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）: QN0603X104J3950HB

客户规格(Customer's Part Number):

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

恭成科技有限公司
Quest for Advanced Materials Electronics Co., Ltd.

营销中心：广东省深圳市龙华新区观澜银星科技大厦 518109
Marketing Center: Yinxing Technology Building, Guanlan, Longhua new district, Shenzhen 518109
电话 Tel: 0086-755-23732935 传真 Fax: 0086-755-23762516
制造中心：河北省唐山市曹妃甸工业区中日生态园 063200
Manufactory: Sino-Japan Eco-industrial park, Caofeidian industrial district, Tangshan, Hebei, China 063200
电话 Tel: 0086-315-7332530
网址 Website: https://www.qamcn.com 邮箱 E-Mail: qam@qamcn.com

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

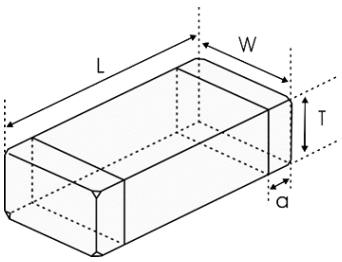


图 1 Fig.1

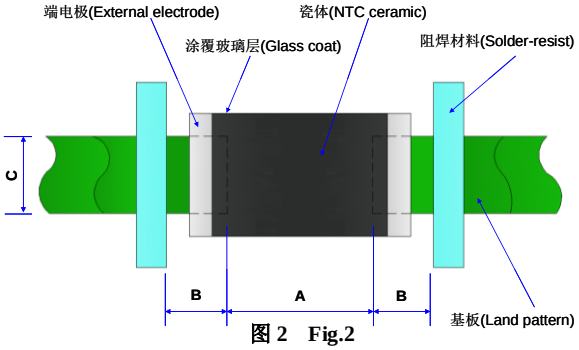


图 2 Fig.2

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	3950	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
4500	4500K

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 （℃）
QN0603X104J3950HB	100±5%	3950±3%	3987	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±15℃；

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±15℃

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%

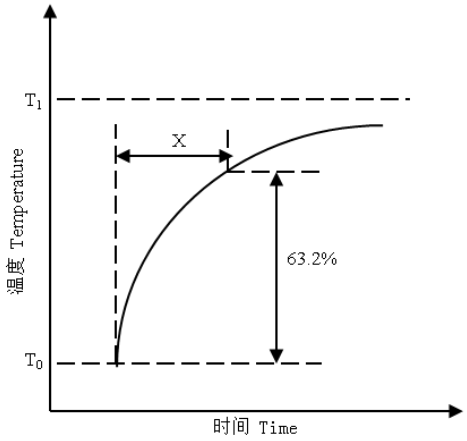
c. Air Pressure: 86kPa to 106kPa

▪ Inspection Equipment

Visual Examination: 20× magnifier

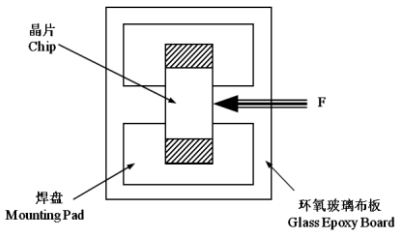
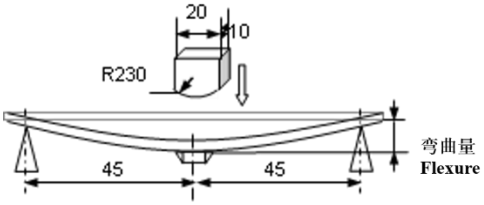
Resistance value test: Thermistor resistance tester

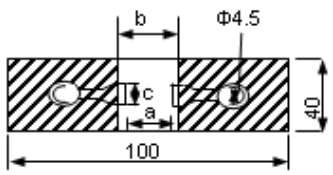
5 电性测试 Electrical Test

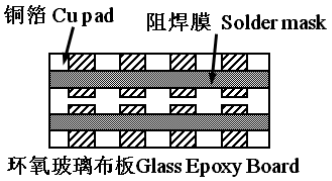
序号 No.	项目 Items	测试方法及备注 Test Methods and Remarks
1	25℃零功率电阻值 Nominal Zero-Power Resistance at 25℃(R25)	环境温度 Ambient temperature：25±0.05℃ 测试功率 Measuring electric power：≤0.1mW
2	B 值常数 Nominal B Constant	分别在环境温度 25±0.05℃， 50±0.05℃或 85±0.05℃下测量电阻值。 Measure the resistance at the ambient temperature of 25±0.05℃, 50±0.05℃ or 85±0.05℃. $B(25\text{-}50℃)=\frac{\ln R_{25}-\ln R_{50}}{1/T_{25}-1/T_{50}}$ $B(25\text{-}85℃)=\frac{\ln R_{25}-\ln R_{85}}{1/T_{25}-1/T_{85}}$ 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 (℃) to T_1 (℃) 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

