

规格承认书

SPECIFICATION

编号(No):

日期(Date):

客户 (Customer):

品名(Product Name): 片式NTC热敏电阻 Chip NTC thermistor

料号 (Part Number) : QN0603X683F4150FB

客户规格(Customer's Part Number):

客户承认 CUSTOMER CONFIRM			
承认章	核准	审核	经办人
STAMP	APPROVE	CHECK	SIGNATURE

东莞市天瑞电子有限公司

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1 外形尺寸 Shape and Dimensions

- 尺寸：见图 1 和表 1
- PCB 焊盘：见图 2 和表 1

Dimensions: See Fig.1 and Table 1.

Recommended PCB pattern for reflow soldering: See Fig.2 and Table 1.

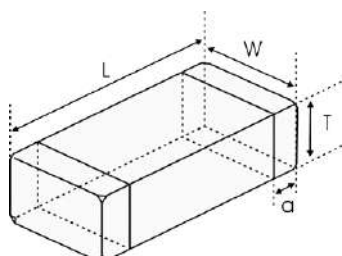


图 1 Fig.1

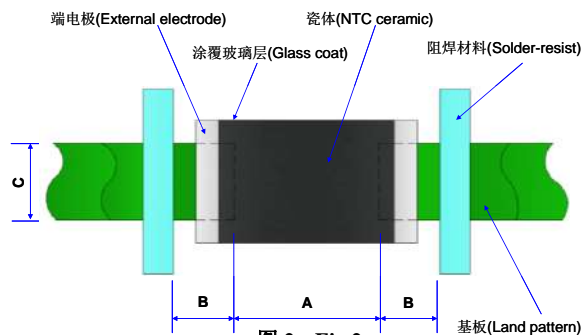


图 2 Fig.2

表 1 (Table 1)

单位 unit: inch[mm]

类别 Type	L	W	T	a	A	B	C
0603 [1608]	0.063±0.006 [1.6±0.15]	0.031±0.006 [0.8±0.15]	0.031±0.006 [0.8±0.15]	0.012±0.008 [0.3±0.2]	[0.6-0.8]	[0.6-0.7]	[0.6-0.8]

2 产品标识 (料号) Product Identification(Part Number)

① 类别 Type		② 外形尺寸(mm) External Dimensions (L×W)	③ 分隔符 Delimiter	④ 25℃ 的零功率电阻 Nominal Zero-Power Resistance		⑤ 电阻值公差 Tolerance of Resistance		⑥ B 值常数 B Constant		⑦ B 值公差 Tolerance of B Constant		⑧ B 值计算方式 B constant calculation method	
QN	片式 NTC 热敏电阻器 Chip NTC Thermistor	0201[0603] 0.6×0.3 0402[1005] 1.0×0.5 0603[1608] 1.6×0.8 0805[2012] 2.0×1.2	X	502	5kΩ	F	±1%	3435	3435K	F	±1%	A	25℃ & 85℃
				683	68kΩ	G	±2%	3950	3950K	H	±3%	B	25℃ & 50℃
				104	100kΩ	H	±3%	4150	4150K				
						J	±5%						

3 电气特性 Electrical Characteristics

型号 Part No	电阻值 Resistance (25℃) (kΩ)	B 常数 B Constant (25/50℃) (K)	B 常数 B Constant (25/85℃) (K)	允许工作电流 Permissible Operating Current (25℃) (mA)	耗散系数 Dissipation Factor (mW/℃)	热时间常数 Thermal Time Constant (s)	额定功率 Rated Electric Power (25℃) (mW)	工作温度 Operating ambient temperature (℃)
QN0603X683F4150FB	68	4150	4210	0.12	1.0	<5	100	-40~+125

4 检验和测试程序

▪ 测试条件

如无特别规定，检验和测试的标准大气环境条件如下：

- 环境温度：20±15℃；
- 相对湿度：65±20%；
- 气压：86 kPa~106 kPa

如果对测试结果有异议，则在下述条件下测试：

- 环境温度：25±2℃；
- 相对湿度：65±5%；
- 气压：86kPa ~ 106kPa

▪ 检查设备

外观检查：20 倍放大镜；

阻值检查：热敏电阻测试仪

4 Test and Measurement Procedures

▪ Test Conditions

Unless otherwise specified, the standard atmospheric conditions for measurement/test as:

- Ambient Temperature: 20±15℃
- Relative Humidity: 65±20%
- Air Pressure: 86kPa to 106kPa

