

# 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

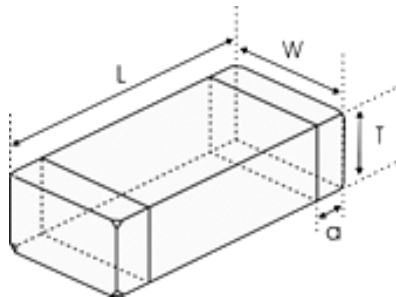
Example: RND 155QN0805X222F3600FA

<b>RND 155QN0805</b>	<b>X</b>	<b>222</b>	<b>F</b>	<b>3600</b>	<b>F</b>	<b>A</b>
Type	Delimiter	Nominal Resistance	Tolerance	B Constant	Tolerance of B Constant	B Constant Calculation Method
RND 155QN0402: 0402 RND 155QN0603: 0603 RND 155QN0805: 0805		222 = 2.2 kΩ 153 = 15 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 °C & 85 °C B = 25 °C & 50 °C

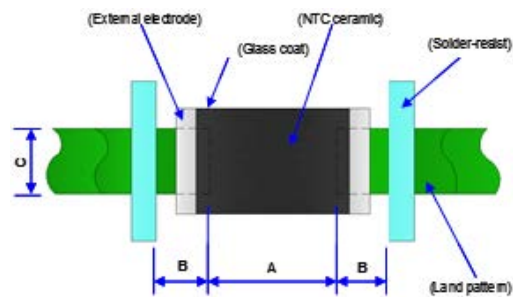
## Electrical Characteristics

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 155QN0805X222F3600FA	2.2 kΩ ±1%	3550 K	3600 K±1%	0.90 mA	2 mW / °C	<5 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

## Test and Measurement Procedures

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

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

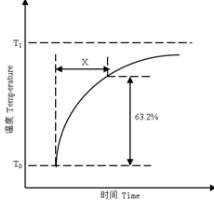
If any doubt on the results, measurements/tests should be made within the following limits

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

Inspection Equipment

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

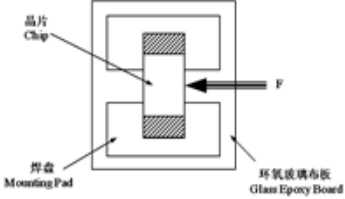
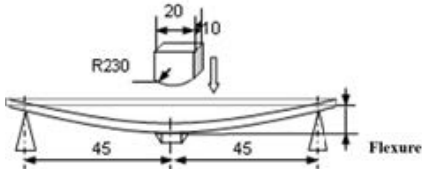
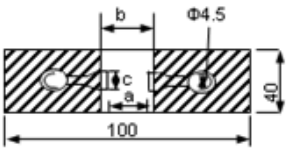
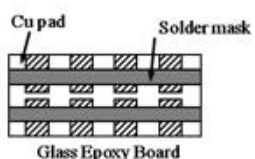
## Electrical Test

