Chip NTC Thermistor

RND components

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
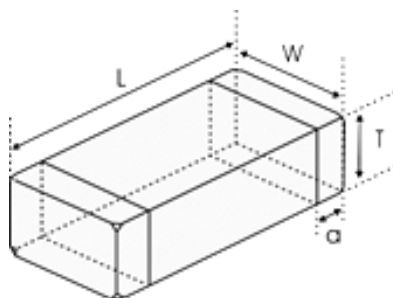
PART NUMBER

Example: RND 155QN0402X104J3950FA

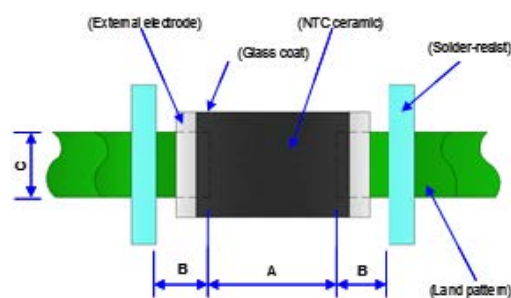| RND 155QN0402	X	104	J	3950	F	A
Type	Delimeter	Nominal Resistance	Tolerance	B Constant	Tolerance of B Constant	B Constant Calculation Method
RND 155QN0402: 0402 RND 155QN0603: 0603 RND 155QN0805: 0805		472 = 4.7 kΩ 683 = 68 kΩ 104 = 100 kΩ	F = ± 1% G = ± 2% H = ± 3% J = ±5 %	3600 = 3600 K 3950 = 3950 K 4050 = 4050 K 4500 = 4500 K	F = ± 1% H = ± 3%	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 155QN0402X104J3950FA	100 kΩ ±5%	3890 K	3950 K ±1%	0.10 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	
0603	1.6 mm	0.8 mm	0.8 mm	0.3 mm	0.6 ... 0.8 mm	0.6 ... 0.7 mm	
0805	2 mm	1.25 mm	0.85 mm	0.5 mm	1 ... 1.1 mm	0.6 ... 0.7 mm	... mm

Chip NTC Thermistor

Test and Measurement Procedures

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

• Ambient Temperature: 20±15℃

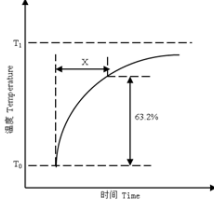• Relative Humidity: 65±20%

• 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

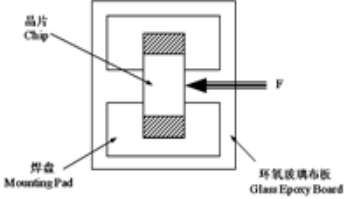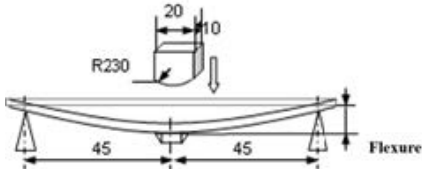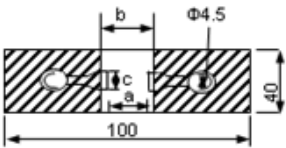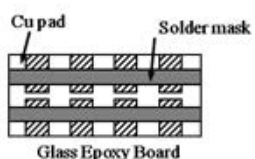• Resistance value test: Thermistor resistance tester

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℃ $B(25\text{-}50℃) = \dfrac{\ln R_{25}-\ln R_{50}}{1/T_{25}-1/T_{50}}$ $B(25\text{-}85℃) = \dfrac{\ln R_{25}-\ln R_{85}}{1/T_{25}-1/T_{85}}$ 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

