Chip NTC Thermistor

Features

- High testing precision
- Steady operating for long time
- Reflow soldering possible
- Short response time

Applications

- Temperature measurement
- Battery chargers
- Temperature sensing, protection and compensation in industrial, telecom and consumer applications
- Inrush current limiting, e.g. in switch-mode power supplies, soft-start motors

PART NUMBER

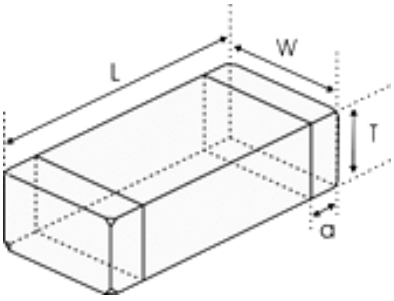
Example: RND 155QN0402X333H3950FA

RND 155QN0402	X	333	H	3950	F	A
Type RND 155QN0402: 0402 RND 155QN0603: 0603 RND 155QN0805: 0805	Delimeter	Nominal Resistance 472 = 4.7 kΩ 333 = 33 kΩ 334 = 330 kΩ	Tolerance F = ± 1% G = ± 2% H = ± 3% J = ±5 %	B Constant 3550 = 3550 K 3950 = 3950 K 4050 = 4050 K 4500 = 4500 K	Tolerance of B Constant F = ± 1% H = ± 3%	B Constant Calculation Method A = 25℃ & 85℃ B = 25℃ & 50℃

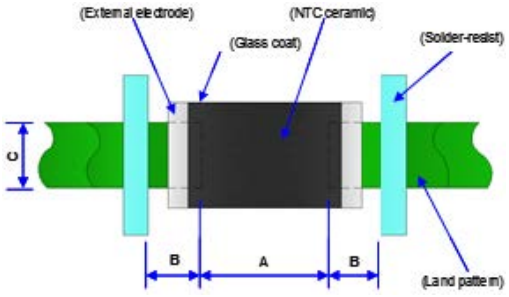
Electrical Characteristics

Type	Resistance @ 25 °C	B Constant @ 25 / 50 °C	B Constant @ 25 / 85 °C	Permissible Operating Current @ 25 °C	Dissipation Factor	Thermal Time Constant	Rated Electric Power @ 25 °C	Operating Ambient Temperature
RND 155QN0402X333H3950FA	33 kΩ ±3%	3920 K	3950 K ±1%	0.31 mA	1 mW / °C	<3 s	100 mW	-40 ... 125 °C

Shape and Dimensions



Dimensions



Recommended PCB pattern for reflow soldering

Type	L	W	T	a	A	B	/
0402	1 mm	0.5 mm	0.5 mm	0.25 mm	0.45 ... 0.55 mm	0.4 ... 0.5 mm	л◊пр ◊◊◊ л◊рр ҮҮ
0603	1.6 mm	0.8 mm	0.8 mm	0.3 mm	0.6 ... 0.8 mm	0.6 ... 0.7 mm	л◊с ◊◊◊ л◊у ҮҮ
0805	2 mm	1.25 mm	0.85 mm	0.5 mm	1 ... 1.1 mm	0.6 ... 0.7 mm	м ... м◊н mm

Test and Measurement Procedures

Unless otherwise specified, the standard atmospheric conditions for measurement/test as

- Ambient Temperature: 20±15℃
- Relative Humidity: 65±20%
- Air Pressure: 86 kPa to 106 kPa

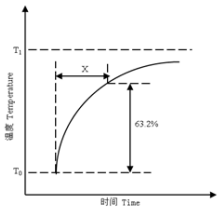
If any doubt on the results, measurements/tests should be made within the following limits

- Ambient Temperature: 20±2℃
- Relative Humidity: 65±5%
- Air Pressure: 86 kPa to 106 kPa

Inspection Equipment

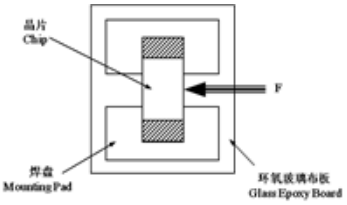
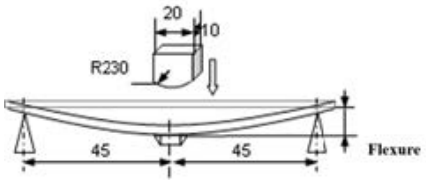
- Visual Examination: 20x magnifier
- Resistance value test: Thermistor resistance tester