Item	Test Methods and Remarks
Nominal Zero-Power Resistance at 25 °C (R25)	Ambient temperature: 25 ± 0.05°C Measuring electric power: ≤0.1 mW
Nominal B Constant	25 ± 0.05°C, 50 ± 0.05°C, 85 ± 0.05°C Measure the resistance at the ambient temperature of 25 ± 0.05°C, 50 ± 0.05°C or 85 ± 0.05°C $B(25-50^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{50}}{1/T_{25} - 1/T_{50}} \quad B(25-85^{\circ}\text{C}) = \frac{\ln R_{25} - \ln R_{85}}{1/T_{25} - 1/T_{85}}$ T: (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 (°C) to T1 (°C) 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°C through self-heated, normally expressed in milliwatts per degree Celsius (mW/°C). It can be calculated by the following formula $\delta = WT - T_0$
Rated Power	The necessary electric power makes thermistor's temperature rise 100°C by self-heating at ambient temperature 25°C
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	<p>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> <table border="1"> <thead> <tr> <th>Size</th> <th>F</th> <th>Duration</th> </tr> </thead> <tbody> <tr> <td>0402, 0603</td> <td>5N</td> <td rowspan="2">10 ± 1 s</td> </tr> <tr> <td>0805</td> <td>10N</td> </tr> </tbody> </table>	Size	F	Duration	0402, 0603	5N	10 ± 1 s	0805	10N	<p>No removal or split of the termination or other defects shall occur</p> 																		
Size	F	Duration																											
0402, 0603	5N	10 ± 1 s																											
0805	10N																												
Resistance to Flexure	IEC 60068-2-21	<p>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>  <table border="1"> <thead> <tr> <th>Size</th> <th>Flexure</th> <th>Pressurizing Speed</th> <th>Duration</th> </tr> </thead> <tbody> <tr> <td>0402, 0603</td> <td>1 mm</td> <td rowspan="2">&lt;0.5 mm/s</td> <td rowspan="2">10 ± 1 s</td> </tr> <tr> <td>0805</td> <td>2 mm</td> </tr> </tbody> </table>	Size	Flexure	Pressurizing Speed	Duration	0402, 0603	1 mm	<0.5 mm/s	10 ± 1 s	0805	2 mm	<p>1. No visible damage 2.   ΔR25/R25   ≤5%</p> <table border="1"> <thead> <tr> <th>Size</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <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> </tbody> </table> 	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
Size	Flexure	Pressurizing Speed	Duration																										
0402, 0603	1 mm	<0.5 mm/s	10 ± 1 s																										
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0805	1.2 mm	4 mm	1.65 mm																										
Vibration	IEC 60068-2-80	<p>1. Solder the chip to the testing jig (glass epoxy board shown in the left) using eutectic solder</p> <p>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</p> <p>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)</p>	<p>No visible damage</p> 																										
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

Item	Standard	Test Methods and Remarks	Requirements															
Solderability	IEC 60068-2-58	<ul style="list-style-type: none"> <li>Solder temperature: <math>245 \pm 5^{\circ}\text{C}</math></li> <li>Duration: <math>10 \pm 1\text{s}</math></li> <li>Solder: Sn/3.0Ag/0.5Cu</li> <li>Flux: 25% resin and 75% ethanol in weight</li> </ul>	1. No visible damage  2. Wetting shall exceed 95% coverage															
Resistance to Soldering Heat	IEC 60068-2-58	<ul style="list-style-type: none"> <li>Solder temperature: <math>245 \pm 5^{\circ}\text{C}</math></li> <li>Duration: <math>10 \pm 1\text{s}</math></li> <li>Solder: Sn/3.0Ag/0.5Cu</li> <li>Flux: 25% resin and 75% ethanol in weight</li> <li>The chip shall be stabilized at normal condition for 1~2 hours before measuring</li> </ul>	1. No visible damage  2. $ \Delta R_{25}/R_{25}  \leq 5\%$  3. $ \Delta B/B  \leq 2\%$															
Temperature Cycling	IEC 60068-2-14	5 cycles of following sequence without loading <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><math>-40 \pm 5^{\circ}\text{C}</math></td> <td><math>30 \pm 3\text{min}</math></td> </tr> <tr> <td>2</td> <td><math>25 \pm 2^{\circ}\text{C}</math></td> <td><math>5 \pm 3\text{min}</math></td> </tr> <tr> <td>3</td> <td><math>125 \pm 2^{\circ}\text{C}</math></td> <td><math>30 \pm 3\text{min}</math></td> </tr> <tr> <td>4</td> <td><math>25 \pm 2^{\circ}\text{C}</math></td> <td><math>5 \pm 3\text{min}</math></td> </tr> </tbody> </table>	Step	Temperature	Time	1	$-40 \pm 5^{\circ}\text{C}$	$30 \pm 3\text{min}$	2	$25 \pm 2^{\circ}\text{C}$	$5 \pm 3\text{min}$	3	$125 \pm 2^{\circ}\text{C}$	$30 \pm 3\text{min}$	4	$25 \pm 2^{\circ}\text{C}$	$5 \pm 3\text{min}$	1. No visible damage  2. $ \Delta R_{25}/R_{25}  \leq 3\%$  3. $\Delta B/B \leq 2\%$
Step	Temperature	Time																
1	$-40 \pm 5^{\circ}\text{C}$	$30 \pm 3\text{min}$																
2	$25 \pm 2^{\circ}\text{C}$	$5 \pm 3\text{min}$																
3	$125 \pm 2^{\circ}\text{C}$	$30 \pm 3\text{min}$																
4	$25 \pm 2^{\circ}\text{C}$	$5 \pm 3\text{min}$																
Resistance to Dry Heat	IEC 60068-2-2	1. $125 \pm 5^{\circ}\text{C}$ in air, for $1000 \pm 24$ hours without loading  2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage  2. $ \Delta R_{25}/R_{25}  \leq 5\%$  3. $ \Delta B/B  \leq 2\%$															
Resistance to Cold	IEC 60068-2-1	1. $-40 \pm 3^{\circ}\text{C}$ in air, for $1000 \pm 24$ hours without loading  2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage  2. $ \Delta R_{25}/R_{25}  \leq 5\%$  3. $ \Delta B/B  \leq 2\%$															
Resistance to Damp Heat	IEC 60068-2-78	1. $40 \pm 2^{\circ}\text{C}$ , 90~95%RH in air, for $1000 \pm 24$ hours without loading  2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage  2. $ \Delta R_{25}/R_{25}  \leq 3\%$  3. $ \Delta B/B  \leq 2\%$															
Resistance to high temperature load	IEC 60539-1 5.25.4	1. $85 \pm 2^{\circ}\text{C}$ in air with permissive operating current for $1000 \pm 48$ hours  2. The chip shall be stabilized at normal condition for 1~2 hours before measuring	1. No visible damage  2. $ \Delta R_{25}/R_{25}  \leq 5\%$  3. $ \Delta B/B  \leq 2\%$															

