

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) : QN0603X103J3450FB

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.

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, Caoheidian 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

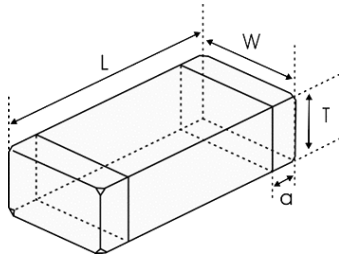


图 1 Fig.1

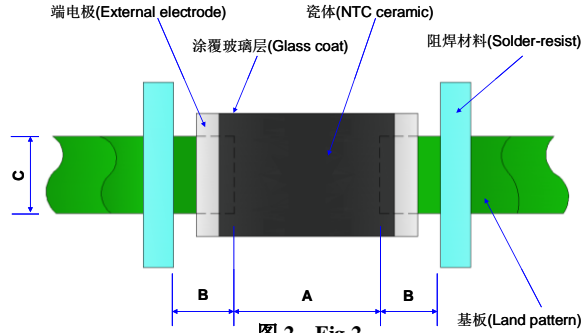


图 2 Fig.2

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 103 J 3450 F 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
103	10kΩ
154	150kΩ
⑤ 电阻值公差 Tolerance of Resistance	
F	±1%
G	±2%
H	±3%
J	±5%

⑥ B 值常数 B Constant	
3450	3450K
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 (℃)
QN0603X103J3450FB	10±5%	3450±1%	3500	0.31	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

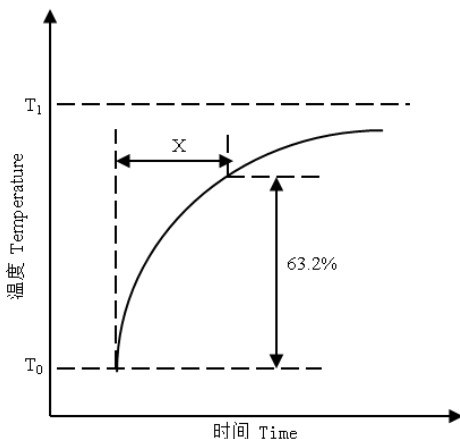
If any doubt on the results, measurements/tests should be made within the following limits:

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

▪ **Inspection Equipment**

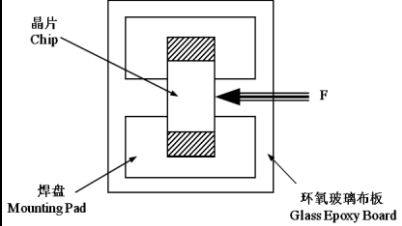
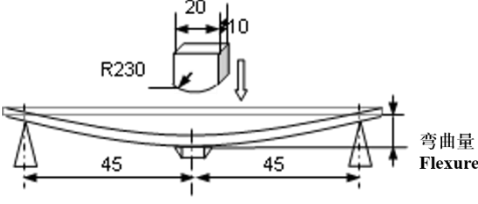
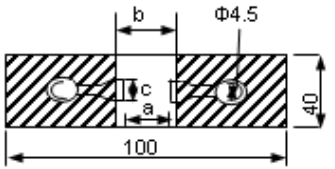
Visual Examination: 20× magnifier
Resistance value test: Thermistor resistance tester

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 1209"> <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 ΔR25/R25 ≤5%</p> <p>单位 unit: mm</p> <table border="1" data-bbox="1157 1512 1524 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
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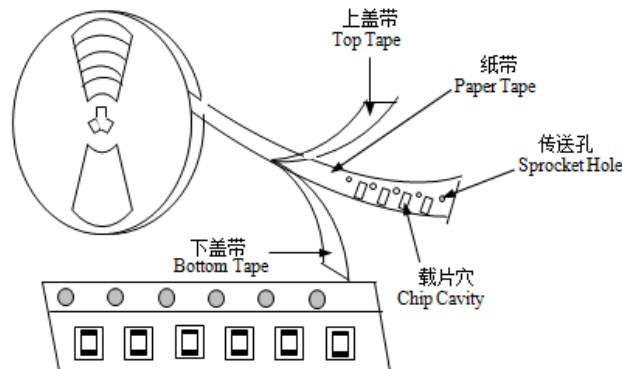
<p>振动 Vibration</p>	<p>IEC 60068-2-80</p>	<p>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）； Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.</p> <p>② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ~ 55 Hz； The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, 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>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