If any doubt on the results, measurements/tests should be made within the following limits:

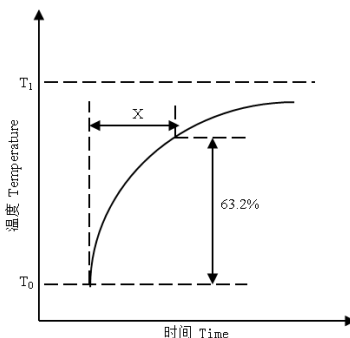
- Ambient Temperature: 25±2℃
- Relative Humidity: 65±5%
- Air Pressure: 86kPa to 106kPa

▪ Inspection Equipment

Visual Examination: 20× magnifier

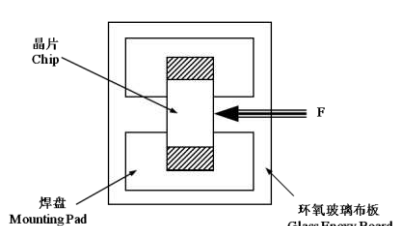
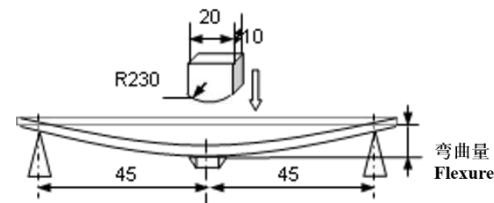
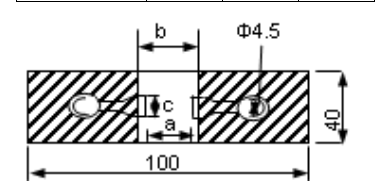
Resistance value test: Thermistor resistance tester

5 电性测试 Electrical Test

序号 No.	项目 Items	测试方法及备注 Test Methods and Remarks
1	25℃ 零功率电阻值 Nominal Zero-Power Resistance at 25℃ (R25)	环境温度 Ambient temperature: 25±0.05℃ 测试功率 Measuring electric power: ≤0.1mW
2	B 值常数 Nominal B Constant	分别在环境温度 25±0.05℃, 50±0.05℃ 或 85±0.05℃ 下测量电阻值。 Measure the resistance at the ambient temperature of 25±0.05℃, 50±0.05℃ or 85±0.05℃. $B(25-50^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{50}}{1/T_{25} - 1/T_{50}} \quad B(25-85^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{85}}{1/T_{25} - 1/T_{85}}$ T: 绝对温度 (K) Absolute temperature (K)
3	热时间常数 Thermal Time Constant	在零功率条件下，当热敏电阻的环境温度发生急剧变化时，热敏电阻元件产生最初温度 T ₀ 与最终温度 T ₁ 两者温度差的 63.2% 的温度变化所需要的时间，通常以秒(S)表示。 The total time for the temperature of the thermistor to change by 63.2% of the difference from ambient temperature T ₀ (°C) to T ₁ (°C) by the drastic change of the power applied to thermistor from Non-zero Power to Zero-Power state, normally expressed in second(S). 

4	耗散系数 Dissipation Factor	在一定环境温度下，NTC 热敏电阻通过自身发热使其温度升高 1℃时所需要的功率，通常以 mW/℃表示。可由下面公式计算： The required power which makes the NTC thermistor body temperature raise 1℃ through self-heated, normally expressed in milliwatts per degree Celsius (mW/℃). It can be calculated by the following formula: $\delta = \frac{W}{T-T_0}$
5	额定功率 Rated Power	在环境温度 25℃下因自身发热使表面温度升高 100℃所需要的功率。 The necessary electric power makes thermistor's temperature rise 100℃ by self-heating at ambient temperature 25℃.
6	允许工作电流 Permissible operating current	在静止空气中通过自身发热使其升温为 1℃的电流。 The current that keep body temperature of chip NTC on the PC board in still air rising 1℃ by self-heating.

