

Chip NTC Thermistor

Features

- = 0.1 mm
- o = 0.2 mm
- k = 0.5 mm
- o = 1 mm

Applications

- U = Automotive engine temperature measurement
- " = Automotive engine coolant temperature measurement
- U = Automotive engine oil temperature measurement
- @ = Automotive engine oil temperature measurement

PART NUMBER

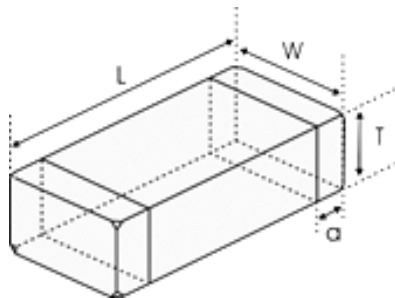
Example: RND 155QN0805X333F3950FB

RND 155QN0805	X	333	F	3950	F	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 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

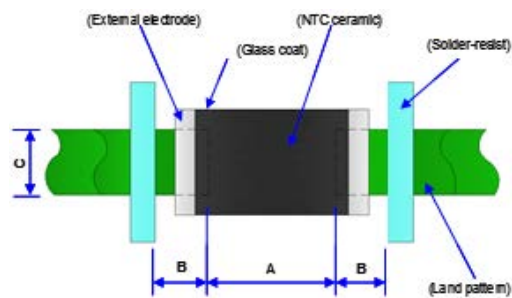
Electrical Characteristics

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 155QN0805X333F3950FB	33 kΩ ±1%	3950 K±1%	3987 K	0.24 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

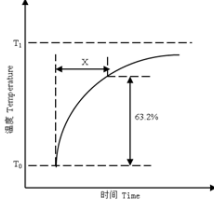
If any doubt on the results, measurements/tests should be made within the following limits

- 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

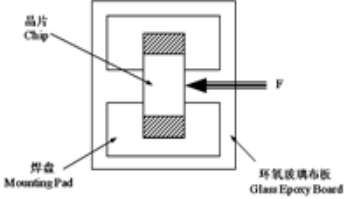
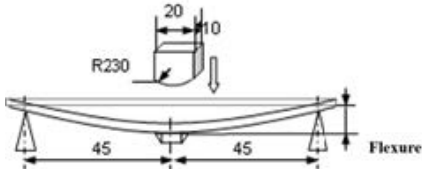
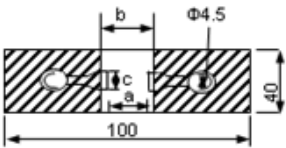
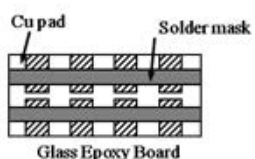
Electrical Test

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 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> 																		
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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"><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 	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: $\leq 75\%RH$
- Keep away from corrosive atmosphere and sunlight
- Period of Storage: 6 Months after delivery

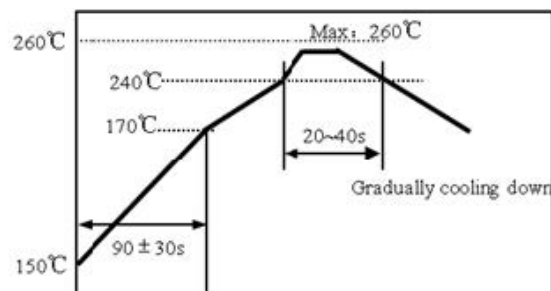
Notes & Warnings

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

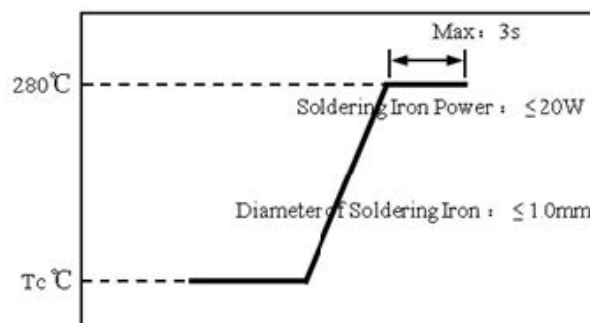
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