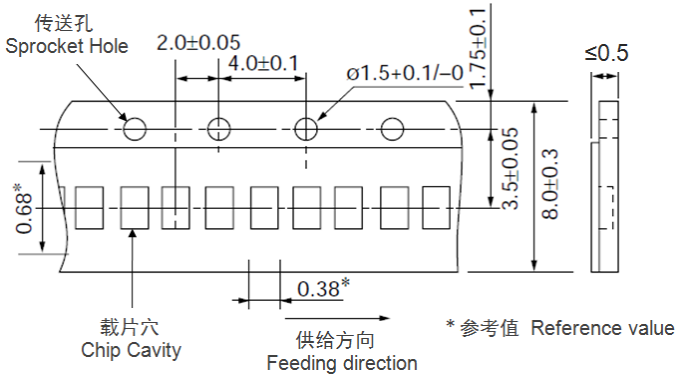
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

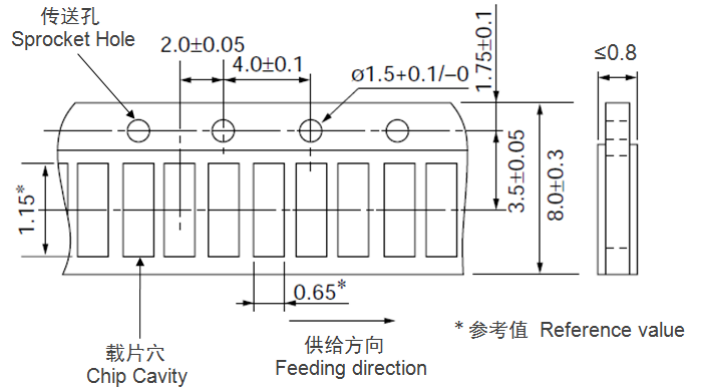


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit: mm)

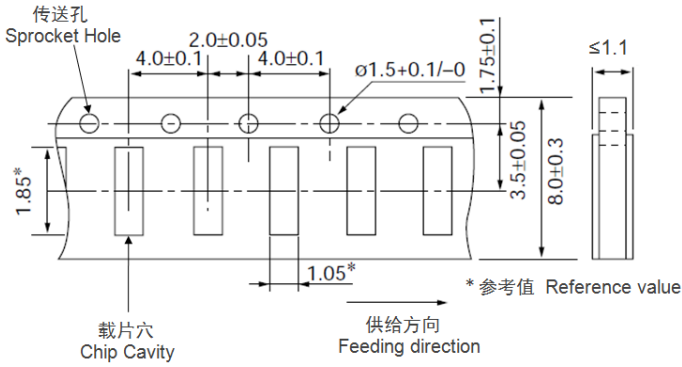
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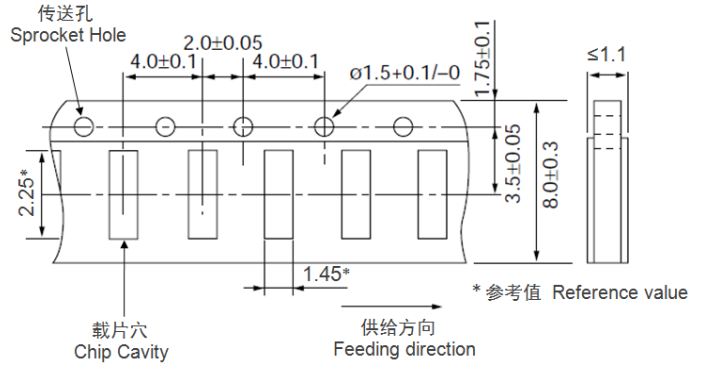
QN0402 系列 QN0402 series