6 信赖性试验 Reliability Test

项目 Items	测试标准 Standard	测试方法及备注 Test Methods and Remarks	要求 Requirements																				
端头附着力 Terminal Strength	IEC 60068-2-21	① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板），按箭头所示方向施加作用力； Solder the chip to the testing jig (glass epoxy board shown in the right) using eutectic solder. Then apply a force in the direction of the arrow. ② 0201、0402 和 0603 系列施加 5N 的作用力，0805 系列产品施加 10N 的作用力； 5N force for 0201, 0402 and 0603 series, 10N force for 0805 series. ③ 保持时间 Duration: 10±1s	端电极无脱落且瓷体无损伤。 No removal or split of the termination or other defects shall occur. 																				
抗弯强度 Resistance to Flexure	IEC 60068-2-21	① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板），按下图箭头所示方向施加作用力； Solder the chip to the test jig (glass epoxy board shown in the right) using a eutectic solder. Then apply a force in the direction shown as follow; ② 弯曲变形量 Flexure 0201: 1mm 0402, 0603, 0805: 2mm ③ 施压速度 Pressurizing Speed: <0.5mm/s; ④ 保持时间 Duration: 10s 	① 无外观损伤。 No visible damage. ② 试验前后 R25 的变化率: ±5% 以内； R25 variation: within ±5% 单位 unit: mm <table border="1" data-bbox="1101 1366 1484 1612"> <thead> <tr> <th>类型 Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>0.25</td> <td>0.3</td> <td>0.3</td> </tr> <tr> <td>0402</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>0603</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>0805</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> </tbody> </table> 	类型 Type	a	b	c	0201	0.25	0.3	0.3	0402	0.4	1.5	0.5	0603	1.0	3.0	1.2	0805	1.2	4.0	1.65
类型 Type	a	b	c																				
0201	0.25	0.3	0.3																				
0402	0.4	1.5	0.5																				
0603	1.0	3.0	1.2																				
0805	1.2	4.0	1.65																				

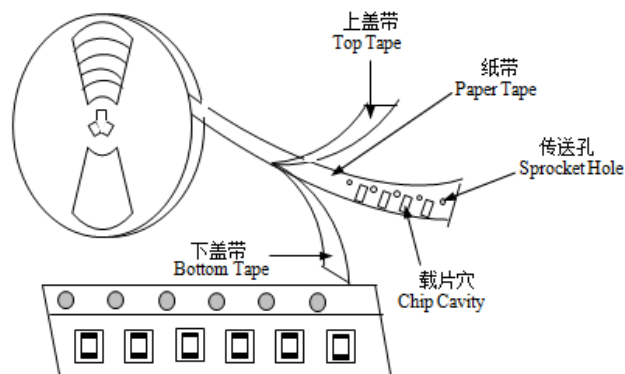
振动 Vibration	IEC 60068-2-80	① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）； Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder. ② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ~ 55 Hz； The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz. ③ 振动频率按 10Hz→55Hz→10Hz 循环，周期为 1 分钟，在空间三个互相垂直的方向上各振动 2 小时（共 6 小时）。 The frequency ranges from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).	无外观损伤。 No visible damage. 															
坠落 Dropping	IEC 60068-2-32	从 1m 的高度让晶片自由坠落到水泥地面 10 次。 Drop a chip 10 times on a concrete floor from a height of 1 meter.	无外观损伤。 No visible damage.															
可焊性 Solderability	IEC 60068-2-58	① 焊接温度 Solder temperature: 245±5℃. ② 浸渍时间 Duration: 3±0.3s. ③ 焊锡成分 Solder: Sn/3.0Ag/0.5Cu. ④ 助焊剂 Flux: (重量比) 25% 松香和 75% 酒精 25% Resin and 75% ethanol in weight.	① 无外观损伤； No visible damage. ② 元件端电极的焊锡覆盖率不小于 95%。 Wetting shall exceed 95% coverage.															
耐焊性 Resistance to Soldering Heat	IEC 60068-2-58	① 焊接温度 Solder temperature: 260±5℃. ② 浸渍时间 Duration: 10±1s. ③ 焊锡成分 Solder: Sn/3.0Ag/0.5Cu. ④ 助焊剂 Flux: (重量比) 25% 松香和 75% 酒精 25% Resin and 75% ethanol in weight. ⑤ 试验后标准条件下放置 1~2 小时后测量。 The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① 无外观损伤； No visible damage. ② 试验前后 R25 的变化率：±3% 以内； R25 variation: within ±3% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±2%															
温度周期 Temperature cycling	IEC 60068-2-14	① 无负载于下表所示的环境条件下重复 5 次。 5 cycles of following sequence without loading. <table border="1" data-bbox="475 1406 1023 1597"> <thead> <tr> <th>步骤 Step</th> <th>温度 Temperature</th> <th>时间 Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40±5℃</td> <td>30±3min</td> </tr> <tr> <td>2</td> <td>25±2℃</td> <td>5±3min</td> </tr> <tr> <td>3</td> <td>125±2℃</td> <td>30±3min</td> </tr> <tr> <td>4</td> <td>25±2℃</td> <td>5±3min</td> </tr> </tbody> </table> ② 试验后标准条件下放置 1~2 小时后测量。 The chip shall be stabilized at normal condition for 1~2 hours before measuring.	步骤 Step	温度 Temperature	时间 Time	1	-40±5℃	30±3min	2	25±2℃	5±3min	3	125±2℃	30±3min	4	25±2℃	5±3min	① 无外观损伤； No visible damage. ② 试验前后 R25 的变化率：±3% 以内； R25 variation: within ±3% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±2%
步骤 Step	温度 Temperature	时间 Time																
1	-40±5℃	30±3min																
2	25±2℃	5±3min																
3	125±2℃	30±3min																
4	25±2℃	5±3min																
高温存放 Resistance to dry heat	IEC 60068-2-2	① 在 125±5℃ 空气中，无负载放置 1000±24 小时。 125±5℃ in air, for 1000±24 hours without loading. ② 试验后标准条件下放置 1~2 小时后测量。 The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① 无外观损伤； No visible damage. ② 试验前后 R25 的变化率：±5% 以内； R25 variation: within ±5% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±2%															

