

Chip NTC Thermistor

Features

- = 0.1 mm
- 0 = 0.2 mm
- k = 0.5 mm
- 0 = 1 mm

Applications

- U = Universal
- " = Automotive
- U = Industrial
- @ = High precision

PART NUMBER

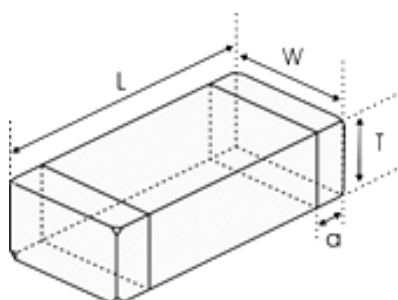
Example: RND 155QN0402X104F3950FA

RND 155QN0402	X	104	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 104 = 100 kΩ 334 = 330 kΩ	F = ± 1% G = ± 2% H = ± 3% J = ± 5%	3450 = 3450 K 3950 = 3950 K 4050 = 4050 K 4500 = 4500 K	F = ± 1% H = ± 3%	A = 25 °C & 85 °C B = 25 °C & 50 °C

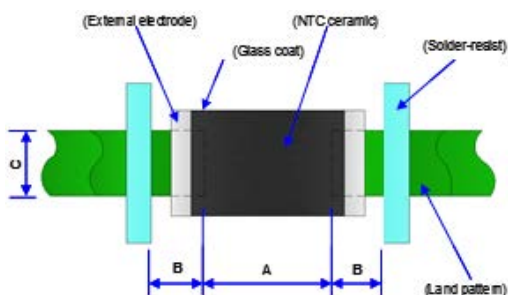
Electrical Characteristics

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 155QN0402X104F3950FA	100 kΩ ±1%	3890 K	3950 K ±1%	0.10 mA	1 mW / °C	<3 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

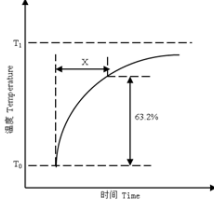
If any doubt on the results, measurements/tests should be made within the following limits

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

Inspection Equipment

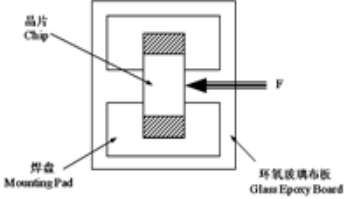
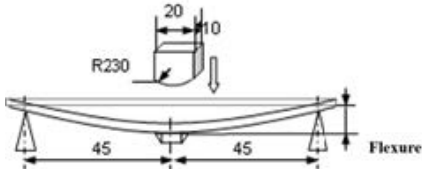
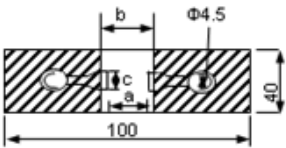
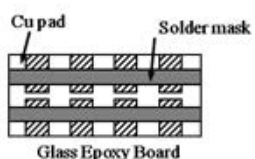
- Visual Examination: 20x magnifier
- Resistance value test: Thermistor resistance tester

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

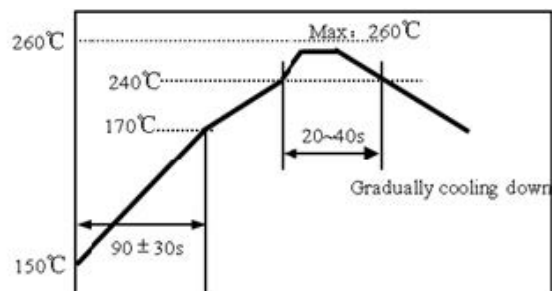
Notes & Warnings

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

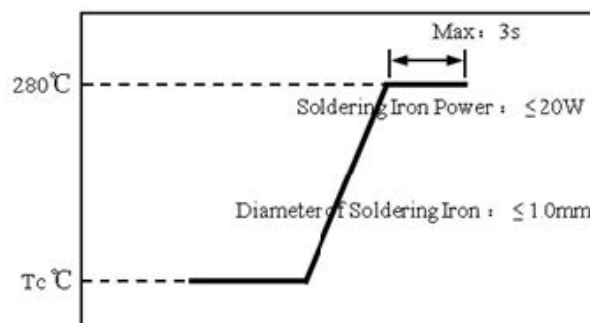
- 1~2°C/sec. Ramp
- Pre-heating: 150~170°C/90±30 sec.
- Time above 240°C: 20~40 sec.
- Peak temperature: 260°C Max./10 sec.
- Solder paste: Sn/3.0Ag/0.5Cu
- Max.2 times for re-flowing



