零的个数 Four digits: The first three digits are significant figures and the Four one denotes number of zeros. 小数点用 R 表示。 Decimal point should be expressed by R. 例如 Example: 4701=4.7kΩ(E-24) 1003=100kΩ(E-96) 10R5=10.5Ω(E-96).	代号 Code	误差精度 Tolerance	代号 Code	包装方法 Packaging Style	代号 Code	无铅化等级 Lead-free Level
	J	1W	0612	0612	G	±25		T	±0.01%	T	编带包装 Tape&Reel	G	无铅型 Lead-free
					H	±50		A	±0.05%				
								B	±0.1%				
								C	±0.25%				
								D	±0.5%				
								F	±1%			(空位)	非无铅 Non-lead-free

◆产品结构 Construction



注[1]: 0612 型号背面专用识别码为圆点“•”。

Note[1]: The thin film chip resistor code is a black dot “•” for 0612

- ①陶瓷基板 Ceramic Substrate
- ②背电极 Bottom Electrode
- ③面电极 Top Electrode
- ④端电极 Edge Electrode
- ⑤中间电极 Barrier Layer
- ⑥外部电极 External Electrode
- ⑦电阻体 NiCr Resistor Layer
- ⑧钝化层 Passivation
- ⑨保护层 Protective Coating
- ⑩薄膜电阻专用识别码[1] Thin Film Chip Resistor Code[1]

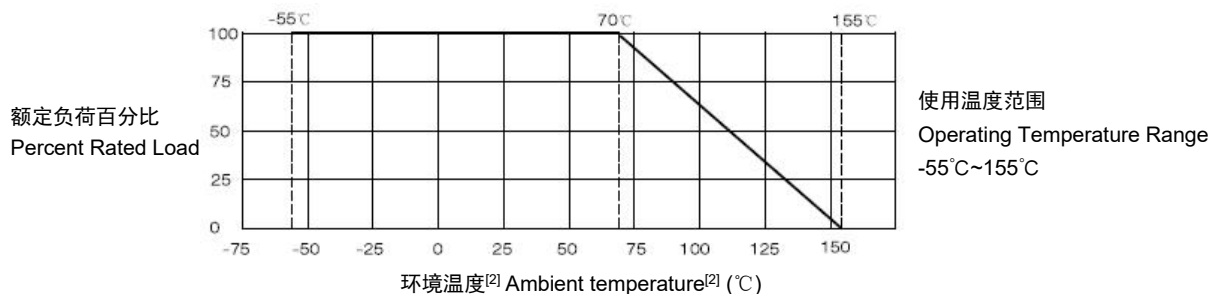
◆规格尺寸 Dimensions

单位 Unit: mm

型号 Type	L	W	t	a	b
0612	1.60±0.20	3.20±0.15	0.55±0.10	0.30±0.20	0.50±0.20

◆产品特性曲线图 Product Characteristic Curve

* 负荷下降曲线 Derating Curve



注[2]: 当电阻使用的环境温度超过 70°C 时, 其额定负荷(额定功率)按上述曲线下降。

Note[2]: For resistors operated in ambient over 70°C ,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°C 下额定功率 Rating Power at 70°C (W)	元件极限电压 Limiting Element Voltage (V)	最大过负荷电压 Max.Overload Voltage (V)	阻值范围 Resistance Range						电阻温度系数 T.C.R (ppm/°C)
				±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0612	1	75	150	5.6kΩ~100kΩ						±25 , ±50

注 Note: [3] 电压、电流为直流或交流有效值。

Voltage,current of DC or AC RMS value .

