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 STAMP	核准 APPROVE	审核 CHECK	经办人 SIGNATURE

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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

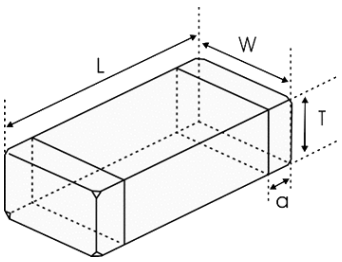


图 1 Fig.1

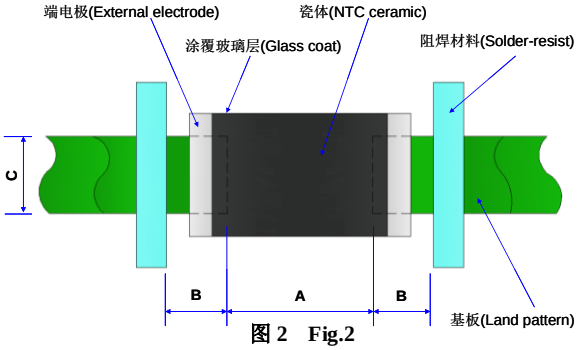


图 2 Fig.2

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±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%

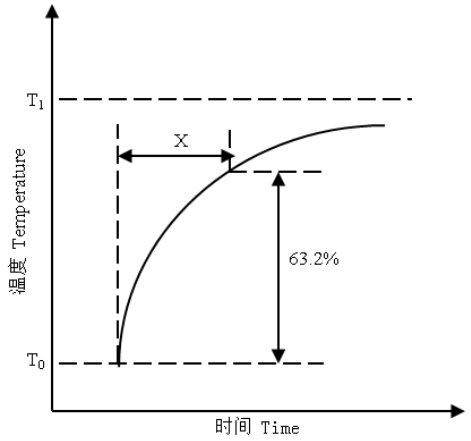
c. Air Pressure: 86kPa to 106kPa

▪ Inspection Equipment

Visual Examination: 20× magnifier

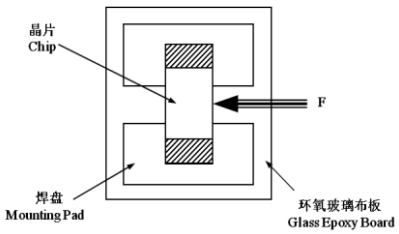
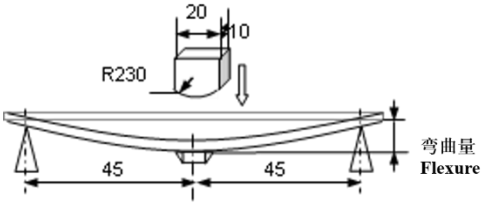
Resistance value test: Thermistor resistance tester

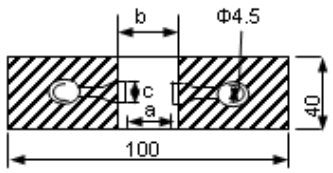
5 电性测试 Electrical Test

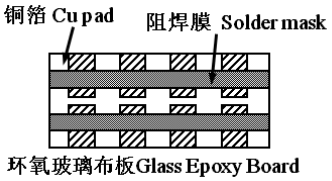
序号 No.	项目 Items	测试方法及备注 Test Methods and Remarks
1	25℃零功率电阻值 Nominal Zero-Power Resistance at 25℃(R25)	环境温度 Ambient temperature：25±0.05℃ 测试功率 Measuring electric power：≤0.1mW
2	B 值常数 Nominal B Constant	分别在环境温度 25±0.05℃， 50±0.05℃或 85±0.05℃下测量电阻值。 Measure the resistance at the ambient temperature of 25±0.05℃,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

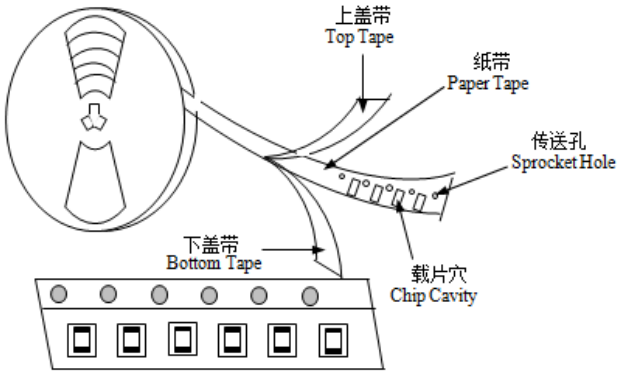
<table>
<tr>
<td>振动
Vibration</td>
<td>IEC 60068-2-80</td>
<td>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）；
Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.
② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ～55 Hz；
The chip shall be subjected to a simple harmonic motion having total amplitude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

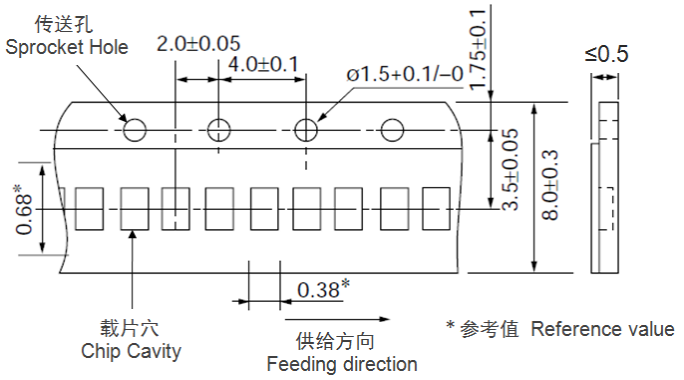
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

