

# Chip NTC Thermistor

## Features

- = 0.1 mm
- 0 = 0.2 mm
- k = 0.5 mm
- o = 0.8 mm

## Applications

- u = universal
- " = automotive
- u = universal
- @ = automotive

## PART NUMBER

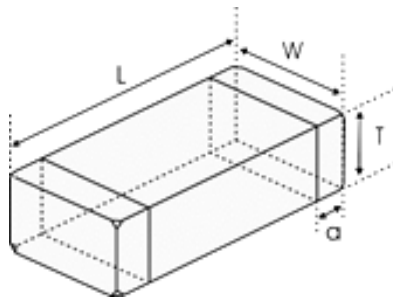
Example: RND 155QN0805X223F3950FA

<b>RND 155QN0805</b>	<b>X</b>	<b>223</b>	<b>F</b>	<b>3950</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		472 = 4.7 kΩ 223 = 22 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

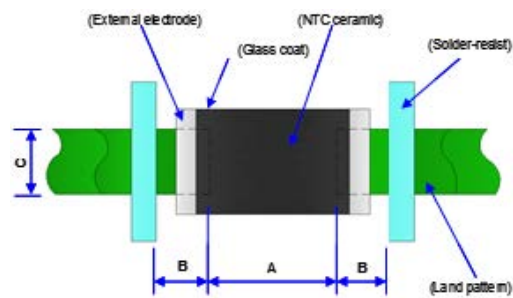
## Electrical Characteristics

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 155QN0805X223F3950FA	22 kΩ ±1%	3920 K	3950 K±1%	0.30 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

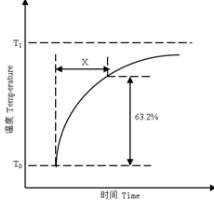
If any doubt on the results, measurements/tests should be made within the following limits

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

Inspection Equipment

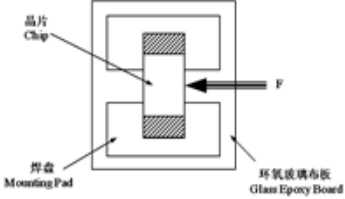
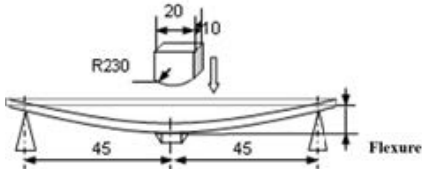
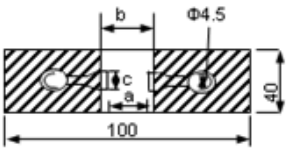
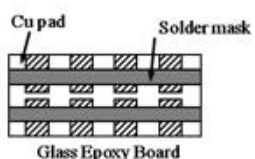
- Visual Examination: 20x magnifier
- Resistance value test: Thermistor resistance tester

## 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

## 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. <table border="1" style="margin: 10px auto;"> <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	No removal or split of the termination or other defects shall occur 																		
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0402, 0603	5N	10 ± 1 s																											
0805	10N																												
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  <table border="1" style="margin: 10px auto;"> <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	1. No visible damage 2. $ \Delta R_{25}/R_{25}  \leq 5\%$ <table border="1" style="margin: 10px auto;"> <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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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

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:  $\leq 75\% \text{RH}$
- Keep away from corrosive atmosphere and sunlight
- Period of Storage: 6 Months after delivery

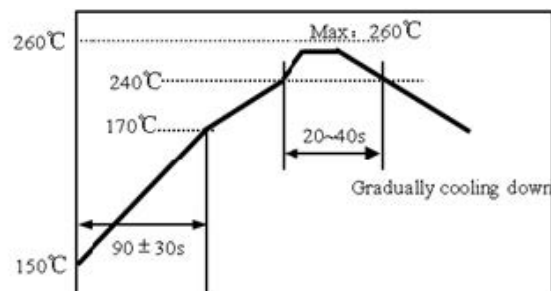
## Notes & Warnings

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

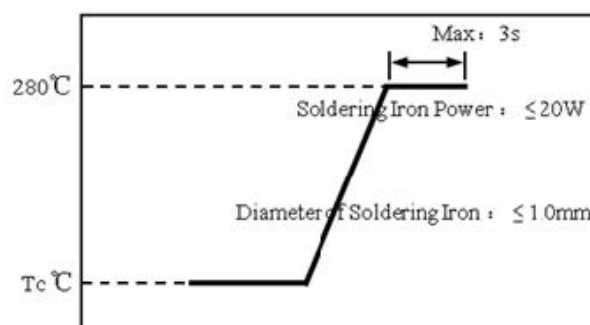
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