Chip NTC Thermistor

Reliability Test

Item	Standard	Test Methods and Remarks	Requirements
Terminal Strength	IEC 60068-2-21	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. **Size / F / Duration** 0402, 0603 — 5N 0805 — 10N Duration 10 ± 1 s 	No removal or split of the termination or other defects shall occur
Resistance to Flexure	IEC 60068-2-21	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 **Size / Flexure / Pressurizing Speed / Duration** 0402, 0603 — 1 mm 0805 — 2 mm Pressurizing Speed <0.5 mm/s Duration 10 ± 1 s	1. No visible damage 2. $\lvert \Delta R25/R25 \rvert \leq 5\%$ **Size / a / b / c** 0402 — 0.4 mm / 1.5 mm / 0.5 mm 0603 — 1 mm / 3 mm / 1.2 mm 0805 — 1.2 mm / 4 mm / 1.65 mm
Vibration	IEC 60068-2-80	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)	No visible damage
Dropping	IEC 60068-2-32	Drop a chip 10 times on a concrete floor from a height of 1 meter	No visible damage

Chip NTC Thermistor

RND components

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. $\lvert \Delta R25/R25 \rvert \leq 5\%$ 3. $\lvert \Delta B/B \rvert \leq 2\%$
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. $\lvert \Delta R25/R25 \rvert \leq 3\%$ 3. $\lvert \Delta B/B \rvert \leq 2\%$
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. $\lvert \Delta R25/R25 \rvert \leq 5\%$ 3. $\lvert \Delta B/B \rvert \leq 2\%$
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. $\lvert \Delta R25/R25 \rvert \leq 5\%$ 3. $\lvert \Delta B/B \rvert \leq 2\%$
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. $\lvert \Delta R25/R25 \rvert \leq 3\%$ 3. $\lvert \Delta B/B \rvert \leq 2\%$
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. $\lvert \Delta R25/R25 \rvert \leq 5\%$ 3. $\lvert \Delta B/B \rvert \leq 2\%$

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

Chip NTC Thermistor

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. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
-40	2,802.339	3,052.414	3,316.494	8.65%	1.29
-39	2,631.172	2,864.149	3,109.960	8.58%	1.29
-38	2,471.465	2,688.600	2,917.499	8.51%	1.29
-37	2,322.389	2,524.839	2,738.075	8.45%	1.28
-36	2,183.178	2,372.011	2,570.734	8.38%	1.28
-35	2,053.125	2,229.326	2,414.597	8.31%	1.28
-34	1,931.579	2,096.056	2,268.852	8.24%	1.28
-33	1,817.936	1,971.528	2,132.752	8.18%	1.28
-32	1,711.640	1,855.122	2,005.605	8.11%	1.28
-31	1,612.176	1,746.264	1,886.776	8.05%	1.28
-30	1,519.069	1,644.424	1,775.675	7.98%	1.28
-29	1,431.877	1,549.112	1,671.757	7.92%	1.28
-28	1,350.194	1,459.875	1,574.519	7.85%	1.28
-27	1,273.641	1,376.292	1,483.498	7.79%	1.28
-26	1,201.869	1,297.974	1,398.260	7.73%	1.27
-25	1,134.553	1,224.563	1,318.409	7.66%	1.27
-24	1,071.394	1,155.725	1,243.576	7.60%	1.27
-23	1,012.113	1,091.149	1,173.417	7.54%	1.27
-22	956.450	1,030.551	1,107.616	7.48%	1.27
-21	904.166	973.663	1,045.880	7.42%	1.27
-20	855.037	920.239	987.936	7.36%	1.27
-19	808.857	870.049	933.530	7.30%	1.26
-18	765.433	822.881	882.429	7.24%	1.26
-17	724.586	778.537	834.414	7.18%	1.26
-16	686.150	736.833	789.282	7.12%	1.26
-15	649.969	697.598	746.845	7.06%	1.26
-14	615.900	660.672	706.928	7.00%	1.26
-13	583.807	625.909	669.369	6.94%	1.26
-12	553.567	593.169	634.015	6.89%	1.25
-11	525.063	562.325	600.726	6.83%	1.25
-10	498.185	533.257	569.371	6.77%	1.25
-9	472.833	505.853	539.826	6.72%	1.25
-8	448.912	480.010	511.979	6.66%	1.25
-7	426.334	455.631	485.723	6.60%	1.24
-6	405.017	432.624	460.958	6.55%	1.24
-5	384.884	410.907	437.593	6.49%	1.24
-4	365.862	390.399	415.541	6.44%	1.24
-3	347.886	371.028	394.721	6.39%	1.24
-2	330.891	352.725	375.059	6.33%	1.23
-1	314.820	335.424	356.484	6.28%	1.23
0	299.617	319.067	338.930	6.23%	1.23
1	285.232	303.597	322.337	6.17%	1.23