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	1,088.761	1,139.407	1,192.290	4.64%	0.67
-39	1,018.547	1,065.210	1,113.899	4.57%	0.66
-38	953.342	996.352	1,041.197	4.50%	0.66
-37	892.755	932.413	973.735	4.43%	0.65
-36	836.430	873.011	911.100	4.36%	0.65
-35	784.039	817.793	852.916	4.29%	0.64
-34	735.281	766.439	798.838	4.23%	0.64
-33	689.881	718.653	748.550	4.16%	0.63
-32	647.587	674.164	701.762	4.09%	0.63
-31	608.167	632.724	658.208	4.03%	0.62
-30	571.406	594.105	617.644	3.96%	0.61
-29	537.110	558.097	579.846	3.90%	0.61
-28	505.096	524.507	544.609	3.83%	0.60
-27	475.199	493.156	511.742	3.77%	0.60
-26	447.265	463.883	481.071	3.71%	0.59
-25	421.154	436.537	452.436	3.64%	0.59
-24	396.683	410.923	425.632	3.58%	0.58
-23	373.792	386.978	400.590	3.52%	0.58
-22	352.370	364.583	377.182	3.46%	0.57
-21	332.314	343.628	355.293	3.39%	0.56
-20	313.527	324.012	334.813	3.33%	0.56
-19	295.923	305.640	315.645	3.27%	0.55
-18	279.419	288.427	297.695	3.21%	0.55
-17	263.939	272.291	280.880	3.15%	0.54
-16	249.415	257.160	265.120	3.10%	0.53
-15	235.781	242.965	250.343	3.04%	0.53
-14	222.977	229.641	236.481	2.98%	0.52
-13	210.948	217.131	223.474	2.92%	0.51
-12	199.643	205.380	211.262	2.86%	0.51
-11	189.013	194.338	199.792	2.81%	0.50
-10	179.015	183.957	189.016	2.75%	0.49
-9	169.606	174.193	178.887	2.69%	0.49
-8	160.749	165.008	169.362	2.64%	0.48
-7	152.409	156.362	160.401	2.58%	0.47
-6	144.551	148.221	151.969	2.53%	0.47
-5	137.146	140.554	144.031	2.47%	0.46
-4	130.155	133.319	136.545	2.42%	0.45
-3	123.563	126.500	129.493	2.37%	0.45
-2	117.345	120.071	122.848	2.31%	0.44
-1	111.476	114.007	116.583	2.26%	0.43
0	105.937	108.286	110.676	2.21%	0.43
1	100.711	102.892	105.109	2.16%	0.42

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2	95.774	97.798	99.855	2.10%	0.41
3	91.107	92.986	94.894	2.05%	0.40
4	86.695	88.439	90.208	2.00%	0.40
5	82.522	84.140	85.780	1.95%	0.39
6	78.567	80.067	81.588	1.90%	0.38
7	74.824	76.216	77.625	1.85%	0.37
8	71.282	72.572	73.878	1.80%	0.37
9	67.929	69.124	70.333	1.75%	0.36
10	64.752	65.860	66.980	1.70%	0.35
11	61.745	62.771	63.808	1.65%	0.34
12	58.895	59.845	60.804	1.60%	0.33
13	56.192	57.071	57.959	1.55%	0.33
14	53.628	54.442	55.262	1.51%	0.32
15	51.196	51.949	52.707	1.46%	0.31
16	48.887	49.583	50.283	1.41%	0.30
17	46.696	47.338	47.984	1.37%	0.29
18	44.614	45.207	45.803	1.32%	0.29
19	42.638	43.184	43.734	1.27%	0.28
20	40.760	41.264	41.769	1.23%	0.27
21	38.975	39.439	39.904	1.18%	0.26
22	37.278	37.705	38.133	1.13%	0.25
23	35.665	36.057	36.450	1.09%	0.24
24	34.130	34.490	34.850	1.04%	0.24
25	32.670	33.000	33.330	1.00%	0.23
26	31.253	31.582	31.912	1.04%	0.24
27	29.905	30.234	30.563	1.09%	0.25
28	28.623	28.950	29.277	1.13%	0.26
29	27.402	27.727	28.053	1.18%	0.27
30	26.240	26.563	26.887	1.22%	0.29
31	25.134	25.454	25.775	1.26%	0.30
32	24.081	24.398	24.716	1.31%	0.31
33	23.077	23.391	23.706	1.35%	0.32
34	22.121	22.431	22.743	1.39%	0.33
35	21.210	21.516	21.824	1.43%	0.35
36	20.341	20.643	20.947	1.47%	0.36
37	19.512	19.810	20.110	1.52%	0.37
38	18.721	19.015	19.311	1.56%	0.38
39	17.967	18.256	18.548	1.60%	0.40
40	17.247	17.532	17.820	1.64%	0.41
41	16.560	16.840	17.123	1.68%	0.42
42	15.904	16.179	16.458	1.72%	0.43
43	15.277	15.548	15.822	1.76%	0.45
44	14.678	14.944	15.214	1.80%	0.46
45	14.106	14.367	14.632	1.84%	0.47
46	13.559	13.816	14.076	1.88%	0.49
47	13.037	13.289	13.545	1.92%	0.50

