

Chip NTC Thermistor

Features

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Applications

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PART NUMBER

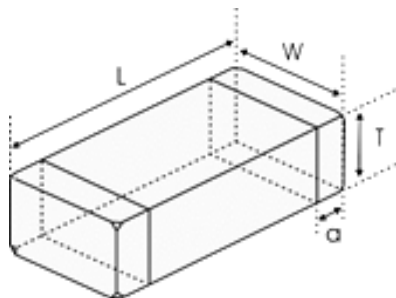
Example: RND 155QN0603X333F3950FA

RND 155QN0603	X	333	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		272 = 2.7 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

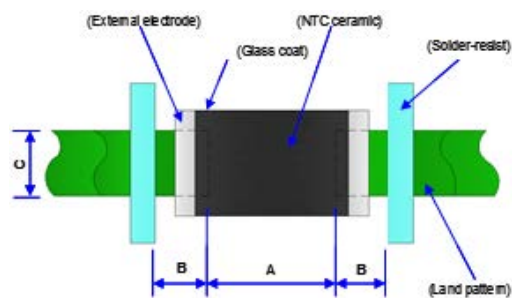
Electrical Characteristics

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 155QN0603X333F3950FA	33 kΩ ±1%	3920 K	3950 K±1%	0.17 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

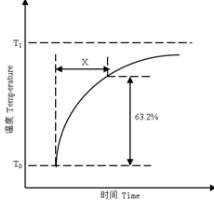
If any doubt on the results, measurements/tests should be made within the following limits

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

Inspection Equipment

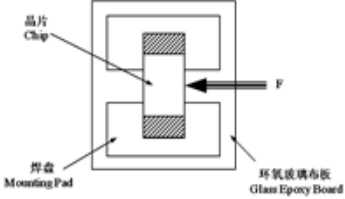
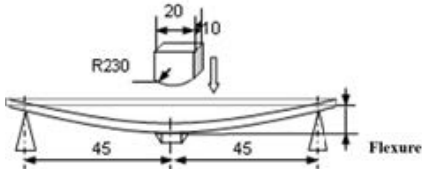
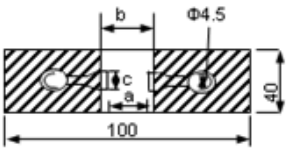
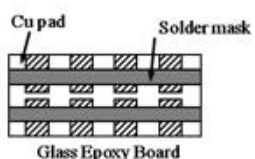
- Visual Examination: 20x magnifier
- Resistance value test: Thermistor resistance tester

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

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 																		
Size	F	Duration																											
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"><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"> 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	$-40 \pm 5^{\circ}\text{C}$	$30 \pm 3\text{min}$																
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 ± 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

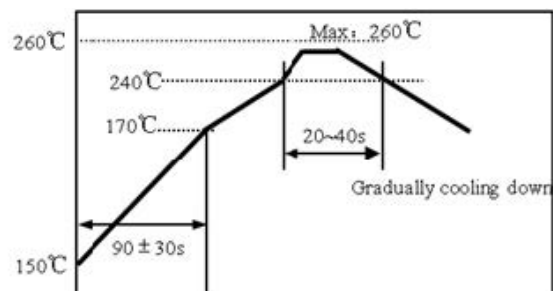
Notes & Warnings

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

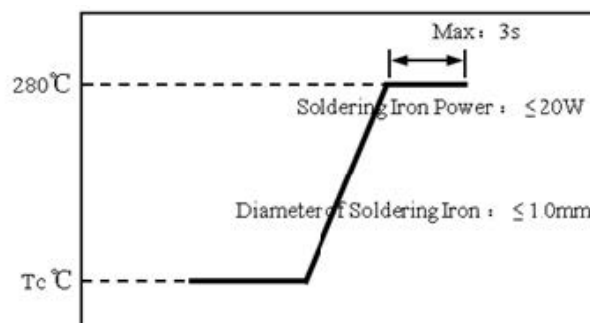
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