<table>
<tr><th>项目
Items</th><th>测试标准
Standard</th><th>测试方法及备注
Test Methods and Remarks</th><th>要求
Requirements</th></tr>
<tr><td>端头附着力
Terminal Strength</td><td>IEC 60068-2-21</td><td>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.
<table>
<tr><th>尺寸 Size</th><th>F</th><th>保持时间 Duration</th></tr>
<tr><td>0201, 0402, 0603</td><td>5N</td><td rowspan="2">10±1s</td></tr>
<tr><td>0805</td><td>10N</td></tr>
</table>
</td><td>端电极无脱落且瓷体无损伤。
No removal or split of the termination or other defects shall occur.
 
</td></tr>
<tr><td>抗弯强度
Resistance to Flexure</td><td>IEC 60068-2-21</td><td>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;
 

<table>
<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>
<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>
</table>
</td><td>① 无外观损伤。
No visible damage.
② ｜ΔR25/R25｜≤5%
单位 unit：mm
<table>
<tr><th>类型 Type</th><th>a</th><th>b</th><th>c</th></tr>
<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>
</table>

</td></tr>
</table>

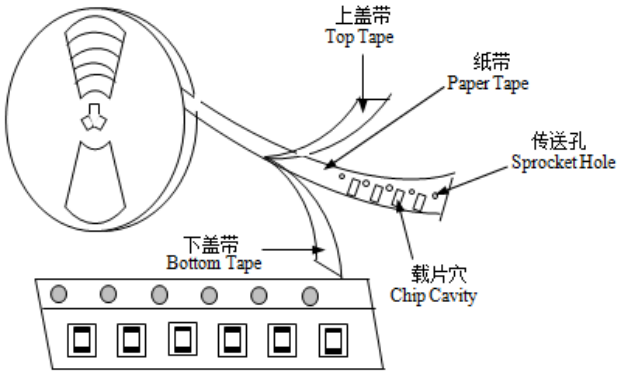
<table>
<tr>
<td>振动
Vibration</td>
<td>IEC 60068-2-80</td>
<td>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）；
Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.
② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ～55 Hz；
The chip shall be subjected to a simple harmonic motion having total amplitude 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 3mutually perpendicular directions (total of 6 hours).</td>
<td>无外观损伤。
No visible damage.
 
</td>
</tr>
<tr>
<td>坠落
Dropping</td>
<td>IEC 60068-2-32</td>
<td>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.</td>
<td>无外观损伤。
No visible damage.</td>
</tr>
<tr>
<td>可焊性
Solderability</td>
<td>IEC 60068-2-58</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>耐焊性
Resistance to Soldering Heat</td>
<td>IEC 60068-2-58</td>
<td>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.</td>
<td>① 无外观损伤；
No visible damage.
② ｜ΔR25/R25｜≤5%
③ ｜ΔB/B｜≤2%</td>
</tr>
<tr>
<td>温度周期
Temperature cycling</td>
<td>IEC 60068-2-14</td>
<td>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>
<tr><th>步骤 Step</th><th>温度 Temperature</th><th>时间 Time</th></tr>
<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>
</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.</td>
<td>① 无外观损伤；
No visible damage.
② ｜ΔR25/R25｜≤3%
③ ｜ΔB/B｜≤2%</td>
</tr>
<tr>
<td>高温存放
Resistance to dry heat</td>
<td>IEC 60068-2-2</td>
<td>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.</td>
<td>① 无外观损伤；
No visible damage.
② ｜ΔR25/R25｜≤5%
③ ｜ΔB/B｜≤2%</td>
</tr>
</table>

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 ｜ΔR25/R25｜≤5% ③ ｜ΔB/B｜≤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 ｜ΔR25/R25｜≤3% ③ ｜ΔB/B｜≤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 ｜ΔR25/R25｜≤5% ③ ｜ΔB/B｜≤2%

