



富捷科技

Product Datasheet

产品规格说明书

FQT Series

Automotive Thin Film Chip Resistor

车规薄膜片式电阻器

安徽省富捷电子科技有限公司

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车规薄膜片式电阻器
Automotive Thin Film Chip Resistor
FQT Series



特点 (Features)

- 精度可达 $\pm 0.05\%$
- 温度系数可达 $\pm 10\text{ppm}$
- 符合 AEC-Q200 标准
- Tolerance to $\pm 0.05\%$
- Low TCR to $\pm 10\text{ppm}$
- Comply with AEC-Q200 standard

应用 (Application)

- 汽车电子
- 导航设备、胎压监测
- 暖气系统、通风系统、空调
- 室内照明、中央门锁、雨刮器模块
- Automotive electronics
- Navigation equipment TPMS
- Heating, Ventilating and Air conditioning
- Indoor lighting, Central door locking, Wiper module

产品料号 (Parts Number Explanation) 示例(Example): FQT1206B5103TSX

F 公司	Q 产品别	T 功能别	1206 尺寸	P 公差	5103 字码	T 包装别	S 端电极	X 特殊码
FOJAN	R:Resistor C:Capacitor L: Inductor D:Diode A:Audion Q:Automotive	C:Normal P:Hi-Power L: Lowohmic A:Array S:Surge H:Hi-Precision V:Hi-Voltage Q:Auto-motive R:Anti-sulfur M:Metal D: LED T: Thin film	0402 0603 0805 1206	A: $\pm 0.05\%$ B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	E24+E96: 4-digits 1001=1K Ω 1R00=1 Ω	T: 7 inch reel Q:10 inch reel R:13 inch reel B:Bulk	S: Sn C: Cu A: Au	A: 10ppm E: 15ppm X: 25ppm V: 50ppm
Company	Type	Functional	Size	Tolerance	Resistance	Packaging	Termination	Special Case

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

0402 因本体太小, 本体上无字码标示

For 0201 and 0402 size, no marking on the body due to the small size of the resistor

±0.5%, ±1%, 的产品, 以四字码标示, 前三位表示阻值的有效数字, 最后一位表示 10 的乘幂

±0.5%, ±1% tolerance product: the marking is 4 digits, the first 3 digits are significant figures of resistance value and the 4th one denotes the power number of 10, (10X)

0603 ±1% E96 系列的标准阻值, 因电阻本体太小, 采用三位代码标示。

Standard E96 series values of 0603 ±1%: due to the small size of the resistor's body, use 3digits code to indicate the resistance value.



$$4992 = 499 \times 10^2 = 49.9K\Omega$$



100Ω以下标示

$$6R81 = 6.81\Omega$$

Below 100Ω: 6R81=6.81Ω

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

■ 0603±1%标记的倍增码 Multiplier Code for 0603 ±1% Marking

代码 Code	Y	X	A	B	C	D	E	F
指数 Multiplier	10^{-2}	10^{-1}	10^0	10^1	10^2	10^3	10^4	10^5

阻值标示如下(So the resistance value are marked as the following examples)



$$10D=124 \times 10^3=124K\Omega$$



$$38Y=243 \times 10^{-2}=2.43\Omega$$

0603 $\pm 1\%$ 的产品, 在标准 E24 系列中, 但不属于 E96 系列, 标示与 5%的字码相同, 但是在中间字码下加一条线 (Standard E24 and not belong to E96 series values of 0603 $\pm 1\%$, the marking is the same as 5% tolerance but marking as underline)

