

Chip NTC Thermistor

Features

- = 5000 VDC
- O = 1000 VDC
- k = 100 VDC
- o = 10 VDC

Applications

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

PART NUMBER

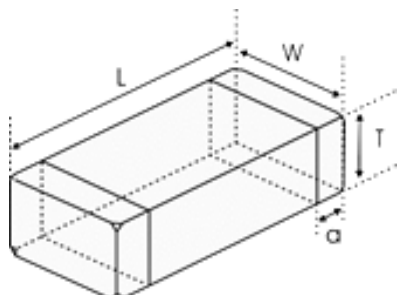
Example: RND 155QN0603X472F3950FA

RND 155QN0603	X	472	F	3950	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 333 = 33 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

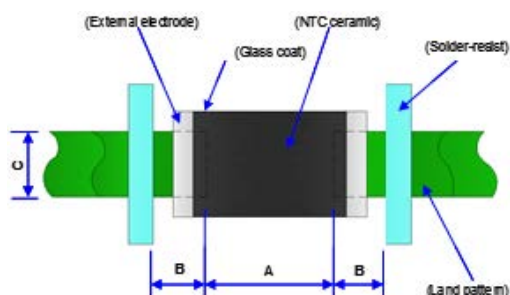
Electrical Characteristics

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 155QN0603X472F3950FA	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

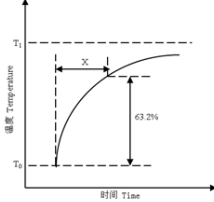
If any doubt on the results, measurements/tests should be made within the following limits

- 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

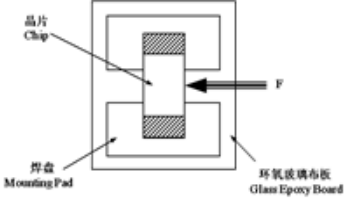
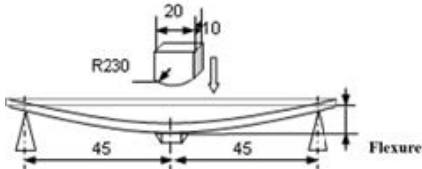
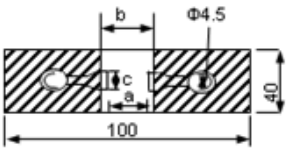
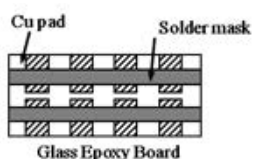
Electrical Test

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 T ₀ (°C) to T ₁ (°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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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																										

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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 	1. No visible damage 2. 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 	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>$-40 \pm 5^{\circ}\text{C}$</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	$25 \pm 2^{\circ}\text{C}$	$5 \pm 3\text{min}$	1. No visible damage 2. $ \Delta R_{25}/R_{25} \leq 3\%$ 3. $\Delta B/B \leq 2\%$
Step	Temperature	Time																
1	$-40 \pm 5^{\circ}\text{C}$	$30 \pm 3\text{min}$																
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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 ± 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 ± 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 ± 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 ± 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

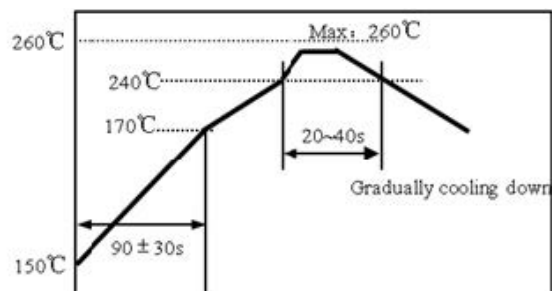
Notes & Warnings

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

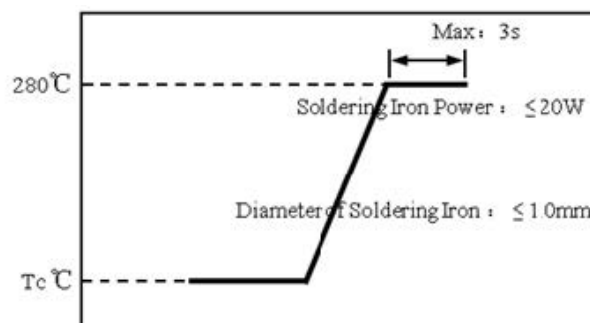
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



