

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) : QN0402X103J3380FB

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

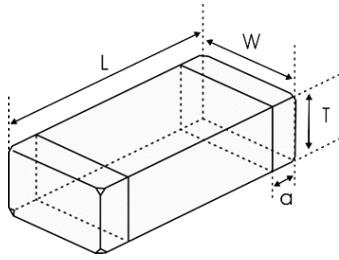


图 1 Fig.1

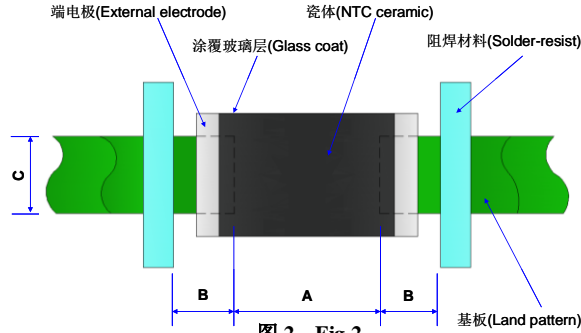


图 2 Fig.2

表 1 (Table 1)

单位 unit: inch[mm]

类别 Type	L	W	T	a	A	B	C
0402 [1005]	0.039±0.006 [1.0±0.15]	0.020±0.006 [0.5±0.15]	0.020±0.006 [0.5±0.15]	0.010±0.004 [0.25±0.1]	[0.45-0.55]	[0.4-0.5]	[0.45-0.55]

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

QN 0402 X 103 J 3380 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	
502	5kΩ
103	10kΩ
474	470kΩ

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

⑥ B 值常数 B Constant	
3380	3380K
3950	3950K
4300	4300K

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 (℃)
QN0402X103J3380FB	10±5%	3380±1%	3435	0.31	1.0	<3	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

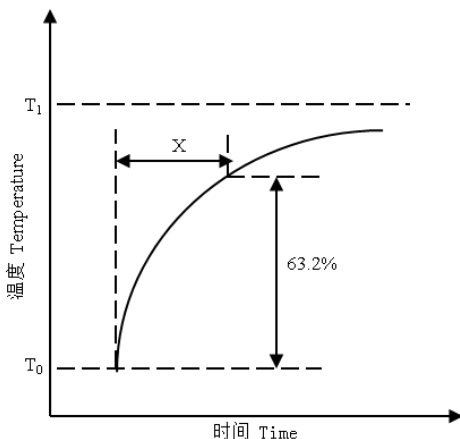
If any doubt on the results, measurements/tests should be made within the following limits:

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

▪ **Inspection Equipment**

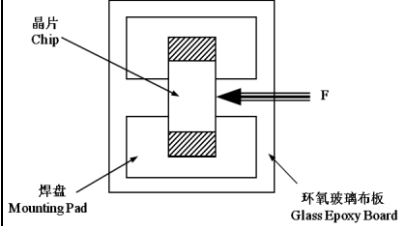
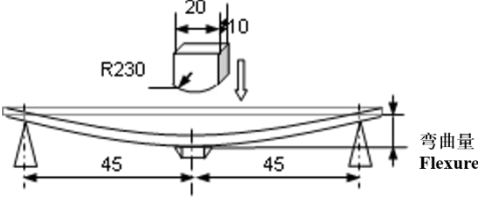
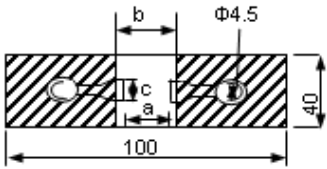
Visual Examination: 20× magnifier
Resistance value test: Thermistor resistance tester

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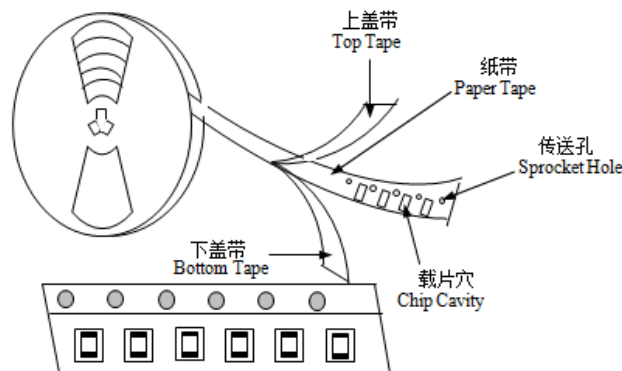
<p>振动 Vibration</p>	<p>IEC 60068-2-80</p>	<p>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）； Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.</p> <p>② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ~ 55 Hz； The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm,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