低温存放 Resistance to cold	IEC 60068-2-1	① 在 $-40\pm 3^{\circ}\text{C}$ 空气中, 无负载放置 1000 ± 24 小时。 $-40\pm 3^{\circ}\text{C}$ in air, for 1000 ± 24 hours without loading. ② 试验后标准条件下放置 1~2 小时后测量。 The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① 无外观损伤; No visible damage. ② 试验前后 R25 的变化率: $\pm 5\%$ 以内; R25 variation: within $\pm 5\%$ ③ 试验前后 B 值的变化率: $\pm 2\%$ 以内。 B constant variation: within $\pm 2\%$
湿热存放 Resistance to damp heat	IEC 60068-2-78	① 在 $40\pm 2^{\circ}\text{C}$, 相对湿度 90~95% 空气中, 无负载放置 1000 ± 24 小时。 $40\pm 2^{\circ}\text{C}$, 90~95% RH in air, for 1000 ± 24 hours without loading. ② 试验后标准条件下放置 1~2 小时后测量。 The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① 无外观损伤; No visible damage. ② 试验前后 R25 的变化率: $\pm 3\%$ 以内; R25 variation: within $\pm 3\%$ ③ 试验前后 B 值的变化率: $\pm 2\%$ 以内。 B constant variation: within $\pm 2\%$
高温负荷 Resistance to high temperature load	IEC 60539-1 5.25.4	① 在 $85\pm 2^{\circ}\text{C}$ 空气中, 施加允许工作电流 1000 ± 48 小时。 $85\pm 2^{\circ}\text{C}$ in air with permissive operating current for 1000 ± 48 hours ② 试验后标准条件下放置 1~2 小时后测量。 The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① 无外观损伤; No visible damage. ② 试验前后 R25 的变化率: $\pm 5\%$ 以内; R25 variation: within $\pm 5\%$ ③ 试验前后 B 值的变化率: $\pm 2\%$ 以内。 B constant variation: within $\pm 2\%$

7 编带 Taping

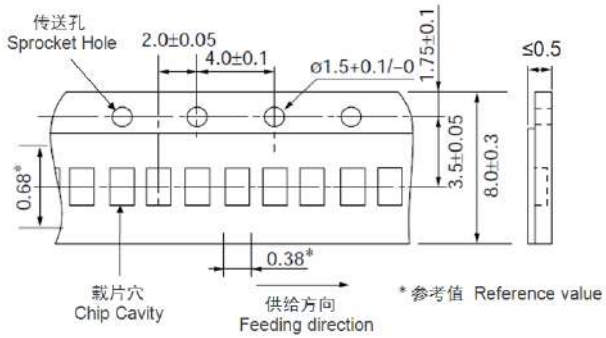
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5 ± 0.15	0.5 ± 0.15	0.8 ± 0.15	0.85 ± 0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

