

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

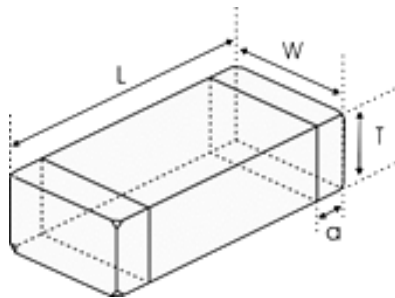
Example: RND 155QN0603X103F3600FA

RND 155QN0603	X	103	F	3600	F	A
Type	Delimiter	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 103 = 10 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

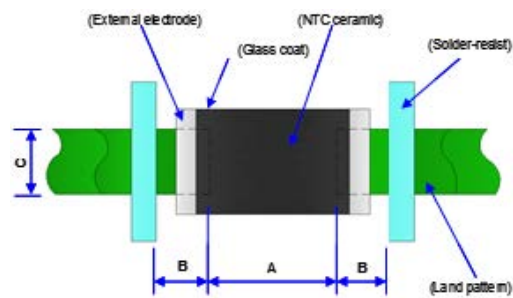
Electrical Characteristics

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 155QN0603X103F3600FA	4.7 kΩ ±1%	3920 K	3950 K ±1%	0.46 mA	1 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

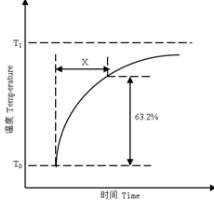
If any doubt on the results, measurements/tests should be made within the following limits

- 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

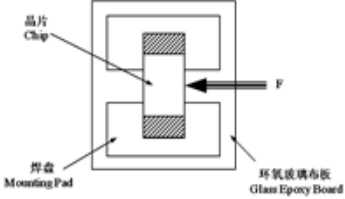
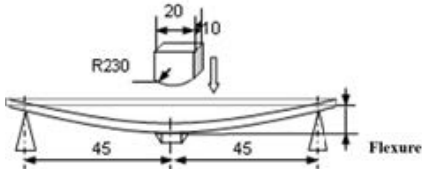
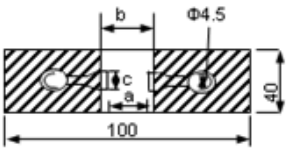
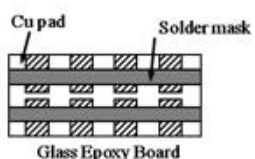
Electrical Test

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

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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																											
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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"><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
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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																										

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

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

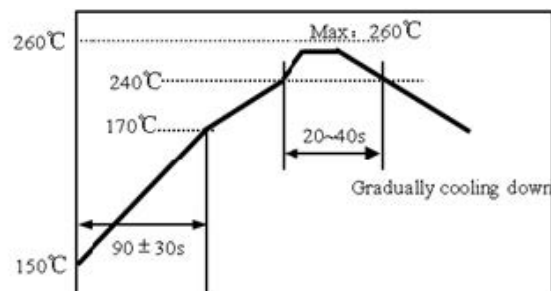
Notes & Warnings

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

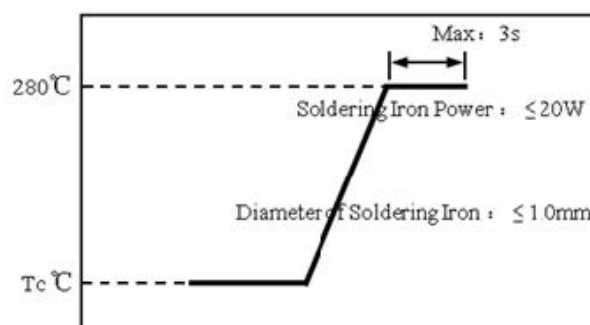
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