 [4] $E = \sqrt{P \times R}$ 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)

◆可靠性测试方法 Reliability Test Methods

项目 Test Item	标准 Specification	测试方法 Test Method
高温存储 High Temperature Exposure (Storage)	$\Delta R \leq \pm (0.2\%R + 0.05\Omega)$	IEC 60115-1 7.3 温度 155°C, 持续时间 1000h, 不通电. 1000h. @T=155°C , Unpowered.
温度循环 Temperature Cycling	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.2\%R + 0.05\Omega)$	JESD22 Method JA-104 -55°C~125°C, 高、低温下暴露时间各 30min, 转换时间: ≤1min, 循环次数: 1000 次。 -55°C (30min) ~ 125°C (30min) , 1000 cycles.
高温高湿 Biased Humidity	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.5\%R + 0.05\Omega)$	MIL-STD-202 Method 103 温度 85°C, 湿度 85%RH 的条件下施加 10%额定功率的电压值或元件极限电压(取小值), 放置 1000 小时。 85°C/85%RH. 1000 hours. Apply 10% of operating power or limiting element voltage whichever is lower.

(续上表 Continue)

项目 Item	标准 Specifications	测试方法 Test Methods
70℃耐久性 Endurance at 70℃	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.2\%R + 0.05\Omega)$	IEC60115-14.25.1 70℃ $\pm 2^\circ\text{C}$, 1000 小时, 额定电压或元件极限电压 (取小值), 通 1.5 小时/断 0.5 小时。 70℃ $\pm 2^\circ\text{C}$, 1000h, rated voltage or limiting element voltage whichever is lower for 1.5h ON / 0.5h OFF.
耐溶剂性 Resistance to Solvents	标志清晰, 无可见损伤 Clearly marked, No mechanical damage	MIL-STD-202 Method 215 浸在三种溶剂 3 分钟后擦拭 10 次, 浸、刷共 3 回, 用水洗清洗剂进行清洗, 并在室温下对整个表面进行通风干燥。 Immersed in three solvents after 3min immersion, brush wipe 10 times, a total of 3 times, washing with washing and cleaning agent, room temperature on the surface of the ventilation drying.
机械冲击 Mechanical Shock	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	MIL-STD-202 Method 213 正半弦波, 峰值加速度: 100g's, 脉冲持续时间 6ms, 三轴六向各 3 次, 共 18 次。 Positive half wave, peak acceleration: 100g's, pulse duration: 6ms, three axis six to each 3 times, a total of 18 times.
振动 Vibration	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	MIL-STD-202 Method 204 频率: 10Hz~2000Hz, 加速度: 5 g's, 一个循环 20 分钟, X、Y、Z 三个方向每个方向 12 个循环, 共 36 个循环。 Frequency: 10Hz ~ 2000Hz, acceleration: 5 g's, a loop 20min, X, Y, Z three directions, each direction 12 cycles, 36 cycles.
耐焊接热 Resistance to Soldering Heat	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	IEC60115-1 11.2 270℃ $\pm 5^\circ\text{C}$ 锡槽, 保持 10s $\pm 1\text{s}$, 浸入深度 10mm $\pm 1\text{mm}$ 。 Lead-free solder bath at 270℃ $\pm 5^\circ\text{C}$ for 10s $\pm 1\text{s}$, immersion dept-h 10mm $\pm 1\text{mm}$
热冲击 Thermal Shock	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	MIL-STD-202 Method 107 -55℃(15 分钟)~常温(≤ 20 秒)~155℃(15 分钟), 300 个循环。 -55℃(15min)~normal temperature($\leq 20\text{s}$) ~ 155℃(30min), 300 cycles.
ESD 静电放电 Electrostatic Discharge (ESD)	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.5\%R + 0.05\Omega)$	AEC-Q200-002 人体模式, 每个电极承受两次放电, 正、负极性各 1 次。 0612: 750V. Human Body Model, 1 pos. + 1 neg. discharge. 0612: 750V.
可焊性 Solder-ability	无可见损伤 No mechanical damage 可焊面积 $\geq 95\%$ 95% Cover Min	IEC 60115-1 11.1 245℃ $\pm 5^\circ\text{C}$ 锡槽, 保持 3s $\pm 0.3\text{s}$, 浸入深度 10mm $\pm 1\text{mm}$ 。 Lead-free solder bath at 245℃ $\pm 5^\circ\text{C}$ for 3s $\pm 0.3\text{s}$, immersion dept-h 10mm $\pm 1\text{mm}$.
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℃ T1= $-(55\pm 3)^\circ\text{C}$, T2= $(125\pm 2)^\circ\text{C}$
可燃性 Flammability	不完全燃尽, 薄垫纸应不被引燃, 松木板应不被烤焦炭化 No ignition of the tissue paper or scorching of the pinewood board	UL-94 V-0 或 V-1 可接受。不需要电气测试。 V-0 or V-1 are acceptable. Electrical test not required.