## Storage

### Storage Conditions

- Storage Temperature:  $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$
- Relative Humidity:  $\leq 75\%RH$
- Keep away from corrosive atmosphere and sunlight
- Period of Storage: 6 Months after delivery

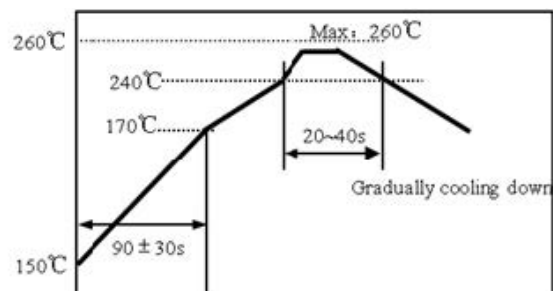
## Notes & Warnings

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

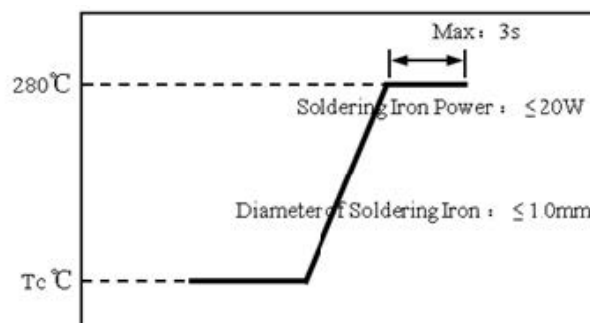
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



## Iron Soldering Profile

- Iron soldering power: Max.20W
- Pre-heating: 150°C/60sec.
- Soldering Tip temperature: 280°C 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