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



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R-T Table

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
-40	150.310	157.253	164.499	4.61%	0.67
-39	140.722	147.124	153.802	4.54%	0.66
-38	131.811	137.716	143.872	4.47%	0.66
-37	123.524	128.973	134.650	4.40%	0.65
-36	115.813	120.844	126.080	4.33%	0.65
-35	108.636	113.282	118.114	4.27%	0.64
-34	101.935	106.225	110.686	4.20%	0.64
-33	95.692	99.656	103.774	4.13%	0.63
-32	89.873	93.536	97.340	4.07%	0.63
-31	84.446	87.834	91.348	4.00%	0.62
-30	79.383	82.516	85.764	3.94%	0.62
-29	74.657	77.556	80.558	3.87%	0.61
-28	70.243	72.925	75.702	3.81%	0.61
-27	66.120	68.602	71.171	3.74%	0.60
-26	62.265	64.563	66.940	3.68%	0.59
-25	58.659	60.788	62.988	3.62%	0.59
-24	55.293	57.266	59.303	3.56%	0.58
-23	52.142	53.970	55.856	3.50%	0.58
-22	49.190	50.884	52.632	3.43%	0.57
-21	46.424	47.995	49.614	3.37%	0.56
-20	43.830	45.287	46.788	3.31%	0.56
-19	41.388	42.739	44.130	3.25%	0.55
-18	39.098	40.351	41.640	3.20%	0.55
-17	36.949	38.111	39.306	3.14%	0.54
-16	34.931	36.010	37.118	3.08%	0.53
-15	33.037	34.038	35.065	3.02%	0.53
-14	31.263	32.192	33.146	2.96%	0.52
-13	29.595	30.458	31.343	2.91%	0.52
-12	28.026	28.828	29.649	2.85%	0.51
-11	26.550	27.294	28.056	2.79%	0.50
-10	25.161	25.852	26.559	2.74%	0.50
-9	23.846	24.488	25.144	2.68%	0.49
-8	22.608	23.204	23.813	2.63%	0.48
-7	21.442	21.996	22.561	2.57%	0.48
-6	20.344	20.858	21.382	2.52%	0.47
-5	19.308	19.785	20.272	2.46%	0.46
-4	18.333	18.776	19.228	2.41%	0.46
-3	17.413	17.825	18.244	2.36%	0.45
-2	16.544	16.927	17.316	2.30%	0.44
-1	15.724	16.079	16.441	2.25%	0.43
0	14.949	15.279	15.615	2.20%	0.43
1	14.216	14.523	14.835	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	13.524	13.809	14.098	2.09%	0.41
3	12.869	13.134	13.402	2.04%	0.41
4	12.251	12.496	12.745	1.99%	0.40
5	11.665	11.893	12.124	1.94%	0.39
6	11.111	11.322	11.536	1.89%	0.38
7	10.586	10.782	10.981	1.84%	0.38
8	10.089	10.271	10.455	1.79%	0.37
9	9.619	9.787	9.958	1.74%	0.36
10	9.172	9.329	9.487	1.69%	0.35
11	8.749	8.894	9.041	1.65%	0.34
12	8.349	8.483	8.618	1.60%	0.34
13	7.968	8.092	8.218	1.55%	0.33
14	7.607	7.723	7.839	1.50%	0.32
15	7.265	7.371	7.479	1.46%	0.31
16	6.940	7.038	7.137	1.41%	0.30
17	6.631	6.722	6.814	1.36%	0.30
18	6.338	6.422	6.506	1.32%	0.29
19	6.059	6.137	6.215	1.27%	0.28
20	5.794	5.866	5.938	1.22%	0.27
21	5.543	5.609	5.675	1.18%	0.26
22	5.303	5.364	5.425	1.13%	0.25
23	5.076	5.132	5.188	1.09%	0.25
24	4.859	4.911	4.962	1.04%	0.24
25	4.653	4.700	4.747	1.00%	0.23
26	4.453	4.500	4.547	1.04%	0.24
27	4.262	4.309	4.356	1.09%	0.25
28	4.081	4.128	4.175	1.13%	0.26
29	3.908	3.955	4.001	1.17%	0.28
30	3.744	3.790	3.836	1.22%	0.29
31	3.588	3.633	3.679	1.26%	0.30
32	3.438	3.484	3.529	1.30%	0.31
33	3.296	3.341	3.386	1.35%	0.32
34	3.161	3.205	3.249	1.39%	0.34
35	3.032	3.075	3.119	1.43%	0.35
36	2.908	2.951	2.995	1.47%	0.36
37	2.791	2.834	2.876	1.51%	0.37
38	2.679	2.721	2.763	1.55%	0.39
39	2.572	2.613	2.655	1.59%	0.40
40	2.469	2.510	2.551	1.64%	0.41
41	2.372	2.412	2.453	1.68%	0.42
42	2.279	2.318	2.358	1.72%	0.44
43	2.189	2.228	2.267	1.76%	0.45
44	2.104	2.142	2.181	1.80%	0.46
45	2.023	2.061	2.098	1.84%	0.48

