

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

恭成料号 (QAMCN Part Number) : QN0603X104J4250HB

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

恭成科技有限公司

Quest for Advanced Materials Electronics Co., Ltd.

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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

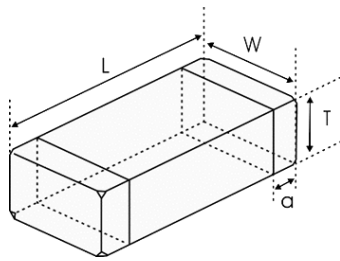


图 1 Fig.1

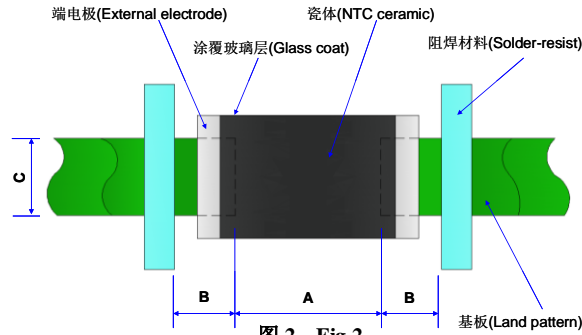


图 2 Fig.2

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)

QN 0603 X 104 J 4250 H B
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① 类别 Type	
QN	片式 NTC 热敏电阻器 Chip NTC Thermistor
② 外形尺寸(mm) External Dimensions (L×W×T)	
0201[0603]	0.60×0.30×0.30
0402[1005]	1.00×0.50×0.50
0603[1608]	1.60×0.80×0.80
0805[2012]	2.00×1.25×0.85
1206[3216]	3.20×1.60×0.85
③ 分隔符 Delimiter	
	X

④ 25℃的零功率电阻 Nominal Zero-Power Resistance	
472	4.7kΩ
683	68kΩ
104	100kΩ

⑤ 电阻值公差 Tolerance of Resistance	
F	±1%
G	±2%
H	±3%
J	±5%

⑥ B 值常数 B Constant	
3600	3600K
3950	3950K
4250	4250K

⑦ B 值公差 Tolerance of B Constant	
F	±1%
H	±3%

⑧ B 值计算方式 B constant calculation method	
A	25℃ & 85℃
B	25℃ & 50℃

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 (℃)
QN0603X104J4250HB	100±5%	4250±3%	4310	0.10	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：

- a. 环境温度：20±5℃；
- b. 相对湿度：65±20%；
- c. 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：

- a. 环境温度：25±2℃；
- b. 相对湿度：65±5%
- c. 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:

- a. Ambient Temperature: 20±5℃
- b. Relative Humidity: 65±20%
- c. Air Pressure: 86kPa to 106kPa

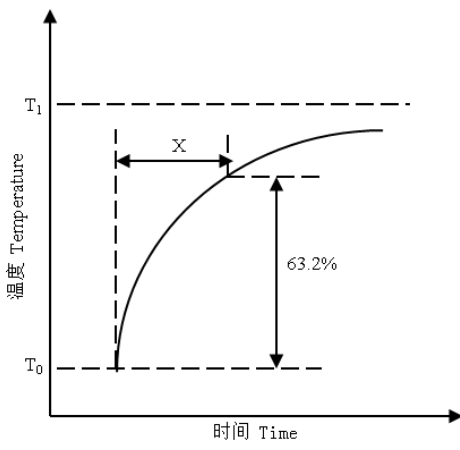
If any doubt on the results, measurements/tests should be made within the following limits:

