

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 (QAM Part Number): QN0402X103J3950HB

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

唐山恭成科技有限公司

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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.

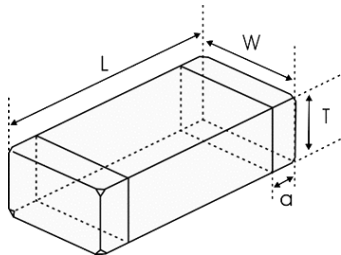


图 1 Fig.1

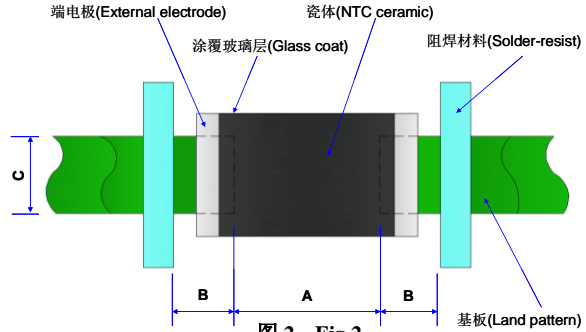


图 2 Fig.2

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** **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)	
0201[0603]	0.6×0.3
0402[1005]	1.0×0.5
0603[1608]	1.6×0.8
0805[2012]	2.0×1.2
③ 分隔符 Delimiter	
X	

④25℃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%

⑥B 值常数 B Constant	
3450	3450K
3950	3950K
4250	4250K
⑦B 值公差 Tolerance of B Constant	
F	±1%
H	±3%
⑧B 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 (℃)
QN0402X103J3950HB	10	3950	3987	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%RH；
- 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

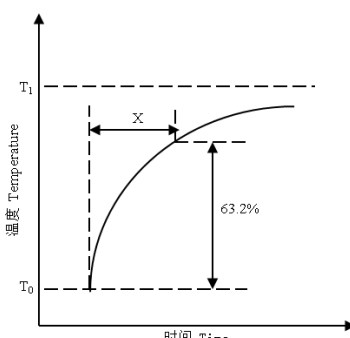
If any doubt on the results, measurements/tests should be made within the following limits:

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

▪ **Inspection Equipment**

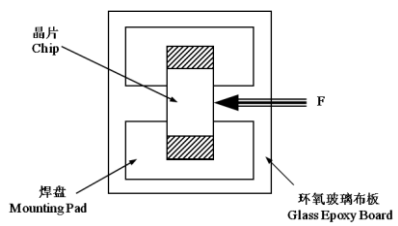
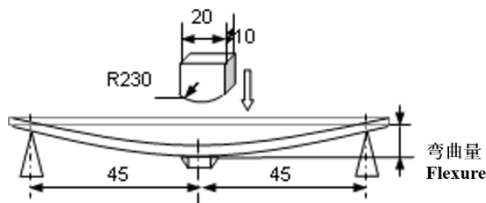
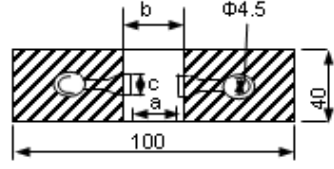
Visual Examination: 20× magnifier
Resistance value test: Thermistor resistance tester

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℃. $B(25-50^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{50}}{1/T_{25} - 1/T_{50}} \quad B(25-85^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{85}}{1/T_{25} - 1/T_{85}}$ 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 T ₀ 与最终温度 T ₁ 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	<p>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：</p> <p>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:</p> $\delta = \frac{W}{T-T_0}$
5	额定功率 Rated Power	<p>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。</p> <p>The necessary electric power makes thermistor's temperature rise 100℃ by self-heating at ambient temperature 25℃.</p>
6	允许工作电流 Permissible operating current	<p>在静止空气中通过自身发热使其升温为 1℃的电流。</p> <p>The current that keep body temperature of chip NTC on the PC board in still air rising 1℃ by self-heating.</p>