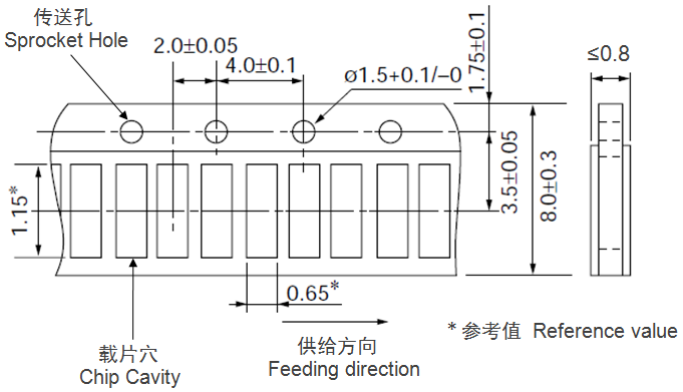


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit：mm)

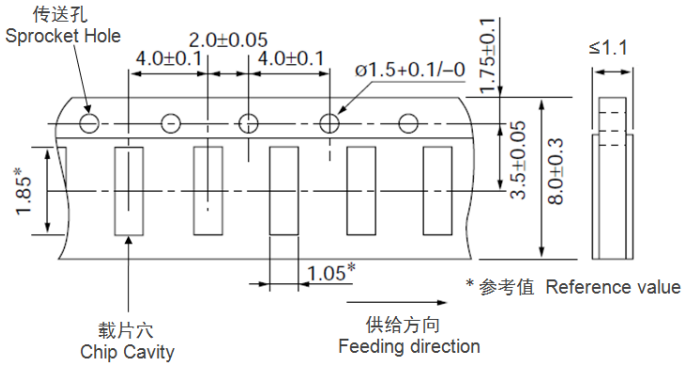
QN0201 系列 QN0201 series



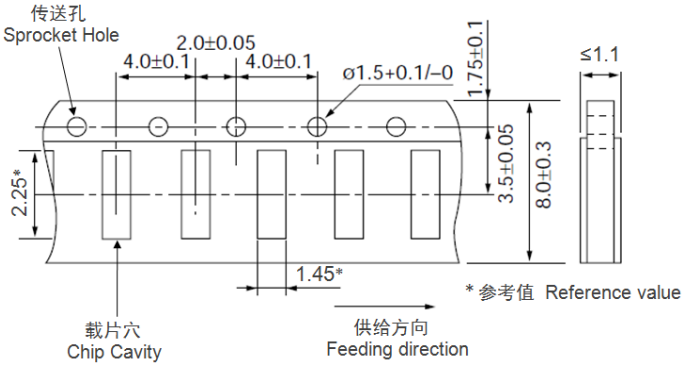
QN0402 系列 QN0402 series



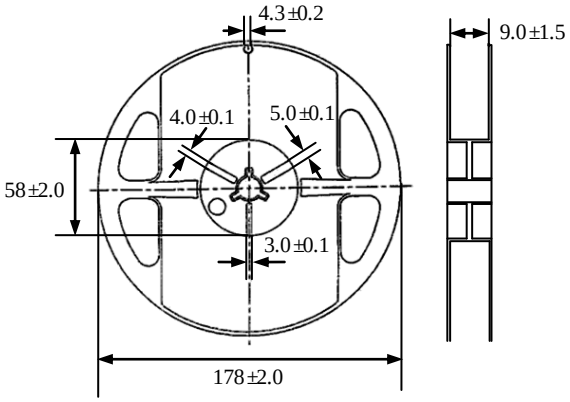
QN0603 系列 QN0603 series

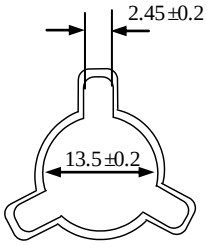


QN0805 系列 QN0805 series



(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.

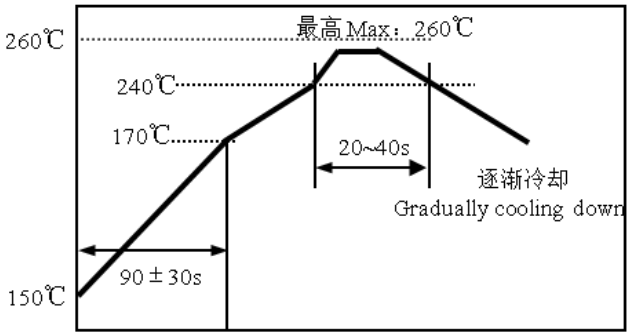
- The QN series thermistors shall not be operated beyond the specified “Operating Temperature Range” in the catalog.

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

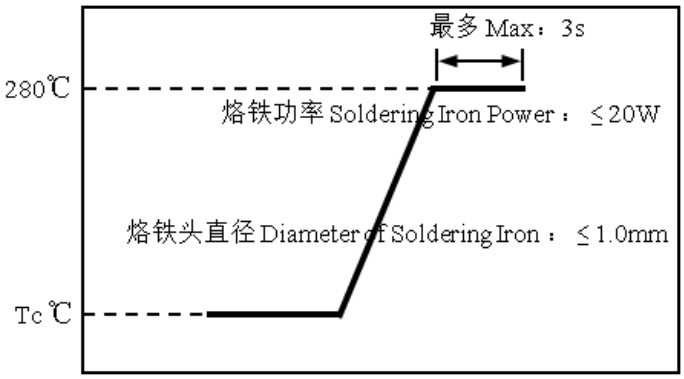


- **手工焊**
  - 烙铁功率：最大 20W
  - 预热：150℃/60sec.
  - 烙铁头温度：最高 280℃
  - 焊接时间：最多 3sec.
  - 焊锡：Sn/3.0Ag/0.5Cu
  - 手工焊：最多 1 次

[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

QN0402X103J3380FB

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	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