Electrical Test

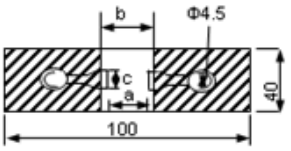
Item	Test Methods and Remarks
Nominal Zero-Power Resistance at 25 ℃(R25)	Ambient temperature: 25 ± 0.05℃ Measuring electric power: ≤0.1 mW
Nominal B Constant	25 ± 0.05℃, 50 ± 0.05℃, 85 ± 0.05℃ Measure the resistance at the ambient temperature of 25 ± 0.05℃, 50 ± 0.05℃ or 85 ± 0.05℃ B(25-50℃) = $\frac{\ln R_{25}-\ln R_{50}}{1/T_{25}-1/T_{50}}$ B(25-85℃) = $\frac{\ln R_{25}-\ln R_{85}}{1/T_{25}-1/T_{85}}$ T: (K) Absolute temperature (K)
Thermal Time Constant	The total time for the temperature of the thermistor to change by 63.2% of the difference from ambient temperature T0 (℃) to T1 (℃) by the drastic change of the power applied to thermistor from non-zero Power to Zero-Power state, normally expressed in second (S) 

Item	Test Methods and Remarks
Dissipation Factor	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 $\delta = WT-T0$
Rated Power	The necessary electric power makes thermistor's temperature rise 100℃ by self-heating at ambient temperature 25℃
Permissible Operating Current	The current that keep body temperature of chip NTC on the PC board in still air rising 1°C by self-heating

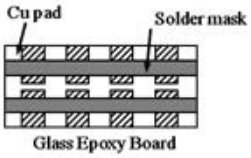
Reliability Test

<table>
<tr><th>Item</th><th>Standard</th><th>Test Methods and Remarks</th><th>Requirements</th></tr>
<tr><td>Terminal Strength</td><td>IEC 60068-2-21</td><td>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>Size</th><th>F</th><th>Duration</th></tr>
<tr><td>0402, 0603</td><td>5N</td><td rowspan="2">10 ± 1 s</td></tr>
<tr><td>0805</td><td>10N</td></tr>
</table></td><td>No removal or split of the termination or other defects shall occur

</td></tr>
<tr><td>Resistance to Flexure</td><td>IEC 60068-2-21</td><td>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>Size</th><th>Flexure</th><th>Pressurizing Speed</th><th>Duration</th></tr>
<tr><td>0402, 0603</td><td>1 mm</td><td rowspan="2"><0.5 mm/s</td><td rowspan="2">10 ± 1 s</td></tr>
<tr><td>0805</td><td>2 mm</td></tr>
</table></td><td>1. No visible damage

2. ΔR25/R25 ≤5%
<table>
<tr><th>Size</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>0402</td><td>0.4 mm</td><td>1.5 mm</td><td>0.5 mm</td></tr>
<tr><td>0603</td><td>1 mm</td><td>3 mm</td><td>1.2 mm</td></tr>
<tr><td>0805</td><td>1.2 mm</td><td>4 mm</td><td>1.65 mm</td></tr>
</table>

</td></tr>
<tr><td>Vibration</td><td>IEC 60068-2-80</td><td>1. Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder

2. The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5 mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz

3. 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)</td><td>No visible damage

</td></tr>
<tr><td>Dropping</td><td>IEC 60068-2-32</td><td>Drop a chip 10 times on a concrete floor from a height of 1 meter</td><td>No visible damage</td></tr>
</table>