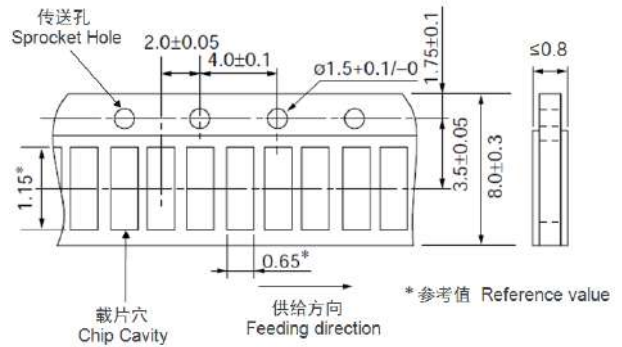


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit: mm)

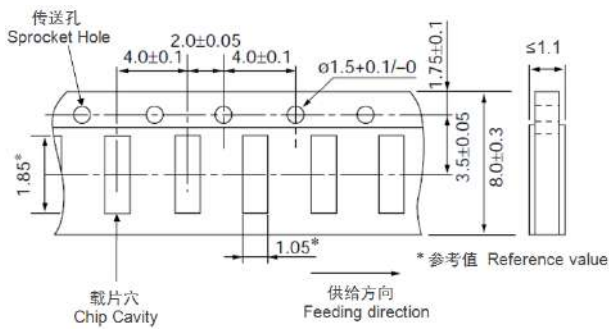
QN0201 系列 QN0201 series



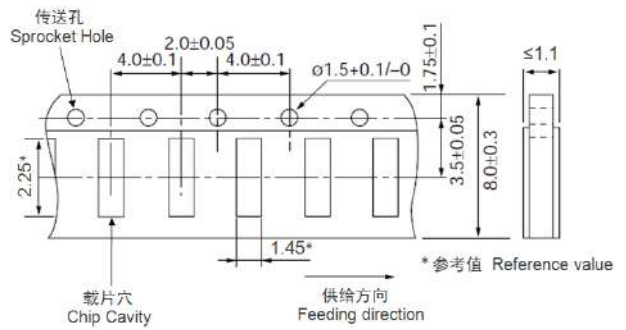
QN0402 系列 QN0402 series



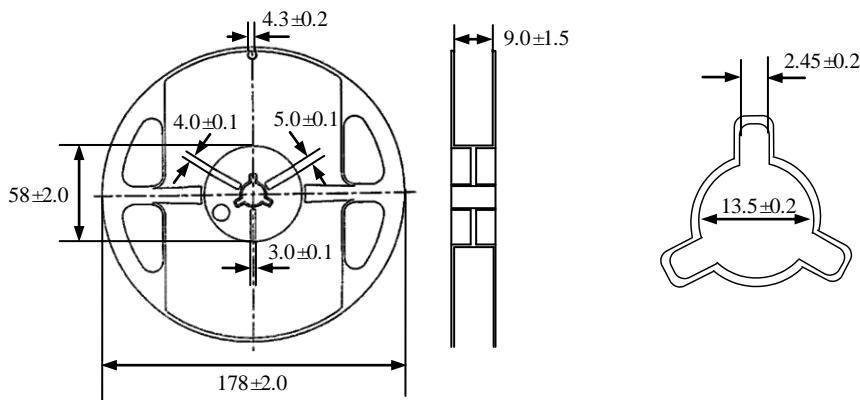
QN0603 系列 QN0603 series



QN0805 系列 QN0805 series



(3) 卷盘尺寸 Reel Dimensions (单位 Unit: mm)



8 储存

- 储存条件

- a. 储存温度: $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$
- b. 相对湿度: $\leq 75\% \text{RH}$
- c. 避免接触粉尘、腐蚀性气氛和阳光

- 储存期限: 6 个月

9 注意事项

- QN 系列热敏电阻不可在以下条件下工作或储存:

- (1) 腐蚀性气体或还原性气体
(氯气、硫化氢气体、氨气、硫酸气体、一氧化氮等)。
- (2) 挥发性或易燃性气体
- (3) 多尘条件
- (4) 高压或低压条件
- (5) 潮湿场所
- (6) 存在盐水、油、化学液体或有机溶剂的场所
- (7) 强烈振动
- (8) 存在类似有害条件的其他场所

- QN 系列热敏电阻的陶瓷属于易碎材料, 使用时不可施加过大压力或冲击。

- QN 系列热敏电阻不可在超过目录规定的温度范围情况下工作。

8 Storage

- Storage Conditions

- a. Storage Temperature: $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$
- b. Relative Humidity: $\leq 75\% \text{RH}$
- c. Keep away from corrosive atmosphere and sunlight.