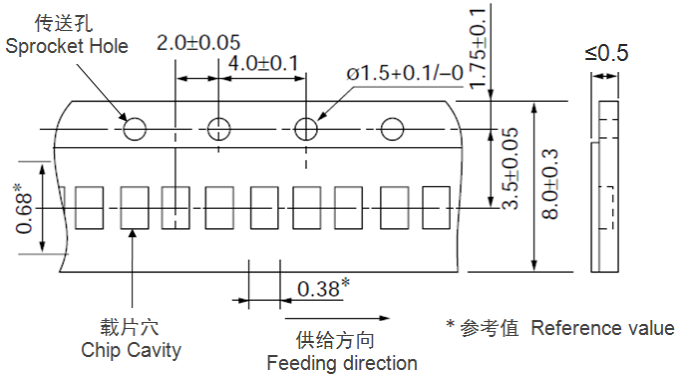
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

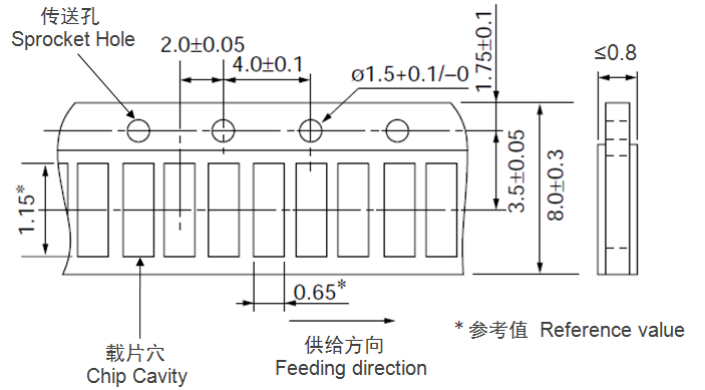


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit: mm)

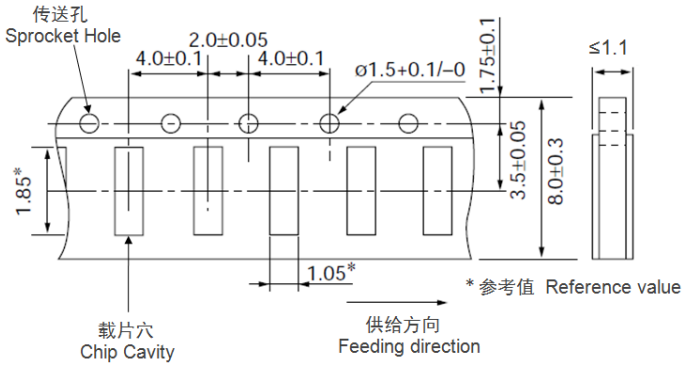
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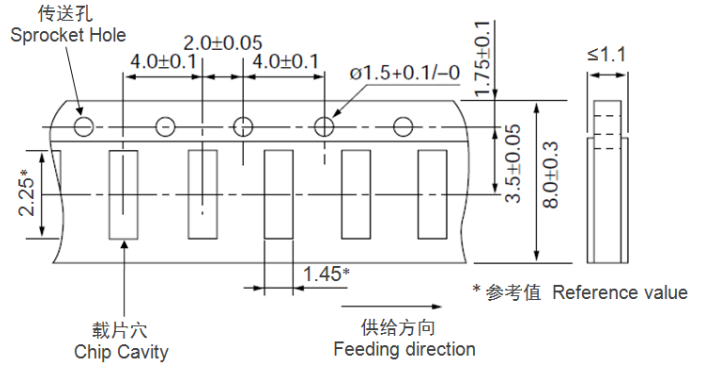
QN0402 系列 QN0402 series