## 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	703.580	736.077	769.998	4.61%	0.67
-39	658.701	688.666	719.923	4.54%	0.66
-38	616.987	644.629	673.442	4.47%	0.66
-37	578.197	603.705	630.275	4.40%	0.65
-36	542.106	565.653	590.164	4.33%	0.65
-35	508.511	530.256	552.876	4.27%	0.64
-34	477.141	497.225	518.102	4.20%	0.64
-33	447.919	466.475	485.751	4.13%	0.63
-32	420.680	437.830	455.634	4.07%	0.63
-31	395.280	411.136	427.585	4.00%	0.62
-30	371.582	386.246	401.448	3.94%	0.62
-29	349.460	363.026	377.080	3.87%	0.61
-28	328.799	341.352	354.349	3.81%	0.61
-27	309.496	321.116	333.139	3.74%	0.60
-26	291.452	302.211	313.336	3.68%	0.59
-25	274.576	284.541	294.838	3.62%	0.59
-24	258.820	268.053	277.587	3.56%	0.58
-23	244.068	252.625	261.456	3.50%	0.58
-22	230.249	238.181	246.362	3.43%	0.57
-21	217.302	224.656	232.237	3.37%	0.56
-20	205.161	211.982	219.008	3.31%	0.56
-19	193.731	200.056	206.567	3.25%	0.55
-18	183.011	188.877	194.912	3.20%	0.55
-17	172.951	178.393	183.988	3.14%	0.54
-16	163.508	168.557	173.745	3.08%	0.53
-15	154.639	159.325	164.136	3.02%	0.53
-14	146.336	150.686	155.149	2.96%	0.52
-13	138.530	142.569	146.711	2.91%	0.52
-12	131.187	134.938	138.782	2.85%	0.51
-11	124.276	127.759	131.327	2.79%	0.50
-10	117.773	121.009	124.320	2.74%	0.50
-9	111.619	114.623	117.696	2.68%	0.49
-8	105.826	108.615	111.467	2.63%	0.48
-7	100.368	102.959	105.606	2.57%	0.48
-6	95.225	97.631	100.088	2.52%	0.47
-5	90.377	92.612	94.892	2.46%	0.46
-4	85.812	87.888	90.005	2.41%	0.46
-3	81.506	83.434	85.399	2.36%	0.45
-2	77.440	79.230	81.055	2.30%	0.44
-1	73.600	75.264	76.957	2.25%	0.43
0	69.975	71.520	73.092	2.20%	0.43
1	66.545	67.980	69.439	2.15%	0.42

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
2	63.306	64.638	65.992	2.09%	0.41
3	60.240	61.477	62.733	2.04%	0.41
4	57.344	58.492	59.658	1.99%	0.40
5	54.602	55.668	56.749	1.94%	0.39
6	52.008	52.998	54.000	1.89%	0.38
7	49.552	50.470	51.400	1.84%	0.38
8	47.227	48.078	48.940	1.79%	0.37
9	45.024	45.813	46.612	1.74%	0.36
10	42.934	43.666	44.406	1.69%	0.35
11	40.955	41.633	42.319	1.65%	0.34
12	39.078	39.707	40.342	1.60%	0.34
13	37.297	37.879	38.466	1.55%	0.33
14	35.609	36.148	36.691	1.50%	0.32
15	34.006	34.504	35.007	1.46%	0.31
16	32.484	32.945	33.409	1.41%	0.30
17	31.040	31.466	31.895	1.36%	0.30
18	29.667	30.060	30.456	1.32%	0.29
19	28.363	28.726	29.091	1.27%	0.28
20	27.123	27.458	27.794	1.22%	0.27
21	25.946	26.254	26.564	1.18%	0.26
22	24.825	25.109	25.393	1.13%	0.25
23	23.759	24.021	24.282	1.09%	0.25
24	22.746	22.986	23.226	1.04%	0.24
25	21.780	22.000	22.220	1.00%	0.23
26	20.843	21.063	21.283	1.04%	0.24
27	19.951	20.170	20.390	1.09%	0.25
28	19.104	19.322	19.541	1.13%	0.26
29	18.295	18.511	18.729	1.17%	0.28
30	17.526	17.741	17.957	1.22%	0.29
31	16.794	17.008	17.222	1.26%	0.30
32	16.094	16.306	16.518	1.30%	0.31
33	15.430	15.639	15.850	1.35%	0.32
34	14.795	15.002	15.210	1.39%	0.34
35	14.191	14.395	14.601	1.43%	0.35
36	13.613	13.815	14.018	1.47%	0.36
37	13.065	13.264	13.464	1.51%	0.37
38	12.538	12.734	12.932	1.55%	0.39
39	12.039	12.232	12.427	1.59%	0.40
40	11.559	11.749	11.941	1.64%	0.41
41	11.104	11.291	11.480	1.68%	0.42
42	10.666	10.850	11.036	1.72%	0.44
43	10.248	10.429	10.613	1.76%	0.45
44	9.851	10.029	10.209	1.80%	0.46
45	9.471	9.646	9.823	1.84%	0.48
46	9.106	9.278	9.452	1.88%	0.49

