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Specifications for Chip NTC thermistor

1 Shape and Dimensions

- Dimensions: See Fig.1 and Table 1.
- Recommended PCB pattern for reflow soldering: See Fig.2 and Table 1

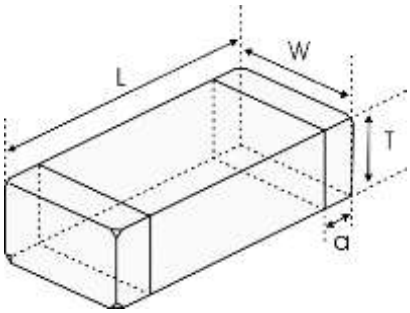

Fig.1

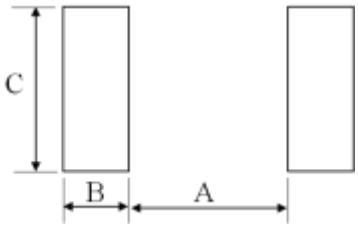

Fig.2

（Table 1） unit: inch[mm]

Type	L	W	T	a	A	B	C
1206 [3216]	0.126±0.008 [3.20±0.2]	0.063±0.008 [1.60±0.2]	0.033±0.008 [0.85±0.2]	0.020±0.012 [0.50±0.3]	1.8~2.5	1.0~1.5	1.2~2.0

2 Product Identification(Part Number)

TP	1206	103	J	3470	H	B
①	②	③	④	⑤	⑥	⑦

① Type	
TP	Chip NTC Thermistor

② External Dimensions (L×W×T)	
0201[0603]	0.60×0.30×0.30
0402[1005]	1.00×0.50×0.50
0603[1608]	1.60×0.80×0.80
0805[2012]	2.00×1.25×0.85
1206[3216]	3.20×1.60×0.85

③ Nominal Zero-Power Resistance	
222	2.2kΩ
103	10kΩ
474	470kΩ

④ Tolerance of Resistance	
F	±1%
G	±2%
H	±3%
J	±5%
K	±10%

⑤ B Constant	
3470	3470K
3950	3950K
4250	4250K

⑥ Tolerance of B Constant	
F	±1%
H	±3%

⑦ B constant calculation method	
A	25℃&85℃
B	25℃&50℃

3 Electrical Characteristics

Part No	Resistance (25℃) (kΩ)	B Constant (25/50℃) (K)	B Constant (25/85℃) (K)	Permissible Operating Current (25℃) (mA)	Dissipation Factor (mW/℃)	Thermal Time Constant (s)	Rated Electric Power(25℃) (mW)	Operating ambient temperature (℃)
TP1206103J3470HB	10±5%	3470±3%	3510	0.66	3.0	＜8	150	-40～+125

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4 Test and Measurement Procedures

・Test Conditions

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

a. Ambient Temperature: 20±15℃

b. Relative Humidity : 65±20%

c. Air Pressure: 86kPa to 106kPa

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

a. Ambient Temperature: 25±2℃

b. Relative Humidity: 65±5%

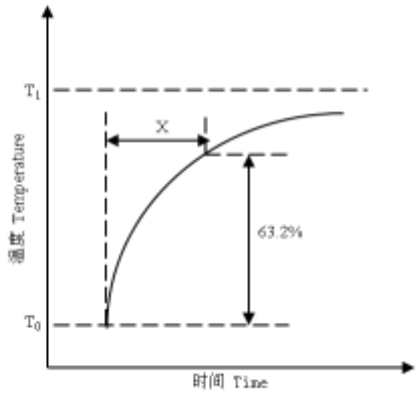
c. Air Pressure: 86kPa to 106kPa

・Inspection Equipment

Visual Examination: 20×magnifier

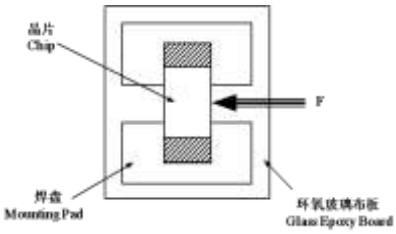
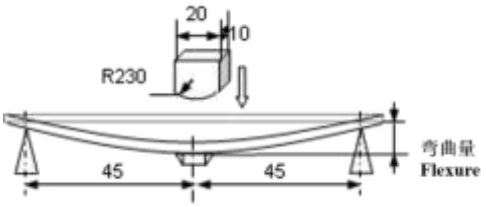
Resistance value test: Thermistor resistance tester

