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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) : QN0402X104F4150FB

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

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.

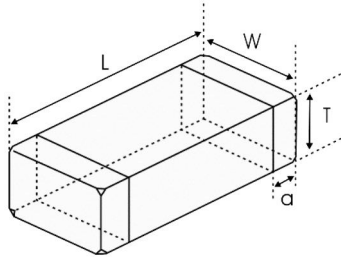


图 1 Fig.1

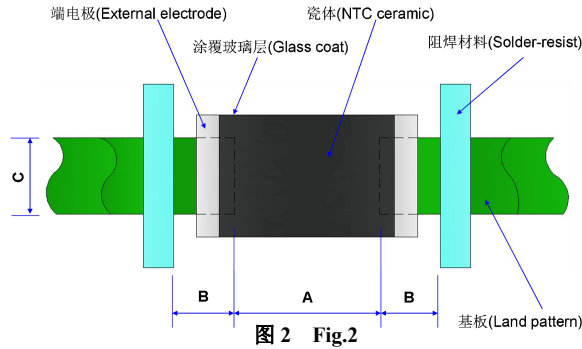


图 2 Fig.2

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 104 F 4150 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)	
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
683	68kΩ
104	100kΩ

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
4150	4150K

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 (℃)
QN0402X104F4150FB	100	4150	4210	0.10	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:

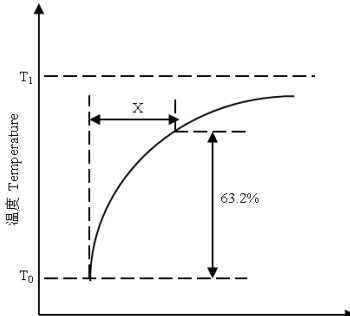
- a. Ambient Temperature: 25±2℃
- b. Relative Humidity: 65±5%
- c. Air Pressure: 86kPa to 106kPa

— Inspection Equipment

Visual Examination: 20× magnifier

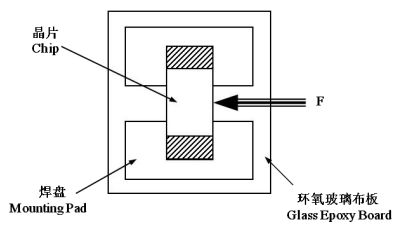
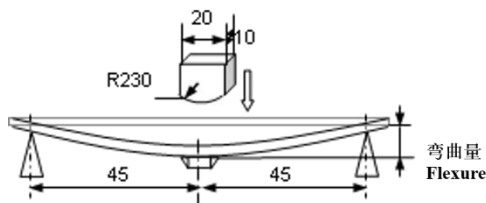
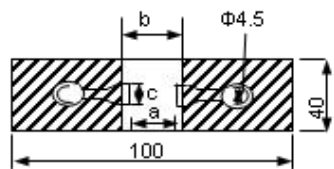
Resistance value test: Thermistor resistance tester

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 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	<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： 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。 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。 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 style="text-align: center;">单位 unit: mm</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <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																				
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																				

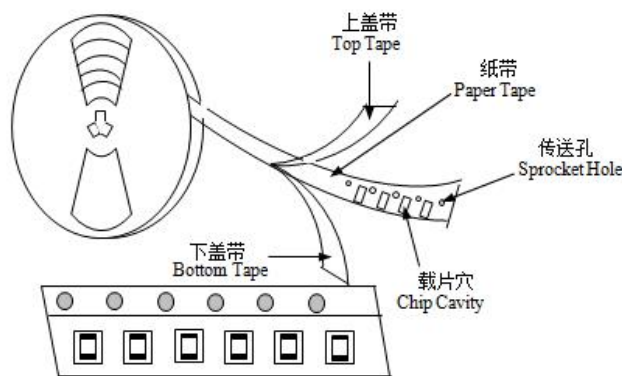
<p>振动 Vibration</p>	<p>IEC 60068-2-80</p>	<p>① 将晶片焊接在测试基板上（如右图所示的环氧玻璃布板）； Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder.</p> <p>② 晶片以全振幅为 1.5mm 进行振动，频率范围为 10Hz ~55 Hz； The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, 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 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 1023 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