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	2,920.332	3,052.414	3,190.151	4.51%	0.67
-39	2,741.958	2,864.149	2,991.486	4.45%	0.67
-38	2,575.527	2,688.600	2,806.356	4.38%	0.66
-37	2,420.174	2,524.839	2,633.768	4.31%	0.66
-36	2,275.101	2,372.011	2,472.801	4.25%	0.65
-35	2,139.573	2,229.326	2,322.612	4.18%	0.65
-34	2,012.908	2,096.056	2,182.419	4.12%	0.64
-33	1,894.480	1,971.528	2,051.504	4.06%	0.64
-32	1,783.709	1,855.122	1,929.201	3.99%	0.63
-31	1,680.057	1,746.264	1,814.899	3.93%	0.63
-30	1,583.029	1,644.424	1,708.030	3.87%	0.62
-29	1,492.167	1,549.112	1,608.071	3.81%	0.61
-28	1,407.044	1,459.875	1,514.538	3.74%	0.61
-27	1,327.268	1,376.292	1,426.983	3.68%	0.60
-26	1,252.474	1,297.974	1,344.993	3.62%	0.60
-25	1,182.324	1,224.563	1,268.184	3.56%	0.59
-24	1,116.506	1,155.725	1,196.201	3.50%	0.59
-23	1,054.728	1,091.149	1,128.715	3.44%	0.58
-22	996.722	1,030.551	1,065.421	3.38%	0.57
-21	942.236	973.663	1,006.037	3.33%	0.57
-20	891.039	920.239	950.300	3.27%	0.56
-19	842.914	870.049	897.967	3.21%	0.56
-18	797.662	822.881	848.813	3.15%	0.55
-17	755.095	778.537	802.626	3.09%	0.54
-16	715.040	736.833	759.214	3.04%	0.54
-15	677.336	697.598	718.394	2.98%	0.53
-14	641.832	660.672	679.998	2.93%	0.53
-13	608.389	625.909	643.869	2.87%	0.52
-12	576.875	593.169	609.862	2.81%	0.51
-11	547.171	562.325	577.841	2.76%	0.51
-10	519.161	533.257	547.680	2.70%	0.50
-9	492.742	505.853	519.261	2.65%	0.49
-8	467.814	480.010	492.475	2.60%	0.49
-7	444.285	455.631	467.219	2.54%	0.48
-6	422.071	432.624	443.398	2.49%	0.47
-5	401.089	410.907	420.923	2.44%	0.47
-4	381.267	390.399	399.711	2.39%	0.46
-3	362.533	371.028	379.684	2.33%	0.45
-2	344.823	352.725	360.771	2.28%	0.44
-1	328.076	335.424	342.904	2.23%	0.44
0	312.233	319.067	326.019	2.18%	0.43
1	297.242	303.597	310.057	2.13%	0.42

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
2	283.052	288.962	294.965	2.08%	0.42
3	269.618	275.111	280.688	2.03%	0.41
4	256.893	262.000	267.181	1.98%	0.40
5	244.839	249.584	254.396	1.93%	0.39
6	233.415	237.824	242.292	1.88%	0.39
7	222.585	226.681	230.829	1.83%	0.38
8	212.317	216.121	219.971	1.78%	0.37
9	202.578	206.109	209.681	1.73%	0.36
10	193.337	196.615	199.928	1.69%	0.36
11	184.568	187.609	190.681	1.64%	0.35
12	176.243	179.063	181.911	1.59%	0.34
13	168.338	170.953	173.590	1.54%	0.33
14	160.830	163.252	165.695	1.50%	0.32
15	153.696	155.940	158.201	1.45%	0.32
16	146.917	148.994	151.085	1.40%	0.31
17	140.473	142.394	144.327	1.36%	0.30
18	134.345	136.121	137.907	1.31%	0.29
19	128.517	130.158	131.806	1.27%	0.28
20	122.972	124.487	126.007	1.22%	0.27
21	117.696	119.093	120.494	1.18%	0.27
22	112.674	113.960	115.251	1.13%	0.26
23	107.892	109.076	110.263	1.09%	0.25
24	103.338	104.427	105.517	1.04%	0.24
25	99.000	100.000	101.000	1.00%	0.23
26	94.785	95.784	96.783	1.04%	0.24
27	90.771	91.767	92.764	1.09%	0.25
28	86.948	87.939	88.933	1.13%	0.27
29	83.306	84.291	85.280	1.17%	0.28
30	79.835	80.813	81.796	1.22%	0.29
31	76.526	77.497	78.471	1.26%	0.30
32	73.372	74.333	75.300	1.30%	0.31
33	70.364	71.315	72.272	1.34%	0.33
34	67.494	68.435	69.382	1.38%	0.34
35	64.756	65.686	66.622	1.43%	0.35
36	62.143	63.061	63.986	1.47%	0.36
37	59.649	60.554	61.467	1.51%	0.38
38	57.267	58.160	59.061	1.55%	0.39
39	54.993	55.872	56.761	1.59%	0.40
40	52.820	53.686	54.562	1.63%	0.41
41	50.744	51.597	52.459	1.67%	0.43
42	48.760	49.599	50.448	1.71%	0.44
43	46.864	47.689	48.524	1.75%	0.45
44	45.051	45.862	46.683	1.79%	0.46
45	43.317	44.114	44.921	1.83%	0.48
46	41.658	42.441	43.235	1.87%	0.49