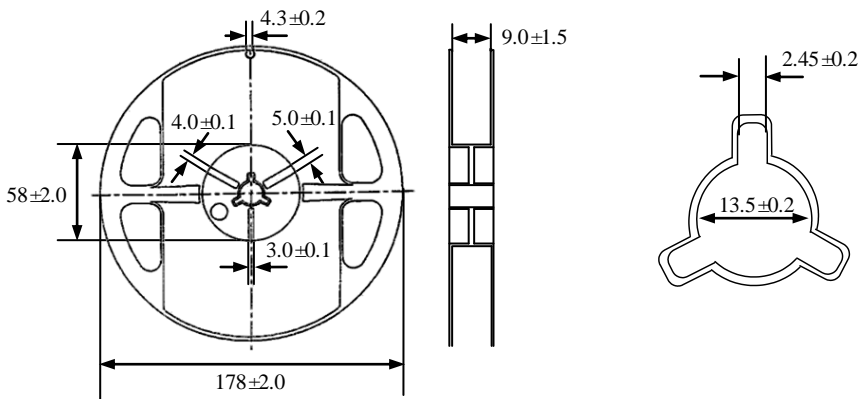
QN0603 系列 QN0603 series



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

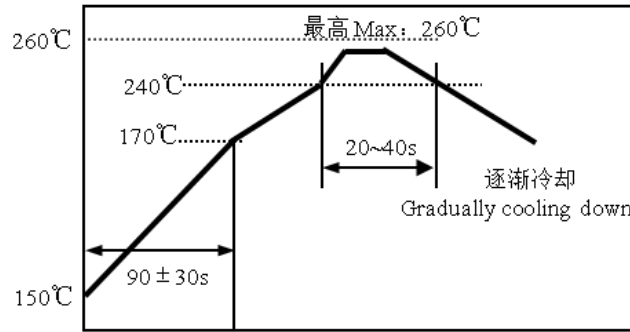
• 回流焊

- 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

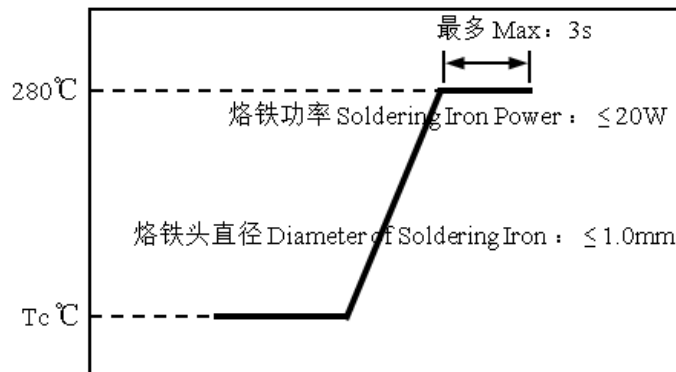
- 烙铁功率: 最大 20W
- 预热: 150°C/60sec.
- 烙铁头温度: 最高 280°C
- 焊接时间: 最多 3sec.
- 焊锡: Sn/3.0Ag/0.5Cu
- 手工焊: 最多 1 次

• 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

QN0603X103J3450FB

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	187.874	203.814	220.555	8.21%	1.38
-39	177.869	192.854	208.579	8.15%	1.38
-38	168.448	182.539	197.314	8.09%	1.38
-37	159.574	172.828	186.715	8.04%	1.38
-36	151.213	163.684	176.740	7.98%	1.38
-35	143.333	155.070	167.348	7.92%	1.38
-34	135.904	146.953	158.504	7.86%	1.38
-33	128.898	139.303	150.173	7.80%	1.38
-32	122.290	132.091	142.322	7.75%	1.38
-31	116.054	125.290	134.923	7.69%	1.38
-30	110.169	118.874	127.946	7.63%	1.38
-29	104.613	112.820	121.367	7.58%	1.38
-28	99.366	107.106	115.160	7.52%	1.38
-27	94.410	101.711	109.303	7.46%	1.38
-26	89.727	96.616	103.774	7.41%	1.38
-25	85.301	91.803	98.554	7.35%	1.38
-24	81.116	87.255	93.624	7.30%	1.38
-23	77.158	82.956	88.966	7.25%	1.38
-22	73.415	78.892	84.565	7.19%	1.38
-21	69.873	75.048	80.404	7.14%	1.38
-20	66.520	71.411	76.471	7.08%	1.38
-19	63.346	67.970	72.750	7.03%	1.38
-18	60.340	64.713	69.230	6.98%	1.38
-17	57.493	61.630	65.899	6.93%	1.37
-16	54.795	58.709	62.746	6.88%	1.37
-15	52.239	55.943	59.760	6.82%	1.37
-14	49.815	53.321	56.932	6.77%	1.37
-13	47.516	50.837	54.253	6.72%	1.37
-12	45.335	48.481	51.715	6.67%	1.37
-11	43.267	46.247	49.308	6.62%	1.37
-10	41.303	44.127	47.027	6.57%	1.37
-9	39.440	42.117	44.863	6.52%	1.37
-8	37.670	40.208	42.810	6.47%	1.36
-7	35.989	38.396	40.862	6.42%	1.36
-6	34.392	36.675	39.013	6.37%	1.36
-5	32.874	35.041	37.257	6.32%	1.36
-4	31.432	33.488	35.590	6.28%	1.36
-3	30.060	32.012	34.006	6.23%	1.36
-2	28.756	30.609	32.502	6.18%	1.36
-1	27.515	29.276	31.071	6.13%	1.36
0	26.334	28.007	29.712	6.09%	1.35
1	25.210	26.800	28.419	6.04%	1.35