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>① 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> <p>② 0201、0402 和 0603 系列施加 5N 的作用力，0805 系列产品施加 10N 的作用力； 5N force for 0201, 0402 and 0603 series, 10N force for 0805 series.</p> <p>③ 保持时间 Duration: 10±1s</p>	<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> 																				
抗弯强度 Resistance to Flexure	IEC 60068-2-21	<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），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> <p>② 弯曲变形量 Flexure 0201: 1mm 0402, 0603, 0805: 2mm</p> <p>③ 施压速度 Pressurizing Speed: <0.5mm/s;</p> <p>④ 保持时间 Duration: 10s</p> 	<p>① 无外观损伤。 No visible damage.</p> <p>② 试验前后 R25 的变化率: ±5% 以内; R25 variation: within ±5%</p> <p>单位 unit: mm</p> <table border="1" data-bbox="1109 1377 1476 1612"> <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
类型 Type	a	b	c																				
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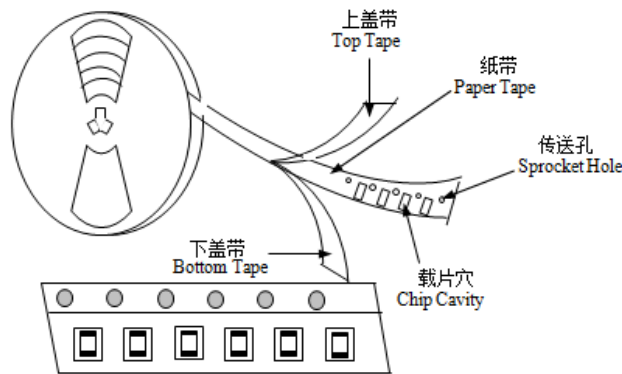
<p>振动 Vibration</p>	<p>IEC 60068-2-80</p>	<p>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）； Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.</p> <p>② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ~ 55 Hz； The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, 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到水泥地面 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 试验前后 R25 的变化率：±3% 以内； R25 variation: within ±3% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±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="475 1406 1024 1599"> <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 试验前后 R25 的变化率：±3% 以内； R25 variation: within ±3% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±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 试验前后 R25 的变化率：±5% 以内； R25 variation: within ±5% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±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 试验前后 R25 的变化率：±5% 以内； R25 variation: within ±5% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±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 试验前后 R25 的变化率：±3% 以内； R25 variation: within ±3% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±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 试验前后 R25 的变化率：±5% 以内； R25 variation: within ±5% ③ 试验前后 B 值的变化率：±2% 以内。 B constant variation: within ±2%

7 编带 Taping

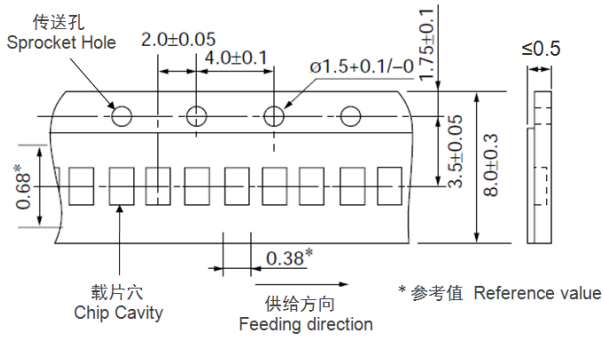
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

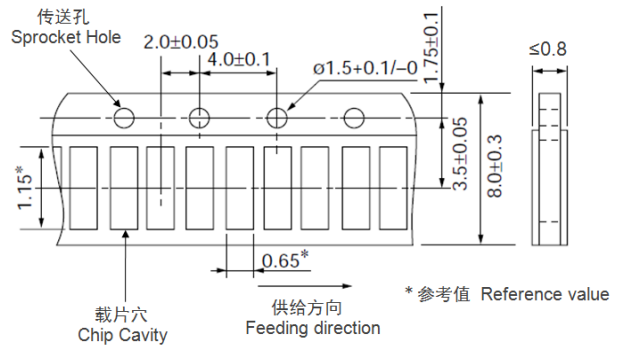


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit: mm)