- Period of Storage: 6 Months

9 Notes & Warnings

- The QN series thermistors shall not be operated and stored under the following environmental condition:

- (1) Corrosive or deoxidized atmospheres
(such as chlorine, sulfurated hydrogen, ammonia, sulfuric acid, nitric oxide and so on)
- (2) Volatile or inflammable atmospheres
- (3) Dusty condition
- (4) Excessive high or low pressure condition
- (5) Humid site
- (6) Places with brine, oil, chemical liquid or organic solvent
- (7) Intense vibration
- (8) Places with analogously deleterious conditions

- The ceramic body of the QN series thermistors is fragile, no excessive pressure or impact shall be exerted on it.

- The QN series thermistors shall not be operated beyond the specified "Operating Temperature Range" in the catalog.

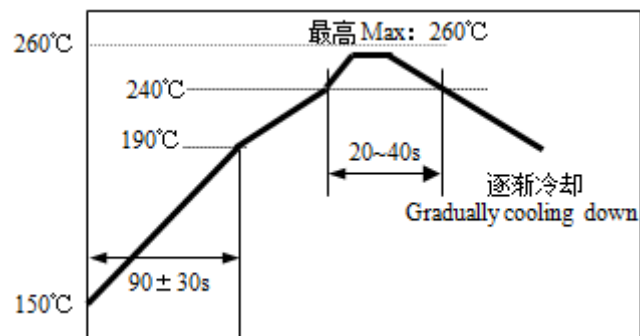
10 建议焊接条件

• 回流焊

- 温升 1~2°C/sec.
- 预热: 150~190°C/90±30 sec.
- 大于 240°C时间: 20~40sec
- 峰值温度: 最高 260°C/10 sec.
- 焊锡: Sn/3.0Ag/0.5Cu
- 回流焊: 最多 2 次

10 Recommended Soldering Technologies• **Re-flowing Profile**

- 1~2°C/sec. Ramp
- Pre-heating: 150~190°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing.



• 手工焊

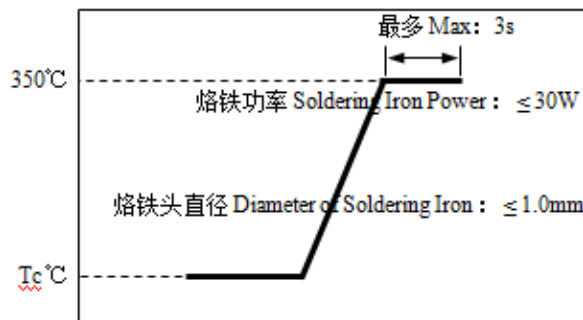
- 烙铁功率: 最大 30W
- 预热: 150°C/60sec.
- 烙铁头温度: 最高 350°C
- 焊接时间: 最多 3sec.
- 焊锡: Sn/3.0Ag/0.5Cu
- 手工焊: 最多 1 次

• **Iron Soldering Profile**

- Iron soldering power: Max.30W
- Pre-heating: 150°C/60sec.
- Soldering Tip temperature: 350°C Max.
- Soldering time: 3 sec Max.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.1 times for iron soldering

[注: 不要使烙铁头接触到端头]

[Note: Take care not to apply the tip of the soldering iron to the terminal electrodes.]