2	24.140	25.651	27.189	5.99%	1.35
3	23.121	24.558	26.019	5.95%	1.35
4	22.151	23.517	24.905	5.90%	1.35
5	21.227	22.526	23.845	5.86%	1.35
6	20.346	21.582	22.836	5.81%	1.34
7	19.506	20.682	21.875	5.77%	1.34
8	18.705	19.825	20.959	5.72%	1.34
9	17.942	19.008	20.087	5.68%	1.34
10	17.213	18.229	19.255	5.63%	1.34
11	16.519	17.485	18.463	5.59%	1.33
12	15.855	16.777	17.707	5.54%	1.33
13	15.222	16.100	16.986	5.50%	1.33
14	14.618	15.455	16.298	5.46%	1.33
15	14.041	14.838	15.642	5.42%	1.33
16	13.489	14.250	15.015	5.37%	1.32
17	12.963	13.688	14.417	5.33%	1.32
18	12.459	13.151	13.846	5.29%	1.32
19	11.978	12.638	13.301	5.25%	1.32
20	11.518	12.148	12.780	5.20%	1.32
21	11.078	11.679	12.282	5.16%	1.31
22	10.657	11.231	11.806	5.12%	1.31
23	10.254	10.802	11.351	5.08%	1.31
24	9.869	10.392	10.916	5.04%	1.31
25	9.500	10.000	10.500	5.00%	1.30
26	9.140	9.625	10.110	5.04%	1.32
27	8.795	9.265	9.736	5.08%	1.34
28	8.465	8.921	9.378	5.12%	1.36
29	8.150	8.592	9.035	5.16%	1.38
30	7.847	8.276	8.706	5.20%	1.40
31	7.558	7.974	8.391	5.24%	1.42
32	7.281	7.684	8.089	5.28%	1.44
33	7.015	7.406	7.800	5.32%	1.45
34	6.760	7.140	7.522	5.35%	1.47
35	6.516	6.885	7.256	5.39%	1.49
36	6.282	6.640	7.000	5.43%	1.51
37	6.058	6.405	6.755	5.47%	1.53
38	5.842	6.180	6.520	5.51%	1.55
39	5.636	5.963	6.294	5.54%	1.57
40	5.438	5.756	6.077	5.58%	1.59
41	5.248	5.556	5.869	5.62%	1.61
42	5.065	5.365	5.669	5.66%	1.63
43	4.890	5.181	5.476	5.69%	1.65
44	4.722	5.005	5.292	5.73%	1.67
45	4.560	4.835	5.114	5.77%	1.69
46	4.405	4.672	4.943	5.80%	1.71
47	4.256	4.515	4.779	5.84%	1.73