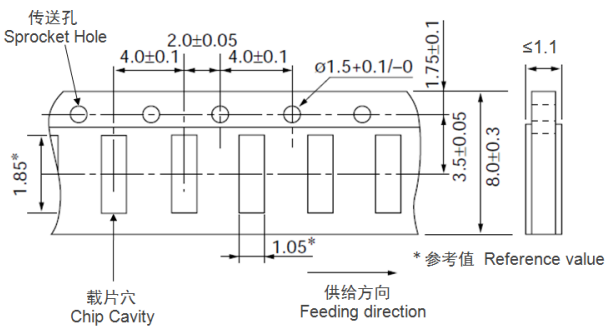
QN0201 系列 QN0201 series



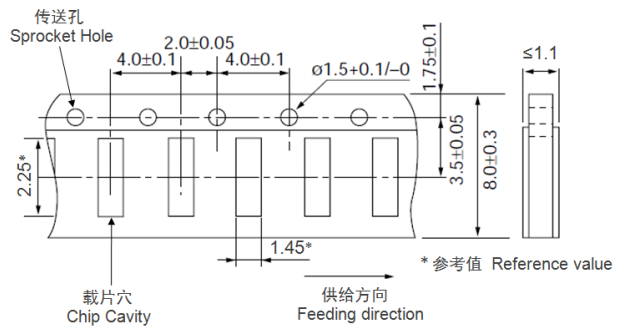
QN0402 系列 QN0402 series



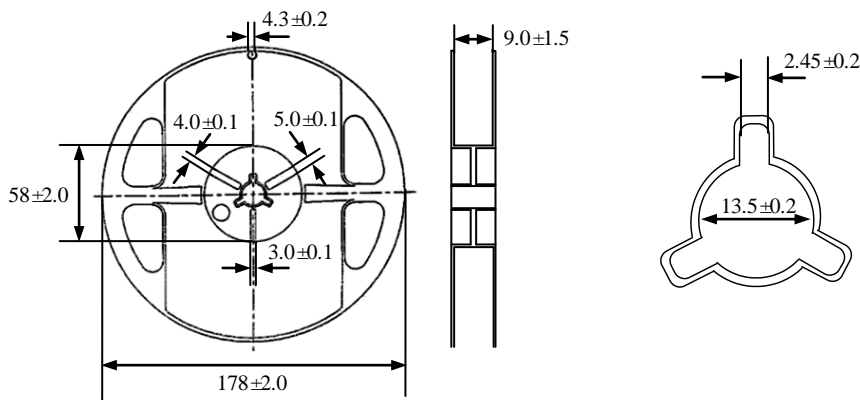
QN0603 系列 QN0603 series



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: $\leq 75\% \text{RH}$
- c. 避免接触粉尘、腐蚀性气氛和阳光

- 储存期限: 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: $\leq 75\% \text{RH}$
- c. Keep away from corrosive atmosphere and sunlight.

- Period of Storage: 6 Months

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) Excessive 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.

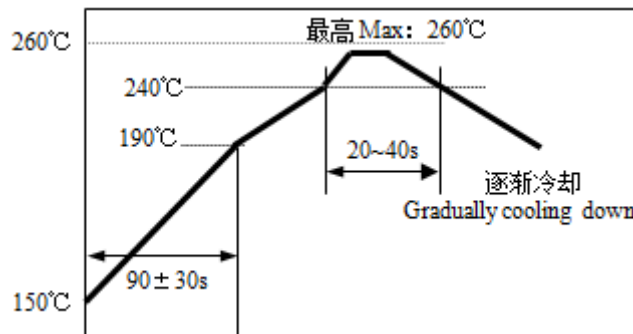
- The QN series thermistors shall not be operated beyond the specified "Operating Temperature Range" in the catalog.

10 建议焊接条件

- 回流焊
 - 温升 1~2°C/sec.
 - 预热: 150~190°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: 150~190°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.

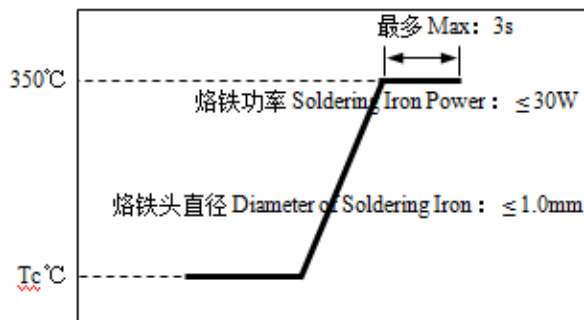


- 手工焊
 - 烙铁功率: 最大 30W
 - 预热: 150°C/60sec.
 - 烙铁头温度: 最高 350°C
 - 焊接时间: 最多 3sec.
 - 焊锡: Sn/3.0Ag/0.5Cu
 - 手工焊: 最多 1 次

- **Iron Soldering Profile**
 - Iron soldering power: Max.30W
 - Pre-heating: 150°C/60sec.
 - Soldering Tip temperature: 350°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