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

Inspection Equipment

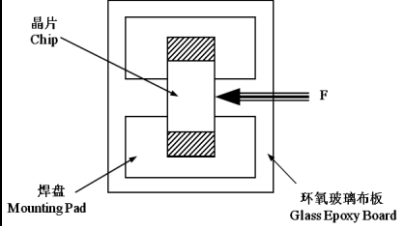
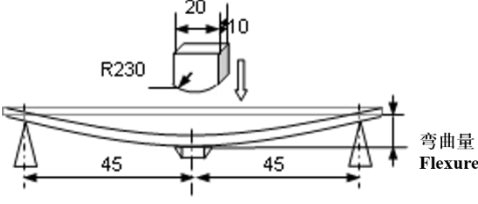
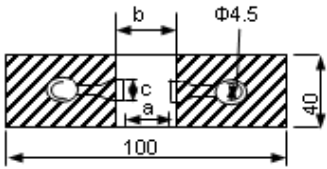
Visual Examination: 20× magnifier
Resistance value test: Thermistor resistance tester

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 T0 与最终温度 T1 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	<p>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.</p> <table border="1" data-bbox="497 1077 1034 1211"> <thead> <tr> <th>尺寸 Size</th> <th>F</th> <th>保持时间 Duration</th> </tr> </thead> <tbody> <tr> <td>0201, 0402, 0603</td> <td>5N</td> <td rowspan="2">10±1s</td> </tr> <tr> <td>0805</td> <td>10N</td> </tr> </tbody> </table>	尺寸 Size	F	保持时间 Duration	0201, 0402, 0603	5N	10±1s	0805	10N	<p>端电极无脱落且瓷体无损伤。 No removal or split of the termination or other defects shall occur.</p> 																						
尺寸 Size	F	保持时间 Duration																															
0201, 0402, 0603	5N	10±1s																															
0805	10N																																
抗弯强度 Resistance to Flexure	IEC 60068-2-21	<p>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;</p>  <table border="1" data-bbox="448 1765 1086 1982"> <thead> <tr> <th>尺寸 Size</th> <th>弯曲变形量 Flexure</th> <th>施压速度 Pressurizing Speed</th> <th>保持时间 Duration</th> </tr> </thead> <tbody> <tr> <td>0201,</td> <td>1mm</td> <td rowspan="2"><0.5mm/s</td> <td rowspan="2">10±1s</td> </tr> <tr> <td>0402, 0603, 0805</td> <td>2mm</td> </tr> </tbody> </table>	尺寸 Size	弯曲变形量 Flexure	施压速度 Pressurizing Speed	保持时间 Duration	0201,	1mm	<0.5mm/s	10±1s	0402, 0603, 0805	2mm	<p>① 无外观损伤。 No visible damage. ② $\Delta R_{25}/R_{25} \leq 5\%$</p> <p>单位 unit: mm</p> <table border="1" data-bbox="1157 1512 1517 1724"> <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
尺寸 Size	弯曲变形量 Flexure	施压速度 Pressurizing Speed	保持时间 Duration																														
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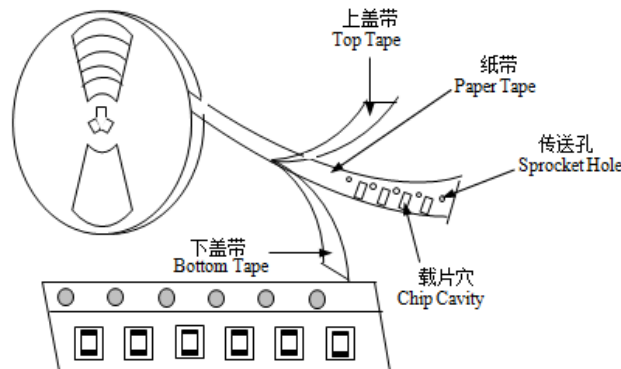
<p>振动 Vibration</p>	<p>IEC 60068-2-80</p>	<p>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）； Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.</p> <p>② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ~55 Hz； The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz.</p> <p>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).</p>	<p>无外观损伤。 No visible damage.</p>  <p>铜箔 Cu pad 阻焊膜 Solder mask 环氧玻璃布板 Glass Epoxy Board</p>															
<p>坠落 Dropping</p>	<p>IEC 60068-2-32</p>	<p>从 1m 的高度让晶片自由坠落至水泥地面 10 次。 Drop a chip 10 times on a concrete floor from a height of 1 meter.</p>	<p>无外观损伤。 No visible damage.</p>															
<p>可焊性 Solderability</p>	<p>IEC 60068-2-58</p>	<p>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.</p>	<p>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.</p>															
<p>耐焊性 Resistance to Soldering Heat</p>	<p>IEC 60068-2-58</p>	<p>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.</p>	<p>① 无外观损伤； No visible damage. ② $\Delta R_{25}/R_{25} \leq 5\%$ ③ $\Delta B/B \leq 2\%$</p>															
<p>温度周期 Temperature cycling</p>	<p>IEC 60068-2-14</p>	<p>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.</p> <table border="1" data-bbox="491 1429 1040 1624"> <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> <p>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.</p>	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	<p>① 无外观损伤； No visible damage. ② $\Delta R_{25}/R_{25} \leq 3\%$ ③ $\Delta B/B \leq 2\%$</p>
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																
<p>高温存放 Resistance to dry heat</p>	<p>IEC 60068-2-2</p>	<p>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.</p>	<p>① 无外观损伤； No visible damage. ② $\Delta R_{25}/R_{25} \leq 5\%$ ③ $\Delta B/B \leq 2\%$</p>															