(续上表 Continue)

项目 Item	标准 Specifications	测试方法 Test Methods
阻燃性 Flame Retardance	不可燃 Not flame	AEC-Q200-001 9Vdc 到 32Vdc (钳位电流高达 500A)、增量为 1.0Vdc 的电压。每种电压等级最少施加 1 小时。 Subjected to voltage from 9.0 to 32.0 VDC (current clamped up to 500A), and each voltage level shall be increased in 1.0 VDC for one hour minimum.
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 1min, then check insulation resistance.
耐电压 Voltage Proof	无击穿或飞弧 No breakdown or flash over	IEC 60115-1 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 AC RMS at a rate of approximately 100V/s between substrate and terminations for 60s±5s.
短时间过负载 Short Time Overload	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.2\%R + 0.05\Omega)$	IEC 60115-1 8.1 施加 2.5 倍额定电压或最大过负荷电压/电流 (取较小值), 持续 5 秒。 Apply 2.5 times rated voltage or max. overload voltage, whichever is lower, for 5s.
低温负载 Operation at Low Temperature	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	IEC 60115-1 10.2 -55℃±5℃, 无负载 1 小时, 额定电压或元件极限电压 (取较小值) 45 分钟, 无负载 15 分钟。 -55℃±5℃, 1h without load, rated voltage or limiting element voltage whichever is lower for 45min, 15min without load.
基板弯曲试验 Substrate Bending Test	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	IEC 60115-1 9.8 保持时间 Duration : 60s±5s 弯曲距离 Bending distance : 5mm
端子强度 Terminal Strength	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.1\%R + 0.05\Omega)$	IEC 60115-1 9.7 施加力: 17.7N, 保持 60s±1s。 Applying force : 17.7N for 60s±1s.
抗硫化性能 Sulfuration Resistant	无可见损伤 No mechanical damage $\Delta R \leq \pm (0.5\%R + 0.05\Omega)$	油浴, 恒温: 105℃±3℃, 放置时间: 1000 小时。 Soaked in industrial oil with sulfur substance contained in 105℃±3℃ for 1000h.

◆包装 Packaging

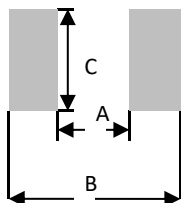
包装方式见附录 Packaging can refer to the Appendix.

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



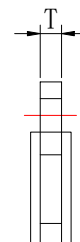
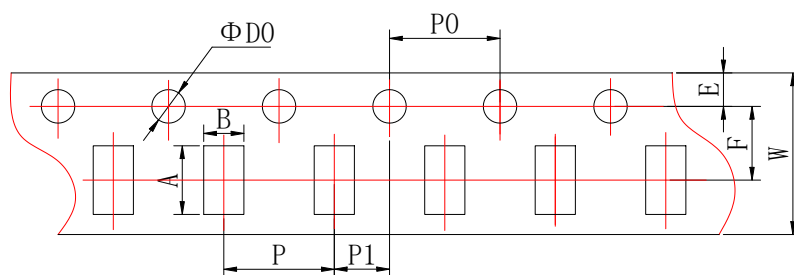
薄膜电阻 Thin Film Resistor			
型号 Type	A	B	C
0612	0.60±0.06	2.90±0.1	3.30±0.1

◆包装 Packaging

* 纸带编带 Paper Taping

适用于 0612:

For 0612:



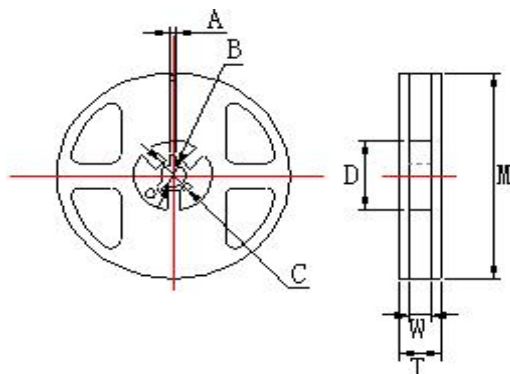
单位 unit: mm

型号 Type	A	B	W	F	E
0612	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
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

* 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	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

◆ 编带包装能力 Taping Ability

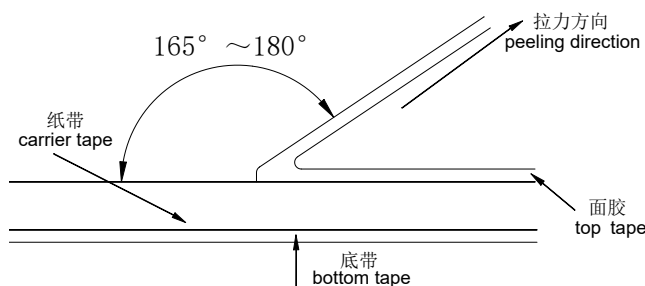
面带拉力 Top tape peel strength

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
型号 Type	0612
数量 Quantity (pcs)	5000

◆ 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

◆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
 四位数字代号表示, 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

 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

 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。

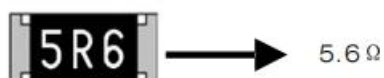
Express the resistance value on the glass side with three digits, the first two digits should be significant and the third denote number of zeros.

例 Example

 30K Ω

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

例 Example

 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



◆片式电阻器使用说明 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：

- 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

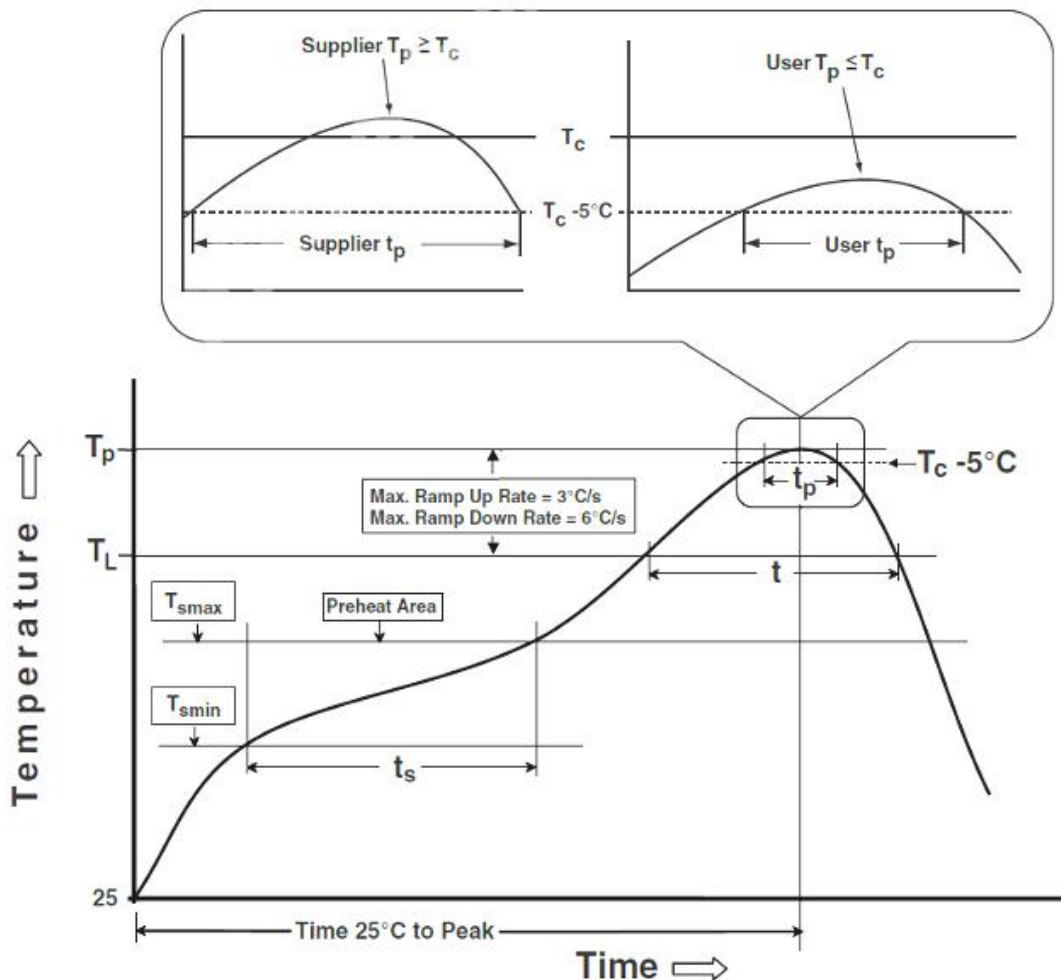
- 1、Avoid applying power exceeding normal rated power, exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 2、Be careful when pick up the products with tweezers. There may be a care that the overcoat and / or the body can be chipped.
- 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.