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
46	1.945	1.982	2.019	1.88%	0.49
47	1.871	1.907	1.943	1.92%	0.50
48	1.800	1.835	1.871	1.95%	0.51
49	1.732	1.766	1.801	1.99%	0.53
50	1.666	1.700	1.735	2.03%	0.54
51	1.604	1.638	1.671	2.07%	0.56
52	1.545	1.577	1.611	2.11%	0.57
53	1.488	1.520	1.552	2.15%	0.58
54	1.433	1.464	1.496	2.18%	0.60
55	1.380	1.411	1.442	2.22%	0.61
56	1.330	1.360	1.391	2.26%	0.62
57	1.282	1.312	1.342	2.30%	0.64
58	1.236	1.265	1.295	2.33%	0.65
59	1.192	1.220	1.249	2.37%	0.67
60	1.150	1.177	1.206	2.41%	0.68
61	1.109	1.136	1.164	2.44%	0.69
62	1.070	1.096	1.123	2.48%	0.71
63	1.032	1.058	1.085	2.52%	0.72
64	0.997	1.022	1.048	2.55%	0.74
65	0.962	0.987	1.013	2.59%	0.75
66	0.929	0.953	0.978	2.62%	0.77
67	0.896	0.920	0.945	2.66%	0.78
68	0.866	0.889	0.913	2.70%	0.80
69	0.837	0.860	0.883	2.73%	0.81
70	0.808	0.830	0.853	2.77%	0.83
71	0.781	0.803	0.825	2.80%	0.84
72	0.755	0.777	0.799	2.83%	0.86
73	0.730	0.751	0.773	2.87%	0.87
74	0.706	0.727	0.748	2.90%	0.89
75	0.683	0.703	0.724	2.94%	0.90
76	0.661	0.681	0.701	2.97%	0.92
77	0.639	0.659	0.678	3.00%	0.93
78	0.619	0.638	0.657	3.04%	0.95
79	0.599	0.617	0.636	3.07%	0.97
80	0.580	0.598	0.616	3.10%	0.98
81	0.561	0.579	0.597	3.14%	1.00
82	0.544	0.561	0.579	3.17%	1.01
83	0.526	0.543	0.561	3.20%	1.03
84	0.510	0.526	0.543	3.24%	1.04
85	0.494	0.510	0.527	3.27%	1.06
86	0.479	0.495	0.511	3.30%	1.08
87	0.464	0.480	0.496	3.33%	1.09
88	0.450	0.465	0.481	3.36%	1.11
89	0.436	0.451	0.466	3.40%	1.13

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
90	0.423	0.438	0.453	3.43%	1.14
91	0.410	0.424	0.439	3.46%	1.16
92	0.398	0.412	0.426	3.49%	1.18
93	0.386	0.400	0.414	3.52%	1.19
94	0.374	0.388	0.401	3.55%	1.21
95	0.363	0.376	0.390	3.58%	1.23
96	0.353	0.366	0.379	3.61%	1.24
97	0.342	0.355	0.368	3.64%	1.26
98	0.332	0.345	0.357	3.67%	1.28
99	0.323	0.335	0.347	3.70%	1.29
100	0.314	0.325	0.338	3.73%	1.31
101	0.305	0.316	0.328	3.76%	1.33
102	0.296	0.307	0.319	3.79%	1.35
103	0.287	0.298	0.310	3.82%	1.36
104	0.279	0.290	0.301	3.85%	1.38
105	0.272	0.282	0.293	3.88%	1.40
106	0.264	0.274	0.285	3.91%	1.42
107	0.257	0.267	0.277	3.94%	1.44
108	0.249	0.259	0.270	3.97%	1.45
109	0.243	0.252	0.262	4.00%	1.47
110	0.236	0.246	0.256	4.02%	1.49
111	0.230	0.239	0.249	4.05%	1.51
112	0.224	0.233	0.242	4.08%	1.53
113	0.218	0.227	0.236	4.11%	1.54
114	0.212	0.221	0.230	4.14%	1.56
115	0.206	0.215	0.224	4.17%	1.58
116	0.201	0.209	0.218	4.19%	1.60
117	0.195	0.203	0.212	4.22%	1.62
118	0.190	0.198	0.207	4.25%	1.64
119	0.185	0.193	0.201	4.28%	1.66
120	0.180	0.188	0.196	4.30%	1.68
121	0.176	0.183	0.191	4.33%	1.69
122	0.171	0.179	0.187	4.36%	1.71
123	0.167	0.174	0.182	4.38%	1.73
124	0.163	0.170	0.177	4.41%	1.75
125	0.159	0.166	0.173	4.44%	1.77