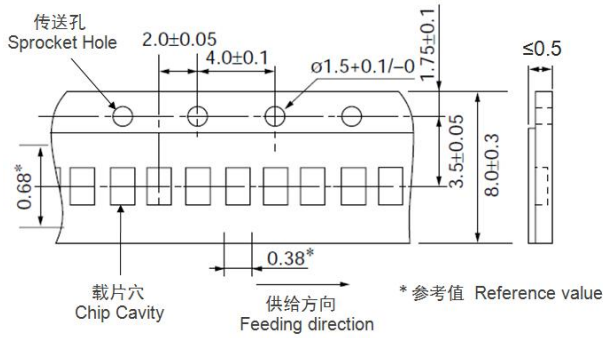
类型 Type	0201	0402	0603	0805
编带厚度 Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2
编带材质 Tape material	纸带 Paper Tape			
每盘数量 Quantity per Reel	15K	10K	4K	4K

(1) 编带图 Taping Drawings

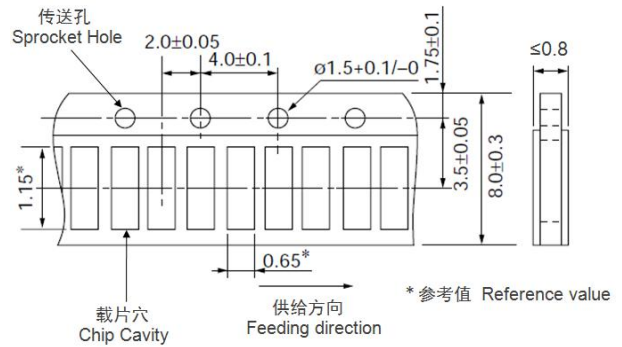


(2) 纸带尺寸 Paper Tape Dimensions (单位 Unit: mm)