Item	Standard	Test Methods and Remarks	Requirements
Solderability	IEC 60068-2-58	• Solder temperature: 245 ± 5℃ • Duration: 10 ± 1s • Solder: Sn/3.0Ag/0.5Cu • Flux: 25% resin and 75% ethanol in weight	1. No visible damage 2. Wetting shall exceed 95% coverage
Resistance to Soldering Heat	IEC 60068-2-58	• Solder temperature: 245 ± 5℃ • Duration: 10±1s • Solder: Sn/3.0Ag/0.5Cu • Flux: 25% resin and 75% ethanol in weight • The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage 2. |ΔR25/R25| ≤5% 3. |ΔB/B| ≤2%
Temperature Cycling	IEC 60068-2-14	5 cycles of following sequence without loading Step / Temperature / Time 1 / -40 ± 5℃ / 30 ± 3min 2 / 25 ± 2 ℃ / 5 ± 3min 3 / 125 ± 2 ℃ / 30 ± 3min 4 / 25±2℃ / 5 ± 3min	1. No visible damage 2. |ΔR25/R25| ≤3% 3. |ΔB/B| ≤2%
Resistance to Dry Heat	IEC 60068-2-2	1. 125 ± 5℃ in air, for 1000 ± 24 hours without loading 2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage 2. |ΔR25/R25| ≤5% 3. |ΔB/B| ≤2%
Resistance to Cold	IEC 60068-2-1	1. -40 ± 3℃ in air, for 1000 ± 24 hours without loading 2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage 2. |ΔR25/R25| ≤5% 3. |ΔB/B| ≤2%
Resistance to Damp Heat	IEC 60068-2-78	1. 40 ± 2℃, 90~95%RH in air, for 1000 ±2 4 hours without loading 2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage 2. |ΔR25/R25| ≤3% 3. |ΔB/B| ≤2%
Resistance to high temperature load	IEC 60539-1 5.25.4	1. 85 ± 2℃in air with permissive operating current for 1000 ± 48 hours 2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage 2. |ΔR25/R25| ≤5% 3. |ΔB/B| ≤2%

Storage

Storage Conditions

- Storage Temperature: -10℃～40℃
- Relative Humidity: ≦ 75%RH
- Keep away from corrosive atmosphere and sunlight
- Period of Storage: 6 Months after delivery

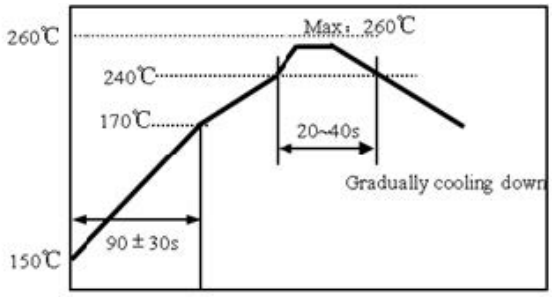
Notes & Warnings

The RND 155QN series thermistors shall not be operated and stored under the following environmental conditions:

- Corrosive or deoxidized atmospheres (such as chlorine, sulfurated hydrogen, ammonia, sulfuric acid, nitric oxide and so on)
- Volatile or inflammable atmospheres
- Dusty condition
- Excessively high or low pressure condition
- Humid site
- Places with brine, oil, chemical liquid or organic solvent
- Intense vibration
- Places with analogously deleterious conditions
- The ceramic body of the RND 155QN series thermistors is fragile, no excessive pressure or impact shall be exerted on it
- The RND 155QN series thermistors shall not be operated beyond the specified “Operating Temperature Range” in the catalog

Re-Flowing Profile

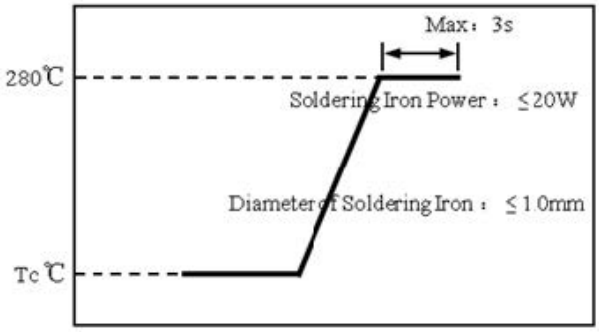
- 1~2℃/sec. Ramp
- Pre-heating: 150~170℃/90±30 sec.
- Time above 240℃: 20~40 sec.
- Peak temperature: 260℃Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