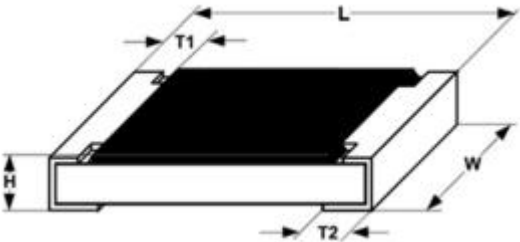


$$331=33 \times 10^1=330\Omega$$



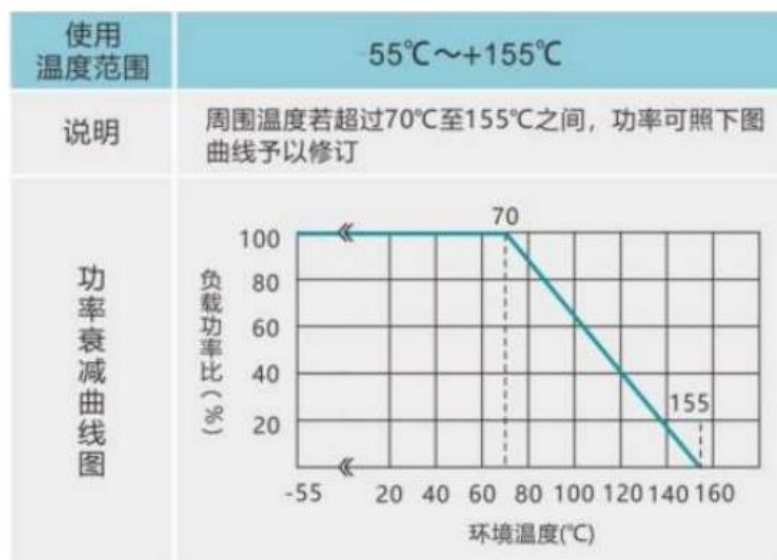
$$560=56 \times 10^0=56\Omega$$

■ 尺寸(Dimension):

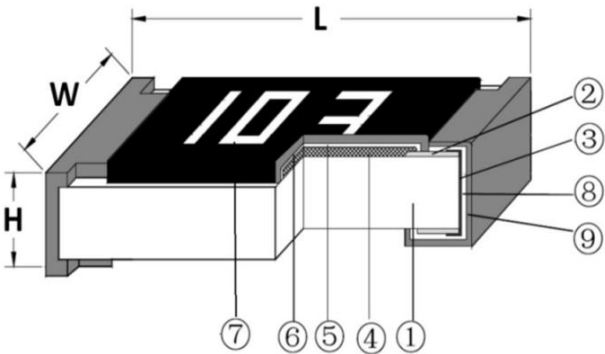
尺寸 dimension					
	单位 (unit) : mm				
型别 (Type)	L	W	H	T1	T2
0402	1.00 ± 0.10	0.50 ± 0.05	0.30 ± 0.05	0.20 ± 0.10	0.25 ± 0.10
0603	1.60 ± 0.15	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
0805	2.00 ± 0.15	1.25 ± 0.15	0.55 ± 0.10	0.35 ± 0.20	0.40 ± 0.20
1206	3.10 ± 0.15	1.60 ± 0.15	0.55 ± 0.10	0.45 ± 0.20	0.50 ± 0.20

■ 功率衰减曲线

(Derating Curve)



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 ₂ O ₃
2	银电极 Conductive layer	银 Ag
3	侧电极 Side conductive layer	镍铬合金 NiCr
4	阻体层 Resistive layer	镍铬合金 NiCr
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 Matte Tin

电气特性 (Electrical characteristics)

型别 Type	0402	0603	0805	1206
额定功率 Rated power	1/16W	1/10W	1/8W	1/4W
最大工作电压 Max Working Voltage	50V	75V	150V	200V
最大过负荷电压 Max Overload Voltage	100V	150V	300V	400V
绝缘耐压 Dielectric Withstanding Voltage	100V	100V	300V	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.



■ 电性规格 (Standard Electrical Specifications)

型别 Type	阻值范围 Resistance Range					T.C.R. (PPM/°C)
	A ± 0.05%	B ± 0.1%	C ± 0.25%	D ± 0.5%	F ± 1%	
0402	49R9~12KR	10R~68KR				±10;±15
		4R7~220KR				±25;±50
0603	49R9~30KR	10R~332KR				±10;±15
		4R7~680KR				±25;±50
0805	49R9~50KR	10R~680KR				±10;±15
		4R7~1MR				±25;±50
1206	49R9~100KR	10R~1MR				±10;±15
		4R7~1M5				±25;±50