低温存放 Resistance to cold	IEC 60068-2-1	① 在-40±3℃空气中，无负载放置 1000±24 小时。 -40±3℃ 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 $ \Delta R25/R25 \leq 5\%$ ③ $ \Delta B/B \leq 2\%$
湿热存放 Resistance to damp heat	IEC 60068-2-78	① 在 40±2℃，相对湿度 90~95% 空气中，无负载放置 1000±24 小时。 40±2℃, 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 $ \Delta R25/R25 \leq 3\%$ ③ $ \Delta B/B \leq 2\%$
高温负荷 Resistance to high temperature load	IEC 60539-1 5.25.4	① 在 85±2℃空气中，施加允许工作电流 1000±48 小时。 85±2℃ 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 $ \Delta R25/R25 \leq 5\%$ ③ $ \Delta B/B \leq 2\%$

7 编带 Taping

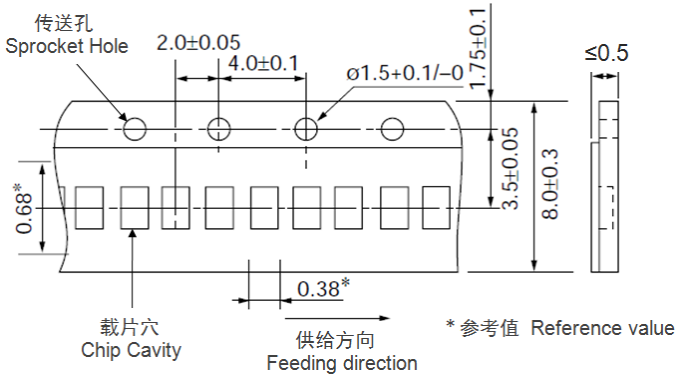
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

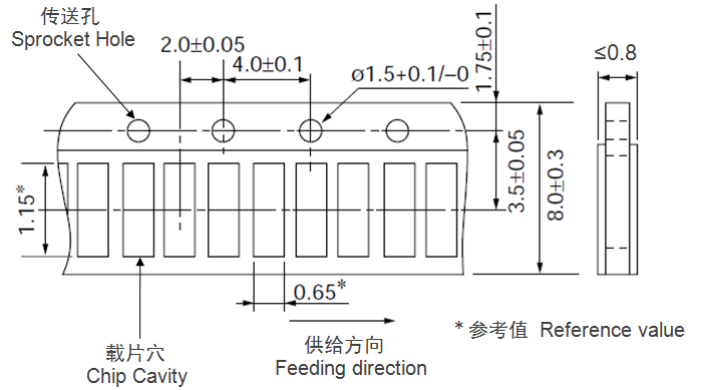


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit: mm)