7 编带 Taping

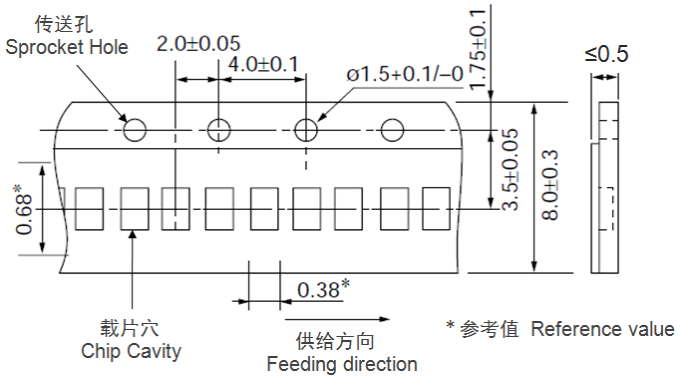
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

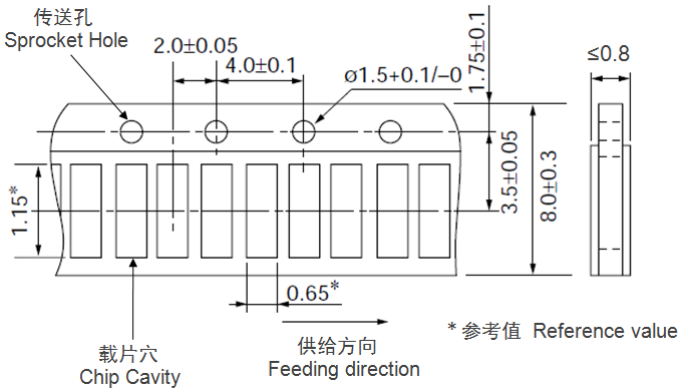


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit：mm)

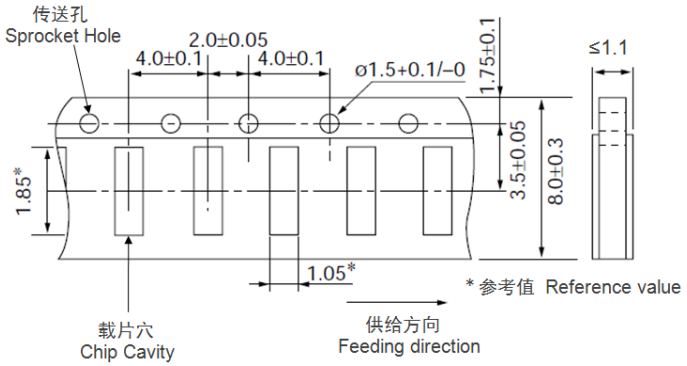
QN0201 系列 QN0201 series



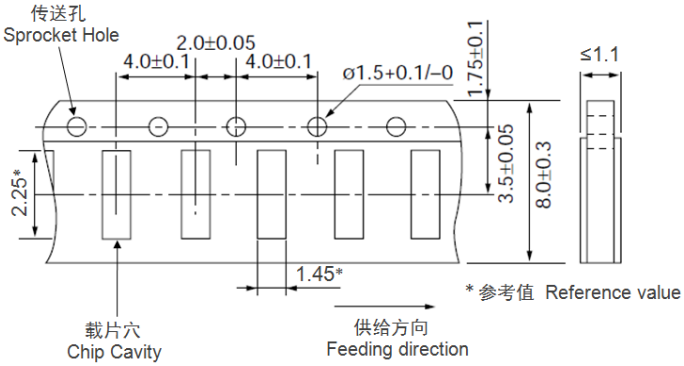
QN0402 系列 QN0402 series



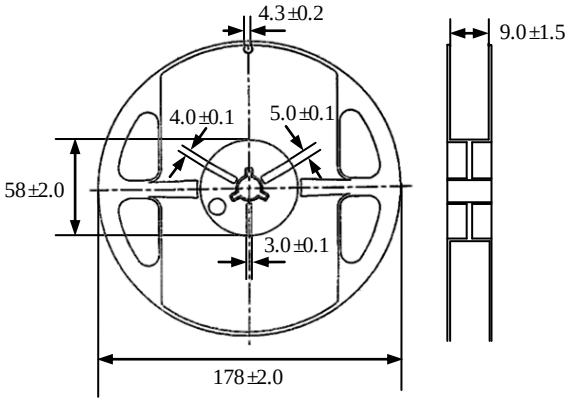
QN0603 系列 QN0603 series

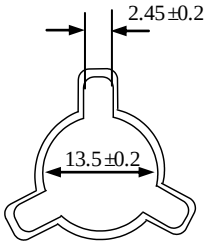


QN0805 系列 QN0805 series



(3) 卷盘尺寸 Reel Dimensions(单位 Unit：mm)





8 储存

- **储存条件**

  a. 储存温度：-10℃～40℃

  b. 相对湿度：≤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**

8 Storage

- **Storage Conditions**

  a. Storage Temperature: -10℃～40℃

  b. Relative Humidity: ≦75%RH

  c. Keep away from corrosive atmosphere and sunlight.