性能 (Performance Specifications)

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℃ 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℃)	Refer to Standard Electrical Specifications
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.	$\pm(0.1\% + 0.05\Omega)$
焊锡性 Solderability	JIS C 5201 4.17	沾助焊剂后浸入锡炉, 锡炉温度 $245 \pm 5^\circ\text{C}$, 时间 3 ± 0.5 秒。 Dip the terminal in a flux and then dip into a soldering bath at $245 \pm 5^\circ\text{C}$ for $3 \pm 0.5\text{sec}$.	> 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 $260 \pm 5^\circ\text{C}$, 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 $260 \pm 5^\circ\text{C}$ for $10 \pm 0.5\text{sec}$. Measure the variation of resistance.	$\pm(0.1\% + 0.05\Omega)$
绝缘电阻 Insulation resistance	JIS C 5201 4.6	电阻本体上加载绝缘耐压 60 ± 5 秒后, 测量绝缘阻抗。 Applied the dielectric withstanding voltage on the center of body for $60 \pm$ 5seconds. Then measure insulation resistance.	>10GΩ

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
绝缘耐压 Dielectric withstandin g voltage	JIS C 5201 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、飞弧及可见机 械性损伤 No evidence of flashover, mechanical damage arcing or insulation breakdown
端子弯曲 Terminal bending	JIS C 5201 4.33	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; 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. 测试板 (test board) 压头 (jig) specimen testing printed 待测物 circuit board 测试基板 supporting jig 测试支架 45±2 45±2 20 Unit: mm position before bend jig 基板原位置 压头 Testing printed circuit board 1.6 印刷电路板 Distance of Bending 压伸间距	±(0.1% +0.05Ω)

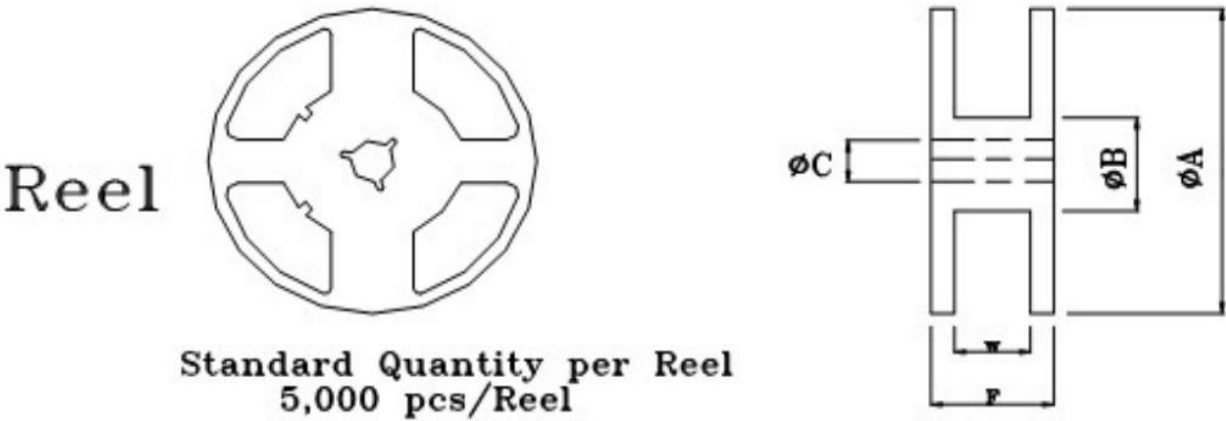
内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
温度循环 Temperature Cycling	JESD22 METHOD JA-104	-55°C~+155°C, 循环 1000 次, 在每一个 极限温度持续时间不超过 30 分钟, 且温度转换时间不超过 1 分钟, 试验结束 24±4 小时后进行测试. 1000 Cycles (-55°C to +155°C) Measurement at 24 ±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme. 1min. maximum transition time.	±(0.3% +0.05Ω) No Visual damage
耐湿特性 Humidity	MIL-STD-202 METHOD 103	加载 10%额定功率, 85°C/85%RH, 持续通电 1000H,试验结束 24±4 小时后 进行测试 1000 hours 85°C/85%RH. Note: Specified conditions: 10% of operating power. Measurement at 24 ±4 hours after test conclusion.	±(0.3% +0.05Ω)
负荷寿命 Load life	JIS C 5201 4.25.1	电阻放入恒温箱中, 温度 125±2°C, 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°C temperature, ON TIME:1.5H, OFF TIME:0.5H, and applied rated voltage for 1000 ⁺²⁴ / ₋₀ H. Measure the variation of resistance.	±(0.3% +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.	±(0.3% +0.05Ω)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
高温储存 High Temperature Exposure(Storage)	MIL-STD-202 METHOD 108	155°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°C. Unpowered. Measurement at 24 ±4 hours after test conclusion	$\pm(0.3\%+0.05\Omega)$
ESD 试验 ESD test	AEC-Q200-002	加载规定静电电压 2 次/间隔 1 秒, 0402 规格:400V, 0603 规格:1KV, 0805 规格:1.5KV,1206 规格: 2KV 0402: 400V, 0603: 1KV, 0805:1.5KV 1206:2KV 2times/1s	$\pm(0.5\%+0.05\Omega)$
抗硫化试验 Sulfuration test	ASTM-B-809- 95	方法一: 温度 105°C, 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°C with humidity and heat (1000hrs)	$\pm(1.0\% +0.05\Omega)$