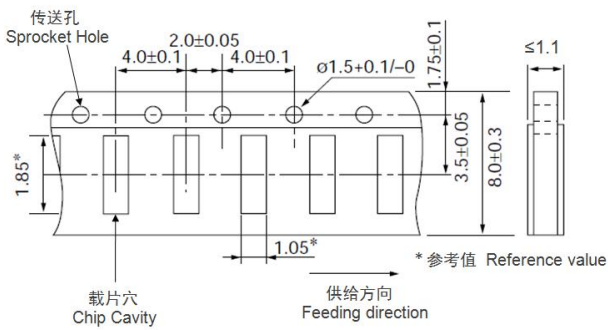
QN0201 系列 QN0201 series



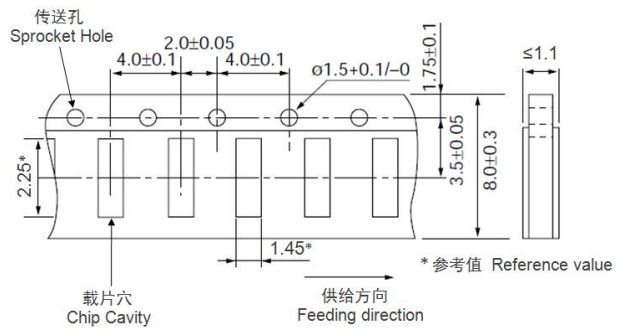
QN0402 系列 QN0402 series



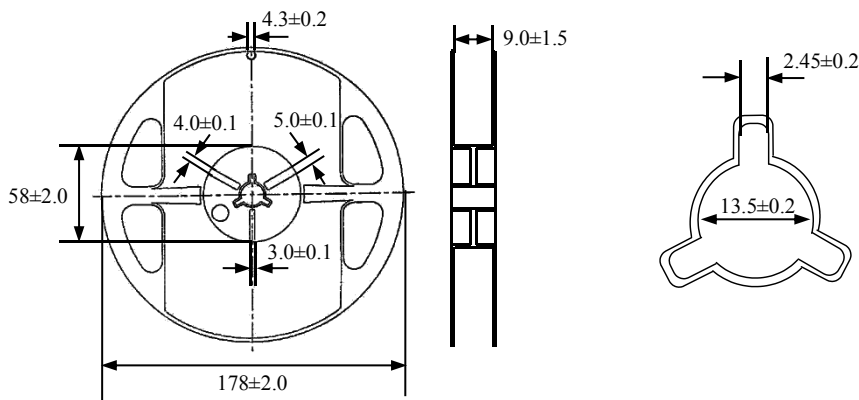
QN0603 系列 QN0603 series



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

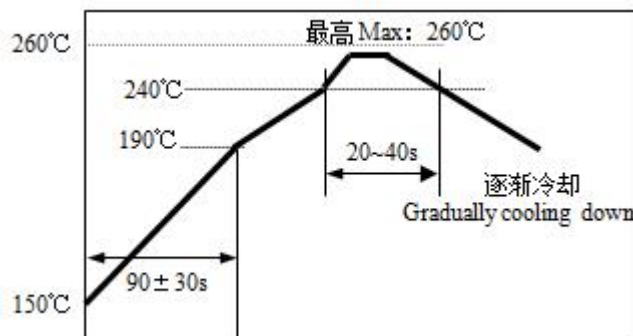
回流焊

- 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

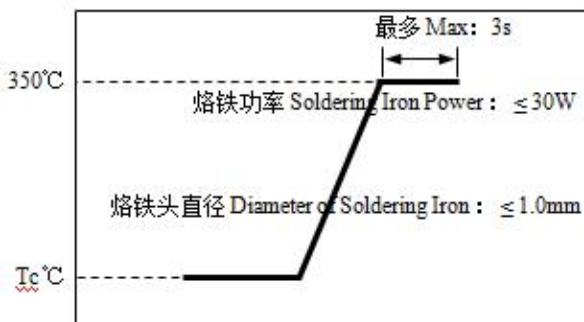
- 烙铁功率：最大 30W
- 预热：150°C/60sec.
- 烙铁头温度：最高 350°C
- 焊接时间：最多 3sec.
- 焊锡：Sn/3.0Ag/0.5Cu
- 手工焊：最多 1 次

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

QN0402X104F4150FB

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	3,837.917	4,022.587	4,215.721	4.80%	0.66
-39	3,572.549	3,741.741	3,918.554	4.73%	0.66
-38	3,327.556	3,482.646	3,644.599	4.65%	0.65
-37	3,101.230	3,243.462	3,391.879	4.58%	0.65
-36	2,892.014	3,022.518	3,158.596	4.50%	0.64
-35	2,727.699	2,849.104	2,975.615	4.44%	0.64
-34	2,546.080	2,657.552	2,773.626	4.37%	0.63
-33	2,377.919	2,480.315	2,586.862	4.30%	0.62
-32	2,222.122	2,316.224	2,414.070	4.22%	0.62
-31	2,077.696	2,164.212	2,254.106	4.15%	0.61
-30	1,962.606	2,043.154	2,126.794	4.09%	0.61
-29	1,836.671	1,910.769	1,987.658	4.02%	0.60
-28	1,719.746	1,787.939	1,858.650	3.95%	0.60
-27	1,611.126	1,673.908	1,738.963	3.89%	0.59
-26	1,510.163	1,567.986	1,627.859	3.82%	0.59
-25	1,428.511	1,482.374	1,538.115	3.76%	0.58
-24	1,340.105	1,389.738	1,441.065	3.69%	0.57
-23	1,257.812	1,303.563	1,350.842	3.63%	0.57
-22	1,181.169	1,223.355	1,266.920	3.56%	0.56
-21	1,109.749	1,148.660	1,188.817	3.50%	0.56
-20	1,050.501	1,086.732	1,124.100	3.44%	0.55
-19	987.769	1,021.201	1,055.659	3.37%	0.54
-18	929.231	960.090	991.874	3.31%	0.54
-17	874.580	903.070	932.396	3.25%	0.53
-16	823.531	849.842	876.906	3.18%	0.53
-15	780.579	805.082	830.271	3.13%	0.52
-14	735.569	758.204	781.457	3.07%	0.51
-13	693.471	714.385	735.856	3.01%	0.51
-12	654.077	673.405	693.235	2.94%	0.50
-11	617.196	635.062	653.380	2.88%	0.49
-10	585.717	602.353	619.399	2.83%	0.49
-9	553.082	568.462	584.211	2.77%	0.48
-8	522.492	536.713	551.265	2.71%	0.47
-7	493.805	506.955	520.404	2.65%	0.47
-6	466.890	479.052	491.483	2.59%	0.46