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



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R-T Table

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
-40	226.056	235.669	245.667	4.24%	0.68
-39	213.084	222.014	231.294	4.18%	0.68
-38	200.945	209.241	217.859	4.12%	0.67
-37	189.578	197.289	205.294	4.06%	0.67
-36	178.929	186.099	193.537	4.00%	0.66
-35	168.950	175.618	182.531	3.94%	0.66
-34	159.567	165.769	172.195	3.88%	0.65
-33	150.767	156.538	162.512	3.82%	0.65
-32	142.511	147.881	153.438	3.76%	0.64
-31	134.762	139.761	144.931	3.70%	0.64
-30	127.485	132.140	136.951	3.64%	0.63
-29	120.649	124.985	129.463	3.58%	0.63
-28	114.223	118.263	122.433	3.53%	0.62
-27	108.182	111.946	115.830	3.47%	0.62
-26	102.499	106.008	109.626	3.41%	0.61
-25	97.151	100.422	103.793	3.36%	0.61
-24	92.116	95.167	98.309	3.30%	0.60
-23	87.375	90.220	93.149	3.25%	0.59
-22	82.907	85.562	88.292	3.19%	0.59
-21	78.696	81.173	83.720	3.14%	0.58
-20	74.725	77.037	79.412	3.08%	0.58
-19	70.980	73.138	75.353	3.03%	0.57
-18	67.445	69.460	71.527	2.98%	0.57
-17	64.109	65.990	67.919	2.92%	0.56
-16	60.958	62.714	64.515	2.87%	0.55
-15	57.981	59.622	61.303	2.82%	0.55
-14	55.162	56.695	58.264	2.77%	0.54
-13	52.498	53.929	55.394	2.72%	0.53
-12	49.979	51.316	52.684	2.67%	0.53
-11	47.596	48.845	50.123	2.61%	0.52
-10	45.341	46.509	47.701	2.56%	0.52
-9	43.207	44.298	45.412	2.51%	0.51
-8	41.186	42.206	43.246	2.46%	0.50
-7	39.272	40.225	41.196	2.42%	0.50
-6	37.458	38.349	39.256	2.37%	0.49
-5	35.739	36.571	37.419	2.32%	0.48
-4	34.109	34.887	35.679	2.27%	0.48
-3	32.563	33.290	34.030	2.22%	0.47
-2	31.096	31.775	32.466	2.17%	0.46
-1	29.704	30.339	30.984	2.13%	0.45
0	28.382	28.976	29.578	2.08%	0.45
1	27.125	27.680	28.243	2.03%	0.44

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
2	25.932	26.450	26.975	1.99%	0.43
3	24.797	25.281	25.772	1.94%	0.43
4	23.719	24.171	24.630	1.90%	0.42
5	22.695	23.117	23.545	1.85%	0.41
6	21.721	22.115	22.514	1.80%	0.40
7	20.795	21.163	21.535	1.76%	0.40
8	19.913	20.257	20.604	1.72%	0.39
9	19.074	19.394	19.719	1.67%	0.38
10	18.275	18.574	18.876	1.63%	0.37
11	17.513	17.792	18.074	1.58%	0.37
12	16.787	17.047	17.310	1.54%	0.36
13	16.095	16.338	16.582	1.50%	0.35
14	15.436	15.662	15.890	1.45%	0.34
15	14.807	15.018	15.230	1.41%	0.34
16	14.208	14.404	14.601	1.37%	0.33
17	13.636	13.819	14.002	1.33%	0.32
18	13.091	13.260	13.431	1.29%	0.31
19	12.570	12.727	12.885	1.24%	0.30
20	12.072	12.219	12.366	1.20%	0.30
21	11.597	11.733	11.870	1.16%	0.29
22	11.144	11.270	11.396	1.12%	0.28
23	10.710	10.827	10.944	1.08%	0.27
24	10.296	10.404	10.512	1.04%	0.26
25	9.900	10.000	10.100	1.00%	0.25
26	9.514	9.614	9.714	1.04%	0.26
27	9.145	9.245	9.344	1.08%	0.28
28	8.792	8.892	8.991	1.12%	0.29
29	8.455	8.554	8.653	1.16%	0.30
30	8.132	8.231	8.329	1.20%	0.31
31	7.824	7.922	8.020	1.24%	0.32
32	7.529	7.626	7.723	1.27%	0.34
33	7.247	7.342	7.439	1.31%	0.35
34	6.976	7.071	7.167	1.35%	0.36
35	6.717	6.811	6.906	1.39%	0.37
36	6.470	6.563	6.656	1.43%	0.39
37	6.232	6.324	6.417	1.46%	0.40
38	6.005	6.096	6.187	1.50%	0.41
39	5.787	5.877	5.967	1.54%	0.42
40	5.579	5.667	5.756	1.58%	0.44
41	5.378	5.465	5.554	1.61%	0.45
42	5.186	5.272	5.359	1.65%	0.46
43	5.002	5.087	5.172	1.69%	0.48
44	4.825	4.909	4.993	1.72%	0.49
45	4.656	4.738	4.821	1.76%	0.50