11 R-T 表 R-T table

QN0603X683F4150FB

温度 Temp. (°C)	R 最小值 R_Min (Kohm)	R 中心值 R_Cent (Kohm)	R 最大值 R_Max (Kohm)	阻值公差 Res TOL.	温度公差 Temp. TOL.(°C)
-40	2,609.784	2,735.359	2,866.691	4.80%	0.66
-39	2,429.333	2,544.384	2,664.617	4.73%	0.66
-38	2,262.738	2,368.199	2,478.328	4.65%	0.65
-37	2,108.836	2,205.554	2,306.477	4.58%	0.65
-36	1,966.570	2,055.313	2,147.845	4.50%	0.64
-35	1,854.835	1,937.391	2,023.418	4.44%	0.64
-34	1,731.335	1,807.135	1,886.066	4.37%	0.63
-33	1,616.985	1,686.614	1,759.066	4.30%	0.62
-32	1,511.043	1,575.033	1,641.567	4.22%	0.62
-31	1,412.833	1,471.664	1,532.792	4.15%	0.61
-30	1,334.572	1,389.345	1,446.220	4.09%	0.61
-29	1,248.936	1,299.323	1,351.607	4.02%	0.60
-28	1,169.427	1,215.798	1,263.882	3.95%	0.60
-27	1,095.566	1,138.257	1,182.495	3.89%	0.59
-26	1,026.911	1,066.230	1,106.944	3.82%	0.59
-25	971.387	1,008.014	1,045.918	3.76%	0.58
-24	911.271	945.022	979.924	3.69%	0.57
-23	855.312	886.423	918.573	3.63%	0.57
-22	803.195	831.881	861.506	3.56%	0.56
-21	754.630	781.089	808.395	3.50%	0.56
-20	714.340	738.978	764.388	3.44%	0.55
-19	671.683	694.417	717.848	3.37%	0.54
-18	631.877	652.861	674.474	3.31%	0.54
-17	594.714	614.088	634.029	3.25%	0.53
-16	560.001	577.893	596.296	3.18%	0.53
-15	530.794	547.456	564.584	3.13%	0.52
-14	500.187	515.579	531.391	3.07%	0.51
-13	471.560	485.782	500.382	3.01%	0.51
-12	444.772	457.916	471.400	2.94%	0.50
-11	419.694	431.842	444.298	2.88%	0.49
-10	398.287	409.600	421.192	2.83%	0.49
-9	376.096	386.554	397.264	2.77%	0.48
-8	355.295	364.965	374.860	2.71%	0.47
-7	335.787	344.730	353.875	2.65%	0.47
-6	317.485	325.756	334.208	2.59%	0.46
-5	301.523	309.217	317.075	2.54%	0.45
-4	285.283	292.399	299.662	2.48%	0.45
-3	270.028	276.610	283.323	2.43%	0.44

-2	255.693	261.781	267.987	2.37%	0.43
-1	242.216	247.847	253.584	2.31%	0.42
0	230.370	235.606	240.938	2.26%	0.42
1	218.365	223.208	228.136	2.21%	0.41
2	207.067	211.546	216.100	2.15%	0.40
3	196.428	200.570	204.779	2.10%	0.40
4	186.407	190.237	194.127	2.04%	0.39
5	177.425	180.980	184.588	1.99%	0.38
6	168.476	171.762	175.095	1.94%	0.37
7	160.038	163.075	166.153	1.89%	0.36
8	152.078	154.884	157.726	1.83%	0.36
9	144.566	147.158	149.782	1.78%	0.35
10	137.738	140.139	142.568	1.73%	0.34
11	131.011	133.227	135.467	1.68%	0.33
12	124.655	126.700	128.766	1.63%	0.33
13	118.649	120.536	122.440	1.58%	0.32
14	112.972	114.711	116.466	1.53%	0.31
15	107.737	109.344	110.963	1.48%	0.30
16	102.638	104.117	105.608	1.43%	0.29
17	97.813	99.174	100.545	1.38%	0.29
18	93.245	94.498	95.757	1.33%	0.28
19	88.920	90.071	91.228	1.28%	0.27
20	84.871	85.929	86.991	1.24%	0.26
21	80.977	81.948	82.922	1.19%	0.25
22	77.286	78.176	79.068	1.14%	0.24
23	73.787	74.602	75.418	1.09%	0.23
24	70.469	71.213	71.959	1.05%	0.23
25	67.320	68.000	68.680	1.00%	0.22
26	64.265	64.944	65.624	1.05%	0.23
27	61.368	62.045	62.723	1.09%	0.24
28	58.619	59.293	59.968	1.14%	0.25
29	56.011	56.680	57.351	1.18%	0.26
30	53.503	54.167	54.833	1.23%	0.27
31	51.147	51.805	52.465	1.28%	0.29
32	48.909	49.560	50.214	1.32%	0.30
33	46.783	47.426	48.073	1.36%	0.31
34	44.762	45.397	46.037	1.41%	0.32
35	42.794	43.421	44.052	1.45%	0.34
36	40.964	41.582	42.205	1.50%	0.35
37	39.224	39.833	40.447	1.54%	0.36
38	37.568	38.167	38.772	1.58%	0.37
39	35.992	36.582	37.177	1.63%	0.38