-5	443.416	454.730	466.286	2.54%	0.45
-4	419.534	429.998	440.679	2.48%	0.45
-3	397.100	406.779	416.652	2.43%	0.44
-2	376.019	384.972	394.098	2.37%	0.43
-1	356.199	364.481	372.918	2.31%	0.42
0	338.779	346.480	354.321	2.26%	0.42
1	321.125	328.247	335.494	2.21%	0.41
2	304.510	311.096	317.794	2.15%	0.40
3	288.865	294.956	301.146	2.10%	0.40
4	274.129	279.761	285.480	2.04%	0.39
5	260.919	266.147	271.453	1.99%	0.38
6	247.759	252.592	257.492	1.94%	0.37
7	235.350	239.816	244.342	1.89%	0.36
8	223.644	227.771	231.950	1.83%	0.36
9	212.598	216.409	220.267	1.78%	0.35
10	202.556	206.087	209.659	1.73%	0.34
11	192.663	195.922	199.216	1.68%	0.33
12	183.316	186.324	189.362	1.63%	0.33
13	174.484	177.259	180.059	1.58%	0.32
14	166.135	168.693	171.273	1.53%	0.31
15	158.437	160.800	163.181	1.48%	0.30
16	150.938	153.114	155.305	1.43%	0.29
17	143.842	145.845	147.860	1.38%	0.29
18	137.125	138.967	140.819	1.33%	0.28
19	130.765	132.458	134.159	1.28%	0.27
20	124.810	126.366	127.928	1.24%	0.26
21	119.084	120.511	121.943	1.19%	0.25
22	113.656	114.965	116.276	1.14%	0.24
23	108.511	109.708	110.908	1.09%	0.23
24	103.630	104.725	105.822	1.05%	0.23
25	99.000	100.000	101.000	1.00%	0.22
26	94.508	95.506	96.506	1.05%	0.23
27	90.247	91.242	92.239	1.09%	0.24
28	86.205	87.195	88.188	1.14%	0.25
29	82.369	83.352	84.339	1.18%	0.26
30	78.681	79.657	80.637	1.23%	0.27
31	75.216	76.183	77.155	1.28%	0.29
32	71.925	72.882	73.844	1.32%	0.30
33	68.798	69.744	70.696	1.36%	0.31
34	65.826	66.760	67.701	1.41%	0.32
35	62.932	63.854	64.782	1.45%	0.34
36	60.242	61.150	62.066	1.50%	0.35