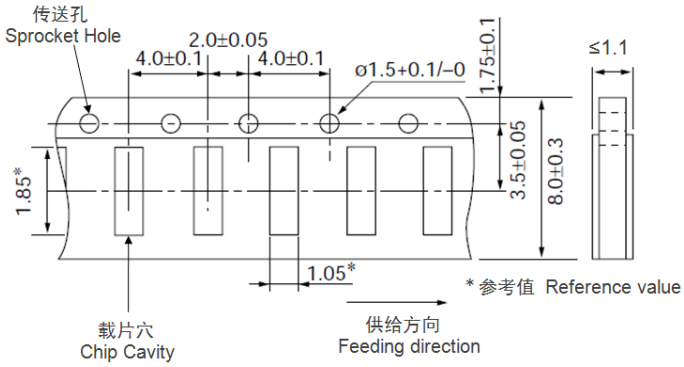
QN0201 系列 QN0201 series



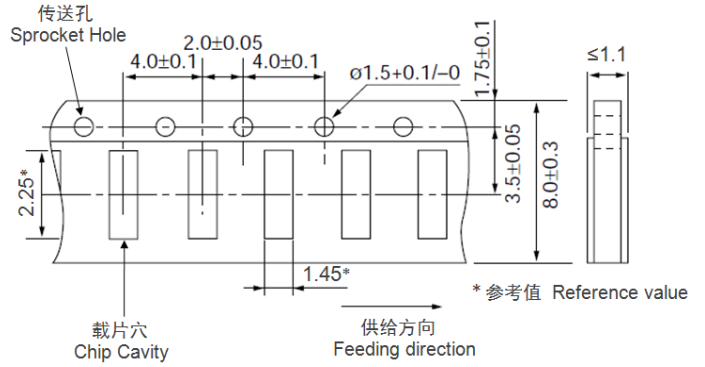
QN0402 系列 QN0402 series



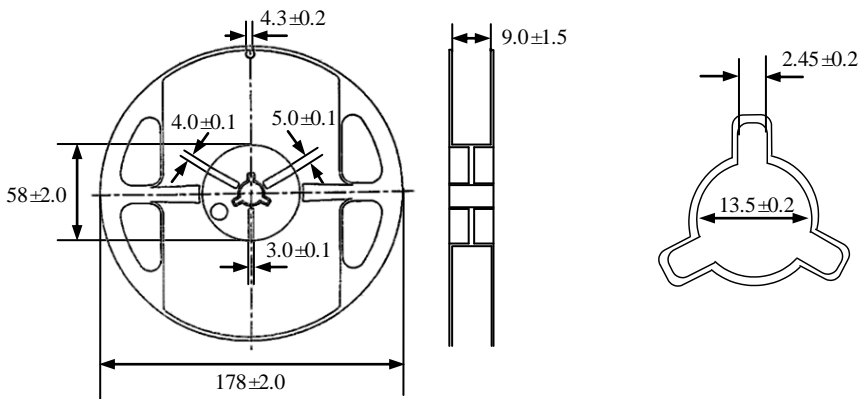
QN0603 系列 QN0603 series



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: $\leq 75\%RH$
 - c. 避免接触粉尘、腐蚀性气氛和阳光
- **储存期限: 产品交付后 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: $\cong 75\%RH$
 - c. Keep away from corrosive atmosphere and sunlight.
- **Period of Storage: 6 Months after delivery**

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) Excessively 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

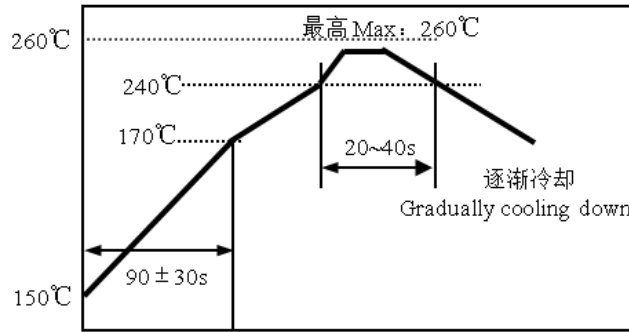
• **回流焊**

- 温升 1~2°C/sec.
- 预热: 150~170°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: 150~170°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**