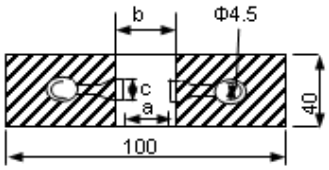
5 Electrical Test

No.	Items	Test Methods and Remarks
1	Nominal Zero-Power Resistance at 25℃(R25)	Ambient temperature：25±0.05℃ Measuring electric power：≤0.1mW
2	Nominal B Constant	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℃)= $\frac{\ln R_{25}-\ln R_{85}}{1/T_{25}-1/T_{85}}$ Absolute temperature (K)
3	Thermal Time Constant	The total time for the temperature of the thermistor to change by 63.2% of the difference from ambient temperature T_0 (℃) to T_1 (℃) by the drastic change of the power applied to thermistor from Non-zero Power to Zero-Power state, normally expressed in second(S). 

4	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: $$\delta = \frac{W}{T-T_0}$$
5	Rated Power	The necessary electric power makes thermistor's temperature rise 100℃ by self-heating at ambient temperature 25℃.
6	Permissible operating current	The current that keep body temperature of chip NTC on the PC board in still air rising 1 ℃ by self-heating.

6 Reliability Test

<table>
<tr><th>Items</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>0201</td><td>2N</td><td rowspan="3">10±1s</td></tr>
<tr><td>0402, 0603</td><td>5N</td></tr>
<tr><td>0805,1206</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>0201,</td><td>1mm</td><td rowspan="2">＜0.5mm/s</td><td rowspan="2">10±1s</td></tr>
<tr><td>0402, 0603, 0805,1206</td><td>2mm</td></tr>
</table></td><td>① No visible damage.
② ｜ΔR25/R25｜≤2%
unit：mm
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>0201</td><td>0.25</td><td>0.3</td><td>0.3</td></tr>
<tr><td>0402</td><td>0.4</td><td>1.5</td><td>0.5</td></tr>
<tr><td>0603</td><td>1.0</td><td>3.0</td><td>1.2</td></tr>
<tr><td>0805</td><td>1.2</td><td>4.0</td><td>1.65</td></tr>
<tr><td>1206</td><td>2.0</td><td>5.8</td><td>1.9</td></tr>
</table>

</td></tr>
</table>

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 1.5mm, 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 3mutually 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.
Solderability	IEC 60068-2-58	① Solder temperature: 245±5℃. ② Duration: 3±0.3s. ③ Solder: 96.5Sn/3.0Ag/0.5Cu. ④ 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	① Solder temperature: 260±5℃. ② Duration: 10±1s. ③ Solder: 96.5Sn/3.0Ag/0.5Cu. ④ Flux: 25% Resin and 75% ethanol in weight. ⑤ The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① No visible damage. ② ｜ΔR25/R25｜≤2% ③ ｜ΔB/B｜≤1%
Temperature cycling	IEC 60068-2-14	① 5 cycles of following sequence without loading. ② The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① No visible damage. ② ｜ΔR25/R25｜≤2% ③ ｜ΔB/B｜≤1%
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｜≤2% ③ ｜ΔB/B｜≤1%

Step	Temperature	Time
1	-40±5℃	30±3min
2	25±2℃	5±3min
3	125±2℃	30±3min
4	25±2℃	5±3min