48	4.112	4.365	4.621	5.87%	1.76
49	3.975	4.220	4.469	5.91%	1.78
50	3.842	4.081	4.323	5.95%	1.80
51	3.715	3.947	4.183	5.98%	1.82
52	3.592	3.818	4.047	6.02%	1.84
53	3.474	3.694	3.917	6.05%	1.86
54	3.361	3.574	3.792	6.09%	1.88
55	3.252	3.459	3.671	6.12%	1.90
56	3.147	3.349	3.555	6.16%	1.93
57	3.046	3.242	3.443	6.19%	1.95
58	2.948	3.140	3.335	6.22%	1.97
59	2.854	3.041	3.231	6.26%	1.99
60	2.764	2.945	3.131	6.29%	2.01
61	2.677	2.854	3.034	6.33%	2.04
62	2.593	2.765	2.941	6.36%	2.06
63	2.513	2.680	2.851	6.39%	2.08
64	2.435	2.598	2.764	6.42%	2.10
65	2.360	2.518	2.681	6.46%	2.12
66	2.287	2.442	2.600	6.49%	2.15
67	2.217	2.368	2.522	6.52%	2.17
68	2.150	2.297	2.447	6.56%	2.19
69	2.085	2.228	2.375	6.59%	2.22
70	2.022	2.162	2.305	6.62%	2.24
71	1.962	2.098	2.237	6.65%	2.26
72	1.904	2.036	2.172	6.68%	2.29
73	1.847	1.976	2.109	6.72%	2.31
74	1.793	1.919	2.048	6.75%	2.33
75	1.740	1.863	1.989	6.78%	2.36
76	1.690	1.809	1.932	6.81%	2.38
77	1.641	1.757	1.877	6.84%	2.40
78	1.593	1.707	1.824	6.87%	2.43
79	1.547	1.658	1.773	6.90%	2.45
80	1.503	1.612	1.723	6.93%	2.47
81	1.461	1.566	1.675	6.96%	2.50
82	1.419	1.522	1.629	7.00%	2.52
83	1.379	1.480	1.584	7.03%	2.55
84	1.341	1.439	1.540	7.06%	2.57
85	1.303	1.399	1.498	7.09%	2.60
86	1.267	1.361	1.458	7.12%	2.62
87	1.232	1.324	1.418	7.15%	2.65
88	1.198	1.288	1.380	7.17%	2.67
89	1.166	1.253	1.343	7.20%	2.70
90	1.134	1.219	1.307	7.23%	2.72
91	1.103	1.186	1.272	7.26%	2.75
92	1.074	1.155	1.239	7.29%	2.77
93	1.045	1.124	1.206	7.32%	2.80

94	1.017	1.094	1.175	7.35%	2.82
95	0.990	1.066	1.144	7.38%	2.85
96	0.964	1.038	1.115	7.41%	2.87
97	0.938	1.011	1.086	7.43%	2.90
98	0.914	0.985	1.058	7.46%	2.93
99	0.890	0.959	1.031	7.49%	2.95
100	0.867	0.935	1.005	7.52%	2.98
101	0.845	0.911	0.979	7.55%	3.00
102	0.823	0.888	0.955	7.57%	3.03
103	0.802	0.865	0.931	7.60%	3.06
104	0.782	0.843	0.908	7.63%	3.08
105	0.762	0.822	0.885	7.66%	3.11
106	0.743	0.802	0.863	7.68%	3.14
107	0.724	0.782	0.842	7.71%	3.16
108	0.706	0.763	0.822	7.74%	3.19
109	0.689	0.744	0.802	7.76%	3.22
110	0.672	0.726	0.782	7.79%	3.24
111	0.655	0.708	0.763	7.82%	3.27
112	0.639	0.691	0.745	7.84%	3.30
113	0.623	0.674	0.727	7.87%	3.33
114	0.608	0.658	0.710	7.90%	3.35
115	0.594	0.642	0.693	7.92%	3.38
116	0.579	0.627	0.677	7.95%	3.41
117	0.566	0.612	0.661	7.97%	3.44
118	0.552	0.598	0.646	8.00%	3.46
119	0.539	0.584	0.631	8.03%	3.49
120	0.526	0.570	0.616	8.05%	3.52
121	0.514	0.557	0.602	8.08%	3.55
122	0.502	0.544	0.588	8.10%	3.58
123	0.490	0.532	0.575	8.13%	3.61
124	0.479	0.519	0.562	8.15%	3.63
125	0.468	0.508	0.549	8.18%	3.66