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



Chip NTC Thermistor

RND components

R-T table

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
-40	1,034.049	1,104.115	1,177.868	6.68%	0.97
-39	968.090	1,032.999	1,101.268	6.61%	0.96
-38	906.784	966.944	1,030.166	6.54%	0.96
-37	849.774	905.557	964.133	6.47%	0.96
-36	796.731	848.479	902.775	6.40%	0.96
-35	747.356	795.384	845.735	6.33%	0.95
-34	701.253	745.837	792.543	6.26%	0.95
-33	658.306	699.713	743.055	6.19%	0.95
-32	618.273	656.745	696.984	6.13%	0.94
-31	580.942	616.704	654.078	6.06%	0.94
-30	546.113	579.369	614.096	5.99%	0.94
-29	513.600	544.539	576.821	5.93%	0.94
-28	483.234	512.028	542.049	5.86%	0.93
-27	454.865	481.674	509.604	5.80%	0.93
-26	428.346	453.317	479.312	5.73%	0.93
-25	403.544	426.811	451.014	5.67%	0.92
-24	380.387	402.079	424.626	5.61%	0.92
-23	358.706	378.938	399.950	5.55%	0.91
-22	338.397	357.272	376.861	5.48%	0.91
-21	319.367	336.985	355.253	5.42%	0.91
-20	301.525	317.973	335.017	5.36%	0.90
-19	284.726	300.084	315.985	5.30%	0.90
-18	268.970	283.315	298.157	5.24%	0.90
-17	254.186	267.590	281.447	5.18%	0.89
-16	240.308	252.836	265.778	5.12%	0.89
-15	227.273	238.987	251.079	5.06%	0.89
-14	215.069	226.028	237.332	5.00%	0.88
-13	203.597	213.853	224.424	4.94%	0.88
-12	192.806	202.407	212.295	4.89%	0.87
-11	182.649	191.639	200.891	4.83%	0.87
-10	173.091	181.513	190.173	4.77%	0.86
-9	164.046	171.934	180.040	4.71%	0.86
-8	155.532	162.923	170.512	4.66%	0.86
-7	147.511	154.438	161.545	4.60%	0.85
-6	139.952	146.447	153.105	4.55%	0.85
-5	132.827	138.918	145.157	4.49%	0.84
-4	126.118	131.832	137.680	4.44%	0.84
-3	119.789	125.151	130.635	4.38%	0.83
-2	113.813	118.846	123.990	4.33%	0.83
-1	108.170	112.895	117.721	4.27%	0.82
0	102.842	107.280	111.809	4.22%	0.82
1	97.801	101.970	106.220	4.17%	0.82

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Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
2	93.040	96.957	100.948	4.12%	0.81
3	88.535	92.215	95.963	4.06%	0.81
4	84.278	87.738	91.258	4.01%	0.80
5	80.248	83.502	86.809	3.96%	0.80
6	76.436	79.496	82.604	3.91%	0.79
7	72.826	75.705	78.626	3.86%	0.79
8	69.409	72.117	74.863	3.81%	0.78
9	66.171	68.720	71.302	3.76%	0.78
10	63.101	65.500	67.929	3.71%	0.77
11	60.191	62.450	64.735	3.66%	0.77
12	57.433	59.560	61.711	3.61%	0.76
13	54.815	56.818	58.841	3.56%	0.75
14	52.335	54.222	56.127	3.51%	0.75
15	49.978	51.757	53.550	3.46%	0.74
16	47.742	49.418	51.106	3.42%	0.74
17	45.620	47.199	48.789	3.37%	0.73
18	43.602	45.091	46.589	3.32%	0.73
19	41.685	43.089	44.500	3.28%	0.72
20	39.863	41.187	42.517	3.23%	0.72
21	38.133	39.382	40.635	3.18%	0.71
22	36.485	37.663	38.844	3.14%	0.70
23	34.919	36.031	37.144	3.09%	0.70
24	33.430	34.479	35.529	3.05%	0.69
25	32.010	33.000	33.990	3.00%	0.69
26	30.633	31.594	32.556	3.04%	0.70
27	29.322	30.255	31.190	3.09%	0.72
28	28.077	28.983	29.891	3.13%	0.73
29	26.888	27.767	28.650	3.18%	0.75
30	25.757	26.611	27.468	3.22%	0.76
31	24.683	25.512	26.345	3.27%	0.78
32	23.654	24.459	25.268	3.31%	0.79
33	22.678	23.459	24.245	3.35%	0.81
34	21.744	22.502	23.266	3.40%	0.82
35	20.856	21.592	22.335	3.44%	0.84
36	20.007	20.722	21.444	3.48%	0.85
37	19.201	19.895	20.596	3.52%	0.87
38	18.428	19.102	19.783	3.56%	0.88
39	17.693	18.348	19.009	3.61%	0.90
40	16.988	17.624	18.267	3.65%	0.92
41	16.319	16.936	17.561	3.69%	0.93
42	15.676	16.275	16.882	3.73%	0.95
43	15.062	15.644	16.234	3.77%	0.96
44	14.478	15.043	15.616	3.81%	0.98
45	13.919	14.468	15.026	3.85%	1.00
46	13.383	13.917	14.459	3.89%	1.01