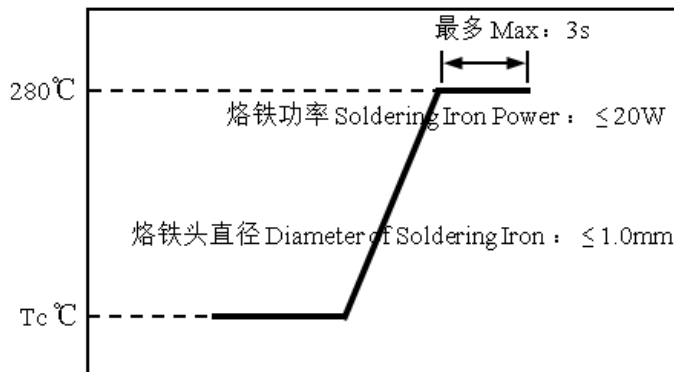
- 烙铁功率: 最大 20W
- 预热: 150°C/60sec.
- 烙铁头温度: 最高 280°C
- 焊接时间: 最多 3sec.
- 焊锡: Sn/3.0Ag/0.5Cu
- 手工焊: 最多 1 次

• **Iron Soldering Profile**

- Iron soldering power: Max.20W
- Pre-heating: 150°C/60sec.
- Soldering Tip temperature: 280°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

QN0603X104J4250HB

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	3,729.038	4,397.119	5,171.929	17.62%	2.37
-39	3,478.493	4,092.874	4,803.729	17.37%	2.35
-38	3,246.464	3,811.717	4,464.199	17.12%	2.34
-37	3,031.465	3,551.749	4,150.924	16.87%	2.32
-36	2,832.135	3,311.236	3,861.705	16.62%	2.30
-35	2,647.234	3,088.599	3,594.543	16.38%	2.29
-34	2,475.624	2,882.396	3,347.615	16.14%	2.27
-33	2,316.266	2,691.310	3,119.262	15.90%	2.26
-32	2,168.208	2,514.137	2,907.970	15.66%	2.24
-31	2,030.577	2,349.778	2,712.357	15.43%	2.22
-30	1,902.576	2,197.225	2,531.163	15.20%	2.21
-29	1,783.468	2,055.558	2,363.235	14.97%	2.19
-28	1,672.582	1,923.932	2,207.520	14.74%	2.17
-27	1,569.300	1,801.573	2,063.055	14.51%	2.16
-26	1,473.053	1,687.773	1,928.958	14.29%	2.14
-25	1,383.318	1,581.881	1,804.422	14.07%	2.12
-24	1,299.448	1,483.100	1,688.475	13.85%	2.10
-23	1,221.196	1,391.113	1,580.712	13.63%	2.08
-22	1,148.151	1,305.413	1,480.504	13.41%	2.07
-21	1,079.936	1,225.531	1,387.277	13.20%	2.05
-20	1,016.202	1,151.037	1,300.502	12.99%	2.03
-19	956.628	1,081.535	1,219.695	12.77%	2.01
-18	900.917	1,016.661	1,144.408	12.57%	1.99
-17	848.795	956.080	1,074.232	12.36%	1.98
-16	800.010	899.481	1,008.790	12.15%	1.96
-15	754.329	846.579	947.735	11.95%	1.94
-14	711.536	797.111	890.746	11.75%	1.92
-13	671.431	750.834	837.529	11.55%	1.90
-12	633.829	707.524	787.812	11.35%	1.88
-11	598.561	666.972	741.345	11.15%	1.86
-10	565.466	628.988	697.897	10.96%	1.84
-9	534.355	593.342	657.194	10.76%	1.82
-8	505.143	559.931	619.110	10.57%	1.80
-7	477.703	528.602	583.461	10.38%	1.78
-6	451.919	499.212	550.077	10.19%	1.76
-5	427.680	471.632	518.801	10.00%	1.74
-4	404.914	445.772	489.525	9.82%	1.72
-3	383.492	421.480	462.071	9.63%	1.70
-2	363.329	398.652	436.316	9.45%	1.68
-1	344.342	377.193	412.144	9.27%	1.66
0	326.457	357.012	389.450	9.09%	1.64
1	309.585	338.006	368.113	8.91%	1.61