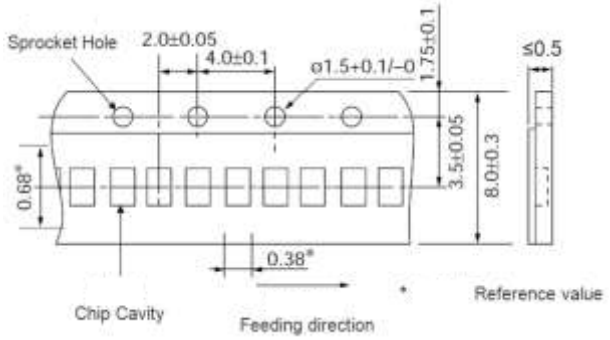
Resistance to cold	IEC 60068-2-1	① -40±3℃ in air, for 1000±24 hours without loading. ② The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① No visible damage. ② ｜ΔR25/R25｜≤2% ③ ｜ΔB/B｜≤1%
Resistance to damp heat	IEC 60068-2-78	① 40±2℃, 90~95%RH in air, for 1000±24 hours without loading. ② The chip shall be stabilized at normal condition for 1~2 hours before measuring.	① No visible damage. ② ｜ΔR25/R25｜≤2% ③ ｜ΔB/B｜≤1%
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｜≤2% ③ ｜ΔB/B｜≤1%

7 Taping

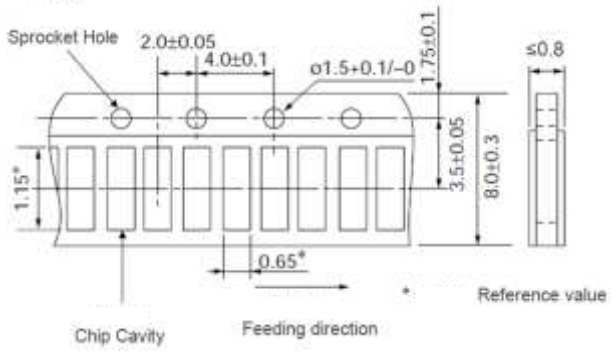
Type	0201	0402	0603	0805	1206
Tape thickness(mm)	0.5±0.15	0.5±0.15	0.8±0.15	0.85±0.2	1.8±0.2
Tape material	Paper Tape				Embossed Tape
Quantity per Reel	15K	10K	4K	4K	3K

(1) Paper Tape Dimensions (Unit：mm)