40	34.436	35.016	35.601	1.67%	0.40
41	33.006	33.576	34.152	1.72%	0.41
42	31.644	32.204	32.770	1.76%	0.42
43	30.346	30.896	31.452	1.80%	0.44
44	29.109	29.648	30.194	1.84%	0.45
45	27.877	28.406	28.941	1.89%	0.46
46	26.752	27.271	27.796	1.93%	0.47
47	25.680	26.188	26.703	1.97%	0.49
48	24.656	25.154	25.660	2.01%	0.50
49	23.680	24.168	24.663	2.05%	0.51
50	22.688	23.166	23.651	2.09%	0.53
51	21.799	22.266	22.741	2.13%	0.54
52	20.949	21.406	21.872	2.17%	0.55
53	20.137	20.585	21.040	2.21%	0.57
54	19.361	19.799	20.246	2.25%	0.58
55	18.568	18.997	19.433	2.30%	0.59
56	17.860	18.279	18.706	2.34%	0.61
57	17.183	17.593	18.011	2.37%	0.62
58	16.535	16.936	17.345	2.41%	0.64
59	15.916	16.308	16.708	2.45%	0.65
60	15.274	15.657	16.047	2.49%	0.66
61	14.708	15.082	15.464	2.53%	0.68
62	14.165	14.531	14.904	2.57%	0.69
63	13.646	14.003	14.368	2.61%	0.71
64	13.148	13.497	13.855	2.65%	0.72
65	12.626	12.967	13.315	2.69%	0.74
66	12.170	12.503	12.844	2.73%	0.75
67	11.733	12.059	12.392	2.76%	0.77
68	11.314	11.632	11.958	2.80%	0.78
69	10.913	11.223	11.542	2.84%	0.79
70	10.491	10.794	11.104	2.88%	0.81
71	10.122	10.418	10.721	2.91%	0.82
72	9.768	10.057	10.354	2.95%	0.84
73	9.428	9.711	10.001	2.98%	0.85
74	9.103	9.379	9.662	3.02%	0.87
75	8.752	9.021	9.297	3.06%	0.88
76	8.452	8.715	8.985	3.10%	0.90
77	8.164	8.421	8.685	3.13%	0.92
78	7.888	8.139	8.396	3.17%	0.93
79	7.622	7.867	8.119	3.20%	0.95
80	7.336	7.575	7.820	3.24%	0.96
81	7.092	7.325	7.565	3.28%	0.98

82	6.856	7.084	7.319	3.31%	0.99
83	6.630	6.853	7.082	3.34%	1.01
84	6.413	6.630	6.854	3.38%	1.03
85	6.176	6.387	6.605	3.42%	1.04
86	5.975	6.182	6.395	3.45%	1.06
87	5.782	5.984	6.192	3.48%	1.07
88	5.596	5.793	5.997	3.52%	1.09
89	5.417	5.610	5.809	3.55%	1.11
90	5.219	5.407	5.601	3.59%	1.12
91	5.054	5.237	5.427	3.62%	1.14
92	4.894	5.074	5.259	3.66%	1.16
93	4.741	4.916	5.098	3.69%	1.17
94	4.593	4.765	4.942	3.72%	1.19
95	4.431	4.598	4.771	3.76%	1.21
96	4.294	4.457	4.626	3.79%	1.22
97	4.162	4.321	4.487	3.82%	1.24
98	4.035	4.191	4.352	3.85%	1.26
99	3.912	4.064	4.222	3.89%	1.27
100	3.773	3.922	4.075	3.92%	1.29
101	3.659	3.805	3.955	3.95%	1.31
102	3.550	3.692	3.839	3.99%	1.33
103	3.444	3.582	3.726	4.02%	1.34
104	3.341	3.477	3.618	4.05%	1.36
105	3.227	3.359	3.496	4.08%	1.38
106	3.132	3.261	3.395	4.11%	1.40
107	3.040	3.167	3.298	4.15%	1.41
108	2.952	3.075	3.204	4.18%	1.43
109	2.866	2.987	3.113	4.21%	1.45
110	2.769	2.887	3.009	4.24%	1.47
111	2.690	2.805	2.925	4.27%	1.48
112	2.613	2.725	2.843	4.30%	1.50
113	2.538	2.649	2.763	4.33%	1.52
114	2.467	2.575	2.687	4.36%	1.54
115	2.384	2.489	2.599	4.40%	1.56
116	2.317	2.420	2.527	4.43%	1.58
117	2.253	2.353	2.458	4.46%	1.59
118	2.190	2.289	2.391	4.48%	1.61
119	2.130	2.226	2.327	4.51%	1.63
120	2.061	2.155	2.253	4.55%	1.65
121	2.005	2.097	2.193	4.58%	1.67
122	1.950	2.040	2.134	4.60%	1.69
123	1.897	1.985	2.077	4.63%	1.71

124	1.846	1.932	2.022	4.66%	1.73
125	1.786	1.870	1.958	4.70%	1.74