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48	12.538	12.785	13.036	1.96%	0.51
49	12.060	12.303	12.549	2.00%	0.53
50	11.603	11.841	12.083	2.04%	0.54
51	11.166	11.399	11.636	2.08%	0.55
52	10.747	10.976	11.208	2.12%	0.57
53	10.346	10.571	10.799	2.16%	0.58
54	9.963	10.182	10.406	2.19%	0.59
55	9.595	9.810	10.029	2.23%	0.61
56	9.243	9.454	9.669	2.27%	0.62
57	8.906	9.112	9.323	2.31%	0.64
58	8.583	8.785	8.991	2.35%	0.65
59	8.273	8.471	8.672	2.38%	0.66
60	7.975	8.169	8.367	2.42%	0.68
61	7.691	7.881	8.074	2.46%	0.69
62	7.418	7.604	7.793	2.49%	0.71
63	7.156	7.338	7.524	2.53%	0.72
64	6.905	7.083	7.265	2.57%	0.74
65	6.664	6.838	7.016	2.60%	0.75
66	6.432	6.602	6.776	2.64%	0.76
67	6.209	6.376	6.546	2.67%	0.78
68	5.995	6.158	6.325	2.71%	0.79
69	5.790	5.949	6.112	2.75%	0.81
70	5.592	5.748	5.908	2.78%	0.82
71	5.403	5.556	5.712	2.82%	0.84
72	5.222	5.371	5.524	2.85%	0.85
73	5.047	5.193	5.343	2.88%	0.87
74	4.879	5.022	5.169	2.92%	0.88
75	4.718	4.858	5.002	2.95%	0.90
76	4.563	4.699	4.840	2.99%	0.92
77	4.413	4.547	4.684	3.02%	0.93
78	4.269	4.400	4.534	3.06%	0.95
79	4.130	4.258	4.389	3.09%	0.96
80	3.996	4.122	4.250	3.12%	0.98
81	3.868	3.991	4.117	3.16%	0.99
82	3.745	3.865	3.988	3.19%	1.01
83	3.626	3.743	3.864	3.22%	1.03
84	3.511	3.626	3.744	3.26%	1.04
85	3.401	3.513	3.629	3.29%	1.06
86	3.295	3.404	3.517	3.32%	1.07
87	3.192	3.300	3.410	3.35%	1.09
88	3.093	3.198	3.307	3.38%	1.11
89	2.998	3.101	3.207	3.42%	1.12
90	2.906	3.007	3.110	3.45%	1.14
91	2.817	2.916	3.017	3.48%	1.16
92	2.732	2.828	2.928	3.51%	1.17
93	2.649	2.744	2.841	3.54%	1.19

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94	2.570	2.662	2.757	3.57%	1.21
95	2.493	2.583	2.676	3.61%	1.22
96	2.419	2.507	2.598	3.64%	1.24
97	2.348	2.434	2.523	3.67%	1.26
98	2.279	2.363	2.451	3.70%	1.27
99	2.212	2.295	2.381	3.73%	1.29
100	2.148	2.229	2.313	3.76%	1.31
101	2.086	2.165	2.247	3.79%	1.33
102	2.026	2.103	2.184	3.82%	1.34
103	1.968	2.044	2.123	3.85%	1.36
104	1.912	1.986	2.063	3.88%	1.38
105	1.858	1.931	2.006	3.91%	1.40
106	1.805	1.877	1.950	3.94%	1.41
107	1.755	1.824	1.897	3.97%	1.43
108	1.706	1.774	1.845	4.00%	1.45
109	1.658	1.725	1.794	4.03%	1.47
110	1.612	1.678	1.746	4.05%	1.49
111	1.568	1.632	1.698	4.08%	1.50
112	1.525	1.588	1.653	4.11%	1.52
113	1.483	1.545	1.609	4.14%	1.54
114	1.443	1.503	1.566	4.17%	1.56
115	1.404	1.463	1.524	4.20%	1.58
116	1.366	1.424	1.484	4.22%	1.60
117	1.330	1.387	1.446	4.25%	1.62
118	1.295	1.350	1.408	4.28%	1.63
119	1.261	1.315	1.372	4.31%	1.65
120	1.228	1.281	1.336	4.34%	1.67
121	1.195	1.248	1.302	4.36%	1.69
122	1.164	1.216	1.269	4.39%	1.71
123	1.134	1.184	1.237	4.42%	1.73
124	1.105	1.154	1.206	4.44%	1.75
125	1.077	1.125	1.175	4.47%	1.77