- **Period of Storage: 6 Months after delivery**

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。

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.

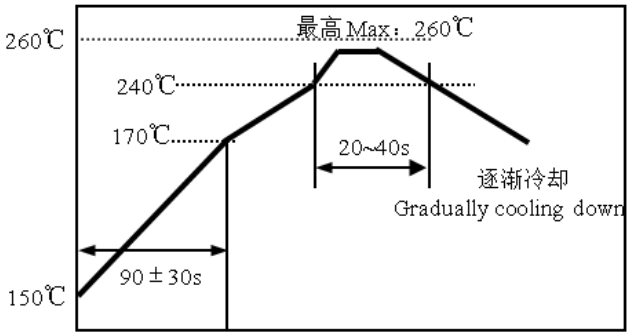
- The QN series thermistors shall not be operated beyond the specified “Operating Temperature Range” in the catalog.

10 建议焊接条件

- **回流焊**
  - 温升 1~2℃/sec.
  - 预热：150~170℃/90±30 sec.
  - 大于 240℃时间：20~40sec
  - 峰值温度：最高 260℃/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℃/sec. Ramp
  - Pre-heating: 150~170℃/90±30 sec.
  - Time above 240℃: 20~40 sec.
  - Peak temperature: 260℃Max./10 sec.
  - Solder paste: Sn/3.0Ag/0.5Cu
  - Max.2 times for re-flowing

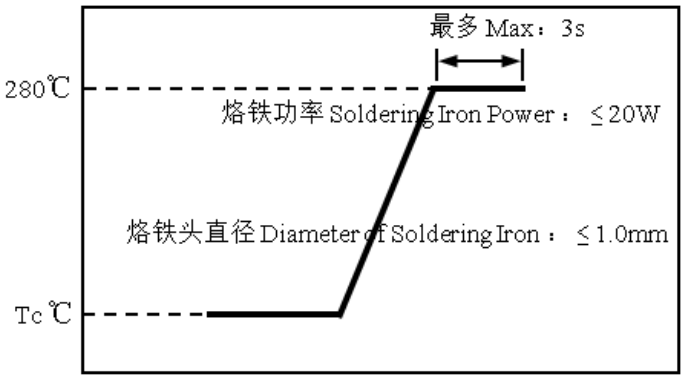


- **手工焊**
  - 烙铁功率：最大 20W
  - 预热：150℃/60sec.
  - 烙铁头温度：最高 280℃
  - 焊接时间：最多 3sec.
  - 焊锡：Sn/3.0Ag/0.5Cu
  - 手工焊：最多 1 次

[注：不要使烙铁头接触到端头]

- **Iron Soldering Profile**
  - Iron soldering power: Max.20W
  - Pre-heating: 150℃/60sec.
  - Soldering Tip temperature: 280℃Max.
  - Soldering time: 3 sec Max.
  - Solder paste: Sn/3.0Ag/0.5Cu
  - Max.1 times for iron soldering