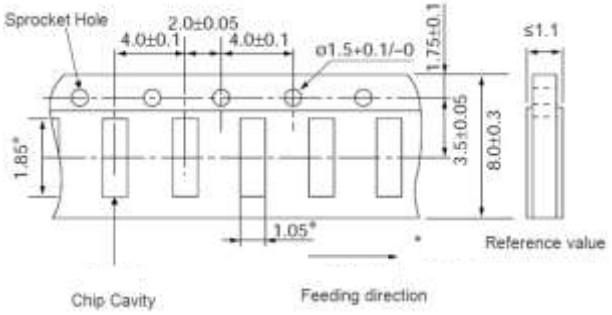
TP0201 series



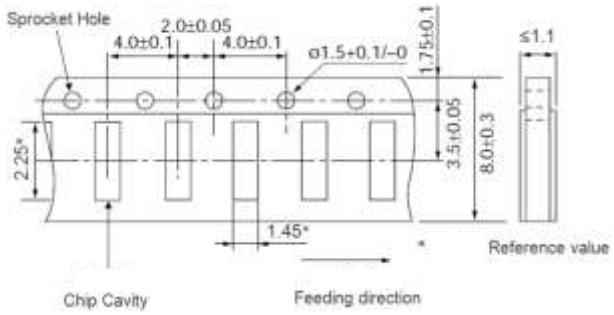
TP0402 series



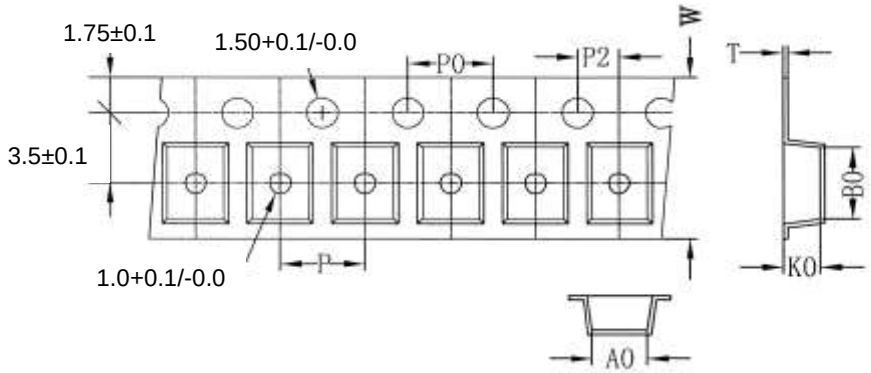
TP0603 series



TP0805 series

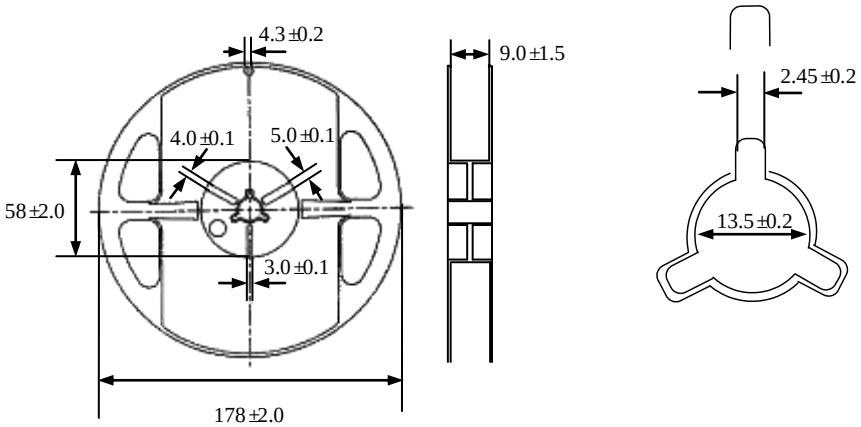


（2） Embossed Tape dimensions. (Unit: mm)

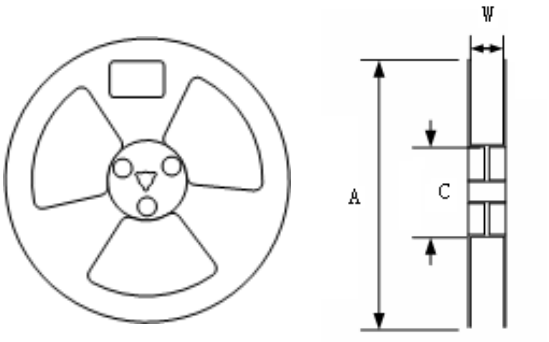


Type	A0 (±0.2)	B0 (±0.2)	K0Max.	T Max.	W (±0.3)	P0 (±0.2)	P (±0.2)	P2 (±0.2)
1206	1.9	3.5	2.0	0.30	8.0	4.0	4.0	2.0

(3) Reel Dimensions(Unit：mm)



(4) Embossed Tape Reel Dimensions（Unit：mm)



Type	Spec.	Dimensions(mm)		
		A	W	C
1206	7"	178±2	8.4+2.0/-0.0	58±2

8 Storage

Storage Conditions

a. Storage Temperature: -10℃～40℃

b. Relative Humidity: ≦75%RH

c. Keep away from corrosive atmosphere and sunlight.

Period of Storage: 6 Months after delivery

9 Notes ＆ Warnings

The TP series thermistors shall not be operated and stored under the following environmental condition:

(1) Corrosive or deoxidized atmospheres

(such as chlorine, sulfurated hydrogen, ammonia, sulfuric acid, nitric oxide and so on)