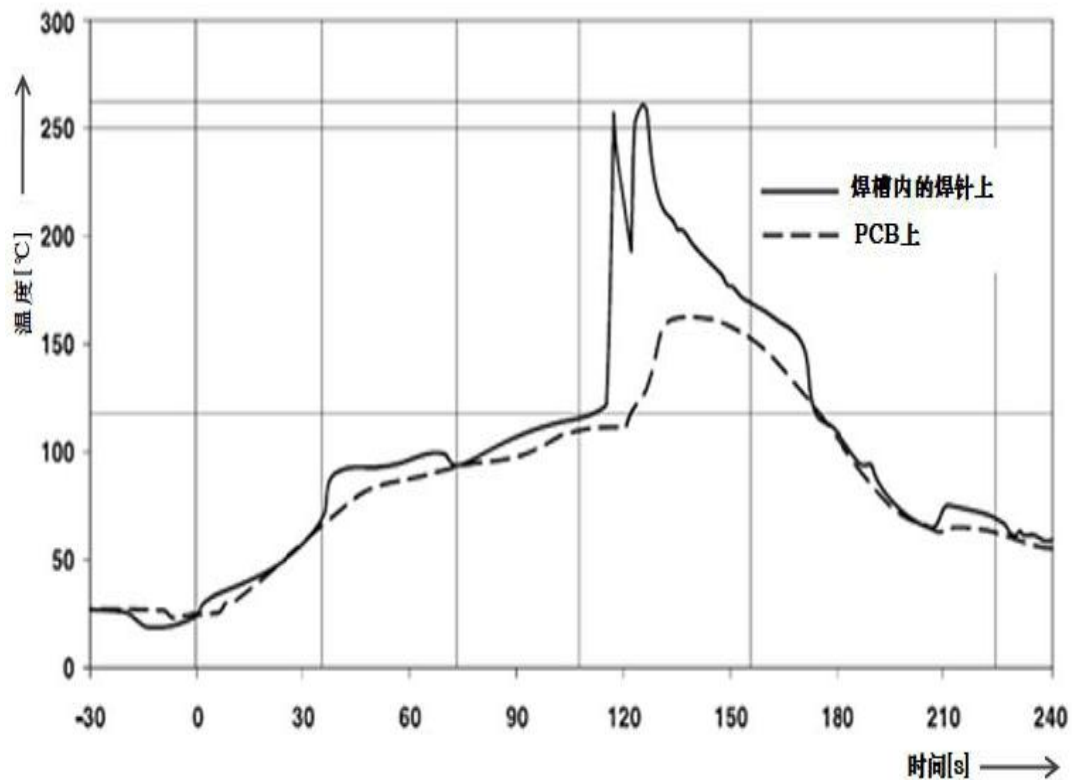
* T_c 最高温度 Maximum temperature of T_c : 260°C

*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	修订确认 Checked by
I 0	2026-07-17	-原版 The original version.	林金宏 Lin JinHong

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