37	57.682	58.577	59.480	1.54%	0.36
38	55.247	56.128	57.018	1.58%	0.37
39	52.929	53.797	54.672	1.63%	0.38
40	50.642	51.494	52.355	1.67%	0.40
41	48.539	49.376	50.223	1.72%	0.41
42	46.535	47.358	48.191	1.76%	0.42
43	44.627	45.435	46.252	1.80%	0.44
44	42.808	43.601	44.404	1.84%	0.45
45	40.996	41.773	42.561	1.89%	0.46
46	39.342	40.104	40.877	1.93%	0.47
47	37.764	38.511	39.270	1.97%	0.49
48	36.259	36.992	37.735	2.01%	0.50
49	34.823	35.540	36.269	2.05%	0.51
50	33.365	34.067	34.780	2.09%	0.53
51	32.057	32.744	33.443	2.13%	0.54
52	30.807	31.480	32.164	2.17%	0.55
53	29.613	30.272	30.942	2.21%	0.57
54	28.472	29.117	29.773	2.25%	0.58
55	27.307	27.936	28.578	2.30%	0.59
56	26.265	26.881	27.509	2.34%	0.61
57	25.269	25.872	26.486	2.37%	0.62
58	24.317	24.906	25.507	2.41%	0.64
59	23.405	23.982	24.570	2.45%	0.65
60	22.462	23.025	23.599	2.49%	0.66
61	21.629	22.179	22.741	2.53%	0.68
62	20.831	21.369	21.918	2.57%	0.69
63	20.067	20.593	21.130	2.61%	0.71
64	19.335	19.849	20.374	2.65%	0.72
65	18.568	19.069	19.581	2.69%	0.74
66	17.897	18.387	18.888	2.73%	0.75
67	17.255	17.733	18.223	2.76%	0.77
68	16.639	17.106	17.585	2.80%	0.78
69	16.048	16.505	16.973	2.84%	0.79
70	15.427	15.873	16.329	2.88%	0.81
71	14.885	15.320	15.766	2.91%	0.82
72	14.365	14.790	15.226	2.95%	0.84
73	13.865	14.281	14.707	2.98%	0.85
74	13.386	13.792	14.209	3.02%	0.87
75	12.870	13.266	13.672	3.06%	0.88
76	12.430	12.816	13.213	3.10%	0.90
77	12.006	12.384	12.772	3.13%	0.92
78	11.600	11.968	12.347	3.17%	0.93

79	11.209	11.569	11.940	3.20%	0.95
80	10.789	11.140	11.501	3.24%	0.96
81	10.429	10.771	11.124	3.28%	0.98
82	10.083	10.418	10.763	3.31%	0.99
83	9.750	10.077	10.414	3.34%	1.01
84	9.430	9.750	10.079	3.38%	1.03
85	9.082	9.393	9.714	3.42%	1.04
86	8.786	9.091	9.404	3.45%	1.06
87	8.502	8.799	9.106	3.48%	1.07
88	8.229	8.519	8.819	3.52%	1.09
89	7.966	8.249	8.542	3.55%	1.11
90	7.675	7.952	8.237	3.59%	1.12
91	7.432	7.702	7.981	3.62%	1.14
92	7.198	7.462	7.734	3.66%	1.16
93	6.972	7.230	7.497	3.69%	1.17
94	6.755	7.007	7.267	3.72%	1.19
95	6.516	6.761	7.016	3.76%	1.21
96	6.315	6.555	6.803	3.79%	1.22
97	6.120	6.355	6.598	3.82%	1.24
98	5.933	6.163	6.400	3.85%	1.26
99	5.753	5.977	6.209	3.89%	1.27
100	5.549	5.767	5.993	3.92%	1.29
101	5.381	5.595	5.816	3.95%	1.31
102	5.220	5.429	5.645	3.99%	1.33
103	5.064	5.268	5.480	4.02%	1.34
104	4.914	5.113	5.320	4.05%	1.36
105	4.745	4.940	5.141	4.08%	1.38
106	4.606	4.796	4.993	4.11%	1.40
107	4.471	4.657	4.850	4.15%	1.41
108	4.341	4.522	4.711	4.18%	1.43
109	4.215	4.393	4.577	4.21%	1.45
110	4.072	4.245	4.426	4.24%	1.47
111	3.955	4.125	4.301	4.27%	1.48
112	3.842	4.008	4.180	4.30%	1.50
113	3.733	3.895	4.064	4.33%	1.52
114	3.628	3.786	3.951	4.36%	1.54
115	3.506	3.661	3.822	4.40%	1.56
116	3.408	3.559	3.717	4.43%	1.58
117	3.313	3.461	3.615	4.46%	1.59
118	3.221	3.366	3.517	4.48%	1.61
119	3.132	3.274	3.421	4.51%	1.63
120	3.031	3.169	3.314	4.55%	1.65

121	2.948	3.083	3.224	4.58%	1.67
122	2.868	3.000	3.138	4.60%	1.69
123	2.790	2.920	3.055	4.63%	1.71
124	2.715	2.842	2.974	4.66%	1.73
125	2.627	2.750	2.879	4.70%	1.74

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