(2) Volatile or inflammable atmospheres

(3) Dusty condition

(4) Excessive high or low pressure condition

(5) Humid site

(6) Places with brine, oil, chemical liquid or organic solvent

(7) Intense vibration

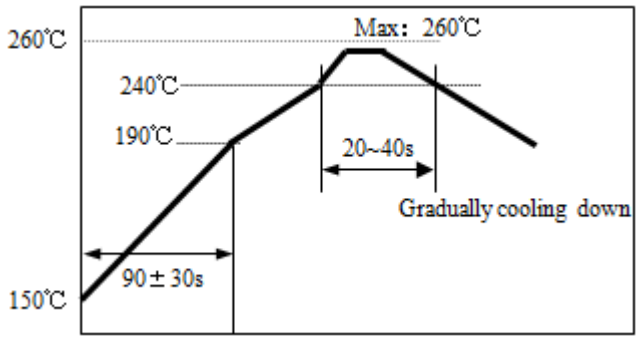
(8) Places with analogously deleterious conditions

• The ceramic body of the TP series thermistors is fragile, no excessive pressure or impact shall be exerted on it.

• The TP series thermistors shall not be operated beyond the specified “Operating Temperature Range” in the catalog.

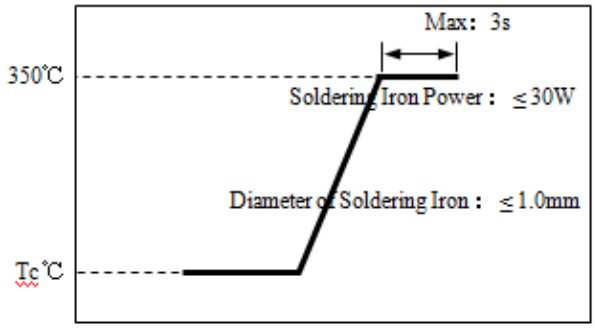
10 Recommended Soldering Technologies

- **Re-flowing Profile**
  - 1~2℃/sec. Ramp
  - Pre-heating: 150~190℃/90±30 sec.
  - Time above 240℃: 20~40 sec.
  - Peak temperature: 260℃Max./10 sec.
  - Solder paste: 96.5Sn/3.0Ag/0.5Cu
  - Max.2 times for re-flowing.



- **Iron Soldering Profile**
  - Iron soldering power: Max.30W
  - Pre-heating: 150℃/60 sec.
  - Soldering Tip temperature: 350℃Max.
  - Soldering time: 3 sec Max.
  - Solder paste: 96.5Sn/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.]



11 R-T table

TP1206103J3470HB

Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
-40	185.590	214.168	246.528	15.11%	2.51
-39	175.842	202.580	232.801	14.92%	2.49
-38	166.686	191.715	219.950	14.73%	2.48
-37	158.037	181.468	207.852	14.54%	2.46
-36	149.897	171.840	196.502	14.35%	2.45
-35	142.180	162.727	185.777	14.17%	2.43
-34	134.974	154.231	175.795	13.98%	2.42
-33	128.108	146.149	166.314	13.80%	2.40
-32	121.581	138.478	157.330	13.61%	2.39
-31	115.481	131.321	148.962	13.43%	2.37
-30	109.722	124.576	141.087	13.25%	2.36
-29	104.219	118.140	133.585	13.07%	2.34
-28	99.059	112.114	126.573	12.90%	2.33
-27	94.155	106.397	119.930	12.72%	2.31
-26	89.553	101.039	113.714	12.54%	2.29
-25	85.172	95.948	107.817	12.37%	2.28
-24	81.024	91.134	102.250	12.20%	2.26
-23	77.100	86.587	96.999	12.02%	2.24
-22	73.382	82.287	92.040	11.85%	2.23
-21	69.855	78.211	87.349	11.68%	2.21
-20	66.517	74.361	82.923	11.51%	2.19
-19	63.352	70.717	78.740	11.35%	2.18
-18	60.360	67.276	74.797	11.18%	2.16
-17	57.516	64.010	71.060	11.01%	2.14
-16	54.810	60.908	67.516	10.85%	2.12
-15	52.252	57.980	64.174	10.68%	2.11
-14	49.824	55.204	61.013	10.52%	2.09
-13	47.518	52.573	58.019	10.36%	2.07
-12	45.326	50.074	55.181	10.20%	2.05
-11	43.247	47.707	52.497	10.04%	2.03
-10	41.272	45.464	49.956	9.88%	2.02
-9	39.394	43.333	47.545	9.72%	2.00
-8	37.613	41.313	45.265	9.57%	1.98
-7	35.918	39.396	43.103	9.41%	1.96
-6	34.303	37.571	41.048	9.25%	1.94
-5	32.776	35.848	39.110	9.10%	1.92
-4	31.310	34.196	37.255	8.95%	1.90
-3	29.923	32.636	35.506	8.79%	1.89
-2	28.607	31.157	33.850	8.64%	1.87
-1	27.353	29.750	32.276	8.49%	1.85
0	26.152	28.404	30.773	8.34%	1.83
1	25.039	27.159	29.385	8.19%	1.81
2	23.980	25.975	28.066	8.05%	1.79

Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
3	22.965	24.842	26.806	7.91%	1.77
4	22.003	23.771	25.616	7.76%	1.75
5	21.095	22.760	24.494	7.62%	1.73
6	20.222	21.789	23.420	7.48%	1.71
7	19.393	20.870	22.402	7.34%	1.69
8	18.601	19.991	21.431	7.20%	1.67
9	17.844	19.153	20.506	7.07%	1.65
10	17.123	18.355	19.627	6.93%	1.63
11	16.437	17.598	18.794	6.80%	1.60
12	15.778	16.872	17.995	6.66%	1.58
13	15.156	16.185	17.242	6.53%	1.56
14	14.560	15.530	16.523	6.40%	1.54
15	13.991	14.905	15.838	6.26%	1.52
16	13.440	14.300	15.177	6.13%	1.50
17	12.925	13.735	14.560	6.00%	1.47
18	12.428	13.191	13.966	5.88%	1.45
19	11.949	12.667	13.395	5.75%	1.43
20	11.497	12.174	12.858	5.62%	1.40
21	11.063	11.701	12.344	5.50%	1.38
22	10.648	11.248	11.852	5.37%	1.36
23	10.250	10.815	11.382	5.25%	1.33
24	9.861	10.392	10.925	5.12%	1.33
25	9.500	10.000	10.500	5.00%	1.30
26	9.130	9.622	10.115	5.12%	1.33
27	8.776	9.259	9.744	5.24%	1.37
28	8.438	8.913	9.391	5.36%	1.41
29	8.115	8.581	9.052	5.48%	1.45
30	7.806	8.264	8.727	5.60%	1.49
31	7.511	7.960	8.416	5.72%	1.54
32	7.228	7.669	8.117	5.84%	1.58
33	6.957	7.390	7.830	5.96%	1.62
34	6.698	7.123	7.556	6.07%	1.66
35	6.451	6.867	7.292	6.19%	1.70
36	6.214	6.622	7.040	6.31%	1.75
37	5.986	6.386	6.797	6.42%	1.79
38	5.768	6.161	6.563	6.54%	1.83
39	5.559	5.944	6.339	6.65%	1.87
40	5.360	5.737	6.125	6.77%	1.92
41	5.169	5.538	5.919	6.88%	1.96
42	4.985	5.347	5.720	6.99%	2.01
43	4.808	5.162	5.529	7.10%	2.05
44	4.639	4.986	5.346	7.22%	2.10
45	4.477	4.817	5.170	7.33%	2.14
46	4.321	4.654	5.001	7.44%	2.19
47	4.172	4.498	4.838	7.55%	2.23

Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
48	4.028	4.347	4.680	7.66%	2.28
49	3.890	4.203	4.529	7.77%	2.32
50	3.758	4.064	4.384	7.88%	2.37
51	3.631	3.931	4.245	7.98%	2.42
52	3.508	3.802	4.109	8.09%	2.46
53	3.392	3.679	3.980	8.20%	2.51
54	3.279	3.560	3.855	8.30%	2.56
55	3.170	3.445	3.735	8.41%	2.61
56	3.065	3.335	3.619	8.52%	2.65
57	2.964	3.228	3.506	8.62%	2.70
58	2.868	3.126	3.399	8.73%	2.75
59	2.775	3.028	3.296	8.83%	2.80
60	2.686	2.933	3.195	8.94%	2.85
61	2.599	2.841	3.098	9.04%	2.90
62	2.517	2.754	3.005	9.14%	2.95
63	2.437	2.669	2.915	9.24%	3.00
64	2.360	2.587	2.829	9.35%	3.05
65	2.285	2.507	2.744	9.45%	3.10
66	2.214	2.431	2.663	9.55%	3.15
67	2.145	2.357	2.585	9.65%	3.20
68	2.078	2.287	2.510	9.75%	3.25
69	2.015	2.219	2.437	9.85%	3.30
70	1.953	2.153	2.367	9.95%	3.36
71	1.894	2.089	2.299	10.05%	3.41
72	1.836	2.027	2.233	10.15%	3.46
73	1.780	1.968	2.169	10.25%	3.51
74	1.727	1.911	2.108	10.35%	3.57
75	1.675	1.855	2.049	10.44%	3.62
76	1.625	1.801	1.991	10.54%	3.67
77	1.577	1.749	1.936	10.64%	3.73
78	1.531	1.700	1.882	10.73%	3.78
79	1.487	1.652	1.831	10.83%	3.84
80	1.443	1.605	1.780	10.92%	3.89
81	1.401	1.559	1.731	11.02%	3.94
82	1.361	1.516	1.684	11.11%	4.00
83	1.322	1.474	1.639	11.21%	4.06
84	1.284	1.433	1.595	11.30%	4.11
85	1.248	1.393	1.552	11.40%	4.17
86	1.212	1.354	1.510	11.49%	4.22
87	1.178	1.318	1.470	11.58%	4.28
88	1.145	1.282	1.432	11.67%	4.34
89	1.113	1.247	1.394	11.77%	4.39
90	1.082	1.213	1.357	11.86%	4.45
91	1.053	1.182	1.323	11.95%	4.51
92	1.024	1.150	1.288	12.04%	4.57

Temp. (℃)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(℃)
93	0.995	1.119	1.255	12.13%	4.63
94	0.968	1.089	1.222	12.22%	4.68
95	0.943	1.061	1.192	12.31%	4.74
96	0.917	1.034	1.162	12.40%	4.80
97	0.892	1.006	1.131	12.49%	4.86
98	0.868	0.980	1.103	12.58%	4.92
99	0.845	0.955	1.076	12.67%	4.98
100	0.823	0.930	1.049	12.75%	5.04
101	0.801	0.907	1.023	12.84%	5.10
102	0.780	0.883	0.998	12.93%	5.16
103	0.760	0.861	0.973	13.02%	5.22
104	0.740	0.839	0.949	13.10%	5.28
105	0.721	0.818	0.926	13.19%	5.35
106	0.703	0.798	0.904	13.27%	5.41
107	0.685	0.778	0.882	13.36%	5.47
108	0.667	0.759	0.861	13.45%	5.53
109	0.650	0.740	0.840	13.53%	5.59
110	0.634	0.722	0.820	13.62%	5.66
111	0.618	0.704	0.801	13.70%	5.72
112	0.602	0.687	0.782	13.78%	5.78
113	0.587	0.670	0.763	13.87%	5.85
114	0.573	0.654	0.746	13.95%	5.91
115	0.559	0.638	0.728	14.03%	5.98
116	0.545	0.623	0.711	14.12%	6.04
117	0.531	0.608	0.695	14.20%	6.11
118	0.518	0.594	0.679	14.28%	6.17
119	0.506	0.580	0.663	14.36%	6.24
120	0.494	0.566	0.648	14.45%	6.30
121	0.482	0.553	0.633	14.53%	6.37
122	0.470	0.540	0.619	14.61%	6.43
123	0.459	0.528	0.605	14.69%	6.50
124	0.448	0.516	0.592	14.77%	6.57
125	0.438	0.504	0.579	14.85%	6.64