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
46	4.493	4.574	4.656	1.79%	0.52
47	4.337	4.416	4.497	1.83%	0.53
48	4.187	4.265	4.345	1.86%	0.54
49	4.043	4.120	4.198	1.90%	0.56
50	3.905	3.981	4.058	1.93%	0.57
51	3.772	3.846	3.922	1.97%	0.58
52	3.644	3.718	3.792	2.00%	0.60
53	3.521	3.594	3.667	2.04%	0.61
54	3.404	3.475	3.547	2.07%	0.62
55	3.290	3.360	3.431	2.11%	0.64
56	3.181	3.250	3.319	2.14%	0.65
57	3.076	3.143	3.212	2.18%	0.67
58	2.975	3.041	3.108	2.21%	0.68
59	2.878	2.943	3.009	2.24%	0.69
60	2.785	2.848	2.913	2.28%	0.71
61	2.695	2.757	2.821	2.31%	0.72
62	2.608	2.669	2.732	2.34%	0.74
63	2.525	2.585	2.646	2.38%	0.75
64	2.444	2.503	2.564	2.41%	0.77
65	2.367	2.425	2.484	2.44%	0.78
66	2.292	2.349	2.407	2.47%	0.80
67	2.221	2.277	2.334	2.51%	0.81
68	2.152	2.206	2.262	2.54%	0.83
69	2.085	2.139	2.194	2.57%	0.84
70	2.021	2.073	2.127	2.60%	0.86
71	1.959	2.011	2.064	2.63%	0.87
72	1.899	1.950	2.002	2.66%	0.89
73	1.841	1.891	1.942	2.70%	0.90
74	1.786	1.835	1.885	2.73%	0.92
75	1.732	1.780	1.829	2.76%	0.93
76	1.680	1.727	1.776	2.79%	0.95
77	1.630	1.676	1.724	2.82%	0.96
78	1.582	1.627	1.674	2.85%	0.98
79	1.535	1.580	1.625	2.88%	1.00
80	1.490	1.534	1.579	2.91%	1.01
81	1.447	1.490	1.533	2.94%	1.03
82	1.405	1.447	1.490	2.97%	1.04
83	1.364	1.405	1.447	3.00%	1.06
84	1.325	1.365	1.406	3.03%	1.08
85	1.287	1.326	1.367	3.06%	1.09
86	1.250	1.289	1.329	3.09%	1.11
87	1.215	1.253	1.292	3.12%	1.12
88	1.181	1.218	1.256	3.15%	1.14
89	1.148	1.184	1.222	3.18%	1.16

Chip NTC Thermistor



Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
90	1.116	1.152	1.189	3.21%	1.17
91	1.085	1.120	1.156	3.24%	1.19
92	1.055	1.090	1.125	3.26%	1.21
93	1.026	1.060	1.095	3.29%	1.23
94	0.998	1.031	1.065	3.32%	1.24
95	0.971	1.003	1.037	3.35%	1.26
96	0.945	0.977	1.009	3.38%	1.28
97	0.919	0.950	0.983	3.41%	1.29
98	0.894	0.925	0.957	3.43%	1.31
99	0.871	0.901	0.932	3.46%	1.33
100	0.847	0.877	0.908	3.49%	1.35
101	0.825	0.854	0.884	3.52%	1.36
102	0.804	0.832	0.862	3.54%	1.38
103	0.782	0.810	0.839	3.57%	1.40
104	0.762	0.790	0.818	3.60%	1.42
105	0.742	0.769	0.797	3.62%	1.43
106	0.723	0.750	0.777	3.65%	1.45
107	0.705	0.731	0.758	3.68%	1.47
108	0.687	0.712	0.739	3.70%	1.49
109	0.669	0.694	0.720	3.73%	1.51
110	0.652	0.677	0.702	3.76%	1.52
111	0.636	0.660	0.685	3.78%	1.54
112	0.620	0.644	0.668	3.81%	1.56
113	0.604	0.628	0.652	3.84%	1.58
114	0.589	0.612	0.636	3.86%	1.60
115	0.575	0.597	0.621	3.89%	1.62
116	0.561	0.583	0.606	3.91%	1.63
117	0.547	0.569	0.591	3.94%	1.65
118	0.534	0.555	0.577	3.96%	1.67
119	0.521	0.542	0.563	3.99%	1.69
120	0.508	0.529	0.550	4.01%	1.71
121	0.496	0.516	0.537	4.04%	1.73
122	0.484	0.504	0.525	4.06%	1.75
123	0.473	0.492	0.512	4.09%	1.77
124	0.462	0.481	0.501	4.11%	1.79
125	0.451	0.470	0.489	4.14%	1.81