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
47	12.870	13.389	13.915	3.93%	1.03
48	12.380	12.883	13.395	3.97%	1.05
49	11.912	12.402	12.899	4.01%	1.06
50	11.464	11.940	12.423	4.05%	1.08
51	11.036	11.497	11.968	4.09%	1.10
52	10.626	11.075	11.533	4.13%	1.11
53	10.233	10.670	11.114	4.17%	1.13
54	9.856	10.280	10.713	4.21%	1.15
55	9.496	9.908	10.329	4.25%	1.17
56	9.151	9.552	9.961	4.28%	1.18
57	8.819	9.209	9.607	4.32%	1.20
58	8.504	8.883	9.270	4.36%	1.22
59	8.198	8.566	8.943	4.40%	1.24
60	7.908	8.267	8.633	4.44%	1.25
61	7.628	7.977	8.334	4.47%	1.27
62	7.358	7.697	8.044	4.51%	1.29
63	7.101	7.430	7.768	4.55%	1.31
64	6.856	7.177	7.506	4.58%	1.32
65	6.618	6.930	7.250	4.62%	1.34
66	6.389	6.693	7.005	4.66%	1.36
67	6.167	6.463	6.766	4.69%	1.38
68	5.958	6.245	6.541	4.73%	1.40
69	5.755	6.035	6.322	4.76%	1.42
70	5.559	5.831	6.111	4.80%	1.43
71	5.372	5.637	5.910	4.84%	1.45
72	5.195	5.453	5.718	4.87%	1.47
73	5.024	5.275	5.534	4.91%	1.49
74	4.856	5.101	5.353	4.94%	1.51
75	4.698	4.937	5.182	4.98%	1.53
76	4.547	4.779	5.018	5.01%	1.55
77	4.399	4.625	4.858	5.04%	1.57
78	4.257	4.477	4.704	5.08%	1.59
79	4.121	4.335	4.557	5.11%	1.61
80	3.989	4.198	4.414	5.15%	1.63
81	3.862	4.066	4.277	5.18%	1.65
82	3.740	3.938	4.143	5.21%	1.67
83	3.620	3.813	4.014	5.25%	1.68
84	3.507	3.695	3.890	5.28%	1.70
85	3.400	3.584	3.774	5.31%	1.72
86	3.293	3.472	3.658	5.35%	1.74
87	3.192	3.367	3.548	5.38%	1.76
88	3.095	3.265	3.442	5.41%	1.78
89	3.001	3.167	3.339	5.44%	1.81
90	2.910	3.072	3.240	5.47%	1.83
91	2.822	2.980	3.144	5.51%	1.85

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Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
92	2.737	2.892	3.052	5.54%	1.87
93	2.656	2.806	2.963	5.57%	1.89
94	2.574	2.721	2.874	5.60%	1.91
95	2.499	2.642	2.791	5.63%	1.93
96	2.427	2.567	2.713	5.66%	1.95
97	2.355	2.492	2.634	5.70%	1.97
98	2.287	2.420	2.558	5.73%	1.99
99	2.221	2.351	2.486	5.76%	2.01
100	2.158	2.285	2.418	5.79%	2.03
101	2.096	2.220	2.349	5.82%	2.06
102	2.037	2.158	2.284	5.85%	2.08
103	1.977	2.096	2.219	5.88%	2.10
104	1.921	2.037	2.157	5.91%	2.12
105	1.868	1.981	2.099	5.94%	2.14
106	1.815	1.925	2.040	5.97%	2.16
107	1.765	1.873	1.985	6.00%	2.19
108	1.716	1.821	1.930	6.03%	2.21
109	1.669	1.772	1.879	6.06%	2.23
110	1.625	1.726	1.831	6.08%	2.25
111	1.582	1.680	1.783	6.11%	2.27
112	1.538	1.634	1.735	6.14%	2.30
113	1.498	1.592	1.690	6.17%	2.32
114	1.457	1.549	1.645	6.20%	2.34
115	1.417	1.507	1.601	6.23%	2.36
116	1.380	1.467	1.559	6.26%	2.39
117	1.343	1.428	1.518	6.29%	2.41
118	1.308	1.392	1.480	6.31%	2.43
119	1.274	1.356	1.442	6.34%	2.46
120	1.240	1.320	1.404	6.37%	2.48
121	1.209	1.288	1.370	6.40%	2.50
122	1.178	1.255	1.336	6.42%	2.53
123	1.147	1.222	1.301	6.45%	2.55
124	1.119	1.193	1.270	6.48%	2.57
125	1.092	1.164	1.239	6.50%	2.60