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Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
47	40.071	40.840	41.620	1.91%	0.50
48	38.553	39.308	40.073	1.95%	0.52
49	37.099	37.840	38.592	1.99%	0.53
50	35.708	36.435	37.172	2.02%	0.54
51	34.376	35.088	35.812	2.06%	0.56
52	33.099	33.798	34.509	2.10%	0.57
53	31.877	32.562	33.259	2.14%	0.58
54	30.705	31.377	32.060	2.18%	0.60
55	29.583	30.241	30.911	2.22%	0.61
56	28.507	29.152	29.809	2.25%	0.63
57	27.475	28.107	28.751	2.29%	0.64
58	26.486	27.105	27.736	2.33%	0.65
59	25.537	26.143	26.761	2.36%	0.67
60	24.626	25.220	25.826	2.40%	0.68
61	23.753	24.334	24.928	2.44%	0.70
62	22.915	23.484	24.065	2.47%	0.71
63	22.110	22.667	23.236	2.51%	0.72
64	21.337	21.883	22.440	2.55%	0.74
65	20.596	21.129	21.675	2.58%	0.75
66	19.883	20.406	20.940	2.62%	0.77
67	19.198	19.710	20.233	2.65%	0.78
68	18.541	19.041	19.553	2.69%	0.80
69	17.909	18.399	18.900	2.72%	0.81
70	17.301	17.781	18.271	2.76%	0.83
71	16.717	17.186	17.667	2.79%	0.84
72	16.156	16.615	17.085	2.83%	0.86
73	15.616	16.065	16.525	2.86%	0.87
74	15.096	15.536	15.986	2.90%	0.89
75	14.597	15.026	15.467	2.93%	0.90
76	14.116	14.536	14.967	2.97%	0.92
77	13.653	14.064	14.486	3.00%	0.93
78	13.208	13.610	14.023	3.03%	0.95
79	12.779	13.172	13.576	3.07%	0.97
80	12.366	12.751	13.146	3.10%	0.98
81	11.968	12.345	12.732	3.14%	1.00
82	11.585	11.954	12.332	3.17%	1.01
83	11.216	11.577	11.947	3.20%	1.03
84	10.861	11.213	11.576	3.23%	1.04
85	10.518	10.863	11.218	3.27%	1.06
86	10.188	10.525	10.873	3.30%	1.08
87	9.870	10.200	10.539	3.33%	1.09
88	9.563	9.885	10.218	3.36%	1.11
89	9.267	9.582	9.908	3.40%	1.13
90	8.981	9.290	9.609	3.43%	1.14
91	8.706	9.008	9.320	3.46%	1.16

Chip NTC Thermistor



Temp. (°C)	R_Min (Kohm)	R_Cent (Kohm)	R_Max (Kohm)	Res TOL.	Temp. TOL.(°C)
92	8.440	8.736	9.041	3.49%	1.18
93	8.184	8.473	8.771	3.52%	1.19
94	7.936	8.219	8.511	3.56%	1.21
95	7.697	7.974	8.260	3.59%	1.23
96	7.467	7.738	8.018	3.62%	1.24
97	7.244	7.509	7.783	3.65%	1.26
98	7.029	7.289	7.557	3.68%	1.28
99	6.821	7.075	7.338	3.71%	1.29
100	6.621	6.869	7.126	3.74%	1.31
101	6.427	6.670	6.922	3.77%	1.33
102	6.240	6.478	6.724	3.80%	1.35
103	6.059	6.292	6.533	3.83%	1.36
104	5.884	6.112	6.348	3.86%	1.38
105	5.715	5.938	6.169	3.89%	1.40
106	5.551	5.770	5.996	3.92%	1.42
107	5.393	5.607	5.828	3.95%	1.43
108	5.240	5.449	5.666	3.98%	1.45
109	5.092	5.297	5.510	4.01%	1.47
110	4.949	5.150	5.358	4.04%	1.49
111	4.811	5.007	5.211	4.07%	1.51
112	4.677	4.869	5.069	4.10%	1.52
113	4.547	4.735	4.931	4.13%	1.54
114	4.422	4.606	4.797	4.16%	1.56
115	4.300	4.481	4.668	4.19%	1.58
116	4.183	4.359	4.543	4.21%	1.60
117	4.069	4.242	4.422	4.24%	1.62
118	3.958	4.128	4.304	4.27%	1.63
119	3.852	4.018	4.190	4.30%	1.65
120	3.748	3.911	4.080	4.33%	1.67
121	3.648	3.807	3.973	4.36%	1.69
122	3.551	3.707	3.869	4.38%	1.71
123	3.456	3.609	3.769	4.41%	1.73
124	3.365	3.515	3.671	4.44%	1.75
125	3.277	3.423	3.576	4.47%	1.77