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



Chip NTC Thermistor



R-T Table

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
-40	1,055.369	1,104.115	1,154.996	4.61%	0.67
-39	988.051	1,032.999	1,079.884	4.54%	0.66
-38	925.481	966.944	1,010.163	4.47%	0.66
-37	867.295	905.557	945.412	4.40%	0.65
-36	813.158	848.479	885.246	4.33%	0.65
-35	762.766	795.384	829.313	4.27%	0.64
-34	715.712	745.837	777.154	4.20%	0.64
-33	671.879	699.713	728.627	4.13%	0.63
-32	631.020	656.745	683.451	4.07%	0.63
-31	592.920	616.704	641.378	4.00%	0.62
-30	557.373	579.369	602.172	3.94%	0.62
-29	524.190	544.539	565.621	3.87%	0.61
-28	493.198	512.028	531.524	3.81%	0.61
-27	464.243	481.674	499.709	3.74%	0.60
-26	437.178	453.317	470.005	3.68%	0.59
-25	411.864	426.811	442.257	3.62%	0.59
-24	388.230	402.079	416.381	3.56%	0.58
-23	366.102	378.938	392.184	3.50%	0.58
-22	345.374	357.272	369.543	3.43%	0.57
-21	325.952	336.985	348.355	3.37%	0.56
-20	307.742	317.973	328.512	3.31%	0.56
-19	290.597	300.084	309.850	3.25%	0.55
-18	274.516	283.315	292.367	3.20%	0.55
-17	259.427	267.590	275.982	3.14%	0.54
-16	245.262	252.836	260.617	3.08%	0.53
-15	231.959	238.987	246.204	3.02%	0.53
-14	219.504	226.028	232.724	2.96%	0.52
-13	207.795	213.853	220.066	2.91%	0.52
-12	196.781	202.407	208.173	2.85%	0.51
-11	186.415	191.639	196.991	2.79%	0.50
-10	176.660	181.513	186.480	2.74%	0.50
-9	167.428	171.934	176.544	2.68%	0.49
-8	158.739	162.923	167.201	2.63%	0.48
-7	150.552	154.438	158.409	2.57%	0.48
-6	142.838	146.447	150.132	2.52%	0.47
-5	135.566	138.918	142.339	2.46%	0.46
-4	128.718	131.832	135.007	2.41%	0.46
-3	122.259	125.151	128.099	2.36%	0.45
-2	116.159	118.846	121.582	2.30%	0.44
-1	110.400	112.895	115.436	2.25%	0.43
0	104.963	107.280	109.638	2.20%	0.43
1	99.817	101.970	104.158	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	94.958	96.957	98.988	2.09%	0.41
3	90.360	92.215	94.100	2.04%	0.41
4	86.016	87.738	89.486	1.99%	0.40
5	81.903	83.502	85.124	1.94%	0.39
6	78.012	79.496	81.000	1.89%	0.38
7	74.328	75.705	77.099	1.84%	0.38
8	70.840	72.117	73.410	1.79%	0.37
9	67.535	68.720	69.918	1.74%	0.36
10	64.402	65.500	66.610	1.69%	0.35
11	61.432	62.450	63.478	1.65%	0.34
12	58.618	59.560	60.512	1.60%	0.34
13	55.945	56.818	57.699	1.55%	0.33
14	53.414	54.222	55.037	1.50%	0.32
15	51.009	51.757	52.510	1.46%	0.31
16	48.727	49.418	50.114	1.41%	0.30
17	46.560	47.199	47.842	1.36%	0.30
18	44.501	45.091	45.684	1.32%	0.29
19	42.544	43.089	43.636	1.27%	0.28
20	40.685	41.187	41.691	1.22%	0.27
21	38.919	39.382	39.846	1.18%	0.26
22	37.237	37.663	38.090	1.13%	0.25
23	35.639	36.031	36.423	1.09%	0.25
24	34.119	34.479	34.839	1.04%	0.24
25	32.670	33.000	33.330	1.00%	0.23
26	31.265	31.594	31.924	1.04%	0.24
27	29.927	30.255	30.585	1.09%	0.25
28	28.656	28.983	29.311	1.13%	0.26
29	27.442	27.767	28.093	1.17%	0.28
30	26.288	26.611	26.935	1.22%	0.29
31	25.192	25.512	25.833	1.26%	0.30
32	24.142	24.459	24.777	1.30%	0.31
33	23.145	23.459	23.775	1.35%	0.32
34	22.192	22.502	22.815	1.39%	0.34
35	21.286	21.592	21.901	1.43%	0.35
36	20.420	20.722	21.027	1.47%	0.36
37	19.597	19.895	20.196	1.51%	0.37
38	18.808	19.102	19.398	1.55%	0.39
39	18.058	18.348	18.640	1.59%	0.40
40	17.338	17.624	17.912	1.64%	0.41
41	16.655	16.936	17.220	1.68%	0.42
42	15.999	16.275	16.555	1.72%	0.44
43	15.373	15.644	15.919	1.76%	0.45
44	14.776	15.043	15.313	1.80%	0.46
45	14.206	14.468	14.734	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	13.659	13.917	14.178	1.88%	0.49
47	13.136	13.389	13.645	1.92%	0.50
48	12.635	12.883	13.135	1.95%	0.51
49	12.158	12.402	12.649	1.99%	0.53
50	11.701	11.940	12.182	2.03%	0.54
51	11.263	11.497	11.736	2.07%	0.56
52	10.845	11.075	11.309	2.11%	0.57
53	10.444	10.670	10.899	2.15%	0.58
54	10.060	10.280	10.505	2.18%	0.60
55	9.691	9.908	10.128	2.22%	0.61
56	9.340	9.552	9.768	2.26%	0.62
57	9.001	9.209	9.421	2.30%	0.64
58	8.679	8.883	9.090	2.33%	0.65
59	8.367	8.566	8.770	2.37%	0.67
60	8.072	8.267	8.466	2.41%	0.68
61	7.786	7.977	8.172	2.44%	0.69
62	7.510	7.697	7.888	2.48%	0.71
63	7.247	7.430	7.617	2.52%	0.72
64	6.997	7.177	7.360	2.55%	0.74
65	6.754	6.930	7.109	2.59%	0.75
66	6.521	6.693	6.869	2.62%	0.77
67	6.294	6.463	6.634	2.66%	0.78
68	6.081	6.245	6.414	2.70%	0.80
69	5.874	6.035	6.200	2.73%	0.81
70	5.673	5.831	5.992	2.77%	0.83
71	5.483	5.637	5.795	2.80%	0.84
72	5.302	5.453	5.607	2.83%	0.86
73	5.128	5.275	5.427	2.87%	0.87
74	4.957	5.101	5.249	2.90%	0.89
75	4.795	4.937	5.082	2.94%	0.90
76	4.641	4.779	4.921	2.97%	0.92
77	4.489	4.625	4.763	3.00%	0.93
78	4.344	4.477	4.613	3.04%	0.95
79	4.206	4.335	4.469	3.07%	0.97
80	4.071	4.198	4.328	3.10%	0.98
81	3.942	4.066	4.194	3.14%	1.00
82	3.817	3.938	4.063	3.17%	1.01
83	3.695	3.813	3.936	3.20%	1.03
84	3.579	3.695	3.815	3.24%	1.04
85	3.470	3.584	3.701	3.27%	1.06
86	3.361	3.472	3.587	3.30%	1.08
87	3.258	3.367	3.479	3.33%	1.09
88	3.159	3.265	3.375	3.36%	1.11
89	3.063	3.167	3.275	3.40%	1.13