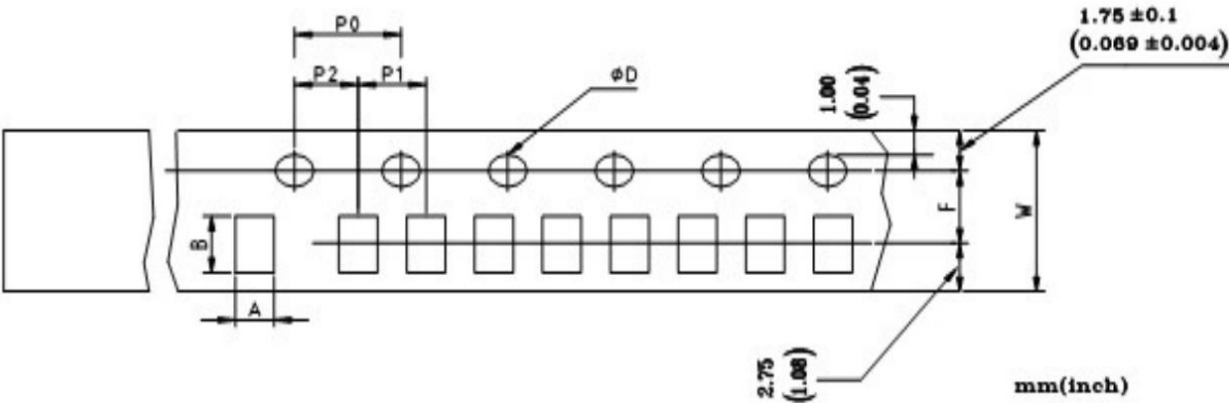
•包装规格 (Tapping Specification)

-卷盘尺寸 (Reel dimension)

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
0603/0805/1206	7"	5K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3



-包装尺寸 (packing dimension)