R-T Table

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
-40	49.732	51.847	54.047	4.24%	0.68
-39	46.879	48.843	50.885	4.18%	0.68
-38	44.208	46.033	47.929	4.12%	0.67
-37	41.707	43.404	45.165	4.06%	0.67
-36	39.364	40.942	42.578	4.00%	0.66
-35	37.169	38.636	40.157	3.94%	0.66
-34	35.105	36.469	37.883	3.88%	0.65
-33	33.169	34.438	35.753	3.82%	0.65
-32	31.353	32.534	33.756	3.76%	0.64
-31	29.648	30.747	31.885	3.70%	0.64
-30	28.047	29.071	30.129	3.64%	0.63
-29	26.543	27.497	28.482	3.58%	0.63
-28	25.129	26.018	26.935	3.53%	0.62
-27	23.800	24.628	25.483	3.47%	0.62
-26	22.550	23.322	24.118	3.41%	0.61
-25	21.373	22.093	22.835	3.36%	0.61
-24	20.266	20.937	21.628	3.30%	0.60
-23	19.222	19.848	20.493	3.25%	0.59
-22	18.240	18.824	19.424	3.19%	0.59
-21	17.313	17.858	18.418	3.14%	0.58
-20	16.440	16.948	17.471	3.08%	0.58
-19	15.616	16.090	16.578	3.03%	0.57
-18	14.838	15.281	15.736	2.98%	0.57
-17	14.104	14.518	14.942	2.92%	0.56
-16	13.411	13.797	14.193	2.87%	0.55
-15	12.756	13.117	13.487	2.82%	0.55
-14	12.136	12.473	12.818	2.77%	0.54
-13	11.550	11.864	12.187	2.72%	0.53
-12	10.995	11.290	11.590	2.67%	0.53
-11	10.471	10.746	11.027	2.61%	0.52
-10	9.975	10.232	10.494	2.56%	0.52
-9	9.506	9.746	9.991	2.51%	0.51
-8	9.061	9.285	9.514	2.46%	0.50
-7	8.640	8.849	9.063	2.42%	0.50
-6	8.241	8.437	8.636	2.37%	0.49
-5	7.863	8.046	8.232	2.32%	0.48
-4	7.504	7.675	7.849	2.27%	0.48
-3	7.164	7.324	7.486	2.22%	0.47
-2	6.841	6.991	7.143	2.17%	0.46
-1	6.535	6.675	6.817	2.13%	0.45
0	6.244	6.375	6.507	2.08%	0.45
1	5.968	6.090	6.213	2.03%	0.44

# Chip NTC Thermistor

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
2	5.705	5.819	5.935	1.99%	0.43
3	5.455	5.562	5.670	1.94%	0.43
4	5.218	5.318	5.418	1.90%	0.42
5	4.993	5.086	5.180	1.85%	0.41
6	4.779	4.865	4.953	1.80%	0.40
7	4.575	4.656	4.738	1.76%	0.40
8	4.381	4.456	4.533	1.72%	0.39
9	4.196	4.267	4.338	1.67%	0.38
10	4.020	4.086	4.153	1.63%	0.37
11	3.853	3.914	3.976	1.58%	0.37
12	3.693	3.750	3.808	1.54%	0.36
13	3.541	3.594	3.648	1.50%	0.35
14	3.396	3.446	3.496	1.45%	0.34
15	3.258	3.304	3.351	1.41%	0.34
16	3.126	3.169	3.212	1.37%	0.33
17	3.000	3.040	3.080	1.33%	0.32
18	2.880	2.917	2.955	1.29%	0.31
19	2.765	2.800	2.835	1.24%	0.30
20	2.656	2.688	2.720	1.20%	0.30
21	2.551	2.581	2.611	1.16%	0.29
22	2.452	2.479	2.507	1.12%	0.28
23	2.356	2.382	2.408	1.08%	0.27
24	2.265	2.289	2.313	1.04%	0.26
25	2.178	2.200	2.222	1.00%	0.25
26	2.093	2.115	2.137	1.04%	0.26
27	2.012	2.034	2.056	1.08%	0.28
28	1.934	1.956	1.978	1.12%	0.29
29	1.860	1.882	1.904	1.16%	0.30
30	1.789	1.811	1.832	1.20%	0.31
31	1.721	1.743	1.764	1.24%	0.32
32	1.656	1.678	1.699	1.27%	0.34
33	1.594	1.615	1.637	1.31%	0.35
34	1.535	1.556	1.577	1.35%	0.36
35	1.478	1.498	1.519	1.39%	0.37
36	1.423	1.444	1.464	1.43%	0.39
37	1.371	1.391	1.412	1.46%	0.40
38	1.321	1.341	1.361	1.50%	0.41
39	1.273	1.293	1.313	1.54%	0.42
40	1.227	1.247	1.266	1.58%	0.44
41	1.183	1.202	1.222	1.61%	0.45
42	1.141	1.160	1.179	1.65%	0.46
43	1.100	1.119	1.138	1.69%	0.48
44	1.062	1.080	1.099	1.72%	0.49
45	1.024	1.042	1.061	1.76%	0.50
46	0.988	1.006	1.024	1.79%	0.52