2	293.683	320.122	348.068	8.73%	1.59
3	278.690	303.287	329.229	8.55%	1.57
4	264.548	287.434	311.518	8.38%	1.55
5	251.205	272.500	294.860	8.21%	1.53
6	238.611	258.426	279.188	8.03%	1.51
7	226.720	245.160	264.437	7.86%	1.48
8	215.488	232.649	250.548	7.69%	1.46
9	204.877	220.847	237.467	7.53%	1.44
10	194.847	209.710	225.142	7.36%	1.42
11	185.364	199.196	213.525	7.19%	1.39
12	176.396	189.268	202.572	7.03%	1.37
13	167.911	179.890	192.241	6.87%	1.35
14	159.881	171.028	182.493	6.70%	1.32
15	152.280	162.651	173.294	6.54%	1.30
16	145.078	154.726	164.604	6.38%	1.28
17	138.257	147.232	156.398	6.23%	1.25
18	131.794	140.142	148.646	6.07%	1.23
19	125.669	133.432	141.321	5.91%	1.21
20	119.861	127.080	134.397	5.76%	1.18
21	114.355	121.066	127.850	5.60%	1.16
22	109.131	115.368	121.657	5.45%	1.13
23	104.174	109.970	115.798	5.30%	1.11
24	99.468	104.852	110.251	5.15%	1.08
25	95.000	100.000	105.000	5.00%	1.06
26	90.500	95.398	100.310	5.15%	1.10
27	86.237	91.032	95.854	5.30%	1.13
28	82.197	86.889	91.619	5.44%	1.17
29	78.368	82.956	87.594	5.59%	1.21
30	74.736	79.222	83.766	5.74%	1.25
31	71.293	75.675	80.126	5.88%	1.29
32	68.026	72.306	76.663	6.03%	1.33
33	64.925	69.104	73.368	6.17%	1.37
34	61.982	66.061	70.232	6.31%	1.41
35	59.187	63.167	67.246	6.46%	1.45
36	56.533	60.415	64.402	6.60%	1.49
37	54.011	57.797	61.693	6.74%	1.53
38	51.615	55.306	59.112	6.88%	1.58
39	49.337	52.934	56.652	7.02%	1.62
40	47.171	50.677	54.307	7.16%	1.66
41	45.113	48.528	52.072	7.30%	1.70
42	43.155	46.482	49.941	7.44%	1.75
43	41.292	44.533	47.908	7.58%	1.79
44	39.518	42.675	45.968	7.72%	1.83
45	37.830	40.904	44.116	7.85%	1.88
46	36.221	39.213	42.347	7.99%	1.92
47	34.688	37.601	40.657	8.13%	1.96