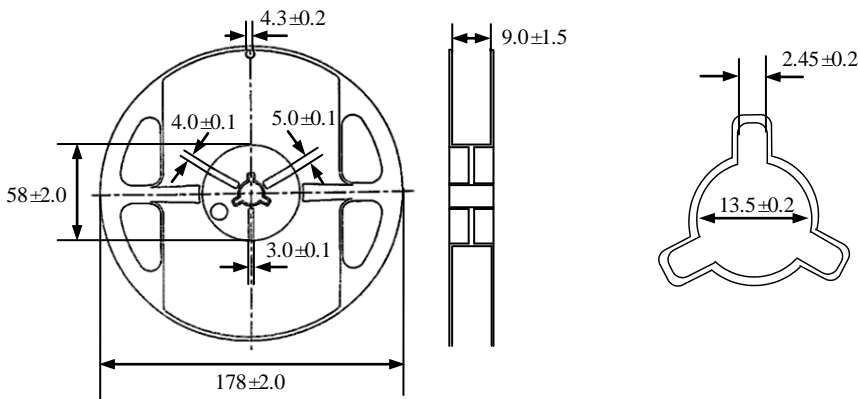
QN0603 系列 QN0603 series



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: $\leq 75\% \text{RH}$
 - 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: $\cong 75\% \text{RH}$
 - c. Keep away from corrosive atmosphere and sunlight.
- **Period of Storage: 6 Months after delivery**

9 Notes & Warnings

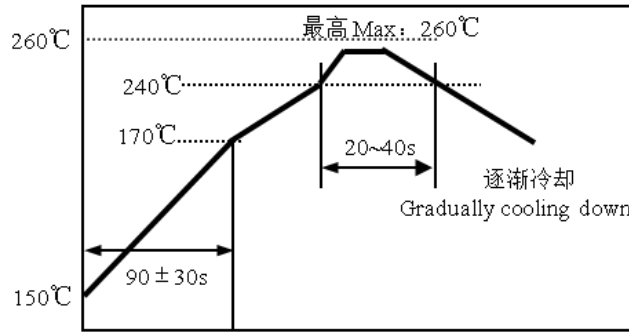
- The QN series thermistors shall not be operated and stored under the following environmental condition:
 - (1) Corrosive or deoxidized atmospheres
(such as chlorine, sulfurated hydrogen, ammonia, sulfuric acid, nitric oxide and so on)
 - (2) Volatile or inflammable atmospheres
 - (3) Dusty condition
 - (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

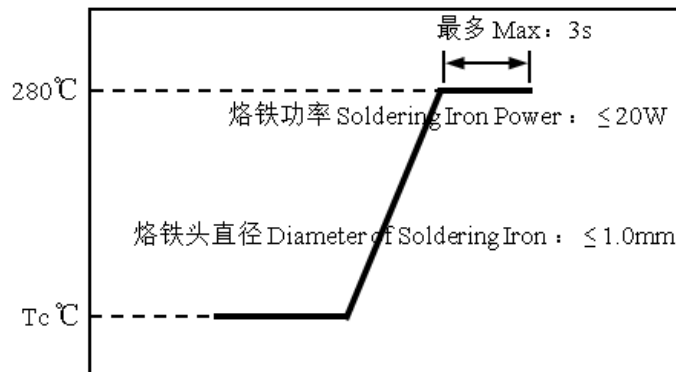
- 烙铁功率: 最大 20W
- 预热: 150°C/60sec.
- 烙铁头温度: 最高 280°C
- 焊接时间: 最多 3sec.
- 焊锡: Sn/3.0Ag/0.5Cu
- 手工焊: 最多 1 次