# Chip NTC Thermistor

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
47	0.954	0.972	0.989	1.83%	0.53
48	0.921	0.938	0.956	1.86%	0.54
49	0.889	0.906	0.924	1.90%	0.56
50	0.859	0.876	0.893	1.93%	0.57
51	0.830	0.846	0.863	1.97%	0.58
52	0.802	0.818	0.834	2.00%	0.60
53	0.775	0.791	0.807	2.04%	0.61
54	0.749	0.764	0.780	2.07%	0.62
55	0.724	0.739	0.755	2.11%	0.64
56	0.700	0.715	0.730	2.14%	0.65
57	0.677	0.692	0.707	2.18%	0.67
58	0.655	0.669	0.684	2.21%	0.68
59	0.633	0.647	0.662	2.24%	0.69
60	0.613	0.627	0.641	2.28%	0.71
61	0.593	0.607	0.621	2.31%	0.72
62	0.574	0.587	0.601	2.34%	0.74
63	0.555	0.569	0.582	2.38%	0.75
64	0.538	0.551	0.564	2.41%	0.77
65	0.521	0.533	0.546	2.44%	0.78
66	0.504	0.517	0.530	2.47%	0.80
67	0.489	0.501	0.513	2.51%	0.81
68	0.473	0.485	0.498	2.54%	0.83
69	0.459	0.471	0.483	2.57%	0.84
70	0.445	0.456	0.468	2.60%	0.86
71	0.431	0.442	0.454	2.63%	0.87
72	0.418	0.429	0.440	2.66%	0.89
73	0.405	0.416	0.427	2.70%	0.90
74	0.393	0.404	0.415	2.73%	0.92
75	0.381	0.392	0.402	2.76%	0.93
76	0.370	0.380	0.391	2.79%	0.95
77	0.359	0.369	0.379	2.82%	0.96
78	0.348	0.358	0.368	2.85%	0.98
79	0.338	0.348	0.358	2.88%	1.00
80	0.328	0.337	0.347	2.91%	1.01
81	0.318	0.328	0.337	2.94%	1.03
82	0.309	0.318	0.328	2.97%	1.04
83	0.300	0.309	0.318	3.00%	1.06
84	0.291	0.300	0.309	3.03%	1.08
85	0.283	0.292	0.301	3.06%	1.09
86	0.275	0.284	0.292	3.09%	1.11
87	0.267	0.276	0.284	3.12%	1.12
88	0.260	0.268	0.276	3.15%	1.14
89	0.253	0.261	0.269	3.18%	1.16
90	0.245	0.253	0.262	3.21%	1.17
91	0.239	0.246	0.254	3.24%	1.19



# Chip NTC Thermistor



Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
92	0.232	0.240	0.248	3.26%	1.21
93	0.226	0.233	0.241	3.29%	1.23
94	0.220	0.227	0.234	3.32%	1.24
95	0.214	0.221	0.228	3.35%	1.26
96	0.208	0.215	0.222	3.38%	1.28
97	0.202	0.209	0.216	3.41%	1.29
98	0.197	0.204	0.211	3.43%	1.31
99	0.192	0.198	0.205	3.46%	1.33
100	0.186	0.193	0.200	3.49%	1.35
101	0.182	0.188	0.195	3.52%	1.36
102	0.177	0.183	0.190	3.54%	1.38
103	0.172	0.178	0.185	3.57%	1.40
104	0.168	0.174	0.180	3.60%	1.42
105	0.163	0.169	0.175	3.62%	1.43
106	0.159	0.165	0.171	3.65%	1.45
107	0.155	0.161	0.167	3.68%	1.47
108	0.151	0.157	0.162	3.70%	1.49
109	0.147	0.153	0.158	3.73%	1.51
110	0.143	0.149	0.154	3.76%	1.52
111	0.140	0.145	0.151	3.78%	1.54
112	0.136	0.142	0.147	3.81%	1.56
113	0.133	0.138	0.143	3.84%	1.58
114	0.130	0.135	0.140	3.86%	1.60
115	0.126	0.131	0.137	3.89%	1.62
116	0.123	0.128	0.133	3.91%	1.63
117	0.120	0.125	0.130	3.94%	1.65
118	0.117	0.122	0.127	3.96%	1.67
119	0.115	0.119	0.124	3.99%	1.69
120	0.112	0.116	0.121	4.01%	1.71
121	0.109	0.114	0.118	4.04%	1.73
122	0.107	0.111	0.115	4.06%	1.75
123	0.104	0.108	0.113	4.09%	1.77
124	0.102	0.106	0.110	4.11%	1.79
125	0.099	0.103	0.108	4.14%	1.81