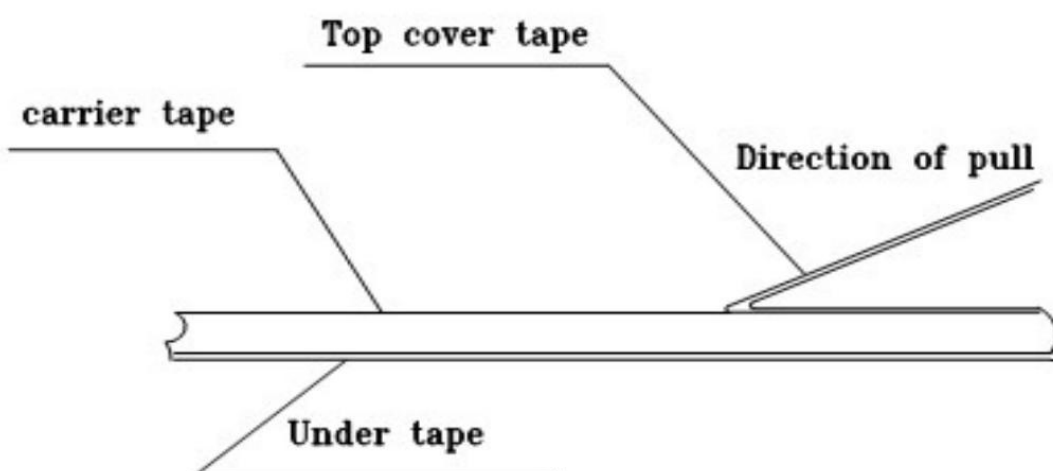
Unit: mm

Dimensions	A	B	D	F	P0	P1	P2	W
0402	0.65 $\pm$ 0.10	1.15 $\pm$ 0.10	1.50 $\pm$ 0.1 0.0	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	2.00 $\pm$ 0.10	2.00 $\pm$ 0.05	8.00 $\pm$ 0.20
0603	1.10 $\pm$ 0.10	1.90 $\pm$ 0.10	1.50 $\pm$ 0.1 0.0	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.10	2.00 $\pm$ 0.05	8.00 $\pm$ 0.20
0805	1.65 $\pm$ 0.20	2.40 $\pm$ 0.20	1.50 $\pm$ 0.1 0.0	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.10	2.00 $\pm$ 0.05	8.00 $\pm$ 0.20
1206	1.90 $\pm$ 0.20	3.50 $\pm$ 0.20	1.50 $\pm$ 0.1 0.0	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.10	2.00 $\pm$ 0.05	8.00 $\pm$ 0.20

■ 上胶带剥离力测试 (Peel force of top cover tape)

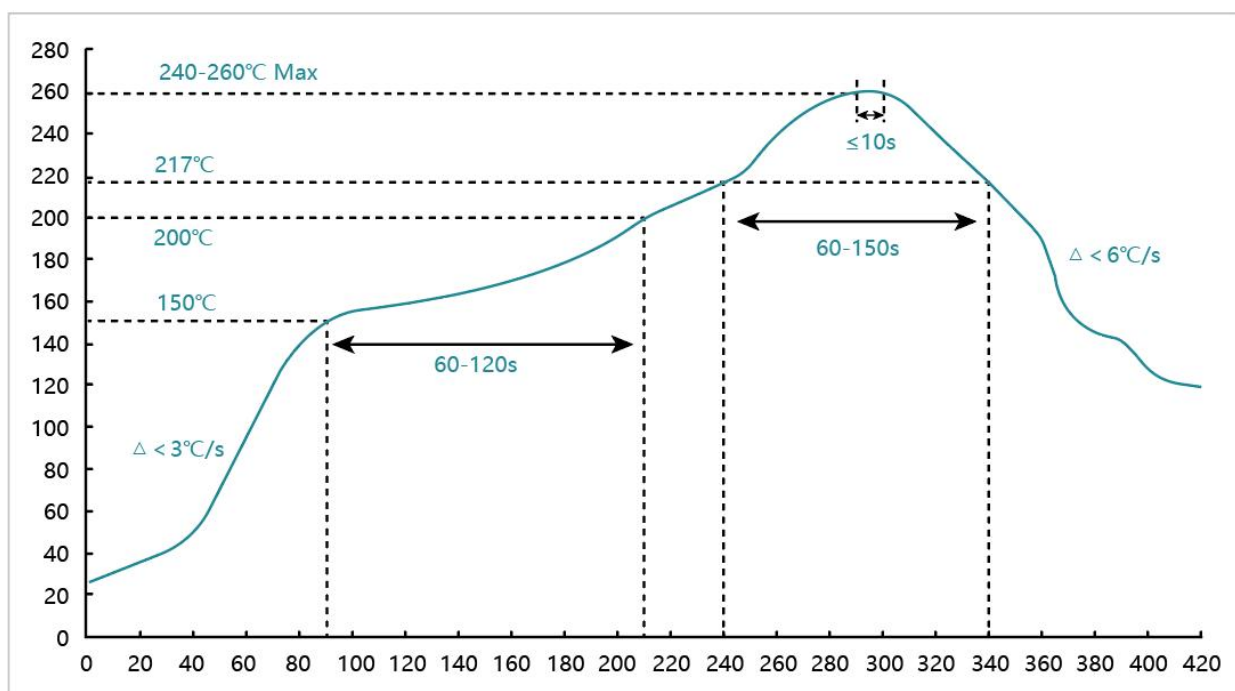
上胶带以 200mm/分钟的速度, 沿 165~180 度角的方向进行剥离, 如下图所示。纸带的剥离力范围为 10g~70g; 载带的剥离力范围为 30~100g。