Chip NTC Thermistor

Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
90	2.970	3.072	3.177	3.43%	1.14
91	2.880	2.980	3.083	3.46%	1.16
92	2.794	2.892	2.992	3.49%	1.18
93	2.711	2.806	2.905	3.52%	1.19
94	2.628	2.721	2.818	3.55%	1.21
95	2.551	2.642	2.737	3.58%	1.23
96	2.477	2.567	2.660	3.61%	1.24
97	2.404	2.492	2.583	3.64%	1.26
98	2.334	2.420	2.509	3.67%	1.28
99	2.267	2.351	2.438	3.70%	1.29
100	2.203	2.285	2.371	3.73%	1.31
101	2.139	2.220	2.303	3.76%	1.33
102	2.079	2.158	2.240	3.79%	1.35
103	2.018	2.096	2.176	3.82%	1.36
104	1.961	2.037	2.115	3.85%	1.38
105	1.907	1.981	2.058	3.88%	1.40
106	1.853	1.925	2.001	3.91%	1.42
107	1.802	1.873	1.947	3.94%	1.44
108	1.751	1.821	1.893	3.97%	1.45
109	1.703	1.772	1.842	4.00%	1.47
110	1.659	1.726	1.795	4.02%	1.49
111	1.614	1.680	1.748	4.05%	1.51
112	1.570	1.634	1.701	4.08%	1.53
113	1.529	1.592	1.657	4.11%	1.54
114	1.487	1.549	1.613	4.14%	1.56
115	1.446	1.507	1.569	4.17%	1.58
116	1.408	1.467	1.529	4.19%	1.60
117	1.370	1.428	1.489	4.22%	1.62
118	1.335	1.392	1.451	4.25%	1.64
119	1.301	1.356	1.414	4.28%	1.66
120	1.266	1.320	1.377	4.30%	1.68
121	1.234	1.288	1.343	4.33%	1.69
122	1.203	1.255	1.310	4.36%	1.71
123	1.171	1.222	1.276	4.38%	1.73
124	1.143	1.193	1.246	4.41%	1.75
125	1.114	1.164	1.215	4.44%	1.77