QN0402X103J3950HB

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	294.947	345.275	403.180	16.77%	2.41
-39	276.298	322.791	376.165	16.54%	2.39
-38	258.956	301.925	351.144	16.30%	2.38
-37	242.820	282.549	327.957	16.07%	2.36
-36	227.800	264.549	306.457	15.84%	2.35
-35	213.811	247.816	286.512	15.61%	2.33
-34	200.774	232.254	267.998	15.39%	2.32
-33	188.620	217.774	250.804	15.17%	2.30
-32	177.283	204.292	234.827	14.95%	2.28
-31	166.703	191.735	219.974	14.73%	2.27
-30	156.824	180.032	206.158	14.51%	2.25
-29	147.596	169.120	193.300	14.30%	2.24
-28	138.971	158.941	181.327	14.08%	2.22
-27	130.906	149.441	170.174	13.87%	2.20
-26	123.362	140.571	159.779	13.66%	2.19
-25	116.302	132.284	150.086	13.46%	2.17
-24	109.676	124.522	141.024	13.25%	2.15
-23	103.472	117.266	132.568	13.05%	2.13
-22	97.658	110.480	124.673	12.85%	2.12
-21	92.209	104.130	117.298	12.65%	2.10
-20	87.098	98.185	110.407	12.45%	2.08
-19	82.304	92.618	103.965	12.25%	2.06
-18	77.804	87.402	97.939	12.06%	2.05
-17	73.578	82.513	92.301	11.86%	2.03
-16	69.609	77.927	87.022	11.67%	2.01
-15	65.878	73.626	82.079	11.48%	1.99
-14	62.371	69.588	77.446	11.29%	1.97
-13	59.073	65.797	73.105	11.11%	1.95
-12	55.969	62.237	69.033	10.92%	1.94
-11	53.048	58.890	65.213	10.74%	1.92
-10	50.297	55.744	61.628	10.55%	1.90
-9	47.705	52.786	58.262	10.37%	1.88
-8	45.263	50.002	55.100	10.19%	1.86
-7	42.961	47.382	52.128	10.02%	1.84
-6	40.790	44.916	49.335	9.84%	1.82
-5	38.741	42.592	46.709	9.67%	1.80
-4	36.805	40.400	44.234	9.49%	1.78
-3	34.978	38.333	41.906	9.32%	1.76

-2	33.252	36.385	39.714	9.15%	1.74
-1	31.622	34.548	37.649	8.98%	1.72
0	30.081	32.814	35.705	8.81%	1.70
1	28.627	31.179	33.874	8.64%	1.68
2	27.251	29.636	32.148	8.48%	1.66
3	25.950	28.178	30.520	8.31%	1.64
4	24.718	26.800	28.984	8.15%	1.61
5	23.551	25.497	27.534	7.99%	1.59
6	22.445	24.263	26.162	7.83%	1.57
7	21.397	23.096	24.867	7.67%	1.55
8	20.404	21.992	23.644	7.51%	1.53
9	19.463	20.947	22.487	7.36%	1.51
10	18.571	19.958	21.394	7.20%	1.48
11	17.725	19.022	20.362	7.05%	1.46
12	16.923	18.135	19.385	6.89%	1.44
13	16.162	17.294	18.460	6.74%	1.42
14	15.439	16.498	17.585	6.59%	1.39
15	14.753	15.742	16.756	6.44%	1.37
16	14.101	15.025	15.970	6.29%	1.35
17	13.481	14.345	15.226	6.14%	1.33
18	12.892	13.699	14.521	6.00%	1.30
19	12.332	13.086	13.852	5.85%	1.28
20	11.800	12.504	13.218	5.71%	1.26
21	11.293	11.951	12.616	5.56%	1.23
22	10.811	11.426	12.045	5.42%	1.21
23	10.352	10.926	11.503	5.28%	1.18
24	9.916	10.452	10.989	5.14%	1.16
25	9.500	10.000	10.500	5.00%	1.14
26	9.080	9.570	10.062	5.14%	1.17
27	8.681	9.162	9.645	5.28%	1.21
28	8.301	8.773	9.247	5.41%	1.25
29	7.940	8.402	8.868	5.55%	1.29
30	7.597	8.049	8.507	5.69%	1.33
31	7.271	7.713	8.162	5.82%	1.37
32	6.960	7.393	7.834	5.96%	1.41
33	6.665	7.088	7.520	6.09%	1.45
34	6.383	6.797	7.220	6.22%	1.49
35	6.115	6.520	6.934	6.36%	1.54
36	5.860	6.255	6.661	6.49%	1.58
37	5.616	6.003	6.400	6.62%	1.62
38	5.384	5.762	6.151	6.75%	1.66
39	5.163	5.532	5.913	6.88%	1.70