• **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

QN0402X103J3380FB

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	182.010	197.390	213.534	8.18%	1.39
-39	172.103	186.540	201.683	8.12%	1.39
-38	162.793	176.350	190.559	8.06%	1.39
-37	154.063	166.800	180.139	8.00%	1.40
-36	145.849	157.820	170.346	7.94%	1.40
-35	138.134	149.390	161.159	7.88%	1.40
-34	130.919	141.510	152.575	7.82%	1.40
-33	124.121	134.090	144.497	7.76%	1.40
-32	117.723	127.110	136.902	7.70%	1.40
-31	111.688	120.530	129.746	7.65%	1.40
-30	106.008	114.340	123.018	7.59%	1.40
-29	100.674	108.530	116.706	7.53%	1.40
-28	95.631	103.040	110.745	7.48%	1.40
-27	90.880	97.870	105.135	7.42%	1.40
-26	86.391	92.989	99.840	7.37%	1.40
-25	82.152	88.381	94.844	7.31%	1.40
-24	78.153	84.036	90.136	7.26%	1.40
-23	74.372	79.931	85.690	7.21%	1.40
-22	70.798	76.052	81.491	7.15%	1.40
-21	67.417	72.384	77.523	7.10%	1.40
-20	64.218	68.915	73.771	7.05%	1.39
-19	61.190	65.634	70.225	6.99%	1.39
-18	58.324	62.529	66.870	6.94%	1.39
-17	55.608	59.589	63.695	6.89%	1.39
-16	53.035	56.804	60.689	6.84%	1.39
-15	50.596	54.166	57.843	6.79%	1.39
-14	48.282	51.665	55.146	6.74%	1.39
-13	46.088	49.294	52.591	6.69%	1.39
-12	44.007	47.046	50.169	6.64%	1.39
-11	42.031	44.913	47.872	6.59%	1.39
-10	40.156	42.889	45.694	6.54%	1.39
-9	38.374	40.967	43.626	6.49%	1.39
-8	36.681	39.142	41.664	6.44%	1.39
-7	35.072	37.408	39.800	6.39%	1.38
-6	33.543	35.761	38.031	6.35%	1.38
-5	32.089	34.196	36.350	6.30%	1.38
-4	30.706	32.707	34.752	6.25%	1.38
-3	29.389	31.291	33.232	6.20%	1.38
-2	28.137	29.945	31.789	6.16%	1.38
-1	26.946	28.664	30.416	6.11%	1.38
0	25.811	27.445	29.110	6.07%	1.38
1	24.729	26.283	27.865	6.02%	1.37

2	23.698	25.177	26.681	5.97%	1.37
3	22.717	24.124	25.554	5.93%	1.37
4	21.782	23.121	24.481	5.88%	1.37
5	20.890	22.165	23.459	5.84%	1.37
6	20.039	21.253	22.485	5.79%	1.37
7	19.227	20.384	21.556	5.75%	1.37
8	18.453	19.555	20.671	5.71%	1.36
9	17.714	18.764	19.827	5.66%	1.36
10	17.009	18.010	19.022	5.62%	1.36
11	16.336	17.290	18.254	5.58%	1.36
12	15.692	16.602	17.521	5.53%	1.36
13	15.078	15.946	16.822	5.49%	1.36
14	14.491	15.319	16.154	5.45%	1.35
15	13.930	14.720	15.516	5.41%	1.35
16	13.394	14.148	14.907	5.36%	1.35
17	12.881	13.601	14.325	5.32%	1.35
18	12.391	13.078	13.769	5.28%	1.35
19	11.922	12.578	13.237	5.24%	1.34
20	11.472	12.099	12.728	5.20%	1.34
21	11.043	11.642	12.243	5.16%	1.34
22	10.632	11.204	11.778	5.12%	1.34
23	10.238	10.785	11.333	5.08%	1.34
24	9.861	10.384	10.907	5.04%	1.33
25	9.500	10.000	10.500	5.00%	1.33
26	9.147	9.632	10.118	5.04%	1.35
27	8.809	9.280	9.751	5.08%	1.37
28	8.486	8.943	9.400	5.12%	1.39
29	8.176	8.619	9.063	5.16%	1.41
30	7.879	8.309	8.741	5.19%	1.43
31	7.594	8.012	8.431	5.23%	1.44
32	7.321	7.727	8.134	5.27%	1.46
33	7.060	7.453	7.849	5.31%	1.48
34	6.809	7.191	7.575	5.35%	1.50
35	6.568	6.939	7.313	5.38%	1.52
36	6.337	6.698	7.061	5.42%	1.54
37	6.116	6.466	6.819	5.46%	1.56
38	5.903	6.243	6.586	5.50%	1.58
39	5.699	6.029	6.363	5.53%	1.60
40	5.503	5.824	6.148	5.57%	1.62
41	5.315	5.627	5.942	5.61%	1.64
42	5.134	5.437	5.744	5.64%	1.66
43	4.960	5.255	5.553	5.68%	1.68
44	4.793	5.080	5.370	5.71%	1.70
45	4.632	4.911	5.193	5.75%	1.73
46	4.478	4.749	5.024	5.78%	1.75
47	4.330	4.593	4.861	5.82%	1.77