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)

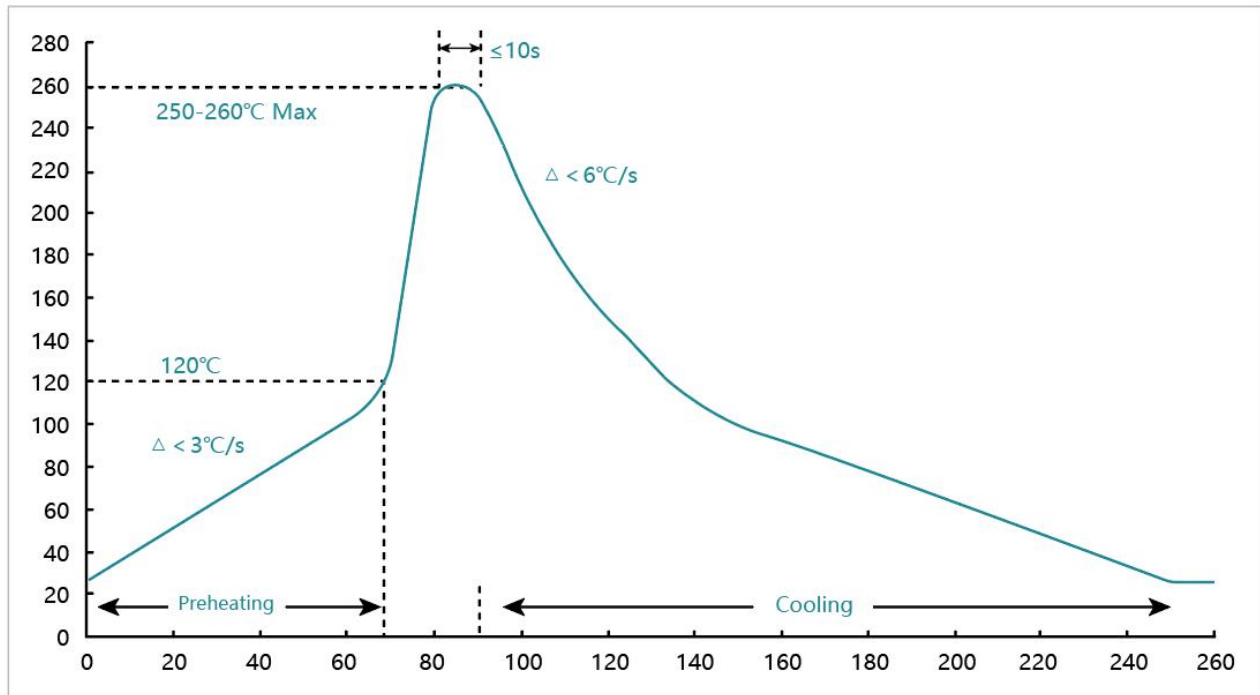


■ 焊接 (soldering)

- 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

▪ 储存 (Storage Data)

自出货日期起，保存在温度 $25 \pm 5^{\circ}\text{C}$ ，湿度 $60 \pm 20\%$ 的条件下，可保证 1 年

Storage time at the environment temp: $25 \pm 5^{\circ}\text{C}$ & humidity: $60 \pm 20\%$ is valid for one year from the date of delivery