40	4.952	5.313	5.685	7.01%	1.75
41	4.751	5.103	5.467	7.14%	1.79
42	4.559	4.903	5.259	7.27%	1.83
43	4.376	4.711	5.060	7.40%	1.88
44	4.201	4.529	4.869	7.53%	1.92
45	4.034	4.354	4.687	7.65%	1.96
46	3.875	4.187	4.512	7.78%	2.01
47	3.723	4.027	4.345	7.90%	2.05
48	3.577	3.874	4.185	8.03%	2.10
49	3.438	3.728	4.032	8.15%	2.14
50	3.306	3.588	3.885	8.28%	2.19
51	3.179	3.454	3.745	8.40%	2.23
52	3.057	3.326	3.610	8.53%	2.28
53	2.941	3.203	3.480	8.65%	2.33
54	2.830	3.086	3.356	8.77%	2.37
55	2.723	2.973	3.237	8.89%	2.42
56	2.621	2.865	3.123	9.01%	2.47
57	2.524	2.761	3.014	9.13%	2.51
58	2.430	2.662	2.908	9.25%	2.56
59	2.341	2.567	2.807	9.37%	2.61
60	2.255	2.476	2.711	9.49%	2.66
61	2.173	2.388	2.618	9.61%	2.71
62	2.095	2.304	2.528	9.73%	2.76
63	2.019	2.224	2.443	9.84%	2.81
64	1.947	2.146	2.360	9.96%	2.85
65	1.878	2.072	2.281	10.08%	2.90
66	1.811	2.001	2.205	10.19%	2.95
67	1.747	1.932	2.131	10.31%	3.00
68	1.686	1.866	2.061	10.42%	3.05
69	1.627	1.803	1.993	10.54%	3.11
70	1.570	1.742	1.927	10.65%	3.16
71	1.516	1.684	1.865	10.76%	3.21
72	1.464	1.628	1.805	10.88%	3.26
73	1.414	1.574	1.747	10.99%	3.31
74	1.366	1.522	1.691	11.10%	3.36
75	1.320	1.472	1.637	11.21%	3.42
76	1.276	1.424	1.585	11.32%	3.47
77	1.233	1.378	1.535	11.43%	3.52
78	1.192	1.333	1.487	11.54%	3.58
79	1.153	1.290	1.441	11.65%	3.63
80	1.115	1.249	1.396	11.76%	3.68
81	1.078	1.209	1.353	11.87%	3.74

82	1.043	1.171	1.311	11.98%	3.79
83	1.009	1.134	1.271	12.09%	3.85
84	0.977	1.099	1.233	12.19%	3.90
85	0.946	1.065	1.196	12.30%	3.96
86	0.915	1.032	1.160	12.40%	4.01
87	0.886	1.000	1.125	12.51%	4.07
88	0.858	0.969	1.091	12.62%	4.12
89	0.832	0.940	1.059	12.72%	4.18
90	0.806	0.911	1.028	12.82%	4.24
91	0.780	0.884	0.998	12.93%	4.30
92	0.756	0.857	0.969	13.03%	4.35
93	0.733	0.831	0.941	13.13%	4.41
94	0.711	0.807	0.913	13.24%	4.47
95	0.689	0.783	0.887	13.34%	4.53
96	0.668	0.760	0.862	13.44%	4.58
97	0.648	0.738	0.837	13.54%	4.64
98	0.629	0.716	0.814	13.64%	4.70
99	0.610	0.695	0.791	13.74%	4.76
100	0.592	0.675	0.769	13.84%	4.82
101	0.574	0.656	0.748	13.94%	4.88
102	0.558	0.637	0.727	14.04%	4.94
103	0.541	0.619	0.707	14.14%	5.00
104	0.526	0.602	0.688	14.24%	5.06
105	0.510	0.585	0.669	14.33%	5.12
106	0.496	0.569	0.651	14.43%	5.18
107	0.481	0.553	0.633	14.53%	5.25
108	0.468	0.538	0.616	14.62%	5.31
109	0.455	0.523	0.600	14.72%	5.37
110	0.442	0.508	0.584	14.82%	5.43
111	0.429	0.495	0.568	14.91%	5.50
112	0.417	0.481	0.553	15.01%	5.56
113	0.406	0.468	0.539	15.10%	5.62
114	0.394	0.456	0.525	15.20%	5.69
115	0.384	0.443	0.511	15.29%	5.75
116	0.373	0.432	0.498	15.38%	5.81
117	0.363	0.420	0.485	15.47%	5.88
118	0.353	0.409	0.473	15.57%	5.94
119	0.344	0.399	0.461	15.66%	6.01
120	0.334	0.388	0.449	15.75%	6.07
121	0.326	0.378	0.438	15.84%	6.14
122	0.317	0.368	0.427	15.93%	6.20
123	0.309	0.359	0.416	16.02%	6.27

124	0.300	0.350	0.406	16.11%	6.34
125	0.293	0.341	0.396	16.20%	6.40

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