# Chip NTC Thermistor

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
47	8.757	8.926	9.097	1.92%	0.50
48	8.423	8.589	8.757	1.95%	0.51
49	8.105	8.268	8.433	1.99%	0.53
50	7.800	7.960	8.121	2.03%	0.54
51	7.509	7.665	7.824	2.07%	0.56
52	7.230	7.383	7.539	2.11%	0.57
53	6.963	7.113	7.266	2.15%	0.58
54	6.706	6.854	7.003	2.18%	0.60
55	6.461	6.605	6.752	2.22%	0.61
56	6.227	6.368	6.512	2.26%	0.62
57	6.001	6.139	6.280	2.30%	0.64
58	5.786	5.922	6.060	2.33%	0.65
59	5.578	5.711	5.846	2.37%	0.67
60	5.381	5.511	5.644	2.41%	0.68
61	5.190	5.318	5.448	2.44%	0.69
62	5.007	5.131	5.259	2.48%	0.71
63	4.831	4.953	5.078	2.52%	0.72
64	4.665	4.784	4.907	2.55%	0.74
65	4.503	4.620	4.739	2.59%	0.75
66	4.347	4.462	4.579	2.62%	0.77
67	4.196	4.308	4.423	2.66%	0.78
68	4.054	4.164	4.276	2.70%	0.80
69	3.916	4.023	4.133	2.73%	0.81
70	3.782	3.887	3.995	2.77%	0.83
71	3.655	3.758	3.863	2.80%	0.84
72	3.535	3.635	3.738	2.83%	0.86
73	3.418	3.517	3.618	2.87%	0.87
74	3.304	3.401	3.499	2.90%	0.89
75	3.197	3.291	3.388	2.94%	0.90
76	3.094	3.186	3.281	2.97%	0.92
77	2.993	3.083	3.176	3.00%	0.93
78	2.896	2.984	3.075	3.04%	0.95
79	2.804	2.890	2.979	3.07%	0.97
80	2.714	2.798	2.885	3.10%	0.98
81	2.628	2.711	2.796	3.14%	1.00
82	2.545	2.625	2.709	3.17%	1.01
83	2.463	2.542	2.624	3.20%	1.03
84	2.386	2.464	2.543	3.24%	1.04
85	2.313	2.389	2.467	3.27%	1.06
86	2.241	2.315	2.391	3.30%	1.08
87	2.172	2.245	2.320	3.33%	1.09
88	2.106	2.177	2.250	3.36%	1.11
89	2.042	2.111	2.183	3.40%	1.13
90	1.980	2.048	2.118	3.43%	1.14
91	1.920	1.987	2.055	3.46%	1.16



# Chip NTC Thermistor



Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
92	1.863	1.928	1.995	3.49%	1.18
93	1.807	1.871	1.937	3.52%	1.19
94	1.752	1.814	1.879	3.55%	1.21
95	1.701	1.762	1.825	3.58%	1.23
96	1.652	1.711	1.773	3.61%	1.24
97	1.603	1.661	1.722	3.64%	1.26
98	1.556	1.613	1.672	3.67%	1.28
99	1.511	1.567	1.625	3.70%	1.29
100	1.469	1.524	1.580	3.73%	1.31
101	1.426	1.480	1.536	3.76%	1.33
102	1.386	1.438	1.493	3.79%	1.35
103	1.345	1.397	1.450	3.82%	1.36
104	1.307	1.358	1.410	3.85%	1.38
105	1.271	1.321	1.372	3.88%	1.40
106	1.235	1.284	1.334	3.91%	1.42
107	1.201	1.249	1.298	3.94%	1.44
108	1.167	1.214	1.262	3.97%	1.45
109	1.136	1.181	1.228	4.00%	1.47
110	1.106	1.150	1.197	4.02%	1.49
111	1.076	1.120	1.165	4.05%	1.51
112	1.047	1.089	1.134	4.08%	1.53
113	1.019	1.061	1.105	4.11%	1.54
114	0.992	1.033	1.075	4.14%	1.56
115	0.964	1.004	1.046	4.17%	1.58
116	0.939	0.978	1.019	4.19%	1.60
117	0.913	0.952	0.992	4.22%	1.62
118	0.890	0.928	0.968	4.25%	1.64
119	0.867	0.904	0.943	4.28%	1.66
120	0.844	0.880	0.918	4.30%	1.68
121	0.823	0.858	0.896	4.33%	1.69
122	0.802	0.837	0.873	4.36%	1.71
123	0.781	0.815	0.851	4.38%	1.73
124	0.762	0.795	0.830	4.41%	1.75
125	0.743	0.776	0.810	4.44%	1.77