48	33.227	36.063	39.043	8.26%	2.01
49	31.835	34.595	37.500	8.40%	2.05
50	30.509	33.195	36.027	8.53%	2.10
51	29.245	31.859	34.620	8.67%	2.14
52	28.040	30.584	33.275	8.80%	2.19
53	26.891	29.366	31.989	8.93%	2.23
54	25.794	28.203	30.759	9.06%	2.28
55	24.748	27.091	29.582	9.20%	2.32
56	23.748	26.028	28.456	9.33%	2.37
57	22.794	25.013	27.378	9.46%	2.42
58	21.883	24.042	26.347	9.59%	2.47
59	21.013	23.113	25.359	9.72%	2.51
60	20.182	22.224	24.413	9.85%	2.56
61	19.387	21.374	23.506	9.97%	2.61
62	18.627	20.561	22.638	10.10%	2.66
63	17.901	19.782	21.806	10.23%	2.70
64	17.207	19.036	21.008	10.36%	2.75
65	16.542	18.323	20.243	10.48%	2.80
66	15.908	17.640	19.512	10.61%	2.85
67	15.301	16.986	18.810	10.74%	2.90
68	14.720	16.360	18.137	10.86%	2.95
69	14.164	15.760	17.491	10.98%	3.00
70	13.632	15.184	16.871	11.11%	3.05
71	13.121	14.631	16.274	11.23%	3.10
72	12.631	14.101	15.702	11.36%	3.15
73	12.162	13.592	15.152	11.48%	3.21
74	11.712	13.104	14.624	11.60%	3.26
75	11.281	12.635	14.117	11.72%	3.31
76	10.869	12.187	13.631	11.84%	3.36
77	10.474	11.757	13.163	11.96%	3.41
78	10.095	11.344	12.714	12.08%	3.47
79	9.732	10.947	12.283	12.20%	3.52
80	9.383	10.566	11.868	12.32%	3.57
81	9.048	10.200	11.469	12.44%	3.63
82	8.727	9.848	11.085	12.56%	3.68
83	8.419	9.510	10.716	12.68%	3.73
84	8.123	9.185	10.360	12.80%	3.79
85	7.838	8.873	10.018	12.91%	3.84
86	7.565	8.572	9.689	13.03%	3.90
87	7.303	8.283	9.372	13.15%	3.95
88	7.050	8.006	9.067	13.26%	4.01
89	6.808	7.738	8.774	13.38%	4.06
90	6.575	7.481	8.491	13.49%	4.12
91	6.352	7.234	8.219	13.61%	4.18
92	6.137	6.997	7.957	13.72%	4.23
93	5.931	6.769	7.705	13.83%	4.29

94	5.732	6.548	7.462	13.95%	4.35
95	5.542	6.337	7.227	14.06%	4.41
96	5.357	6.132	7.001	14.17%	4.46
97	5.179	5.934	6.782	14.28%	4.52
98	5.008	5.744	6.571	14.40%	4.58
99	4.844	5.561	6.367	14.51%	4.64
100	4.685	5.384	6.171	14.62%	4.70
101	4.534	5.214	5.982	14.73%	4.76
102	4.387	5.051	5.800	14.84%	4.82
103	4.246	4.893	5.624	14.95%	4.88
104	4.110	4.741	5.455	15.06%	4.94
105	3.979	4.594	5.291	15.17%	5.00
106	3.853	4.453	5.133	15.27%	5.06
107	3.731	4.316	4.980	15.38%	5.12
108	3.614	4.184	4.832	15.49%	5.18
109	3.501	4.057	4.690	15.60%	5.24
110	3.392	3.934	4.552	15.70%	5.30
111	3.286	3.816	4.419	15.81%	5.36
112	3.185	3.701	4.290	15.91%	5.43
113	3.087	3.591	4.166	16.02%	5.49
114	2.992	3.484	4.045	16.13%	5.55
115	2.901	3.380	3.929	16.23%	5.61
116	2.813	3.281	3.817	16.33%	5.68
117	2.729	3.185	3.709	16.44%	5.74
118	2.647	3.093	3.604	16.54%	5.81
119	2.568	3.003	3.503	16.64%	5.87
120	2.492	2.916	3.405	16.75%	5.93
121	2.418	2.832	3.309	16.85%	6.00
122	2.346	2.751	3.217	16.95%	6.06
123	2.277	2.672	3.128	17.05%	6.13
124	2.210	2.596	3.041	17.16%	6.20
125	2.145	2.522	2.957	17.26%	6.26