Chip NTC Thermistor

Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
2	271.616	288.962	306.646	6.12%	1.22
3	258.724	275.111	291.805	6.07%	1.22
4	246.514	262.000	277.762	6.02%	1.22
5	234.946	249.584	264.471	5.96%	1.22
6	223.984	237.824	251.888	5.91%	1.21
7	213.592	226.681	239.971	5.86%	1.21
8	203.739	216.121	228.682	5.81%	1.21
9	194.393	206.109	217.985	5.76%	1.21
10	185.526	196.615	207.846	5.71%	1.20
11	177.110	187.609	198.233	5.66%	1.20
12	169.122	179.063	189.115	5.61%	1.20
13	161.536	170.953	180.465	5.56%	1.20
14	154.332	163.252	172.257	5.52%	1.19
15	147.486	155.940	164.466	5.47%	1.19
16	140.981	148.994	157.069	5.42%	1.19
17	134.797	142.394	150.043	5.37%	1.18
18	128.917	136.121	143.368	5.32%	1.18
19	123.324	130.158	137.026	5.28%	1.18
20	118.004	124.487	130.998	5.23%	1.17
21	112.940	119.093	125.266	5.18%	1.17
22	108.121	113.960	119.815	5.14%	1.17
23	103.533	109.076	114.630	5.09%	1.16
24	99.163	104.427	109.696	5.05%	1.16
25	95.000	100.000	105.000	5.00%	1.16
26	90.955	95.784	100.616	5.05%	1.18
27	87.104	91.767	96.438	5.09%	1.19
28	83.435	87.939	92.455	5.14%	1.21
29	79.940	84.291	88.657	5.18%	1.23
30	76.609	80.813	85.035	5.22%	1.25
31	73.434	77.497	81.579	5.27%	1.26
32	70.407	74.333	78.282	5.31%	1.28
33	67.521	71.315	75.134	5.36%	1.30
34	64.767	68.435	72.130	5.40%	1.32
35	62.140	65.686	69.260	5.44%	1.34
36	59.632	63.061	66.520	5.49%	1.36
37	57.239	60.554	63.902	5.53%	1.38
38	54.953	58.160	61.400	5.57%	1.39
39	52.771	55.872	59.009	5.61%	1.41
40	50.686	53.686	56.723	5.66%	1.43
41	48.694	51.597	54.537	5.70%	1.45
42	46.790	49.599	52.446	5.74%	1.47
43	44.970	47.689	50.446	5.78%	1.49
44	43.231	45.862	48.532	5.82%	1.51
45	41.567	44.114	46.700	5.86%	1.53
46	39.975	42.441	44.947	5.90%	1.55