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



11 R-T 表 R-T table

QN0603X104J3950HB

温度 Temp. (℃)	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.(℃)
-40	2,949.467	3,452.748	4,031.802	16.77%	2.41
-39	2,762.977	3,227.909	3,761.648	16.54%	2.39
-38	2,589.556	3,019.247	3,511.437	16.30%	2.38
-37	2,428.204	2,825.494	3,279.567	16.07%	2.36
-36	2,278.001	2,645.486	3,064.573	15.84%	2.35
-35	2,138.106	2,478.161	2,865.120	15.61%	2.33
-34	2,007.744	2,322.542	2,679.982	15.39%	2.32
-33	1,886.204	2,177.736	2,508.042	15.17%	2.30
-32	1,772.833	2,042.922	2,348.273	14.95%	2.28
-31	1,667.029	1,917.347	2,199.738	14.73%	2.27
-30	1,568.240	1,800.319	2,061.576	14.51%	2.25
-29	1,475.956	1,691.203	1,932.995	14.30%	2.24
-28	1,389.708	1,589.414	1,813.274	14.08%	2.22
-27	1,309.062	1,494.413	1,701.744	13.87%	2.20
-26	1,233.621	1,405.707	1,597.795	13.66%	2.19
-25	1,163.015	1,322.839	1,500.865	13.46%	2.17
-24	1,096.763	1,245.222	1,410.241	13.25%	2.15
-23	1,034.716	1,172.662	1,325.676	13.05%	2.13
-22	976.581	1,104.798	1,246.725	12.85%	2.12
-21	922.086	1,041.298	1,172.983	12.65%	2.10
-20	870.982	981.854	1,104.073	12.45%	2.08
-19	823.037	926.182	1,039.649	12.25%	2.06
-18	778.035	874.020	979.391	12.06%	2.05
-17	735.780	825.125	923.007	11.86%	2.03
-16	696.086	779.274	870.222	11.67%	2.01
-15	658.783	736.257	820.785	11.48%	1.99
-14	623.712	695.883	774.465	11.29%	1.97
-13	590.726	657.974	731.045	11.11%	1.95
-12	559.690	622.365	690.329	10.92%	1.94
-11	530.476	588.902	652.129	10.74%	1.92
-10	502.966	557.444	616.278	10.55%	1.90
-9	477.052	527.858	582.616	10.37%	1.88
-8	452.630	500.023	550.996	10.19%	1.86
-7	429.607	473.824	521.284	10.02%	1.84
-6	407.895	449.155	493.353	9.84%	1.82
-5	387.411	425.920	467.086	9.67%	1.80
-4	368.052	403.995	442.341	9.49%	1.78
-3	349.777	383.332	419.056	9.32%	1.76
-2	332.521	363.850	397.137	9.15%	1.74
-1	316.219	345.475	376.495	8.98%	1.72
0	300.815	328.139	357.049	8.81%	1.70
1	286.269	311.793	338.744	8.64%	1.68

2	272.511	296.357	321.484	8.48%	1.66
3	259.495	281.775	305.204	8.31%	1.64
4	247.177	267.995	289.841	8.15%	1.61
5	235.513	254.969	275.341	7.99%	1.59
6	224.448	242.628	261.624	7.83%	1.57
7	213.967	230.956	248.671	7.67%	1.55
8	204.038	219.915	236.436	7.51%	1.53
9	194.628	209.467	224.873	7.36%	1.51
10	185.707	199.576	213.944	7.20%	1.48
11	177.252	190.215	203.616	7.05%	1.46
12	169.231	181.348	193.846	6.89%	1.44
13	161.618	172.943	184.599	6.74%	1.42
14	154.391	164.976	175.846	6.59%	1.39
15	147.527	157.420	167.557	6.44%	1.37
16	141.005	150.250	159.702	6.29%	1.35
17	134.808	143.448	152.259	6.14%	1.33
18	128.918	136.991	145.205	6.00%	1.30
19	123.320	130.862	138.518	5.85%	1.28
20	117.995	125.041	132.176	5.71%	1.26
21	112.930	119.511	126.160	5.56%	1.23
22	108.111	114.257	120.451	5.42%	1.21
23	103.525	109.264	115.032	5.28%	1.18
24	99.158	104.515	109.887	5.14%	1.16
25	95.000	100.000	105.000	5.00%	1.14
26	90.799	95.704	100.622	5.14%	1.17
27	86.808	91.617	96.451	5.28%	1.21
28	83.013	87.726	92.475	5.41%	1.25
29	79.404	84.021	88.684	5.55%	1.29
30	75.972	80.493	85.070	5.69%	1.33
31	72.708	77.133	81.623	5.82%	1.37
32	69.602	73.932	78.335	5.96%	1.41
33	66.646	70.881	75.198	6.09%	1.45
34	63.831	67.973	72.203	6.22%	1.49
35	61.149	65.199	69.343	6.36%	1.54
36	58.595	62.554	66.612	6.49%	1.58
37	56.162	60.030	64.004	6.62%	1.62
38	53.842	57.621	61.511	6.75%	1.66
39	51.631	55.322	59.129	6.88%	1.70
40	49.522	53.127	56.852	7.01%	1.75
41	47.510	51.030	54.674	7.14%	1.79
42	45.591	49.028	52.592	7.27%	1.83
43	43.760	47.115	50.600	7.40%	1.88
44	42.011	45.285	48.693	7.53%	1.92
45	40.341	43.537	46.869	7.65%	1.96
46	38.748	41.867	45.124	7.78%	2.01
47	37.227	40.270	43.454	7.90%	2.05