48	4.187	4.443	4.703	5.86%	1.79
49	4.050	4.299	4.552	5.89%	1.81
50	3.918	4.160	4.407	5.92%	1.83
51	3.791	4.027	4.266	5.96%	1.85
52	3.668	3.898	4.131	5.99%	1.87
53	3.550	3.774	4.001	6.03%	1.89
54	3.437	3.654	3.876	6.06%	1.92
55	3.328	3.539	3.755	6.10%	1.94
56	3.222	3.429	3.639	6.13%	1.96
57	3.121	3.322	3.526	6.16%	1.98
58	3.023	3.219	3.418	6.20%	2.00
59	2.929	3.119	3.314	6.23%	2.03
60	2.838	3.024	3.213	6.26%	2.05
61	2.751	2.931	3.116	6.30%	2.07
62	2.666	2.842	3.022	6.33%	2.09
63	2.585	2.756	2.932	6.36%	2.12
64	2.506	2.673	2.844	6.39%	2.14
65	2.431	2.593	2.760	6.43%	2.16
66	2.357	2.516	2.679	6.46%	2.18
67	2.287	2.441	2.600	6.49%	2.21
68	2.219	2.369	2.524	6.52%	2.23
69	2.153	2.300	2.451	6.55%	2.25
70	2.089	2.233	2.380	6.59%	2.27
71	2.028	2.168	2.311	6.62%	2.30
72	1.969	2.105	2.245	6.65%	2.32
73	1.911	2.044	2.181	6.68%	2.34
74	1.856	1.986	2.119	6.71%	2.37
75	1.803	1.929	2.059	6.74%	2.39
76	1.751	1.874	2.001	6.77%	2.42
77	1.701	1.821	1.945	6.80%	2.44
78	1.653	1.770	1.891	6.83%	2.46
79	1.606	1.720	1.838	6.86%	2.49
80	1.561	1.673	1.788	6.89%	2.51
81	1.517	1.626	1.739	6.92%	2.54
82	1.475	1.581	1.691	6.95%	2.56
83	1.434	1.538	1.645	6.98%	2.58
84	1.394	1.496	1.601	7.01%	2.61
85	1.356	1.455	1.557	7.04%	2.63
86	1.319	1.416	1.516	7.07%	2.66
87	1.283	1.377	1.475	7.10%	2.68
88	1.248	1.340	1.436	7.13%	2.71
89	1.214	1.304	1.398	7.16%	2.73
90	1.182	1.270	1.361	7.19%	2.76
91	1.150	1.236	1.325	7.22%	2.78
92	1.119	1.204	1.291	7.25%	2.81
93	1.090	1.172	1.257	7.28%	2.83

94	1.061	1.141	1.225	7.30%	2.86
95	1.033	1.112	1.193	7.33%	2.88
96	1.006	1.083	1.162	7.36%	2.91
97	0.980	1.055	1.133	7.39%	2.94
98	0.954	1.028	1.104	7.42%	2.96
99	0.930	1.002	1.076	7.44%	2.99
100	0.906	0.976	1.049	7.47%	3.01
101	0.883	0.951	1.023	7.50%	3.04
102	0.860	0.927	0.997	7.53%	3.07
103	0.838	0.904	0.972	7.55%	3.09
104	0.817	0.882	0.948	7.58%	3.12
105	0.797	0.860	0.925	7.61%	3.15
106	0.777	0.838	0.902	7.64%	3.17
107	0.758	0.818	0.880	7.66%	3.20
108	0.739	0.798	0.859	7.69%	3.23
109	0.721	0.778	0.838	7.72%	3.25
110	0.703	0.759	0.818	7.74%	3.28
111	0.686	0.741	0.799	7.77%	3.31
112	0.669	0.723	0.779	7.79%	3.33
113	0.653	0.706	0.761	7.82%	3.36
114	0.637	0.689	0.743	7.85%	3.39
115	0.622	0.673	0.726	7.87%	3.42
116	0.607	0.657	0.709	7.90%	3.45
117	0.593	0.641	0.692	7.92%	3.47
118	0.579	0.626	0.676	7.95%	3.50
119	0.565	0.612	0.661	7.97%	3.53
120	0.552	0.598	0.645	8.00%	3.56
121	0.539	0.584	0.631	8.03%	3.59
122	0.527	0.570	0.616	8.05%	3.61
123	0.514	0.557	0.602	8.08%	3.64
124	0.503	0.545	0.589	8.10%	3.67
125	0.491	0.532	0.576	8.13%	3.70

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