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Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
47	38.452	40.840	43.268	5.94%	1.57
48	36.995	39.308	41.660	5.99%	1.59
49	35.600	37.840	40.120	6.03%	1.61
50	34.265	36.435	38.645	6.07%	1.63
51	32.987	35.088	37.231	6.11%	1.65
52	31.762	33.798	35.875	6.15%	1.67
53	30.589	32.562	34.576	6.18%	1.69
54	29.465	31.377	33.330	6.22%	1.71
55	28.388	30.241	32.135	6.26%	1.73
56	27.355	29.152	30.989	6.30%	1.75
57	26.365	28.107	29.889	6.34%	1.77
58	25.416	27.105	28.834	6.38%	1.79
59	24.505	26.143	27.821	6.42%	1.81
60	23.631	25.220	26.849	6.46%	1.83
61	22.793	24.334	25.915	6.49%	1.85
62	21.989	23.484	25.018	6.53%	1.88
63	21.217	22.667	24.156	6.57%	1.90
64	20.475	21.883	23.329	6.61%	1.92
65	19.763	21.129	22.534	6.64%	1.94
66	19.080	20.406	21.769	6.68%	1.96
67	18.423	19.710	21.034	6.72%	1.98
68	17.792	19.041	20.328	6.76%	2.00
69	17.185	18.399	19.648	6.79%	2.03
70	16.602	17.781	18.995	6.83%	2.05
71	16.042	17.186	18.366	6.87%	2.07
72	15.503	16.615	17.761	6.90%	2.09
73	14.985	16.065	17.179	6.94%	2.11
74	14.486	15.536	16.619	6.97%	2.14
75	14.007	15.026	16.079	7.01%	2.16
76	13.546	14.536	15.560	7.04%	2.18
77	13.102	14.064	15.060	7.08%	2.20
78	12.674	13.610	14.578	7.12%	2.23
79	12.263	13.172	14.114	7.15%	2.25
80	11.866	12.751	13.667	7.18%	2.27
81	11.485	12.345	13.236	7.22%	2.30
82	11.117	11.954	12.821	7.25%	2.32
83	10.763	11.577	12.420	7.29%	2.34
84	10.422	11.213	12.034	7.32%	2.37
85	10.093	10.863	11.662	7.36%	2.39
86	9.776	10.525	11.303	7.39%	2.41
87	9.471	10.200	10.957	7.42%	2.44
88	9.176	9.885	10.623	7.46%	2.46
89	8.892	9.582	10.300	7.49%	2.48
90	8.618	9.290	9.989	7.52%	2.51
91	8.354	9.008	9.689	7.56%	2.53

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RND components

Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
92	8.099	8.736	9.399	7.59%	2.56
93	7.853	8.473	9.119	7.62%	2.58
94	7.616	8.219	8.849	7.66%	2.60
95	7.386	7.974	8.587	7.69%	2.63
96	7.165	7.738	8.335	7.72%	2.65
97	6.951	7.509	8.091	7.75%	2.68
98	6.745	7.289	7.856	7.79%	2.70
99	6.546	7.075	7.628	7.82%	2.73
100	6.353	6.869	7.408	7.85%	2.75
101	6.167	6.670	7.196	7.88%	2.78
102	5.988	6.478	6.990	7.91%	2.80
103	5.814	6.292	6.791	7.94%	2.83
104	5.646	6.112	6.599	7.98%	2.85
105	5.484	5.938	6.413	8.01%	2.88
106	5.327	5.770	6.233	8.04%	2.90
107	5.175	5.607	6.059	8.07%	2.93
108	5.028	5.449	5.891	8.10%	2.95
109	4.887	5.297	5.728	8.13%	2.98
110	4.749	5.150	5.570	8.16%	3.01
111	4.616	5.007	5.417	8.19%	3.03
112	4.488	4.869	5.269	8.22%	3.06
113	4.363	4.735	5.126	8.25%	3.08
114	4.243	4.606	4.987	8.28%	3.11
115	4.126	4.481	4.853	8.31%	3.14
116	4.014	4.359	4.723	8.34%	3.16
117	3.904	4.242	4.597	8.37%	3.19
118	3.798	4.128	4.475	8.40%	3.22
119	3.696	4.018	4.356	8.43%	3.24
120	3.597	3.911	4.241	8.46%	3.27
121	3.500	3.807	4.130	8.49%	3.30
122	3.407	3.707	4.022	8.52%	3.32
123	3.317	3.609	3.918	8.55%	3.35
124	3.229	3.515	3.816	8.58%	3.38
125	3.144	3.423	3.718	8.60%	3.40