48	35.773	38.743	41.854	8.03%	2.10
49	34.384	37.281	40.321	8.15%	2.14
50	33.056	35.882	38.852	8.28%	2.19
51	31.786	34.543	37.445	8.40%	2.23
52	30.571	33.260	36.096	8.53%	2.28
53	29.409	32.032	34.802	8.65%	2.33
54	28.297	30.856	33.562	8.77%	2.37
55	27.233	29.729	32.372	8.89%	2.42
56	26.214	28.649	31.231	9.01%	2.47
57	25.239	27.613	30.135	9.13%	2.51
58	24.305	26.620	29.084	9.25%	2.56
59	23.410	25.669	28.074	9.37%	2.61
60	22.553	24.755	27.105	9.49%	2.66
61	21.733	23.881	26.176	9.61%	2.71
62	20.947	23.042	25.283	9.73%	2.76
63	20.193	22.237	24.426	9.84%	2.81
64	19.471	21.464	23.602	9.96%	2.85
65	18.777	20.721	22.809	10.08%	2.90
66	18.111	20.007	22.046	10.19%	2.95
67	17.472	19.321	21.313	10.31%	3.00
68	16.858	18.661	20.607	10.42%	3.05
69	16.268	18.028	19.927	10.54%	3.11
70	15.702	17.419	19.274	10.65%	3.16
71	15.162	16.836	18.649	10.76%	3.21
72	14.643	16.276	18.047	10.88%	3.26
73	14.144	15.738	17.467	10.99%	3.31
74	13.665	15.220	16.909	11.10%	3.36
75	13.204	14.721	16.372	11.21%	3.42
76	12.760	14.240	15.853	11.32%	3.47
77	12.333	13.777	15.352	11.43%	3.52
78	11.922	13.332	14.871	11.54%	3.58
79	11.527	12.903	14.406	11.65%	3.63
80	11.147	12.490	13.959	11.76%	3.68
81	10.783	12.093	13.529	11.87%	3.74
82	10.432	11.711	13.114	11.98%	3.79
83	10.094	11.343	12.714	12.09%	3.85
84	9.770	10.988	12.328	12.19%	3.90
85	9.456	10.646	11.955	12.30%	3.96
86	9.155	10.316	11.596	12.40%	4.01
87	8.865	9.999	11.249	12.51%	4.07
88	8.585	9.692	10.914	12.62%	4.12
89	8.315	9.396	10.592	12.72%	4.18
90	8.055	9.111	10.279	12.82%	4.24
91	7.805	8.836	9.978	12.93%	4.30
92	7.563	8.570	9.687	13.03%	4.35
93	7.330	8.314	9.406	13.13%	4.41

94	7.106	8.066	9.134	13.24%	4.47
95	6.889	7.828	8.872	13.34%	4.53
96	6.681	7.598	8.619	13.44%	4.58
97	6.480	7.376	8.375	13.54%	4.64
98	6.286	7.162	8.139	13.64%	4.70
99	6.099	6.955	7.910	13.74%	4.76
100	5.918	6.755	7.689	13.84%	4.82
101	5.744	6.561	7.476	13.94%	4.88
102	5.575	6.374	7.269	14.04%	4.94
103	5.413	6.194	7.069	14.14%	5.00
104	5.255	6.019	6.875	14.24%	5.06
105	5.104	5.850	6.689	14.33%	5.12
106	4.957	5.686	6.507	14.43%	5.18
107	4.815	5.528	6.331	14.53%	5.25
108	4.678	5.375	6.162	14.62%	5.31
109	4.545	5.227	5.997	14.72%	5.37
110	4.417	5.084	5.837	14.82%	5.43
111	4.293	4.945	5.682	14.91%	5.50
112	4.173	4.811	5.533	15.01%	5.56
113	4.057	4.681	5.388	15.10%	5.62
114	3.944	4.555	5.247	15.20%	5.69
115	3.836	4.433	5.111	15.29%	5.75
116	3.731	4.316	4.980	15.38%	5.81
117	3.630	4.202	4.852	15.47%	5.88
118	3.532	4.092	4.729	15.57%	5.94
119	3.437	3.985	4.609	15.66%	6.01
120	3.345	3.881	4.493	15.75%	6.07
121	3.256	3.781	4.380	15.84%	6.14
122	3.169	3.684	4.270	15.93%	6.20
123	3.086	3.589	4.164	16.02%	6.27
124	3.005	3.498	4.061	16.11%	6.34
125	2.926	3.409	3.961	16.20%	6.40